

AbstractID: 14007 Title: Development of a proton beam double-scattering apparatus for radiobiology research.

Purpose: To develop a proton beam wheel-modulated, double-scattering (WMDS) apparatus which will produce a robust selection of proton fields for the support of radiobiology research goals at the University of Pennsylvania. **Methods and Materials:** A passively spread double-scattering design was chosen for its affordability, and wheel modulation was chosen for its established reliability. The proposed beam line apparatus will allow for a wide range of beam configurations due to its modular design. Beam specific modulation wheel, contoured second scatterer, and compensator design will be supported by the NEU code developed at the Harvard Cyclotron Laboratory. Component milling and construction will be carried out at the Roberts Proton Therapy Center (RPTC) where the finished device will be tested and ultimately utilized. An existing 230 MeV IBA cyclotron currently supporting clinical proton treatments at RPTC will supply an energy-selectable pencil beam to the WMDS apparatus. The WMDS apparatus will then passively shape this pencil beam to the desired modulated field. The apparatus will eventually be installed in the research-dedicated vault at RPTC. **Results:** It is expected that field sizes up to $100 \times 100 \text{ cm}^2$, with maximum water penetrations of up to 7 cm, will be obtainable given the available beam energies, apparatus dimensions, and 5 meter throw available at the proposed location. Smaller fields could bring maximum water penetrations of up to 30 cm with the possibility of full Bragg peak modulation. **Conclusion:** This beam line apparatus is currently under construction at the RPTC and is expected to be ready for testing by May 2010. Presently beam components are being designed to configure the apparatus for a very large, low dose rate, field to study the biological effects of low dose rate proton fields on astronauts. More clinically relevant configurations will eventually be employed for oncological radiobiology studies.