# AbstractID: 11772 Title: Comparison of dose distributions for proton machines with in-room energy degradation with variable energy machines

**Purpose:**
To compare entrance and out-of-target dose values obtainable for single energy proton therapy treatment device with in-room energy degradation with a device that has variable energy selection.

**Method and Materials:**
MCNPX Monte Carlo simulations are utilized to create a hypothetical dual-scattering proton treatment delivery device in which a 250 MeV proton beam is delivered to the treatment room, independent of the desired treatment depth. Energy degradation is achieved in-line using a carbon range shifter located 1.2 m upstream of the isocenter location. Calculations of in-phantom depth-dose and in-air lateral and distance scans are performed for numerous range-shifter and range-modulator wheel settings to provide sufficient input data for a proton dose calculation algorithm. In-phantom and patient dose distributions for this device are compared with those for a delivery device capable of variable room entrance energies from 70-210 MeV.

**Results:**
For a $6\times6\times4$ $cm^3$ target located at 10 cm and 5 cm depth in a water phantom, entrance doses for a single energy device are 69% and 73.8%, respectively, while the variable energy entrance doses are 61% and 64.4%. For a one-field head-and-neck treatment plan, the single energy out-of-target doses are 5.7% higher than the variable energy device.

**Conclusions:**
The proton machine with in-room energy degradation shows higher entrance dose than the machine with continuous entrance energy due to increased energy straggling in the beam. Further investigations are warranted to establish the potential clinical significance of such deviations.

**Conflict of Interest:**
This work was funded in part by Varian Medical Systems.