Purpose: Regular measurement of the coincidence of CBCT image with the MV treatment beam isocentre is an important component of quality assurance for CBCT based IGRT. In this work the coincidence of the imaging isocentre (kV-CBCT) with the treatment isocentre measured using the EPID (MV-EPID) has been measured over an extended period using an algorithm developed to perform the measurement automatically.

Methods: The treatment isocentre was computed by analysing EPID images of the PentaGuide phantom (MODUS Medical Devices) for gantry angles of 0°, 90°, 180° and 270° with collimator angles of 90° and 270°. The position of the centre of the PentaGuide's central air cavity was calculated relative to the radiation isocentre using the EPID images and relative to the CBCT isocentre in the CBCT images. The vector difference between these two measurements gave the coincidence of the MV radiation isocentre and kV-CBCT image origin. Processing was performed on the development platform of the ARTISCAN software (AQUILAB, Lille, France) which utilised image processing to automate these calculations directly from the DICOM images.
The software was first validated using simulated MV and CBCT images of the phantom with known offsets. Site validation was performed with the Synergy system (ELEKTA, Crawley, UK) and using the Hexapod system (ELEKTA) to offset the phantom. In addition, 10 measurements were performed on two Synergy systems over a 17 months period during site validation.

Results: No deviations were observed using the simulated images, and phantom position measurements were confirmed with the offset phantom during on-site validation with minor deviations of: absolute mean error MV and kV was 0.33 mm and 0.35 mm respectively. The distance between isocentres was less than 1 mm over the period of testing (max=0.53, mean=0.26, std=0.16).

Conclusions: The algorithms developed show efficiency and reliability for automatic QA of the isocentre position.