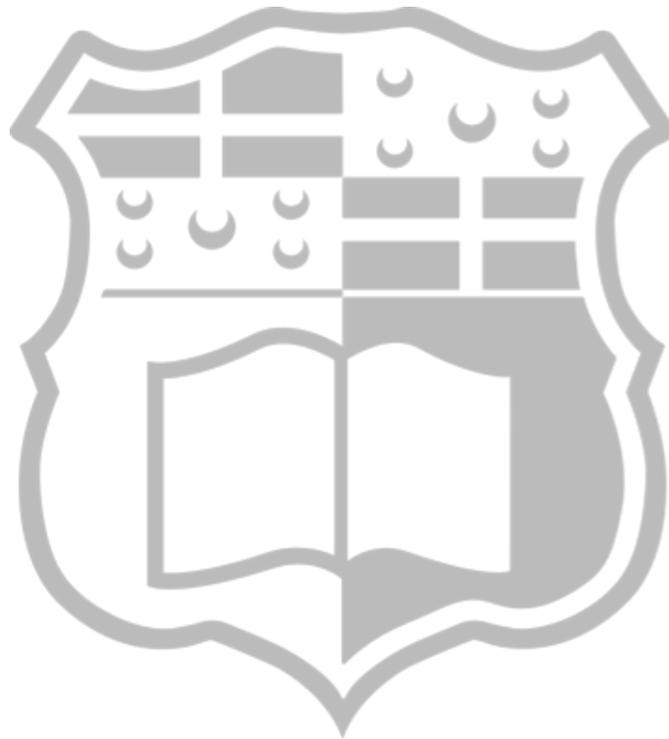




Class Solution Development for Volumetric Modulated Arc Therapy Planning of Cervical Cancer and the Investigation of Source-to-Skin Distance Changes During Radiotherapy Treatment



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Abstract

Background

Cervical cancer continues to be a leading cause of morbidity and mortality worldwide. Advancements in radiotherapy, particularly volumetric modulated arc therapy, reduces treatment-related toxicity by providing highly conformal dose distributions. The implementation of class solutions facilitates consistent and efficient treatment planning, essential for optimising patient outcomes. Patient's anatomy may also change during radiotherapy, which can alter source-to-skin distances, affecting dose distributions and necessitating adjustments in treatment plans. Current practices in Malta reassess treatment plans if monitor unit variations exceed ± 2 % due to source-to-skin distance changes, although this threshold lacks scientific evidence.

Objectives

The study aimed to develop a generalisable volumetric modulated arc therapy treatment planning class solution for cervical cancer which complies with the national clinical protocol based on the EMBRACE II studies, and to facilitate future treatment planning. In addition, it aimed to investigate the dosimetric effects of source-to-skin distance changes in cervical cancer patients by applying different margin adjustments to establish an evidence-based threshold for when a monitor unit adjustment is required.

Research Methodology

The research methodology was quantitative, focusing on data analysis from the optimisation and validation of the volumetric modulated arc therapy class solution and examining absorbed dose variations after applying source-to-skin distance margins of different sizes and directions. An experimental and comparative approach was used to develop a generalisable class solution and investigate the effects of source-to-skin distance changes mimicking patient anatomical fluctuations. CT scans from 20 cervical cancer patients prescribed 45 Gy in 25 fractions were used, together with the Monaco[®] Treatment Planning System v5.11.03 and the Monte Carlo algorithm as the data collection tools.

Results

The class solution achieved a 97.48 % pass rate for hard dose constraints and 46.30 % for soft dose constraints, suggesting it provides a good foundation but requires further patient-specific optimisation. Significant changes in dose distributions were observed with the smallest margin changes (± 0.5 cm), indicating that even minor modifications in treatment plans may require monitor unit adjustment.

Conclusions and Recommendations

The study successfully developed a generalisable volumetric modulated arc therapy class solution for cervical cancer that adhered to the national clinical protocol. A revised monitor unit percentage difference threshold of 1.4 ± 0.4 % was also established, serving as an evidence-based clinical recommendation.

Keywords

Cervical Cancer, EMBRACE, Volumetric Modulated Arc Therapy, Class Solution, Treatment Planning, Source-to-Skin Distance Changes.

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List of Definitions

Class Solution

Prescription templates which standardise planning approaches across clinics or hospitals (Ly & Pellegrini, 2018).

Volumetric Modulated Arc Therapy

A radiation technique which, when compared to conventional radiotherapy techniques, allows for highly conformal dose distributions with improved target volume coverage and sparing of normal tissues through the continuous rotation of a linear accelerator (LINAC) in multiple arcs (Quan et al., 2012).

Monitor Units

The quantity of charge picked up by an ionisation chamber placed in the head of a LINAC, that corresponds to a dose of 1 cGy given to a water phantom under known reference conditions (Gibbons et al., 2014).

Hard Dose Constraints

Strict limits which must always be adhered to during the optimisation process of the treatment plan, unless stated otherwise by the clinician (Micallef et al., 2023).

Soft Dose Constraints

Flexible guidelines which aim to balance between delivering an effective dose to the tumour and minimising exposure to OARs (Hansen et al., 2020).

List of Acronyms

ALARA	As Low As Reasonably Achievable
CI	Conformity Index
CT	Computed Tomography
CTV	Clinical Target Volume
CTV-HR	Clinical Target Volume - High Risk
DNA	Deoxyribonucleic Acid
DVH	Dose Volume Histogram
EBRT	External Beam Radiotherapy
EUD	Equivalent Uniform Dose
GTV	Gross Target Volume
HPV	Human Papillomavirus
IAEA	International Atomic Energy Agency
ICRU	International Commission on Radiation Units and Measurements
ITV	Internal Target Volume
LINAC	Linear Accelerator
MLC	Multileaf Collimator
MRI	Magnetic Resonance Imaging
MSW	Minimum Segment Width
MU	Monitor Unit
NTCP	Normal Tissue Complication Probability
OAR	Organ at Risk
PIBS	Posterior-Inferior Border of Symphysis
PLE	Power Law Exponent
PTV	Planning Target Volume
QA	Quality Assurance
RMS	Root Mean Square
SAMOC	Sir Anthony Mamo Oncology Centre
SD	Standard Deviation
SEM	Standard Error of the Mean
SSD	Source-to-Skin Distance

SU	Statistical Uncertainty
TCP	Tumour Control Probability
TPS	Treatment Planning System
VMAT	Volumetric Modulated Arc Therapy
XVI	X-Ray Volume Image/Imaging

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Chapter 1: Introduction

1.1 Introduction

In this chapter, an overview of the problem statement, background, and context of the study, as well as the objectives and scope of the research, is presented. Additionally, a summary of the research methodology, ethical considerations, relevance and potential impact of the findings is provided.

1.2 Problem Statement

The Sir Anthony Mamo Oncology Centre (SAMOC) is moving towards the development of class solutions for treatment plans across all anatomical areas to enhance ease of use and productivity. In addition, radiotherapy medical physicists in Malta have adapted the EMBRACE clinical protocol for cervical patients in the past years. However, a Volumetric Modulated Arc Therapy (VMAT) class solution for cervical cancer patients has yet to be developed for the updated clinical protocol at SAMOC using Elekta's treatment planning system (TPS), Monaco®.

Moreover, there are currently no clear guidelines as to when changes in the source-to-skin distance (SSD) during radiotherapy for cervical cancer using VMAT require action, such as monitor unit (MU) adjustments. At SAMOC, treatment plans are currently reassessed when the original and adjusted MUs differ by more than $\pm 2\%$, a threshold which is not supported by scientific evidence and has yet to be evaluated for accuracy.

1.3 Background and Context

Cervical cancer develops following the growth of abnormal cells in the cervix lining, with squamous cell carcinoma making up 70% of all cases, being the most common form. Worldwide, cervical cancer is the fourth most prevalent cancer in women and a significant cause of morbidity and mortality (Moore, 2006). Advancements in radiotherapy technologies, such as VMAT, have significantly reduced treatment-related toxicity in patients with locally advanced disease. VMAT is a radiation technique which, when compared to conventional radiotherapy techniques, allows

for highly conformal dose distributions with improved target volume coverage and sparing of normal tissues through the continuous rotation of a linear accelerator (LINAC) in multiple arcs (Quan et al., 2012).

The establishment of a class solution facilitates VMAT use by ensuring consistency within the department, allowing faster treatment planning and serving as an efficient training tool for less experienced staff. In radiation treatment planning, a class solution is defined as a set of geometric beam configurations and dosimetric objectives that, independent of target volume, patient anatomy or organs at risk (OARs) volumes, result in a clinically acceptable dose distribution (Forde et al., 2014). Although the determination of whether a treatment plan is considered clinically acceptable is still often subjective, the use of objective dose-volume histogram (DVH) criteria for treatment plan assessment has increased since the introduction of VMAT (Clarke et al., 2017).

Clinical protocols are established in radiotherapy departments to provide standardised guidelines and ensure consistent and effective treatment plans, which ultimately enhance patient safety and treatment outcomes. The standardisation of these protocols is considered essential to improve treatment quality and ensure homogeneity between different healthcare institutions worldwide. To achieve this, the GEC-ESTRO (Groupe Européen de Curiethérapie and European Society for Radiotherapy and Oncology) network has initiated the EMBRACE clinical protocols which aim to improve clinical outcomes by developing, implementing, and evaluating image-guided radiation therapy for cervical cancer (Berger et al., 2019).

One of the main challenges during VMAT treatment is managing variations in SSD, often caused by patient weight fluctuations resulting from radiation side effects. Changes in SSD can also be caused by an accumulation of fluid in tissues leading to swelling, loss of fluid, organ movement through physiological processes or radiation-induced inflammation. An increase or decrease in patient contours during radiotherapy for cervical cancer patients can change the absorbed dose to the target volume and OARs. Typically, SSD measurements are monitored to maintain stability

between the patients' outer surface and isocenter-to-skin surface distances. An increased SSD, could lead to an excessive absorbed dose which results from a decrease in the patient's contour, while an insufficient absorbed dose could result from a decreased SSD. Changes in SSD not only affect the dose distribution but may also change the patient's treatment outcome. An increased SSD generally necessitates a decrease in MUs since the patient contour is decreased, causing less beam attenuation, while a decreased SSD may require an increase in MUs to prevent overdosing. Before every treatment fraction, kV X-ray volume image (XVI) guidance is used for cervical cancer, which acts as an indicator for any anatomical changes (Pair et al., 2013). Currently, treatment plans done in Malta are reassessed whenever the original and new MUs, obtained after SSD adjustments, vary by more than $\pm 2\%$. However, this threshold value is not based on scientific evidence and was never assessed for accuracy so far.

1.4 Objectives Of The Study

This study was divided into two parts, each with the following objectives:

Part 1

- a) Develop a generalisable VMAT planning class solution for cervical cancer which adheres to the national clinical protocol, with a focus on maximising the absorbed dose to the tumour while sparing OARs.
- b) Facilitate future VMAT treatment planning procedures at SAMOC for cervical cancer.

Part 2

- c) Investigate the dosimetric effects in cervical cancer patients who experience SSD changes during VMAT through the application of different margin adjustments.
- d) Establish an evidence-based threshold which provides an indication to when a change in MUs is required after variations in SSD.

1.5 Scope of the Study

The study was restricted to cervical cancer patients in Malta who received or were receiving radiation therapy at SAMOC along the duration of the study (45 Gy in 25 fractions), and who consented to the use of their data.

1.6 Research Methodology

The methodology for the first part of the study involved a quantitative investigation aimed at developing a VMAT class solution for cervical patients at SAMOC. Through the use of Monaco® TPS version 5.11.03, developed by Elekta (Elekta AB, 2016), the planning class solution was initially created for one randomly selected patient. The optimised template from this patient was then applied to four additional randomly chosen patients for further testing and necessary adjustments. All patients included in the study received a prescribed absorbed dose of 45 Gy delivered in 25 fractions to the pelvic region.

The second part of the study used the same sample of patients, data, and treatment plans as the first part. To simulate an increase in patient contour (SSD decrease), the external contours of the patients were expanded, anteriorly, laterally and uniformly by 0.5 cm, 1.0 cm and 1.5 cm, through the use of created margins, with the added volume assigned a density equal to soft tissue. Conversely, to simulate a reduction in patient contour (SSD increase), the contours were contracted by the same magnitude, where the missing tissue was assigned a density equivalent to air. The optimised (original) treatment plan for each patient obtained in the first part of the study was then recomputed to investigate the effect of SSD changes on the dose distribution. The MUs for each original plan were recorded and subsequently adjusted for each margin by comparing the DVH values of the target volume and OARs to those of the optimised plan, making adjustments until both plans matched.

1.7 Ethical Considerations

Ethics clearance was obtained prior to data collection by obtaining permission from the CEO of Mater Dei and the Chairperson of SAMOC. Through an appointed intermediary, a consent letter was sent to all eligible retrospective and prospective patients, who were included in the study if they returned their written consent through postage-paid envelopes. Approval from the Data Protection Officer at Mater Dei Hospital was obtained and the intermediary anonymised all patient data before the start of this project. This study has been approved by the Faculty Research Ethics Committee and University Research Ethics Committee of the University of Malta.

1.8 Relevance Of The Study

The relevance of the study for the various stakeholders is as follows:

a) For patients:

By developing a generalisable VMAT class solution, the study improves the efficacy of radiotherapy treatments for cervical cancer and ensures optimised treatments for patients. The class solution will serve to minimize treatment planning time, which is critical for patients who need to initiate treatment promptly due to tumour progression and the heightened risk of cancer spreading beyond the treatment site. Furthermore, understanding the impact of SSD changes on treatment plans will enable more accurate adjustments, ensuring that patients continue to receive the correct dosage throughout their treatment. This minimises risks of over- or under-dosing to the target volumes and OARs, which could lead to adverse effects.

b) For the Medical Physics and Radiation Protection professions/practice:

The developed class solution will serve as a useful tool for medical physicists in Malta to facilitate the treatment planning process for cervical patients. In addition, the investigation of different SSD changes with varying sizes and directions will provide an evidence-based understanding of their effects on the absorbed dose to the target volume and OARs. This investigation also aids in determining a revised threshold for MU adjustments during patient treatment planning based on scientific evidence, ultimately enhancing planning accuracy.

1.9 Conclusion

An introduction to the study was presented in this chapter. Chapter 2 presents a critical review of the literature, followed by an explanation of the research methodology in Chapter 3. The results and analysis obtained from both parts of the study are provided in Chapter 4, while Chapter 5 presents the corresponding discussion from the results. Finally, Chapter 6 summarises the key conclusions from the study, the proposed recommendations, and suggestions for future research.

Chapter 2: Literature Review

2.1 Introduction

The evolution of healthcare has led to the development of improved techniques for external beam radiotherapy (EBRT) such as VMAT, which results in improved dose distributions and conformity, driven by the need to mitigate exposure to the surrounding healthy tissues. Despite these advantages, there is a growing concern pertaining to new planning techniques, specifically due to potential workflow disruptions led by increased planning times and learning curves for staff, adversely impacting the operational efficiency of radiotherapy departments and overall quality of the treatment (Koka et al., 2022). In light of this, establishing a class solution provides consistency within a radiotherapy department, reduces planning time and serves as an effective tool for staff training. Globally, many hospitals have adopted the use of class solutions as the initial step in treatment planning due to the mentioned advantages (Neill, 2014).

Meanwhile, SSD changes during radiotherapy, such as those from patient weight changes, pose challenges in maintaining the intended absorbed dose to the target volumes and surrounding OARs. Patient contour fluctuations, typically caused by radiation side effects, can affect the SSD, necessitating potential adjustments in treatment plans or rescanning. An investigation of dose distribution changes due to contour changes was carried out to aid the decision of plan reassessment during the treatment course of cervix patients.

This review will analyse research articles chosen with specific reference to the mentioned topics. The search was carried out using the electronic research databases Google Scholar, HyDi, ScienceDirect and PubMed until 02-09-2024. The following keywords were used from the PICO framework: “Cervical cancer patients (population), VMAT (intervention), SSD changes (comparison) & class solution (outcome)”. Only papers published between 2004 and 2024 were considered and in order to be included, the selected articles had to satisfy the following criteria: (1) full text papers written in English, (2) studies which focus on the development of class solutions, SSD changes, cervical cancer and radiotherapy treatment planning. Duplicate findings were eliminated to prevent data overlap. In addition, the following exclusion criteria were

applied: (1) insufficient data, (2) inadequate methodology, (3) and subjective expert opinion papers.

Where applicable, each selected article was analysed under the following themes: (1) title, author/s, year of publication (2) research methodology, data collection tool (3) sampling method, number of participants, response rate (4) findings and (5) limitations & strengths of the study. By evaluating the selected papers, this review aims to provide insights into the effective use of VMAT and class solution development for cervical cancer, as well as the dosimetric impacts of SSD changes during radiotherapy.

2.2 Cervical Cancer

As the fourth most common malignancy in women around the world, cervical cancer poses a serious challenge to global health. Estimated figures published in 2020 regarding cervical cancer showed a total of more than 600,000 new cases and around 350,000 global deaths each year (Sung et al., 2021). In Malta, data issued in 2023 shows that around 13 women are diagnosed with cervical cancer every year, also causing 5 fatalities annually (HPV Information Centre, 2023).

Cervical cancer typically originates from pathological changes in the epithelial cells of the cervix. This oncogenic process frequently initiates with dysplasia, defined as a pre-cancerous stage that has the capacity to grow into malignancy over time. Absent diagnosis and intervention at an early stage through routine screening, such as human papillomavirus (HPV) tests, cervical screenings and Papanicolaou tests, may progress into cervical cancer and further complications (Heffner & Schust, 2014).

Almost every incidence of cervical cancer arises from HPV, a sexually transmitted disease that can lead to the development of abnormal cells in the cervix (IARC, 2007). A larger number of childbirths, smoking, long-term use of oral contraceptives, and certain sexually transmittable infections, such as HIV and Chlamydia trachomatis, are also significant factors contributing to cervical cancer (Thun et al., 2018). While early and limited disease can be surgically removed, the

standardised treatments for cervical cancer currently involve a combination of EBRT, brachytherapy, and/or chemotherapy, depending on each clinical case (ICRU & GEC-ESTRO, 2013).

2.3 Anatomy of the Cervical Region

In the pelvis, the uterus and vagina are located superior and posterior to the pubic bone respectively, as illustrated in Figure 1. The rectum is positioned posterior to the vagina and uterus, while the urinary bladder and urethra are located anteriorly. The ureters lie close on either side of the cervix, embodied by small tubes that carry urine from the kidney to the bladder (McEvoy & Tetrokalashvili, 2023). These adjacent tissues are all considered to be OARs during cervical cancer treatment planning.

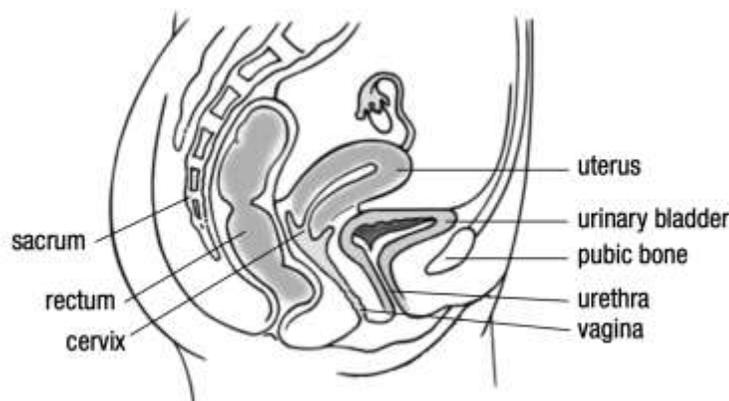


Figure 1: Lateral view of the female pelvic anatomy. Source: WHO, 2014.

2.4 The Linear Accelerator (LINAC)

LINACS accelerate electrons to kinetic energies in the MeV range (between 4 and 25 MeV) through interactions with microwave radiofrequency fields. The monoenergetic electron beam can be either applied directly for superficial treatments, or it can be used in bremsstrahlung to produce photons on a high-density target. By carefully shaping and directing these electron or photon beams to fit the contours of the tumour, the LINAC maximises radiation exposure to the cancer cells while reducing damage to the surrounding healthy tissues (IAEA, 2005).

As a result, the DNA of the cancer cells is damaged by the high-energy radiation, restricting their ability to reproduce and ultimately leading to cell death. Due to their precision and control, LINACS have become a key component for modern radiation therapy, enabling effective tumour treatment with minimal damage to the surrounding healthy tissues, encompassing the main aim of radiotherapy treatment planning (IAEA, 2005).

2.5 External Beam Radiation Therapy (EBRT)

EBRT is a form of radiation therapy which directs electron or photon beams produced by a LINAC towards malignant areas inside the body. EBRT includes 3D conformal radiotherapy, intensity-modulated radiation therapy (IMRT), VMAT, proton and heavy ion beam therapy, among others, which all encompass specific adaptations for the type of tumour and spatio-temporal dynamics. For cervical cancer, the type of EBRT used is often VMAT, with full 360° arcs around the tumour (Koka et al., 2022).

2.5.1 IMRT and VMAT

IMRT produces complex yet highly conformal dose profiles by varying the intensity of each beam through the use of multiple beam angles and multileaf collimators (MLCs), which modulate the intensity of each beam. Meanwhile, VMAT is a type of IMRT which uses a large number of beam directions from an arc trajectory and dynamically distributes doses while the gantry rotates. VMAT has drawn increasing attention as a result of its significantly higher delivery efficiency and smaller MU requirements when compared to fixed-field IMRT (Quan et al., 2012).

In this context, Cozzi et al. (2008) compared VMAT with five-field conventional fixed field IMRT in a planning study including eight cervical cancer patients. Having lower mean absorbed doses, OAR sparing for the bladder and rectum was notably improved with VMAT. Additionally, compared to IMRT, the integral dosage to OARs using VMAT was decreased by approximately 12%. This was also confirmed by a treatment planning comparison by Clivio et al. (2009) which demonstrated acceptable dosimetry results with IMRT, however, VMAT allowed for improvement in sparing some OARs and uncompromised target coverage, particularly through

the use of double arcs. Such results highlight the fact that VMAT is the superior planning technique to treat cervical cancer together with brachytherapy and chemotherapy (Cozzi et al., 2008 & Clivio et al. 2009).

2.6 Treatment Planning

Radiotherapy treatment planning involves the collaboration of clinical experts (oncologists) and technical experts (medical physicists) to ensure the development of high-quality treatment plans. A high-quality plan is defined by the primary aim of treatment planning, which is to closely meet the clinical objectives by delivering the prescribed absorbed dose to the target volume while sparing OARs, adhering to clinical dose constraints while also reducing exposure to as low as reasonably achievable (ALARA). Treatment planning encompasses several stages, from simulation/imaging and contouring to technical plan production and reporting (Hansen, 2022). For simplicity, the following sections will focus on the treatment planning concepts and steps relevant to the aims of this project.

2.6.1 Target Volumes

The International Commission on Radiation Units and Measurements (ICRU) sets standards for specifying volumes and doses in the prescribing, recording, and reporting of radiation therapy plans. According to ICRU Report 83, the Gross Target Volume (GTV) refers to the palpable or apparent extent of the tumour. Surrounding the GTV is the Clinical Target Volume (CTV), which includes the GTV along with any regions suspected of containing microscopic malignant disease. An additional volume known as the Internal Target Volume (ITV), is considered to account for movements, variations in patient positioning, and internal organ motion such as breathing or organ filling, which can cause the tumour to move during treatment. The final Planning Target Volume (PTV) is created by adding an additional margin around the ITV to account for uncertainties in patient setup and daily positioning. Illustrated in Figure 2, these margins ensure that the prescribed absorbed dose covers the entire target area consistently, despite uncertainties (ICRU, 2010).

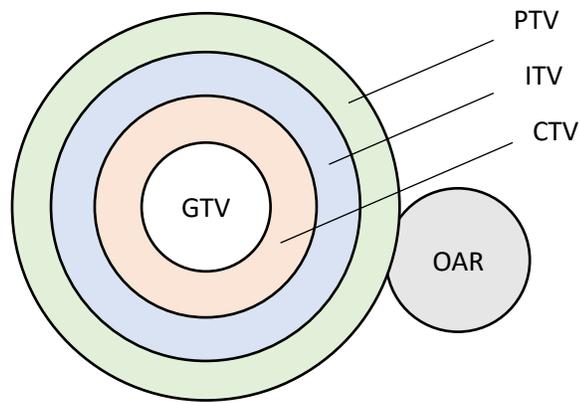


Figure 2. Schematic of the treatment volume and a nearby OAR located in the irradiated (patient) volume. Source: Author.

2.6.2 Organs at Risk (OARs)

In addition to target volumes, OARs are identified and carefully considered during treatment planning. OARs are critical normal (healthy) tissues frequently located near the treatment area that are sensitive to radiation (IAEA, 2005). The goal is to limit the absorbed dose to these OARs to avoid any side effects or damage, while still effectively treating the PTV. For cervical cancer treatment plans, the main OARs which are considered include the spinal canal, bladder, rectum, bowel, kidneys and vagina. In SAMOC, these structures are carefully contoured on the Computed Tomography (CT) images by a team of oncologists.

The vagina requires particular attention in cervical cancer treatment plans, since vaginal absorbed dose points have been defined at the location of the radiation source within the vagina during brachytherapy, which do not reflect the complete absorbed dose received by the entire vaginal structure in VMAT (Wang et al., 2022). To address this issue, Westerveld et al., (2013) defined an anatomical vaginal reference point at the level of the Posterior-Inferior Border of Symphysis (PIBS), ± 2 cm. This landmark serves as a reliable and easily applicable representation of the absorbed dose throughout the whole vagina, based on the specified anatomical landmarks. The associated uncertainty accounts for contouring and dosimetric uncertainties, as well as varying patient anatomies (Westerveld et al., 2013).

2.7 The Monaco[®] Treatment Planning System

Monaco[®] is a template-based planning system which stores data such as beam geometries, VMAT constraints, calculation parameters and settings. Template-based planning is an advantageous planning system since it provides efficient ways for standardisation, allows for ease of use when planning using VMAT or IMRT, and reduces the amount of time required to build such plans, making the process more efficient (Clements et al., 2018).

Monaco[®] is the software of choice both for radiotherapy treatments at SAMOC and for this study due to its many advantages. Firstly, Monaco[®] makes use of constrained optimisation, where the absorbed doses to the OARs, (dose limiting cost functions), are prioritised and achieved before the target doses to the PTV (objective functions) are met. Monaco[®] is also a voxel-based planning system, where the user is able to control the voxels rather than the structures, which gives way to simpler prescriptions, a more intuitive planning process, and quicker planning time overall, particularly when combined with constrained optimisation (Wolff, 2019).

While other TPSs are available, Narayanasamy et al. (2020) found that Elekta's Monaco[®] dose calculations provided more insights to planners through the higher possible outcomes and their associated probabilities, when compared to two other TPSs: Philips Radiation Oncology's Pinnacle³ collapsed cone convolution superposition and Varian's Eclipse anisotropic analytical algorithm.

2.7.1 The Monte Carlo Algorithm

Monaco[®] makes use of the Monte Carlo algorithm, which carries out numerical integrations based on random sampling. Using machine-generated random numbers and probability distributions which determine the physical processes, the radiation transport problem is simulated with the tracks of individual particles. Monte Carlo dose calculation algorithms used in Monaco[®] have been improved in order to replicate patient geometry heterogeneities, beam modification devices such as wedges, and beam geometries. Monte Carlo also considers the radiological variations in various tissues, such as bone and lung, to achieve realistic dosage

computation (Jabbari, 2011). Despite that most algorithms employed in the majority of contemporary TPS are considered accurate, it is widely acknowledged that the Monte Carlo method used by Monaco[®] simulates the closest to actual dosage calculations (Chetty et al., 2007).

2.7.2 Class Solutions

Templates generated by Monaco[®] can be used to create class solutions, defined as prescription templates, which standardise planning approaches across clinics or hospitals. Class solutions are widely used and are considered achievable since there are limited variations in patient geometry within a given population. Moreover, consistency in most treatment goals is ensured through constrained optimisation, where cost functions effectively represent the rules for achieving the desired dose distributions (Ly & Pellegrini, 2018).

2.7.3 Plan Optimisation

Techniques falling under the forward planning category, such as 3D conformal, rely on human intervention to select beam orientation, weights, wedges, and other parameters required to achieve the intended dose distribution. Conversely, IMRT and VMAT make use of inverse planning, which shifts this responsibility to the TPS by adjusting beam intensity based on user-defined constraints. The dose distribution is divided into beamlets, which are traced through the patient to create an initial absorbed dose. Subsequently, the TPS iteratively adjusts the beamlet weights to improve the dose distribution, a process known as optimisation (Srivastava, 2021).

Optimisation in treatment planning is a mathematical process aimed at minimising a cost function. Cost functions are used to assign a numerical penalty to a specific structure, and are categorised as either constraints or objectives. Constraints are mandatory and must be satisfied during optimisation, while objectives are treated as goals that may not be fully achieved in cases where they are too restrictive (Wood et al., 2016). The cost functions used in the final class solution of this study are detailed in Chapter 4.

Monaco® is one of the first TPS available for commercial use and clinical application which enables forward and inverse planning, as well as biological optimisation. Alongside the physical cost functions frequently employed in TPSs, Monaco® introduces three biological cost functions to achieve an optimised treatment plan. These include the Tumor Control Probability (TCP), Normal Tissue Complication Probability (NTCP) and Equivalent Uniform Dose (EUD) (Srivastava, 2021).

Biological optimisation in Monaco® focuses on maximising the TCP, which increases the likelihood of effectively controlling or removing the tumour, while minimising the NTCP, which minimises the risk of complications or damage to surrounding OARs. Surrogates such as the EUD are frequently used in place of TCP and NTCP to guide the optimisation process, ensuring a more precise and targeted treatment plan (Srivastava, 2021). Monaco®'s biological optimisation leverages the EUD to account for both the volume effect of organs and tissue response to radiation, ensuring the required absorbed dose volume is achieved. The EUD is a functional planning tool which represents any two or more dose distributions that yield an equivalent radiobiological impact, expressed as the isoconstraint and isoeffect. The isoconstraint outlines what was requested from the system, while the isoeffect indicates the observed outcome (Wolff, 2019). These functions work alongside traditional physical cost functions, which include statistical parameters of the dose distribution such as maximum dose, minimum dose, and mean dose, to create more effective and targeted treatment plans (Srivastava, 2021).

2.7.4 Stage 1 and Stage 2 Optimisation

Monaco® achieves patient-specific dose distributions through a two-stage optimisation process. In Stage 1, the fluence distribution of IMRT and VMAT beams as well as the weights are optimised to obtain an optimal dose distribution. This is done using a pencil beam algorithm with finite size, which can be employed for rapid dose calculations from segmented beams. The primary aim of Stage 1 optimisation is to work towards an adequate coverage of the target volumes (Winkel et al., 2016).

Stage 2 is then initiated for more precise dose calculations through the use of the Monte Carlo dose calculation algorithm. The second stage focuses on finding the optimal field shapes for the specific treatment plan and also considers any accelerator restrictions such as the MLC and gantry movements (Wood et al., 2016). The objective of Stage 2 is to achieve optimal sparing of the OARs while maintaining acceptable coverage of the target volumes (Winkel et al., 2016).

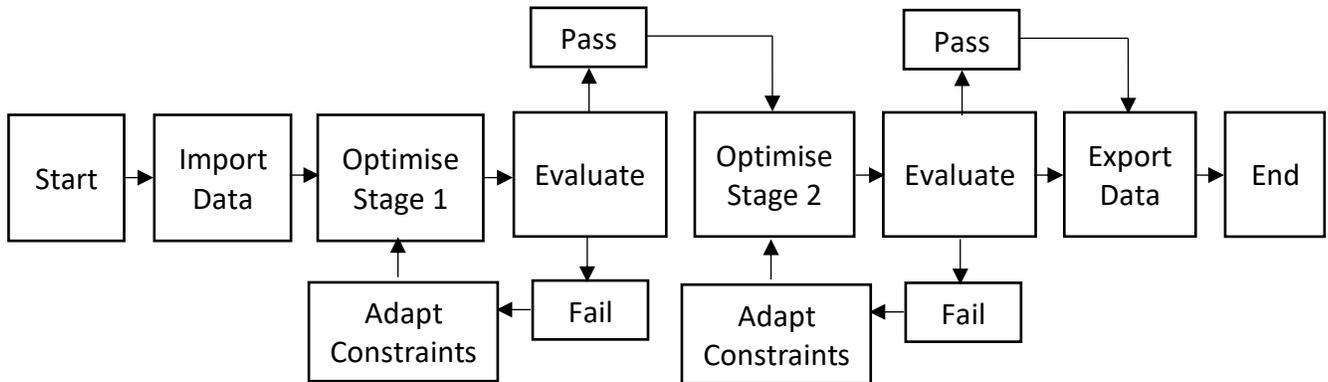


Figure 3. Flow Chart of the Optimisation Process in Monaco®. Source: Author.

The optimisation workflow in Monaco® including both optimisation stages is presented in Figure 3. Initially, a Stage 1 optimisation process is run, and the resulting dosimetric values are evaluated. If the target coverage fails to meet the set requirements, the cost functions for the target volumes are made stricter, while those for the OARs are relaxed, and Stage 1 is re-optimised. Once the coverage requirements are met and the maximum number of iterations is reached, Stage 2 optimisation is initiated. This is carried out iteratively by tightening the cost functions for the OARs based on DVH values, and re-optimising. The process explores multiple solutions through repeated iterations until the maximum number of iterations is reached. By combining this iterative loop with small step sizes, a variety of potential plans are explored, allowing for the achievement of the best plan for treatment (Winkel et al., 2016). The absorbed dose requirements by which the plan is evaluated are typically defined by hard and soft dose constraints and are explained further in Section 2.9.2.

2.8 GEC-ESTRO Recommendations and the EMBRACE Clinical Protocols

A considerable step toward achieving a global agreement on adaptive target definition and reporting of absorbed dose in image guided radiotherapy for cervical cancer patients was the publication of the GEC-ESTRO recommendations in 2008. In particular, the EMBRACE studies established by the GEC-ESTRO GYN network, developed and assessed image guided radiotherapy in cervical cancer with a focus on enhancing clinical outcomes (Pötter et al., 2018). The RetroEMBRACE and EMBRACE I trials have provided evidence showing that the clinical outcome is dependent on the dose prescription and the technique, leading to optimal results through advanced EBRT and brachytherapy techniques, utilising prospective dosage and volume prescription protocols supported by data (Berger et al., 2019).

Meanwhile, the EMBRACE II protocol was derived from a set of studies which integrated and investigated the most cutting-edge EBRT and brachytherapy methods available for treating cervical cancer while providing concurrent chemotherapy to its highest standard. The objectives of EMBRACE II were to validate the results of the RetroEMBRACE and EMBRACE I investigations, benchmark a great overall survival rate through improved local, nodal, and systemic management, as well as a decrease in morbidity and an increase in quality of life. Some of the interventions of the EMBRACE II studies include; the systematic utilisation of IMRT/VMAT, EBRT target considerations related to the primary tumour, requirements for OAR contouring as well as the reduction of treatment time, which contribute to the suggested clinical protocol relevant to this study, presented in the following sections (Pötter et al., 2018).

2.9 Criteria for Treatment Plan Assessment

The assessment of a radiotherapy treatment plan typically involves several criteria to ensure that the plan is both effective and safe for the patient. Key metrics which are currently established in SAMOC and adapted from the EMBRACE II study include the conformity index, and the hard and soft dose constraints (which include the maximum, minimum and mean doses). Quantitative values for the criteria which was used for this study was obtained through the DVH statistics provided by Monaco®.

2.9.1 Dose Volume Histograms (DVH)

DVH statistics provide a clear and quantitative method to assess whether the treatment plan meets the required dose constraints for both the target volumes and OARs. A DVH provides a graphical representation of the distribution of radiation dose within a specified volume, allowing the assessment of whether the treatment plan meets clinical objectives. Typical DVH statistics in treatment planning provide information regarding the volume percentage receiving a specific absorbed dose, the absorbed dose received by a percentage of the volume, the maximum D_{\max} and minimum D_{\min} absorbed dose received by any point within a structure, together with the mean dose D_{mean} received by the whole structure. These histograms allow for the identification of clinically significant features of the absorbed dose distribution, such as areas of excessively high or low doses and other undesirable dose heterogeneities (Srivastava, 2021).

2.9.2 Hard and Soft Dose Constraints

Hard dose constraints are strict limits which must always be adhered to during the optimisation process of the treatment plan, unless stated otherwise by the clinician (Micallef et al., 2023). For cervical cancer, these are currently established by the clinical protocol based from the EMBRACE II studies and serve as a standard assessment for the radiotherapy department in SAMOC. An example of a hard dose constraint for cervical treatment plans is a minimum absorbed dose of 42.8 Gy to the PTV which must be reached by 95 % of the volume (Hansen et al., 2020).

On the other hand, soft dose constraints are more flexible guidelines which aim to balance between delivering an effective absorbed dose to the tumour and minimising exposure to OARs (Hansen et al., 2020). These can be used as optimisation constraints since they are not based on clinical evidence, and are not expected to be completely fulfilled by all patients (Micallef et al., 2023). The hard and soft dose constraints used in this study taken from the SAMOC clinical protocol for cervical cancer (excluding lymph node involvement) with a prescription of 45 Gy in 25 fractions are presented in Table 1. These constraints also align with the recommendations of the International Commission on Radiation Units and Measurements (ICRU), stating that the variation of the target absorbed dose (PTV) should be within the limits of + 7 % and – 5 % of the

prescribed absorbed dose (ICRU, 2010).

Priority	Structure	Gynae (No lymph node involvement or boost) Prescription: 45 Gy in 25 fractions	
		Soft Dose Constraints	Hard Dose Constraints
1	Spinal Canal	/	$D_{0.1 \text{ cc}} < 48 \text{ Gy}$
2	Bowel	$V_{40 \text{ Gy}} < 100 \text{ cc}$ $V_{30 \text{ Gy}} < 350 \text{ cc}$	$D_{\text{max}} < 105 \% (47.3 \text{ Gy})$
3	Rectum	$V_{40 \text{ Gy}} < 85 \%$ $V_{30 \text{ Gy}} < 95 \%$	$D_{\text{max}} < 105 \% (47.3 \text{ Gy})$
4	Bladder	$V_{40 \text{ Gy}} < 75 \%$ $V_{30 \text{ Gy}} < 85 \%$	$D_{\text{max}} < 105 \% (47.3 \text{ Gy})$
5	Kidney	$D_{\text{mean}} < 10 \text{ Gy}$	$D_{\text{mean}} < 15 \text{ Gy}$
6	ITV	/	$D_{99.9 \%} > 95 \% (42.8 \text{ Gy})$
7	PTV	$V_{95 \%} > 98 \%$	$V_{95 \%} > 95 \% (42.8 \text{ Gy})$ $D_{\text{max}} < 107 \% (48.2 \text{ Gy})$
8	CTV-HR + 1 cm	$D_{\text{max}} < 103 \% (46.4 \text{ Gy})$	/
9	Conformality	$\left(\frac{V_{42.75 \text{ Gy}}}{V_{\text{PTV}}}\right) < 1.10$ $\left(\frac{V_{36 \text{ Gy}}}{V_{\text{PTV}}}\right) < 1.55$	/
10	Vagina	$D_{\text{PIBS} - 2 \text{ cm}} < 5 \text{ Gy}$	/

Table 1. Summary of the planning aims for OARs and targets based from the EMBRACE II protocol. Source: Micallef et al., 2023.

In Table 1, V (cc) refers to the volume of a structure and D (Gy) refers to the absorbed dose. A modified CTV structure is considered in this clinical protocol (CTV-HR + 1cm), which includes the CTV and any high risk (HR) regions of containing microscopic disease and an added margin of 1 cm. In the EMBRACE II protocol, D_{max} constraints are interpreted as the absorbed dose to a volume of preferably 0.1 cc ($D_{0.1 \text{ cc}}$), but must not exceed 1.0 cc for all PTV volumes ($D_{1 \text{ cc}}$) and 0.5 cc for CTV-HR and all OAR volumes ($D_{0.5 \text{ cc}}$) (EMBRACE, 2018). Additionally, to achieve better PTV coverage, the soft dose constraint for PTV slightly deviates from EMBRACE II guidelines, which aim for $V_{95 \%} = 95 \%$. The protocol also outlines that the ITV, CTV-HR + 1 cm, kidney, spinal canal and vagina structures might not be contoured in certain patients (Micallef et al., 2023).

2.9.3 Conformality

The conformity index (CI), also referred to as conformality is a measure of the extent that the absorbed radiation dose conforms to the shape of the PTV. A CI close to 1 indicates that the absorbed radiation dose is tightly focused on the target, minimising exposure to surrounding OARs. The CI is defined as the ratio of the target volume which receives a particular absorbed dose (V_{Dose}) and the total target volume (V_{PTV}), as seen in Equation (1) (Al-Rawi et al., 2022). An ideal conformity index would be equal to 1 for optimal conformity, however, this is not always achievable in clinical scenarios (Stanley et al., 2011).

$$CI = \frac{V_{Dose}}{V_{PTV}} \quad (1)$$

2.10 VMAT Plans for Cervical Cancer

With regards to studies focusing on VMAT plans particularly for cervical cancer, Lindegaard et al., (2017) made use of the coverage probability technique and radio/chemotherapy delivering 45 Gy in 25 fractions using VMAT, followed by Magnetic Resonance Imaging (MRI) guided brachytherapy. The results showed that 73 out of 74 pathological nodes found in locally advanced cervical cancer were in total remission at three months, which was promising for nodal control. Despite this, the study was not able to deliver concomitant chemotherapy which aligns with the EMBRACE II criteria.

Another study sought to create simultaneous integrated boost treatment plans with different optimisation functions and auxiliary structures in VMAT for lymph node metastasis in cervical cancer using the RayStation TPS, while considering the EMBRACE II study protocol. The outcome simultaneous integrated boost treatment plans made with 2 arcs were satisfactory according to the quality assurance procedure. However, the created treatment plan failed to achieve the soft dose constraints for the bladder of the majority of the patients as per the EMBRACE II clinical protocol ($V_{40 \text{ Gy}} < 75 \%$ and $V_{30 \text{ Gy}} < 85 \%$), therefore treatment with an empty bladder was recommended. This resulted since the bladder volume was located almost entirely inside the PTV, and the tumour coverage would have been sacrificed to meet the soft dose constraints

(Fjellanger, 2018). Moreover, the bowel hard dose constraint could not be achieved in any of the 5 patients considered in this study, since the bowel and CTV-HR + 1cm structures overlapped ($D_{\max} < 105\%$). Slice-by-slice visual inspection of the dose distributions was suggested to evaluate any potential for plan improvement after the encounter of cold areas due to the large target volumes (Fjellanger, 2018).

2.11 Local Studies on VMAT Class Solutions

In the last two years, the radiotherapy department in Malta updated the clinical protocol to follow the EMBRACE studies. However, no VMAT class solution has been fully developed for cervical cancer patients. Two studies by Bezzina (2015) and Vella (2014) made use of VMAT class solutions for spinal and anal tumours respectively, which met the requirements defined by the clinical protocols used at St. James' University Hospital in Leeds. Despite the positive results demonstrated in both of these studies, it was highlighted that the developed class solution serves as a strong foundation, yet individual optimization of treatment plans remains essential.

2.12 SSD Variations during Radiotherapy Treatment

2.12.1 Findings in the Current Literature

Numerous researchers have reported anatomical changes in cancer patients as a result of weight loss or gain during radiation therapy, resulting in patient contour changes (Hansen et al., 2006 & Ho et al., 2012). A study by Pair et al. (2013) aimed to evaluate the SSD change threshold for replanning and to assess the effects of weight changes on IMRT or VMAT dose delivery in prostate cancer patients. This was done by generating treatment plans for ten patients using clinical IMRT and VMAT for the prostate and seminal vesicles in order to vary the SSDs. A specific dosage change for a designated volume of interest was then used to quantify the differences resulting from the SSD differences. The results showed a change in the target mean absorbed dose by $\pm 2.9\%$ in IMRT and by $\pm 3.6\%$ in VMAT per 1 cm SSD increase or decrease. The mean absorbed dose to the OARs in this study, including the rectum, bladder and femoral heads, showed similar decreasing patterns as the patient size increased, and increasing trends as the patient size decreased. The main limitation of this study was the use of VMAT beams which were not 360°

arcs, which made plans less responsive to changes in patient size. Additionally, routine SSD monitoring was recommended to rule out random fluctuations brought on by patient setup uncertainties such as intrafractional anatomical heterogeneities. (Pair et al. 2013).

Similarly, Chow & Jiang (2013) investigated the dosimetric variations in patients who only experienced weight loss associated with prostate VMAT. It was found that with each centimetre of contour reduction, the maximum absorbed dose to the PTV and CTV-HR + 1cm structures increased by $2.86 \pm 0.30 \%$ and $2.75 \pm 0.38 \%$ per cm respectively, whereas the absorbed dose to the OARs including the rectum and bladder increased by $2.20 \pm 0.20 \%$ and $2.31 \pm 0.83 \%$ per cm of reduced contour, confirming the effects of patient contour reductions on the dose distributions.

2.12.2 Monitor Units (MUs)

The Source-Axis Distance technique is typically used for cervical cancer treatment since it allows the radiation beams to focus on the isocentre. This technique is characterized by a specific dose distribution and MU calculation. A single MU is defined as the quantity of charge picked up by an ionisation chamber placed in the head of a LINAC, that corresponds to a dose of 1 cGy given to a water phantom under known reference conditions (Gibbons et al., 2014). An increase in SSD typically necessitates a decrease in MUs to ensure that the dose constraints of OARs and maximum absorbed dose of PTV are not exceeded. On the other hand, a decrease in SSD, would generally require more MUs to deliver the same absorbed dose as the reference plan (Sellakumar et al., 2011).

2.12.3 X-ray volumetric imaging (XVI)

XVI ensures accurate patient positioning and dose delivery by acquiring three-dimensional images just before each fraction of treatment. It is able to verify and adjust the patient setup to match the reference plan, thus ensuring that the radiation is precisely targeted at the tumour. This imaging modality is vital for maintaining consistent dose distributions and MUs across treatment sessions, as any positional discrepancies or anatomical changes detected by XVI can

prompt adjustments to the treatment setup. It also provides an advantage since it reduces the need for repeated imaging or unnecessary manual interventions during treatment. Unless significant anatomical changes are encountered, such as those occurring due to SSD changes, the dose distributions and MUs stay the same for the duration of all treatment fractions (McBain et al., 2006).

2.13 Gaps in the Current Literature

While much has been published regarding VMAT and its advantages, very little exists in the literature regarding class solution development for radiotherapy treatment planning using VMAT with Monaco® as the TPS of choice, particularly for gynaecological patients. Although there is emerging clinical outcome data in multiple tumour sites, the majority of published data on VMAT is currently limited to planning and feasibility studies. Consequently, a common gap found in the present literature was the need for treatment plan standardisations for cervical cancers.

Furthermore, the current literature focusing on the effects of SSD changes on the planned dose distributions to the target volumes and critical organs is limited, especially for cervical cancer. The radiation oncology team at SAMOC currently assesses whether the patient's physical condition has sufficiently changed to call for a MU change. This is done if the percentage difference between the original and new MUs exceeds $\pm 2\%$, following an SSD increase or decrease. However, this threshold is not supported by scientific evidence and has not yet been tested for its potential to overestimate or underestimate the need for MU adjustments. There are currently no studies which assess the use of XVI guidance in cervical cancer to indicate the need for an MU change when patient contour changes are experienced.

2.14 Conclusion

A critical and systematic review of the literature associated with the development of VMAT class solutions for cervical cancer and the impact of SSD changes during radiotherapy was presented in this chapter. The research methodology used for this study will be described and discussed in the next chapter.

Chapter 3: Research Methodology

3.1 Introduction

The research methodology used for this study is presented in this chapter, which was devised to address the objectives of the study. This study's research approach was quantitative, employing numerical data analysis to investigate the aspects of VMAT planning for cervical cancer treatment. The research strategy focused on creating a generalisable class solution for cervical treatment plans and assessing the impact of simulated patient contour changes on the treatment plans. The data collection techniques included the use of pre-existing CT scans from retrospective and prospective patients. The data collection procedure involved the application of the developed class solution, simulating SSD changes, and adjusting margins to evaluate their impact on dose distribution and MUs. The primary data collection tools were the Monaco® TPS, the Monte Carlo algorithm, as well as the previously acquired CT images, and the data analysis involved the use of DVH and statistical tests such as the mean, standard deviation (SD) and paired t-tests to assess treatment plan quality and the effects of anatomical changes on dose distribution. The ethical considerations and limitations of this study are also outlined in this chapter.

3.2 Research approach

A quantitative research approach was implemented, as it was deemed the most appropriate given the nature of the study. The choice of this approach was supported by the substantial collection of numerical data throughout the study, which necessitated analysis with the appropriate mathematical and statistical techniques, in order to derive the required results and conclusions to reach the objectives of this research.

3.3: Research Methodology: Research Strategy

The overall general strategy for this research was an optimisation study, which included comparative and evaluation aspects. The first part of this project focused on the development of an optimised and generalisable class solution for cervical patients using Monaco® . The second part involved an investigation on the effects of patient contour changes (SSD increase/decrease)

on VMAT absorbed dose delivery in cervical treatment plans and to determine the MU change threshold.

While this study is primarily retrospective, it includes data from both retrospective and prospective cervical cancer patients in Malta who received or were undergoing radiotherapy treatment along the duration of the study. Alternative research structures were possible, including adopting a prospective study which recruits patients undergoing treatment, allowing researchers to observe and adjust plans in real-time as changes occur naturally. However, given the ethical limitations and time constraints of this research, this would lead to a much smaller sample size, reducing the intended generalisability of the research. Hence, the chosen strategies for both parts of the study, explained further below, were considered best-suited based on professional advice and similar literature.

3.3.1: Research Strategy (Part 1): Class Solution Development

The research strategy for the first part of the study was primarily experimental and optimisation-based, which focused towards developing a generalisable class solution by first optimising a treatment plan for one patient and then testing and validating this plan across additional patients. This strategy was deemed most appropriate for the objectives of this study since the approach of first optimising a plan for one patient and then testing and validating the same plan across additional patients ensures that the class solution is not only effective for a single case but is broadly applicable. This process relates to the validation process in machine learning applications, where a model (in this case, a plan) is trained on one set of data and validated on a different, unseen set to test its generalisability. Additionally, through the reference of official dose constraints from clinical protocol, the research ensures that all treatment plans meet current clinical standards, which is critical for the acceptance and implementation of the research findings in actual clinical settings.

Alternative research strategies include comparative studies, which involve evaluating and contrasting various treatment planning methods, and survey-based studies, which focus on gathering data regarding existing practices and patient outcomes. However, an experimental and

optimisation strategy was considered most appropriate since it directly addresses the objective to create an optimised and generalisable class solution which can be applied to future patients. This approach allows for immediate adjustments to the class solution and its validation, ensuring the treatment meets current clinical standards and is effective across multiple cases.

3.3.2: Research Strategy (Part 2): SSD Changes

The research strategy for the second part of the study was experimental and comparative. It involved simulating changes in patient contours to simulate an increase or decrease in SSD, and evaluate their effects. By comparing the effects of different simulated scenarios, the study aimed to determine how variations in patient anatomy influence treatment outcomes.

An alternative research approach could involve an optimisation study to identify the best treatment plan under varying patient conditions. However, an experimental and comparative strategy was deemed more appropriate, as it allows for a detailed exploration of how specific changes in SSDs (simulating changes in patient contour) impact treatment efficacy, better reflecting real clinical scenarios that can affect radiation therapy outcomes. Additionally, current plans are not reoptimised after an SSD change, instead, MUs are adjusted, and the plan is recalculated, making optimisation studies less suitable for this part of the research.

3.4: Data Collection Technique

The data collection technique for this study was based on the original CT simulation scans for 20 retrospective and/or prospective cervical cancer patients who finished treatment or were receiving radiation treatment along the duration of the study at SAMOC. The choice of this technique was primarily driven by the need for high-quality, consistent, and comprehensive data without imposing additional radiation exposures to patients. This approach also leverages existing resources effectively, since pre-existing contours were used, which prevented the need of creating new contours for each patient and hence making the process more time-efficient. Moreover, using existing data was found to facilitate the ethical approval process since it excludes patient intervention. While other methods such as prospective imaging or multi-institutional collaboration are available, they tend to involve greater complexity, higher costs or

increased patient risk. Phantom studies could have also been considered, however, they often lack the accuracy of data obtained from actual patients, making them less suitable for the objectives of this study.

