AbstractID: 9645 Title: A Software Tool To Adapt The QUASAR Penta-Guide Phantom To Make An Additional Measurement Of Cone Beam CT Image Sharpness

Purpose: The QUASAR Penta-Guide phantom was designed to check alignment of kV imaging and MV treatment systems on IGRT linacs with integrated Cone Beam CT (CBCT). Misalignment of the imager panel parallel to the rotation axis is the most likely cause of misregistration of the CBCT image with the MV isocentre on the Elekta Synergy system. However, misalignment perpendicular to the rotation axis will cause image blurring. A method of using the QUASAR Penta-Guide phantom (MODUS) to measure image sharpness has been developed and evaluated as a routine quality control check. **Method and Materials:** Cone Beam CT image data of the Penta-Guide phantom was extracted from equispaced conical sections centered on the air-cavity and collapsed onto equispaced line profiles across the air-cavity edge in the axial plane. A Gaussian burring model was assumed in a curve fit to each line profile. The Gaussian width for all profiles was averaged and converted to MTF_{50}. The sensitivity of the measurement was tested by repeat reconstruction with simulated imager displacements. A similar panel displacement simulation was applied to CBCT images of the CATPhan 600 line pair test object to compare with the MTF_{50} measurements. **Results:** On five repeat scans, a peak MTF_{50} occurred for panel displacements between -0.2mm and 0.4mm. A 1mm displacement reduced the MTF_{50} by 11%. The confidence interval on the peak MTF_{50} was [0.273, 0.282] enabling imager misalignments of greater than 0.4mm to be determined with 95% confidence. A 0.5mm misalignment was noticeable in patient images. A similar shaped curve was observed for CATPhan images showing a maximum limiting resolution of 8 lp/cm which reduced to 3lp/cm for a 1mm displacement. **Conclusion:** The Penta-Guide phantom can be used to routinely check CBCT image sharpness without the requirement for an additional CATPhan scan.