# AbstractID: 5195 Title: MC simulations in support of developing and testing an analytical dose algorithm in ocular proton therapy


**Purpose:** To create a Monte Carlo (MC) model of an ocular proton therapy device, or ocular nozzle, that can predict relative doses to within 3% or 0.5 mm, *D/MU* values, and be used to develop and commission an analytical algorithm to predict doses and *D/MU* values to within similar criteria.

**Methods and Materials:** Depth dose profiles and *D/MU* values were measured in eight ocular proton therapy fields including four unmodulated and four modulated beams using a parallel-plane ionization chamber in water. Crossfield profiles were measured at three or more depths for each of the modulated beams using film. A MC model of the ocular nozzle was constructed using the MCNPX radiation transport code. After benchmark tests against the measurements, the MC model was used to provide dosimetric data needed to develop a broad-beam algorithm capable of predicting relative and absolute doses and to test the algorithm's predictions more comprehensively than could be afforded with measured data. Specifically, MC and analytical predictions were calculated and compared in two-dimensions in a water phantom and in an anthropomorphic model of the eye.

**Results:** Relative depth dose profiles between MC and measurements agreed to within 3% or 0.5 mm. MC predicted *D/MU* values agreed to within 1% of the measured values. Similarly, the analytical algorithm accurately predicted dose distributions where the predictions were generally within 3% or 0.5 mm of measured and simulated values at water depth > 6 mm. At shallower depths, the analytical model underestimated the dose by approximately 3% to 6%, which MC simulations revealed was due to edge-scattered protons from the nozzle's collimators.

**Conclusion:** The MC model accurately predicted dose distributions and *D/MU* values in ocular proton therapy beams. Furthermore, the present work demonstrates the value of the MC method for developing and testing contemporary analytical dose algorithms.