3.5: Data Collection Procedure

The target population for both parts of this study consisted of cervical cancer patients who have received or were currently receiving radiation treatment at SAMOC along the timeline of the data collection process. In order to meet the inclusion criteria, the patients had to be prescribed a dose of 45 Gy in 25 fractions to the cervix, adhering to the EMBRACE II protocols (EMBRACE II, 2018). The highest possible sample size (n) was aimed for this study, and a total of 20 patients with the specified dosimetric requirements and treatment regime gave the required approval to proceed with the study using their CT scans, following a response rate of approximately 40 %. This number of patients was considered sufficient for the commencement of this study since it provided a balance between ensuring robust and reliable results for the class solution (Part 1) and simulated margins (Part 2), while maintaining the feasibility and manageability of the research process, given the complexity of treatment plans and the large amount of data analysis involved. The sampling technique was a combination of retrospective and prospective sampling.

The representativeness of the sample is crucial to ensure that the findings of the study are generalisable to the broader population of cervical cancer patients in Malta. The inclusion criteria considered facilitated the standardisation of the sample, however, random selection within these constraints aimed to mitigate selection bias and ensured that the sample reflects a typical patient population receiving similar treatments. Excluding the CT simulator which was used to collect the CT images from the patients before their treatment, no equipment set-up was involved in both parts of this project.

Prior to data collection, the structures of the 20 patients were contoured and checked by the oncologists at SAMOC according to the national VMAT clinical protocol for cervical cancer. The only point which was not defined was the PIBS – 2 cm, which had to be manually added for each patient in this study. This was done by considering the CT slice which contained the posterior-

inferior border of the pubic symphysis bone, and displacing the interest point inferiorly by 2 cm, as recommended by Westerfield et al. (2013). The absorbed dose was then given by the “Interest Points and Markers” feature in Monaco®. An example of the defined anatomical location of this reference point on the CT image of one of the patients is illustrated in Figure 4.

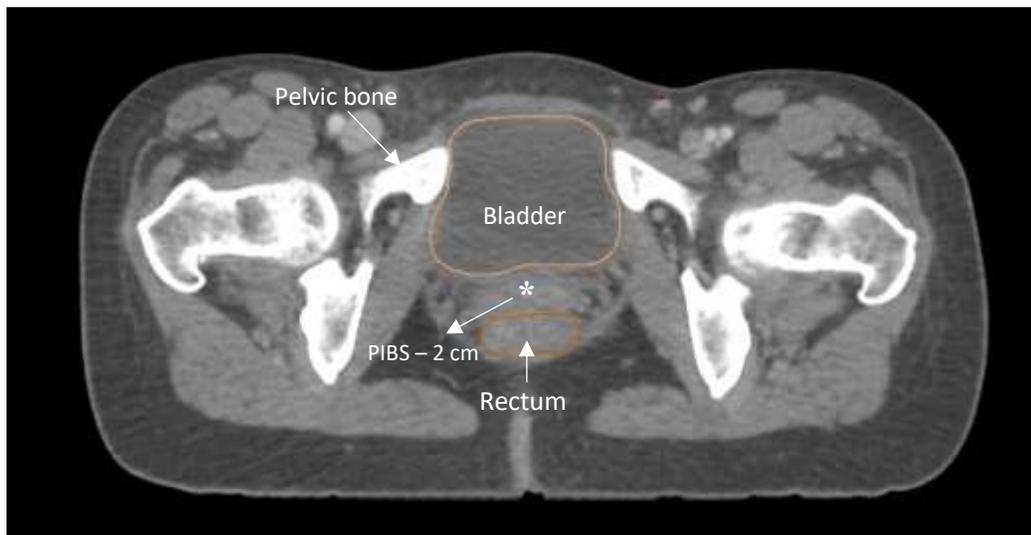


Figure 4. Axial CT slice of the pelvis from one of the patients showing the anatomical location of PIBS – 2cm reference point, marked with an ‘*’.

3.5.1 Data Collection Procedure (Part 1): Class Solution Development

The first part of the study was initiated by assembling the class solution based on one randomly selected patient. This was achieved by optimising a treatment plan for the randomly chosen patient which maximises the absorbed dose to the tumour whilst keeping the absorbed dose to the OARs ALARA, through the use of the parameters and cost functions mentioned in Section 3.6. During optimisation, reference was made to the official hard and soft dose constraints compiled by the radiotherapy team and currently used in SAMOC, based on the national clinical protocol presented in Section 2.9.2, Table 1.

Once the first plan was generated and optimised, the same plan with identical isoconstraints, number of beams, collimator angles and cost function parameters, was tested on four other patients, serving as the testing stage. Five patients were chosen for the testing stage based on

what was done in other similar studies by Fjellanger (2018) and Bezzina (2015), who both used 20 % of their sample size (1 out of $n = 5$) for testing. Given the comparatively larger sample size in this study ($n = 20$), the ratio of the number of patients in the testing set to the validation set was 25 % to 75 % (5:15). This ratio ensured that the model achieved a generalisable class solution, which is important to prevent overfitting and ensure that the template can perform well on unseen patients, thereby improving its clinical applicability (Lever et al., 2016).

The first plan was adjusted as needed to obtain a generalisable plan which satisfied the hard dose constraints for all five patients and meets the soft dose constraints where possible. The class solution with the necessary adjustments was then saved as a template and validated on the remaining 15 patients, ensuring a larger sample to evaluate the applicability of the class solution.

3.5.2 Data Collection Procedure (Part 2): Investigation of SSD Changes

The same 20 patients used in the first part of the study were used for this investigation, each with the same template, isoconstraints, collimator and beam arrangements. For each patient, 18 different SSD changes were simulated; the (1) 'SSD + 0.5 cm' plan, (2) 'SSD + 1.0 cm' and (3) 'SSD + 1.5 cm' plan, where the external contour was increased by 0.5 cm, 1.0 cm and 1.5 cm respectively. Conversely, the (4) 'SSD - 0.5 cm' plan, (5) 'SSD - 1 cm' and (6) 'SSD - 1.5 cm' plans reduced the external contour by 0.5 cm, 1.0 cm and 1.5 cm respectively. These were then compared with the 'base' plan, which consisted of the clinical treatment plan with the finalised class solution without any SSD changes.

The SSD changes were applied in three different ways; anteriorly, laterally, and uniformly (encompassing a combination of lateral and anterior). Since weight gain is typically seen anteriorly and laterally in the pelvis and the couch prevents any posterior changes, given that the patient is set up in a supine position, the changes were not specified in the posterior direction (Pair et al., 2013). The different types of SSD changes considered for the simulation of patient contour changes are demonstrated in Figures 5 and 6.

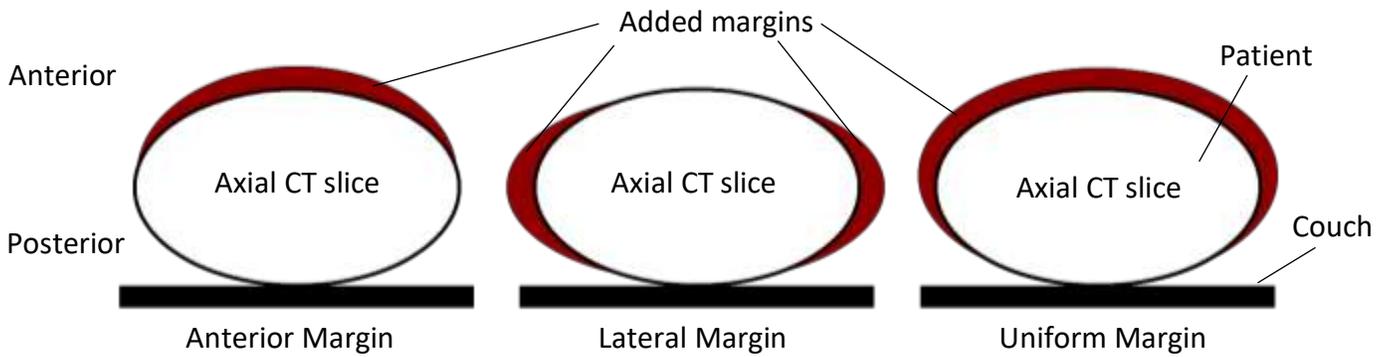


Figure 5. Added external contours to pelvis CT slices for weight gain simulation.

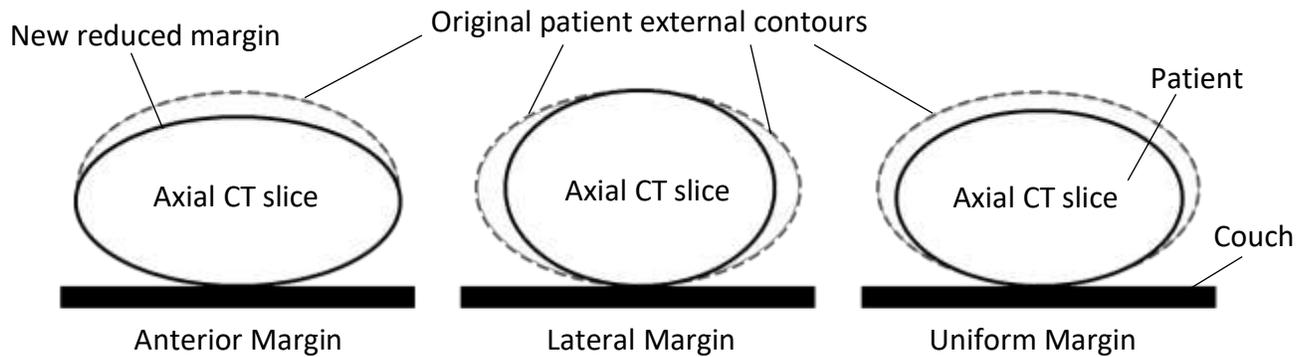


Figure 6. Subtracted external contours to pelvis CT slices for weight loss simulation.

The added tissue was assigned a relative electron density of 1 (mimicking soft tissue), while the missing tissue was given a relative density value of 0.01, which was the lowest achievable value of electron density on Monaco® closest to zero (mimicking air). These values aided the TPS to consider the specified margins as ‘missing’ tissue, or ‘added’ soft tissue/fat. In some plans, a subtraction in margins caused a decrease in volume for the bowel. This was accounted for by the assigned density of 0, where the extra bowel tissue which extended beyond the patient contour was considered to be equivalent to air by the simulated margins. After the margins were created, the plan was recomputed, rather than reoptimised as done in Part 1. This approach was taken since the objective for this part of the study was to evaluate the impact of SSD changes on the

dose distribution without changing the underlying optimisation parameters obtained from the first part of the study.

Once the density overrides were specified and the absorbed doses were recalculated, the expansion and contraction plan in all three directions (uniform, anterior, lateral) were compared with the clinical 'base' treatment plan for each patient. The plan quality was assessed using the DVH statistics of the target and OAR structures by considering the dose constraints outlined in the clinical protocol (refer to Table 1) and comparing the absorbed dose coverage and OAR absorbed dose values with the original plan before the margins were applied. The template in Table 2 was used to collect and fill in the data for each patient after applying the SSD changes for each margin size and direction. In addition, data on the MUs before and after applying the margin adjustments was collected for each of the 20 patients.

In order to determine if a MU change is required after the application of margins, the establishment of a revised threshold was needed. This was achieved by analysing the individual results for each patient (presented in Appendix 6 - 11) after the adjustments and comparing the results to the percentage difference in MUs for each case. The percentage difference in MUs above which the average hard dose constraints were not satisfied was considered as the clinically significant recommended threshold. The method of obtaining this threshold value is further explained in Section 3.7.1.2.

3.6: Data Collection Tool

The primary data collection tool for this research was the Monaco[®] TPS version 5.11.03, developed by Elekta (Elekta AB, 2016). This advanced software was useful for creating, modifying, testing and validating the VMAT class solution and adjusted treatment plans. It also facilitated the generation and review of DVHs, which together with the dose constraints, were used to collect statistical data, ensure consistency and adherence to clinical standards. Meanwhile, previously collected CT scans of the selected patients were used for accurate anatomical representation which provide the necessary imaging data for treatment planning and subsequent analysis. The same TPS, CT images and patients were used for both parts of the study. Alternative

TPSs such as Eclipse by Varian or Pinnacle by Philips are also available for VMAT treatment planning. Despite this, Monaco® was the TPS of choice for both parts of this study since it is the only available system which is currently in use at SAMOC, being the only oncology centre in Malta. This ensures that the developed class solution can be easily adopted by Medical Physicists in Malta to help streamline their workload.

Structure	Constraint	Hard/Soft	Reference Absorbed Dose (Gy)	Volume (cc) or (%)	Pass
PTV	<i>V95% > 95 % (42.8 Gy)</i>	Hard	42.80	...	...
PTV	<i>Dmax < 107 % (48.2 Gy)</i>	Hard	48.20	...	...
PTV	<i>V95% > 98 %</i>	Soft	42.80	...	...
ITV	<i>D99.9% > 95 % (42.8 Gy)</i>	Hard	42.80	...	...
CTV-HR+1	<i>Dmax < 103 % (46.4 Gy)</i>	Soft	46.40	...	...
Bladder	<i>Dmax < 105 % (47.3 Gy)</i>	Hard	47.30	...	...
Bladder	<i>V30Gy < 85 %</i>	Soft	30.00	...	...
Bladder	<i>V40Gy < 75 %</i>	Hard	40.00	...	...
Rectum	<i>Dmax < 105 % (47.3 Gy)</i>	Soft	47.30	...	...
Rectum	<i>V30Gy < 95 %</i>	Soft	30.00	...	...
Rectum	<i>V40Gy < 85 %</i>	Soft	40.00	...	...
Bowel	<i>Dmax < 105 % (47.3 Gy)</i>	Hard	47.30	...	...
Bowel	<i>V30Gy < 350 cc</i>	Soft	30.00	...	...
Bowel	<i>V40Gy < 100 cc</i>	Soft	40.00	...	...
Structure:	Constraint	H/S	Ref. Dose (Gy)	Volume Ratio	Pass
Conformality	< 1.10	Soft	42.75	...	...
Conformality	< 1.55	Soft	36.00	...	...
Structure:	Constraint	H/S	Ref. Dose (Gy)	Dose (Gy)	Pass
PIBS-2cm	<i>DPIBS-2cm < 5 Gy</i>	Soft	5.00	...	...
Kidney Right	<i>Dmean < 10 Gy</i>	Hard	15.00	...	...
	<i>Dmean < 15 Gy</i>	Soft	10.00		...
Kidney Left	<i>Dmean < 10 Gy</i>	Hard	15.00	...	...
	<i>Dmean < 15 Gy</i>	Soft	10.00		...

Table 2. Template used for data inputting of altered DVH statistics.

The Monaco[®] TPS also incorporates the Monte Carlo algorithm as a critical component of its dose calculation engine. In this study, the Monte Carlo algorithm was part of the data collection tools required to ensure that the isoconstraints and cost functions were accurately computed, reflecting the variations in tissue density and patient anatomy. Despite this, Monte Carlo calculations involved a limitation which involves substantial time and computational resources required to optimise a treatment plan.

Ongoing reviews and system updates on the TPS are carried out by Elekta representatives throughout the year, ensuring accurate functioning. In the case of a system upgrade, the Medical Physicists at SAMOC carry out commissioning tests, which include checking of input and output devices, the reference subset of data and the prediction subset, as well as tests on MU calculations and the reference Quality Assurance (QA) test set. Regular QA tests on the TPS include daily final verification of the treatment plans and isodose distributions by the planner ensure that the system's outputs are reproducible and accurate according to the clinical goals (IAEA, 2005).

3.6.1 Monaco[®] Treatment Plan Parameters for Class Solution Development (Part 1)

The segmentation and calculation parameters in Monaco[®] significantly influenced the development of the class solution, given that they are specific to each plan and impact both dose calculation and optimisation. As described in Section 2, the Monaco[®] TPS uses a two-stage process for optimising dose distributions: in Stage 1, an ideal fluence distribution is optimised to meet the prescribed absorbed dose for a single set of beams, while in Stage 2, this fluence is converted into segments with optimised shapes and weights (Winkel et al., 2016). Key parameters affecting these stages are discussed in the following sections.

3.6.1.1 Segmentation Parameters

The concerned parameters for Part 1 of the study included the maximum number of arcs, maximum control points per arc, minimum segment width and fluence smoothing. The maximum number of arcs refers to the maximum allowed arcs per plan. Increasing arcs enhances beam modulation and allows for more complex dose distributions, potentially improving OAR sparing,

but it also increases treatment time. Meanwhile, the maximum number of control points per arc limits the number of segments allowed per arc. Increasing this number can improve dose distribution. Typically, the number of control points depends on plan complexity and balancing plan quality and treatment time (Wolff, 2019).

The 'minimum segment width' defines the smallest segment field area (in cm²) the user is willing to accept, created during Stage 2 optimisation. Although arc size and MUs vary between segments, the dose rate remains constant. In VMAT plans, users can choose to perform Segment Shape Optimisation, which includes smoothing, sequencing, and optimising beam weights and shapes. The Fluence Smoothing parameter affects the smoothness of the fluence in Stage 1 of optimisation. Lower settings can improve plan quality but may produce too many segments, while higher settings can overly smooth the fluence, potentially worsening the outcome. A 'Medium' setting is recommended as a balanced starting point (Gang et al., 2021).

3.6.1.2 Calculation Properties

The calculation properties were defined by the grid spacing, secondary algorithm and statistical uncertainty (SU). The Grid Spacing parameter determines the spacing of calculation points on a 3D grid that covers all contoured structures. Reducing the grid spacing improves resolution and accuracy but significantly increases calculation time. The Secondary Algorithm is used in Stage 2 of the optimisation process after creating MLC beam segments (Roche et al., 2018). Among other options, Monte Carlo was found to be recommended for its higher accuracy, despite the fact that it requires more calculation time (Chetty et al., 2007).

Finally, the accuracy and calculation time of Monte Carlo dose calculation algorithms are determined by their intrinsic SU, despite the fact that these algorithms are acknowledged as the most accurate for treatment planning (Kawrakow, 2004). According to Keall et al. (2008), the square root of the calculation time has an inverse relationship with the Monte Carlo SU. This strikes a balance between the allowable SU and the accuracy of the dose computation. The accuracy of the dose calculation can be improved by a lower SU value, however, the calculation time consequently increases (Kawrakow, 2004).

3.6.2 Monaco[®] Cost Functions

Developing an effective class solution requires a thorough understanding of the parameters available in the TPS. Through an experimental approach, the following parameters provided optimal results and were applied to the class solution as needed.

3.6.2.1 Equivalent Uniform Dose (EUD)

The EUD is a biological cost function defined as the uniform dose which results in the same average surviving clonogen count as the actual non-uniform irradiation when applied homogeneously to a tumour (Wolff, 2019). This metric provides the planner with flexibility in finding an optimal solution by adjusting for cell sensitivity, where higher sensitivity reduces the permissible volume below the prescription dose. However, achieving this might be constrained by other fixed parameters, balancing the need for uniformity with practical limitations in treatment planning. The EUD is effective for simple targets with minimal OAR overlap and also performs well in plans where a maximum target absorbed dose is not a strict requirement (Navia et al., 2023) .

3.6.2.2 Target Penalty

The Target Penalty is a physical cost function which imposes a quadratic penalty for any voxel surpassing a designated threshold absorbed dose, effectively discouraging overdosing in the target region. This mechanism ensures that if a section of the target volume is exposed to an absorbed dose above the threshold, the penalty becomes increasingly severe, leading to a steep dose gradient beyond this point. Consequently, the model does not compensate for any under-dosed (cold) regions by allowing over-dosed (hot) areas within the target. Instead, it promotes uniformity within the target dose distribution while strictly controlling for excessive absorbed doses that could lead to adverse effects. This approach ensures precise targeting and reduces the likelihood of unnecessary tissue damage and frequently results in a steeper Target DVH than an EUD-based cost function. The Target Penalty is considered the most effective cost function for treatment plans which demand greater complexity, as is frequently the case with cervical cancer (Wolff, 2019).

3.6.2.3 Quadratic Overdose

The Quadratic Overdose cost function introduces a flexible approach to managing absorbed dose limits, particularly when small hot spots within the treatment area are considered acceptable. Instead of enforcing a strict maximum absorbed dose limit, this function allows for a controlled violation of the dose threshold, accommodating scenarios where a small amount of overdose might be clinically justified. The penalty incurred begins once the absorbed dose surpasses a pre-defined maximum dose. However, to prevent excessive penalization that could lead to cold spots in the target volume, the function incorporates the Root Mean Square (RMS) metric, representing the acceptable level of dose violation. This approach ensures a balance between maintaining dose uniformity across the target while permitting minor dose exceedances, thereby enhancing the overall quality and safety of VMAT plans. Using a quadratic overdose in a target penalty cost function imposes stricter control over hot spots by penalizing higher absorbed doses more aggressively, whereas without it, the dose distribution may allow for larger hot spots with less penalty, as shown in Figure 7.

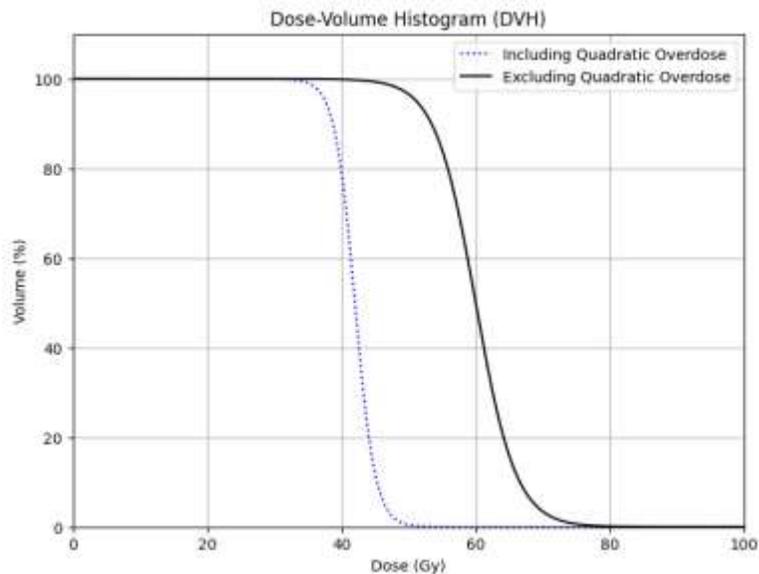


Figure 7. DVH of a Target Penalty with and without a Quadratic Overdose. Source: Author.

3.6.2.4 Serial & Parallel

Serial OARs, such as the spinal cord, are organs which will lose function if any part of their volume receives a maximum absorbed dose. The serial cost function in Monaco® is designed to limit the

maximum absorbed dose received by such organs, allowing the optimiser to focus on controlling hot spots and ensuring that no part of the organ is exposed to absorbed doses that could cause damage or adverse effects. The serial cost function uses an isoconstraint derived from the EUD. This function incorporates a Power-Law Exponent (PLE), which is defined as a volume-effect parameter (Wolff, 2019). As seen in Figure 8, a PLE value of 1 distributes evenly across the DVH curve, while Figures 9 and 10 show higher PLE values of 10 and 20 respectively, which increasingly shift the effect towards the maximum dose, causing an increased penalty for excessive absorbed doses to small volumes (Vella, 2014).

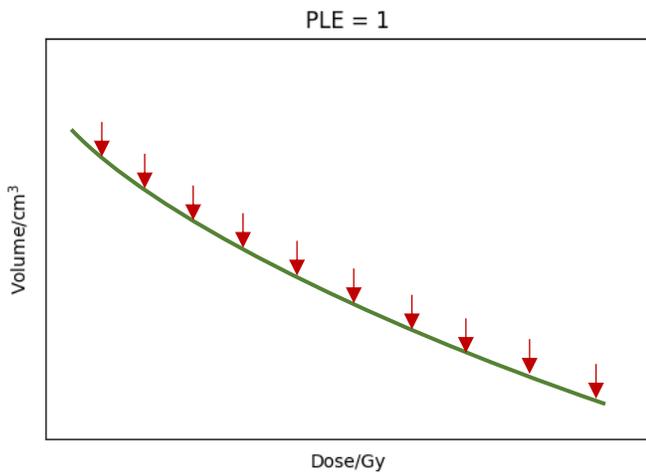


Figure 8. Effect of PLE = 1. Source: Author

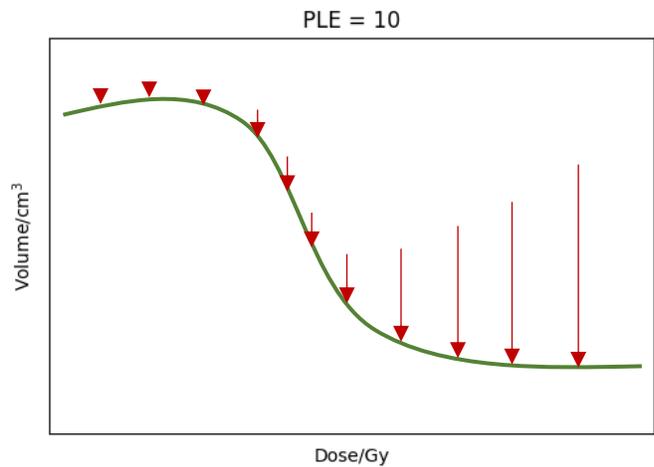


Figure 9. Effect of PLE = 10. Source: Author

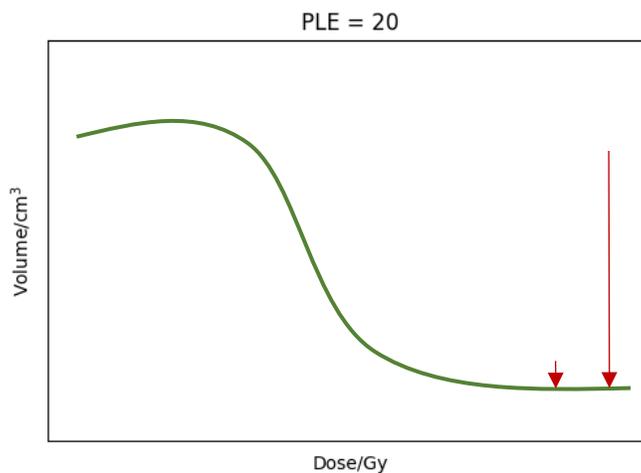


Figure 10. Effect of PLE = 20. Source: Author

On the other hand, parallel OARs such as the lungs differ since they can tolerate higher absorbed doses as long as the exposure is limited to a specific portion of their volume, or in cases where they are paired organs, one organ can compensate for the loss of function in the other. The parallel cost function in Monaco® enables more control to the dose delivered to a certain percentage of the organ's volume, while still allowing overlapping target structures, such as tumours, to receive the prescribed absorbed dose (Wolff, 2019). This approach ensures that critical functions are preserved in serial OARs and that sufficient therapeutic doses are delivered to target structures adjacent to parallel OARs without compromising organ function (Can et al., 2022). During the experimental phase of the study, both the parallel and serial cost function were evaluated for their effectiveness in optimising the dose distribution OARs, specifically the bladder, bowel, rectum and kidneys.

3.6.2.5 Optional Physical Parameters

Monaco® also provides the user to select the optional physical parameters with specific cost functions. An example of these parameters includes the shrink margin, which is used to modify the volume of a structure during optimisation by reducing its size by a specified margin. This is typically used when an overlap between the target volume and OARs is encountered and is often applied to OARs to protect the most sensitive regions while allowing for a slightly higher absorbed dose at the less critical areas at the periphery. A voxel is defined as a three-dimensional pixel, representing a small, discrete element of the patient's anatomy in the CT scans used for planning. Subsequently, the 'optimise over all voxels' option refers to when the optimisation process considers the dose distribution across every voxel within a defined volume during treatment planning. This option is particularly useful when dealing with small structures (Wolff, 2019).

3.7: Data Analysis Technique

3.7.1 Statistical Tests for Data Analysis

The appropriate statistical tests for both parts of this study were determined based on the respective objectives. Statistics provided by the DVHs were crucial for assessing how the radiation dose is distributed across different volumes within the patient. This was done by the TPS itself by calculating the percentage of a target organ or critical structure that received a

particular dose specified by the user. The DVH statistics provided a quantitative way to verify that the absorbed radiation dose adheres to the clinical guidelines (based on the EMBRACE II protocol).

3.7.1.1 Statistical Tests for Data Analysis (Part 1): Class Solution Development

For the first part of the study, the goal was to assess the variability of the class solution by testing if the outcomes (i.e. PTV coverage, doses to OARs etc.) are consistent across all 20 patients. The mean and SD of all outcomes were calculated to assess the spread of results among the sample of patients, and hence, the generalisability of the class solution. The SD S of the mean volume receiving a particular dose as per the clinical protocol for each structure was calculated through Equation (2);

$$S = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n - 1}} \quad (2)$$

where n is the number of patients (20), x_i is the data from each individual patient and \bar{x} is the mean of the patient data per structure (McClave & Sincich, 2018). Subsequently, the uncertainty values for the mean calculations were obtained from the standard error of the mean (SEM) calculation, which measures of how far the sample mean is expected to vary from the actual population mean, denoted in Equation 3;

$$\text{SEM} = \frac{S}{\sqrt{n}} \quad (3)$$

While alternative statistical methods like Analysis of Variance (ANOVA), the Wilcoxon signed-rank test could have been considered for this study, the chosen approach of calculating the mean, SD, and SEM was most appropriate for the aims of the first part of the study. ANOVA would have been useful for comparing outcomes across patient subgroups, and the Wilcoxon test for assessing median differences without assuming normality, but neither directly addressed the study's primary goal of evaluating overall generalisability. The SD effectively measured the spread of outcomes, while the standard error provided a precise estimate of the uncertainty around the mean, making these metrics ideal for determining how reliably the class solution performed across a diverse patient sample.

3.7.1.2 Statistical Tests for Data Analysis (Part 2): Investigation of SSD Changes

For the second part of this study, the percentage difference between the original MUs and the updated MUs was calculated for each patient and each margin adjustment, through Equation (4).

$$\text{Percentage Difference} = \frac{|\text{Updated MUs} - \text{Original MUs}|}{\text{Original MUs}} \times 100 \quad (4)$$

Since the analysis for this part of this study required the comparison of MUs for each patient before and after applying the different margins, a paired samples t-test was considered appropriate. This was carried out for each of the 18 margins in each direction (anteriorly, laterally, and uniformly), which amounts to 18 t-tests (6 margins \times 3 directions). The null hypothesis (H_0) for the paired t-test was that the mean percentage difference between the original MUs and the updated MUs is zero, indicating no significant effect of the margin adjustment. Meanwhile, the alternative hypothesis (H_1) was that the mean percentage difference is not equal to zero, indicating a significant effect of the margin adjustment. This test was conducted through Microsoft Excel for each margin adjustment, comparing the original MUs with the new MUs.

Prior to conducting the t-test, the Shapiro-Wilk Test was performed using Python v.3.12.4 to assess whether the collected followed a normal distribution, which is a necessary condition for a paired t-test. Given a sample size of less than 50 in this study, the Shapiro-Wilk Test Statistic W was appropriate to assess normality. After applying Equation (5) derived from McClave & Sincich (2018), the results indicated no significant difference from normality, confirming that the sample approximates a normal (Gaussian) distribution, making the t-test valid. The code used for this analysis is provided in Appendix 1.

$$W = \frac{(\sum_{i=1}^n a_i x_{(i)})^2}{\sum_{i=1}^n (x_i - \bar{x})^2} \quad (5)$$

The variables in the Shapiro-Wilk test include the sample size n (20), the i -th order statistic $x_{(i)}$, the i -th value in the original sample x_i , the sample mean \bar{x} and the pre-computed constants or

weights a_i which are based on the expected values of the order statistics from a standard normal distribution (McClave & Sincich, 2018).

A p-value of 0.05 was first considered for the paired t-test since it is a widely accepted threshold in scientific research for determining statistical significance (Concato & Hartigan, 2016). However, this value represents a risk of concluding that a difference exists when there is no actual difference, also referred to as false positives (Type I error). Issues in p-value quantification also arise in multiple testing scenarios, where the likelihood of obtaining a statistically significant result by chance increases as more tests are run. To address these, the Bonferroni correction was applied to adjust the significance level, reducing the risk of Type I errors and ensuring that the results are not due to random variability. This correction was considered most appropriate given the number of tests for this part of the study is relatively small (Jafari & Ansari-Pour, 2019). The Bonferroni correction was implemented using Equation (6);

$$\alpha_{\text{corrected}} = \frac{\alpha}{m} \quad (6)$$

where $\alpha_{\text{corrected}}$ is the Bonferroni-corrected significance level, α is the original significance level and m is the number of independent tests or comparisons (18) being performed (Emerson, 2020). Hence, for this part of the study, each individual test would need to have a corrected p-value of 2.8×10^{-3} or less to be considered statistically significant and that the MU differences did not occur due to chance.

Although other statistical methods are available, the paired t-test was optimal for comparing the related samples of original and updated MUs for each patient across different margins. For instance, a Wilcoxon signed-rank test could have been used if the data were not normally distributed, offering a non-parametric alternative that does not assume normality (Vierra et al., 2023). However, the Shapiro-Wilk test confirmed that the data approximated a normal distribution, validating the use of the paired t-test. The paired t-test was chosen over independent samples or one-sample t-test since it specifically accounts for the fact that the same

patients were measured before and after the margin adjustments, making it ideal for comparing two related samples and detecting the effect of the margin adjustments within the same group of patients.

In addition, a repeated measures Multivariate Analysis of Variance (MANOVA) was considered to determine if there are any significant differences in the MU values based on the margin sizes applied and their directions, which could eventually help in identifying the conditions that exceed the MU percentage difference threshold (Imelda et al., 2023). However, after testing the data for its suitability using Python v.3.12.4 (refer to Appendix 2 for code) it was determined that the data collected did not satisfy the no multicollinearity condition, and hence was not suitable for the MANOVA test.

3.7.2 Determination of MU Change Threshold (Part 2)

While the paired t-test provides insights into whether the differences are statistically significant, practical significance was also considered. This refers to whether the magnitude of the observed differences in MUs is large enough to have practical implications, such as requiring a revision of the MUs. To determine practical significance, a threshold was established based on the DVH statistics of the altered plans after margin application. If the mean percentage difference calculated through Equation (4) exceeds this threshold, it would suggest that the change is not only statistically significant but also clinically relevant.

The threshold for determining the clinical significance of changes in MUs was established by closely examining the DVH statistics for each patient after applying the SSD changes. For each patient, the new DVH outcomes were compared with the corresponding percentage difference in MUs. Specifically, the percentage difference at which the hard dose constraints failed to meet the established clinical protocol was identified and set as the threshold. This approach ensured that the selected threshold was both data-driven and clinically relevant, reflecting the point at which adjustments in MUs began to compromise the integrity of the treatment plan.

For the individual margins, the uncertainty value was obtained by using the standard error calculation in Equation (3). The RMS value for each uncertainty was then computed by implementing Equation (7) into Microsoft Excel in order to obtain a single uncertainty value which is representative of all 18 individual uncertainty values for the final percentage difference threshold value. The RMS was chosen since it gives a measure of the overall magnitude of the uncertainties and is particularly useful when combining uncertainties with varying magnitudes (Kirkup & Frenkel, 2006). The RMS is mathematically expressed as:

$$\text{RMS} = \sqrt{\frac{1}{N} \sum_{i=1}^N x_i^2} \quad (7)$$

where N is the number of uncertainty values (18) and x_i represents each individual uncertainty value (McClave & Sincich, 2018).

Meanwhile, the influence of systematic uncertainties for MUs is often mitigated by cancellation given that the dosimetric quantities simulated by Monte Carlo for treatment planning, including MUs, are relative (ratios of absorbed dose values under changing conditions). Hence, to account for other random uncertainties, an uncertainty σ_{MU} of ± 0.1 was assigned to the original and new MU values, since the MU value closest to the base value, rounded to 1 decimal place, was chosen. This accounts for potential small variations in selecting the most appropriate value based on the available precision. When MUs are calculated using separate Monte Carlo calculations, as in this case, error propagation can be used to estimate the final uncertainty (Ma et al., 2005). Hence, the uncertainty for the percentage differences $\sigma_{\%}$ between the original MUs (MU_0) and new MUs (MU_1) was obtained through Equation (8);

$$\sigma_{\%} = \text{Percentage Difference} \times \sqrt{\left(\frac{\sigma_{\text{difference}}}{|\text{MU}_0 - \text{MU}_1|}\right)^2 + \left(\frac{\sigma_{\text{sum}}}{|\text{MU}_0 + \text{MU}_1|}\right)^2} \quad (8)$$

where $\sigma_{\text{difference}}$ and σ_{sum} are the uncertainties in the difference and sum between the two MU values, both calculated as $\sqrt{\sigma_{\text{MU}_0}^2 + \sigma_{\text{MU}_1}^2}$ (Morrison, 2021).

3.7.3 Research hypotheses

The research hypothesis and null hypothesis for the first part of the study are:

- H1₁: The VMAT planning class solution will provide a generalisable plan with appropriate dose conformity to the target while reducing the absorbed dose to OARs and adhering to the clinical protocol requirements.
- H0₁: The developed class solution does not provide a generalisable plan for cervical cancer patients and does not satisfy the requirements set by the clinical protocol.

The hypothesis and null hypothesis for the second part of the study are:

- H1₂: Modifications to account for changes in SSD will significantly deteriorate the quality of the treatment plan as measured by the DVH statistics, requiring a MU change.
- H0₂: Modifications do not significantly deteriorate the quality of the treatment plan as measured by DVH statistics and no MU change is necessary.

3.8 Ethical Considerations

This study has been approved by the University Research Ethics Committee of the University of Malta. The ethical considerations of this research study have been considered by obtaining permission from the CEO of Mater Dei and the Chairperson of SAMOC, while also obtaining data protection clearance from the Data Protection Officer at Mater Dei Hospital. A consent letter was also sent to each patient through letters in postage-paid envelopes in both English and Maltese for retrospective patients. Prospective patients were given the letters during their visit at the hospital. Data from deceased patients were also used following legal approval, in such cases, no consent was required. An intermediary was appointed for the anonymisation of patient data and the coded data files and CT images used were stored on the hospital's database, which is only accessible by designated hospital staff.

3.9: Limitations of the Research Methodology

3.9.1: Response Rate

The main limitation for both parts of this study is the small sample size, leading to limited sample representativeness. As a result, the findings might not be generalisable to all patient demographics or conditions outside of the study sample, potentially reducing the external validity of the study. The main cause of this limitation was the ethical limitations posed on the study, which led to a low response rate ($\approx 40\%$) from patients. The use of postage letters as a means of communication with the target population may have introduced delays and potential misunderstanding of information, particularly among those with a lower socioeconomic background.

To counter this limitation, it was ensured that the letter is clearly written in both Maltese and English, and easy to understand for the general public, considering the unlikelihood that the patients have a background in Physics or Health Science. Efforts were made to include all important information in a concise manner to respect the recipient's time and avoid an overwhelming amount of information. The researcher's contact details were also included to give the recipient an opportunity to ask questions about the study or discuss any concerns. Moreover, apprehensiveness over privacy can deter participation or lead to negative perceptions about the study's management of participant information. To mitigate this, the measures taken to ensure data privacy and security in the letter were highlighted to reassure potential participants.

3.9.2: TPS Limitations

Another limitation of this study was the use of a single TPS. Relying exclusively on the Monaco[®] TPS might introduce bias if this system has unique characteristics which are not shared by other systems, affecting reproducibility in different clinical settings. Although other TPSs were not available for use, standardised protocols for VMAT planning which are universally accepted and independent of the TPS model were used. This includes standard doses, fractionation schedules, and contouring guidelines to ensure that the variability between different TPS features is minimised and that any systemic differences are more likely due to the technology rather than procedural variances.

3.9.3: Computational Load

The Monte Carlo algorithm used in Monaco[®] for optimisation and dose calculation requires significant computational resources, since it simulates the interactions of millions of particles as they pass through different tissues. Inhomogeneities in tissue density and composition, such as the presence of bone, lung, or air cavities, require more complex and numerous calculations to accurately predict how radiation doses are deposited (Chetty et al., 2007). The high computational intensiveness lead to longer processing times, which delayed treatment planning testing. To reduce the overall time required for simulations, parallel processing techniques were used to maximise the features offered by Monaco[®] and perform multiple operations simultaneously.

3.9.4: Human Bias

The contours used for both parts of this study were done by physicians at the time of treatment, are subject to errors arising from misinterpretation of imaging. Although unlikely, the subjective interpretation of contours might introduce bias and lead inadequate tumour coverage or unnecessary radiation exposure to healthy tissues. Human bias may also be introduced during the optimisation and validation of each plan, where a subjective aspect is inevitably present during slice-by-slice inspection of the dose distribution. To reduce such variations, standardised protocols are used for all stages of the treatment planning process to reduce variability and the chance of error.

3.9.5: Patient Contour Change Simulations

Simulating weight gain and loss by adjusting external contours and assigning tissue densities may not fully capture the complex biological and physical changes in actual patients. This simplification could lead to inaccurate assessments of how real weight changes would affect dose distributions and treatment efficacy, and is particularly seen when the bowel which extends beyond the new subtracted margin is removed. Moreover, the algorithm used to generate the margins around the patient contours in Monaco[®] might not properly handle complex geometries or sharp transitions between tissues. This can result in inhomogeneities, such as excess tissue included in the margin or inadequate coverage of the intended margin, as shown in Figure 11,

leading to a lack of accuracy. When large inhomogeneities were encountered, the margin was re-created to generate a better representation.

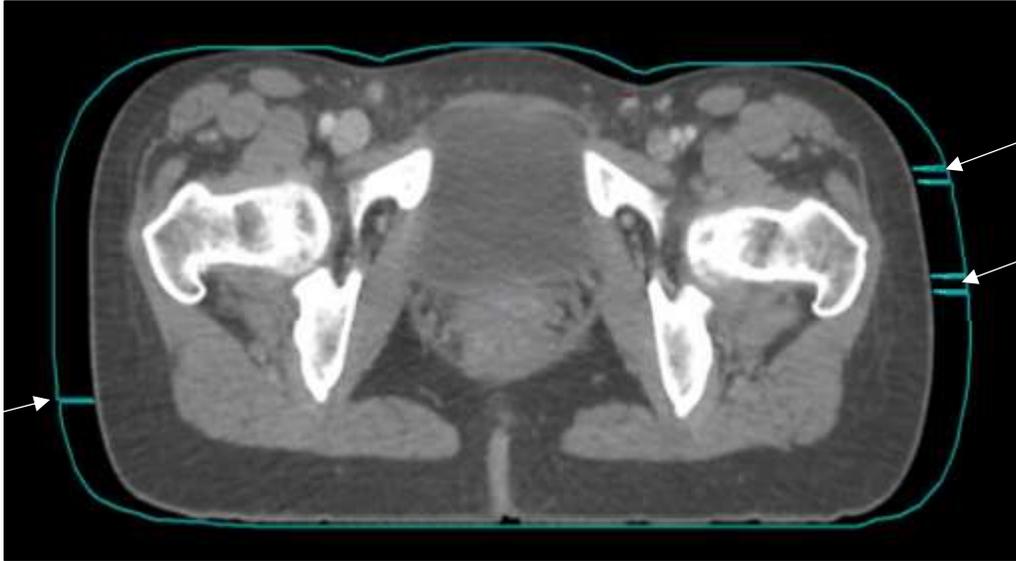


Figure 11. Example of inhomogeneities encountered during margin creation, indicated by arrows.

3.10 Conclusion

This chapter has outlined the research methodology used in this study. The presentation of results and the statistical tests applied will be detailed in the following chapter.

Chapter 4: Results

4.1 Introduction

The results obtained from the developed VMAT class solution for cervical cancer patients (Part 1) and investigation of SSD changes of varying magnitude and directions (Part 2) are presented in this chapter. Data for both parts was obtained from the 20 cervical patients included in the sample for this study who received or were undergoing radiotherapy treatment along the duration of the study.

4.2 Data

4.2.1 Class Solution Development (Part 1)

The final class solution specifications for VMAT treatment of cervical cancer patients receiving 45Gy in 25 fractions is presented in the following Tables. Table 3 outlines the chosen cost functions and corresponding isoconstraints which were applied to each patient. The subsequent individual outcomes, including the weight, relative impact and isoeffects for each patient after optimisation using the class solution are presented in Appendix 3. The outcomes were analysed based on their ability to provide adequate coverage to the tumour while sparing the OARs, assessed by the adherence of each structure to the hard and soft dose constraints outlined in Chapter 2, Table 1. Adherence to these constraints was determined through the DVH statistics provided by Monaco®.

The calculation properties and sequencing parameters for the final class solution were chosen in line with the aims of the study and are presented in Tables 4 and 5 respectively. The optimal and most generalisable plans generated by the class solution were obtained by using one beam with three arcs and a fixed collimator angle at 0° during gantry rotation. As defined by the clinical protocol, the prescribed absorbed dose and fractionations for each patient in this study was set to 45 Gy in 25 fractions.

Structure	Cost Function	Reference Absorbed Dose (Gy)	Isoconstraint
PTV (45 Gy)	Target Penalty	/	45.000
	Quadratic Overdose	46.000	0.100
ITV	Quadratic Overdose	42.800	2.300
CTV-HR + 1cm	Quadratic Overdose	45.000	0.025
Bladder	Serial	/	37.250
	Serial	/	43.100
Rectum	Serial	/	35.650
	Serial	/	43.500
Bowel	Serial	/	25.000
	Serial	/	35.000
Kidney (Right)	Serial	/	1.000
Kidney (Left)	Serial	/	1.000
Patient	Quadratic Overdose	42.750	0.080
	Quadratic Overdose	22.500	0.600
	Quadratic Overdose	16.000	1.600

Table 3. Prescription Parameters of the final Class Solution in Monaco.

Settings	Value
Grid Spacing (cm)	0.30
Secondary Algorithm	Monte Carlo
Statistical uncertainty (%) (Per Calculation)	0.50

Table 4. Class Solution Calculation Properties.

Settings	Value
Segment Shape Optimisation	On
Maximum Number of Arcs	3
Maximum Number of Control Points Per Arc	100
Minimum Segment Width (cm)	0.70
Fluence Smoothing	Medium

Table 5. Class Solution Segmentation Parameters.

For each different cost function and structure, different properties were applied to further optimise the class solution, as outlined in Tables 6, 7 and 8.

Quadratic Overdose			
Structure	Maximum Absorbed Dose (Gy)	RMS Dose Excess (Gy)	Optional Physical Parameters
PTV	46.00	0.100	/
ITV	42.80	2.300	Optimize over all voxels in volume
CTV-HR + 1cm	45.00	0.025	Optimize over all voxels in volume
Patient	42.75	0.080	/
	22.50	0.600	Shrink Margin (2.30 cm)
	16.00	1.600	Shrink Margin (3.00 cm)

Table 6. Cost function properties for structures having a Quadratic Overdose.

Serial			
Structure	Equivalent Uniform Dose (Gy)	Power Law Exponent	Optional Physical Parameters
Bladder	37.25	15	Shrink Margin (0.20 cm)
	43.10	19	Optimize over all voxels in volume
Rectum	35.65	17	Shrink Margin (0.20 cm)
	43.50	19	Optimize over all voxels in volume
Bowel	25.00	3	/
	35.00	17	/
Kidney (Right)	1.00	2	Optimize over all voxels in volume
Kidney (Left)	1.00	2	Optimize over all voxels in volume

Table 7. Cost function properties for structures defined as Serial.

Target Penalty			
Structure	Prescription (Gy)	Minimum Volume (%)	Optional Physical Parameters
PTV	45.00	99.00	/

Table 8. Cost function properties for structures having a Target Penalty.

4.2.2 Investigation of SSD Changes (Part 2)

The percentage difference between the original and new MUs for each patient and margin size (± 0.5 cm, ± 1.0 cm, ± 1.5 cm), in the uniform (anterior + lateral), anterior and lateral directions are presented in Tables 9, 10 and 11 respectively. The original MUs for each patient are listed in the first column. The following columns reflect adjustments made to the MUs per margin in order to achieve the same treatment dose distribution as the ‘base’ plan, obtained before the SSD change simulations and after class solution application.

For ease of comparison, the original (numerical) MU values are included in the second column of Tables 9-11, which were then used to calculate the percentages in the following columns. Given the consistent uncertainties in the MU calculation process (± 0.1), the uncertainty values of the percentage differences remained the same across different margin sizes for each patient. The actual numerical MU values after adjustment for each patient and margin can be viewed in Appendix 5. A summarised version of the percentage difference results is provided in Section 4.3.2, Tables 14, 15 and 16.

Patient	Original MUs ± 0.1	Percentage Difference (%)						Uncertainty
		+ 0.5 cm	- 0.5 cm	+ 1 cm	- 1 cm	+ 1.5 cm	- 1.5 cm	
1	1163.69	2.48	- 0.89	4.37	- 1.11	6.11	- 0.83	± 0.01
2	1113.28	1.72	0.16	3.55	3.25	5.38	18.57	± 0.01
3	1021.92	1.80	- 0.62	3.39	- 1.30	5.10	- 0.50	± 0.01
4	780	1.83	- 1.31	3.37	- 2.23	4.83	- 3.31	± 0.02
5	794.41	1.90	- 1.31	3.50	2.43	5.11	- 3.50	± 0.02
6	901.72	1.98	- 0.63	3.54	0.36	5.20	0.36	± 0.02
7	1099.96	1.79	1.02	0.09	0.60	5.09	1.66	± 0.01
8	1045.85	1.83	- 1.18	3.46	- 2.28	5.02	- 3.18	± 0.01
9	1059.88	2.51	0.06	4.16	- 1.88	5.77	- 2.16	± 0.01
10	942.33	1.88	- 0.62	3.41	- 1.79	4.95	- 2.05	± 0.01
11	937.21	1.72	- 1.12	3.23	- 1.30	4.78	1.58	± 0.02
12	1207.02	2.65	- 0.75	4.56	0.83	5.71	1.08	± 0.01
13	957.18	2.38	2.38	4.47	17.01	6.04	11.79	± 0.01
14	1011.61	1.22	2.46	2.91	0.83	4.55	23.37	± 0.01
15	1099.38	1.91	- 1.13	3.47	- 2.35	5.10	- 2.98	± 0.01
16	888.44	1.64	- 0.16	3.03	- 0.12	4.51	- 1.87	± 0.02
17	938.48	0.96	0.02	2.26	- 0.26	3.78	0.01	± 0.02
18	1145.63	2.38	0.88	4.00	- 1.67	5.62	- 2.60	± 0.01
19	1012.06	1.97	- 1.19	3.45	- 2.28	5.08	- 3.17	± 0.01
20	1275.93	1.36	0.16	3.10	2.67	4.89	17.09	± 0.01

Table 9. Percentage Difference Values for Varying SSDs in the Anterior & Lateral Directions (Uniform).

Patient	Original MUs	Percentage Difference (%)						Uncertainty
		+ 0.5 cm	- 0.5 cm	+ 1 cm	- 1 cm	+ 1.5 cm	- 1.5 cm	
1	1163.69	1.38	- 0.49	2.52	- 0.70	3.72	- 0.66	± 0.01
2	1113.28	1.26	- 0.39	2.47	0.74	3.71	4.20	± 0.01
3	1021.92	1.25	- 0.42	2.26	- 0.50	3.33	- 0.78	± 0.01
4	780	1.44	- 0.72	2.21	- 1.33	3.12	- 1.82	± 0.02
5	794.41	1.42	- 0.61	2.43	- 1.30	3.47	- 1.86	± 0.02
6	901.72	1.32	- 0.69	2.25	0.28	3.14	0.25	± 0.02
7	1099.96	1.34	- 0.47	2.31	- 0.93	1.66	- 1.20	± 0.01
8	1045.85	1.26	- 0.61	2.21	- 1.18	3.17	- 1.52	± 0.01
9	1059.88	1.29	- 0.51	0.03	- 1.17	3.31	- 1.73	± 0.01
10	942.33	1.39	- 0.57	2.41	- 0.87	3.49	- 1.61	± 0.01
11	937.21	1.26	- 0.45	2.30	- 0.72	3.39	- 0.50	± 0.02
12	1207.02	2.07	2.65	3.15	- 0.58	3.98	- 1.00	± 0.01
13	957.18	1.34	- 0.75	2.38	- 1.27	3.43	- 1.59	± 0.01
14	1011.61	1.22	- 0.55	2.15	- 1.10	3.20	- 1.05	± 0.01
15	1099.38	1.31	- 0.63	2.28	- 1.31	3.35	- 1.76	± 0.01
16	888.44	1.05	- 0.77	1.84	- 1.12	2.70	- 1.40	± 0.02
17	938.48	0.57	0.00	1.38	- 0.04	2.27	0.06	± 0.02
18	1145.63	1.43	- 0.40	2.48	- 1.16	3.61	- 1.58	± 0.01
19	1012.06	1.28	- 0.70	2.17	- 0.91	3.16	- 1.29	± 0.01
20	1275.93	0.83	- 0.39	1.96	1.06	3.14	3.45	± 0.01

Table 10. Percentage Difference Values for Varying SSDs in the Anterior Direction.

