Purpose: Electromagnetic tracking has been used to continuously monitor intra-fraction prostate motion. We report on the commissioning of a clinical electromagnetic tracking system with linear accelerator gating (DynamicEdge™GatingInterface, Calypso Medical Technologies, WA).

Methods: Routinely, the motion of the Varian Respiratory Position Management (RPM) block, an external surrogate, is used for gating. With the Dynamic Gating Interface (DGI), the positions of the internal transponders implanted in the tumor are used for gating. The gating limits, defined as +/- thresholds in all three axes around the machine isocenter, define the beam on/off boundary, with a beam hold when the limit is exceeded. An in-house developed 4D stage and a fixture containing three radiofrequency transponders were used for measurements. Beam stability, IMRT dose verification and latency were measured. The 4D stage was set to move in a repetitive sinusoidal pattern with peak amplitude of 1 cm at 15 cycles per minute.

For beam stability, the charge for non-gated vs gated beam delivery was compared. For IMRT dose verification, a solid water phantom with films sandwiched between planes was used. A gating window (±0.2 cm) was set for all five IMRT plans and gated dosimetric accuracy compared to static delivery. For latency measurements, a series of gated lateral MV integrated images were taken at an acquisition rate of 1 fps. By knowing the actual motion trajectory measured with electromagnetic tracking, one can compare the trajectory of the gated integrated image to obtain latency.

Results: The output stability for gated vs non-gated fields was within 1%. For IMRT fields, on average 90% of the points passed the 3% dose, 3mm DTA criteria. The average system latency was measured to be within 281 ms.

Conclusions: The DGI has been commissioned and is being used clinically for prostate cancer patients to manage intra-fraction motion. The latency may not currently be optimized for tumor sites exhibiting respiratory motion.