Proton Range Compared to the Treatment Planning Modeled Range

Part of the commissioning process for a proton facility requires the measurement of a large number of depth doses for a variety of ranges and modulations. These measurements are taken in every treatment room and compared to the predicted depth dose supplied by the treatment planning system, in our case Xio.

In this investigation, we were interested in comparing the range of the protons measured in the treatment room to the range predicted by Xio. The range is defined as the point where the distal edge of the depth dose curve is equal to 90% of the average value of the dose across the spread out bragg peak. This value is of particular interest because this evaluation will quantify the uncertainty associated with the range of the proton beam, which is then entered back into the treatment planning system. This allows Xio to make appropriate suggestions for ranges with the necessary uncertainty included in the suggestion.

Our clinic contains four treatment rooms. Below are charts of the deviations between the ranges measured in the treatment room and the ranges calculated by Xio for each treatment room.

The maximum deviation was found to be 1.6 mm, with the majority of range/modulation combinations falling under 1 mm.

The uncertainty in range chosen to be used for treatment planning purposes is 1.5mm.