Patient	Original MUs	Percentage Difference (%)						Uncertainty
		+ 0.5 cm	- 0.5 cm	+ 1 cm	- 1 cm	+ 1.5 cm	- 1.5 cm	
1	1163.69	0.90	- 0.49	1.60	- 0.79	2.30	- 1.09	± 0.01
2	1113.28	1.73	- 0.39	1.37	- 0.69	- 0.97	- 0.97	± 0.01
3	1021.92	1.02	- 0.42	1.82	- 0.68	2.55	- 0.97	± 0.01
4	780	1.15	- 0.72	1.91	- 1.09	2.65	- 1.51	± 0.02
5	794.41	1.23	- 0.61	2.06	- 1.01	2.89	- 1.41	± 0.02
6	901.72	1.32	- 0.52	2.18	0.31	3.07	0.34	± 0.02
7	1099.96	0.69	- 0.47	2.28	0.60	3.19	- 0.77	± 0.01
8	1045.85	0.11	- 0.61	2.10	- 1.04	2.98	- 1.50	± 0.01
9	1059.88	1.05	- 0.51	1.80	- 1.03	2.56	- 1.40	± 0.01
10	942.33	1.21	- 0.57	1.98	- 0.86	2.72	- 1.18	± 0.01
11	937.21	0.93	- 0.45	1.51	- 0.85	2.08	- 1.20	± 0.02
12	1207.02	2.15	2.65	3.15	2.32	3.64	- 1.00	± 0.01
13	957.18	1.34	- 0.75	2.38	- 1.27	3.01	- 1.59	± 0.01
14	1011.61	0.63	- 0.55	1.19	- 1.03	1.63	- 1.44	± 0.01
15	1099.38	1.19	- 0.63	2.06	- 1.01	2.86	- 1.44	± 0.01
16	888.44	1.11	- 0.77	1.92	- 1.12	2.75	- 1.54	± 0.02
17	938.48	0.53	0.00	1.10	- 0.05	1.87	- 0.17	± 0.02
18	1145.63	1.67	- 0.40	2.48	- 0.74	3.22	- 1.12	± 0.01
19	1012.06	1.38	- 0.70	2.37	- 1.11	3.33	- 1.57	± 0.01
20	1275.93	0.75	- 0.39	1.52	- 0.62	2.29	- 0.84	± 0.01

Table 11. Percentage Difference Values for Varying SSDs in the Lateral Direction.

4.3 Data Analysis & Results

4.3.1 Class Solution Development (Part 1)

Table 13 presents the mean DVH statistics for all 20 patients, reflecting the average results and adherence to dose constraints after the developed class solution was applied. The mean volume (in cc or % according to the corresponding constraint) and absorbed dose (Gy) values of each structure, together with their respective reference dose and corresponding SD and uncertainty values are tabulated. For ease of reference the hard and soft dose constraints discussed in Chapter 2, Table 1 were specified for each structure in the second column and an indication of whether the mean value has adhered to each constraint is provided in the last column. The individual results for each patient from which the means in Table 13 were calculated are presented in Appendices 6-11. For ease of comparison, a column indicating the percentage difference between the original 'base' plan and the adjusted plan of each margin for every patient is given in the last column of the tables in Appendices 6-11.

Results from Table 13 show that all eight hard dose constraints (100 %) were met for the average DVH values, while 5 of the 13 soft dose constraints (38.5 %) failed to meet the recommendation set by the clinical protocol (Micallef et al., 2023). A broader analysis of all 20 patients is presented in Table 12, showing the pass and fail rates for all dose constraints for each patient in the 'base' plans.

Total Dose Constraints			
335			
Total Hard Dose Constraints		Total Soft Dose Constraints	
119		216	
Pass	Fail	Pass	Fail
116	2	100	116
Pass Rate (%)	Fail Rate (%)	Pass Rate (%)	Fail Rate (%)
97.48	2.52	46.30	53.70

Table 12. Pass/fail rate for all hard & soft dose constraints of the 20 patients after application of class solution.

Structure	Constraint	Hard/Soft	Reference Absorbed Dose (Gy)	Volume (cc) or (%)			Pass
				Mean (cc) or (%)	SD	Uncertainty (%) or (cc)	
PTV	$V_{95\%} > 95\%$ (42.8 Gy)	Hard	42.80	98.24 %	1.41	$\pm 0.30\%$	Yes
PTV	$D_{\max} < 107\%$ (48.2 Gy)	Hard	48.20	0.00 %	0.00	$< 0.01\%$	Yes
PTV	$V_{95\%} > 98\%$	Soft	42.80	98.24 %	1.41	$\pm 0.30\%$	Yes
ITV	$D_{99.9\%} > 95\%$ (42.8 Gy)	Hard	42.80	99.98 %	0.03	$\pm 0.01\%$	Yes
CTV-HR + 1 cm	$D_{\max} < 103\%$ (46.4 Gy)	Soft	46.40	0.00 cc	0.00	$< 0.01\text{ cc}$	Yes
Bladder	$D_{\max} < 105\%$ (47.3 Gy)	Hard	47.30	0.00 cc	0.00	$< 0.01\text{ cc}$	Yes
Bladder	$V_{30\text{Gy}} < 85\%$	Soft	30.00	84.85 %	13.43	$\pm 3.00\%$	Yes
Bladder	$V_{40\text{Gy}} < 75\%$	Soft	40.00	53.97 %	16.39	$\pm 3.70\%$	Yes
Rectum	$D_{\max} < 105\%$ (47.3 Gy)	Hard	47.30	0.00 cc	0.01	$< 0.01\text{ cc}$	Yes
Rectum	$V_{30\text{Gy}} < 95\%$	Soft	30.00	85.14 %	18.86	$\pm 4.20\%$	Yes
Rectum	$V_{40\text{Gy}} < 85\%$	Soft	40.00	62.32 %	23.74	$\pm 5.30\%$	Yes
Bowel	$D_{\max} < 105\%$ (47.3 Gy)	Hard	47.30	0.03 cc	0.12	$\pm 0.03\text{ cc}$	Yes
Bowel	$V_{30\text{Gy}} < 350\text{ cc}$	Soft	30.00	431.77 cc	171.17	$\pm 38.00\text{ cc}$	No
Bowel	$V_{40\text{Gy}} < 100\text{ cc}$	Soft	40.00	198.84 cc	91.72	$\pm 20.50\text{ cc}$	No
Structure:	Constraint	H/S	Ref. Dose (Gy)	Volume Ratio	SD	Uncertainty	Pass
Conformality	< 1.10	Soft	42.75	1.13	0.07	± 0.02	No
Conformality	< 1.55	Soft	36.00	1.68	0.23	± 0.05	Yes
Structure:	Constraint	H/S	Ref. Dose (Gy)	Dose (Gy)*	SD	Uncertainty (Gy)	Pass
PIBS – 2cm	$D_{\text{PIBS-2cm}} < 5\text{ Gy}$	Soft	5.00	39.67	12.43	± 2.80	No
Right Kidney	$D_{\text{mean}} < 10\text{ Gy}$	Hard	15.00	2.03	2.876	± 0.60	Yes
	$D_{\text{mean}} < 15\text{ Gy}$	Soft	10.00				Yes
Left Kidney	$D_{\text{mean}} < 10\text{ Gy}$	Hard	15.00	1.953	2.33	± 0.50	Yes
	$D_{\text{mean}} < 15\text{ Gy}$	Soft	10.00				Yes

Table 13. Mean DVH statistics of 20 patients after class solution application.

* Dose (Gy) refers to the total absorbed dose for the PIBS – 2 cm structure and mean absorbed dose to the kidney structures.

4.3.2 Investigation of SSD Changes (Part 2)

Based on data obtained from Tables 9, 10, and 11 in Section 4.2.2, Tables 14, 15 & 16 present the mean percentage differences in MU Changes (calculated through Equation 4), the variability (SD) of changes in margins across the 20 patients, and the uncertainty of the mean value. The absolute value of each percentage difference was taken in order to calculate the mean, since only the magnitude of the MU change is of interest for the purpose of this study.

Margin	Mean (%)	SD	Uncertainty (\pm)
+ 0.5 cm	1.90	0.43	0.10
- 0.5 cm	0.90	0.67	0.15
+ 1 cm	3.37	0.95	0.21
- 1 cm	2.33	3.57	0.80
+ 1.5 cm	5.13	0.55	0.12
- 1.5 cm	5.08	6.82	1.53

Table 14. Mean Percentage Differences: Uniform Margins.

Margin	Mean (%)	SD	Uncertainty (\pm)
+ 0.5 cm	1.28	0.28	0.06
- 0.5 cm	0.64	0.50	0.11
+ 1 cm	2.16	0.60	0.13
- 1 cm	0.91	0.36	0.08
+ 1.5 cm	3.22	0.52	0.12
- 1.5 cm	1.47	0.97	0.22

Table 15. Mean Percentage Differences: Anterior Margins.

Margin	Mean (%)	SD	Uncertainty (\pm)
+ 0.5 cm	1.10	0.46	0.10
- 0.5 cm	0.63	0.50	0.11
+ 1 cm	1.94	0.48	0.11
- 1 cm	0.91	0.44	0.10
+ 1.5 cm	2.63	0.63	0.14
- 1.5 cm	1.15	0.40	0.09

Table 16. Mean Percentage Differences: Lateral Margins.

Tables 14, 15 and 16 were compared with the pass/fail rates for each patient after the margins were applied, presented in Appendices 6-11. A percentage difference below $1.4 \pm 0.4 \%$ was found to be the highest possible threshold which did not result in any fails among the patients' hard dose constraints after the margins were applied. Hence, this value was taken as the recommended threshold which suggests clinical significance. The uncertainty value for this threshold was calculated through the RMS, as explained in Chapter 3.

Table 17 outlines the results obtained after conducting a paired t-test comparing the statistical significance between the original MUs and the new MUs for each SSD change variation. A Bonferroni-corrected p-value (significance level) of 2.8×10^{-3} was considered for all statistical analyses in this part of the study.

Margin	P-value $\times 10^{-3}$		
	Uniform	Anterior	Lateral
+ 0.5 cm	0.0	0.0	0.0
- 0.5 cm	520.3	86.3	92.2
+ 1 cm	0.0	0.0	0.0
- 1 cm	623.3	0.5	13.9
+ 1.5 cm	0.0	0.0	0.0
- 1.5 cm	169.4	166.1	0.0

Table 17. Paired t-test results.

A more detailed representation of the effects of different margin sizes on each structure in the uniform, anterior and lateral directions is presented in Tables 18, 19 and 20 respectively, which tabulate the mean values obtained from the individual results of each patient in Appendices 6-11. The results after SSD simulation can be compared to the original 'base' plan values presented in the first column.

Structure (Constraint)	Original Mean Values	New Mean Values						Units
		Margin Size (cm)						
		+ 0.5	+ 1	+ 1.5	- 0.5	- 1cm	- 1.5	
PTV (> 95 %)	98.24	95.2 ± 0.6	86.9 ± 1.8	68.4 ± 3.7	98.4 ± 0.3	98.3 ± 0.4	97.2 ± 1.4	%
PTV (< 107 %)	0.00	0.06 ± 0.05	0.06 ± 0.05	0.04 ± 0.04	22.80 ± 6.00	20.76 ± 4.80	18.51 ± 4.70	%
PTV (> 98 %)	98.2	95.2 ± 0.4	86.9 ± 1.6	68.4 ± 3.6	98.4 ± 0.2	98.3 ± 0.3	97.2 ± 1.4	%
ITV (> 99.9 %)	100.0	90.2 ± 0.6	90.6 ± 1.8	62.7 ± 3.7	182.9 ± 0.3	99.5 ± 0.4	97.4 ± 1.4	%
CTV-HR + 1 cm (< 0.5 cc)	0.00	0.0 < 0.01	0.0 < 0.01	0.0 < 0.01	43.4 ± 14.7	77.4 ± 21.1	64.7 ± 24.1	cc
Bladder (< 0.5 cc)	0.00	0.0 < 0.01	0.0 < 0.01	0.0 < 0.01	46.2 ± 16.6	42.8 ± 15.0	38.8 ± 15.0	cc
Bladder (85 %)	84.9	83.8 ± 3.2	82.5 ± 3.3	81.3 ± 3.4	86.9 ± 3.0	87.1 ± 3.1	87.2 ± 2.8	%
Bladder (75 %)	54.0	50.3 ± 3.5	48.0 ± 3.5	45.5 ± 3.4	57.7 ± 3.8	58.8 ± 3.9	57.8 ± 4.0	%
Rectum (< 105 %)	0.00	0.0 < 0.01	0.0 < 0.01	0.0 < 0.01	16.1 ± 7.6	18.6 ± 7.4	12.9 ± 6.8	cc
Rectum (< 95 %)	85.1	81.2 ± 5.1	81.4 ± 5.3	81.0 ± 5.6	84.1 ± 4.9	83.9 ± 5.1	84.1 ± 4.9	%
Rectum (< 85 %)	62.3	58.1 ± 5.7	56.7 ± 5.7	54.9 ± 5.7	65.1 ± 5.9	64.0 ± 6.0	63.4 ± 6.0	%
Bowel (< 0.5 cc)	0.03	0.0 < 0.01	0.0 < 0.01	0.0 < 0.01	49.9 ± 12.1	59.6 ± 13.0	54.0 ± 10.2	cc
Bowel (350 cc)	431.8	403.0 ± 42	405.8 ± 36	393.7 ± 35	467.3 ± 39	473.3 ± 42	468.9 ± 40	cc
Bowel (100 cc)	198.8	204.2 ± 22	190.5 ± 21	179.0 ± 20	244.0 ± 23	241.3 ± 24	244.4 ± 25	cc
Conformality (< 1.10)	1.13	1.04 ± 0.01	0.94 ± 0.02	0.72 ± 0.03	1.28 ± 0.05	1.28 ± 0.04	1.28 ± 0.04	/
Conformality (< 1.55)	1.68	1.66 ± 0.04	1.63 ± 0.03	1.59 ± 0.03	1.87 ± 0.07	1.86 ± 0.07	1.85 ± 0.10	/
PIBS – 2cm (< 5 Gy)	39.7	38.5 ± 2.7	38.2 ± 2.7	37.6 ± 2.6	40.6 ± 3.0	41.8 ± 3.1	41.5 ± 3.0	Gy
Right Kidney (< 10 Gy)	2.0	2.2 ± 0.62	2.2 ± 0.62	2.2 ± 0.62	2.0 ± 0.63	2.0 ± 0.6	2.1 ± 0.6	Gy
Right Kidney (< 15 Gy)								
Left Kidney (< 10 Gy)	2.0	2.0 ± 0.55	2.0 ± 0.52	2.0 ± 0.51	1.8 ± 0.53	1.8 ± 0.5	1.9 ± 0.5	Gy
Left Kidney (< 15 Gy)								

Table 18. Mean DVH Statistics of 20 Patients after SSD Changes: Uniform (Anterior + Lateral) Margins

Structure (Constraint)	Original Mean Values	New Mean Values						Units
		Margin Size (cm)						
		0.5	1	1.5	- 0.5	- 1cm	- 1.5	
PTV (> 95 %)	98.24	96.6 ± 0.5	93.8 ± 1.0	88.3 ± 1.8	98.6 ± 0.3	98.6 ± 0.4	93.7 ± 5.0	%
PTV (< 107 %)	0.00	0.06 ± 0.01	0.067 ± 0.06	0.05 ± 0.04	0.00 < 0.01	0.00 < 0.01	5.50 ± 5.20	%
PTV (> 98 %)	98.2	96.6 ± 0.2	93.8 ± 4.8	88.3 ± 1.5	98.6 ± 0.1	98.6 ± 5.0	93.7 ± 4.9	%
ITV (> 99.9 %)	100.0	90.7 ± 0.5	98.2 ± 1.0	91.9 ± 1.8	99.9 ± 0.3	99.8 ± 0.4	99.6 ± 5.0	%
CTV-HR + 1 cm (< 0.5 cc)	0.00	0.01 ± 0.01	0.00 < 0.01	0.00 < 0.01	0.00 < 0.01	0.00 < 0.01	0.06 ± 0.03	cc
Bladder (< 0.5 cc)	0.00	0.00 < 0.01	0.00 < 0.01	0.00 < 0.01	0.00 < 0.01	0.12 ± 0.06	0.80 ± 0.30	cc
Bladder (85 %)	84.9	84.0 ± 3.2	83.3 ± 3.2	82.4 ± 3.3	85.6 ± 3.0	86.1 ± 2.9	86.4 ± 2.8	%
Bladder (75 %)	54.0	50.9 ± 3.5	49.4 ± 3.5	47.9 ± 3.5	53.9 ± 3.6	54.5 ± 3.6	55.6 ± 3.7	%
Rectum (< 105 %)	0.00	0.00 < 0.01	0.00 < 0.01	0.00 < 0.01	0.01 < 0.01	0.07 ± 0.06	0.60 ± 0.6	cc
Rectum (< 95 %)	85.1	82.4 ± 5.1	82.0 ± 5.2	81.9 ± 5.4	83.3 ± 5.0	82.8 ± 5.0	83.7 ± 4.9	%
Rectum (< 85 %)	62.3	58.9 ± 5.8	58.2 ± 5.8	57.3 ± 5.7	60.8 ± 5.8	59.3 ± 5.8	61.5 ± 5.8	%
Bowel (< 0.5 cc)	0.03	0.00 < 0.01	0.00 < 0.01	0.00 < 0.01	0.1 ± 0.07	0.40 ± 0.20	18.00 ± 15.50	cc
Bowel (350 cc)	431.8	423.1 ± 37	415.8 ± 37	406.9 ± 36	439.9 ± 39	459.5 ± 42	448.4 ± 40	cc
Bowel (100 cc)	198.8	205.5 ± 22	199.4 ± 21	191.7 ± 21	219.1 ± 23	221.9 ± 24	225.4 ± 24	cc
Conformality (< 1.10)	1.13	1.09 ± 0.02	1.03 ± 0.02	0.94 ± 0.03	1.16 ± 0.02	1.17 ± 0.02	1.20 ± 0.02	/
Conformality (< 1.55)	1.68	1.68 ± 0.04	1.66 ± 0.04	1.63 ± 0.04	1.74 ± 0.04	1.74 ± 0.04	1.75 ± 0.05	/
PIBS – 2cm (< 5 Gy)	39.7	38.8 ± 2.7	38.5 ± 2.7	38.1 ± 2.7	39.5 ± 2.8	39.8 ± 2.8	39.8 ± 2.9	Gy
Right Kidney (< 10 Gy)	2.0	2.2 ± 0.6	2.2 ± 0.6	2.2 ± 0.6	2.2 ± 0.6	2.2 ± 0.6	2.2 ± 0.6	Gy
Right Kidney (< 15 Gy)								
Left Kidney (< 10 Gy)	2.0	2.0 ± 0.5	2.0 ± 0.5	2.0 ± 0.5	1.9 ± 0.5	1.9 ± 0.5	1.9 ± 0.5	Gy
Left Kidney (< 15 Gy)								

Table 19. Mean DVH Statistics of 20 Patients after SSD Changes: Anterior Margins

Structure (Constraint)	Original Mean Values	New Mean Values						Units
		Margin Size (cm)						
		0.5	1	1.5	-0.5	-1cm	-1.5	
PTV (> 95 %)	98.24	96.8 ± 0.5	95.3 ± 0.6	92.6 ± 0.9	98.7 ± 0.3	98.8 ± 0.3	99.0 ± 0.2	%
PTV (< 107 %)	0.00	0.02 ± 0.01	0.04 ± 0.03	0.05 ± 0.04	0.00 ± 0	0.00 < 0.01	1.0 ± 0.8	%
PTV (> 98 %)	98.2	96.80 ± 0.3	95.30 ± 0.3	92.60 ± 0.6	98.65 ± 0.06	98.8 ± 5.0	99.0 ± 0.1	%
ITV (> 99.9 %)	100.0	90.6 ± 0.6	99.5 ± 0.6	98.0 ± 0.9	100.0 ± 0.3	100.0 ± 0.3	100.0 ± 0.3	%
CTV-HR + 1 cm (< 0.5 cc)	0.00	0.01 ± 0.01	0.00 < 0.01	0.00 < 0.01	0.00 < 0.01	0.00 < 0.01	0.00 < 0.01	cc
Bladder (< 0.5 cc)	0.00	0 < 0.01	0.00 < 0.01	0.00 < 0.01	0.00 < 0.01	0.01 ± 0.01	1.50 ± 1.4	cc
Bladder (85 %)	84.9	84.4 ± 3.1	83.9 ± 3.2	83.4 ± 3.3	85.4 ± 3.0	85.8 ± 2.9	85.7 ± 2.9	%
Bladder (75 %)	54.0	51.5 ± 3.6	50.5 ± 3.6	49.7 ± 3.6	53.5 ± 3.6	54.20 ± 3.5	54.4 ± 3.7	%
Rectum (< 105 %)	0.00	0 < 0.01	0.00 < 0.01	0.00 < 0.01	0.00 < 0.01	0.01 < 0.01	0.05 ± 0.02	cc
Rectum (< 95 %)	85.1	82.4 ± 5.2	82.0 ± 5.3	81.90 ± 5.5	83.4 ± 4.9	83.6 ± 4.9	83.8 ± 4.8	%
Rectum (< 85 %)	62.3	56.1 ± 5.7	55.2 ± 5.6	57.1 ± 5.7	60.7 ± 5.8	60.8 ± 6.1	61.5 ± 5.8	%
Bowel (< 0.5 cc)	0.03	0 < 0.01	0.00 < 0.01	0.00 < 0.01	0.07 ± 0.05	0.09 ± 0.03	4.0 ± 3.0	cc
Bowel (350 cc)	431.8	424.9 ± 37	419.1 ± 37	422.8 ± 37	437.8 ± 39	448.0 ± 41	445.1 ± 39	cc
Bowel (100 cc)	198.8	206.3 ± 22	201.1 ± 22	196.9 ± 22	217.9 ± 23	219.5 ± 23	223.6 ± 23	cc
Conformality (< 1.10)	1.13	1.08 ± 0.02	1.01 ± 0.03	0.97 ± 0.03	1.16 ± 0.02	1.17 ± 0.02	1.19 ± 0.02	/
Conformality (< 1.55)	1.68	1.66 ± 0.05	1.67 ± 0.04	1.64 ± 0.04	1.74 ± 0.04	1.74 ± 0.04	1.67 ± 0.09	/
PIBS – 2cm (< 5 Gy)	39.7	39.0 ± 2.7	38.7 ± 2.7	38.4 ± 2.7	39.5 ± 2.7	39.7 ± 2.8	39.6 ± 2.8	Gy
Right Kidney (< 10 Gy)	2.0	2.2 ± 0.6	2.2 ± 0.6	2.2 ± 0.6	2.2 ± 0.6	2.2 ± 0.6	2.1 ± 0.6	Gy
Right Kidney (< 15 Gy)								
Left Kidney (< 10 Gy)	2.0	2.0 ± 0.5	2.0 ± 0.5	2.0 ± 0.5	1.9 ± 0.52	1.9 ± 0.5	1.9 ± 0.5	Gy
Left Kidney (< 15 Gy)								

Table 20. Mean DVH Statistics of 20 Patients after SSD Changes: Lateral Margins

Chapter 5: Discussion

5.1 Introduction

This chapter presents a discussion and interpretation of the results obtained in both parts of this study, which involves class solution development for cervical cancer treatment plans (Part 1) and investigation of SSD changes with different margins across varying directions (Part 2). The findings from the statistical tests conducted are also discussed.

5.2 Discussion

5.2.1 Class Solution Development

For the first part of the study, the objective was to develop a generalisable VMAT class solution for cervical cancer patients following the EMBRACE clinical protocol for use in SAMOC. This goal was achieved through the testing and validation of the class solution on 20 patients. The final class solution's performance was evaluated by its ability to adapt and optimise treatment plans across varying patient anatomies through the DVH statistics and slice-by-slice inspection, demonstrating overall effectiveness, thereby achieving the objective for this part of the study.

5.2.1.1 Adherence of Class Solution to Hard and Soft Dose Constraints

The success of the class solution was measured by comparing the pass and fail rates shown in Table 12. These constraints represent the strictness of the dose limits imposed on patients during treatment, where the hard constraints are more rigid and soft constraints allow for more flexibility. Out of 119 hard dose constraints among all 20 patients, 116 passed and only two failed, resulting in a high pass rate of 97.48% and a low fail rate of 2.52%. The high pass rate proved that the class solution was able to adhere to the strict values imposed by the clinical protocol across almost all patients. Meanwhile, the approximately equal pass (46.30 %) and fail (53.70 %) rates for the soft dose constraints indicate that while some flexibility is allowed, there is considerable variability in whether these less rigid limits are met. Further optimisation of the class solution to make each treatment plan more individualised could increase this percentage value since patient-specific factors may influence the ability to meet these softer constraints. The specific structures

which fail to meet the soft dose constraints could also serve as an indicator to where the treatment plans might need adjustment after the class solution is applied.

Out of the 121 hard dose constraints evaluated, only two failed to meet the required 'hard' criteria to pass. The first instance occurred in patient 6, where the bowel constraint at 47.3 Gy ($D_{\max} < 105\%$) was narrowly missed by a volume percentage difference of 0.02 %. The second instance involved patient 20, where the PTV hard dose constraint at 42.8 Gy ($V_{95\%} > 95\%$), representing the minimum required tumour coverage, failed to pass by a small volume percentage difference of 0.15 %. The most probable cause for these outliers was based on the contour observations, where both patient 6 and 20 had significant bowel and PTV overlap due to a comparatively larger bowel structure. This leads to a decreased absorbed dose to the PTV in order to allow the algorithm to reach the OAR hard dose constraints. Further detail on the individual DVH results for patients 6 and 20 can be viewed in Appendix 4.

Moreover, an exception was made for Patients 7 and 17, who had considerably elevated kidneys when compared to other patients, causing them to be much closer to the PTV. This caused significant computational load to focus on lowering the absorbed dose to the kidneys rather than evenly distributing the weight on all cost functions. To avoid this, the EUD to the kidneys was slightly increased before optimisation to allow the algorithm to focus on the entire cost functions. Through this minor adjustment, all hard dose constraints including the PTV coverage and kidneys were achieved.

The exceptions encountered highlighted the inherent challenges posed by patient-specific anatomical variations, aligning with the observations made by Fjellanger (2018), Bezzina (2015) and Vella (2014). To maintain the aim of having applicable and generalisable treatment plans for the remaining patients, it was deemed necessary to accept these deviations. Through this, the overall coverage and adherence to the constraints of the other plans were maintained, ensuring that the class solution remained robust and broadly effective without being significantly compromised by atypical cases. While it establishes a consistent baseline, it still requires further

adjustments by medical physicists to ensure that each plan is fully optimised and tailored to the individual patients. In light of this, the class solution is able to serve as a foundational framework to increase the efficiency of the planning process, allowing planners to focus on fine-tuning rather than starting anew, ultimately improving both the precision and quality of patient care.

It was also observed that a significant dose was being delivered to the vaginal reference point (PIBS – 2 cm), with an average absorbed dose of 39.67 ± 2.78 Gy, where only one patient out of 20 managed to reach the soft dose constraint of $D_{\text{PIBS-2cm}} < 5$ Gy. This high absorbed dose is largely attributable to the anatomical position of the vagina, which is almost entirely covered by the PTV in most patients. Moreover, since the vagina is not contoured in these plans and only represented by a single point, it was not possible to control its absorbed dose effectively through cost functions.

The class solution development was initiated by incorporating cost functions into the prescription process. This ensured that the target volumes received the intended absorbed dose while minimising excessive exposure to the patient's healthy tissue. Throughout optimisation, it was also ensured that the relative impact and weighting were approximately balanced among all structures, such that the computational resources are not solely taken up by one structure. A discussion for each parameter and cost function chosen for the respective volumes is presented in the following sections.

5.2.1.2 Calculation Properties

The calculation properties for this class solution were defined by the grid spacing, algorithm and SU per calculation, presented in Table 4. A grid spacing of 0.3 cm was chosen based on recommendations from Javid et al. (2023) and Park et al. (2014), both of which demonstrated that this spacing reduces in computation time without compromising dose accuracy. While the literature recommends a SU values between 1 % and 3 % for lung, larynx, and prostate cases (Palanisam et al., 2019) and 1.5 % for brain and spine cases (Goodall & Ebert, 2020), there are currently no published studies examining its impact on cervical cancer plans, which are typically

more complex. Therefore, an SU value of 0.5% was adopted according to the current Standard Operating Procedure in use at SAMOC for Monaco® VMAT plans (SAMOC Radiotherapy Department, 2021). Additionally, the Monte Carlo algorithm, which is the standard in Monaco® and many other TPSs, was used as the algorithm in this class solution.

5.2.1.3 Segmentation Parameters

Table 5 in the previous section presents the segmentation parameters in Monaco®, which involve the segment shape optimisation, pilot beamlets, maximum number of arcs, maximum number of control points per arc, minimum segment width and fluence smoothing. As mentioned in Section 3.6.1.1, these are concerned with how the radiation beams are delivered to the patient in order to achieve the desired dose distribution.

The choice for the number of arcs was based on previous cervical plans and studies which investigated VMAT results with different number of arcs. Lee et al. (2012) found that a significantly inferior conformity index resulted with one arc when compared to a higher number of arcs, meanwhile Bezzina (2015) found that using two arcs instead of one provided better results with respect to target coverage and conformity. For this study, the outcome of the class solution using 2 and 3 arcs was tested, where three arcs resulted in better coverage and OAR sparing results, hence being the preferred choice. The use of three arcs allows for more flexibility to optimise the dose distribution following class solution application and prevents increased complexity in treatment time and planning which may result with a fourth arc. The class solution also included whole arcs starting from 180° and rotating by 360° for better dose distribution (Guckenberger, 2009).

The Monaco® Training Guide recommends enabling Segment Shape Optimisation for VMAT plans. Although this setting increases planning time, it enhances plan quality, reduces the number of segments and shortens overall delivery time. To balance treatment time and plan quality, the Monaco® Training Guide also recommends setting the maximum number of control points per

arc to a value between 70 and 150 (Elekta AB, 2010). For the class solution, a mid-range value of 100 was selected to achieve a tradeoff between planning quality and treatment efficiency.

Wang et al. (2018) found that cervical VMAT plans generated with a Minimum Segment Width (MSW) of 1.0 cm had dose distributions comparable to those with a 0.5 cm MSW. However, plans with a 1.5 cm MSW showed a reduction in quality, despite still meeting clinical requirements. Therefore, the middle range MSW value of 0.7 cm was selected for this class solution to enhance delivery efficiency and accuracy without compromising VMAT plan quality. The Fluence Smoothing parameter was set to 'Medium', which was the recommended setting for cervical cancer treatment plans by Gang et al. (2021). These settings were also analogous to all other cervical plans previously developed in SAMOC.

5.2.1.4 Target Penalty

As shown in Table 8, the Target Penalty cost function was used for the PTV structure in the class solution, with a minimum volume of 99 % and prescription of 45 Gy, corresponding to the prescribed absorbed dose. This was preferred over the Target EUD cost function since the target for each patient was complex with significant OAR overlap, hence the Target Penalty cost function performed better. A high minimum volume percentage was also chosen to make the Target Penalty work harder and achieve the PTV hard dose constraints (Wolff, 2019). A lower value of the minimum volume resulted in loss of PTV coverage in some patients, and a high maximum absorbed dose in others.

5.2.1.5 Quadratic Overdose

For the patients included in this study, the Quadratic Overdose cost function was observed to be more effective for limiting the absorbed dose to the OARs without significantly compromising the coverage to the PTV. Other similar cost functions such as the 'Maximum Dose' were not appropriate for these types of treatment plans since, the dose threshold is specified for a point dose, which refers to a volume of just 0.01 cc, rather than for a larger volume of tissue as seen in cervical plans (Wolff, 2019). Thus, a more gradual approach adopted by the Quadratic Overdose

cost function was deemed more appropriate than applying a penalty all at once when a single voxel exceeds the maximum absorbed dose threshold. In light of this, the primary goal of applying a Quadratic Overdose cost function is to allow more flexibility than the target penalty while still limiting high absorbed doses within the structures. Table 6 outlines that a Quadratic Overdose cost function was used for the PTV, ITV, CTV-HR + 1 cm and Patient structures.

For the PTV structure, a Quadratic Overdose cost function was used alongside the Target Penalty. This combination was necessary since, without the Quadratic Overdose, the Target Penalty alone was observed to drive the absorbed dose within the target to levels significantly exceeding the prescription dose of 45 Gy, as stated in the literature (Wolff, 2019). Therefore, the Quadratic Overdose was considered the most appropriate dose-limiting function, as it effectively prevented excessive dose restrictions that could lead to cold spots in the target volume. This decision was supported by common clinical assumptions and oncologist recommendations that a small hot spot is acceptable, especially when aiming to create a generalisable class solution.

The maximum absorbed dose and RMS dose excess of the PTV were set to 46.0 Gy and 0.1 Gy respectively. Since the prescribed absorbed dose for all patients was 45.0 Gy, the maximum dose was set slightly above this value to allow for minor variations but still stay close enough to prevent significant overdosing. Meanwhile, the RMS dose excess was selected to achieve a trade-off between dose uniformity and flexibility in dose distribution. The value was chosen based off the desired level of dose homogeneity within the target volume and the acceptable level of variation from the prescribed absorbed dose. As the initial optimisation process was carried out, a lower RMS value was found to provide the best target coverage and sparing of healthy tissue as it enforced stricter uniformity, while higher values allowed for more variation.

As opposed to the PTV, the Quadratic Overdose was the only cost function required for the ITV, CTV-HR +1 cm and Patient structures. The primary objective of the ITV was to ensure that these critical volumes receive the appropriate coverage, while the CTV-HR +1cm aimed to limit the maximum absorbed dose in the region to avoid exceeding the dose constraints and account for

possibilities of receiving brachytherapy. These volumes are well-defined and do not need to account for positional uncertainties, making the Quadratic Overdose sufficient to achieve the necessary dose uniformity. Conversely, the PTV, required a Target Penalty in addition to Quadratic Overdose to ensure adequate dose coverage across the expanded volume, including the margins that account for potential patient or organ movement. This combination guarantees that the CTV-HR + 1cm and ITV within the PTV are adequately treated, addressing any variations and thereby eliminating the need for a separate Target Penalty cost function for the ITV and CTV.

A minimum dose of 42.80 Gy was set with an experimentally derived RMS dose excess of 2.30 Gy for the ITV, to provide optimal coverage. For the CTV-HR + 1 cm, a minimum dose of 45.00 Gy with an RMS dose excess of 0.025 Gy was applied, which resulted in optimal OAR sparing results. Since the ITV includes the CTV-HR + 1cm and accounts for internal motion, a minimum dose of 42.80 Gy ensures that even with potential motion, the absorbed dose within the ITV remains close to the prescribed absorbed dose (45 Gy). A minimum absorbed dose value of 45.00 Gy limited the maximum dose such that it does not exceed the hard dose constraint. The very low RMS dose excess of 0.025 Gy indicates a strong emphasis on dose uniformity within the CTV, to ensure that the absorbed dose distribution within the CTV-HR + 1cm is as close to the prescribed absorbed dose as possible, with minimal variation.

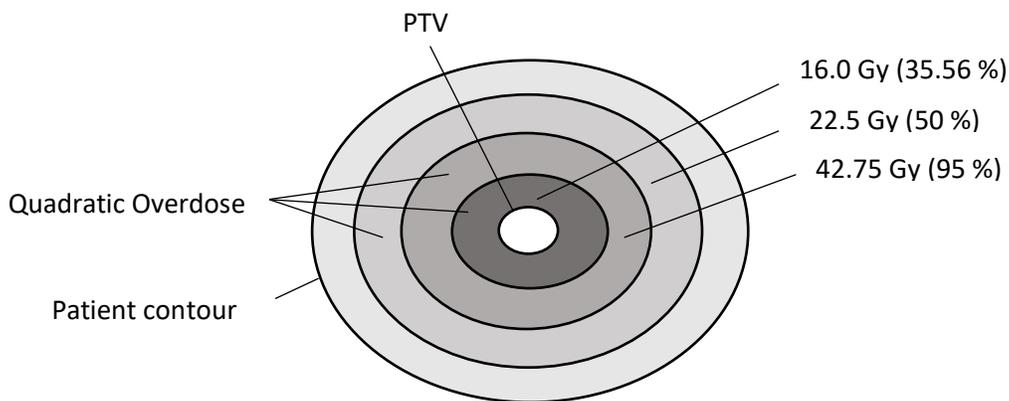


Figure 12. Multiple Quadratic Overdose cost functions on patient contour. Source: Author.

Finally, three Quadratic Overdose cost functions were applied to the patient's external contour, with minimum doses of 42.75 Gy, 22.50 Gy and 16.00 Gy consecutively. Using multiple Quadratic

Overdose cost functions with varying dose thresholds allowed for different levels of dose control across the patient's anatomy, as shown in Figure 12, where the percentages adjacent to the minimum dose are relative to the prescribed absorbed dose of 45 Gy. The highest dose threshold (42.75 Gy) was applied closer to the target volumes where higher doses are more acceptable while the lower thresholds were used in regions farther from the target, such as superficial tissues, to minimise the absorbed dose. These values were found to provide optimal balance and smooth dose gradients, preventing hot or cold spots and ensuring generalisable results across patients.

5.2.1.6 Serial

For all the OARs considered in the class solution, serial cost functions provided optimal results which aligned with the objectives of this study. Among all 20 patients, serial cost functions were preferred over parallel for the bladder, rectum, bowel and kidneys. This was driven by the need to reduce the absorbed dose to these OARs while maintaining coverage, which was not achieved by the parallel cost functions. Although the parallel cost function adhered to the hard dose constraints of the OARs, it did not provide adequate coverage to the PTV and hence the minimum hard dose requirement to the tumour was not achieved. Consequently, the serial cost function was preferred over the parallel for all OARs to ensure optimal treatment outcomes.

Two serial cost functions with different Equivalent Uniform Dose (EUD) values were applied to the bowel, rectum and bladder, which proved better OAR sparing when compared to only one serial cost function. This also allows more flexibility for the planner to adjust the parameters as needed according to the individual patient and the unique OAR anatomy. More than two serial cost functions in the same OAR structure were avoided as it resulted to a significant decrease in coverage to the target volume and higher computational load. The EUD value for each structure was first chosen to be less than the maximum hard dose constraint provided by the clinical protocol, and was later adjusted according to the optimisation results.

High PLE values were chosen for the bladder, rectum and the second bowel cost function (EUD = 35 Gy), which had relatively higher EUD values when compared to other OARs. Given that the

PLE for serial cost functions ranges from 1 through 20 (Wolff, 2019), a value close to 20 was chosen for high EUD values to provide a maximum dose effect and limit the algorithm from exceeding the given EUD. Meanwhile, a PLE value close to 1 was chosen for lower EUD values seen in the kidneys and first bowel cost function. A lower PLE value was observed to apply evenly across the whole DVH curve and provided a mean dose effect across the structure, as discussed in Section 3.6.2.4.

5.2.1.7 Optional Physical Parameters

Optional physical parameters were included within specific cost functions to further optimise the class solution. For relatively small structures (including the kidneys, rectum, bladder, ITV and CTV-HR +1 cm), the 'optimise over all voxels in volume' option was enabled such that the algorithm evaluated the absorbed dose across the entire volume instead of focusing on just specific points or regions (Wolff, 2019).

Moreover, a 'Shrink Margin' was added to the Bladder (EUD = 37.25 Gy), Rectum (EUD = 35.65 Gy) and Patient (Maximum Dose = 22.50 Gy & 16.00 Gy) cost functions. The first Quadratic Overdose of the Patient structure had a zero shrink margin and was set to the higher dose target (Max. Dose = 42.75 Gy), which was used to keep the high absorbed dose inside the target. The second and third Quadratic Overdose of the Patient contour had a shrink margin of 2.3 cm and 3.0 cm applied respectively, which were chosen to keep the absorbed dose inside the structure homogeneous. By using the quadratic overdose cost functions and a series of stepped shrink margins (0 cm, 2.3 cm & 3 cm), the absorbed dose to the patient was able to be controlled. The shrink margin values were adjusted in Stage 1 until the weight and relative impact were balanced.

A shrink margin of 0.2 cm was also applied to the lower dose value of the Bladder and Rectum structures since significant overlap was observed between these OARs and the PTV. After experimentation, a 0.2 cm value best resulted in a reduction of absorbed dose to the OARs while keeping the PTV coverage adequate and in line with the minimum hard dose constraint. Shrinking the margin was also observed to reduce the spillover of absorbed dose into non-target tissues,

particularly in cervical plans where the proximity of the target to critical structures requires a very precise dose distribution.

5.2.2 Investigation of SSD Changes

5.2.2.1 Decrease in SSD

As expected, the simulated plans with a decrease in SSD (increase in patient contour) resulted in a significant loss of coverage and absorbed dose decrease to the target and OARs, when compared to the 'base' plan. This outcome was least evident in the + 0.5 cm margin results and proved to be more evident as the margin size increases. Considering the uniform margin, 7 out of 20 patients (35 %) failed to reach the minimum PTV hard dose constraint ($V_{95\%} > 95\%$) with just a + 0.5 cm increase in margin. This percentage increases to 85 % with a + 1cm increase and 95 % with a + 1.5 cm, showing a substantial rise between the + 0.5 cm and + 1cm, suggesting that further margins between this range merit investigation in future research. The effect of decreasing the SSD on all structures for each individual patient in all three directions can be seen in the Tables presented in Appendices 6, 8 and 10.

Subsequently, the new MUs associated with an increase in margins required adjustment in order to reach the same dose distribution as the 'base plan' for each patient. Tables 9, 10 and 11 show that as the margin size increases, a higher MU change was needed. This result aligns with the observation stated above, stating that larger margin sizes result in a larger dose distribution change, which was also concluded by Pair et al. (2013).

5.2.2.2 Increase in SSD

On the other hand, an increase in SSD (decrease in patient contour) resulted in a higher maximum absorbed dose to all structures and an increased risk to the OARs when compared to the base plan for each patient. This is supported by the fact that a mean of 60 %, 70 % and 75 % of patients failed to adhere to the maximum hard dose constraint to the PTV ($D_{\max} < 107\%$ (48.2 Gy)) after the – 0.5 cm, – 1 cm and – 1.5 cm margins were applied respectively, concluded from Tables 18, 19 and 20. A notable observation was that although a 0.5 cm margin decrease was considered to

be a relatively small change in SSD, it still resulted in significant changes to the original plan which would need to be addressed. These results align to the conclusion made by Chow & Jiang (2013), discussed in Chapter 2.

In contrast with the previous subsection, as the margin size increases, a decrease in MU was required in order to reach the same dose distribution as the base plan. However, some exceptions were encountered, since some patients required an increase in MUs in order to achieved the same dose distribution, which goes against what was stated. A possible reason for this is the depth-dose effect, which refers to how the radiation dose absorbed by tissue changes with depth beneath the skin's surface (Yoon & Zhang, 2018). Typically, the absorbed dose initially increases to a maximum (known as the peak) at a certain SSD, then gradually decreases as the radiation penetrates deeper. Since the SSD is increased in this case, the depth of maximum absorbed dose is no longer at the desired location of the PTV, and hence a higher dose may be required to reach the desired distribution (IAEA, 2005). However, the presence of the depth-dose effect varies according to individual patient parameters and, therefore, was not observed in all patients.

5.2.2.3 Direction of SSD Changes

For a more extensive investigation and to account for all variables, the direction towards which the SSD changes were applied was also considered. The most common SSD changes seen in patient contours were considered (uniformly, anteriorly and laterally) and since the table prevents SSD changes in the posterior direction, this was not included. Different results were obtained based on each direction.

Tables 14 and 18 show that the uniform margins produced the highest mean differences and percentage differences between the original MUs and adjusted MUs when compared to the anterior and lateral results. The second highest percentage differences were observed in the anterior direction and the lowest in the lateral directions. A cause for this could be that anterior beams might encounter more tissue and varied densities before reaching the target, leading to

greater absorbed dose variations, whereas lateral beams may traverse more uniform tissue, resulting in lower percentage differences. Meanwhile, the dose distributions differ between anterior and lateral directions due to the varying thickness and composition of tissues in those directions. Uniform margins, on the other hand, do not account for these variations, and therefore resulted in less optimal dose distributions and higher mean percentage differences.

These results should be considered when adjusting MUs in a treatment plan, as variations in SSD and changes in patient weight can lead to different outcomes. In order to account for all variations, the clinically significant MU percentage difference threshold of $1.40 \pm 0.04 \%$ was based on the uniform margins as a conservative approach, since the largest differences were seen with this margin.

5.2.2.4 Statistical Outcomes

The paired t-test results shown in Table 17 indicate the statistical significance between the original and updated MUs when the Bonferroni-corrected p-value is less than 2.8×10^{-3} . The results suggest that for positive margin increases (+ 0.5 cm, + 1 cm, + 1.5 cm), there are significant differences in MUs between the original and new settings across all three directions (uniform, anterior, lateral). Conversely, the majority of the negative margin adjustments show higher p-values than 2.8×10^{-3} . Only the lateral margin at -1.5 cm ($p = 0$) and the anterior margin at -1 cm ($p = 0.5 \times 10^{-3}$) show a significant difference, while the other directions are not significant with p-values of 0.17. These findings imply that increasing the margin tends to produce significant changes in MUs, whereas reducing the margin does not consistently result in significant differences, with some variations based on direction and extent of margin reduction. This could be due to the differences encountered among the patients when the SSD was increased, where some patients required an increase in MUs and others a decrease due to the depth-dose effect. In light of this, the paired t-test values proved to be higher for the negative margins.

In the context of the objectives for this part of the study, when the paired t-test was applied to the MU percentage differences, it provided concrete evidence to identify whether the changes

observed are due to random chance or significant enough to warrant an adjustment in the MU settings. This decision however, is not only based on the t-test result, but also on the determined MU percentage change threshold value of $1.4 \pm 0.4 \%$.

5.2.2.5 MU Percentage Difference Threshold Value

During data analysis, what constitutes a clinically relevant change in MUs was defined by setting a threshold percentage difference. A percentage difference of more than $1.4 \pm 0.4\%$ in MUs was considered clinically relevant as it affected the dose delivered to the target tissue or OARs in the majority of the 20 patients. This was based on the pass/fail rate of the hard and soft dose constraints obtained from the DVH statistics tables in Appendices 6-11.

The concluded threshold value represents the recommended acceptable range for MU percentage differences, for use in clinical practice. In cases where the MU percentage difference falls within this range, the difference is considered small and likely not clinically significant, suggesting that a MU change may not be necessary. However, if the difference exceeds this range, it indicates a substantial deviation from the expected values that may require adjustment to ensure accurate dose delivery. When the paired t-test shows a statistically significant difference ($p < 2.8 \times 10^{-3}$), and the difference in MU percentage exceeds the threshold of $1.4 \pm 0.4 \%$, it strongly indicates that the change in MU is both statistically and clinically significant, warranting a MU adjustment. Conversely, if the t-test shows no significant results or the percentage difference falls within the threshold range, a MU adjustment may not be required. It is important to note that the clinical threshold holds more weight than the statistical significance, when determining the need of a MU adjustment.

5.3 Conclusion

The observations made from the data provided in the previous chapter were presented in this chapter. The major findings, conclusions and recommendations from this study are presented in the following chapter.

Chapter 6: Conclusions & Recommendations

6.1 Introduction

The main conclusions drawn from both parts of this study are presented in this final chapter, as well as the recommendations for clinical practice and future research. The most prominent results derived from the data collected are summarised below.

6.2 Summary Of Conclusions From The Study

6.2.1 Class Solution Development (Part 1)

The main conclusions of the first part of the study were:

- a) A generalisable VMAT class solution for cervical cancer patients which adhered to the national clinical protocol was successfully developed and validated, showing effectiveness across various patient anatomies.
- b) The class solution demonstrated a high pass rate of 97.48% for hard dose constraints, indicating strong adherence to strict clinical protocols.
- c) The class solution showed approximately equal pass and fail rates for soft dose constraints, suggesting the need for further adjustment and optimisation to improve consistency and personalisation in treatment plans.
- d) Larger anatomical structures and significant overlaps with target volumes (PTV) in specific patients posed challenges in meeting certain hard dose constraints, requiring exceptions and adjustments to the class solution.
- e) The Quadratic Overdose cost function effectively limited the maximum absorbed dose inside the PTV, while serial cost functions provided optimal OAR absorbed dose sparing.
- f) The inclusion of optional physical parameters, such as shrink margins and optimising over all voxels, further refined the class solution, reducing the likelihood of cold and hot spots.
- g) The use of three arcs in VMAT plans provided better coverage and sparing of OARs, with flexibility for treatment planners to optimise the dose distribution effectively.
- h) Although the class solution provides a strong baseline for treatment planning, further adjustments by medical physicists are necessary to fully optimise plans for individual patients.

6.2.2 Investigation of SSD Changes (Part 2)

- a) A decrease in SSD (increase in patient contour) resulted in a significant loss of coverage and a decreased absorbed dose to the target and OARs, particularly for larger margin sizes.
- b) An increase in SSD (decrease in patient contour) led to higher maximum absorbed doses to all structures and increased risks to the OARs, particularly for negative margin adjustments.
- c) Larger margin sizes (+0.5 cm, +1 cm, +1.5 cm) showed a direct correlation with increased MU adjustments needed to achieve the desired dose distribution, while smaller negative margins had inconsistent results.
- d) SSD changes in different directions (uniform, anterior, lateral) led to varying percentage differences, with uniform margins showing the largest differences, followed by anterior and lateral directions.
- e) A threshold value of $1.4 \pm 0.4\%$ in MU percentage differences was established as the acceptable range, with deviations beyond this suggesting the need for MU adjustments. This was presented as a revised value to the current $\pm 2\%$ threshold in use at SAMOC.

6.3 Recommendations for Professional Practice

6.3.1 Class Solution Development (Part 1)

- a) Although the class solution proved to be generalisable, further optimisation of treatment plans is required by adjusting the class solution based on patient-specific factors, especially when soft dose constraints are not met.
- b) A strong focus on adhering to hard dose constraints should be maintained during treatment planning to ensure patient safety and protocol compliance.
- c) In cases where the kidneys are close to the PTV, the EUD should be increased before application of the class solution to allow for equal optimisation across all structures.
- d) All VMAT class solutions should be updated based on emerging clinical data and/or protocols to ensure they remain effective.

6.3.2 Investigation of SSD Changes (Part 2)

- a) SSD changes in patients should be routinely evaluated, since these can impact absorbed dose coverage and necessitate MU adjustments.
- b) The impact of margin size on dose distribution should be considered during treatment planning, particularly for larger margins, which may require larger MU adjustments to maintain target coverage.
- c) Treatment plans should be adjusted by considering the direction of SSD changes (uniform, anterior, lateral), with particular attention to uniform margins, which typically show the highest percentage differences and may require more precise MU adjustments.
- d) The $1.4 \pm 0.4\%$ MU percentage difference threshold is recommended as a clinical guideline to determine when MU adjustments are necessary.
- e) Given the variability in how SSD changes affect different patients, a personalised approach to treatment planning should be adopted, adjusting MUs and margins based on individual patient anatomy and response to SSD changes.
- f) Ensure patient education on the potential impact of weight changes on their treatment plans to maintain optimal outcomes.

6.4 Recommendations for Future Research

6.4.1 Class Solution Development (Part 1)

- a) Conduct studies with larger and more diverse patient cohorts to further validate the robustness and generalisability of VMAT class solutions for cervical cancer.
- b) Develop class solutions for different cancer types and prescribed absorbed doses which are not found in the literature (such as cervical cancer class solution for prescribed absorbed doses of 55 Gy instead of 45 Gy).
- c) Research the impact of specific anatomical variations, such as larger organ volumes or significant overlaps with target volumes, on treatment outcomes, and develop tailored class solution variations to address these challenges.

- d) Perform comparative studies of different cost functions, (such as Quadratic Overdose, Maximum Dose, Parallel, Serial etc.) across various cancer types and anatomical sites to determine their relative effectiveness in different clinical scenarios.
- e) Explore adaptive VMAT planning techniques that can dynamically adjust to patient-specific anatomical changes during treatment, potentially improving absorbed dose coverage and sparing of OARs.
- f) The PIBS – 2 cm dose reference point may benefit from further investigation for more accurate absorbed dose representation.
- g) Research the effects of advanced sequencing parameters, such as the number of arcs and fluence smoothing, on treatment quality and delivery efficiency in various clinical settings.
- h) Explore multi-objective optimisation techniques that balance competing goals, such as maximising target coverage while minimising the OAR absorbed dose, to enhance the overall quality of VMAT treatment plans.
- i) Investigate the integration of AI and machine learning techniques in treatment planning to predict optimal cost function parameters and improve the efficiency and accuracy of VMAT class solutions.

