# AbstractID: 13174 Title: Improving Computational Efficiency in Monte Carlo Simulations of a Passive Scattering Proton Therapy Treatment Head

**Purpose:** To increase the computational efficiency of the Monte Carlo simulation of a passive scattering proton therapy treatment head during the generation of a phase-space file.
**Method and Materials:** Geant4 Monte Carlo toolkit was used to simulate the transport of particles through the treatment head of a passive scattering proton therapy machine. With this application we have studied the impact that different aspects have on the time spent during the creation of a phase-space file. We have mainly been focused on discarding primary protons that unlikely will reach the phase-space plane. Further, a simplified and equivalent model of the ionization chambers within the nozzle, changes in the production cut values for secondary particles and the physics models included were also considered.
**Results:** most of the time is reduced by discarding the tracking of protons that will not reach the phase-space plane. For a 25-cm-diameter snout the average saved time is about 4% whereas a 30% of the time is saved for a typical case using a 12-cm-diameter snout. Moreover, a simpler and faster model of the ionization chambers reduces the time in 8-10%. However, changes in the production cut values do not save a large amount of time, provided that secondary particles are not being considered for tracking. In addition, the kinetic energy distribution of the beam can be biased with non-suitable production cut values.
**Conclusion:** we have developed some techniques to increase the efficiency of the Monte Carlo simulation of passive scattering proton therapy nozzle with Geant4. In our typical case around 35% of the time is saved. The work presented here can be used in Monte Carlo simulations of other passive scattering proton therapy treatment heads. Time reduction should be investigated for each particular case.