Purpose:Utilization of an aSi EPID to develop an in vivo patient dose verification system for rotational IMRT (rIMRT) delivery requires accurate knowledge of gantry angle as a function of time. Currently the accuracy of the gantry angle stamp in the header of the EPID image is limited to approximately +/-3 degrees. This work investigates several unique methods for a more accurate determination of the gantry angle during rIMRT.

Methods:Gantry angles were determined using: (1) an incremental rotary encoder attached to the rotational axis of the gantry, (2) a direct analogue-to-digital measurement of the gantry potentiometer, and (3) through EPID image analyses of an in-house phantom (manufactured at sub-millimeter precision). The phantom consists of a cylindrical acrylic frame with one wire wrapped helically around its surface and one straight wire traversing its central axis. This design creates EPID images with unique and identifiable wire intersection points as a function of gantry orientation. Analysis of the treatment console log files was compared to the above methods.

Results:The gantry potentiometer is considered the most accurate gantry angle but is unavailable during treatment. The ClinacLog produced discrepancies of up to ±2 degrees, the DynaLog up to ±1 degrees, and the encoder up to ±0.5 degrees with respect to the potentiometer. Preliminary analysis comparing our phantom-determined gantry angles with the encoder gantry angles showed agreement within ±0.5 degrees of each other for 85% of the data and differed at most by 1.3 degrees from each other.

Conclusions:We have developed several techniques to determine gantry angle as a function of time during rIMRT. We have shown a strong agreement in gantry determination by our phantom and encoder. This investigation of gantry angle is critical to develop an accurate in vivo patient dose verification system for rIMRT delivery.