

of the immobilisation device encroaching into the treatment field and with the immobilisation device included in the body contour. RANDO® was treated using these plans with thermoluminescent dosimeters (TLDs) placed at various positions within the treatment field and the treatment isocentre. The doses measured with the TLDs were compared with the doses calculated by TPS.

**RESULTS:** The Eclipse™ TPS calculation of MUs accurately matched the manual MU calculation when a treatment field passed through the immobilisation devices. The TLD measurements of the RANDO® treatment plans compared well with the TPS prediction of dose distribution and MUs when the amount of immobilisation device encroaching on the treatment field was varied.

**DISCUSSION & CONCLUSIONS:** This study verified that the Eclipse™ TPS is able to adequately model the change in dose distribution and MUs when complex immobilisation devices are introduced into the planning process.

#### REFERENCES:

<sup>1</sup>Planning Reference Guide for Algorithms, Eclipse 6.5, Varian Medical Systems Inc, 2004.

### AN INVESTIGATION OF MRI DOSE PLANNING FOR HIGH PRECISION PROSTATE RADIOTHERAPY

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**INTRODUCTION:** To achieve high precision prostate radiotherapy requires accurate delineation of the prostate combined with accurate targeting of treatment with image-guided techniques. MRI scans have been shown to have lower inter-observer variability in prostate contouring than CT scans. If dose planning could also be performed on MRI scans then uncertainties due to registration to a CT scan would be reduced, as well as the resources required to use two imaging modalities. The feasibility of dose planning directly on MRI scans is investigated in this study.

**METHODS:** Ten patients treated at the Newcastle Mater Hospital had three  $0.9 \times 7$  mm gold markers implanted by a urologist under trans-rectal guidance. Each patient then underwent a planning CT with urethral contrast. The prostate was delineated on the CT for field definition as per our normal protocol. Patients were treated with daily on-line corrections using electronic portal images of the implanted markers. The patients also received a MRI scan in the treatment position following their planning CT. Several MRI sequences were utilized; a T2 whole pelvis scan, a T2 small field-of-view scan to visualise prostate borders, and a T2\* gradient echo scan to visualise implanted markers. All scans were transferred to the Pinnacle treatment planning system. The CT and MRI scans were registered using bony anatomy. Dose plans were produced on both sets of scans. For the CT scans, plans were produced with full electron density information, a bulk uniform density of 1, and bulk density plus a density of 1.3 assigned to the bone regions. For the MRI plans, uniform and uniform+bone densities were assigned to the scans and dose plans using the same beam arrangements produced. The doses to the ICRU point for the dose plans were then compared.

**RESULTS:** Dose plans for two patients have been analyzed to date. Assigning a bulk uniform density to the CT scan was found to give average dose errors of 2.7% to the ICRU point compared to the full density plan. When the bulk density of bony anatomy was added, this was reduced to within 1%. Bulk density MRI plans gave average dose errors of 3.7%, which was reduced to 2.3% with bulk density of bone added.

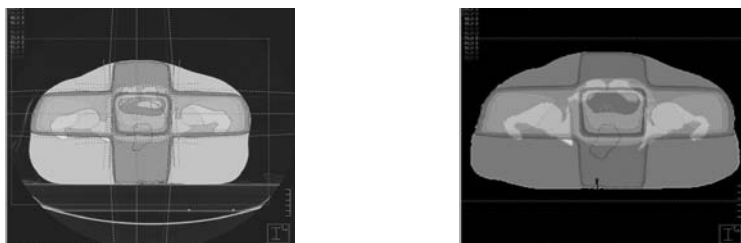


Figure 1. Example of bulk density CT and MRI dose plans.

**DISCUSSION & CONCLUSIONS:** The CT results suggest that scans with bulk densities assigned produce reasonably accurate dose plans for prostate. By optimizing the densities used, further improvements may be achieved. However the errors when bulk densities were assigned to MRI scans were greater. This is due to differences in patient contour due to both MRI spatial uniformity and patient positioning differences. Further work is required to quantify the errors due to spatial uniformity differences with a rigid phantom.