AbstractID: 10429 Title: Quality Control of External Beam Treatment Delivery: Mechanical Parameters

Purpose: The focus of this study is to develop a methodology using statistical process control (SPC) that provides effective quality control of mechanical parameters in external beam treatment delivery. **Materials and Methods:** A four-field box clinical treatment technique was used as the evaluation tool. Parameters tested were gantry angle, table height, table lateral, and collimator field size. The dosimeter, GafChromic EBT film, was placed vertically in a pelvic phantom in the transverse plane at isocenter. All films were digitized and evaluated using a Vidar film scanner and RIT, Inc. software. Dose distributions of accurate treatment delivery were measured and compared to treatment delivery with a single mechanical parameter deviated at 0.5, 1.0 and 1.5 times the TG-40 parameter specification. Each distribution was sampled in the penumbra region using three sampling sets (SS). Each SS consisted of different (size and/or position) regions of interest (ROI). Set-A and B were 1.5cm x 1.5cm while Set-C was 0.8cm x 1.0cm. Set-A and C were centered in the same locations along each beam entry 7cm from isocenter. Set-B was positioned at the corners of the dose box in the distribution. **Results:** Two process behavior charts (PBC) were prepared for each SS, evaluating the mean dose and mean dose range. PBC for Set-A were unable to distinguish between accurate and inaccurate distributions. Set-B detected all mechanical parameters deviated at 1.0 and 1.5 times the TG-40 specification but also indicated four false-positives. These PBC were also effectively unable to distinguish between the accurate and inaccurate distributions. Set-C PBC detected all mechanical parameters deviated at the 1.0 and 1.5 level and reliably indicated the inaccurate distributions. **Conclusions:** Small and therefore more homogeneous, strategically located ROI can be effective in SPC to detect inaccurately delivered treatments. Quality control of linac mechanical parameters can be performed using SPC-based methodology.