

AbstractID: 11224 Title: Comparing Geant4 and MCNPX for joint research to minimize uncertainties in proton therapy

Purpose: To “cross validate” the Monte Carlo codes (MCNPX and GEANT4) used at two different institutions for dose calculation and basic research in proton therapy. **Methods and Materials:** Geant4 and MCNPX are being used at the MGH (Massachusetts General Hospital) and at the MDACC (MD Andersen cancer Center), respectively, as Monte Carlo systems to provide simulations for research and clinical purposes in proton therapy. A current collaboration between the two institutions concerning the minimization of uncertainties necessitates a synchronization of the systems in order to produce consistent results. Simple validation geometries, consisting of a square brass aperture, half beam blocks, comprising lung and bone material, and a water phantom were used for initial synchronization of dose deposition from mono-energetic proton sources. More complex phantoms and source models were employed to solidify confidence in the validation. Finally, a CT volume of a human head, irradiated with spread out Bragg peaks was used to verify the validity of both Monte Carlo systems. The results of the simulations, lateral and longitudinal dose profiles were compared using absolute differences, the distance to agreement as well as the gamma analysis method. **Results:** All profiles agreed within 2 mm in the high dose gradient regions of the Bragg peaks, while the gamma analysis for a 2% and 2mm criterion resulted in 97.5% of all points in lateral depth doses and 95% of all points in depth dose profiles passing the test. **Conclusions:** With the proper choice of physics parameters, the two Monte Carlo systems produce results that agree very well. The use of different Monte Carlo systems at different institutions is, therefore, no source of additional systematic uncertainties in the ongoing research of minimizing uncertainties associated with proton therapy.