

AbstractID: 13802 Title: Commissioning of Varian Ring & Tandem HDR Applicators: Reproducibility and Inter-Observer Variability of Dwell Position Offsets

**Purpose:** Studies have shown that dwells within Varian HDR ring applicators can deviate from intended positions by several millimeters. Quantifying this offset is an important part of commissioning. The aims of this study were to 1) determine the reproducibility of offsets, 2) study the inter-observer variation in the measurement, and 3) quantify the dosimetric impact.

**Method and Materials:** Offsets were measured for 4 ring applicators. Applicators were taped to a piece of film and exposed on a simulator. An HDR plan with 10 dwells (1cm spacing) was delivered. The resulting image shows delivered dwell positions superimposed on the ring's lumen. Using this technique, dwell positions were measured five times for each ring to determine the reproducibility of source positioning. Data were analyzed by two independent observers. A cervical treatment plan was used to quantify the dosimetric impact of the offsets.

**Results:** For the 45 and 60 degree rings, measured offsets were 3.0mm and 3.6mm, respectively. The 30 degree ring showed substantial variation in distal dwell positions (maximum difference between experiments of 2.9mm), and was replaced by the vendor. Subsequent testing of the new ring showed an offset of 2.4mm that was more reproducible. When comparing observers, the average difference in measured dwell positions was 0.04mm (StDev = 0.4mm, max 1.3mm). Dosimetric consequences were generally small. Point A, bladder, and rectum doses varied by less than 1%, 2%, and 5%, respectively.

**Conclusion:** Results indicate that Varian rings can show systematic and random offsets of >3mm. Some can be considered defective and should be replaced. Each applicator should be individually commissioned and reproducibility should be confirmed with multiple tests. Inter-observer variability in the determination of dwell positions was less than 1.3mm. Offsets translated to < 5% variation in dose to critical structures, which is less than vendor-reported results (up to 20% variation).