6.4.2 Recommendations for Future Research: Investigation of SSD Changes (Part 2)

- a) Investigate the effects of margin sizes between + 0.5 cm and + 1 cm for better understanding of the significant changes in coverage and dose distribution occurring within this range.
- b) Conduct research on how SSD changes affect various anatomical sites beyond the cervix, to generalise findings and improve treatment planning for different cancer types.
- c) Further explore the depth-dose effect in relation to SSD changes, particularly how it influences MU adjustments and dose distribution in deeper tissues versus superficial structures.
- d) Establish a separate clinical threshold for the different SSD changes directions based on their individual effects.
- e) Investigate the long-term effects of SSD changes on patient outcomes, particularly in relation to weight fluctuations during treatment, to improve predictive models for MU adjustments.

- f) Research adaptive planning strategies that can automatically adjust MUs and margins in response to real-time changes in SSD, enhancing treatment precision.
- g) Explore models in operations research such as convolutional neural networks (CNNs) which can predict optimal margin adjustments based on individual patient anatomy and SSD changes, potentially reducing the need for trial-and-error in planning.

6.5 Conclusion

Overall, the observations made from the data prove that all objectives of this study were largely met, contributing valuable insights and tools for the treatment of cervical cancer using VMAT. The study successfully developed a generalisable VMAT planning class solution that adheres to the national clinical protocol, based on the EMBRACE II study, optimising absorbed dose conformity while effectively minimising exposure to critical organs. This class solution has been validated and is set to facilitate future VMAT treatment planning at SAMOC, ensuring a more efficient and standardised approach to cervical cancer treatments. Additionally, the investigation into the dosimetric effects of SSD changes during VMAT provided a clinical threshold on when a change in MUs is necessary, enhancing OAR safety and treatment accuracy. These outcomes underscore the study's success in addressing the core objectives and lay the groundwork for ongoing improvements in VMAT planning and patient management.

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Appendix

Appendix 1: Python Code - Shapiro-Wilk Test

```
# Importing libraries
from scipy import stats

# Providing Data (Replaced for each set)
data = [1163.69, 1113.28, 1021.92, 780, 794.41, 901.72, 1099.96,
1045.85, 1059.88, 942.33,
        937.21, 1207.02, 957.18, 1011.61, 1099.38, 888.44, 938.48,
1145.63, 1012.06, 1275.93]

# Performing the Shapiro-Wilk test
stat, p_value = stats.shapiro(data)

print(f"Shapiro-Wilk Test: {stat}")
print(f"P-value: {p_value}")

# Result
alpha = 0.05
if p_value > alpha:
    print("Data looks Gaussian")
else:
    print("Data does not look Gaussian")
```

Appendix 2: Python Code - Multicollinearity Test for MANOVA

```
# Importing Libraries
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt

# Loading the Excel file containing the data
file_path = '/Users/user/Desktop/Book1.csv'.xls'
data = pd.read_excel(file_path)

# Calculating the correlation matrix
correlation_matrix = data.corr()

# Displaying the correlation matrix
print(correlation_matrix)
plt.figure(figsize=(10, 8))
sns.heatmap(correlation_matrix, annot=True, cmap='coolwarm', fmt='.2f')
plt.show()
```

Appendix 3: Optimised Individual Patient Parameters After Class Solution

The following tables present the cost function results for each patient after applying the class solution. Note that the weight and relative impact were not manually adjusted and the structures which were not contoured for specific patients were not included. The '+' symbols indicate the relative impact of a specific cost function, where more '+' symbols represent a higher impact on the optimisation process.

Patient 1

Structure	Cost Function	Weight	Isoconstraint	Isoeffect	Relative Impact
PTV	Target Penalty	1.00	45.000	42.022	
	Quadratic Overdose	5.18	0.100	0.093	+++
ITV	Quadratic Overdose	69.83	2.300	2.281	++++
CTV-HR + 1 cm	Quadratic Overdose	3.06	0.025	0.029	+++
Bladder	Serial	3.67	37.250	37.251	+++
	Serial	0.02	43.100	42.850	
Rectum	Serial	5.12	35.650	35.497	+++
	Serial	13.07	43.500	43.420	++++
Bowel	Serial	102.73	25.000	24.609	++++
	Serial	1.26	35.000	35.198	+++
Patient	Quadratic Overdose	4.29	0.080	0.081	+++
	Quadratic Overdose	11.48	0.600	0.564	++++
	Quadratic Overdose	82.08	1.600	1.603	++++

Patient 2

Structure	Cost Function	Weight	Isoconstraint	Isoeffect	Relative Impact
PTV	Target Penalty	1.00	45.000	40.894	
	Quadratic Overdose	8.54	0.100	0.107	++++
ITV	Quadratic Overdose	14.44	2.300	2.210	++++
CTV-HR + 1 cm	Quadratic Overdose	5.12	0.025	0.037	++++
Bladder	Serial	15.29	37.250	37.256	++++
	Serial	60.80	43.100	43.022	++++
Rectum	Serial	10.16	35.650	35.470	++++
	Serial	23.25	43.500	43.447	++++
Bowel	Serial	0.87	25.000	24.105	++
	Serial	26.99	35.000	34.950	++++
Kidney (Right)	Serial	1.94	1.000	1.052	+++
Kidney (Left)	Serial	13.96	1.000	0.978	++++
Patient	Quadratic Overdose	9.41	0.080	0.079	++++
	Quadratic Overdose	20.52	0.600	0.582	++++
	Quadratic Overdose	67.27	1.600	1.554	++++

Patient 3

Structure	Cost Function	Weight	Isoconstraint	Isoeffect	Relative Impact
PTV	Target Penalty	1.00	45.000	42.885	
	Quadratic Overdose	3.37	0.100	0.100	+++
ITV	Quadratic Overdose	61.20	2.300	2.309	++++
CTV-HR + 1 cm	Quadratic Overdose	3.56	0.025	0.037	++++
Bladder	Serial	14.95	37.250	37.272	++++
	Serial	3.00	43.100	43.035	+++
Rectum	Serial	7.34	35.650	35.532	+++
	Serial	0.84	43.500	43.393	+++
Bowel	Serial	0.02	25.000	22.807	
	Serial	5.11	35.000	34.980	+++
Patient	Quadratic Overdose	4.06	0.080	0.084	+++
	Quadratic Overdose	7.96	0.600	0.582	++++
	Quadratic Overdose	2.42	1.600	1.625	+++

Patient 4

Structure	Cost Function	Weight	Isoconstraint	Isoeffect	Relative Impact
PTV	Target Penalty	1.00	45.000	40.881	
	Quadratic Overdose	4.17	0.100	0.089	+++
ITV	Quadratic Overdose	7.81	2.300	2.293	+++
CTV-HR + 1 cm	Quadratic Overdose	5.68	0.025	0.033	+++
Bladder	Serial	6.55	37.250	36.845	+++
	Serial	65.20	43.100	43.186	++++
Rectum	Serial	2.65	35.650	35.659	+++
	Serial	38.96	43.500	43.621	++++
Bowel	Serial	463.91	25.000	24.738	++++
	Serial	0.04	35.000	35.169	+
Patient	Quadratic Overdose	6.65	0.080	0.084	+++
	Quadratic Overdose	23.57	0.600	0.562	+++
	Quadratic Overdose	0.02	1.600	1.173	

Patient 5

Structure	Cost Function	Weight	Isoconstraint	Isoeffect	Relative Impact
PTV	Target Penalty	1.00	45.000	42.174	
	Quadratic Overdose	3.33	0.100	0.096	+++
ITV	Quadratic Overdose	56.51	2.300	2.273	++++
CTV-HR + 1 cm	Quadratic Overdose	2.53	0.025	0.019	+++
Bladder	Serial	9.38	37.250	37.188	++++
	Serial	84.80	43.100	43.104	++++
Rectum	Serial	0.41	35.650	35.681	++
	Serial	21.08	43.500	43.429	++++
Bowel	Serial	1.32	25.000	24.692	+++
	Serial	13.28	35.000	34.917	++++
Patient	Quadratic Overdose	5.46	0.080	0.081	+++

	Quadratic Overdose	32.73	0.600	0.580	++++
	Quadratic Overdose	0.02	1.600	1.504	

Patient 6

Structure	Cost Function	Weight	Isoconstraint	Isoeffect	Relative Impact
PTV	Target Penalty	1.00	45.000	42.292	
	Quadratic Overdose	0.89	0.100	0.101	++
ITV	Quadratic Overdose	72.06	2.300	2.259	++++
CTV-HR + 1 cm	Quadratic Overdose	0.74	0.025	0.039	+++
Bladder	Serial	0.37	37.250	37.473	++
	Serial	55.66	43.100	43.137	++++
Bowel	Serial	295.63	25.000	24.602	++++
	Serial	0.14	35.000	34.733	+
Patient	Quadratic Overdose	5.84	0.080	0.081	+++
	Quadratic Overdose	14.96	0.600	0.576	+++
	Quadratic Overdose	0.41	1.600	1.651	++

Patient 7

Structure	Cost Function	Weight	Isoconstraint	Isoeffect	Relative Impact
PTV	Target Penalty	1.00	45.000	42.336	
	Quadratic Overdose	5.70	0.100	0.102	+++
Bladder	Serial	0.01	37.250	35.951	
	Serial	76.88	43.100	43.119	++++
Rectum	Serial	0.19	35.650	35.482	++
	Serial	25.38	43.500	43.531	++++
Bowel	Serial	0.01	25.000	20.199	
	Serial	0.01	35.000	34.894	
Kidney (Right)	Serial	0.07	5.000	1.308	+
Kidney (Left)	Serial	0.07	5.000	1.215	+
Patient	Quadratic Overdose	0.01	0.080	0.072	
	Quadratic Overdose	6.65	0.600	0.583	+++
	Quadratic Overdose	126.00	1.600	1.570	++++

Patient 8

Structure	Cost Function	Weight	Isoconstraint	Isoeffect	Relative Impact
PTV	Target Penalty	1.00	45.000	42.147	
	Quadratic Overdose	7.24	0.100	0.108	+++
Bladder	Serial	2.01	37.250	37.150	+++
	Serial	0.01	43.100	42.557	
Rectum	Serial	0.40	35.650	35.675	++
	Serial	0.22	43.500	43.470	++
Bowel	Serial	353.77	25.000	24.740	++++
	Serial	9.57	35.000	34.887	+++
Patient	Quadratic Overdose	9.48	0.080	0.082	+++

	Quadratic Overdose	12.92	0.600	0.582	+++
	Quadratic Overdose	0.01	1.600	1.325	

Patient 9

Structure	Cost Function	Weight	Isoconstraint	Isoeffect	Relative Impact
PTV	Target Penalty	1.00	45.000	42.467	
	Quadratic Overdose	5.63	0.100	0.103	++++
Bladder	Serial	3.31	37.250	37.247	+++
	Serial	0.03	43.100	42.880	+
Rectum	Serial	3.77	35.650	35.590	+++
	Serial	7.81	43.500	43.566	++++
Bowel	Serial	5.30	25.000	24.998	++++
	Serial	39.75	35.000	34.972	++++
Patient	Quadratic Overdose	12.94	0.080	0.083	++++
	Quadratic Overdose	10.43	0.600	0.546	++++
	Quadratic Overdose	10.89	1.600	1.566	++++

Patient 10

Structure	Cost Function	Weight	Isoconstraint	Isoeffect	Relative Impact
PTV	Target Penalty	1.00	45.000	42.002	
	Quadratic Overdose	2.69	0.100	0.099	+++
ITV	Quadratic Overdose	56.98	2.300	2.291	++++
CTV-HR + 1 cm	Quadratic Overdose	6.47	0.025	0.036	++++
Bladder	Serial	16.55	37.250	37.166	++++
	Serial	0.02	43.100	42.590	
Rectum	Serial	23.35	35.650	35.526	++++
	Serial	0.01	43.500	42.823	
Bowel	Serial	0.01	25.000	22.310	
	Serial	48.30	35.000	34.974	++++
Patient	Quadratic Overdose	6.51	0.080	0.082	++++
	Quadratic Overdose	19.67	0.600	0.579	++++
	Quadratic Overdose	0.01	1.600	1.346	

Patient 11

Structure	Cost Function	Weight	Isoconstraint	Isoeffect	Relative Impact
PTV	Target Penalty	1.00	45.000	40.546	
	Quadratic Overdose	7.31	0.100	0.099	+++
ITV	Quadratic Overdose	46.67	2.300	2.260	++++
CTV-HR + 1 cm	Quadratic Overdose	4.49	0.025	0.034	+++
Bladder	Serial	1.39	37.250	37.591	+++

	Serial	75.15	43.100	43.018	++++
Rectum	Serial	25.26	35.650	35.720	++++
	Serial	13.30	43.500	43.102	+++
Bowel	Serial	175.96	25.000	24.898	++++
	Serial	59.79	35.000	34.983	++++
Patient	Quadratic Overdose	10.36	0.080	0.076	+++
	Quadratic Overdose	39.28	0.600	0.606	++++
	Quadratic Overdose	0.01	1.600	1.302	

Patient 12

Structure	Cost Function	Weight	Isoconstraint	Isoeffect	Relative Impact
PTV	Target Penalty	1.00	45.000	43.532	
	Quadratic Overdose	4.75	0.100	0.103	++++
Bladder	Serial	2.89	37.250	37.166	++++
	Serial	0.01	43.100	42.662	
Rectum	Serial	3.06	35.650	35.477	++++
	Serial	0.87	43.500	43.414	+++
Bowel	Serial	0.01	25.000	23.933	
	Serial	12.59	35.000	35.018	++++
Patient	Quadratic Overdose	5.58	0.080	0.082	++++
	Quadratic Overdose	0.77	0.600	0.541	+++
	Quadratic Overdose	18.26	1.600	1.549	++++

Patient 13

Structure	Cost Function	Weight	Isoconstraint	Isoeffect	Relative Impact
PTV	Target Penalty	1.00	45.000	43.564	
	Quadratic Overdose	4.79	0.100	0.112	++++
Bladder	Serial	0.01	37.250	34.445	
	Serial	0.01	43.100	40.669	
Rectum	Serial	0.01	35.650	31.017	
	Serial	0.01	43.500	31.426	
Bowel	Serial	0.01	25.000	18.566	
	Serial	0.01	35.000	34.522	
Patient	Quadratic Overdose	13.47	0.080	0.083	++++
	Quadratic Overdose	16.50	0.600	0.527	++++
	Quadratic Overdose	0.01	1.600	1.299	

Patient 14

Structure	Cost Function	Weight	Isoconstraint	Isoeffect	Relative Impact
PTV	Target Penalty	1.00	45.000	42.430	
	Quadratic Overdose	7.09	0.100	0.099	+++
Bladder	Serial	10.57	37.250	37.130	+++
	Serial	0.01	43.100	42.414	
Rectum	Serial	3.98	35.650	35.474	+++
	Serial	1.25	43.500	43.506	++
Bowel	Serial	173.33	25.000	24.957	++++
	Serial	7.41	35.000	34.866	+++
Patient	Quadratic Overdose	13.06	0.080	0.081	+++
	Quadratic Overdose	13.97	0.600	0.578	+++
	Quadratic Overdose	0.05	1.600	1.417	+

Patient 15

Structure	Cost Function	Weight	Isoconstraint	Isoeffect	Relative Impact
PTV	Target Penalty	1.00	45.000	41.809	
	Quadratic Overdose	8.08	0.100	0.116	++++
Bladder	Serial	6.60	37.250	36.921	+++
	Serial	0.01	43.100	42.387	
Rectum	Serial	3.57	35.650	35.436	+++
	Serial	0.01	43.500	41.951	
Bowel	Serial	98.55	25.000	25.026	++++
	Serial	74.36	35.000	34.945	++++
Patient	Quadratic Overdose	13.88	0.080	0.079	++++
	Quadratic Overdose	5.70	0.600	0.607	+++
	Quadratic Overdose	0.32	1.600	1.422	++

Patient 16

Structure	Cost Function	Weight	Isoconstraint	Isoeffect	Relative Impact
PTV	Target Penalty	1.00	45.000	41.943	
	Quadratic Overdose	2.49	0.100	0.101	+++
ITV	Quadratic Overdose	43.72	2.300	2.217	++++
CTV-HR + 1 cm	Quadratic Overdose	7.36	0.025	0.032	++++
Bladder	Serial	14.00	37.250	37.059	++++
	Serial	0.14	43.100	42.756	++
Rectum	Serial	7.22	35.650	35.559	+++
	Serial	28.14	43.500	43.475	++++
Bowel	Serial	0.01	25.000	22.549	
	Serial	16.16	35.000	34.878	++++
Kidney (Right)	Serial	61.12	1.000	1.021	++++
Kidney (Left)	Serial	0.01	1.000	1.035	
Patient	Quadratic Overdose	5.47	0.080	0.079	+++
	Quadratic Overdose	50.18	0.600	0.586	++++
	Quadratic Overdose	0.01	1.600	1.375	

Patient 17

Structure	Cost Function	Weight	Isoconstraint	Isoeffect	Relative Impact
PTV	Target Penalty	1.00	45.000	41.431	
	Quadratic Overdose	6.09	0.100	0.105	+++
ITV	Quadratic Overdose	3.00	2.300	2.261	+++
CTV-HR + 1 cm	Quadratic Overdose	10.31	0.025	0.039	++++
Bladder	Serial	11.08	37.250	37.335	+++
	Serial	0.39	43.100	42.963	++
Bowel	Serial	217.66	25.000	24.846	++++
	Serial	0.01	35.000	34.834	
Kidney (Right)	Serial	16.99	9.500	9.847	++++
Kidney (Left)	Serial	75.76	8.000	8.041	++++
Patient	Quadratic Overdose	14.96	0.080	0.081	+++
	Quadratic Overdose	10.58	0.600	0.569	+++
	Quadratic Overdose	0.01	1.600	1.320	

Patient 18

Structure	Cost Function	Weight	Isoconstraint	Isoeffect	Relative Impact
PTV	Target Penalty	1.00	45.000	41.550	
	Quadratic Overdose	10.62	0.100	0.100	+++
Bladder	Serial	3.71	37.250	37.267	+++
	Serial	0.82	43.100	42.850	++
Rectum	Serial	1.88	35.650	35.208	++
	Serial	0.01	43.500	42.863	
Bowel	Serial	297.32	25.000	24.984	++++
	Serial	23.00	35.000	34.788	+++
Patient	Quadratic Overdose	11.04	0.080	0.079	+++
	Quadratic Overdose	18.59	0.600	0.610	+++
	Quadratic Overdose	0.22	1.600	1.463	++

Patient 19

Structure	Cost Function	Weight	Isoconstraint	Isoeffect	Relative Impact
PTV	Target Penalty	1.00	45.000	42.600	
	Quadratic Overdose	6.36	0.100	0.106	++++
Bladder	Serial	12.77	37.250	37.108	++++
	Serial	4.34	43.100	43.033	+++
Rectum	Serial	3.55	35.650	35.463	+++
	Serial	0.01	43.500	42.998	+
Bowel	Serial	0.06	25.000	24.294	+
	Serial	35.73	35.000	35.015	++++
Patient	Quadratic Overdose	16.58	0.080	0.081	++++
	Quadratic Overdose	5.79	0.600	0.613	++++
	Quadratic Overdose	2.66	1.600	1.564	+++

Patient 20

Structure	Cost Function	Weight	Isoconstraint	Isoeffect	Relative Impact
PTV	Target Penalty	1.00	45.000	39.465	
	Quadratic Overdose	8.56	0.100	0.101	+++
ITV	Quadratic Overdose	96.98	2.300	2.303	++++
Bladder	Serial	6.58	37.250	37.357	+++
	Serial	22.37	43.100	43.029	+++
Rectum	Serial	2.57	35.650	35.706	+++
	Serial	17.93	43.500	43.471	+++
Bowel	Serial	425.47	25.000	25.095	++++
	Serial	12.73	35.000	34.936	+++
Patient	Quadratic Overdose	7.47	0.080	0.079	+++
	Quadratic Overdose	12.19	0.600	0.564	+++
	Quadratic Overdose	82.20	1.600	1.612	++++

**Appendix 4. Original DVH Statistics
Following Class Solution.**

Patient 1

Structure (Constraint)	V > (cc)	V > (%)	Pass
PTV (> 95 %)	1877.83	98.40	Yes
PTV (< 107 %)	0.00	0.00	Yes
PTV (> 98 %)	1877.83	98.40	Yes
ITV (> 99.9 %)	1155.71	99.99	Yes
CTV-HR + 1 cm (< 0.5 cc)	0.00	0.00	Yes
Bladder (< 0.5 cc)	0.00	0.00	Yes
Bladder (85 %)	239.39	84.64	Yes
Bladder (75 %)	149.72	52.94	Yes
Rectum (< 0.5 cc)	0.00	0.00	Yes
Rectum (< 95 %)	41.93	100.00	No
Rectum (< 85 %)	35.81	85.41	No
Bowel (< 0.5 cc)	0.00	0.00	Yes
Bowel (350 cc)	350.57	25.58	No
Bowel (100 cc)	186.95	13.64	No
Structure (Constraint)	Volume Ratio	Pass	
CI (<1.10)	1.13	No	
CI (<1.55)	1.71	No	
PIBS – 2cm (< 5 Gy)	44.96	No	

Patient 2

Structure (Constraint)	V > (cc)	V > (%)	Pass
PTV (> 95 %)	2069.06	96.04	Yes
PTV (< 107 %)	0.00	0.00	Yes
PTV (> 98 %)	2069.06	96.04	No
ITV (> 99.9 %)	1125.09	99.90	Yes
CTV-HR + 1 cm (< 0.5 cc)	0.00	0.00	Yes
Bladder (< 0.5 cc)	0.00	0.00	Yes
Bladder (85 %)	281.80	94.44	No
Bladder (75 %)	209.75	70.29	Yes
Rectum (< 0.5 cc)	0.00	0.00	Yes
Rectum (< 95 %)	118.32	99.05	No
Rectum (< 85 %)	101.41	84.89	Yes
Bowel (< 0.5 cc)	0.00	0.00	Yes

Bowel (350 cc)	764.37	30.55	No
Bowel (100 cc)	101.41	17.02	No
Structure (Constraint)	Volume Ratio	Pass	
CI (<1.10)	1.05	Yes	
CI (<1.55)	1.59	No	
Structure (Constraint)	Dose (Gy)	Pass	
PIBS – 2cm (< 5 Gy)	44.00	No	
Right Kidney (< 15 Gy)	1.04	Yes	
Right Kidney (< 10 Gy)		Yes	
Left Kidney (< 15 Gy)	0.96	Yes	
Left Kidney (< 10 Gy)		Yes	

Patient 3

Structure (Constraint)	V > (cc)	V > (%)	Pass
PTV (> 95 %)	1700.65	99.51	Yes
PTV (< 107 %)	0.00	0.00	Yes
PTV (> 98 %)	1700.65	99.51	Yes
ITV (> 99.9 %)	1139.70	100.00	Yes
CTV-HR + 1 cm (< 0.5 cc)	0.00	0.00	Yes
Bladder (< 0.5 cc)	0.00	0.00	Yes
Bladder (85 %)	447.06	86.22	No
Bladder (75 %)	274.68	52.97	Yes
Rectum (< 0.5 cc)	0.00	0.00	Yes
Rectum (< 95 %)	79.99	89.77	Yes
Rectum (< 85 %)	56.36	63.25	Yes
Bowel (< 0.5 cc)	0.00	0.00	Yes
Bowel (350 cc)	342.21	20.11	Yes
Bowel (100 cc)	158.08	9.29	No
Structure (Constraint)	Volume Ratio	Pass	
CI (<1.10)	1.14	No	
CI (<1.55)	1.59	No	
PIBS – 2cm (< 5 Gy)	9.85	No	

Patient 4

Structure (Constraint)	V > (cc)	V > (%)	Pass
PTV (> 95 %)	1297.24	96.93	Yes
PTV (< 107 %)	0.00	0.00	Yes
PTV (> 98 %)	1297.24	96.93	No

ITV (> 99.9 %)	859.43	100.00	Yes
CTV-HR + 1 cm (< 0.5 cc)	0.00	0.00	Yes
Bladder (< 0.5 cc)	0.00	0.00	Yes
Bladder (85 %)	158.27	97.62	No
Bladder (75 %)	117.45	72.44	Yes
Rectum (< 0.5 cc)	0.00	0.00	Yes
Rectum (< 95 %)	41.12	100.00	No
Rectum (< 85 %)	38.79	94.33	No
Bowel (< 0.5 cc)	0.00	0.00	Yes
Bowel (350 cc)	275.47	34.64	Yes
Bowel (100 cc)	173.07	21.77	No
Structure (Constraint)	Volume Ratio	Pass	
CI (<1.10)	1.09	Yes	
CI (<1.55)	1.56	No	
PIBS – 2cm (< 5 Gy)	44.75	No	

Patient 5

Structure (Constraint)	V > (cc)	V > (%)	Pass
PTV (> 95 %)	1463.08	98.46	Yes
PTV (< 107 %)	0.00	0.00	Yes
PTV (> 98 %)	1463.08	98.46	Yes
ITV (> 99.9 %)	1013.69	100.00	Yes
CTV-HR + 1 cm (< 0.5 cc)	0.00	0.00	Yes
Bladder (< 0.5 cc)	0.00	0.00	Yes
Bladder (85 %)	299.87	97.79	No
Bladder (75 %)	212.15	69.19	Yes
Rectum (< 0.5 cc)	0.00	0.00	Yes
Rectum (< 95 %)	53.63	90.99	Yes
Rectum (< 85 %)	48.01	81.47	Yes
Bowel (< 0.5 cc)	0.03	0.00	Yes
Bowel (350 cc)	263.94	23.53	Yes
Bowel (100 cc)	101.45	9.04	No
Structure (Constraint)	Volume Ratio	Pass	
CI (<1.10)	1.09	Yes	
CI <1.55	1.56	No	
PIBS – 2cm (< 5 Gy)	45.38	No	

Patient 6

Structure (Constraint)	V > (cc)	V > (%)	Pass
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PTV (> 95 %)	1711.87	98.83	Yes
PTV (< 107 %)	0.05	0.00	Yes
PTV (> 98 %)	1711.87	98.83	Yes
ITV (> 99.9 %)	1202.58	100.00	Yes
CTV-HR + 1 cm (< 0.5 cc)	0.00	0.00	Yes
Bladder (< 0.5 cc)	0.00	0.00	Yes
Bladder (85 %)	426.71	89.81	No
Bladder (75 %)	299.25	62.98	Yes
Bowel (< 0.5 cc)	0.53	0.03	No
Bowel (350 cc)	555.20	33.16	No
Bowel (100 cc)	348.80	20.83	No
Structure (Constraint)	Volume Ratio	Pass	
CI (<1.10)	1.08	Yes	
CI (<1.55)	1.48	Yes	
PIBS – 2cm (< 5 Gy)	45.16	No	

Patient 7

Structure (Constraint)	V > (cc)	V > (%)	Pass
PTV (> 95 %)	2195.45	98.62	Yes
PTV (< 107 %)	0.00	0.00	Yes
PTV (> 98 %)	2195.45	98.62	Yes
Bladder (< 0.5 cc)	0.00	0.00	Yes
Bladder (85 %)	380.28	87.33	No
Bladder (75 %)	283.02	64.99	Yes
Rectum (< 0.5 cc)	0.00	0.00	Yes
Rectum (< 95 %)	49.03	99.15	No
Rectum (< 85 %)	43.87	88.71	No
Bowel (< 0.5 cc)	0.00	0.00	Yes
Bowel (350 cc)	305.12	21.23	Yes
Bowel (100 cc)	206.93	14.40	No
Structure (Constraint)	Volume Ratio	Pass	
CI (<1.10)	1.06	Yes	
CI (<1.55)	1.43	Yes	
PIBS – 2cm (< 5 Gy)	45.46	No	
Structure (Constraint)	Dose (Gy)	Pass	

Right Kidney (< 15 Gy)	1.42	Yes
Right Kidney (< 10 Gy)		Yes
Left Kidney (< 15 Gy)	1.34	Yes
Left Kidney (< 10 Gy)		Yes

Structure (Constraint)	Volume Ratio	Pass
CI (<1.10)	1.18	No
CI (<1.55)	1.08	Yes
PIBS – 2cm (< 5 Gy)	38.75	No

Patient 8

Structure (Constraint)	V > (cc)	V > (%)	Pass
PTV (> 95 %)	908.45	98.67	Yes
PTV (< 107 %)	0.00	0.00	Yes
PTV (> 98 %)	908.45	98.67	Yes
Bladder (< 0.5 cc)	0.00	0.00	Yes
Bladder (85 %)	126.49	70.05	Yes
Bladder (75 %)	68.20	37.76	Yes
Rectum (< 0.5 cc)	0.00	0.00	Yes
Rectum (< 95 %)	29.59	68.66	Yes
Rectum (< 85 %)	22.37	51.90	Yes
Bowel (< 0.5 cc)	0.00	0.00	Yes
Bowel (350 cc)	423.45	26.90	No
Bowel (100 cc)	189.33	12.03	No
Structure (Constraint)	Volume Ratio	Pass	
CI (<1.10)	1.17	No	
CI (<1.55)	1.82	No	
PIBS – 2cm (< 5 Gy)	24.17	No	

Patient 9

Structure (Constraint)	V > (cc)	V > (%)	Pass
PTV (> 95 %)	1091.66	99.15	Yes
PTV (< 107 %)	0.00	0.00	Yes
PTV (> 98 %)	1091.66	99.15	Yes
Bladder (< 0.5 cc)	0.00	0.00	Yes
Bladder (85 %)	300.30	77.26	Yes
Bladder (75 %)	170.96	43.98	Yes
Rectum (< 0.5 cc)	0.00	0.00	Yes
Rectum (< 95 %)	61.93	89.79	Yes
Rectum (< 85 %)	42.88	62.17	Yes
Bowel (< 0.5 cc)	0.00	0.00	Yes
Bowel (350 cc)	380.33	30.85	No
Bowel (100 cc)	160.25	13.00	No

Patient 10

Structure (Constraint)	V > (cc)	V > (%)	Pass
PTV (> 95 %)	1381.34	98.11	Yes
PTV (< 107 %)	0.00	0.00	Yes
PTV (> 98 %)	1381.34	98.11	Yes
ITV (> 99.9 %)	803.96	100.00	Yes
CTV-HR + 1 cm (< 0.5 cc)	0.00	0.00	Yes
Bladder (< 0.5 cc)	0.00	0.00	Yes
Bladder (85 %)	158.90	90.38	No
Bladder (75 %)	84.74	48.20	Yes
Rectum (< 0.5 cc)	0.02	0.03	Yes
Rectum (< 95 %)	73.29	97.79	No
Rectum (< 85 %)	48.61	64.86	Yes
Bowel (< 0.5 cc)	0.00	0.00	Yes
Bowel (350 cc)	812.43	21.05	No
Bowel (100 cc)	365.76	9.47	No
Structure (Constraint)	Volume Ratio	Pass	
CI (<1.10)	1.15	No	
CI (<1.55)	1.81	No	
PIBS – 2cm (< 5 Gy)	44.48	No	
Structure (Constraint)	Dose (Gy)	Pass	
Right Kidney (< 15 Gy)	0.51		
Right Kidney (< 10 Gy)		Yes	
Left Kidney (< 15 Gy)	0.58	Yes	
Left Kidney (< 10 Gy)		Yes	

Patient 11

Structure (Constraint)	V > (cc)	V > (%)	Pass
PTV (> 95 %)	1112.93	95.40	Yes

PTV (< 107 %)	0.00	0.00	Yes
PTV (> 98 %)	1112.93	95.40	No
ITV (> 99.9 %)	656.02	99.96	Yes
CTV-HR + 1 cm (< 0.5 cc)	0.00	0.00	Yes
Bladder (< 0.5 cc)	0.00	0.00	Yes
Bladder (85 %)	280.33	96.89	No
Bladder (75 %)	195.99	67.74	Yes
Rectum (< 0.5 cc)	0.00	0.00	Yes
Rectum (< 95 %)	52.11	98.70	No
Rectum (< 85 %)	40.09	75.94	Yes
Bowel (< 0.5 cc)	0.01	0.00	Yes
Bowel (350 cc)	412.42	49.74	No
Bowel (100 cc)	278.88	33.63	No
Structure (Constraint)	Volume Ratio	Pass	
CI (<1.10)	1.07	Yes	
CI (<1.55)	1.73	No	
PIBS – 2cm (< 5 Gy)	44.37	No	

Patient 12

Structure (Constraint)	V > (cc)	V > (%)	Pass
PTV (> 95 %)	1205.49	99.87	Yes
PTV (< 107 %)	0.00	0.00	Yes
PTV (> 98 %)	1205.49	99.87	Yes
Bladder (< 0.5 cc)	0.00	0.00	Yes
Bladder (85 %)	227.00	65.84	Yes
Bladder (75 %)	133.94	38.85	Yes
Rectum (< 0.5 cc)	0.00	0.00	Yes
Rectum (< 95 %)	57.85	86.89	Yes
Rectum (< 85 %)	35.45	53.25	Yes
Bowel (< 0.5 cc)	0.00	0.00	Yes
Bowel (350 cc)	512.09	18.80	No
Bowel (100 cc)	157.80	5.79	No
Structure (Constraint)	Volume Ratio	Pass	
CI (<1.10)	1.24	No	
CI (<1.55)	1.86	No	
PIBS – 2cm (< 5 Gy)	44.78	No	

Patient 13

Structure (Constraint)	V > (cc)	V > (%)	Pass
PTV (> 95 %)	666.85	99.86	Yes
PTV (< 107 %)	0.00	0.00	Yes
PTV (> 98 %)	666.85	99.86	Yes
Bladder (< 0.5 cc)	0.00	0.00	Yes
Bladder (85 %)	41.52	44.92	Yes
Bladder (75 %)	13.86	15.00	Yes
Rectum (< 0.5 cc)	0.00	0.00	Yes
Rectum (< 95 %)	17.69	24.91	Yes
Rectum (< 85 %)	0.01	0.01	Yes
Bowel (< 0.5 cc)	0.00	0.00	Yes
Bowel (350 cc)	250.54	8.22	Yes
Bowel (100 cc)	93.80	3.08	Yes
Structure (Constraint)	Volume Ratio	Pass	
CI (<1.10)	1.31	No	
CI (<1.55)	2.16	No	
PIBS – 2cm (< 5 Gy)	2.76	Yes	

Patient 14

Structure (Constraint)	V > (cc)	V > (%)	Pass
PTV (> 95 %)	1069.78	99.48	Yes
PTV (< 107 %)	0.00	0.00	Yes
PTV (> 98 %)	1069.78	99.48	Yes
Bladder (< 0.5 cc)	0.00	0.00	Yes
Bladder (85 %)	369.68	85.59	No
Bladder (75 %)	165.50	38.32	Yes
Rectum (< 0.5 cc)	0.00	0.00	Yes
Rectum (< 95 %)	59.82	90.65	Yes
Rectum (< 85 %)	38.32	56.06	Yes
Bowel (< 0.5 cc)	0.00	0.00	Yes
Bowel (350 cc)	179.74	22.91	Yes
Bowel (100 cc)	72.62	9.26	Yes

Structure (Constraint)	Volume Ratio	Pass
CI (<1.10)	1.18	No
CI (<1.55)	1.85	No
PIBS – 2cm (< 5 Gy)	45.84	No

Patient 15

Structure (Constraint)	V > (cc)	V > (%)	Pass
PTV (> 95 %)	915.14	98.71	Yes
PTV (< 107 %)	0.00	0.00	Yes
PTV (> 98 %)	915.14	98.71	Yes
Bladder (< 0.5 cc)	0.00	0.00	Yes
Bladder (85 %)	210.71	73.34	Yes
Bladder (75 %)	105.82	36.83	Yes
Rectum (< 0.5 cc)	0.00	0.00	Yes
Rectum (< 95 %)	61.23	66.04	Yes
Rectum (< 85 %)	28.49	30.73	Yes
Bowel (< 0.5 cc)	0.01	0.00	Yes
Bowel (350 cc)	575.04	31.30	No
Bowel (100 cc)	277.72	15.11	No
Structure (Constraint)	Volume Ratio	Pass	
CI (<1.10)	1.17	No	
CI (<1.55)	1.90	No	
PIBS – 2cm (< 5 Gy)	42.49	No	

Patient 16

Structure (Constraint)	V > (cc)	V > (%)	Pass
PTV (> 95 %)	1541.71	98.47	Yes
PTV (< 107 %)	0.00	0.00	Yes
PTV (> 98 %)	1541.71	98.47	Yes
ITV (> 99.9 %)	979.10	100.00	Yes
CTV-HR + 1 cm (< 0.5 cc)	0.00	0.00	Yes
Bladder (< 0.5 cc)	0.00	0.00	Yes
Bladder (85 %)	480.10	80.00	Yes
Bladder (75 %)	58.91	84.26	No
Rectum (< 0.5 cc)	0.00	0.00	Yes
Rectum (< 95 %)	67.67	67.67	Yes

Rectum (< 85 %)	58.91	84.26	Yes
New Bowel (< 0.5 cc)	0.00	0.00	Yes
New Bowel (350 cc)	507.69	21.91	No
New Bowel (100 cc)	250.64	10.82	No
Structure (Constraint)	Volume Ratio	Pass	
CI (<1.10)	1.11	No	
CI (<1.55)	1.68	No	
PIBS – 2cm (< 5 Gy)	44.34	No	
Structure (Constraint)	Dose (Gy)	Pass	
Right Kidney (< 15 Gy)	0.09	Yes	
Right Kidney (< 10 Gy)		Yes	
Left Kidney (< 15 Gy)	0.81	Yes	
Left Kidney (< 10 Gy)		Yes	

Patient 17

Structure (Constraint)	V > (cc)	V > (%)	Pass
PTV (> 95 %)	1439.25	97.90	Yes
PTV (< 107 %)	0.00	0.00	Yes
PTV (> 98 %)	1439.25	97.90	No
ITV (> 99.9 %)	953.72	99.99	Yes
CTV-HR + 1 cm (< 0.5 cc)	0.00	0.00	Yes
Bladder (< 0.5 cc)	0.00	0.00	Yes
Bladder (85 %)	111.94	97.81	No
Bladder (75 %)	71.40	62.39	Yes
Bowel (< 0.5 cc)	0.02	0.00	Yes
Bowel (350 cc)	381.69	31.84	No
Bowel (100 cc)	211.86	17.67	No
Structure (Constraint)	Volume Ratio	Pass	
CI (<1.10)	1.03	Yes	
CI (<1.55)	1.53	Yes	
PIBS – 2cm (< 5 Gy)	45.44	No	
Structure (Constraint)	Dose (Gy)	Pass	
Right Kidney (< 15 Gy)	7.10	Yes	
Right Kidney (< 10 Gy)		Yes	

Left Kidney (< 15 Gy)	6.09	Yes
Left Kidney (< 10 Gy)		Yes

Patient 18

Structure (Constraint)	V > (cc)	V > (%)	Pass
PTV (> 95 %)	1091.22	98.08	Yes
PTV (< 107 %)	0.00	0.00	Yes
PTV (> 98 %)	1012.29	90.98	No
Bladder (< 0.5 cc)	0.00	0.00	Yes
Bladder (85 %)	113.03	86.59	No
Bladder (75 %)	64.26	49.23	Yes
Rectum (< 0.5 cc)	0.00	0.00	Yes
Rectum (< 95 %)	35.33	84.87	Yes
Rectum (< 85 %)	18.52	44.49	Yes
Bowel (< 0.5 cc)	0.00	0.00	Yes
Bowel (350 cc)	432.08	27.54	No
Bowel (100 cc)	151.83	9.68	No
Structure (Constraint)	Volume Ratio	Pass	
CI (<1.10)	1.13	No	
CI (<1.55)	1.80	No	
PIBS – 2cm (< 5 Gy)	45.32	No	

Patient 19

Structure (Constraint)	V > (cc)	V > (%)	Pass
PTV (> 95 %)	826.20	99.39	Yes
PTV (< 107 %)	0.00	0.00	Yes
PTV (> 98 %)	826.20	99.39	Yes
Bladder (< 0.5 cc)	0.00	0.00	Yes
Bladder (85 %)	342.14	98.42	No
Bladder (75 %)	160.75	46.24	Yes
Rectum (< 0.5 cc)	0.00	0.00	Yes
Rectum (< 95 %)	36.90	79.74	Yes
Rectum (< 85 %)	20.94	45.26	Yes
Bowel (< 0.5 cc)	0.00	0.00	Yes

Bowel (350 cc)	272.73	30.12	Yes
Bowel (100 cc)	111.02	12.26	No
Structure (Constraint)	Volume Ratio	Pass	
CI (<1.10)	1.19	No	
CI (<1.55)	1.96	No	
PIBS – 2cm (< 5 Gy)	46.21	No	

Patient 20

Structure (Constraint)	V > (cc)	V > (%)	Pass
PTV (> 95 %)	1855.62	94.85	No
PTV (< 107 %)	0.00	0.00	Yes
PTV (> 98 %)	1855.62	94.85	No
ITV (> 99.9 %)	1192.74	99.98	Yes
Bladder (< 0.5 cc)	0.00	0.00	Yes
Bladder (85 %)	141.96	92.01	No
Bladder (75 %)	99.90	64.75	Yes
Rectum (< 0.5 cc)	0.00	0.00	Yes
Rectum (< 95 %)	66.35	97.81	No
Rectum (< 85 %)	54.84	54.84	Yes
Bowel (< 0.5 cc)	0.00	0.00	Yes
Bowel (350 cc)	638.31	33.10	No
Bowel (100 cc)	378.68	19.63	No
Structure (Constraint)	Volume Ratio	Pass	
CI (<1.10)	1.03	Yes	
CI (<1.55)	1.55	No	
PIBS – 2cm (< 5 Gy)	44.89	No	

Appendix 5: Original and Adjusted MU Values for Each Applied Margin: Uniform

Patient	Original MUs	New MUs					
		+ 0.5 cm	- 0.5 cm	+ 1 cm	- 1 cm	+ 1.5 cm	- 1.5 cm
1	1163.69	1192.5	1153.3	1214.6	1150.8	1234.8	1154
2	1113.28	1132.4	1115.1	1152.8	1149.5	1173.2	1320
3	1021.92	1040.3	1015.6	1056.6	1008.6	1074	1016.8
4	780.0	794.3	769.8	806.3	762.6	817.7	754.2
5	794.41	809.5	784	822.2	813.7	835	766.6
6	901.72	919.6	896	933.6	905	948.6	905
7	1099.96	1119.6	1111.2	1101	1106.6	1156	1118.2
8	1045.85	1065	1033.5	1082	1022	1098.3	1012.6
9	1059.88	1086.5	1060.5	1104	1040	1121	1037
10	942.33	960	936.5	974.5	925.5	989	923
11	937.21	953.3	926.7	967.5	925	982	952
12	1207.02	1239	1198	1262	1217	1276	1220
13	957.18	980	980	1000	1120	1015	1070
14	1011.61	1024	1036.5	1041	1020	1057.6	1248
15	1099.38	1120.4	1087	1137.5	1073.5	1155.4	1066.6
16	888.44	903	887	915.4	887.4	928.5	871.8
17	938.48	947.5	938.7	959.7	936	974	938.6
18	1145.63	1172.9	1155.7	1191.5	1126.5	1210	1115.8
19	1012.06	1032	1000	1047	989	1063.5	980
20	1275.93	1293.3	1278	1315.5	1310	1338.3	1494

Anterior

Patient	Original MUs	New MUs					
		+ 0.5 cm	- 0.5 cm	+ 1 cm	- 1 cm	+ 1.5 cm	- 1.5 cm
1	1163.69	1179.8	1158	1193	1155.6	1207	1156
2	1113.28	1127.3	1108.9	1140.8	1121.5	1154.6	1160
3	1021.92	1034.7	1017.6	1045	1016.8	1056	1014
4	780.0	791.2	774.4	797.2	769.6	804.3	765.8
5	794.41	805.7	789.6	813.7	784.1	822	779.6
6	901.72	913.6	895.5	922	904.2	930	904
7	1099.96	1114.7	1094.8	1125.4	1089.7	1118.2	1086.8
8	1045.85	1059	1039.5	1069	1033.5	1079	1030
9	1059.88	1073.5	1054.5	1060.2	1047.5	1095	1041.5
10	942.33	955.4	937	965	934.1	975.2	927.2
11	937.21	949	933	958.8	930.5	969	932.5
12	1207.02	1232	1239	1245	1200	1255	1195
13	957.18	970	950	980	945	990	942
14	1011.61	1024	1006	1033.4	1000.5	1044	1001
15	1099.38	1113.8	1092.5	1124.5	1085	1136.2	1080
16	888.44	897.8	881.6	904.8	878.5	912.4	876
17	938.48	943.8	938.5	951.4	938.1	959.8	939
18	1145.63	1162	1141	1174	1132.3	1187	1127.5
19	1012.06	1025	1005	1034	1002.8	1044	999
20	1275.93	1286.5	1271	1301	1289.5	1316	1320

Lateral

Patient	Original MUs	New MUs					
		+ 0.5 cm	- 0.5 cm	+ 1 cm	- 1 cm	+ 1.5 cm	- 1.5 cm
1	1163.69	1174.2	1158	1182.3	1154.54	1190.5	1151
2	1113.28	1132.5	1108.9	1128.5	1105.6	1102.5	1102.5
3	1021.92	1032.3	1017.6	1040.5	1015	1048	1012
4	780.0	789	774.4	794.9	771.5	800.7	768.2
5	794.41	804.2	789.6	810.8	786.4	817.4	783.2
6	901.72	913.6	897	921.4	904.5	929.4	904.8
7	1099.96	1107.5	1094.8	1125	1106.6	1135	1091.5
8	1045.85	1047	1039.5	1067.8	1035	1077	1030.2
9	1059.88	1071	1054.5	1079	1049	1087	1045
10	942.33	953.7	937	961	934.2	968	931.2
11	937.21	945.9	933	951.4	929.2	956.7	926
12	1207.02	1233	1239	1245	1235	1251	1195
13	957.18	970	950	980	945	986	942
14	1011.61	1018	1006	1023.6	1001.2	1028.1	997
15	1099.38	1112.5	1092.5	1122	1088.3	1130.8	1083.5
16	888.44	898.3	881.6	905.5	878.5	912.9	874.8
17	938.48	943.5	938.5	948.8	938	956	936.9
18	1145.63	1164.8	1141	1174	1137.2	1182.5	1132.8
19	1012.06	1026	1005	1036	1000.8	1045.8	996.2
20	1275.93	1285.5	1271	1295.3	1268	1305.2	1265.2

Appendix 6. DVH Statistics After SSD Changes: + 0.5 cm

Patient 1		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1765.78	92.53	No	-5.87	1863.15	97.63	Yes	-0.77	1876.47	98.33	Yes	-0.07
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1765.78	92.53	No	-5.87	1863.15	97.63	No	-0.77	1876.47	98.33	Yes	-0.07
ITV (> 99.9 %)	Hard	1131.43	97.89	No	-2.10	1155.15	99.94	Yes	-0.06	1155.65	99.99	Yes	-0.01
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	233.29	82.48	Yes	-2.16	230.75	81.58	Yes	-1.61	232.93	82.35	Yes	-0.84
Bladder (75 %)	Soft	139.41	49.29	Yes	-3.65	144.27	51.01	Yes	-2.23	147.17	52.03	Yes	-1.21
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	233.29	82.48	Yes	-17.52	41.93	100.00	No	0.00	41.93	100.00	No	0.00
Rectum (< 85 %)	Soft	34.86	83.15	Yes	-2.26	36.48	87.02	No	-0.92	36.42	36.42	Yes	-51.52
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	41.93	100.00	Yes	74.42	349.20	349.20	Yes	323.06	353.39	25.78	No	-0.36
Bowel (100 cc)	Soft	171.14	12.49	No	-1.15	179.76	13.11	No	-0.60	183.00	13.35	No	-0.36
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.00		Yes	-12.02	1.07		Yes	-6.43	1.10		Yes	-3.65
CI (<1.55)	Soft	1.65		No	-3.89	1.69		No	-1.95	1.70		No	-1.09
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	43.86		No	-2.44	44.10		No	-1.91	44.49		No	-1.05

Patient 2		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1940.81	90.08	No	-5.96	1988.55	92.30	No	-3.74	1940.81	90.08	No	-5.96
PTV (< 107 %)	Hard	3.74	0.17	No	0.17	4.25	0.20	No	0.20	3.74	0.17	No	0.17
PTV (> 98 %)	Soft	1940.81	90.08	No	-5.96	1988.55	92.30	No	-3.74	1940.81	90.08	No	-5.96
ITV (> 99.9 %)	Hard	1095.50	97.27	No	-2.63	1111.00	98.64	No	-1.26	1095.50	97.27	No	-2.63
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	279.21	93.57	No	-0.87	279.42	93.64	No	-0.80	279.21	93.57	No	-0.87
Bladder (75 %)	Soft	201.88	67.66	Yes	-2.63	202.83	67.98	Yes	-2.31	201.88	67.66	Yes	-2.63
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	117.80	98.61	No	-0.44	118.00	98.78	No	-0.27	117.80	98.61	No	-0.44
Rectum (< 85 %)	Soft	99.05	82.92	Yes	-1.97	99.99	83.70	Yes	-1.19	99.05	82.92	Yes	-1.97
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	741.53	29.64	No	-0.91	747.12	29.86	No	-0.69	741.53	29.64	No	-0.91
Bowel (100 cc)	Soft	404.30	16.16	No	-0.86	409.72	16.38	No	-0.64	404.30	16.16	No	-0.86
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	0.95		Yes	-9.56	1.45		No	37.13	0.95		Yes	-9.56
CI (<1.55)	Soft	1.33		Yes	-16.69	1.56		No	-1.84	1.55		No	-2.47
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	43.07		No	-2.10	42.92		No	-2.45	43.07		No	-2.10
Right Kidney (< 15 Gy)	Hard	1.04		Yes	0.00	1.02		Yes	-1.35	1.04		Yes	0.00
Right Kidney (< 10 Gy)	Soft	1.04		Yes	0.00	1.02		Yes	-1.35	1.04		Yes	0.00
Left Kidney (< 15 Gy)	Hard	0.96		Yes	0.00	0.94		Yes	-1.26	0.96		Yes	0.00
Left Kidney (< 10 Gy)	Soft	0.96		Yes	0.00	0.94		Yes	-1.26	0.96		Yes	0.00

Patient 3		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1678.39	98.20	Yes	-1.31	1688.48	98.79	Yes	-0.72	1691.79	98.99	Yes	-0.52
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1678.39	98.20	Yes	-1.31	1688.48	98.79	Yes	-0.72	1691.79	98.99	Yes	-0.52
ITV (> 99.9 %)	Hard	1139.40	99.97	Yes	-0.03	1139.67	100.00	Yes	0.00	1139.66	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	441.15	85.08	No	-1.14	442.05	85.25	No	-0.97	444.26	85.68	No	-0.54
Bladder (75 %)	Soft	262.20	50.57	Yes	-2.40	265.11	51.13	Yes	-1.84	267.56	51.60	Yes	-1.37
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	79.45	89.16	Yes	-0.61	79.55	89.28	Yes	-0.49	79.71	89.45	Yes	-0.32
Rectum (< 85 %)	Soft	54.64	61.32	Yes	-1.93	55.32	62.08	Yes	-1.17	55.23	61.98	Yes	-1.27
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	328.17	19.29	Yes	-0.82	333.25	19.59	Yes	-0.52	337.09	19.81	Yes	-0.30
Bowel (100 cc)	Soft	146.87	8.63	No	-0.66	150.86	8.87	No	-0.42	153.95	9.05	No	-0.24
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.08		Yes	-5.82	1.10		Yes	-3.87	1.11		No	-3.16
CI (<1.55)	Soft	1.55		Yes	-2.79	1.56		No	-1.94	1.57		No	-1.55
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	9.67		No	-1.81	9.73		No	-1.25	9.81		No	-0.43

