AbstractID: 6507 Title: Analytical and Monte-Carlo (GEANT4) calculations of collimator scatter of proton beams

Purpose: Collimator scatter of proton beams is being implemented in the proton dose model in ECLIPSE (Varian). Due to the energy loss and angular scatter distributions at the collimator walls (brass) the spectrum of scatter protons is rather intricate. This contribution is significant for the 'horns' of transverse profiles verified in the initial plateau of Bragg curves. Using an analytical integration procedure of Bethe-Bloch equation and its application to the Molière multiple scatter model the calculated contributions are compared with measured data and Monte-Carlo calculations (GEANT4). The production of secondary protons and radiation effects is determined by an integration of the inelastic cross-section of the corresponding wall material over the energy.

Method and Materials: Monte-Carlo calculations have been carried out with GEANT4. Measurement data of transverse profiles and Bragg curves have been made available by the Harvard cyclotron and the proton center of MD Anderson (Houston).

Results: Material properties and collimator length have an influence to the beam-line (energy spectrum, fluence, angular distribution). Since the collimator edge act as further proton source, the distance to the water tank significantly affects the Bragg curves of small field sizes (from 0.5 x 0.5 cm^2 to 2 x 2 cm^2). For larger field sizes the collimator scatter leads to 'horns' in the transverse profiles and to a buildup effect in the initial plateau of Bragg curves.

Conclusion: Monte-Carlo and analytical calculations are in good agreement with measurement data. A practical impact is also application of proton beams to the stereotactic radiotherapy.

Conflict of Interest (only if applicable): Varian Medical Systems