Purpose: Investigate dosimetric variability between in-vivo dosimeters (DVS) coupled with real-time electromagnetic tracking beacons (Calypso) versus daily linear fiducial soft tissue markers (Visicoil).

Methods: Single fraction in-vivo dose measurements were collected from 20 patients that received surgically implanted bilateral dosimeters plus a position localizing device within the prostate. 10 patients were implanted with DVS dosimeters and Visicoil fiducial markers, and 10 with DVS dosimeters and Calypso position tracking beacons. Predicted dose was calculated with Eclipse TPS (Varian) and imported into the DVS dose reader. Each patient completed a full course of IGRT treatment (43 fractions, 180cGy/fraction). 934 DVS readings were collected over a 4-month period. Percentage dose variability between planned and measured dose was analyzed using a 1 tailed t-test with unequal variances. 3 frequencies of dose variability were compared (>5%, >7%, >10%). Respective p-values were calculated to test statistical significance between the two patient cohorts.

Results: 934 DVS readings (nVisicoil, DVS = 670, nCalypso, DVS = 264) were analyzed with the following average reading count per patient: n(Visicoil, DVS) = 33.5, n(Calypso, DVS) = 13.2. Average readings showed diverging dose variability frequencies. Visicoil frequencies: 80(11.9%) >5%, 33(4.9%) >7% and 7(1.0%) >10%; Calypso frequencies: 78(29.6%) >5%, 36(13.6%) >7% and 10(3.8%) >10%. P-values were calculated to show differences between the two cohorts using reading frequencies of two dosimeters (DVS1, DVS2) within the defined parameters (>5%, >7% and >10%). Results exhibited statistical significance within the following sets: >5% DVS1 and DVS2 (pDVS1 = 0.029 pDVS2 = 0.004), >7% DVS2 (pDVS2 = 0.021), and >10% DVS2 (pDVS2 = 0.019). 2 dosimeters did not satisfy statistical significance criteria: DVS1 (>7% pDVS1 = 0.088, >10% pDVS1 = 0.105).

Conclusions: This report shows how two coexisting technologies in-vivo can affect one another. Specifically, DVS dosimeters exhibit significantly different behavior when coupled with Calypso or Visicoil localizing devices.