Patient 4		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1249.32	93.35	No	-3.58	1263.92	94.44	No	-2.49	1272.50	95.08	Yes	-1.85
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1249.32	93.35	No	-3.58	1263.92	94.44	No	-2.49	1272.50	95.08	No	-1.85
ITV (> 99.9 %)	Hard	855.37	99.52	No	-0.48	857.52	99.77	No	-0.23	858.42	99.88	No	-0.12
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	157.28	97.01	No	-0.61	157.39	97.08	No	-0.54	157.69	97.26	No	-0.36
Bladder (75 %)	Soft	112.90	69.64	Yes	-2.80	113.59	70.06	Yes	-2.38	114.80	70.81	Yes	-1.63
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	41.12	100.00	No	0.00	41.12	100.00	No	0.00	41.12	100.00	No	0.00
Rectum (< 85 %)	Soft	38.34	93.23	No	-1.10	38.45	93.50	No	-0.83	38.55	93.74	No	-0.59
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	268.08	33.71	Yes	-0.93	269.29	33.86	Yes	-0.78	270.98	34.08	Yes	-0.56
Bowel (100 cc)	Soft	167.49	21.06	No	-0.71	168.80	21.23	No	-0.54	169.40	21.30	No	-0.47
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.01		Yes	-7.14	1.03		Yes	-5.42	1.04		Yes	-4.33
CI (<1.55)	Soft	1.53		Yes	-2.36	1.53		Yes	-1.86	1.04		Yes	-33.31
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	43.98		No	-1.72	43.92		No	-1.85	44.25		No	-1.13

Patient 5		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1412.84	95.08	Yes	-3.38	1430.04	96.23	Yes	-2.23	1435.68	96.61	Yes	-1.85
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.02	0.00	Yes	0.00
PTV (> 98 %)	Soft	1412.84	95.08	No	-3.38	1430.04	96.23	No	-2.23	1435.68	96.61	No	-1.85
ITV (> 99.9 %)	Hard	1012.10	99.84	No	-0.16	1013.47	99.89	No	-0.11	1013.46	99.98	Yes	-0.02
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	297.80	97.11	No	-0.68	298.24	97.26	No	-0.53	298.82	97.45	No	-0.34
Bladder (75 %)	Soft	201.50	65.71	Yes	-3.48	204.12	66.57	Yes	-2.62	205.35	66.97	Yes	-2.22
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	53.50	90.77	Yes	-0.22	53.53	90.83	Yes	-0.16	53.58	90.90	Yes	-0.09
Rectum (< 85 %)	Soft	47.37	80.37	Yes	-1.10	47.52	80.63	Yes	-0.84	47.64	80.84	Yes	-0.63
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	251.78	22.45	Yes	-1.08	254.49	22.69	Yes	-0.84	256.26	22.85	Yes	-0.68
Bowel (100 cc)	Soft	91.75	8.18	Yes	-0.86	94.58	8.43	Yes	-0.61	95.14	8.48	Yes	-0.56
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.02		Yes	-6.87	1.04		Yes	-5.09	1.05		Yes	-4.28
CI (<1.55)	Soft	1.53		Yes	-2.31	1.53		Yes	-1.83	1.54		Yes	-1.47
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	43.50		No	-4.15	43.68		No	-3.76	43.82		No	-3.44

Patient 6		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1676.22	96.77	Yes	-2.06	1692.12	97.69	Yes	-1.14	1692.44	97.71	Yes	-1.12
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1676.22	96.77	No	-2.06	1692.12	97.69	No	-1.14	1692.44	97.71	No	-1.12
ITV (> 99.9 %)	Hard	1202.50	99.99	Yes	-0.01	1202.57	100.00	Yes	0.00	1202.57	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.10	0.05	Yes	0.00	0.10	0.05	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	422.99	89.03	No	-0.78	423.62	89.16	No	-0.65	424.84	89.42	No	-0.39
Bladder (75 %)	Soft	286.13	60.22	Yes	-2.76	289.72	60.98	Yes	-2.00	292.57	61.58	Yes	-1.40
Bowel (< 0.5 cc)	Hard	0.01	0.00	Yes	-0.03	0.05	0.00	Yes	-0.03	0.05	0.00	Yes	-0.03
Bowel (350 cc)	Soft	542.58	32.41	No	-0.75	546.03	32.62	No	-0.54	547.38	32.70	No	-0.46
Bowel (100 cc)	Soft	335.19	20.02	No	-0.81	339.67	20.29	No	-0.54	339.94	20.31	No	-0.52
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.02		Yes	-5.28	1.04		Yes	-3.42	1.05		Yes	-2.49
CI (<1.55)	Soft	1.36		Yes	-8.36	1.38		Yes	-7.01	1.40		Yes	-5.66
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	44.58		No	-1.27	44.67		No	-1.07	44.93		No	-0.50

Patient 7		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	2141.59	96.20	Yes	-2.42	2160.82	97.07	Yes	-1.55	2179.89	97.92	Yes	-0.70
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	2141.59	96.20	No	-2.42	2160.82	97.07	No	-1.55	2179.89	97.92	No	-0.70
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	376.29	86.41	No	-0.92	376.66	86.50	No	-0.83	379.32	87.11	No	-0.22
Bladder (75 %)	Soft	273.92	62.90	Yes	-2.09	275.46	63.26	Yes	-1.73	280.20	64.35	Yes	-0.64
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	48.91	98.90	No	-0.25	48.93	98.95	No	-0.20	48.97	99.03	No	-0.12
Rectum (< 85 %)	Soft	43.21	87.37	No	-1.34	43.42	87.80	No	-0.91	43.49	87.93	No	-0.78
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	300.18	20.89	Yes	-0.34	301.55	20.98	Yes	-0.25	303.22	21.10	Yes	-0.13
Bowel (100 cc)	Soft	199.82	13.90	No	-0.50	201.87	14.05	No	-0.35	204.11	14.20	No	-0.20
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.01		Yes	-5.09	1.03		Yes	-3.53	1.05		Yes	-1.78
CI (<1.55)	Soft	1.39		Yes	-2.32	1.40		Yes	-1.70	1.41		Yes	-0.84
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	44.82		No	-1.41	44.81		No	-1.44	44.92		No	-1.20
Right Kidney (< 15 Gy)	Hard	1.44		Yes	1.55	1.43	Yes	Yes	1.13	1.43	Yes	Yes	1.06
Right Kidney (< 10 Gy)	Soft	1.44		Yes	1.55	1.43	Yes	Yes	1.13	1.43	Yes	Yes	1.06
Left Kidney (< 15 Gy)	Hard	1.34		Yes	0.30	1.34	Yes	Yes	0.45	1.33	Yes	Yes	-0.60
Left Kidney (< 10 Gy)	Soft	1.34		Yes	0.30	1.34	Yes	Yes	0.45	1.33	Yes	Yes	-0.60

Patient 8		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	887.98	96.45	Yes	-2.22	896.53	97.37	Yes	-1.30	907.59	98.57	Yes	-0.10
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	887.98	96.45	No	-2.22	896.53	97.37	No	-1.30	907.59	98.57	Yes	-0.10
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	122.54	67.86	Yes	-2.19	123.68	68.49	Yes	-1.56	126.09	69.83	Yes	-0.22
Bladder (75 %)	Soft	64.85	35.91	Yes	-1.85	65.84	36.46	Yes	-1.30	67.93	37.62	Yes	-0.14
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	29.43	68.28	Yes	-0.38	29.49	68.43	Yes	-0.23	29.57	68.62	Yes	-0.04
Rectum (< 85 %)	Soft	21.51	49.91	Yes	-1.99	21.85	50.70	Yes	-1.20	22.28	51.70	Yes	-0.20
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	402.28	25.56	No	-1.34	409.17	25.99	No	-0.91	420.80	26.73	No	-0.17
Bowel (100 cc)	Soft	177.19	11.26	No	-0.77	181.41	11.52	No	-0.51	188.79	11.99	No	-0.04
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.08		Yes	-7.57	1.12		No	-4.66	1.17		No	-0.45
CI (<1.55)	Soft	1.76		No	-2.99	1.78		No	-1.89	1.81		No	-0.21
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	24.37		No	0.84	24.62		No	1.87	25.33		No	4.80

Patient 9		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1063.96	96.64	Yes	-2.51	1080.48	98.14	Yes	-1.01	1082.90	98.36	Yes	-0.79
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1063.96	96.64	No	-2.51	1080.48	98.14	Yes	-1.01	1082.90	98.36	Yes	-0.79
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	292.90	75.36	Yes	-1.90	294.83	75.85	Yes	-1.41	295.87	76.12	Yes	-1.14
Bladder (75 %)	Soft	161.62	41.58	Yes	-2.40	164.21	42.25	Yes	-1.73	164.86	42.42	Yes	-1.56
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	61.52	89.18	Yes	-0.61	61.67	89.40	Yes	-0.39	61.64	89.36	Yes	-0.43
Rectum (< 85 %)	Soft	40.84	59.21	Yes	-2.96	41.72	60.48	Yes	-1.69	41.45	60.08	Yes	-2.09
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	359.82	29.19	No	-1.66	369.26	29.95	No	-0.90	373.54	30.30	No	-0.55
Bowel (100 cc)	Soft	145.64	11.81	No	-1.19	153.14	12.42	No	-0.58	155.03	12.58	No	-0.42
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.07		Yes	-9.01	1.12		No	-5.25	1.13		No	-4.60
CI (<1.55)	Soft	1.74		No	60.75	1.77		No	63.24	1.77		No	63.73
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	37.92		No	-2.14	38.26		No	-1.26	38.56		No	-0.48

Patient 10		Uniform				Anterior				Lateral						
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff			
PTV (> 95 %)	Hard	1323.62	94.01	No	-4.10	1346.08	95.61	Yes	-2.50	1352.85	96.09	Yes	-2.02			
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00			
PTV (> 98 %)	Soft	1323.62	94.01	No	-4.10	1346.08	95.61	No	-2.50	1352.85	96.09	No	-2.02			
ITV (> 99.9 %)	Hard	802.66	99.84	No	-0.16	803.73	99.97	Yes	-0.03	803.80	99.98	Yes	-0.02			
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00			
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00			
Bladder (85 %)	Soft	156.32	88.92	No	-1.46	156.76	89.17	No	-1.21	157.49	89.58	No	-0.80			
Bladder (75 %)	Soft	77.89	44.31	Yes	-3.89	79.26	45.09	Yes	-3.11	80.88	46.00	Yes	-2.20			
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	-0.03	0.00	0.00	Yes	-0.03	0.00	0.00	Yes	-0.03			
Rectum (< 95 %)	Soft	72.77	97.10	No	-0.69	72.96	97.35	No	-0.44	72.95	97.34	No	-0.45			
Rectum (< 85 %)	Soft	45.95	61.31	Yes	-3.55	46.88	62.56	Yes	-2.30	46.72	62.35	Yes	-2.51			
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00			
Bowel (350 cc)	Soft	781.39	20.24	No	-0.81	787.74	20.41	No	-0.64	795.79	20.61	No	-0.44			
Bowel (100 cc)	Soft	337.23	8.74	No	-0.73	345.42	8.95	No	-0.52	347.38	9.00	No	-0.47			
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff			
CI (< 1.10)	Soft	1.04		Yes	-9.71	1.07		Yes	-6.83	1.08		Yes	-6.14			
CI (<1.55)	Soft	1.75		No	-3.53	1.76		No	-2.58	1.77		No	-2.24			
Structure (Constraint)	H/S	Mean Dose (Gy)			Pass	% diff	Dose (Gy)			Pass	% diff	Dose (Gy)			Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	43.62			No	-1.94	43.65			No	-1.88	44.19			No	-0.66
Right Kidney (< 15 Gy)	Hard	0.52			Yes	1.96	0.52			Yes	1.37	0.52			Yes	1.17
Right Kidney (< 10 Gy)	Hard	0.52			Yes	1.96	0.52			Yes	1.37	0.52			Yes	1.17
Left Kidney (< 15 Gy)	Hard	0.59			Yes	1.72	0.59			Yes	1.37	0.59			Yes	1.54
Left Kidney (< 10 Gy)	Hard	0.59			Yes	1.72	0.59			Yes	1.37	0.59			Yes	1.54

Patient 11		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1039.86	89.14	No	-6.26	1067.73	91.53	No	-3.87	1082.86	92.82	No	-2.58
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1039.86	89.14	No	-6.26	1067.73	91.53	No	-3.87	1082.86	92.82	No	-2.58
ITV (> 99.9 %)	Hard	646.03	98.44	No	-1.52	652.05	99.36	No	-0.60	653.61	99.59	No	-0.37
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	278.68	96.32	No	-0.57	279.11	96.74	No	-0.15	279.47	96.59	No	-0.30
Bladder (75 %)	Soft	187.10	64.66	Yes	-3.08	188.92	65.30	Yes	-2.44	191.76	66.28	Yes	-1.46
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	51.93	98.35	No	-0.35	52.00	98.49	No	-0.21	52.01	98.51	No	-0.19
Rectum (< 85 %)	Soft	39.11	74.09	Yes	-1.85	39.27	74.39	Yes	-1.55	39.41	74.66	Yes	-1.28
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	407.27	49.12	No	-0.62	408.73	49.29	No	-0.45	409.47	49.38	No	-0.36
Bowel (100 cc)	Soft	267.58	32.27	No	-1.36	270.68	32.64	No	-0.99	273.13	32.94	No	-0.69
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.96		Yes	-10.25	1.00		Yes	-6.88	1.01		Yes	-5.35
CI (<1.55)	Soft	1.70		No	-1.81	1.72		No	-0.94	1.71		No	-1.36
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	43.42		No	-2.14	43.55		No	-1.84	44.01		No	-0.82

Patient 12		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1191.73	98.73	Yes	-1.14	1199.61	99.38	Yes	-0.49	1196.87	99.15	Yes	-0.72
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1191.73	98.73	Yes	-1.14	1199.61	99.38	Yes	-0.49	1196.87	99.15	Yes	-0.72
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	225.39	65.38	Yes	-0.46	228.01	66.14	Yes	0.30	226.99	65.84	Yes	0.00
Bladder (75 %)	Soft	124.49	36.11	Yes	-2.74	127.72	37.05	Yes	-1.80	126.65	36.74	Yes	-2.11
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	58.38	87.68	Yes	0.79	58.60	88.01	Yes	1.12	58.50	87.87	Yes	0.98
Rectum (< 85 %)	Soft	33.13	49.76	Yes	-3.49	33.85	50.84	Yes	-2.41	33.58	50.44	Yes	-2.81
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	523.92	19.24	No	0.44	536.44	19.70	No	0.90	536.09	19.69	No	0.89
Bowel (100 cc)	Soft	145.86	5.28	Yes	-5.79	143.86	5.28	No	-0.51	140.79	5.17	No	-0.62
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.13		No	-8.34	1.17		No	-5.35	1.16		No	-6.17
CI (<1.55)	Soft	1.81		No	-2.71	1.84		No	-1.35	1.83		No	-1.82
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	38.15		No	-14.81	38.44		No	-14.17	38.63		No	-13.74

Patient 13		Uniform				Anterior				Lateral						
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff			
PTV (> 95 %)	Hard	661.47	99.06	Yes	-0.80	664.92	99.57	Yes	-0.29	665.00	99.58	Yes	-0.28			
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00			
PTV (> 98 %)	Soft	661.47	99.06	Yes	-0.80	664.92	99.57	Yes	-0.29	665.00	99.58	Yes	-0.28			
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00			
Bladder (85 %)	Soft	38.73	41.90	Yes	-3.02	39.20	42.41	Yes	-2.51	39.18	42.39	Yes	-2.53			
Bladder (75 %)	Soft	12.79	13.84	Yes	-1.16	13.07	14.14	Yes	-0.86	13.15	14.23	Yes	-0.77			
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00			
Rectum (< 95 %)	Soft	14.49	20.41	Yes	-4.50	16.02	22.57	Yes	-2.34	14.77	20.80	Yes	-4.11			
Rectum (< 85 %)	Soft	0.00	0.00	Yes	-0.01	0.00	0.00	Yes	-0.01	0.00	0.00	Yes	-0.01			
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00			
Bowel (350 cc)	Soft	234.55	7.70	Yes	-0.52	240.58	7.89	Yes	-0.33	243.18	7.98	Yes	-0.24			
Bowel (100 cc)	Soft	81.72	2.68	Yes	-0.40	87.28	2.86	Yes	-0.22	87.69	2.88	Yes	-0.20			
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff			
CI (< 1.10)	Soft	1.19		No	-9.57	1.23		No	-6.16	1.24		No	-5.81			
CI (< 1.55)	Soft	2.07		No	-4.21	2.10		No	-2.75	2.10		No	-2.68			
Structure (Constraint)	H/S	Dose (Gy)			Pass	% diff	Dose (Gy)			Pass	% diff	Dose (Gy)			Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	2.75			Yes	-0.25	2.82			Yes	1.99	2.77			Yes	0.22

Patient 14		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1061.72	98.73	Yes	-0.75	1061.21	98.69	Yes	-0.79	1066.02	99.13	Yes	-0.35
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1061.72	98.73	Yes	-0.75	1061.21	98.69	Yes	-0.79	1066.02	99.13	Yes	-0.35
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	362.57	83.95	Yes	-1.64	362.78	83.99	Yes	-1.60	367.03	84.98	Yes	-0.61
Bladder (75 %)	Soft	156.58	36.25	Yes	-2.07	157.00	36.35	Yes	-1.97	162.51	37.63	Yes	-0.69
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	58.97	89.37	Yes	-1.28	58.98	89.38	Yes	-1.27	59.26	89.81	Yes	-0.84
Rectum (< 85 %)	Soft	35.31	53.51	Yes	-2.55	35.74	54.16	Yes	-1.90	36.10	54.71	Yes	-1.35
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	173.93	22.17	Yes	-0.74	174.33	22.22	Yes	-0.69	177.22	22.59	Yes	-0.32
Bowel (100 cc)	Soft	69.55	8.87	Yes	-0.39	69.04	8.80	Yes	-0.46	70.82	9.03	Yes	-0.23
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.14		No	-3.26	1.11		No	-5.78	1.15		No	-2.92
CI (<1.55)	Soft	1.83		No	-1.13	1.81		No	-2.18	1.83		No	-1.13
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	43.15		No	-5.87	43.37		No	-5.39	43.60		No	-4.88

Patient 15		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	889.13	95.90	Yes	-2.81	899.81	97.05	Yes	-1.66	901.83	97.27	Yes	-1.44
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	889.13	95.90	No	-2.81	899.81	97.05	No	-1.66	901.83	97.27	No	-1.44
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	203.50	70.83	Yes	-2.51	204.83	71.30	Yes	-2.04	206.57	71.90	Yes	-1.44
Bladder (75 %)	Soft	98.00	34.11	Yes	-2.72	99.69	34.70	Yes	-2.13	100.87	35.11	Yes	-1.72
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	59.06	63.69	Yes	-2.35	59.87	64.57	Yes	-1.47	59.67	64.36	Yes	-1.68
Rectum (< 85 %)	Soft	27.00	29.12	Yes	-1.61	27.59	29.75	Yes	-0.98	27.39	29.54	Yes	-1.19
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	548.35	29.84	No	-1.46	556.33	30.28	No	-1.02	557.87	30.36	No	-0.94
Bowel (100 cc)	Soft	261.08	14.21	No	-0.90	266.30	14.49	No	-0.62	267.11	14.45	No	-0.66
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.06		Yes	-9.26	1.09		Yes	-6.26	1.10		No	-5.75
CI (<1.55)	Soft	1.83		No	-3.44	1.85		No	-2.37	1.86		No	-2.20
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	44.28		No	-2.53	44.77		No	-1.45	44.60		No	-1.83

Patient 16		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1493.37	95.38	Yes	-3.09	1518.17	96.97	Yes	-1.50	1515.19	96.78	Yes	-1.69
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1493.37	95.38	No	-3.09	1518.17	96.97	No	-1.50	1515.19	96.78	No	-1.69
ITV (> 99.9 %)	Hard	975.28	99.60	No	-0.40	978.36	99.92	Yes	-0.08	978.04	99.89	No	-0.11
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	471.03	78.49	Yes	-1.51	473.07	78.83	Yes	-1.17	474.95	79.14	Yes	-0.86
Bladder (75 %)	Soft	280.24	46.70	Yes	-37.56	283.91	47.31	Yes	-36.95	285.58	47.59	Yes	-36.67
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	67.48	96.51	No	28.84	67.52	96.57	No	28.90	67.55	96.61	No	28.94
Rectum (< 85 %)	Soft	57.99	82.94	Yes	-1.32	58.32	83.42	Yes	-0.84	58.25	83.31	Yes	-0.95
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	475.49	21.05	No	-0.86	479.99	21.25	No	-0.66	482.06	21.34	No	-0.57
Bowel (100 cc)	Soft	223.26	9.88	No	-0.94	228.53	10.12	No	-0.70	228.21	10.10	No	-0.72
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.03		Yes	-7.99	1.06		Yes	-4.89	1.05		Yes	-5.42
CI (<1.55)	Soft	1.64		No	-2.57	1.65		No	-1.66	1.65		No	-1.77
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	43.53		No	-1.83	43.86		No	-1.09	43.81		No	-1.19
Right Kidney (< 15 Gy)	Hard	0.95		Yes	930.43	0.94		Yes	923.91	0.94		Yes	926.09
Right Kidney (< 10 Gy)	Soft	0.95		Yes	1015.29	0.94		Yes	1008.24	0.94		Yes	1010.59
Left Kidney (< 15 Gy)	Hard	0.82		Yes	788.04	0.81		Yes	782.61	0.82		Yes	785.87
Left Kidney (< 10 Gy)	Soft	0.82		Yes	861.18	0.81		Yes	855.29	0.82		Yes	858.82

Patient 17		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1415.93	96.32	Yes	-1.58	1427.70	97.12	Yes	-0.78	1428.65	97.18	Yes	-0.72
PTV (< 107 %)	Hard	0.07	0.00	Yes	0.00	0.16	0.01	Yes	0.01	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1415.93	96.32	No	-1.58	1427.70	97.12	No	-0.78	1428.65	97.18	No	-0.72
ITV (> 99.9 %)	Hard	0.04	0.00	No	-99.99	0.08	0.01	No	-99.98	0.00	0.00	No	-99.99
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	111.50	97.43	No	-0.38	111.62	97.45	No	-0.36	111.91	97.79	No	-0.02
Bladder (75 %)	Soft	68.80	60.12	Yes	-2.27	69.38	60.63	Yes	-1.76	70.32	61.44	Yes	-0.95
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.01	0.00	Yes	0.00
Bowel (350 cc)	Soft	387.85	32.36	No	0.52	389.36	32.48	No	0.64	381.69	31.84	No	0.00
Bowel (100 cc)	Soft	206.51	17.23	No	-0.44	208.26	17.37	No	-0.30	208.99	17.44	No	-0.23
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.99		Yes	-3.87	1.01		Yes	-2.21	1.01		Yes	-2.18
CI (<1.55)	Soft	1.52		Yes	-0.72	1.52		Yes	-0.23	1.52		Yes	-0.62
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	43.11		No	-5.13	44.53		No	-2.00	44.27		No	-2.57
Right Kidney (< 15 Gy)	Hard	7.18		Yes	1.18	7.14		Yes	0.68	7.15		Yes	0.80
Right Kidney (< 10 Gy)	Hard	7.18		Yes	1.18	7.14		Yes	0.68	7.15		Yes	0.80
Left Kidney (< 15 Gy)	Hard	6.12		Yes	0.54	6.09		Yes	0.13	6.11		Yes	0.41
Left Kidney (< 10 Gy)	Hard	6.12		Yes	0.54	6.09		Yes	0.13	6.11		Yes	0.41

Patient 18		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1047.91	94.19	No	-3.89	1068.35	96.02	Yes	-2.06	1065.12	95.73	Yes	-2.35
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1047.91	94.19	No	-3.89	1068.35	96.02	No	-2.06	1065.12	95.73	No	-2.35
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	111.10	85.11	No	-1.48	111.74	85.60	No	-0.99	111.80	85.65	No	-0.94
Bladder (75 %)	Soft	59.75	45.78	Yes	-3.45	61.01	46.74	Yes	-2.49	61.72	47.28	Yes	-1.95
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	34.89	83.82	Yes	-1.05	34.83	83.68	Yes	-1.19	35.07	84.27	Yes	-0.60
Rectum (< 85 %)	Soft	17.66	42.43	Yes	-2.06	17.84	42.86	Yes	-1.63	17.93	43.07	Yes	-1.42
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	406.83	25.93	No	-1.61	416.88	26.57	No	-0.97	414.84	26.44	No	-1.10
Bowel (100 cc)	Soft	131.48	8.38	No	-1.30	140.24	8.94	No	-0.74	136.74	8.72	No	-0.96
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.04		Yes	-8.38	1.06		Yes	-6.26	1.08		Yes	-5.11
CI (<1.55)	Soft	1.74		No	-3.14	1.76		No	-2.38	1.77		No	-1.94
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	44.14		No	-2.61	44.13		No	-2.62	44.52		No	-1.77

Patient 19		Uniform				Anterior				Lateral						
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff			
PTV (> 95 %)	Hard	808.95	97.31	Yes	-2.08	817.40	98.33	Yes	-1.06	816.84	98.26	Yes	-1.13			
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00			
PTV (> 98 %)	Soft	808.95	97.31	No	-2.08	817.40	98.33	Yes	-1.06	816.84	98.26	Yes	-1.13			
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00			
Bladder (85 %)	Soft	339.09	97.54	No	-0.88	340.07	97.83	No	-0.59	340.35	97.91	No	-0.51			
Bladder (75 %)	Soft	150.04	43.16	Yes	-3.08	153.23	44.08	Yes	-2.16	153.75	44.23	Yes	-2.01			
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00			
Rectum (< 95 %)	Soft	36.26	78.37	Yes	-1.37	36.48	78.84	Yes	-0.90	36.44	78.76	Yes	-0.98			
Rectum (< 85 %)	Soft	19.97	43.16	Yes	-2.10	20.44	44.16	Yes	-1.10	20.24	43.74	Yes	-1.52			
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00			
Bowel (350 cc)	Soft	261.48	28.88	Yes	-1.24	265.84	29.36	Yes	-0.76	265.39	29.31	Yes	-0.81			
Bowel (100 cc)	Soft	103.29	11.41	No	-0.85	106.27	11.74	No	-0.52	105.39	11.64	No	-0.62			
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff			
CI (< 1.10)	Soft	1.08		Yes	-9.28	1.12		No	-5.91	1.11		No	-6.23			
CI (<1.55)	Soft	1.87		No	-4.38	1.90		No	-2.99	1.90		No	-3.09			
Structure (Constraint)	H/S	Dose (Gy)			Pass	% diff	Dose (Gy)			Pass	% diff	Dose (Gy)			Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	43.87			No	-5.07	45.53			No	-1.47	45.58			No	-1.37

Patient 20		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1776.27	90.80	No	-4.05	1811.92	92.62	No	-2.23	1821.09	93.09	No	-1.76
PTV (< 107 %)	Hard	20.31	1.04	No	1.04	19.96	1.02	No	1.02	4.93	0.25	No	0.25
PTV (> 98 %)	Soft	1776.27	90.80	No	-4.05	1811.92	92.62	No	-2.23	1821.09	93.09	No	-1.76
ITV (> 99.9 %)	Hard	1184.76	99.31	No	-0.67	1189.15	99.68	No	-0.30	1191.43	99.87	No	-0.11
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	140.66	91.17	No	-0.84	140.58	91.11	No	-0.90	141.30	91.58	No	-0.43
Bladder (75 %)	Soft	94.52	61.26	Yes	-3.49	94.79	61.43	Yes	-3.32	97.44	63.15	Yes	-1.60
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	66.12	97.46	No	-0.35	66.12	97.46	No	-0.35	66.17	97.54	No	-0.27
Rectum (< 85 %)	Soft	53.37	78.67	Yes	23.83	53.87	79.41	Yes	24.57	53.88	79.42	Yes	24.58
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	623.34	32.32	No	-0.78	626.70	32.49	No	-0.61	629.57	32.64	No	-0.46
Bowel (100 cc)	Soft	358.70	18.60	No	-1.03	364.67	18.91	No	-0.72	366.12	18.98	No	-0.65
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.96		Yes	-7.42	0.98		Yes	-4.84	0.99		Yes	-3.97
CI (<1.55)	Soft	1.53		Yes	-1.67	1.54		Yes	-0.91	1.54		Yes	-1.01
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	43.50		No	-3.10	43.76		No	-2.52	43.94		No	-2.13

Appendix 7. DVH Statistics After SSD Changes: – 0.5 cm

Patient 1		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1896.92	99.40	Yes	1.00	1895.12	99.30	Yes	0.90	1895.46	99.32	Yes	0.92
PTV (< 107 %)	Hard	0.06	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1896.92	99.40	Yes	1.00	1895.12	99.30	Yes	0.90	1895.46	99.32	Yes	0.92
ITV (> 99.9 %)	Hard	1155.76	100.00	Yes	0.00	1155.79	100.00	Yes	0.00	1155.79	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	-0.04	0.00	0.00	Yes	-0.04	0.00	0.00	Yes	-0.04
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	237.01	83.80	Yes	0.61	236.66	83.67	Yes	0.48	235.45	83.25	Yes	0.06
Bladder (75 %)	Soft	154.44	54.61	Yes	1.37	153.38	54.23	Yes	0.99	151.84	53.69	Yes	0.45
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	41.93	100.00	No	0.00	41.93	100.00	No	0.00	41.93	100.00	No	0.00
Rectum (< 85 %)	Soft	37.22	88.77	No	0.83	37.10	88.50	No	0.56	37.09	88.47	No	0.53
Bowel (< 0.5 cc)	Hard	0.12	0.01	Yes	0.01	0.01	0.00	Yes	0.00	0.02	0.00	Yes	0.00
Bowel (350 cc)	Soft	366.72	26.75	No	0.61	363.35	26.51	No	0.37	361.82	26.40	No	0.26
Bowel (100 cc)	Soft	194.92	14.22	No	0.51	192.10	14.01	No	0.30	190.82	13.92	No	0.21
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.18		No	3.90	1.17		No	2.53	1.16		No	1.83
CI (<1.55)	Soft	1.73		No	0.57	1.74		No	0.81	1.73		No	0.75
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	45.47		No	1.14	45.19		No	0.50	45.26		No	0.68

Patient 2		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	2064.29	95.81	Yes	-0.23	2071.94	96.17	Yes	0.13	2083.28	96.70	Yes	0.66
PTV (< 107 %)	Hard	466.64	21.66	No	21.66	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	2064.29	95.81	No	-0.23	2071.94	96.17	No	0.13	2083.28	96.70	No	0.66
ITV (> 99.9 %)	Hard	1125.86	99.96	Yes	0.06	1125.89	99.96	Yes	0.06	1125.67	99.95	Yes	0.05
CTV-HR + 1 cm (< 0.5 cc)	Soft	44.46	12.98	No	12.98	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	35.60	11.93	No	11.93	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	284.07	95.20	No	0.76	283.25	94.93	No	0.49	282.29	94.61	No	0.17
Bladder (75 %)	Soft	216.24	72.47	Yes	2.18	213.38	71.51	Yes	1.22	211.62	70.92	Yes	0.63
Rectum (< 0.5 cc)	Hard	22.80	19.09	No	19.09	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	118.53	99.22	No	0.17	118.54	99.23	No	0.18	118.49	99.19	No	0.14
Rectum (< 85 %)	Soft	105.83	88.59	No	3.70	102.19	85.54	No	0.65	102.28	85.62	No	0.73
Bowel (< 0.5 cc)	Hard	142.41	5.69	No	5.69	0.03	0.00	Yes	0.00	0.02	0.00	Yes	0.00
Bowel (350 cc)	Soft	797.09	31.86	No	1.31	773.28	30.91	No	0.36	769.16	30.74	No	0.19
Bowel (100 cc)	Soft	458.03	18.31	No	1.29	432.80	17.30	No	0.28	429.86	17.18	No	0.16
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.12		No	6.26	1.07		Yes	1.90	1.08		Yes	2.06
CI (<1.55)	Soft	1.65		No	3.33	1.60		No	0.34	1.60		No	0.69
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	44.12		No	0.28	44.48		No	1.10	44.49		No	1.13
Right Kidney (< 15 Gy)	Hard	0.96		Yes	-7.32	1.00		Yes	-3.76	1.00		Yes	-3.76
Right Kidney (< 10 Gy)	Soft	0.96		Yes	-7.32	1.00		Yes	-3.76	1.00		Yes	-3.76
Left Kidney (< 15 Gy)	Hard	0.88		Yes	-7.43	0.92		Yes	-3.66	0.92		Yes	-3.66
Left Kidney (< 10 Gy)	Soft	0.88		Yes	-7.43	0.92		Yes	-3.66	0.92		Yes	-3.66

Patient 3		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1703.62	99.68	Yes	0.17	1702.68	99.63	Yes	0.12	1702.68	99.63	Yes	0.12
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.01	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1703.62	99.68	Yes	0.17	1702.68	99.63	Yes	0.12	1702.68	99.63	Yes	0.12
ITV (> 99.9 %)	Hard	1139.71	100.00	Yes	0.00	1139.71	100.00	Yes	0.00	1139.71	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	45.72	0.00	No	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	448.96	86.58	No	0.36	448.54	86.50	No	0.28	447.82	86.36	No	0.14
Bladder (75 %)	Soft	278.64	53.74	Yes	0.77	277.21	53.46	Yes	0.49	276.83	53.39	Yes	0.42
Rectum (< 0.5 cc)	Hard	0.01	0.02	Yes	0.02	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	80.15	89.95	Yes	0.18	80.09	89.88	Yes	0.11	80.10	89.89	Yes	0.12
Rectum (< 85 %)	Soft	278.64	63.97	Yes	0.72	56.75	63.68	Yes	0.43	56.86	63.81	Yes	0.56
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	448.96	20.24	No	0.13	342.79	20.15	Yes	0.04	343.85	20.21	Yes	0.10
Bowel (100 cc)	Soft	278.64	9.41	No	0.12	158.75	9.33	No	0.04	159.66	9.38	No	0.09
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.16		No	1.68	1.15		No	0.85	1.15		No	1.18
CI (<1.55)	Soft	1.60		No	0.85	1.60		No	0.45	1.60		No	0.56
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	9.89		No	0.41	9.75		No	-1.02	9.78		No	-0.69

Patient 4		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1312.80	98.10	Yes	1.17	1308.04	97.74	Yes	0.81	1306.81	97.65	Yes	0.72
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1312.80	98.10	Yes	1.17	1308.04	97.74	No	0.81	1306.81	97.65	No	0.72
ITV (> 99.9 %)	Hard	859.45	100.00	Yes	0.00	859.45	100.00	Yes	0.00	859.45	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	158.62	97.84	No	0.22	158.52	97.78	No	0.16	158.39	97.70	No	0.08
Bladder (75 %)	Soft	120.24	74.17	Yes	1.73	119.44	73.67	Yes	1.23	118.67	73.20	Yes	0.76
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	41.12	100.00	No	0.00	41.12	100.00	No	0.00	41.12	100.00	No	0.00
Rectum (< 85 %)	Soft	39.02	94.89	No	0.56	38.97	94.76	No	0.43	38.93	94.67	No	0.34
Bowel (< 0.5 cc)	Hard	0.45	0.06	Yes	0.06	0.04	0.01	Yes	0.01	0.06	0.01	Yes	0.01
Bowel (350 cc)	Soft	280.64	35.29	Yes	0.65	279.07	35.10	Yes	0.46	277.69	34.92	Yes	0.28
Bowel (100 cc)	Soft	177.11	22.27	No	0.50	175.46	22.07	No	0.30	175.19	22.03	No	0.26
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.14		No	4.44	1.12		No	2.96	1.12		No	2.65
CI (<1.55)	Soft	1.59		No	1.58	1.58		No	1.02	1.58		No	0.93
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	45.10		No	0.78	45.25		No	1.11	45.11		No	0.80

Patient 5		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	14477.21	99.41	Yes	0.95	1472.89	99.12	Yes	0.66	1471.01	98.99	Yes	0.53
PTV (< 107 %)	Hard	128.87	8.67	No	8.67	0.00		Yes	0.00	48.20	0.00	No	0.00
PTV (> 98 %)	Soft	14477.21	99.41	Yes	0.95	1472.89	99.12	Yes	0.66	1471.01	98.99	Yes	0.53
ITV (> 99.9 %)	Hard	42.80	1013.69	Yes	913.69	1013.69	100.00	Yes	0.00	1013.69	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	42.22	20.04	No	20.04	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	27.83	9.08	No	9.08	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	301.88	98.45	No	0.66	300.69	98.06	No	0.27	300.33	97.94	No	0.15
Bladder (75 %)	Soft	224.06	73.07	Yes	3.88	216.38	70.56	Yes	1.37	215.09	70.14	Yes	0.95
Rectum (< 0.5 cc)	Hard	4.63	7.86	No	7.86	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	53.70	91.12	Yes	0.13	53.69	91.10	Yes	0.11	53.67	91.06	Yes	0.07
Rectum (< 85 %)	Soft	48.45	82.22	Yes	0.75	48.39	82.11	Yes	0.64	48.37	82.08	Yes	0.61
Bowel (< 0.5 cc)	Hard	5.95	0.53	No	0.53	0.03	0.00	Yes	0.00	0.02	0.00	Yes	0.00
Bowel (350 cc)	Soft	281.50	25.10	Yes	1.57	269.54	24.03	Yes	0.50	267.66	23.86	Yes	0.33
Bowel (100 cc)	Soft	115.44	10.29	No	1.25	105.47	9.40	No	0.36	104.76	9.34	No	0.30
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.17		No	6.93	1.12		No	2.50	1.12		No	2.32
CI (<1.55)	Soft	1.62		No	3.30	1.58		No	1.01	1.58		No	0.92
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	44.89		No	-1.10	44.85		No	-1.17	44.68		No	-1.54

Patient 6		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1717.67	99.16	Yes	0.33	1718.19	99.19	Yes	0.36	1716.73	99.11	Yes	0.28
PTV (< 107 %)	Hard	171.63	9.91	No	9.91	0.13	0.01	Yes	0.01	0.07	0.00	Yes	0.00
PTV (> 98 %)	Soft	1717.67	99.16	Yes	0.33	1718.19	99.19	Yes	0.36	1716.73	99.11	Yes	0.28
ITV (> 99.9 %)	Hard	1202.58	100.00	Yes	0.00	1202.58	100.00	Yes	0.00	1202.58	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	2.05	1.06	No	1.01	0.00	0.00	Yes	-0.05	0.00	0.00	Yes	-0.05
Bladder (< 0.5 cc)	Hard	14.44	3.04	No	3.04	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	428.81	90.25	No	0.44	428.35	90.15	No	0.34	427.63	90.00	No	0.19
Bladder (75 %)	Soft	305.51	64.30	Yes	1.32	305.34	64.26	Yes	1.28	302.82	63.73	Yes	0.75
Bowel (< 0.5 cc)	Hard	43.13	2.58	No	2.55	1.49	0.00	No	-0.03	0.97	0.06	No	0.03
Bowel (350 cc)	Soft	565.34	33.77	No	0.61	559.23	33.40	No	0.24	558.34	33.35	No	0.19
Bowel (100 cc)	Soft	360.01	21.50	No	0.67	353.50	21.11	No	0.28	352.02	21.03	No	0.20
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.11		No	3.44	1.10		Yes	2.08	1.09		Yes	1.64
CI (<1.55)	Soft	1.51		Yes	1.84	1.50		Yes	0.77	1.49		Yes	0.72
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	45.02		No	-0.30	44.91		No	-0.54	45.00		No	-0.35

Patient 7		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	2171.54	97.55	Yes	-1.07	2204.25	99.02	Yes	0.40	2203.25	98.97	Yes	0.35
PTV (< 107 %)	Hard	1819.59	81.74	No	81.74	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	2171.54	97.55	No	-1.07	2204.25	99.02	Yes	0.40	2203.25	98.97	Yes	0.35
Bladder (< 0.5 cc)	Hard	284.38	65.30	No	65.30	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	421.18	96.72	No	9.39	382.14	87.75	No	0.42	381.09	87.51	No	0.18
Bladder (75 %)	Soft	357.13	82.01	No	17.02	285.83	65.64	Yes	0.65	284.64	65.36	Yes	0.37
Rectum (< 0.5 cc)	Hard	37.48	75.80	No	75.80	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	49.44	99.98	No	0.83	49.05	99.18	No	0.03	49.06	99.20	No	0.05
Rectum (< 85 %)	Soft	47.67	96.40	No	7.69	44.08	89.14	No	0.43	44.08	89.13	No	0.42
Bowel (< 0.5 cc)	Hard	126.99	8.84	No	8.84	0.01	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	335.79	23.36	Yes	2.13	307.22	21.38	Yes	0.15	306.45	20.54	Yes	-0.69
Bowel (100 cc)	Soft	232.05	16.14	No	1.74	209.63	14.59	No	0.19	208.96	14.54	No	0.14
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.38		No	29.53	1.08		Yes	1.42	1.08		Yes	1.27
CI (<1.55)	Soft	1.80		No	26.13	1.44		Yes	0.77	1.43		Yes	0.66
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	45.17		No	-0.63	45.58		No	0.25	45.75		No	0.63
Right Kidney (< 15 Gy)	Hard	0.95		Yes	-32.72	1.42		Yes	0.00	1.42		Yes	-0.14
Right Kidney (< 10 Gy)	Soft	0.95		Yes	-32.72	1.42		Yes	0.00	1.42		Yes	-0.14
Left Kidney (< 15 Gy)	Hard	0.90		Yes	-32.81	1.32		Yes	-0.90	1.32		Yes	-0.97
Left Kidney (< 10 Gy)	Soft	0.90		Yes	-32.81	1.32		Yes	-0.90	1.32		Yes	-0.97

Patient 8		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	914.60	99.34	Yes	0.67	912.48	99.11	Yes	0.44	912.26	99.08	Yes	0.41
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	914.60	99.34	Yes	0.67	912.48	99.11	Yes	0.44	912.26	99.08	Yes	0.41
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	128.85	71.35	Yes	1.30	128.06	70.92	Yes	0.87	127.52	70.61	Yes	0.56
Bladder (75 %)	Soft	70.33	38.95	Yes	1.19	69.49	38.48	Yes	0.72	69.51	38.49	Yes	0.73
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	29.68	68.88	Yes	0.22	29.62	68.74	Yes	0.08	29.64	68.77	Yes	0.11
Rectum (< 85 %)	Soft	22.90	53.15	Yes	1.25	22.62	52.49	Yes	0.59	22.74	52.78	Yes	0.88
Bowel (< 0.5 cc)	Hard	0.12	0.01	Yes	0.01	0.03	0.00	Yes	0.00	0.01	0.00	Yes	0.00
Bowel (350 cc)	Soft	435.86	27.69	No	0.79	429.17	27.26	No	0.36	430.30	27.34	No	0.44
Bowel (100 cc)	Soft	197.19	12.53	No	0.50	193.53	12.29	No	0.26	193.70	12.31	No	0.28
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.22		No	4.43	1.20		No	2.37	1.20		No	2.73
CI (<1.55)	Soft	1.85		No	1.94	1.83		No	0.99	1.84		No	1.15
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	25.16		No	4.08	25.22		No	4.33	25.11		No	3.91

Patient 9		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1091.33	99.12	Yes	-0.03	1095.46	99.50	Yes	0.35	1094.22	99.39	Yes	0.24
PTV (< 107 %)	Hard	762.39	69.25	No	69.25	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1091.33	99.12	Yes	-0.03	1095.46	99.50	Yes	0.35	1094.22	99.39	Yes	0.24
Bladder (< 0.5 cc)	Hard	149.06	38.35	No	38.35	0.01	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	331.73	85.35	No	8.09	304.13	78.25	Yes	0.99	301.69	77.62	Yes	0.36
Bladder (75 %)	Soft	230.45	59.29	Yes	15.31	174.87	44.99	Yes	1.01	172.75	44.45	Yes	0.47
Rectum (< 0.5 cc)	Hard	36.61	53.07	No	53.07	0.00	0.01	Yes	0.01	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	62.18	90.14	Yes	0.35	62.01	89.89	Yes	0.10	61.98	89.85	Yes	0.06
Rectum (< 85 %)	Soft	53.36	77.36	Yes	15.19	43.50	63.06	Yes	0.89	43.40	62.92	Yes	0.75
Bowel (< 0.5 cc)	Hard	82.04	6.65	No	6.65	0.01	0.00	Yes	0.00	0.01	0.00	Yes	0.00
Bowel (350 cc)	Soft	473.29	38.39	No	7.54	386.87	31.38	No	0.53	383.70	31.12	No	0.27
Bowel (100 cc)	Soft	205.82	16.70	No	3.70	164.93	13.38	No	0.38	163.08	13.12	No	0.12
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.57		No	33.26	1.22		No	3.09	1.20		No	1.87
CI (<1.55)	Soft	2.21		No	104.06	1.84		No	69.59	1.82		No	68.57
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	40.03		No	3.29	39.27		No	1.33	38.98		No	0.60

Patient 10		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1389.53	98.69	Yes	0.58	1390.58	98.77	Yes	0.66	1388.68	98.63	Yes	0.52
PTV (< 107 %)	Hard	177.73	12.62	No	12.62	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1389.53	98.69	Yes	0.58	1390.58	98.77	Yes	0.66	1388.68	98.63	Yes	0.52
ITV (> 99.9 %)	Hard	803.96	100.00	Yes	0.00	803.96	100.00	Yes	0.00	803.96	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	25.31	5.48	No	5.48	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.01	0.00	Yes	0.00	0.01	0.08	Yes	0.08	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	159.03	90.46	No	0.08	160.29	91.17	No	0.79	159.49	90.72	No	0.34
Bladder (75 %)	Soft	85.75	48.77	Yes	0.57	87.57	49.81	Yes	1.61	85.84	48.83	Yes	0.63
Rectum (< 0.5 cc)	Hard	13.46	17.96	No	17.93	0.06	0.08	Yes	0.05	0.05	0.06	Yes	0.03
Rectum (< 95 %)	Soft	73.84	98.53	No	0.74	73.46	98.03	No	0.24	73.54	98.14	No	0.35
Rectum (< 85 %)	Soft	55.69	74.31	Yes	9.45	49.66	66.27	Yes	1.41	49.60	66.18	Yes	1.32
Bowel (< 0.5 cc)	Hard	86.57	2.24	No	2.24	0.02	0.00	Yes	0.00	0.02	0.00	Yes	0.00
Bowel (350 cc)	Soft	844.48	21.88	No	0.83	827.01	21.42	No	0.37	819.47	21.23	No	0.18
Bowel (100 cc)	Soft	425.90	11.03	No	1.56	377.61	9.78	No	0.31	374.20	9.69	No	0.22
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.25		No	8.64	1.18		No	3.35	1.17		No	2.47
CI (<1.55)	Soft	1.90		No	5.13	1.84		No	1.44	1.83		No	1.03
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	44.73		No	0.56	44.96		No	1.07	44.49		No	0.03
Right Kidney (< 15 Gy)	Hard	0.49		Yes	-4.89	0.51		Yes	-0.98	0.51		Yes	-0.78
Right Kidney (< 10 Gy)	Hard	0.49		Yes	-4.89	0.51		Yes	-0.98	0.51		Yes	-0.78
Left Kidney (< 15 Gy)	Hard	0.56		Yes	-3.77	0.58		Yes	-0.86	0.58		Yes	-0.69
Left Kidney (< 10 Gy)	Hard	0.56		Yes	-3.77	0.58		Yes	-0.86	0.58		Yes	-0.69

Patient 11		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1139.10	97.64	Yes	2.24	1124.98	96.43	Yes	1.03	1122.52	96.22	Yes	0.82
PTV (< 107 %)	Hard	576.97	49.46	No	49.46	0.02	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1139.10	97.64	No	2.24	1124.98	96.43	No	1.03	1122.52	96.22	No	0.82
ITV (> 99.9 %)	Hard	654.24	99.69	No	-0.27	656.08	99.97	Yes	0.01	656.21	99.99	Yes	0.03
CTV-HR + 1 cm (< 0.5 cc)	Soft	128.35	44.80	No	44.80	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	98.09	33.90	No	33.90	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	284.61	98.37	No	1.48	281.19	97.18	No	0.29	280.66	97.00	No	0.11
Bladder (75 %)	Soft	223.31	77.18	No	9.44	200.78	69.39	Yes	1.65	197.35	68.21	Yes	0.47
Rectum (< 0.5 cc)	Hard	15.23	28.85	No	28.85	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	52.79	100.00	No	1.30	52.19	98.85	No	0.15	52.15	98.78	No	0.08
Rectum (< 85 %)	Soft	48.05	91.02	No	15.08	40.40	76.53	Yes	0.59	40.18	76.11	Yes	0.17
Bowel (< 0.5 cc)	Hard	175.90	21.21	No	21.21	0.28	0.03	Yes	0.03	0.05	0.01	Yes	0.01
Bowel (350 cc)	Soft	434.42	52.39	No	2.65	414.68	50.01	No	0.27	413.74	49.90	No	0.16
Bowel (100 cc)	Soft	320.28	38.62	No	4.99	284.23	34.28	No	0.65	281.77	33.98	No	0.35
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.36		No	26.81	1.11		No	3.67	1.10		Yes	2.47
CI (<1.55)	Soft	1.93		No	11.39	1.74		No	0.17	1.75		No	0.79
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	44.55		No	0.40	44.98		No	1.37	44.68		No	0.69

Patient 12		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1206.30	99.93	Yes	0.06	1205.89	99.90	Yes	0.03	1205.79	99.89	Yes	0.02
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1206.30	99.93	Yes	0.06	1205.89	99.90	Yes	0.03	1205.79	99.89	Yes	0.02
Bladder (< 0.5 cc)	Hard	0.03	0.01	Yes	0.01	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	236.22	68.52	Yes	2.68	235.19	68.22	Yes	2.38	234.25	67.95	Yes	2.11
Bladder (75 %)	Soft	138.47	40.16	Yes	1.31	136.52	39.60	Yes	0.75	136.08	39.47	Yes	0.62
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	59.45	89.30	Yes	2.41	59.30	89.06	Yes	2.17	59.31	89.09	Yes	2.20
Rectum (< 85 %)	Soft	36.16	54.31	Yes	1.06	35.62	53.50	Yes	0.25	35.79	53.75	Yes	0.50
Bowel (< 0.5 cc)	Hard	0.04	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	586.59	21.54	No	2.74	579.80	21.29	No	2.49	572.97	21.04	No	2.24
Bowel (100 cc)	Soft	169.17	6.21	No	0.42	164.23	6.03	No	0.24	162.59	5.97	No	0.18
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.29		No	4.18	1.27		No	2.35	1.27		No	2.21
CI (<1.55)	Soft	1.94		No	4.01	1.91		No	2.89	1.91		No	2.75
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	39.44		No	-11.92	39.23		No	-12.38	39.32		No	-12.20

Patient 13		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	661.49	99.06	Yes	-0.80	667.26	99.92	Yes	0.06	667.29	99.93	Yes	0.07
PTV (< 107 %)	Hard	464.11	69.50	No	69.50	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	661.49	99.06	Yes	-0.80	667.26	99.92	Yes	0.06	667.29	99.93	Yes	0.07
Bladder (< 0.5 cc)	Hard	0.48	0.52	Yes	0.52	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	42.39	45.86	Yes	0.94	42.83	46.34	Yes	1.42	42.48	45.96	Yes	1.04
Bladder (75 %)	Soft	14.83	16.05	Yes	1.05	14.52	15.70	Yes	0.70	14.33	15.50	Yes	0.50
Rectum (< 0.5 cc)	Hard	0.54	0.76	No	0.76	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	17.86	25.15	Yes	0.24	18.55	26.13	Yes	1.22	19.28	27.15	Yes	2.24
Rectum (< 85 %)	Soft	4.49	6.33	Yes	6.32	0.02	0.03	Yes	0.02	0.02	0.03	Yes	0.02
Bowel (< 0.5 cc)	Hard	75.04	2.46	No	2.46	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	373.06	12.24	No	4.02	255.49	8.38	Yes	0.16	253.85	8.33	Yes	0.11
Bowel (100 cc)	Soft	162.46	5.33	No	2.25	96.99	3.18	Yes	0.10	96.61	3.17	Yes	0.09
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.94		No	47.42	1.35		No	3.00	1.35		No	3.17
CI (<1.55)	Soft	2.94		No	36.43	2.19		No	1.43	2.19		No	1.64
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	2.24		Yes	-18.73	2.67		Yes	-3.26	2.75		Yes	-0.36

