

Spring 2014, CIS II Project #8, Johns Hopkins University

A New Generation of Quality Assurance For Radiation Oncology

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Johns Hopkins University
February 27, 2014

BIO  **MARYLAND**
Biotechnology Development Program

RAVEN QA

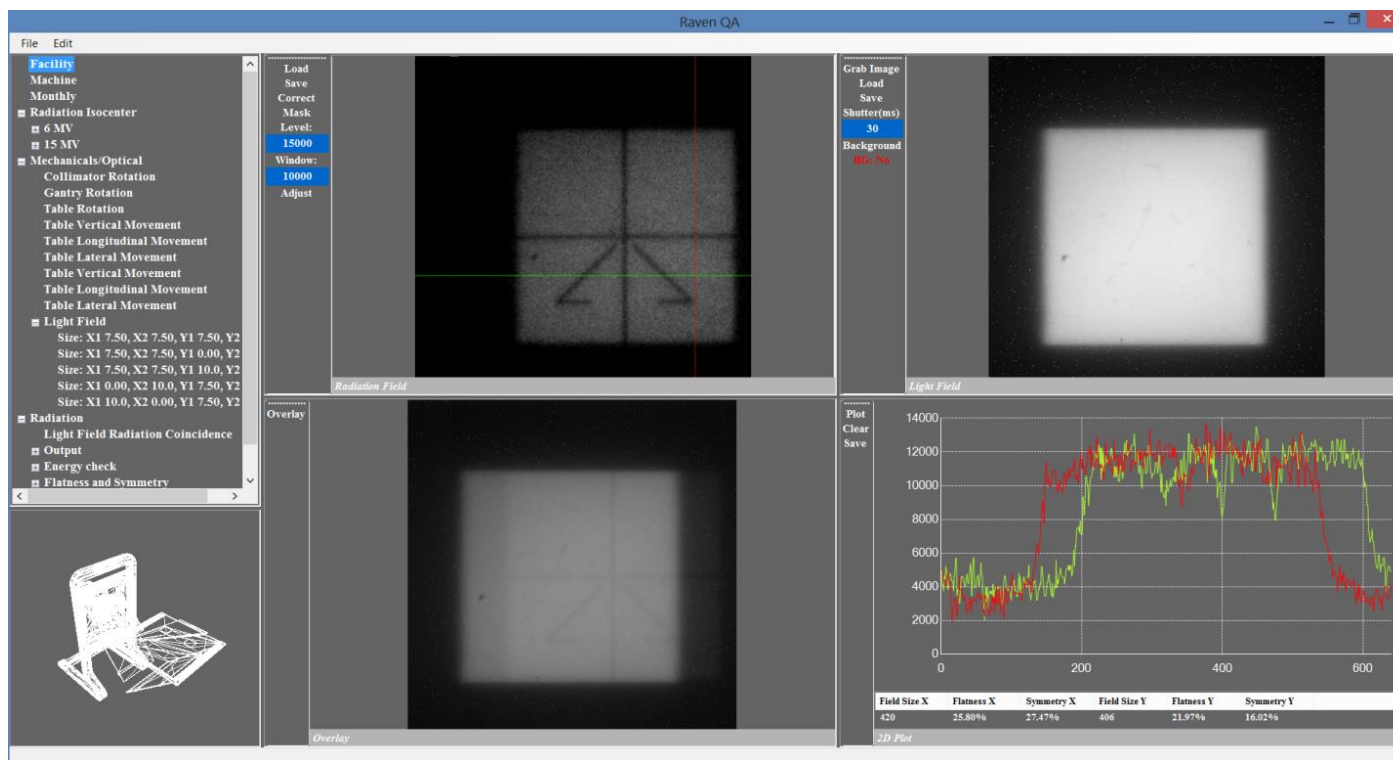

JOHNS HOPKINS
MEDICINE
SCHOOL OF MEDICINE

 **LABORATORY FOR**
Computational
Sensing + Robotics
THE JOHNS HOPKINS UNIVERSITY

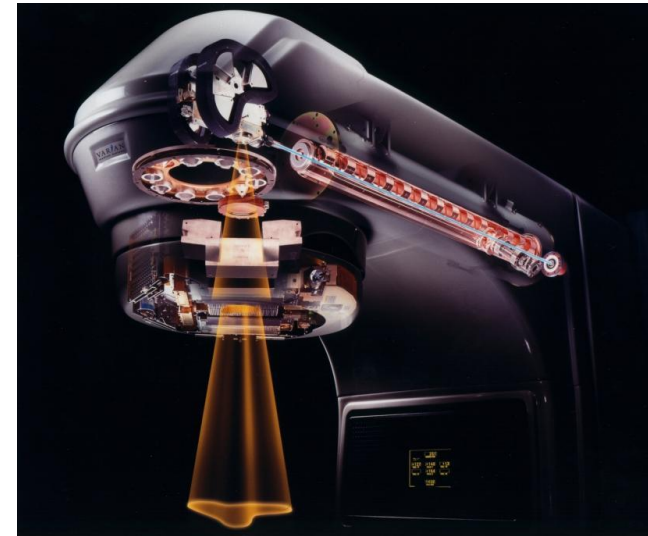
1. Project Goal

