AbstractID: 8647 Title: Dose perturbations caused by implanted helical gold markers used in patients receiving proton radiation therapy for prostate cancer

Purpose:
Implanted gold fiducial markers are widely used in radiation therapy to improve targeting accuracy; however recent investigations have revealed that metallic fiducial markers can cause extreme perturbations in dose distributions for proton therapy, suggesting that smaller markers should be considered. This study's objective was to test the dosimetric impact of various small helical, gold markers for tumor localization in patients receiving proton therapy.

Method and Materials:
Small, medium, and large helical wire markers with lengths of 10 mm and respective diameters of 0.04 mm, 0.25 mm and 0.5 mm were implanted in an anthropomorphic phantom. Radiographic visibility was assessed for a kV x-ray imaging system, and dosimetric impact was characterized by Monte Carlo simulations and measurements of proton dose. Acceptable dosimetric perturbation was estimated from previous studies to be 10%.

Results:
Radiographic visibility was confirmed for all markers considered. Monte Carlo simulations indicated that the size of the marker dose perturbation depended on marker size, orientation, and distance from the beam's distal fall off. Simulations also revealed that dose perturbation in the lateral, opposed field treatment-technique was 31% for large markers and 23% for medium markers in a typical orientation. Perturbation was not observed for the small marker, but it was deemed too fragile for transrectal implantation. Radiochromic film measurements confirmed the accuracy of the Monte Carlo model.

Conclusion:
Proton dose perturbations from medium and large sized markers exceeded 10%. This suggests that great care should be exercised if these markers are implanted in patients receiving proton therapy for prostate cancer.

Conflict of Interest (only if applicable):
A similar presentation of this work will be made at the ICRS, International Conference on Radiation Shielding; the ICRS presentation will be more preliminary and delivered to a different audience.