Patient 14		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1061.47	98.71	Yes	-0.77	1072.36	99.72	Yes	0.24	1071.80	99.67	Yes	0.19
PTV (< 107 %)	Hard	437.71	40.70	No	40.70	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1061.47	98.71	Yes	-0.77	1072.36	99.72	Yes	0.24	1071.80	99.67	Yes	0.19
Bladder (< 0.5 cc)	Hard	100.18	23.19	No	23.19	0.01	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	380.75	88.15	No	2.56	373.67	86.52	No	0.93	371.86	86.10	No	0.51
Bladder (75 %)	Soft	245.46	56.83	Yes	18.51	170.48	39.47	Yes	1.15	167.59	38.80	Yes	0.48
Rectum (< 0.5 cc)	Hard	6.67	10.10	No	10.10	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	60.35	91.46	Yes	0.81	60.18	91.20	Yes	0.55	60.11	91.10	Yes	0.45
Rectum (< 85 %)	Soft	38.71	58.66	Yes	2.60	37.56	56.92	Yes	0.86	37.52	56.86	Yes	0.80
Bowel (< 0.5 cc)	Hard	55.23	7.04	No	7.04	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	185.00	23.58	Yes	0.67	182.82	23.31	Yes	0.40	181.41	23.13	Yes	0.22
Bowel (100 cc)	Soft	96.64	12.32	Yes	3.06	75.03	9.57	Yes	0.31	74.39	9.48	Yes	0.22
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.46		No	23.39	1.22		No	3.06	1.21		No	2.11
CI (<1.55)	Soft	2.10		No	13.45	1.87		No	1.14	1.86		No	0.84
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	46.18		No	0.74	43.89		No	-4.25	44.07		No	-3.85

Patient 15		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	921.50	99.39	Yes	0.68	920.32	99.27	Yes	0.56	919.32	99.16	Yes	0.45
PTV (< 107 %)	Hard	214.61	23.15	No	-76.24	0.00	0.00	Yes	-99.27	0.00	0.00	Yes	-99.16
PTV (> 98 %)	Soft	921.50	99.39	Yes	0.68	920.32	99.27	Yes	0.56	919.32	99.16	Yes	0.45
Bladder (< 0.5 cc)	Hard	27.56	9.59	No	9.59	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	232.34	80.87	Yes	7.53	213.67	74.38	Yes	1.04	211.90	73.76	Yes	0.42
Bladder (75 %)	Soft	130.99	45.60	Yes	8.77	108.86	37.89	Yes	1.06	107.27	37.34	Yes	0.51
Rectum (< 0.5 cc)	Hard	0.79	0.86	No	0.86	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	72.30	77.98	Yes	11.94	62.27	67.16	Yes	1.12	62.40	67.30	Yes	1.26
Rectum (< 85 %)	Soft	34.34	37.04	Yes	6.31	29.19	31.48	Yes	0.75	29.27	31.57	Yes	0.84
Bowel (< 0.5 cc)	Hard	79.84	4.35	No	4.35	0.03	0.00	Yes	0.00	0.01	0.00	Yes	0.00
Bowel (350 cc)	Soft	613.76	33.40	No	2.10	586.22	31.90	No	0.60	583.80	31.77	No	0.47
Bowel (100 cc)	Soft	318.94	17.36	No	2.25	284.06	15.46	No	0.35	282.58	15.38	No	0.27
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.37		No	17.23	1.21		No	3.38	1.20		No	2.69
CI (<1.55)	Soft	2.06		No	8.74	1.92		No	1.34	1.92		No	1.12
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	45.64		No	0.46	45.47		No	0.10	45.51		No	0.18

Patient 16		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1544.78	98.67	Yes	0.20	1551.15	99.07	Yes	0.60	1551.27	99.08	Yes	0.61
PTV (< 107 %)	Hard	442.62	28.27	No	28.27	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1544.78	98.67	Yes	0.20	1551.15	99.07	Yes	0.60	1551.27	99.08	Yes	0.61
ITV (> 99.9 %)	Hard	977.59	99.84	No	-0.16	979.12	100.00	Yes	0.00	979.12	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	191.83	44.50	No	44.50	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	140.95	23.49	No	23.49	0.03	0.00	Yes	0.00	0.02	0.00	Yes	0.00
Bladder (85 %)	Soft	498.14	83.00	Yes	3.00	484.01	80.65	Yes	0.65	482.52	80.40	Yes	0.40
Bladder (75 %)	Soft	328.23	54.69	Yes	-29.57	300.49	50.07	Yes	-34.19	298.91	49.81	Yes	-34.45
Rectum (< 0.5 cc)	Hard	19.55	27.96	No	27.96	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	67.68	96.79	No	29.12	67.73	96.86	No	29.19	67.70	96.83	No	29.16
Rectum (< 85 %)	Soft	62.93	90.01	No	5.75	59.27	84.77	Yes	0.51	59.29	84.80	Yes	0.54
Bowel (< 0.5 cc)	Hard	76.08	3.37	No	3.37	0.10	0.00	Yes	0.00	0.13	0.01	Yes	0.01
Bowel (350 cc)	Soft	494.12	21.88	No	-0.03	498.54	22.07	No	0.16	495.90	21.96	No	0.05
Bowel (100 cc)	Soft	251.16	11.20	No	0.38	244.27	10.82	No	0.00	243.42	10.78	No	-0.04
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.24		No	10.90	1.15		No	3.04	1.15		No	2.95
CI (<1.55)	Soft	1.78		No	5.96	1.70		No	1.07	1.70		No	1.05
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	43.60		No	-1.67	44.63		No	0.65	44.53		No	0.42
Right Kidney (< 15 Gy)	Hard	0.89		Yes	864.13	0.92		Yes	903.26	0.92		Yes	901.09
Right Kidney (< 10 Gy)	Soft	0.89		Yes	943.53	0.92		Yes	985.88	0.92		Yes	983.53
Left Kidney (< 15 Gy)	Hard	0.77		Yes	739.13	0.80		Yes	769.57	0.80		Yes	767.39
Left Kidney (< 10 Gy)	Soft	0.77		Yes	808.24	0.80		Yes	841.18	0.80		Yes	838.82

Patient 17		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1438.89	97.88	Yes	-0.02	1439.08	97.89	Yes	-0.01	1439.21	97.90	Yes	0.00
PTV (< 107 %)	Hard	70.72	4.81	No	4.81	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1438.89	97.88	No	-0.02	1439.08	97.89	No	-0.01	1439.21	97.90	No	0.00
ITV (> 99.9 %)	Hard	953.66	99.99	Yes	0.00	953.68	99.99	Yes	0.00	953.71	99.99	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	111.94	97.81	No	0.00	112.01	97.88	No	0.07	111.99	97.86	No	0.05
Bladder (75 %)	Soft	71.17	62.19	Yes	-0.20	71.33	62.33	Yes	-0.06	71.29	62.29	Yes	-0.10
Bowel (< 0.5 cc)	Hard	11.09	0.93	No	0.93	0.02	0.00	Yes	0.00	0.01	0.00	Yes	0.00
Bowel (350 cc)	Soft	382.54	31.91	No	0.07	381.55	31.83	No	-0.01	381.86	31.86	No	0.02
Bowel (100 cc)	Soft	215.26	17.96	No	0.29	211.70	17.66	No	-0.01	211.90	17.68	No	0.01
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.04		Yes	0.97	1.03		Yes	0.02	1.03		Yes	0.02
CI (<1.55)	Soft	1.54		Yes	0.61	1.53		Yes	-0.03	1.53		Yes	-0.01
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	44.14		No	-2.85	43.97		No	-3.24	44.58		No	-1.89
Right Kidney (< 15 Gy)	Hard	7.09		Yes	-0.06	7.09		Yes	-0.04	7.09		Yes	-0.10
Right Kidney (< 10 Gy)	Hard	7.09		Yes	-0.06	7.09		Yes	-0.04	7.09		Yes	-0.10
Left Kidney (< 15 Gy)	Hard	6.09		Yes	0.05	6.09		Yes	0.05	6.08		Yes	-0.07
Left Kidney (< 10 Gy)	Hard	6.09		Yes	0.05	6.09		Yes	0.05	6.08		Yes	-0.07

Patient 18		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1078.06	96.89	Yes	-1.19	1097.53	98.64	Yes	0.56	1095.65	98.48	Yes	0.40
PTV (< 107 %)	Hard	398.06	35.78	No	35.78	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1078.06	96.89	No	-1.19	1097.53	98.64	Yes	0.56	1095.65	98.48	Yes	0.40
Bladder (< 0.5 cc)	Hard	12.57	9.63	No	9.63	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	109.27	83.72	Yes	-2.87	113.39	86.87	No	0.28	113.24	86.75	No	0.16
Bladder (75 %)	Soft	63.16	48.39	Yes	-0.84	65.45	50.14	Yes	0.91	64.92	49.74	Yes	0.51
Rectum (< 0.5 cc)	Hard	12.78	30.71	No	30.71	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	35.44	85.14	Yes	0.27	35.41	85.08	Yes	0.21	35.35	84.94	Yes	0.07
Rectum (< 85 %)	Soft	23.56	56.60	Yes	12.11	18.73	45.00	Yes	0.51	18.68	44.87	Yes	0.38
Bowel (< 0.5 cc)	Hard	36.43	2.32	No	2.32	0.00	0.00	Yes	0.00	0.01	0.00	Yes	0.00
Bowel (350 cc)	Soft	517.79	33.01	No	5.47	438.52	27.95	No	0.41	435.23	27.74	No	0.20
Bowel (100 cc)	Soft	194.71	12.41	No	2.73	156.81	10.00	No	0.32	154.87	9.87	No	0.19
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.36		No	19.67	1.16		No	2.47	1.16		No	1.93
CI (<1.55)	Soft	2.05		No	14.06	1.82		No	1.03	1.81		No	0.74
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	64.83		No	43.05	45.24		No	-0.19	45.24		No	-0.17

Patient 19		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	829.49	99.78	Yes	0.39	828.11	99.62	Yes	0.23	828.52	99.67	Yes	0.28
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	829.49	99.78	Yes	0.39	828.11	99.62	Yes	0.23	828.52	99.67	Yes	0.28
Bladder (< 0.5 cc)	Hard	0.04	0.01	Yes	0.01	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	343.37	98.78	No	0.36	342.84	98.63	No	0.21	342.78	98.61	No	0.19
Bladder (75 %)	Soft	166.43	47.88	Yes	1.64	163.66	47.08	Yes	0.84	163.35	46.99	Yes	0.75
Rectum (< 0.5 cc)	Hard	0.01	0.01	Yes	0.01	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	37.21	80.41	Yes	0.67	37.06	80.09	Yes	0.35	37.05	80.07	Yes	0.33
Rectum (< 85 %)	Soft	21.78	47.07	Yes	1.81	21.39	46.23	Yes	0.97	21.53	46.52	Yes	1.26
Bowel (< 0.5 cc)	Hard	0.07	0.01	Yes	0.01	0.02	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	280.62	31.00	Yes	0.88	277.46	30.65	Yes	0.53	277.08	30.60	Yes	0.48
Bowel (100 cc)	Soft	116.21	12.84	No	0.58	113.30	12.51	No	0.25	113.87	12.58	No	0.32
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.25		No	5.05	1.22		No	2.48	1.22		No	2.90
CI (<1.55)	Soft	2.01		No	2.65	1.98		No	1.29	1.99		No	1.48
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	46.77		No	1.21	46.36		No	0.33	46.40		No	0.40

Patient 20		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1852.18	94.68	No	-0.17	1852.98	94.72	No	-0.13	1867.31	95.45	Yes	0.60
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1852.18	94.68	No	-0.17	1852.98	94.72	No	-0.13	1867.31	95.45	No	0.60
ITV (> 99.9 %)	Hard	1179.17	98.84	No	-1.14	1183.67	99.22	No	-0.76	1192.45	99.95	Yes	-0.03
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	142.49	92.35	No	0.34	142.43	92.31	No	0.30	142.02	92.04	No	0.03
Bladder (75 %)	Soft	102.69	66.56	Yes	1.81	102.36	66.34	Yes	1.59	100.45	65.10	Yes	0.35
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	66.40	97.88	No	0.07	66.38	97.85	No	0.04	66.36	97.82	No	0.01
Rectum (< 85 %)	Soft	55.62	81.99	Yes	27.15	55.49	81.80	Yes	26.96	55.19	81.36	Yes	26.52
Bowel (< 0.5 cc)	Hard	0.30	0.02	Yes	0.02	0.11	0.01	Yes	0.01	0.01	0.00	Yes	0.00
Bowel (350 cc)	Soft	648.35	33.62	No	0.52	645.01	33.44	No	0.34	642.59	33.32	No	0.22
Bowel (100 cc)	Soft	390.96	20.27	No	0.64	387.33	20.08	No	0.45	384.13	19.92	No	0.29
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.06		Yes	2.73	1.05		Yes	1.82	1.05		Yes	2.00
CI (<1.55)	Soft	1.56		No	0.13	1.55		No	-0.06	1.56		No	0.66
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	44.80		No	-0.22	44.82		No	-0.16	44.71		No	-0.42

Appendix 8. DVH Statistics After SSD Changes: + 1.0 cm

Patient 1		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1370.73	71.83	No	-26.57	1795.76	94.10	No	-4.30	1858.74	97.40	Yes	-1.00
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1370.73	71.83	No	-26.57	1795.76	94.10	No	-4.30	1858.74	97.40	No	-1.00
ITV (> 99.9 %)	Hard	889.21	76.94	No	-23.06	1143.02	98.90	No	-1.10	1154.92	99.92	Yes	-0.08
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	224.59	79.41	Yes	-3.78	227.88	80.57	Yes	-2.62	44.95	81.93	Yes	-1.26
Bladder (75 %)	Soft	133.79	47.30	Yes	-5.94	140.00	49.50	Yes	-3.74	145.34	51.39	Yes	-1.85
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	41.93	100.00	No	0.00	41.92	100.00	No	0.00	41.93	100.00	No	0.00
Rectum (< 85 %)	Soft	35.55	84.80	Yes	-3.14	36.22	86.39	No	-1.55	36.17	36.17	Yes	-51.78
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	329.59	24.05	Yes	-2.09	342.68	25.00	Yes	-1.14	349.59	25.50	Yes	-0.64
Bowel (100 cc)	Soft	161.90	11.80	No	-1.91	174.00	12.69	No	-1.02	179.12	13.07	No	-0.64
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	0.78		Yes	-31.35	1.00		Yes	-12.00	1.07		Yes	-6.29
CI (<1.55)	Soft	1.62		No	-5.99	1.66		No	-3.63	1.69		No	-1.92
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	43.01		No	-4.33	43.53		No	-3.18	44.03		No	-2.07

Patient 2		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1568.90	72.82	No	-23.22	1810.87	84.05	No	-11.99	1978.25	91.82	No	-4.22
PTV (< 107 %)	Hard	3.55	0.16	No	0.16	3.86	0.18	No	0.18	1.81	0.08	No	0.08
PTV (> 98 %)	Soft	1568.90	72.82	No	-23.22	1810.87	84.05	No	-11.99	1978.25	91.82	No	-4.22
ITV (> 99.9 %)	Hard	916.12	81.34	No	-18.56	1041.32	92.46	No	-7.44	1107.25	98.31	No	-1.59
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	276.72	92.74	No	-1.70	277.28	92.93	No	-1.51	280.29	93.93	No	-0.51
Bladder (75 %)	Soft	193.36	64.80	Yes	-5.49	196.55	65.87	Yes	-4.42	204.09	68.40	Yes	-1.89
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	117.54	98.39	No	-0.66	117.75	98.57	No	-0.48	118.15	98.90	No	-0.15
Rectum (< 85 %)	Soft	95.38	79.84	Yes	-5.05	98.53	82.48	Yes	-2.41	99.47	83.26	Yes	-1.63
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	723.30	28.91	No	-1.64	734.09	29.34	No	-1.21	750.42	29.99	No	-0.56
Bowel (100 cc)	Soft	386.21	15.44	No	-1.58	396.94	15.86	No	-1.16	412.00	16.47	No	-0.55
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	0.77		Yes	-26.62	0.88		Yes	-16.05	0.98		Yes	-7.28
CI (<1.55)	Soft	1.51		Yes	-5.08	1.54		Yes	-3.54	1.56		No	-2.06
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	42.29		No	-3.87	42.37		No	-3.69	43.44		No	-1.27
Right Kidney (< 15 Gy)	Hard	1.06		Yes	1.73	1.03		Yes	-0.39	1.03		Yes	-0.39
Right Kidney (< 10 Gy)	Soft	1.06		Yes	1.73	1.03		Yes	-0.39	1.03		Yes	-0.39
Left Kidney (< 15 Gy)	Hard	0.97		Yes	1.26	0.95		Yes	-0.84	0.94		Yes	-1.68
Left Kidney (< 10 Gy)	Soft	0.97		Yes	1.26	0.95		Yes	-0.84	0.94		Yes	-1.68

Patient 3		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1582.46	92.59	No	-6.92	1666.68	97.52	Yes	-1.99	1678.49	98.21	Yes	-1.30
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1582.46	92.59	No	-6.92	1666.68	97.52	No	-1.99	1678.49	98.21	Yes	-1.30
ITV (> 99.9 %)	Hard	1103.27	96.80	No	-3.20	1138.79	99.92	Yes	-0.08	1139.04	99.94	Yes	-0.06
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	448.54	83.98	Yes	-2.24	438.06	84.48	Yes	-1.74	442.05	85.25	No	-0.97
Bladder (75 %)	Soft	250.65	48.34	Yes	-4.63	256.92	49.55	Yes	-3.42	262.66	50.65	Yes	-2.32
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	78.99	88.65	Yes	-1.12	79.25	88.94	Yes	-0.83	79.49	89.21	Yes	-0.56
Rectum (< 85 %)	Soft	53.36	59.89	Yes	-3.36	54.62	61.30	Yes	-1.95	54.33	60.98	Yes	-2.27
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	317.11	18.64	Yes	-1.47	326.00	19.16	Yes	-0.95	332.58	19.55	Yes	-0.56
Bowel (100 cc)	Soft	138.22	8.12	No	-1.17	145.81	8.57	No	-0.72	150.31	8.83	No	-0.46
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.00		Yes	-12.41	1.06		Yes	-7.16	1.08		Yes	-5.74
CI (<1.55)	Soft	1.51		Yes	-5.09	1.54		Yes	-3.40	1.55		Yes	-2.71
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	9.54		No	-3.13	9.67		No	-1.78	9.76		No	-0.86

Patient 4		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1136.58	84.93	No	-12.00	1230.26	91.93	No	-5.00	1246.29	93.13	No	-3.80
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1136.58	84.93	No	-12.00	1230.26	91.93	No	-5.00	1246.29	93.13	No	-3.80
ITV (> 99.9 %)	Hard	811.15	94.38	No	-5.62	851.16	99.03	No	-0.97	855.26	99.51	No	-0.49
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	156.60	96.59	No	-1.03	156.93	96.79	No	-0.83	157.45	97.11	No	-0.51
Bladder (75 %)	Soft	108.75	67.07	Yes	-5.37	111.38	68.70	Yes	-3.74	113.26	69.86	Yes	-2.58
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	41.12	100.00	No	0.00	41.12	100.00	No	0.00	41.12	100.00	No	0.00
Rectum (< 85 %)	Soft	37.97	92.33	No	-2.00	38.30	93.13	No	-1.20	38.40	93.38	No	-0.95
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	262.12	32.96	Yes	-1.68	265.73	33.42	Yes	-1.22	268.38	33.75	Yes	-0.89
Bowel (100 cc)	Soft	162.60	20.45	No	-1.32	166.51	20.94	No	-0.83	166.66	20.96	No	-0.81
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.91		Yes	-16.42	0.99		Yes	-8.89	1.01		Yes	-7.65
CI (<1.55)	Soft	1.50		Yes	-4.30	1.52		Yes	-2.87	1.52		Yes	-2.44
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	43.12		No	-3.64	43.77		No	-2.20	43.72		No	-2.30

Patient 5		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1289.85	86.80	No	-11.66	1388.93	93.47	No	-4.99	1403.63	94.46	No	-4.00
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1289.85	86.80	No	-11.66	1388.93	93.47	No	-4.99	1403.63	94.46	No	-4.00
ITV (> 99.9 %)	Hard	963.70	95.07	No	-4.93	1007.94	99.43	No	-0.57	1011.48	99.78	No	-0.22
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	295.89	96.49	No	-1.30	296.79	96.79	No	-1.00	298.20	97.25	No	-0.54
Bladder (75 %)	Soft	191.63	62.49	Yes	-6.70	197.95	64.55	Yes	-4.64	201.10	65.58	Yes	-3.61
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	53.38	90.57	Yes	-0.42	53.44	90.67	Yes	-0.32	53.53	90.82	Yes	-0.17
Rectum (< 85 %)	Soft	46.62	79.10	Yes	-2.37	47.07	79.86	Yes	-1.61	47.29	80.24	Yes	-1.23
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	242.23	21.59	Yes	-1.94	248.50	22.15	Yes	-1.38	251.33	22.41	Yes	-1.12
Bowel (100 cc)	Soft	83.65	7.46	Yes	-1.58	90.01	8.02	Yes	-1.02	90.42	8.06	Yes	-0.98
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	0.92		Yes	-15.43	0.99		Yes	-9.12	1.00		Yes	-7.98
CI (<1.55)	Soft	1.49		Yes	-4.38	1.51		Yes	-3.12	1.52		Yes	-2.57
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	42.99		No	-5.27	43.33		No	-4.53	43.26		No	-4.67

Patient 6		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1583.48	91.42	No	-7.41	1666.43	96.21	Yes	-2.62	1670.74	96.45	Yes	-2.38
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1583.48	91.42	No	-7.41	1666.43	96.21	No	-2.62	1670.74	96.45	No	-2.38
ITV (> 99.9 %)	Hard	1182.56	98.34	No	-1.66	1202.09	99.96	Yes	-0.04	1202.52	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	419.45	88.28	No	-1.53	421.06	88.62	No	-1.19	423.76	89.19	No	-0.62
Bladder (75 %)	Soft	274.72	57.82	Yes	-5.16	281.61	59.27	Yes	-3.71	288.26	60.67	Yes	-2.31
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	-0.03	0.00	0.00	Yes	-0.03	0.01	0.00	Yes	-0.03
Bowel (350 cc)	Soft	532.66	31.82	No	-1.34	539.07	32.20	No	-0.96	542.84	32.42	No	-0.74
Bowel (100 cc)	Soft	323.38	19.32	No	-1.51	333.24	19.90	No	-0.93	333.80	19.94	No	-0.89
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.09		Yes	1.22	1.05		Yes	-2.49	1.03		Yes	-4.35
CI (<1.55)	Soft	1.45		Yes	-2.29	1.40		Yes	-5.66	1.39		Yes	-6.34
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	44.65		No	-1.12	44.28		No	-1.94	44.15		No	-2.23

Patient 7		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	2193.76	98.55	Yes	-0.07	2113.04	94.92	No	-3.70	2117.22	95.11	Yes	-3.51
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	2193.76	98.55	Yes	-0.07	2113.04	94.92	No	-3.70	2117.22	95.11	No	-3.51
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	380.38	87.35	No	0.02	373.66	85.81	No	-1.52	376.68	86.50	No	-0.83
Bladder (75 %)	Soft	282.71	64.92	Yes	-0.07	269.23	61.83	Yes	-3.16	272.87	62.66	Yes	-2.33
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	49.02	99.13	No	-0.02	48.91	98.90	No	-0.25	48.85	98.79	No	-0.36
Rectum (< 85 %)	Soft	43.81	88.59	No	-0.12	43.21	87.37	No	-1.34	42.81	86.57	No	-2.14
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	305.25	21.24	Yes	0.01	298.52	20.77	Yes	-0.46	298.94	20.80	Yes	-0.43
Bowel (100 cc)	Soft	207.07	14.41	No	0.01	197.45	13.74	No	-0.66	197.76	13.76	No	-0.64
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.06		Yes	-0.18	0.99		Yes	-6.51	0.99		Yes	-6.56
CI (<1.55)	Soft	1.42		Yes	-0.08	1.38		Yes	-2.96	1.38		Yes	-2.84
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	45.18		No	-0.62	44.54		No	-2.02	44.52		No	-2.07
Right Kidney (< 15 Gy)	Hard	1.42		Yes	-0.07	1.43			0.92	1.45			1.97
Right Kidney (< 10 Gy)	Soft	1.42		Yes	-0.07	1.43		yes	0.92	1.45		yes	1.97
Left Kidney (< 15 Gy)	Hard	1.34		Yes	0.00	1.35		yes	0.90	1.35		yes	1.20
Left Kidney (< 10 Gy)	Soft	1.34		Yes	0.00	1.35		yes	0.90	1.35		yes	1.20

Patient 8		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	852.05	92.54	No	-6.13	882.74	95.88	Yes	-2.79	883.16	95.92	Yes	-2.75
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	852.05	92.54	No	-6.13	882.74	95.88	No	-2.79	883.16	95.92	No	-2.75
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	119.44	66.14	Yes	-3.91	121.47	67.27	Yes	-2.78	122.70	67.95	Yes	-2.10
Bladder (75 %)	Soft	61.65	34.14	Yes	-3.62	64.12	35.50	Yes	-2.26	64.33	35.62	Yes	-2.14
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	29.29	67.97	Yes	-0.69	29.41	68.25	Yes	-0.41	29.41	68.24	Yes	-0.42
Rectum (< 85 %)	Soft	20.82	48.30	Yes	-3.60	21.56	50.04	Yes	-1.86	21.34	49.52	Yes	-2.38
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	387.40	24.61	No	-2.29	400.74	25.46	No	-1.44	398.99	25.35	No	-1.55
Bowel (100 cc)	Soft	166.83	10.60	No	-1.43	175.72	11.16	No	-0.87	175.36	11.14	No	-0.89
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.00		Yes	-15.01	1.08		Yes	-8.13	1.06		Yes	-9.19
CI (<1.55)	Soft	1.72		No	-5.43	1.76		No	-3.18	1.75		No	-3.61
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	24.47		No	1.23	24.83		No	2.73	24.76		No	2.46

Patient 9		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	998.17	90.66	No	-8.49	1091.48	99.14	Yes	-0.01	1072.23	97.39	Yes	-1.76
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	48.20	0.00	No	0.00	48.20	0.00	No	0.00
PTV (> 98 %)	Soft	998.17	90.66	No	-8.49	1091.48	99.14	Yes	-0.01	1072.23	97.39	No	-1.76
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	286.42	73.69	Yes	-3.57	300.47	77.31	Yes	0.05	292.12	75.16	Yes	-2.10
Bladder (75 %)	Soft	153.26	39.43	Yes	-4.55	170.64	43.90	Yes	-0.08	160.69	41.34	Yes	-2.64
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	61.17	88.68	Yes	-1.11	61.90	89.74	Yes	-0.05	61.47	89.11	Yes	-0.68
Rectum (< 85 %)	Soft	39.03	56.58	Yes	-5.59	42.82	62.08	Yes	-0.09	40.19	58.26	Yes	-3.91
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	348.04	28.23	Yes	-2.62	379.55	30.79	No	-0.06	368.43	29.89	No	-0.96
Bowel (100 cc)	Soft	136.76	11.09	No	-1.91	160.23	13.00	No	0.00	151.08	12.26	No	-0.74
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.97		Yes	-18.14	1.18		No	-0.14	1.08		Yes	-8.14
CI (<1.55)	Soft	1.69		No	56.23	1.81		No	66.98	1.75		No	61.35
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	37.35		No	-3.62	38.79		No	0.09	38.37		No	-0.99

Patient 10		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1155.04	82.04	No	-16.07	1290.44	91.66	No	-6.45	1319.16	93.70	No	-4.41
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1155.04	82.04	No	-16.07	1290.44	91.66	No	-6.45	1319.16	93.70	No	-4.41
ITV (> 99.9 %)	Hard	736.37	91.59	No	-8.41	796.20	99.03	No	-0.97	801.99	99.75	No	-0.25
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	154.35	87.80	No	-2.58	155.29	88.33	No	-2.05	156.63	89.09	No	-1.29
Bladder (75 %)	Soft	72.57	41.28	Yes	-6.92	75.56	42.98	Yes	-5.22	78.48	44.64	Yes	-3.56
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	-0.03	0.00	0.00	Yes	-0.03	0.00	0.00	Yes	-0.03
Rectum (< 95 %)	Soft	72.29	96.46	No	-1.33	72.73	97.04	No	-0.75	72.71	97.02	No	-0.77
Rectum (< 85 %)	Soft	43.60	58.17	Yes	-6.69	45.66	60.93	Yes	-3.93	45.38	60.56	Yes	-4.30
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	754.70	19.55	No	-1.50	768.73	19.91	No	-1.14	784.34	20.32	No	-0.73
Bowel (100 cc)	Soft	313.40	8.12	No	-1.35	329.85	8.54	No	-0.93	334.93	8.68	No	-0.79
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.90		Yes	-21.72	1.01		Yes	-12.31	1.03		Yes	-10.53
CI (<1.55)	Soft	1.70		No	-6.28	1.73		No	-4.42	1.74		No	-3.67
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	43.07		No	-3.17	43.28		No	-2.69	43.75		No	-1.65
Right Kidney (< 15 Gy)	Hard	0.53			3.52	0.52			2.35	0.52			2.35
Right Kidney (< 10 Gy)	Hard	0.53			3.52	0.52			2.35	0.52			2.35
Left Kidney (< 15 Gy)	Hard	0.60			3.43	0.60			2.23	0.60			2.23
Left Kidney (< 10 Gy)	Hard	0.60			3.43	0.60			2.23	0.60			2.23

Patient 11		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	838.77	71.90	No	-23.50	987.63	84.66	No	-10.74	1052.51	90.22	No	-5.18
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	838.77	71.90	No	-23.50	987.63	84.66	No	-10.74	1052.51	90.22	No	-5.18
ITV (> 99.9 %)	Hard	544.03	82.90	No	-17.06	623.71	95.04	No	-4.92	648.55	98.82	No	-1.14
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	277.21	95.81	No	-1.08	278.07	96.11	No	-0.78	278.95	96.41	No	-0.48
Bladder (75 %)	Soft	179.27	61.96	Yes	-5.78	183.09	63.28	Yes	-4.46	189.56	65.51	Yes	-2.23
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	51.77	98.06	No	-0.64	51.88	98.27	No	-0.43	51.95	98.40	No	-0.30
Rectum (< 85 %)	Soft	38.18	72.31	Yes	-3.63	39.00	73.87	Yes	-2.07	38.95	73.78	Yes	-2.16
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	403.18	48.62	No	-1.12	406.18	48.99	No	-0.75	407.48	49.14	No	-0.60
Bowel (100 cc)	Soft	257.93	31.11	No	-2.52	264.31	31.88	No	-1.75	269.46	32.50	No	-1.13
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.78		Yes	-27.61	0.92		Yes	-14.42	0.97		Yes	-9.43
CI (<1.55)	Soft	1.66		No	-4.15	1.70		No	-2.08	1.69		No	-2.37
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	42.65		No	-3.87	43.06		No	-2.95	43.77		No	-1.35

Patient 12		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1151.60	95.40	Yes	-4.47	1191.50	98.71	Yes	-1.16	186.06	98.26	Yes	-1.61
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1151.60	95.40	No	-4.47	1191.50	98.71	Yes	-1.16	186.06	98.26	Yes	-1.61
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	221.49	64.25	Yes	-1.59	225.30	65.35	Yes	-0.49	225.74	65.48	Yes	-0.36
Bladder (75 %)	Soft	118.19	34.28	Yes	-4.57	124.12	36.00	Yes	-2.85	123.54	35.83	Yes	-3.02
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	57.69	86.65	Yes	-0.24	58.25	87.48	Yes	0.59	58.21	87.43	Yes	0.54
Rectum (< 85 %)	Soft	31.74	47.67	Yes	-5.58	33.06	49.65	Yes	-3.60	32.78	49.24	Yes	-4.01
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	495.40	18.19	No	-0.61	518.29	19.03	No	0.23	521.47	19.15	No	0.35
Bowel (100 cc)	Soft	121.70	4.47	No	-1.32	135.08	4.96	No	-0.83	132.61	4.87	No	-0.92
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.04		Yes	-16.09	1.13		No	-8.87	1.11		No	-10.09
CI (<1.55)	Soft	1.75		No	-5.75	1.80		No	-3.03	1.80		No	-3.49
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	37.41		No	-16.47	38.00		No	-15.13	38.08		No	-14.96

Patient 13		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	636.95	95.38	Yes	-4.48	660.78	98.95	Yes	-0.91	661.64	99.08	Yes	-0.78
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	636.95	95.38	No	-4.48	660.78	98.95	Yes	-0.91	661.64	99.08	Yes	-0.78
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	36.16	39.12	Yes	-5.80	37.44	40.51	Yes	-4.41	38.09	41.21	Yes	-3.71
Bladder (75 %)	Soft	11.80	12.76	Yes	-2.24	12.41	13.42	Yes	-1.58	12.76	13.80	Yes	-1.20
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	12.36	17.41	Yes	-7.50	14.97	21.08	Yes	-3.83	13.13	18.49	Yes	-6.42
Rectum (< 85 %)	Soft	0.00	0.00	Yes	-0.01	0.00	0.00	Yes	-0.01	0.00	0.00	Yes	-0.01
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	224.42	7.36	Yes	-0.86	233.72	7.67	Yes	-0.55	239.84	7.87	Yes	-0.35
Bowel (100 cc)	Soft	73.84	2.42	Yes	-0.66	82.65	2.71	Yes	-0.37	84.47	2.77	Yes	-0.31
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.06		Yes	-19.07	1.17		No	-10.59	1.19		No	-9.75
CI (<1.55)	Soft	2.00		No	-7.43	2.06		No	-4.54	2.07		No	-4.28
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	2.73		Yes	-1.27	2.73		Yes	-0.98	2.77		Yes	0.47

Patient 14		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	940.21	87.43	No	-12.05	1012.23	94.13	No	-5.35	1055.64	98.17	Yes	-1.31
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	940.21	87.43	No	-12.05	1012.23	94.13	No	-5.35	1055.64	98.17	Yes	-1.31
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	343.26	79.48	Yes	-6.11	350.13	81.06	Yes	-4.53	363.29	84.11	Yes	-1.48
Bladder (75 %)	Soft	136.87	31.69	Yes	-6.63	143.40	33.20	Yes	-5.12	158.49	36.69	Yes	-1.63
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	57.12	86.56	Yes	-4.09	57.78	87.57	Yes	-3.08	58.73	89.01	Yes	-1.64
Rectum (< 85 %)	Soft	32.23	48.85	Yes	-7.21	34.09	51.66	Yes	-4.40	35.03	53.09	Yes	-2.97
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	162.71	20.74	Yes	-2.17	166.94	21.28	Yes	-1.63	174.68	22.27	Yes	-0.64
Bowel (100 cc)	Soft	60.74	7.74	Yes	-1.52	63.89	8.14	Yes	-1.12	68.31	8.71	Yes	-0.55
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.05		Yes	-10.80	1.06		Yes	-10.46	1.12		No	-5.07
CI (<1.55)	Soft	1.77		No	-3.90	1.78		No	-3.86	1.81		No	-1.94
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	44.02		No	-3.97	44.65		No	-2.61	44.82		No	-2.22

Patient 15		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	839.80	90.58	No	-8.13	879.95	94.91	No	-3.80	885.85	95.55	Yes	-3.16
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	839.80	90.58	No	-8.13	879.95	94.91	No	-3.80	885.85	95.55	No	-3.16
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	197.92	68.89	Yes	-4.45	200.69	69.86	Yes	-3.48	204.12	71.05	Yes	-2.29
Bladder (75 %)	Soft	91.51	31.85	Yes	-4.98	95.42	33.21	Yes	-3.62	98.23	34.19	Yes	-2.64
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	57.70	62.23	Yes	-3.81	59.14	63.78	Yes	-2.26	58.63	63.23	Yes	-2.81
Rectum (< 85 %)	Soft	25.72	27.74	Yes	-2.99	26.98	29.10	Yes	-1.63	26.70	28.80	Yes	-1.93
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	528.26	28.75	No	-2.55	544.04	29.61	No	-1.69	546.27	29.73	No	-1.57
Bowel (100 cc)	Soft	247.93	13.49	No	-1.62	258.53	14.07	No	-1.04	260.08	14.16	No	-0.95
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.95		Yes	-18.37	1.04		Yes	-11.04	0.50		Yes	-56.78
CI (<1.55)	Soft	1.78		No	-6.29	1.82		No	-4.08	1.83		No	-3.70
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	43.53		No	-4.19	44.22		No	-2.67	44.45		No	-2.16

Patient 16		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1328.65	84.86	No	-13.61	1458.65	84.86	No	-10.73	1475.05	94.21	No	-4.26
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1328.65	84.86	No	-13.61	1428.65	84.86	No	-10.75	1475.05	94.21	No	-4.26
ITV (> 99.9 %)	Hard	903.02	92.22	No	-7.78	972.09	99.28	No	-0.72	971.08	99.18	No	-0.82
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	463.69	77.26	Yes	-2.74	467.55	77.91	Yes	-2.09	472.08	78.66	Yes	-1.34
Bladder (75 %)	Soft	267.16	44.52	Yes	-39.74	276.33	46.04	Yes	-38.22	279.22	46.53	Yes	-37.73
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	67.35	96.32	No	28.65	67.45	96.48	No	28.81	67.49	96.52	No	28.85
Rectum (< 85 %)	Soft	57.14	81.72	Yes	-2.54	57.88	82.79	Yes	-1.47	57.76	82.61	Yes	-1.65
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	462.47	20.48	No	-1.43	470.29	20.82	No	-1.09	475.33	21.04	No	-0.87
Bowel (100 cc)	Soft	211.19	9.35	No	-1.47	221.07	9.79	No	-1.03	220.89	9.78	No	-1.04
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.92		Yes	-17.56	1.02		Yes	-8.74	1.01		Yes	-9.67
CI (<1.55)	Soft	1.60		No	-4.88	1.63		No	-2.98	1.63		No	-2.99
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	42.89		No	-3.27	43.70		No	-1.44	43.56		No	-1.76
Right Kidney (< 15 Gy)	Hard	0.96		Yes	944.57	0.95		Yes	928.26	0.95		Yes	936.96
Right Kidney (< 10 Gy)	Soft	0.96		Yes	1030.59	0.95		Yes	1012.94	0.95		Yes	1022.35
Left Kidney (< 15 Gy)	Hard	0.83		Yes	796.74	0.82		Yes	785.87	0.82		Yes	792.39
Left Kidney (< 10 Gy)	Soft	0.83		Yes	870.59	0.82		Yes	858.82	0.82		Yes	865.88

Patient 17		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1338.11	91.03	No	-6.87	1402.59	95.41	Yes	-2.49	1412.83	96.11	Yes	-1.79
PTV (< 107 %)	Hard	0.03	0.00	Yes	0.00	0.13	0.01	Yes	0.01	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1338.11	91.03	No	-6.87	1402.59	95.41	No	-2.49	1412.83	96.11	No	-1.79
ITV (> 99.9 %)	Hard	923.67	96.84	No	-3.15	949.96	99.60	No	-0.39	951.95	99.81	No	-0.18
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	110.93	96.93	No	-0.88	111.21	97.18	No	-0.63	111.69	97.60	No	-0.21
Bladder (75 %)	Soft	65.76	57.46	Yes	-4.93	67.33	58.83	Yes	-3.56	69.55	60.77	Yes	-1.62
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	383.09	31.96	No	0.12	387.89	32.36	No	0.52	379.93	31.70	No	-0.14
Bowel (100 cc)	Soft	199.64	16.66	No	-1.01	203.73	17.00	No	-0.67	206.27	17.21	No	-0.46
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.93		Yes	#DIV/0!	0.98		Yes	#DIV/0!	0.99		Yes	#DIV/0!
CI (<1.55)	Soft	1.49		Yes	#DIV/0!	1.51		Yes	#DIV/0!	1.51		Yes	#DIV/0!
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	43.69		No	-3.85	43.70		No	-3.83	44.19		No	-2.75
Right Kidney (< 15 Gy)	Hard	7.16		Yes	0.90	7.15		Yes	0.82	7.16		Yes	0.85
Right Kidney (< 10 Gy)	Hard	7.16		Yes	0.90	7.15		Yes	0.82	7.16		Yes	0.85
Left Kidney (< 15 Gy)	Hard	6.08		Yes	-0.07	6.08		Yes	-0.03	6.10		Yes	0.16
Left Kidney (< 10 Gy)	Hard	6.08		Yes	-0.07	6.08		Yes	-0.03	6.10		Yes	0.16

Patient 18		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	980.43	88.12	No	-9.96	1038.97	93.38	No	-4.70	1046.04	94.02	No	-4.06
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	980.43	88.12	No	-9.96	1038.97	93.38	No	-4.70	1046.04	94.02	No	-4.06
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	109.63	83.99	Yes	-2.60	110.86	84.93	Yes	-1.66	111.35	85.31	No	-1.28
Bladder (75 %)	Soft	56.59	43.35	Yes	-5.88	58.57	44.88	Yes	-4.35	60.65	46.46	Yes	-2.77
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	34.46	82.80	Yes	-2.07	34.58	83.09	Yes	-1.78	34.85	83.73	Yes	-1.14
Rectum (< 85 %)	Soft	16.94	40.70	Yes	-3.79	17.48	42.00	Yes	-2.49	17.60	42.27	Yes	-2.22
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	391.65	24.97	No	-2.57	406.04	25.88	No	-1.66	408.16	26.02	No	-1.52
Bowel (100 cc)	Soft	119.53	7.62	No	-2.06	132.28	8.43	No	-1.25	130.59	8.32	No	-1.36
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.94		Yes	-17.11	1.01		Yes	-11.26	1.03		Yes	-8.86
CI (<1.55)	Soft	1.70		No	-5.82	1.73		No	-4.13	1.74		No	-3.25
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	43.44		No	-4.15	43.59		No	-3.82	44.29		No	-2.27

Patient 19		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	765.64	92.10	No	-7.29	804.03	96.72	Yes	-2.67	802.12	96.49	Yes	-2.90
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	765.64	92.10	No	-7.29	804.03	96.72	No	-2.67	802.12	96.49	No	-2.90
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	336.07	96.68	No	-1.74	338.28	97.31	No	-1.11	338.79	97.46	No	-0.96
Bladder (75 %)	Soft	141.63	40.74	Yes	-5.50	148.06	42.59	Yes	-3.65	149.25	42.93	Yes	-3.31
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	35.79	77.35	Yes	-2.39	36.19	78.20	Yes	-1.54	36.16	78.14	Yes	-1.60
Rectum (< 85 %)	Soft	19.06	41.19	Yes	-4.07	20.09	43.41	Yes	-1.85	19.63	42.43	Yes	-2.83
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	251.64	27.80	Yes	-2.32	260.72	28.80	Yes	-1.32	259.31	28.64	Yes	-1.48
Bowel (100 cc)	Soft	97.30	10.75	Yes	-1.51	102.81	11.36	No	-0.90	101.12	11.17	No	-1.09
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.97		Yes	-18.35	1.06		Yes	-10.33	1.05		Yes	-11.22
CI (<1.55)	Soft	1.80		No	-7.75	1.86		No	-4.92	1.86		No	-5.15
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	44.60		No	-3.49	45.14		No	-2.31	45.10		No	-2.40

Patient 20		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1511.70	77.27	No	-17.58	1707.53	87.28	No	-7.57	1768.84	90.42	No	-4.43
PTV (< 107 %)	Hard	20.22	1.03	No	1.03	22.49	1.15	No	1.15	13.44	0.69	No	0.69
PTV (> 98 %)	Soft	1511.70	77.27	No	-17.58	1707.53	87.28	No	-7.57	1768.84	90.42	No	-4.43
ITV (> 99.9 %)	Hard	1070.64	89.74	No	-10.24	1160.50	97.28	No	-2.70	1186.10	99.42	No	-0.56
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	139.27	90.26	No	-1.75	139.62	90.49	No	-1.52	141.08	91.44	No	-0.57
Bladder (75 %)	Soft	89.45	57.98	Yes	-6.77	90.92	58.93	Yes	-5.82	96.08	62.27	Yes	-2.48
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	65.94	97.19	No	-0.62	66.03	97.34	No	-0.47	66.09	97.42	No	-0.39
Rectum (< 85 %)	Soft	52.11	76.82	Yes	21.98	53.21	78.43	Yes	23.59	53.29	78.56	Yes	23.72
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	610.83	31.67	No	-1.43	618.47	32.07	No	-1.03	623.45	32.32	No	-0.78
Bowel (100 cc)	Soft	341.04	17.68	No	-1.95	354.12	18.36	No	-1.27	357.21	18.52	No	-1.11
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.83		Yes	-19.85	0.92		Yes	-11.05	0.95		Yes	-7.79
CI (<1.55)	Soft	1.49		Yes	-4.08	1.52		Yes	-2.16	1.52		Yes	-2.09
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	42.78		No	-4.70	43.11		No	-3.97	43.67		No	-2.73

Appendix 9. DVH Statistics After SSD Changes: – 1.0 cm

Patient 1		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1892.90	99.19	Yes	0.79	1893.93	99.24	Yes	0.84	1897.90	99.45	Yes	1.05
PTV (< 107 %)	Hard	161.76	8.48	No	8.48	0.12	0.01	Yes	0.01	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1892.90	99.19	Yes	0.79	1893.93	99.24	Yes	0.84	1897.90	99.45	Yes	1.05
ITV (> 99.9 %)	Hard	1154.22	99.86	No	-0.14	1155.36	99.96	Yes	-0.04	1155.79	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.02	0.01	Yes	0.01	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.65	0.23	No	0.23	0.05	0.02	Yes	0.02	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	239.30	84.61	Yes	1.42	238.25	84.24	Yes	1.05	236.08	83.47	Yes	0.28
Bladder (75 %)	Soft	158.22	55.94	Yes	2.70	156.09	55.19	Yes	1.95	152.35	53.86	Yes	0.62
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	41.93	100.00	No	0.00	41.93	100.00	No	0.00	41.93	100.00	No	0.00
Rectum (< 85 %)	Soft	37.42	89.26	No	1.32	37.21	88.75	No	0.81	37.21	88.76	No	0.82
Bowel (< 0.5 cc)	Hard	28.23	2.06	No	2.06	0.15	0.01	Yes	0.01	0.07	0.01	Yes	0.01
Bowel (350 cc)	Soft	416.28	30.37	No	4.23	366.75	26.76	No	0.62	364.24	26.57	No	0.43
Bowel (100 cc)	Soft	223.41	16.30	No	2.59	194.94	14.22	No	0.51	192.93	14.08	No	0.37
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.26		No	10.31	1.19		No	4.11	1.17		No	2.93
CI (<1.55)	Soft	1.80		No	4.78	1.74		No	1.17	1.74		No	1.24
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	46.35		No	3.09	45.48		No	1.17	45.28		No	0.71

Patient 2		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	2029.59	94.20	No	-1.84	2055.61	95.41	Yes	-0.63	2091.40	97.07	Yes	1.03
PTV (< 107 %)	Hard	328.78	15.26	No	15.26	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	2029.59	94.20	No	-1.84	2055.61	95.41	No	-0.63	2091.40	97.07	No	1.03
ITV (> 99.9 %)	Hard	1123.79	99.78	No	-0.12	1126.05	99.98	Yes	0.08	1125.93	99.97	Yes	0.07
CTV-HR + 1 cm (< 0.5 cc)	Soft	12.49	3.65	No	3.65	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	5.58	1.87	No	1.87	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	283.92	95.15	No	0.71	284.87	95.47	No	1.03	282.33	94.62	No	0.18
Bladder (75 %)	Soft	214.38	71.85	Yes	1.56	216.92	72.70	Yes	2.41	212.12	71.09	Yes	0.80
Rectum (< 0.5 cc)	Hard	20.73	17.36	No	17.36	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	118.88	99.51	No	0.46	118.64	99.31	No	0.26	118.49	99.19	No	0.14
Rectum (< 85 %)	Soft	107.97	90.38	No	5.49	102.76	86.02	No	1.13	102.53	85.83	No	0.94
Bowel (< 0.5 cc)	Hard	116.89	116.89	No	116.89	1.12	0.04	No	0.04	0.04	0.00	Yes	0.00
Bowel (350 cc)	Soft	796.24	31.82	No	1.27	782.03	31.26	No	0.71	773.20	30.90	No	0.35
Bowel (100 cc)	Soft	458.60	18.33	No	1.31	441.21	17.63	No	0.61	433.21	17.31	No	0.29
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.12		No	6.21	1.09		Yes	3.19	1.09		Yes	3.36
CI (<1.55)	Soft	1.62		No	1.72	1.59		No	-0.09	1.61		No	1.20
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	45.04		No	2.38	44.78		No	1.79	44.46		No	1.06
Right Kidney (< 15 Gy)	Hard	0.95		Yes	-8.77	0.99		Yes	-4.53	0.99		Yes	-4.72
Right Kidney (< 10 Gy)	Soft	0.95		Yes	-8.77	0.99		Yes	-4.53	0.99		Yes	-4.72
Left Kidney (< 15 Gy)	Hard	0.85		Yes	-11.31	0.91		Yes	-5.24	0.91		Yes	-4.82
Left Kidney (< 10 Gy)	Soft	0.85		Yes	-11.31	0.91		Yes	-5.24	0.91		Yes	-4.82

Patient 3		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1705.74	99.80	Yes	0.29	1703.20	99.66	Yes	0.15	1703.90	99.70	Yes	0.19
PTV (< 107 %)	Hard	0.13	0.01	Yes	0.01	0.01	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1705.74	99.80	Yes	0.29	1703.20	99.66	Yes	0.15	1703.90	99.70	Yes	0.19
ITV (> 99.9 %)	Hard	1139.71	100.00	Yes	0.00	1139.70	100.00	Yes	0.00	1139.71	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.01	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.11	0.02	Yes	0.02	0.01	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	450.29	86.84	No	0.62	448.87	86.57	No	0.35	448.31	86.46	No	0.24
Bladder (75 %)	Soft	283.42	54.66	Yes	1.69	278.42	53.69	Yes	0.72	278.30	53.67	Yes	0.70
Rectum (< 0.5 cc)	Hard	0.30	0.33	Yes	0.33	0.02	0.02	Yes	0.02	0.01	0.01	Yes	0.01
Rectum (< 95 %)	Soft	80.33	90.15	Yes	0.38	80.12	89.91	Yes	0.14	80.15	89.95	Yes	0.18
Rectum (< 85 %)	Soft	57.72	64.77	Yes	1.52	56.93	63.89	Yes	0.64	57.19	64.19	Yes	0.94
Bowel (< 0.5 cc)	Hard	0.05	0.00	Yes	0.00	0.01	0.00	Yes	0.00	0.01	0.00	Yes	0.00
Bowel (350 cc)	Soft	347.04	20.40	Yes	0.29	342.90	20.16	Yes	0.05	345.14	20.29	Yes	0.18
Bowel (100 cc)	Soft	162.68	9.56	No	0.27	158.97	9.34	No	0.05	160.86	9.46	No	0.17
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.18		No	3.61	1.16		No	1.25	1.16		No	2.04
CI (<1.55)	Soft	1.62		No	1.88	1.60		No	0.66	1.61		No	0.99
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	9.99		No	1.44	9.89		No	0.44	9.80		No	-0.47

Patient 4		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1320.73	98.69	Yes	1.76	1312.88	98.10	Yes	1.17	1310.62	97.93	Yes	1.00
PTV (< 107 %)	Hard	149.48	11.17	No	11.17	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1320.73	98.69	Yes	1.76	1312.88	98.10	Yes	1.17	1310.62	97.93	No	1.00
ITV (> 99.9 %)	Hard	859.45	100.00	Yes	0.00	859.45	100.00	Yes	0.00	859.45	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	106.32	27.95	No	27.95	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	24.25	14.96	No	14.96	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	158.67	97.87	No	0.25	158.84	97.97	No	0.35	158.43	97.72	No	0.10
Bladder (75 %)	Soft	126.10	77.78	No	5.34	121.10	74.69	Yes	2.25	119.25	73.55	Yes	1.11
Rectum (< 0.5 cc)	Hard	10.01	24.34	No	24.34	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	41.12	100.00	No	0.00	41.12	100.00	No	0.00	41.12	100.00	No	0.00
Rectum (< 85 %)	Soft	40.49	98.48	No	4.15	39.03	94.91	No	0.58	38.99	94.82	No	0.49
Bowel (< 0.5 cc)	Hard	5.18	0.65	No	0.65	0.38	0.05	Yes	0.05	0.27	0.03	Yes	0.03
Bowel (350 cc)	Soft	284.60	35.79	Yes	1.15	281.55	35.41	Yes	0.77	278.82	35.06	Yes	0.42
Bowel (100 cc)	Soft	179.94	22.63	No	0.86	176.97	22.25	No	0.48	176.33	22.18	No	0.41
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.20		No	9.84	1.14		No	4.39	1.13		No	3.89
CI (<1.55)	Soft	1.63		No	4.11	1.59		No	1.45	1.58		No	1.42
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	51.63		No	15.36	45.29		No	1.20	45.21		No	1.02

