AbstractID: 13055 Title: Geometric uncertainty evalution of proton beam delivery

Purpose:
To develop a method to measure the agreement between the isocenters of a proton beam and the x-ray system used to position the patient. X-ray portal images are performed for the setup and all proton beams. The isocenter of proton beams can vary with rotation of couch, gantry and MLC and differ from X-ray isocenter. Couch corrections are determined for each gantry angle to maintain the concentricity with the proton beam and the virtual crosshair of the x-ray system is adjusted with gantry angle before initial clinical use to account for the change.

Method and Material:
A 50.8-mm diameter steel ball is placed at the isocenter and aligned with the 50.8-mm sphere target exported from the Eclipse treatment planning system to Medcom's X-ray acquisition system at the setup and different gantry angles. Variation of the metal ball from the spherical target at different gantry, MLC rotation and couch angles is quantified by delivering star pattern treatment plans that have 10-mm width. Both MatrixX and films are used with Omnipro IMRT software. Different levels of isodose are used for the best recognition of metal ball and star patterns. The asymmetric magnitude is reported for the symmetric fields after centering the metal ball or elliptical beam center of star patterns.

Results:
When metal ball is aligned with virtual crosshair at setup position, up to 2 mm variation of isocenter is reported by both the X-ray portal images and proton star patterns for the rotation of couch, gantry and MLC. When the metal ball is corrected with X-ray virtual crosshair at different angles, the variation of proton beam isocenter is reduced to below 1 mm.

Conclusion:
A method is established to measure the concentricity of proton beams with X-ray portal images and rotation of couch, gantry and MLC.