AbstractID: 13893 Title: Real Time dose verification for Novel Shielded balloon brachytherapy

Purpose:
The validation of a novel approach for reducing skin doses to an acceptable level during Accelerated Partial Breast Irradiation (APBI) when the balloon-to-skin distance is inadequate (less than 7 mm) is reported. The study uses a real time dose verification method for a metallic shielded balloon applicator using scintillation fiber technology.

Method and Materials:
Partial shielding of the radiation dose to the skin using iron or other ferrous powder could enable the extension of APBI to some patients. With small external and pre-determined magnetic fields (<few Gauss), the metallic elements deposition can be controlled on the inner surface of a balloon. Geant4 simulations were used to generate an attenuation dose curve for various radiation lengths after cross-calibration with dedicated data acquired at Jefferson Lab. Some powder was then injected into various inflated MammoSite and rectal balloons within realistic breast and torso phantoms of differing sizes. The dose on the external surface of the skin was measured from a 6.1 Ci ^{192}Ir of a GammaMed 12i afterloader unit, with a MOSFET, ion chamber and scintillating fiber array detectors.

Results:
Realistic Monte Carlo simulation studies for the amount and distribution of the required shielding material were compared to dedicated phantom data. A decrease of the skin dose was measured to an acceptable level (≈350−450 cGy) during standard breast Brachytherapy treatments with relatively weak magnetic fields. Additional measurements provided negligible corrections (< few %) on the saline water density from the suspended iron powder.

Conclusion:
This project opens the possibility to increasing the survival expectancy and minimizing negative side effects during brachytherapy treatments, as well as improving cosmetic outcome for all APBI patients. The proposed method may also be used in other procedures for brain, heart, rectal, or vaginal cancers.