AbstractID: 7001 Title: Development of a Novel Detector for Measuring Proton Energy Spectra

Purpose: The purpose of this study was to design an instrument for measuring proton energy spectra, and present energy deposition results that compare calibration runs with two state of the art Monte Carlo codes, HETC-HEDS, and GEANT.

Method and Materials: The proton energy spectrum analyzer developed in this study is based on a telescope called the Cosmic Ray telescope of the Effects of radiation (CRaTER), originally designed to achieve characterization of the global lunar radiation environment and its biological impacts. It employs a stack of silicon detectors and tissue-equivalent plastic (TEP) to establish the linear energy transfer (LET) spectra of cosmic radiation relevant for human and electronic parts considerations. Measured and calculated spectra were obtained using $dE/dX= (E_0-E_f)/L$, where E_0 and E_f are the energies of the particles as measured by the silicon detectors at either end of each TEP section and L is the length of the material.

Results: Results show a very good agreement between experimental and computer models. A comparison of the peak position shows that HETC-HEDS simulation of the instrument in a clinical proton beam yield a peak at channel 50. In comparison, the peak channel was 55 with Geant and 57 from the MGH data. The reason for the discrepancy is that the HETC-HEDS analysis was performed for energies down to 0.2 MeV, while the analyses with GEANT and the MGH data included around 20 more energy channels.

Conclusion: An LET energy spectrum was designed and computational testing for proton therapy. Comparisons between calibration runs and two simulation runs using GEANT and HETC-HEDS show promising results in being able to use the instrument for proton therapy calibration purposes. Future investigations will include analyses for different geometrical configurations, as well as investigating the detector's response to other charged particles.