Patient 5		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1470.55	98.96	Yes	0.50	1477.55	99.43	Yes	0.97	1474.88	99.25	Yes	0.79
PTV (< 107 %)	Hard	390.17	26.26	No	26.26	0.16	0.01	Yes	0.01	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1470.55	98.96	Yes	0.50	1477.55	99.43	Yes	0.97	1474.88	99.25	Yes	0.79
ITV (> 99.9 %)	Hard	1011.97	99.83	No	-0.17	1013.69	100.00	Yes	0.00	1013.69	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	148.75	70.63	No	70.63	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	98.92	32.26	No	32.26	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	303.78	99.07	No	1.28	301.18	98.22	No	0.43	300.57	98.02	No	0.23
Bladder (75 %)	Soft	235.59	76.83	No	7.64	220.05	71.76	Yes	2.57	217.07	70.79	Yes	1.60
Rectum (< 0.5 cc)	Hard	18.95	32.15	No	32.15	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	53.72	91.15	Yes	0.16	53.75	91.20	Yes	0.21	53.69	91.10	Yes	0.11
Rectum (< 85 %)	Soft	48.27	81.90	Yes	0.43	48.52	82.33	Yes	0.86	48.48	82.26	Yes	0.79
Bowel (< 0.5 cc)	Hard	18.54	1.65	No	1.65	0.10	0.01	Yes	0.01	0.05	0.00	Yes	0.00
Bowel (350 cc)	Soft	303.64	27.07	Yes	3.54	273.62	24.39	Yes	0.86	270.00	24.07	Yes	0.54
Bowel (100 cc)	Soft	128.67	11.47	No	2.43	108.39	9.66	No	0.62	107.13	9.55	No	0.51
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.24		No	13.74	1.14		No	3.97	1.13		No	3.77
CI (<1.55)	Soft	1.68		No	7.72	1.59		No	1.59	1.59		No	1.51
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	48.05		No	5.88	44.94		No	-0.98	44.81		No	-1.27

Patient 6		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1707.76	98.59	Yes	-0.24	1708.60	98.64	Yes	-0.19	98.64	Yes	-0.19	-0.19
PTV (< 107 %)	Hard	0.07	0.00	Yes	0.00	0.01	0.00	Yes	0.00	0.00	Yes	0.00	0.00
PTV (> 98 %)	Soft	1707.76	98.59	Yes	-0.24	1708.60	98.64	Yes	-0.19	98.64	Yes	-0.19	-0.19
ITV (> 99.9 %)	Hard	1202.58	100.00	Yes	0.00	1202.58	100.00	Yes	0.00	100.00	Yes	0.00	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	-0.05	0.00	0.00	Yes	-0.05	0.00	0.00	Yes	-0.05
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	425.98	89.66	No	-0.15	426.04	89.67	No	-0.14	426.21	89.70	No	-0.11
Bladder (75 %)	Soft	296.98	62.50	Yes	-0.48	297.62	62.64	Yes	-0.34	297.62	62.64	Yes	-0.34
Bowel (< 0.5 cc)	Hard	0.34	0.02	Yes	-0.01	0.34	0.02	Yes	-0.01	0.34	0.02	Yes	-0.01
Bowel (350 cc)	Soft	553.50	33.06	No	-0.10	553.56	33.07	No	-0.09	553.98	33.09	No	-0.07
Bowel (100 cc)	Soft	346.72	20.71	No	-0.12	346.82	20.72	No	-0.11	346.82	20.72	No	-0.11
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.07		Yes	-0.88	1.07		Yes	-0.72	1.07		Yes	-0.69
CI (<1.55)	Soft	1.48		Yes	-0.33	1.48		Yes	-0.26	1.48		Yes	-0.30
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	44.46		No	-1.54	44.30		No	-1.90	44.50		No	-1.45

Patient 7		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	2181.72	98.00	Yes	-0.62	2209.87	99.27	Yes	-98.62	2209.87	99.27	Yes	0.65
PTV (< 107 %)	Hard	1613.47	72.48	No	72.48	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	2181.72	98.00	No	-0.62	2209.87	99.27	Yes	-98.62	2209.87	99.27	Yes	0.65
Bladder (< 0.5 cc)	Hard	221.42	50.85	No	50.85	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	413.08	94.86	No	7.53	381.64	87.64	No	-87.33	381.64	87.64	No	0.31
Bladder (75 %)	Soft	332.80	76.42	No	11.43	285.98	65.67	Yes	-64.99	285.98	65.67	Yes	0.68
Rectum (< 0.5 cc)	Hard	29.27	59.18	No	59.18	0.05	0.00	Yes	0.00	0.05	0.00	Yes	0.00
Rectum (< 95 %)	Soft	49.45	99.99	No	0.84	49.06	99.21	No	-99.15	49.06	99.21	No	0.06
Rectum (< 85 %)	Soft	46.02	93.06	No	4.35	44.31	89.60	No	-88.71	44.31	89.60	No	0.89
Bowel (< 0.5 cc)	Hard	137.72	9.58	No	9.58	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	335.29	28.33	Yes	7.10	308.16	21.44	Yes	-21.23	308.16	21.44	Yes	0.21
Bowel (100 cc)	Soft	238.77	16.61	No	2.21	210.95	14.68	No	-14.40	210.95	14.68	No	0.28
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.31		No	23.35	1.09		Yes	2.43	1.09		Yes	2.48
CI (<1.55)	Soft	1.72		No	20.37	1.44		Yes	1.35	1.44		Yes	1.24
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	45.05		No	-0.90	46.04		No	1.28	45.75		No	0.64
Right Kidney (< 15 Gy)	Hard	0.86		Yes	-39.56	1.41		Yes	-0.56	1.40		Yes	-1.27
Right Kidney (< 10 Gy)	Soft	0.86		Yes	-39.56	1.41		Yes	-0.56	1.40		Yes	-1.27
Left Kidney (< 15 Gy)	Hard	0.82		Yes	-38.50	1.32		Yes	-1.50	1.31		Yes	-1.65
Left Kidney (< 10 Gy)	Soft	0.82		Yes	-38.50	1.32		Yes	-1.50	1.31		Yes	-1.65

Patient 8		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	917.65	99.67	Yes	1.00	914.71	99.35	Yes	0.68	914.14	99.29	Yes	0.62
PTV (< 107 %)	Hard	0.06	0.01	Yes	0.01	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	917.65	99.67	Yes	1.00	914.71	99.35	Yes	0.68	914.14	99.29	Yes	0.62
Bladder (< 0.5 cc)	Hard	0.59	0.33	No	0.33	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	131.50	72.82	Yes	2.77	129.58	71.76	Yes	1.71	128.38	71.09	Yes	1.04
Bladder (75 %)	Soft	72.65	40.23	Yes	2.47	70.59	39.09	Yes	1.33	70.36	38.96	Yes	1.20
Rectum (< 0.5 cc)	Hard	0.27	0.63	Yes	0.63	0.00	0.00	Yes	0.00	0.01	0.01	Yes	0.01
Rectum (< 95 %)	Soft	29.76	69.06	Yes	0.40	29.67	68.85	Yes	0.19	29.68	68.88	Yes	0.22
Rectum (< 85 %)	Soft	23.38	54.24	Yes	2.34	22.87	53.08	Yes	1.18	22.96	53.28	Yes	1.38
Bowel (< 0.5 cc)	Hard	3.79	0.24	No	0.24	0.18	0.01	Yes	0.01	0.14	0.01	Yes	0.01
Bowel (350 cc)	Soft	450.05	28.59	No	1.69	434.40	27.60	No	0.70	435.65	27.68	No	0.78
Bowel (100 cc)	Soft	204.58	13.00	No	0.97	196.70	12.50	No	0.47	196.84	12.51	No	0.48
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.27		No	8.46	1.22		No	4.16	1.22		No	4.52
CI (<1.55)	Soft	1.89		No	3.86	1.85		No	1.79	1.85		No	2.11
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	25.51		No	5.55	25.31		No	4.70	25.18		No	4.16

Patient 9		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1098.24	99.75	Yes	0.60	1096.83	99.62	Yes	0.47	1096.83	99.62	Yes	0.05
PTV (< 107 %)	Hard	292.90	26.60	No	26.60	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1098.24	99.75	Yes	0.60	1096.83	99.62	Yes	0.47	1096.83	99.62	Yes	0.05
Bladder (< 0.5 cc)	Hard	5.55	1.43	No	1.43	0.22	0.06	Yes	0.06	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	306.43	78.84	Yes	1.58	306.57	78.88	Yes	1.62	304.22	78.27	Yes	1.01
Bladder (75 %)	Soft	180.12	46.34	Yes	2.36	177.84	45.76	Yes	1.78	174.92	45.00	Yes	1.02
Rectum (< 0.5 cc)	Hard	4.01	5.81	No	5.81	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	62.15	90.10	Yes	0.31	62.07	89.98	Yes	0.19	62.08	89.99	Yes	0.20
Rectum (< 85 %)	Soft	45.15	65.45	Yes	3.28	43.77	63.45	Yes	1.28	43.92	42.86	Yes	-2.76
Bowel (< 0.5 cc)	Hard	90.85	7.37	No	7.37	0.16	0.01	Yes	0.01	0.02	0.00	Yes	0.00
Bowel (350 cc)	Soft	484.55	39.31	No	8.46	391.74	31.78	No	0.93	387.41	31.43	No	0.58
Bowel (100 cc)	Soft	227.60	18.46	No	5.46	168.06	13.63	No	0.63	166.45	13.50	No	0.50
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.42		No	20.73	1.24		No	4.78	1.23		No	3.95
CI (<1.55)	Soft	2.05		No	89.38	1.85		No	70.95	1.84		No	70.26
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	41.79		No	7.83	39.50		No	1.92	39.50		No	1.92

Patient 10		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1397.39	99.25	Yes	1.14	1393.82	99.00	Yes	0.89	1391.50	98.84	Yes	0.73
PTV (< 107 %)	Hard	82.67	5.87	No	5.87	0.00	0.00	Yes	0.00	0.01	0.00	Yes	0.00
PTV (> 98 %)	Soft	1397.39	99.25	Yes	1.14	1393.82	99.00	Yes	0.89	1391.50	98.84	Yes	0.73
ITV (> 99.9 %)	Hard	803.96	100.00	Yes	0.00	803.96	100.00	Yes	0.00	803.96	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.48	0.10	Yes	0.10	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	2.42	1.38	No	1.38	1.10	0.63	No	0.63	0.01	0.00	Yes	0.00
Bladder (85 %)	Soft	161.44	91.83	No	1.45	161.01	91.58	No	1.20	159.77	90.88	No	0.50
Bladder (75 %)	Soft	91.41	52.00	Yes	3.80	89.65	51.00	Yes	2.80	86.67	49.30	Yes	1.10
Rectum (< 0.5 cc)	Hard	3.59	4.80	No	4.77	0.09	0.11	Yes	0.08	0.01	0.02	Yes	-0.01
Rectum (< 95 %)	Soft	73.51	98.09	No	0.30	73.54	98.13	No	0.34	73.54	98.13	No	0.34
Rectum (< 85 %)	Soft	51.15	68.25	Yes	3.39	49.98	66.69	Yes	1.83	50.06	66.80	Yes	1.94
Bowel (< 0.5 cc)	Hard	48.20	1.25	No	1.25	0.19	0.00	Yes	0.00	0.09	0.00	Yes	0.00
Bowel (350 cc)	Soft	860.17	22.28	No	1.23	838.95	21.73	No	0.68	824.23	21.35	No	0.30
Bowel (100 cc)	Soft	427.95	11.09	No	1.62	385.36	9.98	No	0.51	379.76	984.00	No	974.53
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.28		No	11.56	1.21		No	5.23	1.19		No	4.01
CI (<1.55)	Soft	1.91		No	5.70	1.85		No	2.33	1.85		No	1.96
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	45.54		No	2.37	45.24		No	1.70	44.85		No	0.84
Right Kidney (< 15 Gy)	Hard	0.49		Yes	-4.89	0.50		Yes	-1.37	0.50		Yes	-1.37
Right Kidney (< 10 Gy)	Hard	0.49		Yes	-4.89	0.50		Yes	-1.37	0.50		Yes	-1.37
Left Kidney (< 15 Gy)	Hard	0.56		Yes	-4.46	0.58		Yes	-1.37	0.58		Yes	-1.03
Left Kidney (< 10 Gy)	Hard	0.56		Yes	-4.46	0.58		Yes	-1.37	0.58		Yes	-1.03

Patient 11		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1130.68	96.92	Yes	1.52	1123.78	96.33	Yes	0.93	1129.81	96.85	Yes	1.45
PTV (< 107 %)	Hard	476.36	40.83	No	40.83	0.02	0.01	Yes	0.01	0.01	0.00	Yes	0.00
PTV (> 98 %)	Soft	1130.68	96.92	No	1.52	1123.78	96.33	No	0.93	1129.81	96.85	No	1.45
ITV (> 99.9 %)	Hard	651.89	99.33	No	-0.63	653.92	99.64	No	-0.32	656.26	100.00	Yes	0.04
CTV-HR + 1 cm (< 0.5 cc)	Soft	88.91	31.03	No	31.03	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	73.66	25.46	No	25.46	0.01	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	287.08	99.22	No	2.33	281.69	97.36	No	0.47	281.10	97.15	No	0.26
Bladder (75 %)	Soft	227.10	78.49	No	10.75	204.59	70.71	Yes	2.97	199.01	68.78	Yes	1.04
Rectum (< 0.5 cc)	Hard	11.42	21.63	No	21.63	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	52.79	100.00	No	1.30	52.24	98.94	No	0.24	52.17	98.82	No	0.12
Rectum (< 85 %)	Soft	47.53	90.02	No	14.08	40.58	76.87	Yes	0.93	40.56	76.83	Yes	0.89
Bowel (< 0.5 cc)	Hard	156.08	18.82	No	18.82	2.95	0.03	No	0.03	0.02	0.02	Yes	0.02
Bowel (350 cc)	Soft	431.81	52.08	No	2.34	416.00	50.17	No	0.43	414.96	50.04	No	0.30
Bowel (100 cc)	Soft	325.29	39.23	No	5.60	287.70	34.70	No	1.07	283.90	34.24	No	0.61
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.33		No	24.40	1.13		No	5.16	1.12		No	4.61
CI (<1.55)	Soft	1.89		No	9.31	1.73		No	-0.42	1.76		No	1.54
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	51.24		No	15.49	45.36		No	2.24	44.76		No	0.89

Patient 12		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1203.89	99.73	Yes	-0.14	1206.20	99.92	Yes	0.05	1206.17	99.92	Yes	0.05
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1203.89	99.73	Yes	-0.14	1206.20	99.92	Yes	0.05	1206.17	99.92	Yes	0.05
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.02	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	231.36	67.11	Yes	1.27	236.83	68.70	Yes	2.86	235.50	68.31	Yes	2.47
Bladder (75 %)	Soft	132.13	38.33	Yes	-0.52	138.35	40.13	Yes	1.28	137.65	39.93	Yes	1.08
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	58.99	88.60	Yes	1.71	59.44	89.28	Yes	2.39	59.44	89.28	Yes	2.39
Rectum (< 85 %)	Soft	34.67	52.08	Yes	-1.17	35.93	53.96	Yes	0.71	35.93	54.44	Yes	1.19
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.06	0.00	Yes	0.00	0.05	0.00	Yes	0.00
Bowel (350 cc)	Soft	555.31	20.39	No	1.59	593.07	21.78	No	2.98	577.99	21.22	No	2.42
Bowel (100 cc)	Soft	152.31	5.59	No	-0.20	170.10	6.25	No	0.46	166.28	6.11	No	0.32
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.21		No	-1.88	1.29		No	3.84	1.28		No	3.70
CI (<1.55)	Soft	1.87		No	0.51	1.93		No	3.91	1.71		No	-11.27
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	38.76		No	-13.45	39.48		No	-11.83	39.50		No	-11.80

Patient 13		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	636.44	95.31	Yes	-4.55	667.42	99.95	Yes	0.09	667.40	99.94	Yes	0.08
PTV (< 107 %)	Hard	413.49	61.92	No	61.92	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	636.44	95.31	No	-4.55	667.42	99.95	Yes	0.09	667.40	99.94	Yes	0.08
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.04	0.04	Yes	0.04	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	40.26	43.55	Yes	-1.37	43.83	47.41	Yes	2.49	43.10	46.63	Yes	1.71
Bladder (75 %)	Soft	13.89	15.02	Yes	0.02	14.96	16.19	Yes	1.19	14.45	15.63	Yes	0.63
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	14.14	19.92	Yes	-4.99	19.17	26.99	Yes	2.08	20.36	28.67	Yes	3.76
Rectum (< 85 %)	Soft	0.89	1.25	Yes	1.24	0.03	0.04	Yes	0.03	0.02	0.03	Yes	0.02
Bowel (< 0.5 cc)	Hard	68.71	2.25	No	2.25	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	350.15	11.49	No	3.27	260.07	8.53	Yes	0.31	255.06	8.37	Yes	0.15
Bowel (100 cc)	Soft	148.70	4.88	No	1.80	99.67	3.27	Yes	0.19	98.07	3.22	Yes	0.14
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.85		No	40.85	1.38		No	5.08	1.37		No	4.69
CI (<1.55)	Soft	2.87		No	32.82	2.21		No	2.48	2.21		No	2.44
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	2.17		Yes	-95.15	2.71		Yes	-93.95	2.79		Yes	-93.77

Patient 14		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1068.09	99.32	Yes	-0.16	1073.00	99.78	Yes	0.30	1072.94	99.78	Yes	0.30
PTV (< 107 %)	Hard	276.17	25.68	No	25.68	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1068.09	99.32	Yes	-0.16	1073.00	99.78	Yes	0.30	1072.94	99.78	Yes	0.30
Bladder (< 0.5 cc)	Hard	86.79	20.09	No	20.09	0.42	0.10	Yes	0.10	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	379.28	87.81	No	2.22	376.84	87.25	No	1.66	374.05	86.60	No	1.01
Bladder (75 %)	Soft	231.35	53.56	Yes	15.24	174.94	40.50	Yes	2.18	169.51	39.25	Yes	0.93
Rectum (< 0.5 cc)	Hard	5.77	8.74	No	8.74	0.02	0.03	Yes	0.03	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	60.57	91.80	Yes	1.15	60.56	91.78	Yes	1.13	60.25	91.30	Yes	0.65
Rectum (< 85 %)	Soft	40.07	60.72	Yes	4.66	38.11	57.75	Yes	1.69	37.90	57.44	Yes	1.38
Bowel (< 0.5 cc)	Hard	29.50	3.76	No	3.76	0.14	0.02	Yes	0.02	0.01	0.00	Yes	0.00
Bowel (350 cc)	Soft	185.88	23.70	Yes	0.79	185.03	23.59	Yes	0.68	182.76	23.30	Yes	0.39
Bowel (100 cc)	Soft	86.40	11.01	Yes	1.75	76.49	9.75	Yes	0.49	76.10	9.70	Yes	0.44
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.42		No	20.44	1.24		No	5.27	1.23		No	3.93
CI (<1.55)	Soft	2.05		No	11.00	1.88		No	1.88	1.88		No	1.67
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	46.65		No	1.77	46.42		No	1.25	46.21		No	0.81

Patient 15		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	921.23	99.37	Yes	0.66	916.30	98.83	Yes	0.12	912.55	98.43	Yes	-0.28
PTV (< 107 %)	Hard	102.43	15.43	No	15.43	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	921.23	99.37	Yes	0.66	916.30	98.83	Yes	0.12	912.55	98.43	Yes	-0.28
Bladder (< 0.5 cc)	Hard	50.86	8.00	No	8.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	320.24	80.54	Yes	7.20	310.36	79.51	Yes	6.17	306.45	79.25	Yes	5.91
Bladder (75 %)	Soft	283.94	49.25	Yes	12.42	254.54	46.48	Yes	9.65	249.25	44.99	Yes	12.16
Rectum (< 0.5 cc)	Hard	93.83	29.28	No	29.28	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	70.58	76.12	Yes	10.08	65.55	70.70	Yes	4.66	63.55	68.54	Yes	2.50
Rectum (< 85 %)	Soft	30.83	33.24	Yes	2.51	26.54	28.62	Yes	-2.11	25.24	27.22	Yes	-3.51
Bowel (< 0.5 cc)	Hard	189.44	9.36	No	9.36	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	792.38	43.13	No	11.83	750.54	40.85	No	9.55	747.32	40.68	No	9.38
Bowel (100 cc)	Soft	286.26	15.57	No	0.46	275.54	14.99	No	-0.12	275.54	14.99	No	-0.12
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.31		No	11.90	1.23		No	5.73	1.22		No	4.56
CI (<1.55)	Soft	1.99		No	5.03	1.94		No	2.17	1.93		No	1.84
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	46.40		No	2.13	45.84		No	0.90	45.67		No	0.52

Patient 16		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1543.92	98.61	Yes	0.14	1553.74	99.24	Yes	0.77	1554.45	99.28	Yes	0.81
PTV (< 107 %)	Hard	661.34	42.24	No	42.24	0.01	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1543.92	98.61	Yes	0.14	1553.74	99.24	Yes	0.77	1554.45	99.28	Yes	0.81
ITV (> 99.9 %)	Hard	973.12	99.38	No	-0.62	979.14	100.00	Yes	0.00	979.14	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	283.85	65.85	No	65.85	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	214.59	35.76	No	35.76	0.24	0.04	Yes	0.04	0.13	0.02	Yes	0.02
Bladder (85 %)	Soft	525.78	87.61	No	7.61	487.08	81.16	Yes	1.16	483.42	80.55	Yes	0.55
Bladder (75 %)	Soft	367.46	61.23	Yes	-23.03	304.78	50.79	Yes	-33.47	301.31	50.21	Yes	-34.05
Rectum (< 0.5 cc)	Hard	26.65	38.12	No	38.12	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	67.74	96.89	No	29.22	67.77	96.93	No	29.26	67.75	96.89	No	29.22
Rectum (< 85 %)	Soft	63.02	90.13	No	5.87	59.41	84.97	Yes	0.71	59.46	85.03	No	0.77
Bowel (< 0.5 cc)	Hard	114.51	5.07	No	5.07	0.36	0.02	Yes	0.02	0.54	0.02	No	0.02
Bowel (350 cc)	Soft	502.84	22.26	No	0.35	503.94	22.31	No	0.40	498.64	22.08	No	0.17
Bowel (100 cc)	Soft	263.81	11.68	No	0.86	248.55	11.00	No	0.18	247.08	10.94	No	0.12
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.33		No	19.60	1.16		No	4.55	1.16		No	4.44
CI (<1.55)	Soft	1.86		No	10.55	1.71		No	1.64	1.71		No	1.61
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	56.05		No	26.42	44.91		No	1.28	44.82		No	1.08
Right Kidney (< 15 Gy)	Hard	0.86		Yes	832.61	0.92		Yes	898.91	0.92		Yes	894.57
Right Kidney (< 10 Gy)	Soft	0.86		Yes	909.41	0.92		Yes	981.18	0.92		Yes	976.47
Left Kidney (< 15 Gy)	Hard	0.86		Yes	832.61	0.80		Yes	766.30	0.80		Yes	765.22
Left Kidney (< 10 Gy)	Soft	0.86		Yes	909.41	0.80		Yes	837.65	0.80		Yes	836.47

Patient 17		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1443.70	98.21	Yes	0.31	1439.74	97.94	Yes	0.04	1440.15	97.97	Yes	0.07
PTV (< 107 %)	Hard			Yes	0.00			Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1443.70	98.21	Yes	0.31	1439.74	97.94	No	0.04	1440.15	97.97	No	0.07
ITV (> 99.9 %)	Hard	953.15	99.94	Yes	-0.05	953.66	99.99	Yes	0.00	953.70	99.99	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	132.85	28.57	No	28.57	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	13.34	11.66	No	11.66	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	113.24	98.95	No	1.14	112.09	97.94	No	0.13	112.04	97.90	No	0.09
Bladder (75 %)	Soft	78.71	68.78	Yes	6.39	71.80	62.74	Yes	0.35	71.42	62.40	Yes	0.01
Bowel (< 0.5 cc)	Hard	46.12	3.85	No	3.85	0.02	0.00	Yes	0.00	0.03	0.00	Yes	0.00
Bowel (350 cc)	Soft	383.25	31.97	No	0.13	381.55	31.83	No	-0.01	381.67	31.84	No	0.00
Bowel (100 cc)	Soft	217.83	18.17	No	0.50	211.60	17.65	No	-0.02	211.97	17.68	No	0.01
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.10		Yes	6.06	1.04		Yes	0.28	1.04		Yes	0.26
CI (<1.55)	Soft	1.57		No	2.66	1.53		Yes	-0.02	1.53		Yes	0.07
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	44.00		No	-3.17	44.33		No	-2.44	44.26		No	-2.61
Right Kidney (< 15 Gy)	Hard	7.07		Yes	-0.31	7.09		Yes	-0.06	7.10		Yes	-0.01
Right Kidney (< 10 Gy)	Hard	7.07		Yes	-0.31	7.09		Yes	-0.06	7.10		Yes	-0.01
Left Kidney (< 15 Gy)	Hard	6.08		Yes	-0.16	6.08		Yes	-0.07	6.09		Yes	0.07
Left Kidney (< 10 Gy)	Hard	6.08		Yes	-0.16	6.08		Yes	-0.07	6.09		Yes	0.07

Patient 18		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1104.06	99.23	Yes	1.15	1102.02	99.05	Yes	0.97	1098.49	98.73	Yes	0.65
PTV (< 107 %)	Hard	367.85	33.06	No	33.06	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1104.06	99.23	Yes	1.15	1102.02	99.05	Yes	0.97	1098.49	98.73	Yes	0.65
Bladder (< 0.5 cc)	Hard	38.26	29.31	No	29.31	0.02	0.02	Yes	0.02	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	117.58	90.08	No	3.49	113.83	87.21	No	0.62	113.44	86.91	No	0.32
Bladder (75 %)	Soft	80.10	61.37	Yes	12.14	67.11	51.41	Yes	2.18	65.52	50.20	Yes	0.97
Rectum (< 0.5 cc)	Hard	14.09	33.85	No	33.85	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	36.56	87.84	Yes	2.97	35.49	85.26	Yes	0.39	35.46	85.20	Yes	0.33
Rectum (< 85 %)	Soft	24.47	58.79	Yes	14.30	18.97	45.58	Yes	1.09	18.98	45.59	Yes	1.10
Bowel (< 0.5 cc)	Hard	40.61	2.59	No	2.59	0.06	0.00	Yes	0.00	0.07	0.00	Yes	0.00
Bowel (350 cc)	Soft	472.80	30.14	No	2.60	445.51	28.40	No	0.86	437.91	27.92	No	0.38
Bowel (100 cc)	Soft	196.57	12.53	No	2.85	160.93	10.26	No	0.58	157.19	10.06	No	0.38
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.39		No	22.34	1.19		No	4.91	1.17		No	3.53
CI (<1.55)	Soft	2.02		No	11.93	1.84		No	1.98	1.83		No	1.45
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	54.88		No	21.09	45.58		No	0.57	45.24		No	-0.18

Patient 19		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	830.59	99.91	Yes	0.52	828.93	99.72	Yes	0.33	829.50	99.78	Yes	0.39
PTV (< 107 %)	Hard	0.01	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	830.59	99.91	Yes	0.52	828.93	99.72	Yes	0.33	829.50	99.78	Yes	0.39
Bladder (< 0.5 cc)	Hard	3.79	1.09	No	1.09	0.20	0.06	Yes	0.06	0.01	0.00	Yes	0.00
Bladder (85 %)	Soft	344.34	99.06	No	0.64	343.40	98.79	No	0.37	343.28	98.75	No	0.33
Bladder (75 %)	Soft	172.69	49.68	Yes	3.44	166.41	47.87	Yes	1.63	165.81	47.70	Yes	1.46
Rectum (< 0.5 cc)	Hard	0.15	0.33	Yes	0.33	0.00	0.00	Yes	0.00	0.00	0.01	Yes	0.01
Rectum (< 95 %)	Soft	37.54	81.13	Yes	1.39	37.17	80.32	Yes	0.58	37.18	80.35	Yes	0.61
Rectum (< 85 %)	Soft	22.35	48.29	Yes	3.03	21.62	46.73	Yes	1.47	21.82	47.16	Yes	1.90
Bowel (< 0.5 cc)	Hard	6.90	0.76	No	0.76	0.02	0.00	Yes	0.00	0.07	0.01	Yes	0.01
Bowel (350 cc)	Soft	286.57	31.65	Yes	1.53	279.95	30.92	Yes	0.80	279.02	30.82	Yes	0.70
Bowel (100 cc)	Soft	121.10	13.38	No	1.12	114.98	12.70	No	0.44	116.08	12.82	No	0.56
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.30		No	9.88	1.24		No	4.38	1.24		No	4.89
CI (<1.55)	Soft	2.06		No	5.20	2.00		No	2.27	2.01		No	2.54
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	47.37		No	2.50	45.69		No	-1.12	46.57		No	0.78

Patient 20		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1829.75	93.53	No	-1.32	1837.09	93.91	No	-0.94	1872.66	95.73	Yes	0.88
PTV (< 107 %)	Hard	180.43	9.22	No	9.22	0.02	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1829.75	93.53	No	-1.32	1837.09	93.91	No	-0.94	1872.66	95.73	No	0.88
ITV (> 99.9 %)	Hard	1151.33	96.51	No	-3.47	1167.05	97.83	No	-2.15	1191.89	99.91	Yes	-0.07
Bladder (< 0.5 cc)	Hard	0.02	0.01	Yes	0.01	0.01	0.01	Yes	0.01	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	143.00	92.68	No	0.67	142.93	92.63	No	0.62	142.23	92.18	No	0.17
Bladder (75 %)	Soft	105.03	68.07	Yes	3.32	104.67	67.84	Yes	3.09	100.83	65.35	Yes	0.60
Rectum (< 0.5 cc)	Hard	0.15	0.22	Yes	0.22	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	66.44	97.93	No	0.12	66.46	97.97	No	0.16	66.41	97.89	No	0.08
Rectum (< 85 %)	Soft	56.16	82.78	Yes	27.94	55.96	82.48	Yes	27.64	55.57	81.91	Yes	27.07
Bowel (< 0.5 cc)	Hard	89.53	4.64	No	4.64	1.26	0.07	No	0.07	0.05	0.00	Yes	0.00
Bowel (350 cc)	Soft	673.37	34.91	No	1.81	649.23	33.66	No	0.56	644.22	33.40	No	0.30
Bowel (100 cc)	Soft	428.21	22.20	No	2.57	393.30	20.39	No	0.76	387.04	20.07	No	0.44
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.10		No	6.48	1.06		Yes	2.37	1.07		Yes	3.18
CI (<1.55)	Soft	1.57		No	0.85	1.54		Yes	-0.72	1.57		No	1.02
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	45.00		No	0.24	45.01		No	0.26	44.63		No	-0.60

Appendix 10. DVH Statistics After SSD Changes: + 1.5 cm

Patient 1		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	751.85	39.40	No	-59.00	1575.30	82.54	No	-15.86	1829.62	95.87	Yes	-2.53
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	751.85	39.40	No	-59.00	1575.30	82.54	No	-15.86	1829.62	95.87	No	-2.53
ITV (> 99.9 %)	Hard	489.07	42.31	No	-57.69	1036.22	89.65	No	-10.35	1151.37	99.62	No	-0.38
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	220.43	77.93	Yes	-5.26	224.78	79.47	Yes	-3.72	230.55	81.51	Yes	-1.68
Bladder (75 %)	Soft	144.24	49.65	Yes	-3.59	146.54	50.64	Yes	-2.60	147.25	52.30	Yes	-0.94
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	41.92	99.99	No	-0.01	41.93	100.00	No	0.00	41.93	100.00	No	0.00
Rectum (< 85 %)	Soft	34.87	83.16	Yes	-4.78	35.90	85.62	No	-2.32	35.84	85.49	No	-2.45
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	319.77	23.33	Yes	-2.81	335.98	24.51	Yes	-1.63	346.05	25.25	Yes	-0.89
Bowel (100 cc)	Soft	150.36	10.97	No	-2.74	167.89	12.25	No	-1.46	175.22	12.78	No	-0.93
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	0.45		Yes	-60.93	0.89		Yes	-21.77	1.03		Yes	-9.20
CI (<1.55)	Soft	1.57		No	-8.81	1.63		No	-5.50	1.67		No	-2.87
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	41.90		No	-6.81	43.13		No	-4.07	43.97		No	-2.20

Patient 2		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	968.44	44.95	No	-51.09	1504.07	69.81	No	-26.23	1911.51	88.72	No	-7.32
PTV (< 107 %)	Hard	1.34	0.06	No	0.06	1.63	0.08	No	0.08	2.55	0.12	No	0.12
PTV (> 98 %)	Soft	968.44	44.95	No	-51.09	1504.07	69.81	No	-26.23	1911.51	88.72	No	-7.32
ITV (> 99.9 %)	Hard	586.43	52.07	No	-47.83	895.98	79.55	No	-20.35	1082.40	96.10	No	-3.80
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	274.14	91.87	No	-2.57	275.26	92.25	No	-2.19	279.72	93.74	No	-0.70
Bladder (75 %)	Soft	183.39	61.46	Yes	-8.83	189.85	63.63	Yes	-6.66	201.88	67.66	Yes	-2.63
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	117.08	98.01	No	-1.04	117.44	98.31	No	-0.74	117.98	98.76	No	-0.29
Rectum (< 85 %)	Soft	92.09	77.08	Yes	-7.81	97.33	81.48	Yes	-3.41	98.80	82.71	Yes	-2.18
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	704.19	28.15	No	-2.40	720.80	28.81	No	-1.74	745.76	29.81	No	-0.74
Bowel (100 cc)	Soft	366.65	14.65	No	-2.37	383.90	15.34	No	-1.68	407.50	16.29	No	-0.73
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	0.49		Yes	-53.49	0.44		Yes	-58.25	0.42		Yes	-60.15
CI (<1.55)	Soft	1.47		Yes	-7.86	1.40		Yes	-12.15	1.39		Yes	-12.78
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	41.56		No	-5.54	41.88		No	-4.82	42.62		No	-3.13
Right Kidney (< 15 Gy)	Hard	1.07		Yes	3.08	1.04		Yes	-0.19	1.04		Yes	0.29
Right Kidney (< 10 Gy)	Soft	1.07		Yes	3.08	1.04		Yes	-0.19	1.04		Yes	0.29
Left Kidney (< 15 Gy)	Hard	0.98		Yes	2.72	0.95		Yes	-0.21	0.94		Yes	-1.57
Left Kidney (< 10 Gy)	Soft	0.98		Yes	2.72	0.95		Yes	-0.21	0.94		Yes	-1.57

Patient 3		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1141.03	66.76	No	-32.75	1607.84	94.08	No	-5.43	1650.22	96.56	Yes	-2.95
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1141.03	66.76	No	-32.75	1607.84	94.08	No	-5.43	1650.22	96.56	No	-2.95
ITV (> 99.9 %)	Hard	789.86	69.30	No	-30.70	1118.84	98.17	No	-1.83	1131.03	99.24	No	-0.76
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	429.63	82.86	Yes	-3.36	433.43	83.59	Yes	-2.63	440.69	84.99	Yes	-1.23
Bladder (75 %)	Soft	238.61	46.02	Yes	-6.95	248.74	47.97	Yes	-5.00	257.66	49.69	Yes	-3.28
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	78.54	88.14	Yes	-1.63	78.99	88.65	Yes	-1.12	79.21	88.90	Yes	-0.87
Rectum (< 85 %)	Soft	52.06	58.42	Yes	-4.83	54.00	60.60	Yes	-2.65	53.57	60.11	Yes	-3.14
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	306.42	18.01	Yes	-2.10	319.05	18.75	Yes	-1.36	328.81	19.33	Yes	-0.78
Bowel (100 cc)	Soft	129.57	7.62	No	-1.67	140.50	8.26	No	-1.03	147.08	8.65	No	-0.64
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	0.77		Yes	-32.36	1.01		Yes	-11.12	1.04		Yes	-8.57
CI (<1.55)	Soft	1.48		Yes	-7.30	1.51		Yes	-4.82	1.53		Yes	-3.75
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	9.49		No	-3.62	9.51		No	-3.49	9.67		No	-1.86

Patient 4		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	846.25	98.35	Yes	1.42	1158.45	86.56	No	-10.37	1205.05	90.04	No	-6.89
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	846.25	98.35	Yes	1.42	1158.45	86.56	No	-10.37	1205.05	90.04	No	-6.89
ITV (> 99.9 %)	Hard	619.70	72.10	No	-27.90	819.73	95.38	No	-4.62	845.25	98.35	No	-1.65
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	155.71	96.04	No	-1.58	156.35	96.44	No	-1.18	157.28	97.01	No	-0.61
Bladder (75 %)	Soft	104.34	64.36	Yes	-8.08	108.58	66.98	Yes	-5.46	111.61	68.84	Yes	-3.60
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	41.11	99.98	No	-0.02	41.11	99.98	No	-0.02	41.12	100.00	No	0.00
Rectum (< 85 %)	Soft	37.50	91.20	No	-3.13	38.04	92.50	No	-1.83	38.26	93.04	No	-1.29
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	256.57	32.29	Yes	-2.35	262.07	32.96	Yes	-1.68	265.86	33.43	Yes	-1.21
Bowel (100 cc)	Soft	157.69	19.83	No	-1.94	163.86	20.61	No	-1.16	164.16	20.64	No	-1.13
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.70		Yes	-35.44	0.93		Yes	-14.40	0.96		Yes	-11.45
CI (<1.55)	Soft	1.47		Yes	-6.18	1.50		Yes	-4.05	1.51		Yes	-3.38
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	42.55		No	-4.92	43.20		No	-3.48	43.68		No	-2.40

Patient 5		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	932.48	62.75	No	-35.71	1304.64	87.79	No	-10.67	1345.26	90.53	No	-7.93
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	932.48	62.75	No	-35.71	1304.64	87.79	No	-10.67	1345.26	90.53	No	-7.93
ITV (> 99.9 %)	Hard	717.09	70.74	No	-29.26	970.32	95.72	No	-4.28	994.72	98.13	No	-1.87
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	293.50	95.71	No	-2.08	295.32	96.31	No	-1.48	297.37	96.97	No	-0.82
Bladder (75 %)	Soft	180.57	58.89	Yes	-10.30	191.27	62.38	Yes	-6.81	196.36	64.03	Yes	-5.16
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	53.26	90.36	Yes	-0.63	53.36	90.53	Yes	-0.46	53.51	90.79	Yes	-0.20
Rectum (< 85 %)	Soft	45.81	77.73	Yes	-3.74	46.61	79.09	Yes	-2.38	46.97	79.70	Yes	-1.77
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	232.84	20.76	Yes	-2.77	242.14	21.59	Yes	-1.94	246.85	22.01	Yes	-1.52
Bowel (100 cc)	Soft	74.91	6.68	Yes	-2.36	84.82	7.56	Yes	-1.48	86.05	7.67	Yes	-1.37
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	0.69		Yes	-36.98	0.93		Yes	-14.72	0.95		Yes	-12.54
CI (<1.55)	Soft	1.46		Yes	-6.55	1.49		Yes	-4.38	1.50		Yes	-3.77
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	42.14		No	-7.16	42.90		No	-5.48	43.26		No	-4.68

Patient 6		Uniform				Anterior				Lateral						
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff			
PTV (> 95 %)	Hard	1116.99	64.49	No	-34.34	1607.03	92.78	No	-6.05	1636.22	94.46	No	-4.37			
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00			
PTV (> 98 %)	Soft	1116.99	64.49	No	-34.34	1607.03	92.78	No	-6.05	1636.22	94.46	No	-4.37			
ITV (> 99.9 %)	Hard	861.17	71.61	No	-28.39	1182.55	98.33	No	-1.67	1200.53	99.80	No	-0.20			
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00			
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00			
Bladder (85 %)	Soft	415.84	87.52	No	-2.29	418.41	88.06	No	-1.75	422.68	88.96	No	-0.85			
Bladder (75 %)	Soft	262.33	55.21	Yes	-7.77	273.89	57.64	Yes	-5.34	283.92	59.76	Yes	-3.22			
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	-0.03	0.00	0.00	Yes	-0.03	0.00	0.00	Yes	-0.03			
Bowel (350 cc)	Soft	521.24	31.13	No	-2.03	532.14	31.79	No	-1.37	538.09	32.14	No	-1.02			
Bowel (100 cc)	Soft	311.36	18.60	No	-2.23	311.36	18.60	No	-2.23	327.84	19.58	No	-1.25			
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff			
CI (<1.10)	Soft	0.73		Yes	-32.16	0.97		Yes	-9.77	0.98		Yes	-9.26			
CI (<1.55)	Soft	1.39		Yes	-6.05	1.43		Yes	-3.40	1.43		Yes	-3.39			
Structure (Constraint)	H/S	Dose (Gy)			Pass	% diff	Dose (Gy)			Pass	% diff	Dose (Gy)			Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	43.46			No	-3.75	43.32			No	-4.07	43.27			No	-4.18

Patient 7		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1664.49	74.77	No	-23.85	1997.68	89.74	No	-8.88	2027.49	91.08	No	-7.54
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1664.49	74.77	No	-23.85	1997.68	89.74	No	-8.88	2027.49	91.08	No	-7.54
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	Yes	Yes	0.00
Bladder (85 %)	Soft	367.96	84.50	Yes	-2.83	370.64	85.11	No	-2.22	375.33	86.19	No	-1.14
Bladder (75 %)	Soft	254.50	58.44	Yes	-6.55	263.02	60.40	Yes	-4.59	268.26	61.60	Yes	-3.39
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	48.71	98.51	No	-0.64	48.85	98.79	No	-0.36	48.79	98.67	No	-0.48
Rectum (< 85 %)	Soft	41.63	84.18	Yes	-4.53	42.94	86.82	No	-1.89	42.28	85.50	No	-3.21
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	290.63	20.22	Yes	-1.01	295.82	20.58	Yes	-0.65	296.29	20.62	Yes	-0.61
Bowel (100 cc)	Soft	185.79	12.93	No	-1.47	196.65	13.47	No	-0.93	193.76	13.48	No	-0.92
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.78		Yes	-26.86	0.94		Yes	-11.81	0.95		Yes	-10.53
CI (<1.55)	Soft	1.35		Yes	-5.57	1.37		Yes	-4.21	1.37		Yes	-3.98
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	43.39		No	-4.54	44.14		No	-2.90	44.23		No	-2.70
Right Kidney (< 15 Gy)	Hard	1.47		Yes	3.53	1.45		Yes	2.12	1.46		Yes	2.61
Right Kidney (< 10 Gy)	Soft	1.47		Yes	3.53	1.45		Yes	2.12	1.46		Yes	2.61
Left Kidney (< 15 Gy)	Hard	1.37		Yes	2.62	1.36		Yes	1.87	1.36		Yes	1.95
Left Kidney (< 10 Gy)	Soft	1.37		Yes	2.62	1.36		Yes	1.87	1.36		Yes	1.95

Patient 8		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	766.19	83.22	No	-15.45	862.91	93.72	No	-4.95	861.93	93.62	No	-5.05
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	766.19	83.22	No	-15.45	862.91	93.72	No	-4.95	861.93	93.62	No	-5.05
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	116.18	64.34	Yes	-5.71	119.36	66.10	Yes	-3.95	121.18	67.11	Yes	-2.94
Bladder (75 %)	Soft	58.75	32.53	Yes	-5.23	62.55	34.64	Yes	-3.12	62.76	34.76	Yes	-3.00
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	29.19	67.72	Yes	-0.94	29.37	68.14	Yes	-0.52	29.32	68.03	Yes	-0.63
Rectum (< 85 %)	Soft	20.02	46.46	Yes	-5.44	21.18	49.15	Yes	-2.75	20.91	48.53	Yes	-3.37
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	372.96	23.69	No	-3.21	392.11	24.91	No	-1.99	390.15	24.79	No	-2.11
Bowel (100 cc)	Soft	156.13	9.92	No	-2.11	169.94	10.80	No	-1.23	169.05	10.74	No	-1.29
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	0.88		Yes	-24.93	1.03		Yes	-12.03	1.01		Yes	-13.72
CI (<1.55)	Soft	1.67		No	-7.89	1.73		No	-4.43	1.72		No	-5.09
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	24.32		No	0.63	24.59		No	1.75	24.89		No	2.97

Patient 9		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	845.23	76.77	No	-22.38	1036.17	94.11	No	-5.04	1054.44	95.77	Yes	-3.38
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	845.23	76.77	No	-22.38	1036.17	94.11	No	-5.04	1054.44	95.77	No	-3.38
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	279.51	71.91	Yes	-5.35	285.66	73.49	Yes	-3.77	288.82	74.31	Yes	-2.95
Bladder (75 %)	Soft	144.73	37.24	Yes	-6.74	153.00	39.36	Yes	-4.62	156.41	40.24	Yes	-3.74
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	60.82	88.17	Yes	-1.62	61.35	88.94	Yes	-0.85	61.26	88.81	Yes	-0.98
Rectum (< 85 %)	Soft	37.13	53.82	Yes	-8.35	39.90	57.84	Yes	-4.33	38.93	56.44	Yes	-5.73
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	336.74	27.32	Yes	-3.53	353.95	28.71	No	-2.14	363.79	29.51	No	-1.34
Bowel (100 cc)	Soft	127.75	10.36	No	-2.64	141.87	11.51	No	-1.49	147.23	11.94	No	-1.06
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.80		Yes	-32.11	1.01		Yes	-14.21	1.04		Yes	-11.89
CI (<1.55)	Soft	1.64		Yes	51.81	1.71		No	57.71	1.72		No	59.06
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	36.67		No	-5.37	37.33		No	-3.66	37.90		No	-2.20

Patient 10		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	718.94	51.06	No	-47.05	1160.67	82.44	No	-15.67	1256.22	89.23	No	-8.88
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	718.94	51.06	No	-47.05	1160.67	82.44	No	-15.67	1256.22	89.23	No	-8.88
ITV (> 99.9 %)	Hard	474.70	59.05	No	-40.95	735.33	91.46	No	-8.54	785.38	97.69	No	-2.31
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	151.89	86.40	No	-3.98	153.54	87.37	No	-3.01	155.64	88.53	No	-1.85
Bladder (75 %)	Soft	66.53	37.84	Yes	-10.36	71.68	40.78	Yes	-7.42	76.19	43.34	Yes	-4.86
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	-0.03	0.00	0.00	Yes	-0.03	0.00	0.00	Yes	-0.03
Rectum (< 95 %)	Soft	71.73	95.71	No	-2.08	72.41	96.63	No	-1.16	72.47	96.70	No	-1.09
Rectum (< 85 %)	Soft	40.93	54.62	Yes	-10.24	44.32	59.13	Yes	-5.73	43.92	58.61	Yes	-6.25
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	729.55	18.90	No	-2.15	750.56	19.44	No	-1.61	773.24	20.03	No	-1.02
Bowel (100 cc)	Soft	288.90	7.48	No	-1.99	314.88	8.16	No	-1.31	332.74	8.36	No	-1.11
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.57		Yes	-50.02	0.90		Yes	-21.31	0.97		Yes	-15.60
CI (<1.55)	Soft	1.65		No	-9.07	1.70		No	-6.21	1.72		No	-5.08
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	42.58		No	-4.27	43.26		No	-2.74	43.77		No	-1.59
Right Kidney (< 15 Gy)	Hard	0.54		Yes	4.89	0.53		Yes	2.94	0.53		Yes	2.94
Right Kidney (< 10 Gy)	Hard	0.54		Yes	4.89	0.53		Yes	2.94	0.53		Yes	2.94
Left Kidney (< 15 Gy)	Hard	0.61		Yes	4.63	0.60		Yes	2.74	0.60		Yes	2.74
Left Kidney (< 10 Gy)	Hard	0.61		Yes	4.63	0.60		Yes	2.74	0.60		Yes	2.74

Patient 11						Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	528.38	45.29	No	-50.11	831.28	71.26	No	-24.14	1005.72	86.21	No	-9.19
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	528.38	45.29	No	-50.11	831.28	71.26	No	-24.14	1005.72	86.21	No	-9.19
ITV (> 99.9 %)	Hard	368.30	56.12	No	-43.84	537.08	81.84	No	-18.12	633.32	96.50	No	-3.46
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	275.31	95.15	No	-1.74	277.11	95.77	No	-1.12	278.38	96.21	No	-0.68
Bladder (75 %)	Soft	170.17	58.82	Yes	-8.92	176.83	61.11	Yes	-6.63	187.10	64.66	Yes	-3.08
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	51.57	97.67	No	-1.03	51.77	98.07	No	-0.63	51.86	98.22	No	-0.48
Rectum (< 85 %)	Soft	37.28	70.62	Yes	-5.32	38.47	72.87	Yes	-3.07	38.69	73.19	Yes	-2.75
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	398.66	48.08	No	-1.66	403.54	48.67	No	-1.07	405.99	48.96	No	-0.78
Bowel (100 cc)	Soft	247.19	29.81	No	-3.82	257.71	31.08	No	-2.55	265.94	32.07	No	-1.56
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.48		Yes	-54.95	0.77		Yes	-28.33	0.92		Yes	-13.98
CI (<1.55)	Soft	1.62		No	-6.80	1.67		No	-3.74	1.68		No	-3.31
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	41.80		No	-5.78	42.68		No	-3.80	43.34		No	-2.32

Patient 12		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1057.99	87.65	No	-12.22	1174.58	97.30	Yes	-2.57	1175.21	97.36	Yes	-2.51
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1057.99	87.65	No	-12.22	1174.58	97.30	No	-2.57	1175.21	97.36	No	-2.51
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	218.14	63.27	Yes	-2.57	222.70	64.60	Yes	-1.24	224.00	64.97	Yes	-0.87
Bladder (75 %)	Soft	112.28	32.57	Yes	-6.28	120.26	34.88	Yes	-3.97	119.68	34.72	Yes	-4.13
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	56.86	85.40	Yes	-1.49	57.85	86.90	Yes	0.01	57.65	86.58	Yes	-0.31
Rectum (< 85 %)	Soft	30.17	45.31	Yes	-7.94	32.40	48.67	Yes	-4.58	31.50	47.31	Yes	-5.94
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	474.78	17.44	No	-1.36	500.28	18.37	No	-0.43	518.84	19.05	No	0.25
Bowel (100 cc)	Soft	112.29	4.12	No	-1.67	127.16	4.67	No	-1.12	130.66	4.80	No	-0.99
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	0.93		Yes	-24.70	1.08		Yes	-12.77	1.07		Yes	-13.56
CI (<1.55)	Soft	1.71		No	-8.07	1.78		No	-4.60	1.77		No	-4.71
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	37.05		No	-17.26	37.47		No	-16.33	37.66		No	-15.90

Patient 13		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	549.61	82.30	No	-17.56	649.45	97.25	Yes	-2.61	654.57	98.02	Yes	-1.84
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	549.61	82.30	No	-17.56	649.45	97.25	No	-2.61	654.57	98.02	Yes	-1.84
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	33.71	36.47	Yes	-8.45	36.06	39.01	Yes	-5.91	36.98	40.01	Yes	-4.91
Bladder (75 %)	Soft	10.88	11.77	Yes	-3.23	11.73	12.69	Yes	-2.31	12.35	13.36	Yes	-1.64
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	10.52	14.81	Yes	-10.10	13.95	19.64	Yes	-5.27	12.24	17.23	Yes	-7.68
Rectum (< 85 %)	Soft	0.00	0.00	Yes	-0.01	0.00	0.00	Yes	-0.01	0.00	0.00	Yes	-0.01
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	214.94	7.05	Yes	-1.17	227.16	7.45	Yes	-0.77	236.61	7.76	Yes	-0.46
Bowel (100 cc)	Soft	66.22	2.17	Yes	-0.91	78.24	2.57	Yes	-0.51	81.29	2.67	Yes	-0.41
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.88		Yes	-33.30	1.11		No	-15.58	1.13		No	-13.92
CI (<1.55)	Soft	1.93		No	-10.61	2.02		No	-6.33	2.03		No	-5.87
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	2.77		Yes	0.43	2.76		Yes	-0.18	2.81		Yes	1.81

