

## AbstractID: 9252 Title: A Track Repeating Algorithm for Fast Proton Dose Calculations

**Purpose:** Monte Carlo tracking programs are utilized for accurate dose calculations in proton radiation therapy. They are superior to commonly used analytical dose calculations in accuracy, however, they are highly demanding computer resources. The aim of this work is to characterize fast algorithm for accurate dose calculations based on a track repeating Monte Carlo approach.

**Methods and Materials:** A few hundred thousand proton trajectories in water, generated with GEANT4, were stored in a database in discrete steps. The trajectories were utilized to calculate dose in various materials by rescaling the step length and angles between consecutive steps. The extrapolation is applied to a variety of materials, including bone and metals, which are important for patient with prostheses.

**Results:** The track repeating approach reduced the CPU time required for a complete dose calculation in a patient by more than two orders of magnitude. The track repeating approach reproduced the results from the traditional Monte Carlo approaches within 4% in dose and within 1 mm in distance to agreement.

**Conclusion:** A fast track repeating algorithm based on GEANT4 provided a substantial reduction in CPU time with very little loss in accuracy. The approach is not limited to GEANT4 and the developed tool can be utilized with other Monte Carlo programs.