AbstractID: 14063 Title: Benchmarking MCNPX for carbon ion beams

Purpose: To investigate the accuracy of carbon ion beam dose deposition simulated with the MCNPX Monte Carlo code. **Method and Materials:** The capability for heavy ion transport was added to the MCNPX code beginning in v2.6, but to date there has been no benchmarking for use in radiotherapy applications. We have simulated the interactions of $^{12}C^{6+}$ ions in the energy range 130 - 430MeV/u using three versions of MCNPX, the 2.7b and 2.7c released versions, and a modified 2.7b_m version. The phantom consisted of a cubic PMMA container, 1.6mm thick, filled with water. The depth dose data obtained were normalized to their respective entrance doses and were compared to published experimental data. **Results:** We have evaluated the position and height of the Bragg peaks, curve shapes and exit doses. v2.7b did not generate projectile fragments while v2.7b_m did. While v2.7c calculates fragmentation in a manner similar to v2.7b_m, there are still substantial deviations from experimental data in the tail and in the region 6 mm proximal to Bragg peak. The positioning of the Bragg peaks and their heights were found to be acceptable. In the case of the 330MeV/u $^{12}C^{6+}$ beam, for example, the calculated peak locations coincided with measurements within available experimental uncertainties, and relative heights differed by less than 10%. At 6mm beyond the peak the predicted dose was almost 50% lower than the measured value and the simulated curve's width was larger by 2mm at the FWHM. **Conclusions:** The discrepancy in the tail of the distributions indicates that the released transport codes insufficiently model target and/or projectile fragmentation and transport. The discrepancy in FWHM suggests slightly incorrect stopping powers which might be due to the water ionization potential employed in the code. However, this is contraindicated by the good positioning of the peaks and is being investigated.