Design and release a **commercial** software for Raven QA which includes:

- Image Acquisition
- Image Processing
- Motor Control
- User Workflow Guidance.



2. Raven QA Technology



Courtesy of Dr. John W. Wong

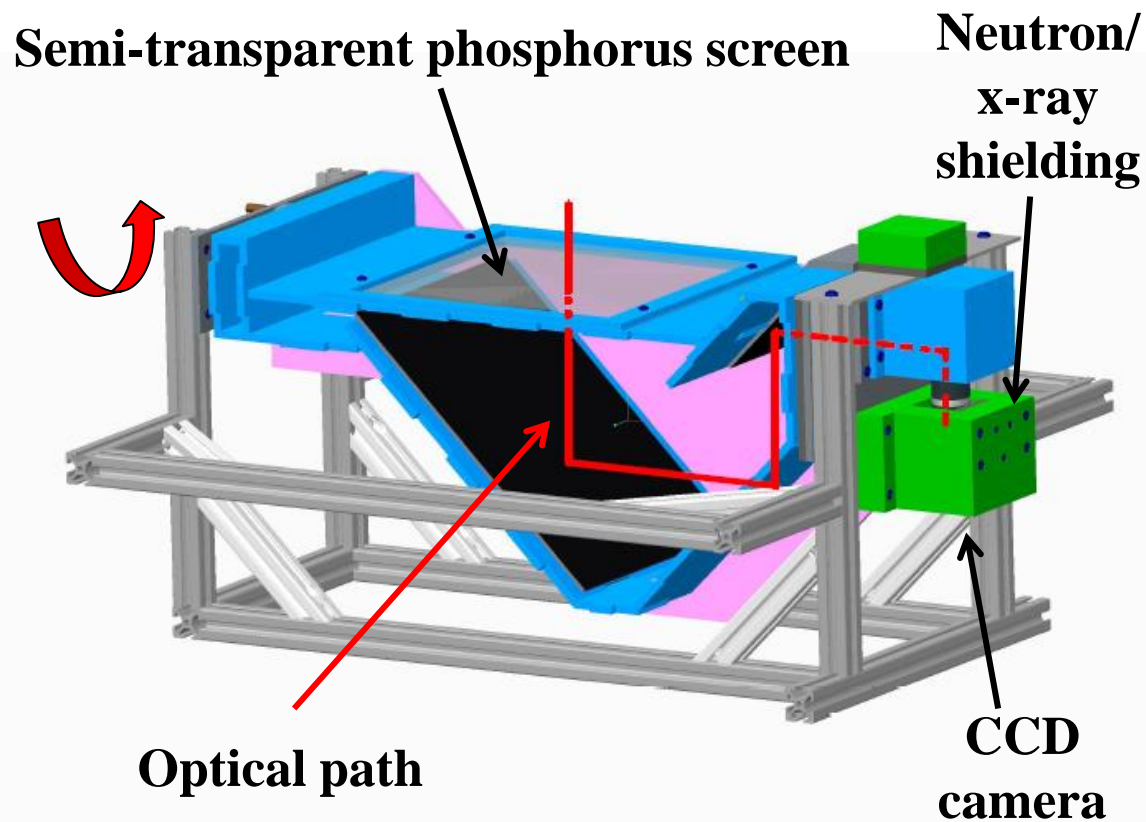
Patient Positioning Guides ← QA → Radiation Delivery

- A unifying device for mechanical and dosimetric quality assurance (QA) measurements in radiation therapy
- For monthly QA of Radiation Therapy Machines, no other device measures and records : Optical/Mechanical/Radiation data !!!