Patient 14		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	940.21	87.43	No	-12.05	1012.23	94.13	No	-5.35	1055.64	98.17	Yes	-1.31
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	940.21	87.43	No	-12.05	1012.23	94.13	No	-5.35	1055.64	98.17	Yes	-1.31
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	343.26	79.48	Yes	-6.11	350.13	81.06	Yes	-4.53	363.29	84.11	Yes	-1.48
Bladder (75 %)	Soft	136.87	31.69	Yes	-6.63	143.40	33.20	Yes	-5.12	158.49	36.69	Yes	-1.63
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	57.12	86.56	Yes	-4.09	57.78	87.57	Yes	-3.08	58.73	89.01	Yes	-1.64
Rectum (< 85 %)	Soft	32.23	48.85	Yes	-7.21	34.09	51.66	Yes	-4.40	35.03	53.09	Yes	-2.97
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	162.71	20.74	Yes	-2.17	166.94	21.28	Yes	-1.63	174.68	22.27	Yes	-0.64
Bowel (100 cc)	Soft	60.74	7.74	Yes	-1.52	63.89	8.14	Yes	-1.12	68.31	8.71	Yes	-0.55
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.94		Yes	-20.79	1.00		Yes	-15.59	1.10		Yes	-6.96
CI (<1.55)	Soft	1.73		No	-6.47	1.74		No	-5.57	1.80		No	-2.61
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	43.55		No	-5.00	44.29		No	-3.39	44.73		No	-2.42

Patient 15		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	717.59	77.40	No	-21.31	845.22	91.16	No	-7.55	863.59	93.15	No	-5.56
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	717.59	77.40	No	-21.31	845.22	91.16	No	-7.55	863.59	93.15	No	-5.56
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	192.34	66.95	Yes	-6.39	196.63	68.44	Yes	-4.90	201.67	70.20	Yes	-3.14
Bladder (75 %)	Soft	84.36	29.37	Yes	-7.46	91.04	31.69	Yes	-5.14	95.51	33.25	Yes	-3.58
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	56.11	60.52	Yes	-5.52	58.49	63.08	Yes	-2.96	57.72	62.26	Yes	-3.78
Rectum (< 85 %)	Soft	24.33	26.23	Yes	-4.50	26.37	28.44	Yes	-2.29	25.95	27.98	Yes	-2.75
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	509.00	27.70	No	-3.60	531.71	28.94	No	-2.36	536.26	29.19	No	-2.11
Bowel (100 cc)	Soft	233.44	12.71	No	-2.40	250.12	13.61	No	-1.50	253.48	13.80	No	-1.31
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.81		Yes	-30.72	0.97		Yes	-16.59	0.99		Yes	-14.92
CI (<1.55)	Soft	1.72		No	-9.24	1.79		No	-5.95	1.80		No	-5.04
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	43.16		No	-5.00	44.03		No	-3.09	44.18		No	-2.75

Patient 16		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	876.36	55.97	No	-42.50	1407.78	89.92	No	-8.55	1388.95	88.71	No	-9.76
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	876.36	55.97	No	-42.50	1407.78	89.92	No	-8.55	1388.95	88.71	No	-9.76
ITV (> 99.9 %)	Hard	608.11	62.11	No	-37.89	943.95	96.41	No	-3.59	937.90	95.79	No	-4.21
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	455.81	75.95	Yes	-4.05	462.46	77.06	Yes	-2.94	468.81	78.12	Yes	-1.88
Bladder (75 %)	Soft	253.85	42.30	Yes	-41.96	268.32	44.71	Yes	-39.55	272.79	45.46	Yes	-38.80
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	67.22	96.15	No	28.48	67.35	96.33	No	28.66	67.45	96.46	No	28.79
Rectum (< 85 %)	Soft	56.08	80.20	Yes	-4.06	57.52	82.26	Yes	-2.00	57.29	81.94	Yes	-2.32
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	449.30	19.89	No	-2.02	461.71	20.44	No	-1.47	469.15	20.77	No	-1.14
Bowel (100 cc)	Soft	198.71	8.80	No	-2.02	214.59	9.50	No	-1.32	213.66	9.46	No	-1.36
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.61		Yes	-45.16	0.96		Yes	-13.42	0.95		Yes	-15.08
CI (<1.55)	Soft	1.56		No	-7.20	1.61		No	-4.25	1.61		No	-4.25
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	42.52		No	-4.10	43.08		No	-2.84	43.23		No	-2.51
Right Kidney (< 15 Gy)	Hard	0.97		Yes	957.61	0.95		Yes	934.78	0.96		Yes	947.83
Right Kidney (< 10 Gy)	Soft	0.97		Yes	1044.71	0.95		Yes	1020.00	0.96		Yes	1034.12
Left Kidney (< 15 Gy)	Hard	0.83		Yes	804.35	0.82		Yes	788.04	0.82		Yes	795.65
Left Kidney (< 10 Gy)	Soft	0.83		Yes	878.82	0.82		Yes	861.18	0.82		Yes	869.41

Patient 17		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1069.67	72.76	No	-25.14	1348.01	91.70	No	-6.20	1380.24	93.89	No	-4.01
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1069.67	72.76	No	-25.14	1348.01	91.70	No	-6.20	1380.24	93.89	No	-4.01
ITV (> 99.9 %)	Hard	753.75	79.03	No	-20.96	929.12	97.42	No	-2.57	945.55	99.14	No	-0.85
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	109.98	96.10	No	-1.71	110.72	96.75	No	-1.06	111.36	97.31	No	-0.50
Bladder (75 %)	Soft	61.82	54.02	Yes	-8.37	64.71	56.54	Yes	-5.85	68.07	59.48	Yes	-2.91
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	375.33	31.31	No	-0.53	382.67	31.93	No	0.09	377.36	31.48	No	-0.36
Bowel (100 cc)	Soft	192.06	16.02	No	-1.65	199.14	16.61	No	-1.06	203.55	16.98	No	-0.69
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.76		Yes	-26.98	0.94		Yes	-9.32	0.95		Yes	-7.77
CI (<1.55)	Soft	1.46		Yes	-4.47	1.49		Yes	-2.29	1.49		Yes	-2.26
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	43.11		No	-5.13	43.30		No	-4.71	43.99		No	-3.19
Right Kidney (< 15 Gy)	Hard	7.12		Yes	0.37	7.14		Yes	0.58	7.14		Yes	0.63
Right Kidney (< 10 Gy)	Hard	7.12		Yes	0.37	7.14		Yes	0.58	7.14		Yes	0.63
Left Kidney (< 15 Gy)	Hard	6.04		Yes	-0.84	6.06		Yes	-0.43	6.06		Yes	-0.36
Left Kidney (< 10 Gy)	Hard	6.04		Yes	-0.84	6.06		Yes	-0.43	6.06		Yes	-0.36

Patient 18		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	795.70	71.52	No	-26.56	991.05	89.07	No	-9.01	1018.57	91.55	No	-6.53
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	795.70	71.52	No	-26.56	991.05	89.07	No	-9.01	1018.57	91.55	No	-6.53
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	108.14	82.85	Yes	-3.74	109.81	84.13	Yes	-2.46	110.86	84.94	Yes	-1.65
Bladder (75 %)	Soft	52.58	40.28	Yes	-8.95	56.10	42.98	Yes	-6.25	59.20	45.35	Yes	-3.88
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	33.90	81.46	Yes	-3.41	34.25	82.29	Yes	-2.58	34.67	83.30	Yes	-1.57
Rectum (< 85 %)	Soft	16.16	38.82	Yes	-5.67	17.06	40.99	Yes	-3.50	17.21	41.35	Yes	-3.14
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	376.85	24.02	No	-3.52	395.26	25.20	No	-2.34	401.86	25.62	No	-1.92
Bowel (100 cc)	Soft	107.82	6.87	No	-2.81	124.17	7.92	No	-1.76	124.89	7.96	No	-1.72
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.75		Yes	-33.43	0.99		Yes	-12.96	0.99		Yes	-12.96
CI (<1.55)	Soft	1.65		No	-8.53	1.72		No	-4.53	1.72		No	-4.53
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	42.96		No	-5.22	43.31		No	-4.44	44.11		No	-2.67

Patient 19		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	657.26	79.06	No	-20.33	778.88	93.69	No	-5.70	777.45	93.52	No	-5.87
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	657.26	79.06	No	-20.33	778.88	93.69	No	-5.70	777.45	93.52	No	-5.87
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	331.58	95.39	No	-3.03	336.46	96.79	No	-1.63	337.08	96.97	No	-1.45
Bladder (75 %)	Soft	133.03	38.27	Yes	-7.97	142.91	41.11	Yes	-5.13	145.27	41.79	Yes	-4.45
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	60.80	97.08	Yes	-79.74	60.87	98.00	Yes	-79.74	60.83	97.79	Yes	-79.74
Rectum (< 85 %)	Soft	18.08	39.08	Yes	-6.18	19.85	42.89	Yes	-2.37	19.00	41.05	Yes	-4.21
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bowel (350 cc)	Soft	242.77	26.81	Yes	-3.31	254.72	28.14	Yes	-1.98	254.00	28.13	Yes	-30.12
Bowel (100 cc)	Soft	90.51	10.00	Yes	-2.26	99.44	10.98	Yes	-1.28	97.30	10.75	Yes	-1.51
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.82		Yes	-31.23	1.01		Yes	-15.29	0.99		Yes	-16.53
CI (<1.55)	Soft	1.74		No	-11.04	1.82		No	-6.81	1.82		No	-7.02
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	43.87		No	-5.07	44.91		No	-2.82	44.74		No	-3.18

Patient 20		Uniform				Anterior				Lateral					
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff		
PTV (> 95 %)	Hard	909.70	46.50	No	-48.35	1492.61	76.30	No	-18.55	1675.58	85.65	No	-9.20		
PTV (< 107 %)	Hard	13.80	0.71	No	0.71	17.00	0.87	No	0.87	17.29	0.88	No	0.88		
PTV (> 98 %)	Soft	909.70	46.50	No	-48.35	1492.61	76.30	No	-18.55	1675.58	85.65	No	-9.20		
ITV (> 99.9 %)	Hard	654.38	54.85	No	-45.13	1042.26	87.37	No	-12.61	1158.27	97.09	No	-2.89		
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00		
Bladder (85 %)	Soft	137.79	89.30	No	-2.71	138.47	89.75	No	-2.26	140.75	91.22	No	-0.79		
Bladder (75 %)	Soft	83.78	54.30	Yes	-10.45	86.95	56.35	Yes	-8.40	94.56	61.29	Yes	-3.46		
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00		
Rectum (< 95 %)	Soft	65.81	97.02	No	-0.79	65.95	97.22	No	-0.59	66.01	97.31	No	-0.50		
Rectum (< 85 %)	Soft	50.55	74.51	Yes	19.67	52.40	77.24	Yes	22.40	52.63	77.58	Yes	22.74		
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00		
Bowel (350 cc)	Soft	598.64	31.04	No	-2.06	610.22	31.64	No	-1.46	617.60	32.02	No	-1.08		
Bowel (100 cc)	Soft	321.79	16.68	No	-2.95	343.77	17.82	No	-1.81	348.83	18.09	No	-1.54		
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff		
CI (< 1.10)	Soft	0.52		Yes	-49.56	0.81		Yes	-21.26	0.90		Yes	-12.41		
CI (<1.55)	Soft	1.45		Yes	-6.49	1.50		Yes	-3.63	1.51		Yes	-3.15		
Structure (Constraint)	H/S	Dose (Gy)			Pass	% diff	Dose (Gy)			Pass	% diff				
PIBS – 2 cm (< 5 Gy)	Soft	42.15			No	-6.11	42.74			No	-4.80	43.52		No	-3.06

Appendix 11. DVH Statistics After SSD Changes: – 1.5 cm

Patient 1		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1885.85	98.82	Yes	0.42	0.48	0.02	No	-98.38	1899.52	99.53	Yes	1.13
PTV (< 107 %)	Hard	154.62	8.10	No	8.10	1890.42	99.06	No	99.06	61.47	3.22	No	3.22
PTV (> 98 %)	Soft	1885.85	98.82	Yes	0.42	0.48	0.02	No	-98.38	1899.52	99.53	Yes	1.13
ITV (> 99.9 %)	Hard	1150.88	99.58	No	-0.42	1153.82	99.83	No	-0.17	1155.79	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	2.82	1.12	No	1.12	0.01	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	6.36	2.25	No	2.25	0.36	0.13	Yes	0.13	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	241.67	85.44	No	2.25	239.79	84.78	Yes	1.59	236.08	83.47	Yes	0.28
Bladder (75 %)	Soft	161.72	57.18	Yes	3.94	158.34	55.98	Yes	2.74	152.95	54.08	Yes	0.84
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	41.93	100.00	No	0.00	41.93	100.00	No	0.00	41.93	100.00	No	0.00
Rectum (< 85 %)	Soft	37.68	89.86	No	1.92	37.36	89.11	No	1.17	37.27	88.90	No	0.96
Bowel (< 0.5 cc)	Hard	26.96	1.97	No	1.97	0.00	0.00	Yes	0.00	8.50	0.62	No	0.62
Bowel (350 cc)	Soft	407.36	29.72	No	3.58	370.30	27.02	No	0.88	374.97	27.36	No	1.22
Bowel (100 cc)	Soft	220.06	16.06	No	2.35	197.65	14.42	No	0.71	200.24	14.61	No	0.90
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.27		No	11.56	1.20		No	5.40	1.20		No	5.03
CI (<1.55)	Soft	1.80		No	4.58	1.74		No	1.35	1.76		No	2.40
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	46.49		No	3.39	45.82		No	1.92	45.43		No	1.05

Patient 2		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	2007.70	93.19	No	-2.85	2034.88	94.45	No	-1.59	2097.76	97.37	Yes	1.33
PTV (< 107 %)	Hard	377.38	17.52	No	17.52	0.48	0.02	Yes	0.02	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	2007.70	93.19	No	-2.85	2034.88	94.45	No	-1.59	2097.76	97.37	No	1.33
ITV (> 99.9 %)	Hard	1122.99	99.71	No	-0.19	1126.05	99.98	Yes	0.08	1126.10	99.98	Yes	0.08
CTV-HR + 1 cm (< 0.5 cc)	Soft	60.23	17.59	No	17.59	0.13	0.04	Yes	0.04	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	46.41	15.55	No	15.55	0.02	0.01	Yes	0.01	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	288.07	96.54	No	2.10	285.77	95.77	No	1.33	282.52	94.68	No	0.24
Bladder (75 %)	Soft	223.32	74.84	Yes	4.55	219.81	73.67	Yes	3.38	212.78	71.31	Yes	1.02
Rectum (< 0.5 cc)	Hard	28.07	23.49	No	23.49	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	118.97	99.59	No	0.54	118.69	99.36	No	0.31	118.54	99.23	No	0.18
Rectum (< 85 %)	Soft	108.62	90.92	No	6.03	219.81	86.32	No	1.43	102.95	86.18	No	1.29
Bowel (< 0.5 cc)	Hard	127.35	5.09	No	5.09	10.46	0.42	No	0.42	0.40	0.02	Yes	0.02
Bowel (350 cc)	Soft	795.51	31.80	No	1.25	788.42	31.51	No	0.96	776.98	31.05	No	0.50
Bowel (100 cc)	Soft	461.23	18.43	No	1.41	448.00	17.91	No	0.89	436.29	17.44	No	0.42
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.30		No	23.34	1.26		No	19.55	1.22		No	15.75
CI (<1.55)	Soft	1.62		No	1.66	1.57		No	-1.48	1.56		No	-2.11
Structure (Constraint)	H/S	45.62		No	-1.38	45.02		No	-1.30	44.54		No	-1.29
PIBS – 2 cm (< 5 Gy)	Soft	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
Right Kidney (< 15 Gy)	Hard	0.94		Yes	-9.73	0.98		Yes	-5.30	0.99		Yes	-5.11
Right Kidney (< 10 Gy)	Soft	0.94		Yes	-9.73	0.98		Yes	-5.30	0.99		Yes	-5.11
Left Kidney (< 15 Gy)	Hard	0.86		Yes	-9.63	0.90		Yes	-5.55	0.90		Yes	-5.45
Left Kidney (< 10 Gy)	Soft	0.86		Yes	-9.63	0.90		Yes	-5.55	0.90		Yes	-5.45

Patient 3		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1707.11	99.88	Yes	0.37	1704.28	99.72	Yes	0.21	1704.78	99.75	Yes	0.24
PTV (< 107 %)	Hard	1.08	0.06	No	0.06	0.12	0.01	Yes	0.01	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1707.11	99.88	Yes	0.37	1704.28	99.72	Yes	0.21	1704.78	99.75	Yes	0.24
ITV (> 99.9 %)	Hard	1139.71	100.00	Yes	0.00	1139.71	100.00	Yes	0.00	1139.71	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.48	0.18	Yes	0.18	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.80	0.15	No	0.15	0.03	0.01	Yes	0.01	0.01	0.00	Yes	0.00
Bladder (85 %)	Soft	452.92	87.35	No	1.13	450.26	86.83	No	0.61	448.68	86.53	No	0.31
Bladder (75 %)	Soft	288.52	55.64	Yes	2.67	281.44	54.28	Yes	1.31	279.79	53.96	Yes	0.99
Rectum (< 0.5 cc)	Hard	1.13	1.27	No	1.27	0.11	0.12	Yes	0.12	0.08	0.09	Yes	0.09
Rectum (< 95 %)	Soft	80.56	90.40	Yes	0.63	80.23	90.04	Yes	0.27	80.17	89.98	Yes	0.21
Rectum (< 85 %)	Soft	58.35	65.48	Yes	2.23	57.13	64.11	Yes	0.86	57.51	64.54	Yes	1.29
Bowel (< 0.5 cc)	Hard	0.18	0.01	Yes	0.01	0.00	0.00	Yes	0.00	0.02	0.00	Yes	0.00
Bowel (350 cc)	Soft	349.24	20.53	Yes	0.42	343.06	20.16	Yes	0.05	346.80	20.38	Yes	0.27
Bowel (100 cc)	Soft	164.88	9.69	No	0.40	159.19	9.36	No	0.07	162.20	9.53	No	0.24
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.20		No	5.25	1.16		No	1.89	1.17		No	2.86
CI (<1.55)	Soft	1.64		No	2.78	1.61		No	1.04	1.61		No	1.41
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	9.97		No	1.21	9.91		No	0.63	9.94		No	0.90

Patient 4		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1326.21	99.10	Yes	2.17	1316.96	98.41	Yes	1.48	1314.48	98.22	Yes	1.29
PTV (< 107 %)	Hard	47.93	3.58	No	3.58	0.04	0.00	Yes	0.00	0.04	0.00	Yes	0.00
PTV (> 98 %)	Soft	1326.21	99.10	Yes	2.17	1316.96	98.41	Yes	1.48	1314.48	98.22	Yes	1.29
ITV (> 99.9 %)	Hard	859.46	100.00	Yes	0.00	859.46	100.00	Yes	0.00	859.45	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	39.69	10.44	No	10.44	0.01	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.10	0.06	Yes	0.06	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	159.21	98.20	No	0.58	159.04	98.10	No	0.48	158.52	97.78	No	0.16
Bladder (75 %)	Soft	124.54	76.82	No	4.38	122.52	75.57	No	3.13	120.07	74.06	Yes	1.62
Rectum (< 0.5 cc)	Hard	4.48	10.89	No	10.89	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	41.12	100.00	No	0.00	41.12	100.00	No	0.00	41.12	100.00	No	0.00
Rectum (< 85 %)	Soft	40.14	97.61	No	3.28	39.12	95.13	No	0.80	39.05	94.96	No	0.63
Bowel (< 0.5 cc)	Hard	28.63	3.60	No	3.60	1.73	0.22	No	0.22	1.69	0.21	No	0.21
Bowel (350 cc)	Soft	289.27	36.38	Yes	1.74	283.82	35.69	Yes	1.05	280.28	35.25	Yes	0.61
Bowel (100 cc)	Soft	183.36	23.06	No	1.29	178.48	22.44	No	0.67	177.64	22.34	No	0.57
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.20		No	10.63	1.15		No	5.82	1.15		No	5.23
CI (<1.55)	Soft	1.62		No	3.98	1.59		No	1.80	1.59		No	1.96
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	49.51		No	10.64	45.55		No	1.78	45.47		No	1.60

Patient 5		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1484.46	99.89	Yes	1.43	1480.54	99.63	Yes	1.17	1477.68	99.40	Yes	0.94
PTV (< 107 %)	Hard	19.46	1.31	No	1.31	1.09	0.07	No	0.07	0.03	0.00	Yes	0.00
PTV (> 98 %)	Soft	1484.46	99.89	Yes	1.43	1480.54	99.63	Yes	1.17	1477.68	99.40	Yes	0.94
ITV (> 99.9 %)	Hard	1013.69	100.00	Yes	0.00	1013.69	100.00	Yes	0.00	1013.69	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	1.82	0.87	No	0.87	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.44	0.14	Yes	0.14	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	302.31	98.59	No	0.80	301.66	98.37	No	0.58	300.71	98.07	No	0.28
Bladder (75 %)	Soft	231.02	75.34	No	6.15	223.57	72.91	Yes	3.72	218.75	71.34	Yes	2.15
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	53.86	91.38	Yes	0.39	53.79	91.27	Yes	0.28	53.71	91.13	Yes	0.14
Rectum (< 85 %)	Soft	49.29	83.63	Yes	2.16	48.75	82.72	Yes	1.25	48.62	82.49	Yes	1.02
Bowel (< 0.5 cc)	Hard	11.09	1.05	No	1.05	311.00	0.03	No	0.03	0.17	0.01	Yes	0.01
Bowel (350 cc)	Soft	290.37	25.89	Yes	2.36	279.05	24.88	Yes	1.35	272.80	24.32	Yes	0.79
Bowel (100 cc)	Soft	121.36	10.82	No	1.78	111.87	9.97	No	0.93	109.35	9.75	No	0.71
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.21		No	10.85	1.15		No	5.69	1.15		No	5.01
CI (<1.55)	Soft	1.63		No	4.47	1.60		No	2.23	1.60		No	2.05
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	46.08		No	1.53	45.17		No	-0.47	44.97		No	-0.91

Patient 6		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1707.46	98.57	Yes	-0.26	1708.78	98.65	Yes	-0.18	1708.08	98.61	Yes	-0.22
PTV (< 107 %)	Hard	0.01	0.00	Yes	0.00	0.02	0.00	Yes	0.00	0.02	0.00	Yes	0.00
PTV (> 98 %)	Soft	1707.46	98.57	Yes	-0.26	1708.78	98.65	Yes	-0.18	1708.08	98.61	Yes	-0.22
ITV (> 99.9 %)	Hard	1202.58	100.00	Yes	0.00	1202.58	100.00	Yes	0.00	1202.58	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	-0.05	0.00	0.00	Yes	-0.05	0.00	0.00	Yes	-0.05
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	425.84	89.63	No	-0.18	426.07	89.67	No	-0.14	426.21	89.70	No	-0.11
Bladder (75 %)	Soft	296.65	62.44	Yes	-0.54	297.18	62.55	Yes	-0.43	297.68	62.65	Yes	-0.33
Bowel (< 0.5 cc)	Hard	0.29	0.02	Yes	-0.01	0.36	0.02	Yes	-0.01	0.36	0.02	Yes	-0.01
Bowel (350 cc)	Soft	553.16	33.04	No	-0.12	553.76	33.08	No	-0.08	553.54	33.06	No	-0.10
Bowel (100 cc)	Soft	346.24	20.68	No	-0.15	346.93	20.72	No	-0.11	346.48	20.70	No	-0.13
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.07		Yes	-1.04	1.07		Yes	-0.70	1.07		Yes	-0.78
CI (<1.55)	Soft	1.48		Yes	-0.39	1.48		Yes	-0.25	1.48		Yes	-0.34
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	44.41		No	-1.65	44.63		No	-1.16	44.48		No	-1.49

Patient 7		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	220.22	99.73	Yes	1.11	2212.31	99.38	Yes	0.76	2206.54	99.12	Yes	0.50
PTV (< 107 %)	Hard	1336.65	60.04	No	60.04	0.00	0.00	Yes	0.00	325.05	14.60	No	14.60
PTV (> 98 %)	Soft	220.22	99.73	Yes	1.11	2212.31	99.38	Yes	0.76	2206.54	99.12	Yes	0.50
Bladder (< 0.5 cc)	Hard	205.20	47.12	No	47.12	0.00	0.00	Yes	0.00	27.70	6.36	No	6.36
Bladder (85 %)	Soft	402.52	92.43	No	5.10	384.87	88.38	No	1.05	379.97	87.26	No	-0.07
Bladder (75 %)	Soft	326.53	74.98	Yes	9.99	290.45	66.70	Yes	1.71	287.86	66.10	Yes	1.11
Rectum (< 0.5 cc)	Hard	24.93	50.41	No	50.41	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	49.34	99.77	No	0.62	49.06	99.21	No	0.06	48.98	99.05	No	-0.10
Rectum (< 85 %)	Soft	46.10	93.22	No	4.51	44.15	89.29	No	0.58	44.25	89.47	No	0.76
Bowel (< 0.5 cc)	Hard	84.81	5.90	No	5.90	1.52	0.11	No	0.11	64.76	4.51	No	4.51
Bowel (350 cc)	Soft	350.22	24.37	No	3.14	310.41	21.60	Yes	0.37	347.58	24.18	Yes	2.95
Bowel (100 cc)	Soft	237.75	16.54	No	2.14	213.99	14.89	No	0.49	229.12	15.94	No	1.54
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.28		No	20.17	1.10		Yes	3.18	1.13		No	6.02
CI (<1.55)	Soft	1.63		No	14.62	1.45		Yes	1.78	1.49		Yes	4.72
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	46.51		No	2.31	45.91		No	0.99	45.61		No	0.32
Right Kidney (< 15 Gy)	Hard	1.09		Yes	-23.41	1.40		Yes	-1.13	1.23		Yes	-13.05
Right Kidney (< 10 Gy)	Soft	1.09		Yes	-23.41	1.40		Yes	-1.13	1.23		Yes	-13.05
Left Kidney (< 15 Gy)	Hard	1.03		Yes	-22.55	1.32		Yes	-1.20	1.16		Yes	-13.18
Left Kidney (< 10 Gy)	Soft	1.03		Yes	-22.55	1.32		Yes	-1.20	1.16		Yes	-13.18

Patient 8		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	919.01	99.82	Yes	1.15	915.90	99.48	Yes	0.81	915.69	99.45	Yes	0.78
PTV (< 107 %)	Hard	5.97	0.65	No	0.65	0.00	0.00	Yes	0.00	0.01	0.00	Yes	0.00
PTV (> 98 %)	Soft	919.01	99.82	Yes	1.15	915.90	99.48	Yes	0.81	915.69	99.45	Yes	0.78
Bladder (< 0.5 cc)	Hard	8.95	4.96	No	4.96	0.02	0.01	Yes	0.01	0.03	0.01	Yes	0.01
Bladder (85 %)	Soft	133.52	73.94	Yes	3.89	130.70	72.38	Yes	2.33	129.23	71.56	Yes	1.51
Bladder (75 %)	Soft	74.32	41.15	Yes	3.39	71.49	39.59	Yes	1.83	71.14	39.39	Yes	1.63
Rectum (< 0.5 cc)	Hard	2.66	6.18	No	6.18	0.01	0.01	Yes	0.01	0.01	0.02	Yes	0.02
Rectum (< 95 %)	Soft	29.81	69.18	Yes	0.52	29.70	68.92	Yes	0.26	29.71	68.94	Yes	0.28
Rectum (< 85 %)	Soft	23.72	55.04	Yes	3.14	23.01	53.38	Yes	1.48	23.19	53.80	Yes	1.90
Bowel (< 0.5 cc)	Hard	17.62	1.12	No	1.12	1.16	0.07	No	0.07	0.68	0.04	No	0.04
Bowel (350 cc)	Soft	461.43	29.31	No	2.41	439.46	27.92	No	1.02	442.15	28.09	No	1.19
Bowel (100 cc)	Soft	210.55	13.38	No	1.35	199.50	12.67	No	0.64	200.00	12.71	No	0.68
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.31		No	11.57	1.23		No	5.35	1.25		No	6.42
CI (<1.55)	Soft	1.91		No	5.40	1.86		No	2.35	1.87		No	2.89
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	25.55		No	5.72	25.41		No	5.13	25.43		No	5.23

Patient 9		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1098.62	99.78	Yes	0.63	1098.10	99.74	Yes	0.59	1097.38	99.67	Yes	0.52
PTV (< 107 %)	Hard	270.35	24.56	No	24.56	0.02	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1098.62	99.78	Yes	0.63	1098.10	99.74	Yes	0.59	1097.38	99.67	Yes	0.52
Bladder (< 0.5 cc)	Hard	19.71	5.07	No	5.07	3.14	0.81	No	0.81	0.05	0.01	Yes	0.01
Bladder (85 %)	Soft	308.68	79.42	Yes	2.16	309.12	79.53	Yes	2.27	305.23	78.53	Yes	1.27
Bladder (75 %)	Soft	182.84	47.04	Yes	3.06	181.04	46.58	Yes	2.60	176.42	45.39	Yes	1.41
Rectum (< 0.5 cc)	Hard	0.71	1.02	No	1.02	0.02	0,02	Yes	0.00	0.03	0,05	Yes	0.18
Rectum (< 95 %)	Soft	62.06	89.97	Yes	0.18	62.16	90.11	Yes	0.32	62.13	90.07	Yes	0.28
Rectum (< 85 %)	Soft	44.69	64.79	Yes	2.62	44.18	64.04	Yes	1.87	44.33	64.26	Yes	2.09
Bowel (< 0.5 cc)	Hard	98.96	8.03	No	8.03	3.10	0.25	No	0.25	0.25	0.02	Yes	0.02
Bowel (350 cc)	Soft	498.42	39.70	No	8.85	397.35	32.23	No	1.38	389.62	31.60	No	0.75
Bowel (100 cc)	Soft	232.47	18.86	No	5.86	171.47	13.91	No	0.91	168.77	13.69	No	0.69
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.43		No	21.66	1.26		No	6.89	1.24		No	5.46
CI (<1.55)	Soft	2.07		No	91.44	1.87		No	72.58	1.86		No	71.44
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	40.14		No	3.58	39.66		No	2.36	39.44		No	1.79

Patient 10		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1398.14	99.31	Yes	1.20	1396.45	99.19	Yes	1.08	1393.94	99.01	Yes	0.90
PTV (< 107 %)	Hard	128.97	9.16	No	9.16	0.34	0.02	Yes	0.02	0.08	0.01	Yes	0.01
PTV (> 98 %)	Soft	1398.14	99.31	Yes	1.20	1396.45	99.19	Yes	1.08	1393.94	99.01	Yes	0.90
ITV (> 99.9 %)	Hard	803.96	100.00	Yes	0.00	803.96	100.00	Yes	0.00	803.96	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	14.27	3.09	No	3.09	0.11	0.02	Yes	0.02	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	7.49	4.26	No	4.26	4.04	2.30	No	2.30	0.03	0.02	Yes	0.02
Bladder (85 %)	Soft	162.04	92.17	No	1.79	161.91	92.10	No	1.72	159.81	90.90	No	0.52
Bladder (75 %)	Soft	93.95	53.44	Yes	5.24	92.13	52.41	Yes	4.21	87.37	49.69	Yes	1.49
Rectum (< 0.5 cc)	Hard	3.27	4.36	No	4.33	0.13	0.18	Yes	0.15	0.19	0.25	Yes	0.22
Rectum (< 95 %)	Soft	73.14	97.59	No	-0.20	73.63	98.25	No	0.46	73.60	98.21	No	0.42
Rectum (< 85 %)	Soft	51.10	68.18	Yes	3.32	50.46	67.34	Yes	2.48	50.53	67.43	Yes	2.57
Bowel (< 0.5 cc)	Hard	84.44	2.19	No	2.19	1.20	0.03	No	0.03	0.02	0.00	Yes	0.00
Bowel (350 cc)	Soft	876.22	22.70	No	1.65	849.25	22.00	No	0.95	828.32	21.46	No	0.41
Bowel (100 cc)	Soft	452.51	11.72	No	2.25	393.22	10.19	No	0.72	385.40	9.98	No	0.51
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.33		No	15.69	1.23		No	7.29	1.21		No	5.50
CI (<1.55)	Soft	1.95		No	7.92	1.87		No	3.25	1.85		No	2.21
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	46.46		No	4.45	45.96		No	3.33	45.22		No	1.66
Right Kidney (< 15 Gy)	Hard	0.47		Yes	-7.44	0.50		Yes	-1.96	0.50		Yes	-2.15
Right Kidney (< 10 Gy)	Hard	0.47		Yes	-7.44	0.50		Yes	-1.96	0.50		Yes	-2.15
Left Kidney (< 15 Gy)	Hard	0.54		Yes	-6.69	0.57		Yes	-1.54	0.58		Yes	-1.20
Left Kidney (< 10 Gy)	Hard	0.54		Yes	-6.69	0.57		Yes	-1.54	0.58		Yes	-1.20

Patient 11		Uniform				Anterior				Lateral				
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	
PTV (> 95 %)	Hard	1099.60	100.00	Yes	4.60	1118.75	95.90	Yes	0.50	1135.01	97.29	Yes	1.89	
PTV (< 107 %)	Hard	521.17	44.67	No	44.67	0.59	0.05	Yes	0.05	0.01	0.00	Yes	0.00	
PTV (> 98 %)	Soft	1099.60	100.00	Yes	4.60	1118.75	95.90	No	0.50	1135.01	97.29	No	1.89	
ITV (> 99.9 %)	Hard	643.89	98.11	No	-1.85	649.95	99.04	No	-0.92	656.27	100.00	Yes	0.04	
CTV-HR + 1 cm (< 0.5 cc)	Soft	229.85	80.22	No	80.22	0.39	0.14	Yes	0.14	0.00	0.00	Yes	0.00	
Bladder (< 0.5 cc)	Hard	124.46	43.01	No	43.01	0.08	0.03	Yes	0.03	0.00	0.00	Yes	0.00	
Bladder (85 %)	Soft	287.17	99.25	No	2.36	282.12	97.51	No	0.62	281.39	97.25	No	0.36	
Bladder (75 %)	Soft	230.18	79.55	No	11.81	208.18	71.95	Yes	4.21	200.48	69.29	Yes	1.55	
Rectum (< 0.5 cc)	Hard	28.51	54.01	No	54.01	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	
Rectum (< 95 %)	Soft	52.79	99.99	No	1.29	52.28	99.02	No	0.32	52.24	98.96	No	0.26	
Rectum (< 85 %)	Soft	46.17	87.45	No	11.51	40.81	77.31	Yes	1.37	40.79	77.26	Yes	1.32	
Bowel (< 0.5 cc)	Hard	114.72	13.84	No	13.84	13.24	1.60	No	1.60	0.70	0.08	No	0.08	
Bowel (350 cc)	Soft	421.76	50.86	No	1.12	416.94	50.28	No	0.54	416.05	50.17	No	0.43	
Bowel (100 cc)	Soft	305.98	36.90	No	3.27	290.59	35.05	No	1.42	285.89	34.48	No	0.85	
Structure (Constraint)	H/S	Volume Ratio			Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.32			No	23.13	1.14		No	6.51	1.14		No	6.38
CI (<1.55)	Soft	1.88			No	8.70	1.72		No	-1.00	1.77		No	2.18
Structure (Constraint)	H/S	Dose (Gy)			Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	49.47			No	11.48	45.67		No	2.92	44.96		No	1.33

Patient 12		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1203.76	99.72	Yes	-0.15	1206.45	99.95	Yes	0.08	1206.44	99.94	Yes	0.07
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1203.76	99.72	Yes	-0.15	1206.45	99.95	Yes	0.08	1206.44	99.94	Yes	0.07
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.51	0.15	No	0.15	0.12	0.03	Yes	0.03
Bladder (85 %)	Soft	231.16	67.05	Yes	1.21	238.76	69.25	Yes	3.41	236.59	68.63	Yes	2.79
Bladder (75 %)	Soft	131.48	38.14	Yes	-0.71	140.33	40.70	Yes	1.85	139.23	40.38	Yes	1.53
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.02	0.02	Yes	0.02	0.02	0.03	Yes	0.03
Rectum (< 95 %)	Soft	58.98	88.58	Yes	1.69	59.52	89.39	Yes	2.50	59.58	89.49	Yes	2.60
Rectum (< 85 %)	Soft	34.58	51.94	Yes	-1.31	36.28	54.49	Yes	1.24	36.65	55.05	Yes	1.80
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.49	0.02	Yes	0.02	0.07	0.00	Yes	0.00
Bowel (350 cc)	Soft	553.57	20.33	No	1.53	604.71	22.21	No	3.41	582.94	21.41	No	2.61
Bowel (100 cc)	Soft	151.37	5.56	No	-0.23	175.33	6.44	No	0.65	170.47	6.26	No	0.47
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (<1.10)	Soft	1.21		No	-2.22	1.30		No	5.24	1.30		No	5.18
CI (<1.55)	Soft	1.87		No	0.33	1.95		No	4.82	1.95		No	4.60
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	38.91		No	-13.10	39.55		No	-11.68	39.50		No	-11.78

Patient 13		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	631.04	94.50	No	-5.36	667.54	99.96	Yes	0.10	667.53	99.96	Yes	0.10
PTV (< 107 %)	Hard	412.80	61.82	No	61.82	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	631.04	94.50	No	-5.36	667.54	99.96	Yes	0.10	667.53	99.96	Yes	0.10
Bladder (< 0.5 cc)	Hard	0.53	0.57	No	0.57	0.58	0.62	No	0.62	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	47.71	51.62	Yes	6.70	44.95	48.63	Yes	3.71	43.81	47.39	Yes	2.47
Bladder (75 %)	Soft	14.87	16.09	Yes	1.09	15.44	16.70	Yes	1.70	14.67	15.87	Yes	0.87
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	19.33	27.22	Yes	2.31	19.75	27.81	Yes	2.90	21.64	30.48	Yes	5.57
Rectum (< 85 %)	Soft	0.88	1.24	Yes	1.23	0.04	0.06	Yes	0.05	0.04	0.06	Yes	0.05
Bowel (< 0.5 cc)	Hard	66.28	2.17	No	2.17	0.04	0.00	Yes	0.00	0.02	0.00	Yes	0.00
Bowel (350 cc)	Soft	345.13	11.32	Yes	3.10	264.71	8.68	Yes	0.46	257.00	8.43	Yes	0.21
Bowel (100 cc)	Soft	146.42	4.80	No	1.72	102.09	3.35	No	0.27	99.60	3.27	Yes	0.19
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.79		No	35.93	1.40		No	6.66	1.40		No	6.60
CI (<1.55)	Soft	2.80		No	29.86	2.23		No	3.30	2.23		No	3.43
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	6.42		No	132.75	2.70		Yes	-2.14	2.73		Yes	-1.12

Patient 14		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1054.20	98.03	Yes	-1.45	1072.30	99.72	Yes	0.24	1073.60	99.84	Yes	0.36
PTV (< 107 %)	Hard	306.96	28.54	No	28.54	0.03	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1054.20	98.03	Yes	-1.45	1072.30	99.72	Yes	0.24	1073.60	99.84	Yes	0.36
Bladder (< 0.5 cc)	Hard	79.91	18.50	No	18.50	2.32	0.54	No	0.54	0.02	0.01	Yes	0.01
Bladder (85 %)	Soft	386.70	89.53	No	3.94	378.82	87.71	No	2.12	375.77	87.00	No	1.41
Bladder (75 %)	Soft	226.67	52.48	Yes	14.16	178.58	41.35	Yes	3.03	171.30	39.66	Yes	1.34
Rectum (< 0.5 cc)	Hard	5.64	8.54	No	8.54	0.04	0.06	Yes	0.06	0.03	0.05	Yes	0.05
Rectum (< 95 %)	Soft	60.47	91.64	Yes	0.99	60.78	92.11	Yes	1.46	60.52	91.72	Yes	1.07
Rectum (< 85 %)	Soft	40.22	60.96	Yes	4.90	38.41	58.21	Yes	2.15	38.33	58.08	Yes	2.02
Bowel (< 0.5 cc)	Hard	39.56	5.04	No	5.04	0.50	0.06	Yes	0.06	0.05	0.01	Yes	0.01
Bowel (350 cc)	Soft	188.83	24.07	Yes	1.16	187.29	23.88	Yes	0.97	183.99	23.45	Yes	0.54
Bowel (100 cc)	Soft	90.64	11.55	Yes	2.29	78.05	9.95	Yes	0.69	77.29	9.85	Yes	0.59
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.41		No	19.11	1.26		No	6.86	1.25		No	5.46
CI (<1.55)	Soft	2.04		No	10.37	1.89		No	2.40	1.89		No	2.34
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	46.96		No	2.44	46.71		No	1.89	46.60		No	1.66

Patient 15		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	925.75	99.85	Yes	1.14	924.00	99.66	Yes	0.95	923.10	99.56	Yes	0.85
PTV (< 107 %)	Hard	80.20	8.65	No	8.65	0.09	0.01	Yes	0.01	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	925.75	99.85	Yes	1.14	924.00	99.66	Yes	0.95	923.10	99.56	Yes	0.85
Bladder (< 0.5 cc)	Hard	20.36	7.09	No	7.09	1.84	0.64	No	0.64	0.07	0.02	Yes	0.02
Bladder (85 %)	Soft	223.22	77.70	Yes	4.36	219.71	76.48	Yes	3.14	214.00	74.49	Yes	1.15
Bladder (75 %)	Soft	118.25	41.16	Yes	4.33	114.33	39.80	Yes	2.97	109.75	38.20	Yes	1.37
Rectum (< 0.5 cc)	Hard	3.51	3.78	No	3.78	0.09	0.10	Yes	0.10	0.16	0.17	Yes	0.17
Rectum (< 95 %)	Soft	65.31	70.44	Yes	4.40	63.45	68.44	Yes	2.40	63.78	68.79	Yes	2.75
Rectum (< 85 %)	Soft	31.19	33.63	Yes	2.90	29.90	32.25	Yes	1.52	30.00	32.36	Yes	1.63
Bowel (< 0.5 cc)	Hard	71.21	3.88	No	3.88	5.98	0.33	No	0.33	0.66	0.04	No	0.04
Bowel (350 cc)	Soft	643.00	35.00	No	3.70	603.53	32.85	No	1.55	595.71	32.42	No	1.12
Bowel (100 cc)	Soft	314.92	17.14	No	2.03	293.82	15.99	No	0.88	289.60	15.76	No	0.65
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.36		No	16.48	1.26		No	7.91	1.24		No	6.48
CI (<1.55)	Soft	2.04		No	7.30	1.95		No	2.98	1.95		No	2.66
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	47.13		No	3.74	46.08		No	1.44	46.02		No	1.29

Patient 16		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1556.58	99.42	Yes	0.95	1555.04	99.32	Yes	0.85	1557.01	99.45	Yes	0.98
PTV (< 107 %)	Hard	625.23	39.93	No	39.93	0.12	0.01	Yes	0.01	0.02	0.00	Yes	0.00
PTV (> 98 %)	Soft	1556.58	99.42	Yes	0.95	1555.04	99.32	Yes	0.85	1557.01	99.45	Yes	0.98
ITV (> 99.9 %)	Hard	978.91	99.98	Yes	-0.02	979.14	100.00	Yes	0.00	979.14	100.00	Yes	0.00
CTV-HR + 1 cm (< 0.5 cc)	Soft	297.48	69.01	No	69.01	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	206.96	34.49	No	34.49	0.46	0.08	Yes	0.08	0.44	0.07	Yes	0.07
Bladder (85 %)	Soft	524.77	87.44	No	7.44	489.81	81.62	Yes	1.62	484.51	80.73	Yes	0.73
Bladder (75 %)	Soft	373.37	62.21	Yes	-22.05	308.29	51.37	Yes	-32.89	304.00	50.66	Yes	-33.60
Rectum (< 0.5 cc)	Hard	27.56	39.42	No	39.42	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	67.83	97.01	No	29.34	67.80	96.98	No	29.31	67.76	96.91	No	29.24
Rectum (< 85 %)	Soft	61.52	87.99	No	3.73	59.56	85.19	No	0.93	59.69	85.38	No	1.12
Bowel (< 0.5 cc)	Hard	108.14	4.79	No	4.79	1.10	0.05	No	0.05	1.14	0.05	No	0.05
Bowel (350 cc)	Soft	514.56	22.78	No	0.87	509.34	22.55	No	0.64	501.73	22.21	No	0.30
Bowel (100 cc)	Soft	275.25	12.19	No	1.37	253.07	11.20	No	0.38	250.90	11.11	No	0.29
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.37		No	22.71	1.18		No	5.98	1.18		No	6.13
CI (<1.55)	Soft	1.87		No	11.23	1.72		No	2.16	1.72		No	2.27
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	53.36		No	20.33	45.07		No	1.65	44.90		No	1.25
Right Kidney (< 15 Gy)	Hard	0.86		Yes	832.61	0.92		Yes	894.57	0.91		Yes	886.96
Right Kidney (< 10 Gy)	Soft	0.86		Yes	909.41	0.92		Yes	976.47	0.91		Yes	968.24
Left Kidney (< 15 Gy)	Hard	0.76		Yes	722.83	0.80		Yes	764.13	0.79		Yes	760.87
Left Kidney (< 10 Gy)	Soft	0.76		Yes	790.59	0.80		Yes	835.29	0.79		Yes	831.76

Patient 17		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1069.67	72.76	No	-25.14	1438.60	97.86	Yes	-0.04	1441.92	98.09	Yes	0.19
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1069.67	72.76	No	-25.14	1438.60	97.86	No	-0.04	1441.92	98.09	Yes	0.19
ITV (> 99.9 %)	Hard	753.75	79.03	No	-20.96	952.93	99.91	Yes	-0.08	953.72	100.00	Yes	0.01
CTV-HR + 1 cm (< 0.5 cc)	Soft	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	109.98	96.10	No	-1.71	112.24	98.08	No	0.27	112.04	97.90	No	0.09
Bladder (75 %)	Soft	61.82	54.02	Yes	-8.37	73.14	63.91	Yes	1.52	71.63	62.59	Yes	0.20
Bowel (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.03	0.00	Yes	0.00	0.04	0.00	Yes	0.00
Bowel (350 cc)	Soft	375.33	31.31	No	-0.53	381.24	31.81	No	-0.03	382.27	31.89	No	0.05
Bowel (100 cc)	Soft	192.06	16.02	No	-1.65	212.19	17.70	No	0.03	212.73	17.75	No	0.08
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	0.76		Yes	-26.98	1.04		Yes	0.84	1.04		Yes	0.89
CI (<1.55)	Soft	1.46		Yes	-4.47	1.53		Yes	-0.17	1.53		Yes	0.29
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2cm (< 5 Gy)	Soft	43.11		No	-5.13	44.53		No	-2.00	44.53		No	-2.00
Right Kidney (< 15 Gy)	Hard	7.12		Yes	0.37	7.09		Yes	-0.06	7.09		Yes	-0.06
Right Kidney (< 10 Gy)	Hard	7.12		Yes	0.37	7.09		Yes	-0.06	7.09		Yes	-0.06
Left Kidney (< 15 Gy)	Hard	6.04		Yes	-0.84	6.09		Yes	0.03	6.09		Yes	0.07
Left Kidney (< 10 Gy)	Hard	6.04		Yes	-0.84	6.09		Yes	0.03	6.09		Yes	0.07

Patient 18		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1108.00	99.59	Yes	1.51	1104.46	99.27	Yes	1.19	1101.26	98.98	Yes	0.90
PTV (< 107 %)	Hard	272.89	24.53	No	24.53	0.02	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1108.00	99.59	Yes	1.51	1104.46	99.27	Yes	1.19	1101.26	98.98	Yes	0.90
Bladder (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	114.07	87.39	No	0.80	114.17	87.47	No	0.88	113.65	87.07	No	0.48
Bladder (75 %)	Soft	168.96	48.60	Yes	-49.23	178.47	51.34	Yes	-49.23	168.14	48.37	Yes	-49.23
Rectum (< 0.5 cc)	Hard	0.52	1.26	No	1.26	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	36.80	88.41	Yes	3.54	35.60	85.53	Yes	0.66	35.54	85.37	Yes	0.50
Rectum (< 85 %)	Soft	20.50	49.25	Yes	4.76	19.16	46.03	Yes	1.54	19.16	46.03	Yes	1.54
Bowel (< 0.5 cc)	Hard	39.34	2.51	No	2.51	0.55	0.04	No	0.04	0.22	0.01	Yes	0.01
Bowel (350 cc)	Soft	493.08	31.43	No	3.89	451.52	28.78	No	1.24	441.51	28.15	No	0.61
Bowel (100 cc)	Soft	213.58	13.61	No	3.93	165.84	10.57	No	0.89	161.48	10.29	No	0.61
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.37		No	20.91	1.21		No	6.83	1.19		No	-35.12
CI (<1.55)	Soft	2.00		No	10.99	1.85		No	2.79	1.82		No	1.07
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	55.27		No	21.96	45.99		No	1.49	45.36		No	0.09

Patient 19		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	830.93	99.95	Yes	0.56	829.49	99.78	Yes	0.39	830.11	99.86	Yes	0.47
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	830.93	99.95	Yes	0.56	829.49	99.78	Yes	0.39	830.11	99.86	Yes	0.47
Bladder (< 0.5 cc)	Hard	28.23	8.12	No	8.12	1.32	0.38	No	0.38	0.16	0.05	Yes	0.05
Bladder (85 %)	Soft	344.91	99.22	No	0.80	343.85	98.91	No	0.49	343.50	98.82	No	0.40
Bladder (75 %)	Soft	178.47	51.34	Yes	5.10	168.96	48.60	Yes	2.36	168.14	48.37	Yes	2.13
Rectum (< 0.5 cc)	Hard	2.31	5.00	No	5.00	0.00	0.01	Yes	0.01	0.02	0.05	Yes	0.05
Rectum (< 95 %)	Soft	37.76	81.60	Yes	1.86	37.27	80.55	Yes	0.81	37.31	80.64	Yes	0.90
Rectum (< 85 %)	Soft	22.86	49.40	Yes	4.14	21.78	47.06	Yes	1.80	22.21	47.99	Yes	2.73
Bowel (< 0.5 cc)	Hard	29.93	3.31	No	3.31	0.29	0.03	Yes	0.03	0.42	0.05	Yes	0.05
Bowel (350 cc)	Soft	292.19	32.27	Yes	2.15	283.01	31.26	Yes	1.14	280.71	31.01	Yes	0.89
Bowel (100 cc)	Soft	125.40	13.85	No	1.59	116.73	12.89	No	0.63	117.73	13.00	No	0.74
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.35		No	13.73	1.26		No	6.05	1.27		No	6.75
CI (<1.55)	Soft	2.10		No	7.53	2.02		No	3.16	0.20		Yes	-89.65
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	47.99		No	3.84	47.15		No	2.03	46.95		No	1.60

Patient 20		Uniform				Anterior				Lateral			
Structure (Constraint)	H/S	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff	V > (cc)	V > (%)	Pass	% diff
PTV (> 95 %)	Hard	1807.00	92.37	No	-2.48	1818.72	92.97	No	-1.88	1876.35	95.91	Yes	1.06
PTV (< 107 %)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
PTV (> 98 %)	Soft	1807.00	92.37	No	-2.48	1818.72	92.97	No	-1.88	1876.35	95.91	No	1.06
ITV (> 99.9 %)	Hard	1129.48	94.68	No	-5.30	1149.82	96.38	No	-3.60	1190.14	99.76	No	-0.22
Bladder (< 0.5 cc)	Hard	0.22	0.14	Yes	0.14	0.08	0.05	Yes	0.05	0.00	0.00	Yes	0.00
Bladder (85 %)	Soft	143.21	92.82	No	0.81	143.21	92.82	No	0.81	142.29	92.22	No	0.21
Bladder (75 %)	Soft	106.60	69.09	Yes	4.34	106.47	69.00	Yes	4.25	101.58	65.83	Yes	1.08
Rectum (< 0.5 cc)	Hard	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00	0.00	0.00	Yes	0.00
Rectum (< 95 %)	Soft	66.46	97.97	No	0.16	66.54	98.08	No	0.27	66.42	97.90	No	0.09
Rectum (< 85 %)	Soft	56.43	83.18	Yes	28.34	56.11	82.71	Yes	27.87	55.76	82.19	Yes	27.35
Bowel (< 0.5 cc)	Hard	131.32	6.81	No	6.81	6.43	0.33	No	0.33	0.32	0.02	Yes	0.02
Bowel (350 cc)	Soft	679.48	35.23	No	2.13	651.61	33.78	No	0.68	647.05	33.55	No	0.45
Bowel (100 cc)	Soft	441.79	22.91	No	3.28	398.97	20.69	No	1.06	390.99	20.27	No	0.64
Structure (Constraint)	H/S	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff	Volume Ratio		Pass	% diff
CI (< 1.10)	Soft	1.11		No	7.78	1.06		Yes	2.60	1.08		Yes	4.46
CI (<1.55)	Soft	1.56		No	0.59	1.53		Yes	-1.41	1.58		No	1.43
Structure (Constraint)	H/S	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff	Dose (Gy)		Pass	% diff
PIBS – 2 cm (< 5 Gy)	Soft	45.47		No	1.29	45.51		No	1.37	44.63		No	-0.59