Proton therapy is the standard of care for treating ocular malignancies and often performed on a horizontal beamline dedicated exclusively to ocular treatments. Commercial equipment for performing routine QA on non-dedicated proton systems, such as detector arrays or multilayer ionization chambers, are often not practical for utilization in ocular beamlines. In this work, we designed, fabricated, and validated a 3D printed phantom used for simultaneous measurements of absolute proton range and X-ray-to-radiation coincidence. An Ender 3 Pro printer was used to print a phantom from polylactic acid designed with a cone (width=23mm and height=7mm) mounted on top of a 25mm water box. Gafchromic film was placed behind the phantom (Figure 1) and irradiated to 300cGy with circle diameters on exposed film proportional to the proton range. Multiple exposures were performed by decreasing proton range using a variable water column to generate a calibration curve relating proton range to circle diameter of exposed film. A BB placed in the center of the film was used to check X-ray-to-radiation coincidence. Overall, proton range determined using the phantom was within 0.1mm to Markus chamber measurements. Proton range and X-ray-to-radiation coincidence measurements were sensitive to within 0.1mm and 0.2mm, respectively. Time for set-up, measurements, and analysis took <5 minutes and is included in the daily QA procedure on our institution's ocular beamline.

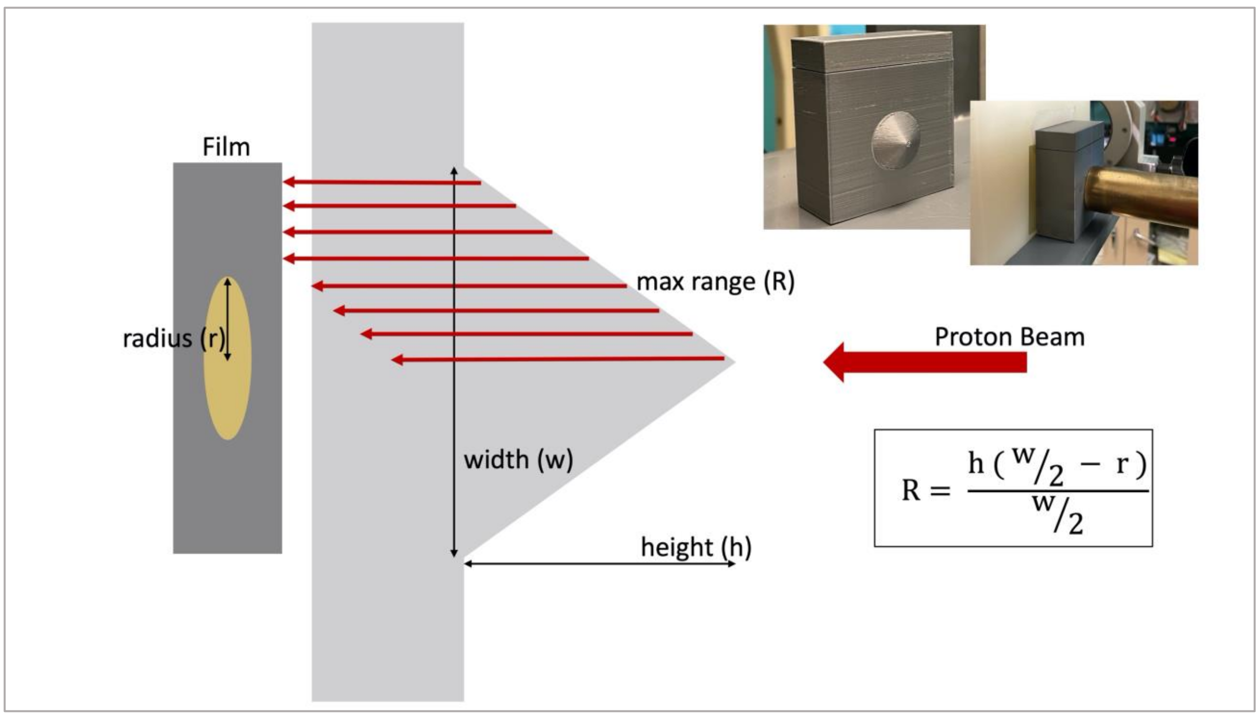

Figure 1: Phantom design with cone mounted on rectangular water box. Gafchromic film placed behind the phantom was irradiated to generate a diameter vs. proton range calibration curve.

References:

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