

Dosimetric comparison of full bladder versus empty bladder in endometrial cases and how they correlate to overall bowel dose

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PURPOSE/OBJECTIVES

AIM: The purpose of this study is to dosimetrically compare the bowel bag doses in a full bladder versus empty bladder to see how much overdose it can get when a patient is unable to fill their bladder and is treated when empty.

MATERIALS and METHODS

The data of 18 patients being treated to the endometrium and pelvis lymph nodes were analyzed. All patients were treated (Rx=50.4Gy, 6MV) on the TrueBeam using volumetric modulated arc therapy (VMAT). All treatment plans were transferred from full bladder scan onto their respective empty bladder scan. Isocenters were radiographically matched so that they were in the same spot and the bowel bag and bladder structures were re-contoured. The plans were then calculated using the preset MU values from the original treatment plan to see what the dose distribution would look like if the patient were not able to fill up their bladder for a particular treatment day. Specifically, we investigated how the bowel bag dose would differ in these scenarios and whether dose constraints would be met on a day-to-day basis. The objective of the bowel bag constraint that we investigated specifically was $V45 < 195\text{cc}$ as per Quantec.

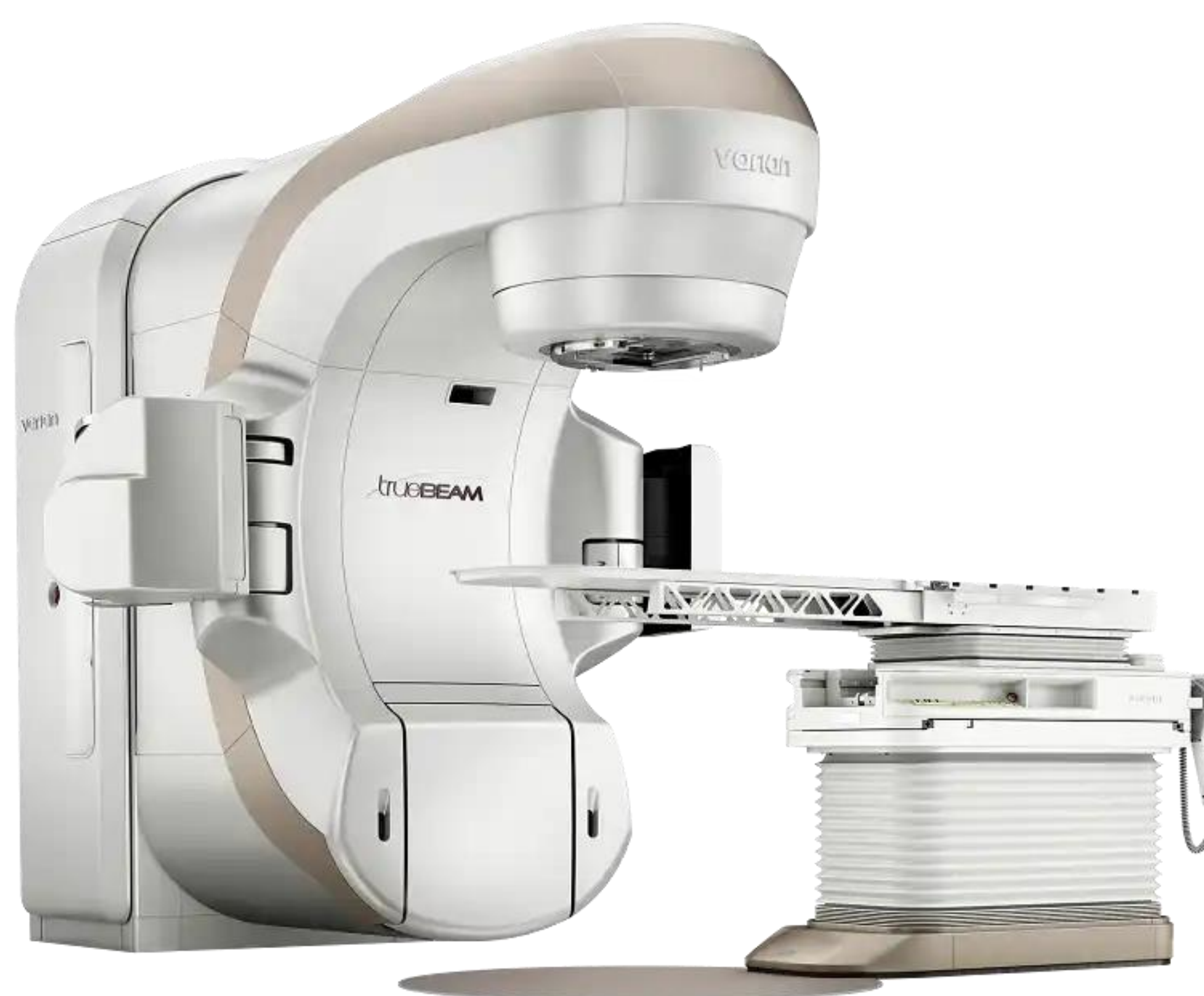
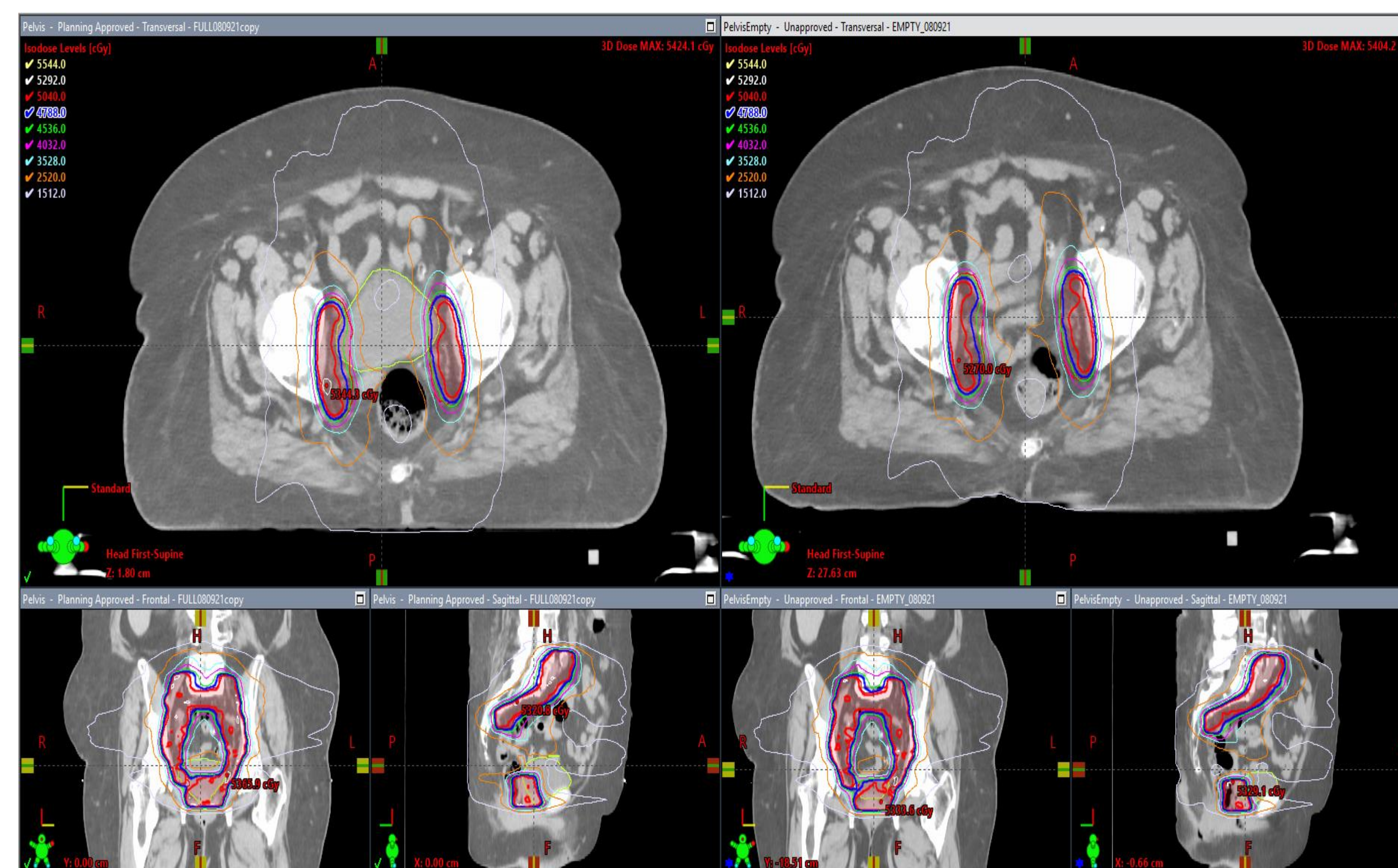
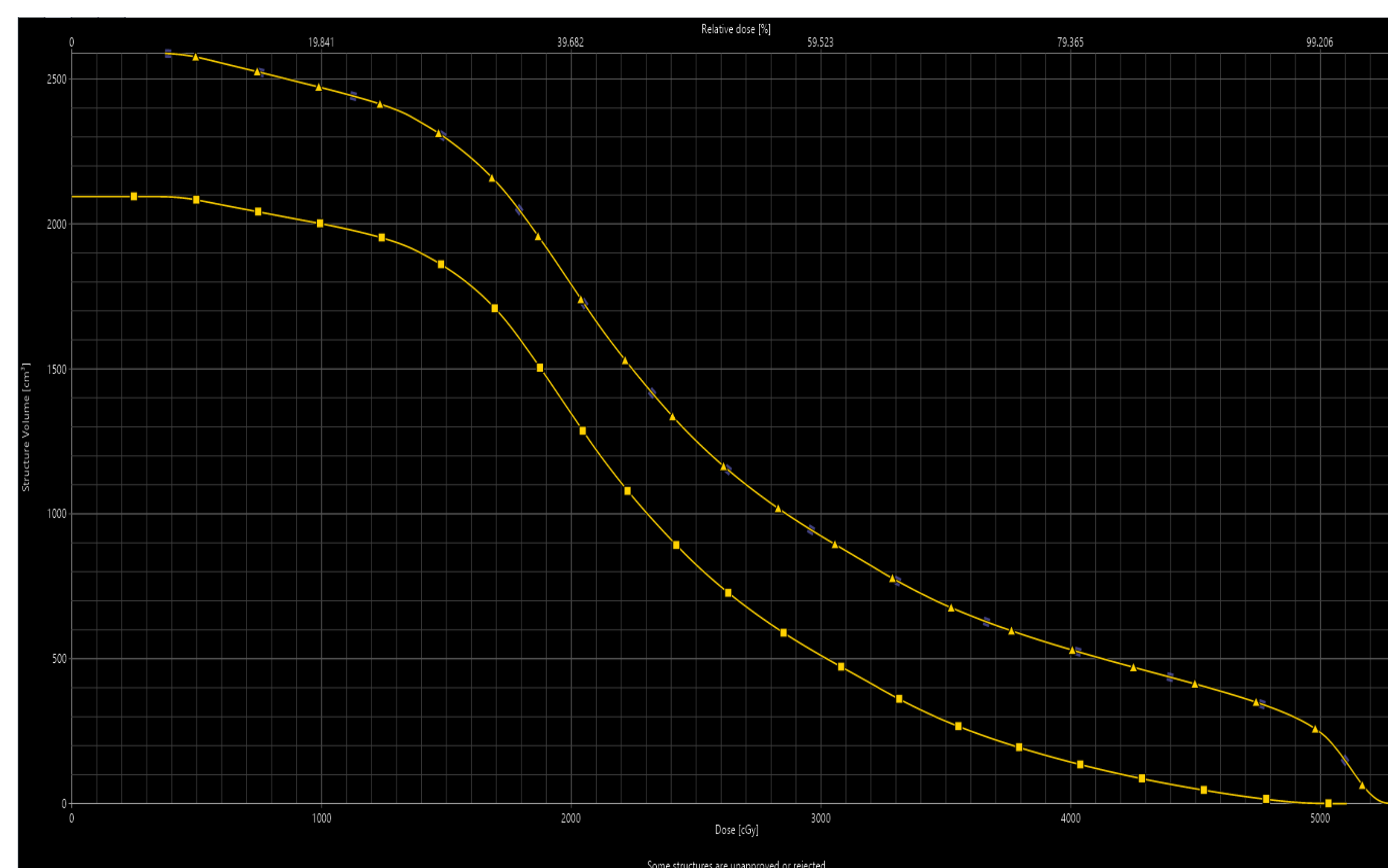


