



A New Generation of Quality Assurance For Radiation Oncology



Computer Integrated Surgery II
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Introduction

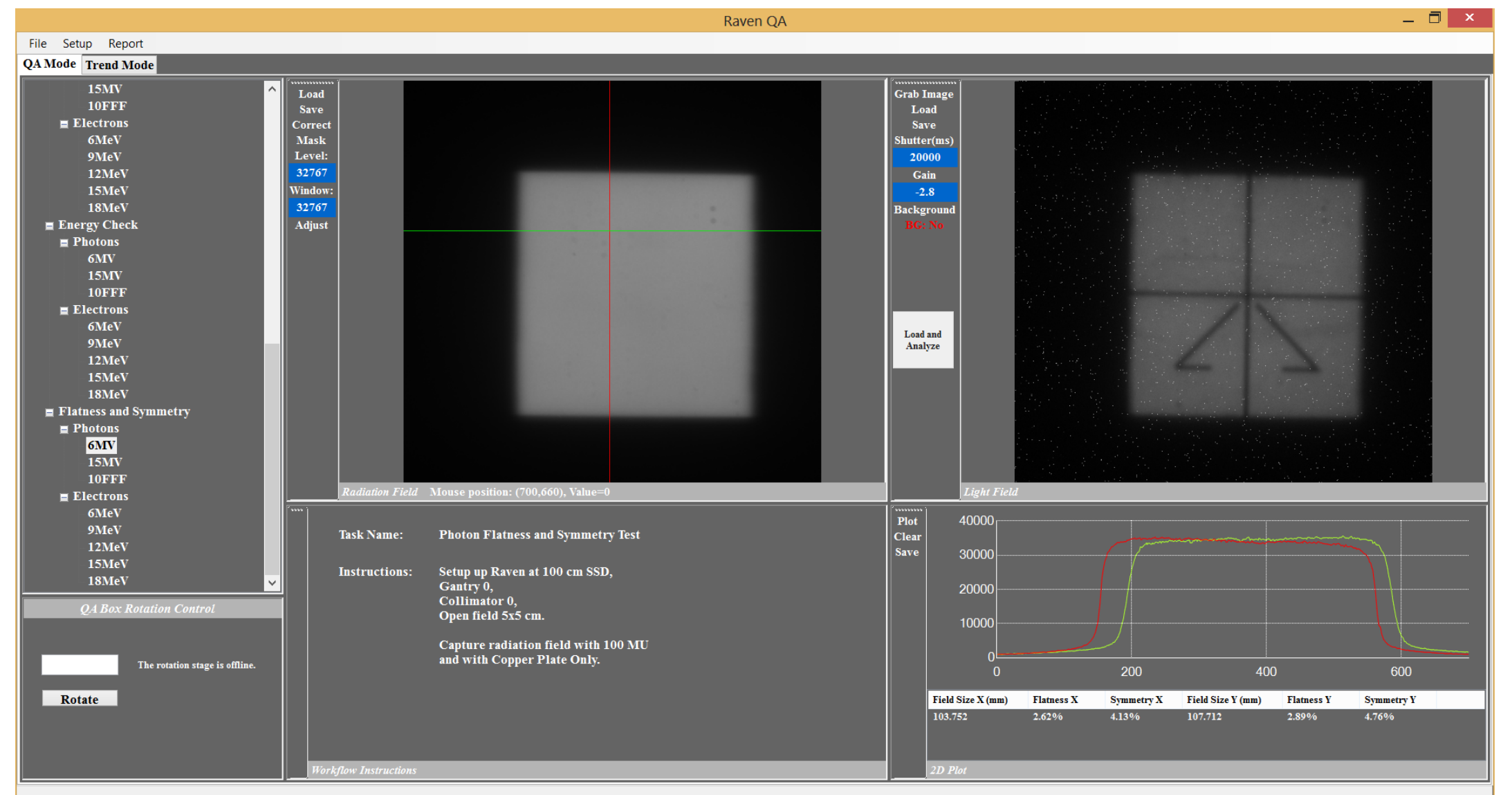
- Raven QA is a unifying device for mechanical and dosimetric quality assurance (QA) in radiation therapy. The aim of this project is to release a commercial software for Raven QA which includes image acquisition, image processing, motor control and user workflow guidance.
- The general problem is to perform a TG-142 standard QA procedure with Raven QA hardware. The main research area of this project is computer vision (medical image processing) and automation. The software must cover every step in the QA including self-calibration and report generation.

The Problem

- Raven QA self-calibration: Raven QA's rotation axis and camera axis is not perfectly aligned, so image shifts when the box rotates.
- QA workflow redesign: traditional QA takes a long time, up to 8 hours. Raven QA needs a TG-142 standard new QA workflow to reduce the whole procedure within 1.5 hours.
- Image processing: the basic task Raven QA will do is to deal with the medical images in different conditions (optical and radiation). Raven QA must process these images with high accuracy.

The Solution

- Grayscale projection integration (GPI) algorithm is employed to address Raven QA self-calibration. GPI can get line positions with low noise. A linear equation solver finds cross points of the lines. Point cloud registration is used to find the transform equation.
- A new workflow is designed which enables the physicist completes the QA within 1.5 hour with minimum times to go inside the radiation room.
- The following steps solve the general image processing work: undistortion and unify, alignment, pre-filter, core algorithm (edge detection or quality calculation), database updating.



