AbstractID: 5707 Title: Implementation of the Varian Eclipse System for Proton Therapy Treatment Planning

Purpose: To configure and test a treatment planning system (TPS) (Varian, Palo Alto) for use with a passively-scattered proton therapy delivery system.

Methods and Materials: Since the mechanical designs of the commercial beam delivery apparatus (Probeat, Hitachi Limited, Japan) had not yet been completed, measurements of the required data were not possible. Instead, we designed our own therapy system components using analytical methods. The MCNPX (Los Alamos National Laboratory) Monte Carlo (MC) code was used to simulate beam profiles. Separate codes were developed to create the initial proton sources, the absorbed dose and fluence tallies, and simple homogeneous water phantoms (see Zheng *et al.*, separate contribution). Up to 10^8 proton histories were tracked per simulation to achieve < 2% statistical uncertainties. Additional codes were developed to generate ancillary TPS configuration files, e.g., for the range modulator wheels, flattening filters, and variable range shifter. The MC beam characteristics such as penetration range were compared with values from independent one-dimensional analytical calculations.

Results:
A complete set of configuration parameters and beam profiles were generated, including 832 dose and fluence profiles, in approximately four weeks (simulation time using 60 CPUs). With the simulated configuration data, the TPS has undergone extensive development and testing during the past year. Preliminary results indicate that the MC, TPS, and independent analytical calculations are in good agreement (< 4 mm differences in penetration range).

Conclusion:
The results of this study demonstrate the practicality of MC models to calculate beam data for configuring a proton treatment planning system. Additional simulations with the manufacturer's preliminary equipment designs are now in progress. Validation tests of Eclipse in heterogeneous media are in progress (see Titt et al., separate contribution). Confirmatory measurements are planned.

Conflict of Interest:
This work was funded in part by a research grant from Varian.