Monte Carlo Simulation of Single-Plane Magnetically Focused Narrow Proton Beams

Supplementary Figures:

**Figure 1:** 2D longitudinal depth dose profiles in a water phantom are shown in A) for magnetically focused, and in C) for passively collimated (elliptically shaped collimator) proton beams. Cross sectional dose distributions at Bragg depth (71.0 mm) are shown in B) for focused, and in D) for collimated beams. Panels E) and F) respectively show overlapping longitudinal and cross sectional dose contour lines for both simulation cases (blue: 20% of ICRU Reference Dose (RD); green: 50% RD; yellow: 80% RD; orange: 90% RD). Note the close match of the planned treatment volume, defined as the volume containing >= 90% RD. The figure shows qualitatively the smaller entrance dose and penumbra volume of the focused case compared to the collimated case.

**Figure 2:** Central and Integrated Depth Dose Profiles are shown for both simulations cases. The panels qualitatively show the focused beams have a lower central and integrated entrance dose, as well as a lower total integrated dose compared to the collimated case.