2. Raven QA Technology

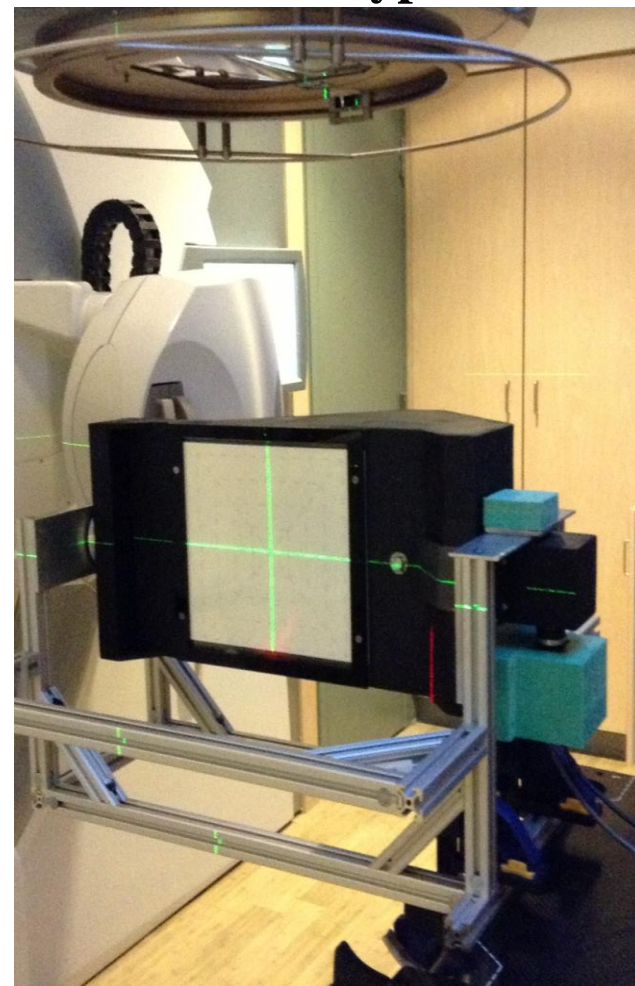


- A mirror system that allows capturing images at the isocenter plane with a stationary camera

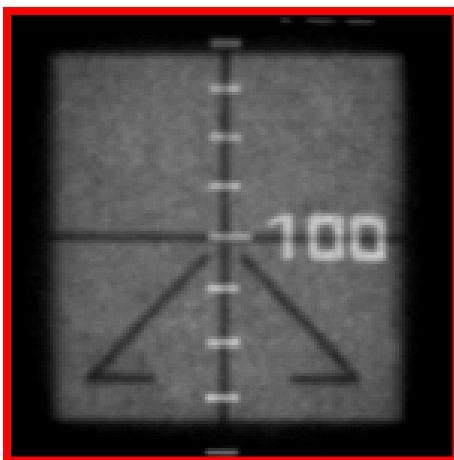
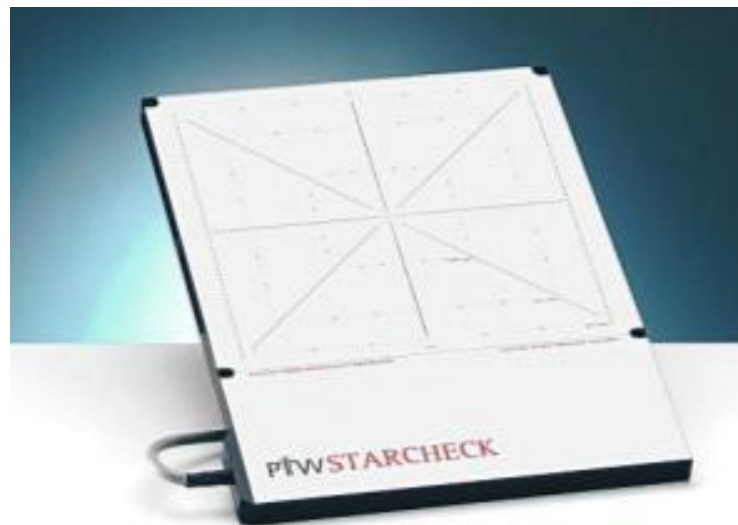
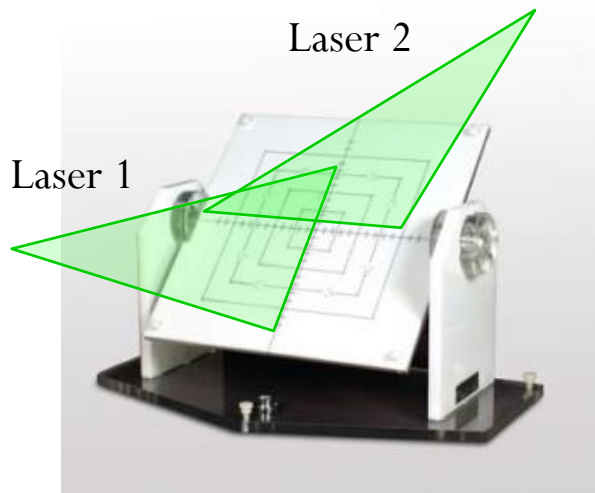


