# AbstractID: 10308 Title: Characterizing Secondary Gamma Fluence from a Scanned Beam Proton Therapy Nozzle

**Purpose:** Recently, several studies have investigated the use of secondary prompt gamma-ray emission as a method for dose verification. The purpose of this study was to characterize the secondary prompt gammas produced within a scanned beam proton therapy nozzle. Characterizing the scattered gammas will help determine the prompt gamma fluence created within the treatment nozzle and its proportion to that created within the patient.

**Method and Materials:** Monte Carlo simulations were performed using a model of a clinical scanned-beam treatment nozzle to investigate the gamma fluence at the end of the nozzle. Energy spectrums were calculated for low, medium and high proton beam energies at the isocenter and several points off-axis. The energy peaks from the spectrum were used to identify specific nozzle elements responsible for the scattered photons. The simulations were also performed with a tissue phantom placed at the isocenter to estimate the ratio of scattered gammas radiation from the nozzle to scattered radiation from the patient.

**Results:** Calculated results show that the gamma fluence created in the nozzle is 1% of the gamma fluence created by the patient at isocenter. The gamma fluence from the tissue phantom falls off more quickly than the nozzle gamma fluence as you move laterally away from isocenter, resulting in up to 7% of the total gamma fluence coming from the nozzle.

**Conclusion:** Based on the proportion of gamma production by the nozzle and the significant oxygen and carbon emission lines from the nozzle, we think that in order to isolate the spectrum emitted from the patient from that emitted from the nozzle, it would be necessary to shield the detector from the prompt gamma produced in the nozzle.