

Title:

Measurement of the mechanical isocenter of a proton gantry

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Purpose:

To investigate a method to analyze the position and accuracy of the gantry mechanical isocenter in a proton gantry. The outcome measurements can be incorporated into a couch correction algorithm to compensate for gantry imperfections.

Materials and Methods:

A 2-inch steel sphere is fastened to the patient couch, close to the mechanical isocenter of a proton gantry. An assembly of 3 mutually perpendicular dial gauges touching the surface of the steel sphere and 5 clinometers is attached to the proton snout. The 210 ton Hitachi proton gantry, installed at the MD Anderson Proton Therapy Center in Houston, Texas, is rotated with speeds of 1 revolution and 0.5 revolutions per minute in clockwise and counterclockwise directions. Simultaneously dial gauge data and clinometer data are recorded on a personal computer using software designed for the purpose of this project. The mechanical isocenter and its uncertainty are obtained by analyzing the trajectory of the dial gauge tips as a function of gantry angle.

Results:

Our measurement results show the isocenter of the Hitachi proton gantry having an uncertainty sphere within 0.8 mm, and with little hysteresis effect (0.03 mm) when the gantry makes a full rotation.

Conclusion:

Our method successively demonstrated the ability to accurately determine the mechanical isocenter and its uncertainty.