Auto Analysis Commissioning on EPID Image based Winston-Lutz Tests

J. Xu, C Kalavagunta, J Xu
Department of Radiation Oncology School of Medicine,
University of Maryland, Baltimore, MD

INTRODUCTION

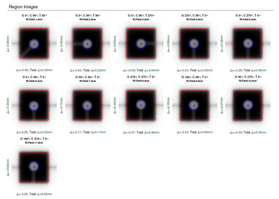
In an auto analysis QA system, multiple factors, e.g. the reliability of algorithm to detect imaging and radiation isocenter, may affect the result of Winston Lutz tests and accuracy of SRS plans delivery to patients in further.

This project aims to commission an auto analysis QA system on EPID image based Winston Lutz tests through comparing and quantifying differences between two systems.

METHOD

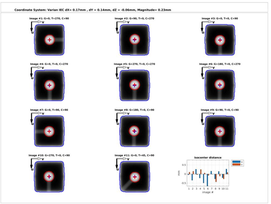
Winston Lutz QA plans using MLC or cone applicators are delivered on a Varian Edge machine. And EPID images with a BB target setup at the imaging isocenter in small radiation fields at geometries composited by different gantry, collimator and couch angles are imported to Total QA and DoseLab Pro 7.

Figure 1. The Winston Lutz QA report of DoseLab Pro 7



3D target position
X position: +0.17 mm
Y position: +0.10 mm
Z position: -0.07 mm

Figure 2. The Winston Lutz QA report of Total QA



Filename	Gantry Angle	Couch Angle	Collimator Angle	dU	dV	Magnitude
RLField.3.dcm	0.0	270	90	-0.54	0.1	0.11
RLField.18.dcm	90	0.0	270	-0.34	0.15	0.37
RLField.6.dcm	0.0	0.0	90	0.27	-0.03	0.27
RLField.5.dcm	0.0	0.0	270	-0.22	0.25	0.33
RLField.8.dcm	270	0.0	270	-0.49	0.06	0.49
RLField.11.dcm	180	0.0	270	-0.66	-0.07	0.67
RLField.2.dcm	0.0	90	90	0.16	-0.01	0.16
RLField.9.dcm	180	0.0	90	-0.26	-0.43	0.5
RLField.7.dcm	90	0.0	90	0.15	-0.11	0.19
RLField.4.dcm	270	0.0	90	-0.3	-0.27	0.33
RLField.1.dcm	0.0	45	90	-0.28	0.09	0.29

The endpoints, maximum offset from imaging center to the center of radiation in all fields and coincidence between imaging and radiation isocenters are used in evaluation.

Moreover, to quantify the scale of uncertainties in two auto analysis systems, 0.5mm and 1 mm shift are introduced in BB's alignment. Then EPID images with a known offset are analyzed by two systems.

RESULTS

Winston Lutz MLC plan

- The average difference of the maximum offset calculated by Total QA and DoseLab is -0.029mm with 0.046mm SD. The difference of the isocenter coincidence is less than 0.07mm.
- Total QA detected 0.5 mm shift in the range of 0.2 to 0.67mm. And DoseLab detected this known shift in the range of 0.24 to 0.66mm. The number of failure field (≥ 0.90) is same as that of DoseLab. The offset detectable in 3D target positon has the maximum difference in 0.02 mm
- Total QA detected 1.0 mm shift in the range of 0.2 to 0.67mm. The number of failure field (≥ 0.90) is 3 less than that of DoseLab. The offset detectable in 3D target positon has the maximum difference in 0.05 mm

Winston Lutz cone plan

- The average difference of the maximum offset calculated by Total QA and DoseLab is -0.019mm with 0.068mm SD. The difference of the isocenter coincidence is less than 0.03mm.

Figure 3. The difference of offset from imaging center to the radiation center calculated by Total QA and DoseLab in each field of Winston Lutz MLC plan. The blue bar represents the x direction on the EPID images and the yellow one represents the y direction.

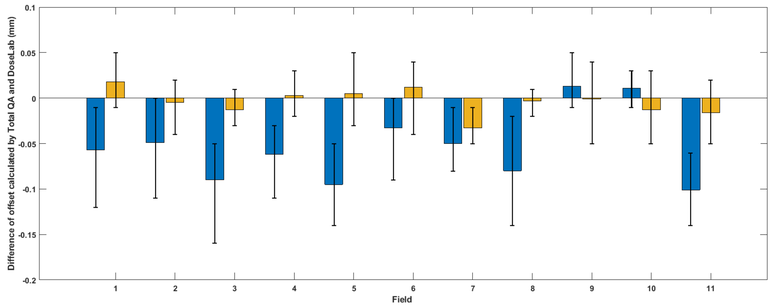
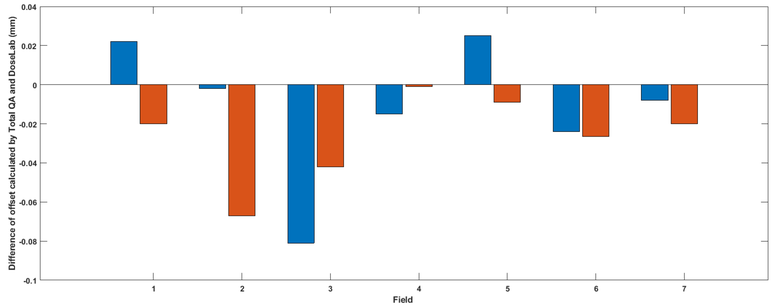


Figure 4. The difference of offset from imaging center to the radiation center calculated by Total QA and DoseLab in each field of Winston Lutz cone plan. The blue bar represents the x direction on the EPID images and the red one represents the y direction.



CONCLUSIONS

Considering 1mm tolerance of Winston Lutz tests, auto analysis of Total QA and DoseLab Pro 7 are comparable.

CONTACT INFORMATION

Jingzhu Xu's email: Jingzhu.Xu@umm.edu