AbstractID: 12762 Title: The depth-dose curves of 126 MeV antiprotons in water using MCNPX simulation code

Purpose: To simulate dose contributions from various annihilation products to the depth dose profile for the irradiation of 126 MeV antiprotons in water using the MCNPX simulation code.

Methods and Materials: A cylindrical water phantom (100 cm long, 15 cm radius) was generated using MCNPX version 27-b. Cylindrical detectors (0.5 mm depth, 1 cm radius) of water were positioned along the central axis of the beam. Antiprotons with 126 MeV and 5 cm x 5 cm field size were used. Particle and photon transport in the code included pions, kaons, muons, secondary protons, neutrons, gamma and other heavy and light ions. Tallies utilized within the cylindrical detector region included the "+F6" collision heating tally and individualized "F6" tallies for detailing the energy depositions for the particles averaged over detector elements. A total of 100,000 histories were run. The depth-dose profile from antiprotons was compared to that of protons of identical energy and field size. The relative contributions from various annihilation products to the total antiproton depth-dose were studied.

Results: In shallow depth region, the dose levels for antiproton were slightly higher compared to proton due to antiproton's annihilations in flight. In Bragg peak region, the dose levels with antiproton were augmented by higher than 2 compared with proton, at iso-fluence, mainly due to antiproton's annihilations at rest. At peak depth, the contributions from antiprotons (without annihilations) were about two and six times higher than that from secondary protons and annihilation pions, respectively. The remaining part of the total dose was attributed to contributions from muons, kaons, gamma, light and heavy ions.

Conclusions: Our results are in excellent agreement with recent FLUKA simulation results. However, somewhat higher contributions from kaons to the total dose at the Bragg peak were observed compared to the previous study.