Figure 1: Varian Truebeam (www.varian.com)



Full Bladder: Left
 Empty Bladder: Right



Square: Bowel on full scan
 Triangle: Bowel on empty scan

RESULTS

The V45 was identified as the metric used to evaluate the bowel bag constraint. All PTVs were getting adequate coverage to keep results consistent. In the empty bladder plan, 13/18 patients did not meet dose constraint whereas 17/18 patients met constraints in the full bladder plan. Full bladder scan provided lower bowel bag dose (mean: $V45=141.8\text{cc}$) than empty bladder scan (mean: $V45=285.2\text{cc}$)

CONCLUSION

A significant number of patients would not be meeting constraints if the plans were to be treated on an empty bladder scan. Comparing the average values of the 2 scans, the cc values are significantly higher in the empty scan. This is due to the bladder pushing bowel bag away from parts of the treatment field, thus decreasing the amount of dose received by the bowel bag. Seeing as how there is a large increase in the bowel bag dose when treating empty, a bladder PRV may be useful in determining how full a bladder should be before treatment to ensure that dose constraints are being met throughout the course of treatment. Using the criteria of dose constraints used in clinic, it can be determined that a full bladder is ideal in treating endometrium/pelvis cases. Future case studies may involve developing a metric for bladder filling (e.g., bladder PRV) which can be generated for clinicians to determine whether a patient has sufficiently filled up for treatment.