AbstractID: 10110 Title: Dosimetric validation of the proton-sensitive BANG® 3 PRO-2 polymer gel dosimeter irradiated by single field therapeutic proton beams

Purpose: A dosimetric validation of the next-generation 3D polymer gel dosimeter (BANG®-3-PRO-2) developed for proton radiotherapy dosimetry is presented. Dose response curve is determined using both proton and electron beams. Lateral and depth profiles are compared to ion chamber measurements. 2D dose distributions are evaluated against those generated by a treatment planning system (TPS). **Methods and Materials:** The dosimeters were read out using a characterized optical computed tomography scanner. The calibration was performed by correlating the change in optical density along the beam axis to the depth-dose curve from a pristine proton beam delivery (28.4 cm range, 4.5 cm circular aperture) obtained using ion-chamber measurements. The dose range of 150-650 cGy was covered. Depth and lateral pristine-beam and spread out Bragg peak (SOBP) dose profiles were compared to ion-chamber measurements. **Results:** The dose response exhibited a sigmoid behavior in the studied dose range. The dose distributions read out from the dosimeters showed good agreement with ion chamber scanned profiles and were able to accurately reproduce the key features of the expected dose distributions. Planar dose along the beam axis were compared to the Eclipse TPS dose maps using the gamma metric with Δd=3 mm and ΔD=3% or 15 cGy, whichever is greater. Over 95% of dose points pass these criteria. For SOBP delivery (315 cGy peak dose), no response quenching in the peak region (characteristic of other dosimeter types) was observed. For a pristine beam delivery (300 cGy peak dose), the gel dosimeter demonstrated a ~5% under-response at the Bragg peak. **Conclusion:** This new polymer formulation is capable of reproducing single proton beam dose distributions with high spatial accuracy. Under dosing response in the BP or SOBP due to LET dependencies was found to be insignificant and superior to many other currently used proton-sensitive dosimeters.