AbstractID: 8873 Title: Using the air/water interface to improve the accuracy of entrance dosimetry

Purpose:
To improve ionization chamber localization accuracy for depth-dose measurements used for TPS dose calculation algorithm commissioning and periodic linear accelerator QA.

Method and Materials:
Ionization chamber depth-dose scans are set to include points above the water surface, which produces inflections in the depth-dose curves. Monte Carlo simulations are performed with the EGSnrc Cavity usercode, which simulates the detailed ionization chamber and phantom geometries, and with DOSXYZnrc, which excludes the chamber geometry. The inflection point location in the Cavity simulation with respect to the chamber center quantifies the chamber's absolute location. The difference between the Cavity and DOSXYZnrc depth-dose results quantifies the ion chamber's effective point of measurement (EPOM) variation as a function of depth. Measurements and simulations are performed for 6 and 18 MV photon beams for multiple field sizes. Measurement results are aligned to the surface position by matching the computed inflection points.

Results:
The dose inflection point due to the air-water interface is clearly identifiable in both measurements and calculations. A Cavity simulation at 6 MV with a 10×10 cm^2 field finds that the inflection point occurs when the central electrode is ~1 mm beneath the water surface. After applying the recommended EPOM shift to Cavity simulation results, the distance-to-agreement between the Cavity computed "surface" dose and the DOSXYZnrc dose was >2 mm. By 1.0 cm depth, the distance-to-agreement is negligible. 18 MV simulations yielded discrepancies in the in-air dose, presumably due to differences in contaminant electrons.

Conclusion:
The proposed method of conducting depth-dose measurements is trivial to implement and provides a way to automatically account for, and correct, shifts and/or offsets in initial chamber positioning. This allows for improved matching, not only of measured and calculated data, but also of measured data such as that acquired in periodic QA testing.

Conflict of Interest (only if applicable):