Raven QA Software Screenshot: Flatness and Symmetry Test

Outcomes and Results

- Image processing, motor controlling and workflow guidance are perfectly done.
- A software demo was shown within Dr. John W. Wong's group.
- The Raven QA can do part of the self-calibration now, including alignment map and distortion map. The accuracy of alignment map needs improving.
- The database for users has been setup.

Future Work

- Inclinometer-motor cooperation.
- AAPM-2014 live demo.
- Software release for real commercial use.

Lessons Learned

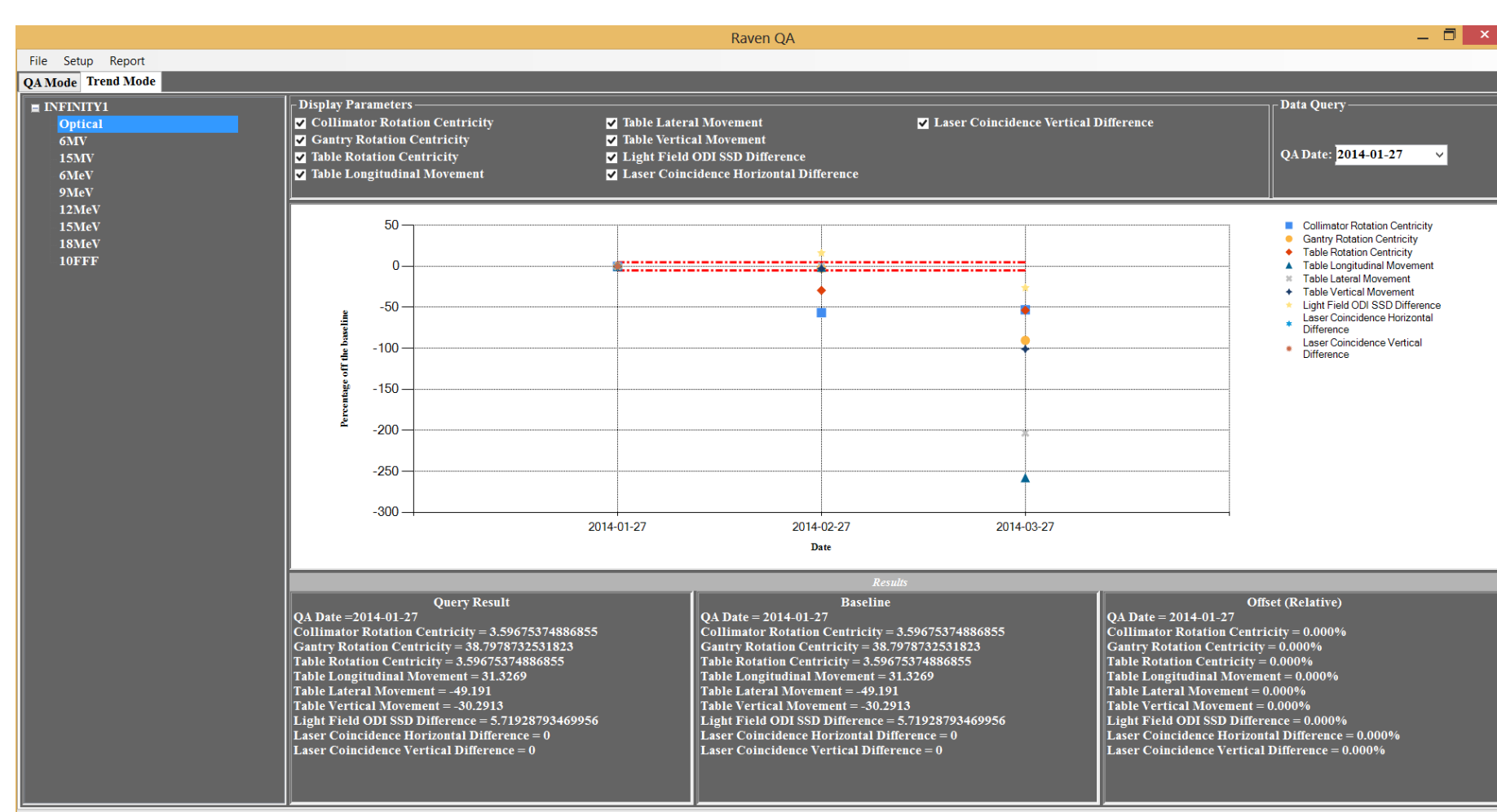
- Buy important devices early. The shipping is slow.
- Controlling software can never run properly without enough experiments.

Credits

- I did all the tasks in C# (early experiments were done in Matlab by Esteban Velarde and Junghoon Lee).

Support by and Acknowledgements

- Thanks to Dr. John W. Wong and Dr. Kai Ding's guidance.
- Thanks to Esteban Velarde and Junghoon Lee's experiments and Matlab codes.
- Thanks to the financial support from JPLC.



Raven QA Software Screenshot: Trend Analysis

