AbstractID: 8774 Title: Monte Carlo generation of phase spaces for dose computation in TomoTherapy

Purpose: Generate phase spaces using Monte Carlo simulations for TomoTherapy® dose computation, measure accuracy of phase spaces, and present properties of phase spaces. **Method and Materials:** The PENELOPE 2006 Monte Carlo code system is used to generate phase spaces for the TomoTherapy® treatment device. The PENELOPE geometry package is used to model the head of the treatment device for each one of the three possible field sizes: 1 x 40 cm^2, 2.5 x 40 cm^2 and 5 x 40 cm^2, and a phase-space plane is positioned downstream from the collimating jaws of the device. Incident electrons are projected onto the linear accelerator's target assembly and Monte Carlo transport is performed through the head of the linear accelerator until particles cross the phase-space plane. The incident electron energy distribution and the focal spot size are adjusted until the resulting dose profiles computed with a phase space match the TomoTherapy® open-field gold standard profiles. Fluence maps, dose profiles and off-axis spectra are presented. **Results:** A 5.5 MeV monoenergetic incident electron source produced optimal results. Computed dose profiles match the TomoTherapy® open-field gold standard profiles within 2% / 1mm. The energy spectra, fluence maps and dose profiles exhibit the shape produced by a treatment device with no flattening filter, such as the TomoTherapy® device: minimal beam hardening along the central axis, minimal spectral shape change as a function of off-axis angle, about 99.5% of the particles in the phase spaces are photons, and cone shape fluence maps and dose profiles in the lateral direction. **Conclusion:** Phase spaces for the three possible field sizes were generated. Dose computed from these phase spaces match TomoTherapy® gold standard dose profiles within 2% / 1mm and can be used for static or helical delivery dose computations.