Courtesy of Dr. John W. Wong

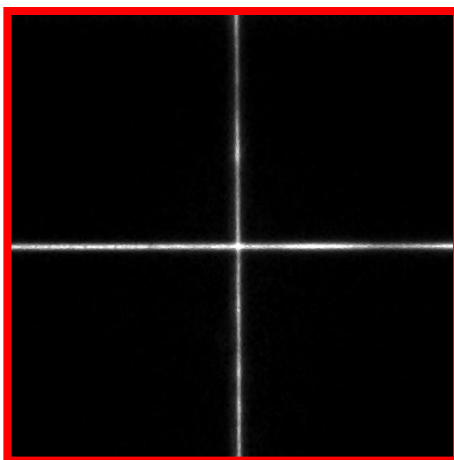
Prototype



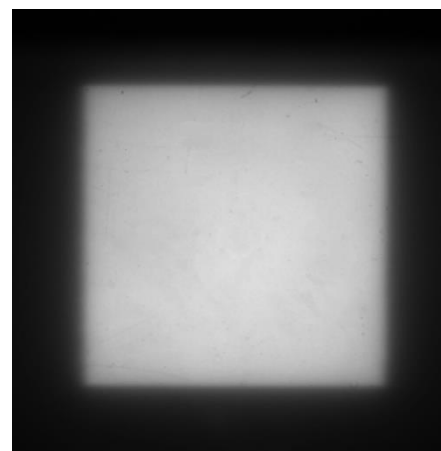
4. Image Acquisition & Processing



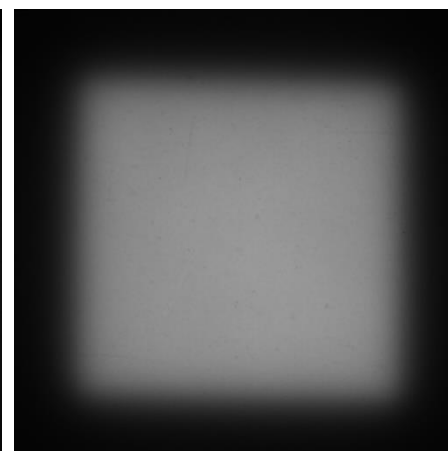
*Light field with
ODI*



*Room Lateral
Laser*



*6 MV x-ray at
dmax*



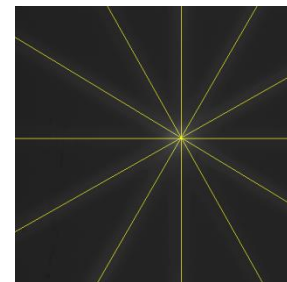
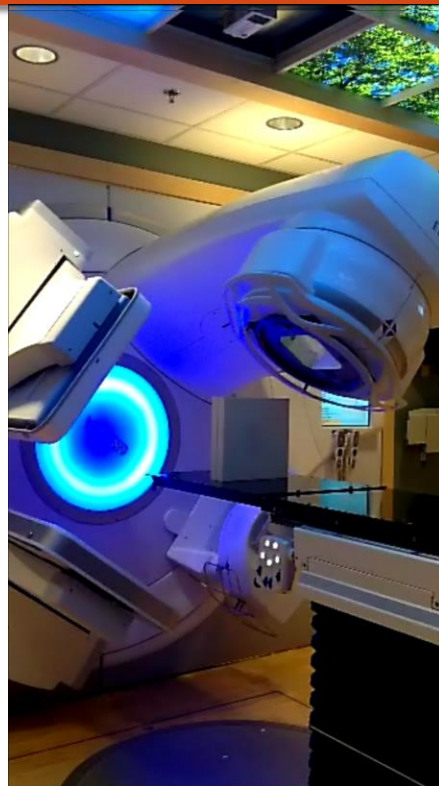
*12 MeV electron at
dmax*

