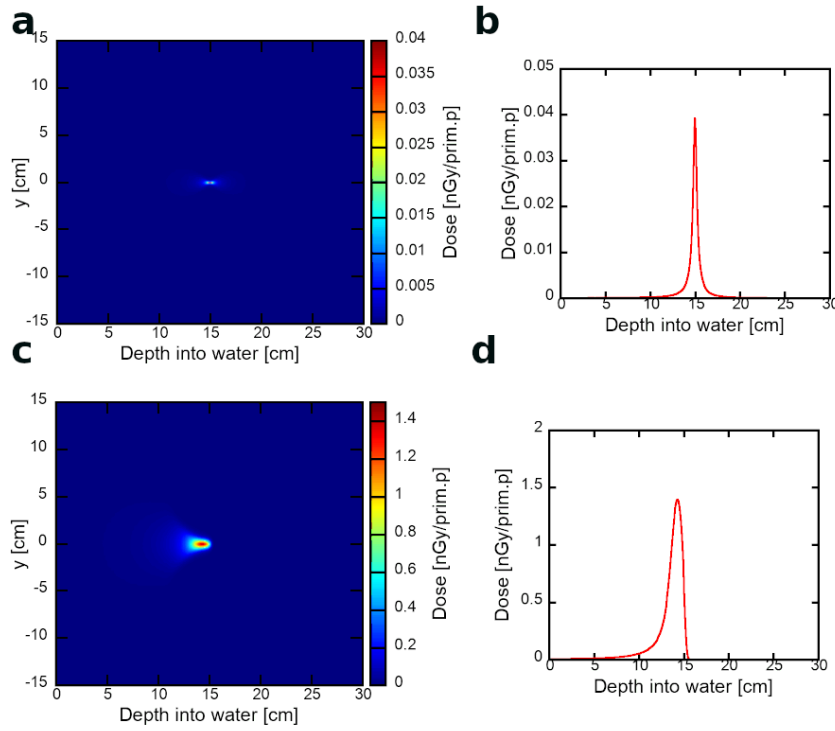
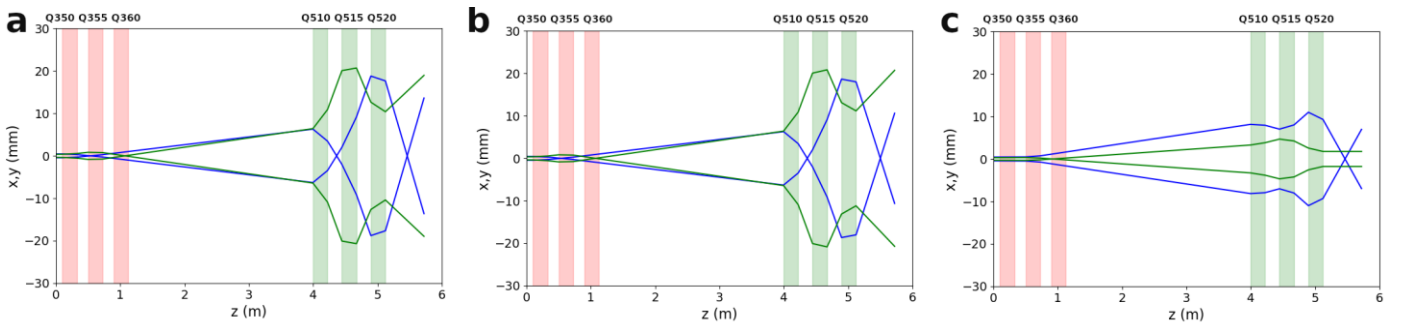




Supplementary Figure 1. Fluka simulations. Simulations of 2D and 1D dose distributions for beams focused with $f/1.2$ at 15 cm in a $30 \times 30 \times 30 \text{ cm}^3$ water phantom. 2D (a) and 1D (b) dose distribution for 6 MV photons, and 2D (c) and 1D (d) dose distribution for 147 MeV protons.



Supplementary Figure 2. Optimised beam envelopes. (a) 158 MeV and $f/11.2$, (b) 158 MeV and $f/12.3$ and (c) 201 MeV and $f/18.2$. The blue and green lines are beam envelopes in the horizontal and vertical planes, respectively. The quadrupole magnets are marked with red and green bars.