AbstractID: 11674 Title: Uncertainty in the patient scatter and compensator scatter correction factor for proton therapy D/MU calculations

Purpose:
Interest in the tissue sparing benefit of proton therapy is growing. For lung and prostate cancer patients specifically, studies have shown that radiation pneumonitis and rectal bleeding may be reduced by using proton therapy. To verify these benefits on a large scale, multi-institutional studies are needed; however, a universal method of absolute dosimetry does not yet exist in proton therapy. Moreover, little is known about the conversion of absorbed dose values from phantom measurements to those inside a patient, the uncertainties related to this conversion or the effect of either on dose per monitor unit (D/MU) calculations. Thus, this study focuses on determining the uncertainty for one conversion factor (Fcsps), which accounts for scatter from the range compensator and internal patient scatter.

Method and Materials:
A sample of 16 prostate and 32 lung treatment fields was collected. Fcsps data was calculated by comparing pencil beam algorithm (PBA) and verification plan results. Then dose profiles were calculated parallel to the field axis and through the calibration point using Monte Carlo calculations (MCC) and PBA. The profiles were normalized to remove stopping power differences and compared. Differences in dose at the calibration point were taken as the uncertainty in Fcsps.

Results:
There was notable spread in the range of Fcsps data between prostate and thoracic regions which suggests dependence on patient anatomy. A maximum Fcsps value differed from unity by 7.4% indicating Fcsps as a significant factor in D/MU calculations. Differences between MCC and PBA calculated dose revealed as much as 6.9% uncertainty in dose calculations due largely to Fcsps. Additionally, positional errors of approximately 2 mm have potential to affect a 1.3% change in dose to the patient.

Conclusion:
In some cases, failing to account for Fcsps may substantially impact the dose delivered to the patient beyond acceptable uncertainties.