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Verification of MV Radiation Isocenter Using the CIRS ISO Phantom Model 23A

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INTRODUCTION

With advances in radiation techniques, high levels of mechanical precision are needed to accurately deliver radiation fields. TG-142 recommends annual verification of the mechanical and radiation isocenters. Older linacs still in use in many clinics may require more frequent monitoring. However, these tests can be time consuming.

Many vendors have developed products to assist physicists with routine QA of their linacs. These tools can simplify QA workflows for the clinical physicist, especially when coupled with analysis software. CIRS recently redesigned their ISO Phantom for the analysis of mechanical, radiation, and imaging isocenters.

AIM

The purpose of this study is to evaluate the accuracy of the new CIRS ISO Phantom and accompanying ISO Analyze software in determining the radiation and mechanical isocenter of a linear accelerator. Additionally, we set out to evaluate the impact of the new phantom and software on data collection and analysis efficiency.

METHOD

To evaluate the software we performed Isocenter measurements on an Elekta Synergy using traditional techniques and the CIRS ISO Phantom.

Traditional Techniques Include:

- Winston-Lutz Test with Elekta BB phantom
  - 8 images including two couch kicks
- 3 Starshots with film for the gantry, couch, and collimator
  - 8 gantry
  - 8 collimator angles
  - 5 couch positions
- Analysis performed following clinical protocol using commercial software

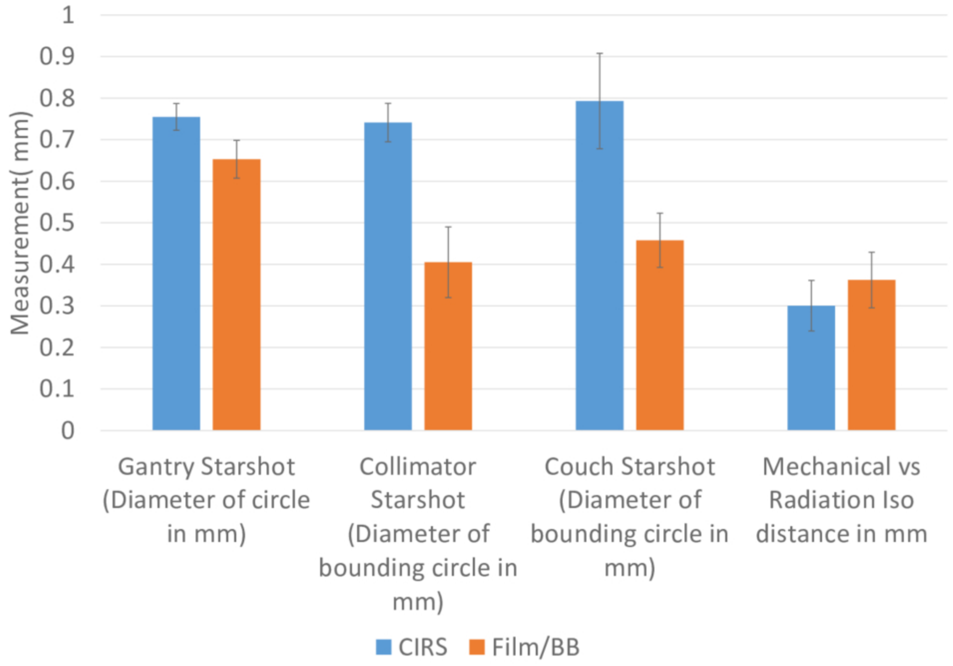
These measurements were repeated using the CIRS ISO Phantom Model 23A and analyzed by the CIRS ISO Analyze software. The software automatically handles image importing and labeling, as well as, analysis for all the metric.

Timing measurements were completed by measuring:

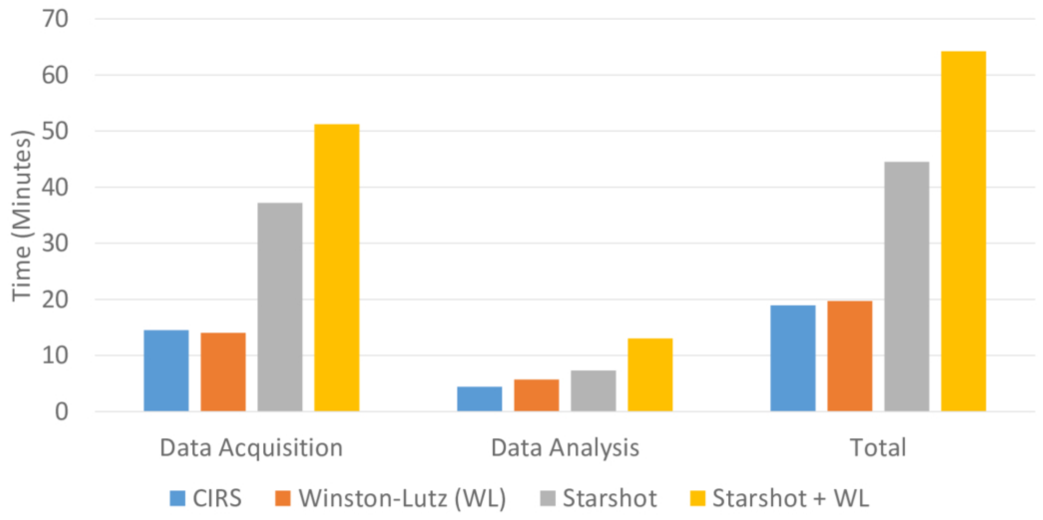
- Phantom Setup Time
- Measurement Time
- Data Analysis and Pre-Processing

RESULTS

- All differences in measurements were less than 0.5 mm
  - Phantom is accurate for routine QA
- Winston-Lutz results matched within 0.07 mm
- Starshots exhibited disagreement
  - ISO Phantom results are theorized to be dependent on initial alignment, as it relies on the central BB
  - Further study is needed
- The ISO Phantom data collection and analysis was 3.4 times faster than the traditional techniques (19±1.2 minutes vs 64±3.3 minutes).
  - Most of time is taken performing star shots using traditional techniques
  - ISO Phantom was able to collect the starshot information with an additional minute of measurement time



Plot of the measured results for the shotshot and Winston-Lutz tests using both techniques.



Plot of time, in minutes, to perform data acquisition and analysis for the ISO Phantom and traditional techniques. Note that a majority of the time was spent performing starshot aquistions.

CONCLUSIONS

- The CIRS ISO Phantom accurately measured the radiation MV isocenter within 0.5 mm.
- The measurement time with the ISO Phantom including the Starshot-equivalent measurement was the same as the Winston-Lutz alone for the traditional measurements
- Faster data acquisition and analysis makes it feasible to perform the tests more often
- This may be critical for validating the performance of older machines, where mechanical wear may cause increased variation in the isocenter position and require more frequent checks

REFERENCES

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