Purpose: To assess intrafraction prostate motion using the Calypso system and determine the related dosimetric consequences of this motion during the short treatment times utilized in fractionated RapidArc(RA)/SmartArc (SA) treatment of prostate cancer

Methods: Thirty patients previously treated with fractionated IMRT and Calypso were available for analysis. Calypso tracking data was acquired and was limited to 30 seconds prior to beam on time and 90 seconds of beam on time. Patients were then re-planned utilizing SA IMRT in Pinnacle v9.0 with PTV margins of 0, 2, or 6mm to a dose of 7920 cGy in 44 fractions. Probability density functions (PDFs) for motion in all directions were generated for each tracking session to represent the probability of displacement of the prostate in all directions. The planned static 3D dose distribution was then convolved with the PDFs to ascertain the true delivered dose. Dose metrics for the CTV, PTV, bladder and rectum were then acquired utilizing this dose convolution method, and the planned and delivered doses to these specific volumes were calculated and compared for each margin size.

Results: The prescription dose coverage of the CTV volume was not significantly altered from planning to delivery for PTV margins of 0mm, 2mm, or 6mm and remained >99% even for 0 mm margins. Mean dose to the CTV, PTV, rectum, and bladder was significantly greater as margins were increased without a significant change in either PTV or CTV coverage.

Conclusions: This study confirms that the dosimetric impact of intrafraction motion of the prostate when assessed with Calypso in patients treated with fractionated SA is not clinically significant over the course of 44 fractions. Due to the short treatment times, reduction of PTV margins is feasible without compromising CTV coverage even when intrafraction motion monitoring is not utilized.