AbstractID: 6696 Title: Monte Carlo investigation of local shielding to reduce stray radiation doses to patients receiving proton therapy

Purpose: The purpose of this study was to quantify the effectiveness of local shielding in reducing the stray radiation exposure to a patient receiving curative proton therapy for prostate cancer by varying the thickness and material of the shielding in the treatment head.

Method and Materials: Effective dose, *E*, was predicted using Monte Carlo simulations of a 76-Gy prostate treatment with protons. A passive-scattering treatment nozzle was modeled together with a detailed anthropomorphic phantom. Protons, neutrons, and photons were tracked throughout the geometry. Tallies of energy deposition and fluence were made for these particles in selected organs. Eleven different compositions of shielding material were tested, and the thickness of additional shielding was varied from 0 to 35 cm. A comparison was made between using brass and tungsten alloy for the field-defining collimator.

Results: *E* from stray radiation for the unmodified nozzle was 583 mSv for the prostate treatment. Additional shielding of the treatment head reduced *E* by up to 66 mSv. Using tungsten alloy instead of brass for the collimator material reduced *E* by 50 mSv. Implementing both techniques together reduced *E* by 87 mSv.

Conclusion: This study suggests that a significant reduction in effective dose from stray radiation may be reasonably achievable for patients receiving proton therapy. By adding local shielding to the treatment head and exchanging the brass collimator with a tungsten alloy replacement, the effective dose to proton therapy patients from stray radiation was reduced by 15%.

Conflict of Interest (only if applicable):