AbstractID: 13077 Title: Dose Perturbation by a Steel Magnetic Injection Port in a Breast Tissue Expander in Proton Radiotherapy: a Monte Carlo Study

Introduction: The use of a tissue expander in breast reconstruction is a popular option for patients undergo mastectomy. We applied Monte Carlo simulation to analyze the dose deposition from proton beams in the presence of a tissue expander containing a steel magnetic injection port.

Methods:. A steel injection port for breast tissue expander (Mentor®) was studied with a single anterior (AP) proton beam. A general-purpose Monte Carlo particle transport code FLUKA was applied for simulation. A 10x10 cm beam was delivered to a water phantom of 50x50x50 cm with the port positioned at the surface. Data on the proton fluence and dose deposited in phantom were collected for a range of initial proton energies forming the spread out Bragg peak (SOBP) of 100 to 200 MeV.

Results: Our simulation shows that low energy proton fluence is disturbed significantly by the presence of the steel injection port. Impact of the port components varies at the crossbeam plane. The needle shielding plate edge decreases fluence in the beam direction by almost at 30%. The proton range shifts about 50 % for lower energies (100 MeV) and 15% for higher energies (200 MeV). Dose changes at distances close to metal-phantom interface are between 5 and 10%; however, there are dramatic changes (up to 100%) in dose deposition at deep areas where the SOBP suppose to form. Combining multiple beams with various energies and weights into SOBP will cause multiple spots of significant over- and under dose.

Conclusions: The dose perturbation by a steel injection port for breast tissue expanders is significant if the implant is in a proton field. The accuracy in treatment planning with conventional algorithms may be questionable in the presence of the inhomogeneity. Avoidance of such metallic components should be considered if adjuvant proton radiotherapy is considered.