AbstractID: 11471 Title: Reducing the Simulation Time of a Prostate Cancer Clinical Setup by Two Orders of Magnitude

Purpose: Demonstrate the feasibility of utilizing the Fast Dose Calculator (FDC), a track repeating algorithm, for the simulation of a clinical proton radiotherapy setup including: beam nozzle with range shifter, aperture, range compensator and patient geometry. **Methods and Materials:** A database of discretized proton trajectories in water was generated with GEANT4. Information about the energy deposited, length and direction is stored for each trajectory step. Proton trajectories in any other material are extrapolated from the database by scaling step lengths and angles. Scaling parameters for various materials are obtained by comparing GEANT4 doses in the various materials to those obtained from FDC by scaling the trajectories in water. FDC allows for arbitrary geometry descriptions based on the geometry package of ROOT. The voxelized geometry from a CT-scan of a patient being treated for prostate cancer was used to simulate the dose deposited by a passively scattered proton beam. A beam defining aperture and a range compensator were included in the simulation. This setup was used to calculate the dose distribution produced by a proton beam defined by the phase space at the front-end of the aperture. In a second set of simulations a simplified version of a nozzle was included. In both cases the results were compared with a GEANT4 full simulation. **Results:** Doses calculated with FDC and GEANT4 were compared using the Gamma function. The comparison showed good agreement with less than 1% of the voxels with values above unity. FDC was found to be more than one hundred times faster than GEANT4. **Conclusions:** A fast track repeating algorithm has been tested in complex and realistic geometries for proton therapy. The algorithm preserves adequate accuracy and reduces calculation times by more than two orders of magnitude. Research Sponsored by the Gulf Coast Center for Computational Cancer Research.