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Abstract

# Validation of Commercial Software for Winston-Lutz Test

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## Abstract

Objectives: Accurate knowledge of machine isocentricity is critical for radiation therapy and especially important for stereotactic radiosurgery (SRS) and stereotactic body radiation therapy (SBRT) treatments. The coincidence of radiation and imaging isocenter is also paramount in an era of image guided treatments. We have streamlined the QA process in order to simultaneously evaluate the treatment and imaging isocenters using a commercially available software - PipsPro (v4.5, Standard Imaging).

Methods: Winton-Lutz pointer is aligned based on light field and crosshairs. Orthogonal kilovoltage images of the pointer are acquired and if required the pointer is further adjusted so that it is aligned with the imaging isocenter. Eight megavoltage images of the pointer are acquired at various combinations of gantry and couch angles. The acquired images are exported from our record and verify system and imported into PipsPro for analysis. In order to make corrections based on the results from PipsPro, the coordinate system convention within PipsPro as well as the accuracy of results needs to be verified. To that regard, the above technique was repeated with various, predetermined shifts of the pointer from a reference isocenter.

Results: PipsPro correctly reads in the gantry and couch angles from the DICOM headers of the image. Results show that the image processing within PipsPro performs accurate determination of deviation of the center of pointer from center of radiation field. From our offset-pointer tests and the projection of the pointer in the 2D images, we are provided with the information to decipher the imaging coordinate system. The 3D location of isocenter is accurately determined from 2D deviations as noted from projection images. The 3D deviation of the pointer during the offset-pointer tests match the true pointer offsets in magnitude and 3D coordinate convention is thus verified. The precision of the results depends on the pixel resolution of the acquired images and the overall results can be determined to within sub-millimeter accuracy. The entire test including setup and analysis can be completed in less than 20 minutes using our method. The image export and analysis portions can be completed within two minutes and has been streamlined with the use for batch files for quick processing. The gantry, couch and projection image coordinate systems are determined one-time during the validation process and can be used during subsequent tests for pointer adjustments.

Conclusions: With increasing demands for hypo-fractionated treatments and the requirement for frequent isocentricity checks, a quick Winston-Lutz test tool is crucial. Our validations show that PipsPro provides accurate representation of the deviation from isocenter and can be used as a useful tool for LINAC QA before hypo-fractionated treatments.

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