AbstractID: 13762 Title: A comparison of proton beam monitor units predicted by the treatment planning system and obtained from physical calibration

Purpose: To compare the proton monitor units predicted by the treatment planning system and obtained from physical calibration.

Method and Materials: Monitor units for proton beam calibration are product of the machine calibration factor (CF), mod factor (MF), Spread out Bragg Peak depth dose (SOBPPdd), field size factor (FSF), inverse square factor (ISF), off center ratio (OCR), and bolus gap factor (BGF). The CF is defined as 1cGy/MU at the center of modulation for the mod wheel 60. The SOBPPdd, MF, FSF, BGF and OCR were measured during the commissioning of proton machines for each beam energy. The proton beam monitor units in treatment planning system are calculated based on the OCR, MF, SOBPdd, ISF from virtual SAD and proton scatter parameters. The differences in the monitor unit calculation between the treatment planning system and from the physical calibration arise from the BGF, FSF and patient scatter. The BGF and FSF are handled correctly in the physical calibration. The patient scattering and heterogeneity are handled by the proton pencil beam dose kernel in the treatment planning system. The proton monitor units from the treatment planning system and physical calibration were compared for prostate, lung and brain patients.

Results: The differences in monitor units between the treatment planning system and physical calibration were within 1% for breast cases, and 3%for most of the other cases in the study. The differences increased at higher energy and for thicker compensators. There were also larger differences for some of the cases where the field sizes were smaller than 3 cm. The treatment planning algorithm does not always accommodate special treatment situations adequately.

Conclusion: Treatment planning algorithms cannot always accommodate special treatment situations. For such cases, in addition to routine MU calculation, it is important to carry out a physical calibration of treatment fields.