4. Image Acquisition & Processing



RAVEN QA

- The all important Radiation Isocenter QA
 - Star-shot diameter for Gantry, Collimator, Table
- The use of *Center Of Mass (COM)* calculations of a small field (2x2 cm)

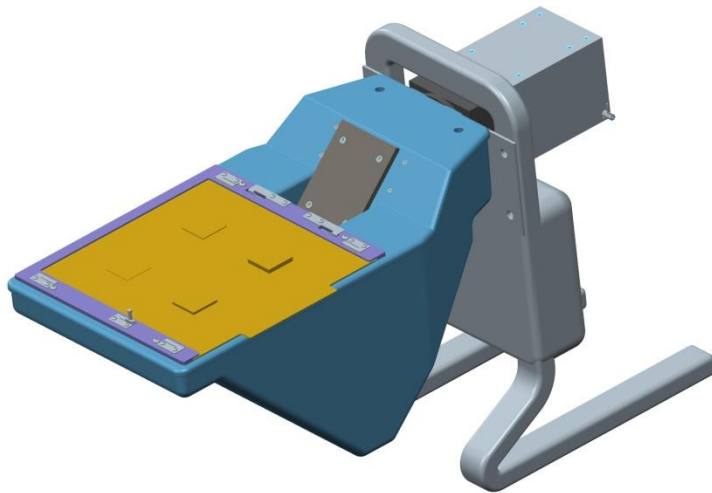


Film star-shot, diameter = 0.7 mm
Raven QA COM diameter = 0.3 mm

Robotic Raven QA rotation for gantry isocenter with COM

5. Motor Control

Raven QA



Octavus for IMRT QA



~\$65K

- **Improved efficiency for radiation isocenter COM measurements**
- **Extension to patient specific fixed or rotating gantry IMRT**

6. Deliverables



- **Minimum: Image Acquisition, Image Processing, Motor controlling.** These three functions are the key structure of the Raven QA. The first release of the software will contain all of them. They must be done.
- **Expected: Minimum deliverables and 3D rendering, workflow guidance, report generation.** These work will enhance the user experience of the Raven QA. 3D rendering allows them to see the orientation of the box outside the operation room, workflow guidance accelerates their work, and report generation allows them reviewing the work in the future.
- **Maximum: Expected deliverables and Internet database.** We hope our users can access to the software everywhere, so an Internet database is needed, and it also marks that all the functions of Raven QA have been done. If time permits, I will submit a conference or journal paper on the motor controlling work.

7. Dependencies



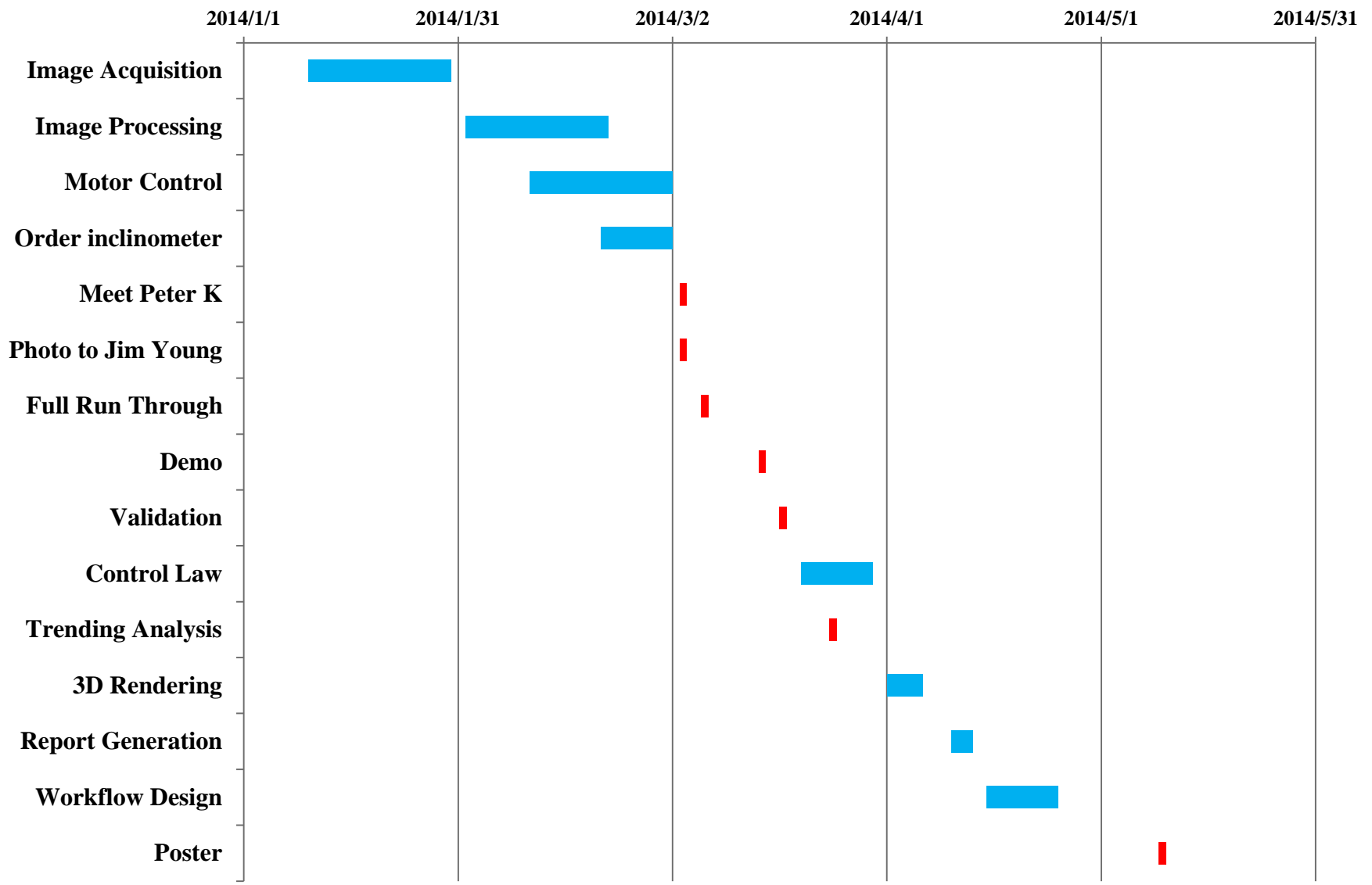
- **Inclinometer**
 - **Order online, around 1000 dollars**
 - **The budget and design will be checked by Dr. John**
 - **Before March 15th**
- **Software Commercialization**
 - **Meet ISO standards**
 - **Consult Dr. Peter Kanzanzides**
- **Validation**
 - **Cross compare with Mapcheck**
 - **Check image processing results with Esteban's Matlab codes**
 - **Full run through**
- **Multi-language Manual:**
 - **Consult Esteban and Pat Wong for Spanish, French, Portuguesse**

8. Management Plan



- **Programming Language: C#**
- **Meeting time:**
 - **twice a week (everyday these days) with Dr. Kai**
 - **once a month with Dr. John**
- **Version control: Git**
- **Documentation share: Dropbox**

8. Management Plan



9. Reading List



- **AAPM (American Association of Physicists in Medicine) (1994) Comprehensive QA for radiation oncology: Report of AAPM radiation therapy committee task group 40. *Med. Phys.* 21:582-618.**
- **AAPM (American Association of Physicists in Medicine) (1986) Neutron measurements around high energy x-ray radiotherapy machines. Report 19. AAPM, New York.**
- **AAPM (American Association of Physicists in Medicine) (1984) Physical aspects of quality assurance in radiation therapy, Report 13. AAPM, New York.**
- **Biggs P., Capalucci J., Russell M. (1991) Comparison of the penumbra between focused and non-divergent blocks-implications for multi-leaf collimators. *Med. Phys.* 18:753-758.**

Thanks for your attention!

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