2026 JULY 19–22 VANCOUVER, BC
JOINT AAPM | COMP MEETING

Initial Evaluation of the RAVIN CAM System for Identification of Proton-Induced Activation in a Clinical Proton Therapy Facility

Sina Mossahebi[1,2], Jerimy Polf[3], Matthew O'Neil[3]
[1]University of Maryland School of Medicine, Baltimore, Maryland
[2]Maryland Proton Treatment Center, Baltimore, Maryland
[3]M3D Inc., Ann Arbor, Michigan

ABSTRACT

Purpose: Secondary radiation from proton therapy can induce activation in beamline components, range shifters, and phantoms/patients. Rapid identification and localization of activated regions are critical for radiation safety, compliance, and workflow efficiency. We report an initial evaluation of the RAVIN CAM (M3D Imaging, Inc.), a handheld radiation imaging system, for detecting and visualizing proton-induced activation and hotspots in post-treatment surveys of range shifters, anthropomorphic phantom, and radioactive material storage areas.

Methods: Proton beams were delivered under clinical conditions to a Rando phantom using range shifter with Varian ProBeam proton therapy system. Following irradiations, post-delivery surveys were performed with the RAVIN CAM, a portable imaging survey meter that combines a real-time solid-state CZT gamma detector with optical imaging to overlay radiation intensity heat maps on visual objects. Surveys performed on (1) an irradiated range shifter, (2) a RANDO phantom positioned at isocenter, and (3) items stored in the radioactive materials room. Activated regions were identified as elevated intensity heat map "hotspots".

Results: The RAVIN CAM successfully imaged localized activation consistent with expected proton beam paths and material composition, as well as providing an energy spectrum and dose rate at the camera. Hotspots were visualized on irradiated range shifters with a dose rate of 0.307 mrem/hr at 60 cm and within the RANDO phantom in regions corresponding to high dose deposition at 0.548 mrem/hr at 55 cm. In the radioactive materials room, activated materials exhibited clear spatial delineation relative to background. The handheld system's overlay images facilitated rapid identification and preliminary spectral characterization of activation zones.

Conclusions: The RAVIN CAM demonstrates promise as a tool for post-proton delivery activation surveys in a clinical environment. Its imaging capabilities may enhance traditional survey techniques by providing spatial maps, preliminary isotope and visual information.

CONTACT

Matthew O'Neil, BS
M3D Inc., Ann Arbor, Michigan
matt@m3dimaging.com

INTRODUCTION

- Proton therapy produces secondary neutrons and nuclear activation in beamline components and patients or phantoms.
- Conventional radiation surveys rely on point measurements that lack spatial information.
- The RAVIN CAM is a handheld radiation imaging system that overlays real-time radiation intensity maps on optical images.
- We report an initial evaluation of the RAVIN CAM (M3D Imaging, Inc.), a handheld radiation imaging system, for detecting and visualizing proton-induced activation and hotspots in post-treatment surveys of range shifters, anthropomorphic phantom, and radioactive material storage areas.

METHODS AND MATERIALS

- Proton beams were delivered under clinical conditions to a Rando phantom using range shifter with Varian ProBeam proton therapy system.
- Following irradiations, post-delivery surveys were performed with the RAVIN CAM, a portable imaging survey meter that combines a real-time solid-state CZT gamma detector with optical imaging to overlay radiation intensity heat maps on visual objects.
  - Surveys performed on
  - An irradiated range shifter,
  - A RANDO phantom positioned at isocenter, and
  - Items stored in the radioactive materials room.
- Activated regions were identified as elevated intensity heat map "hotspots".

Figure 1: *A) RAVIN CAM can provide a spatial localization of radiation sources at distances of several meters with visual context of surveyed objects*

RESULTS

- The RAVIN CAM successfully imaged localized activation consistent with expected proton beam paths and material composition, as well as providing an energy spectrum and dose rate at the camera.
- Hotspots were visualized on irradiated range shifters with a dose rate of 0.307 mrem/hr at 60 cm and within the RANDO phantom in regions corresponding to high dose deposition at 0.548 mrem/hr at 55 cm.
- In the radioactive materials room, activated materials exhibited clear spatial delineation relative to background.

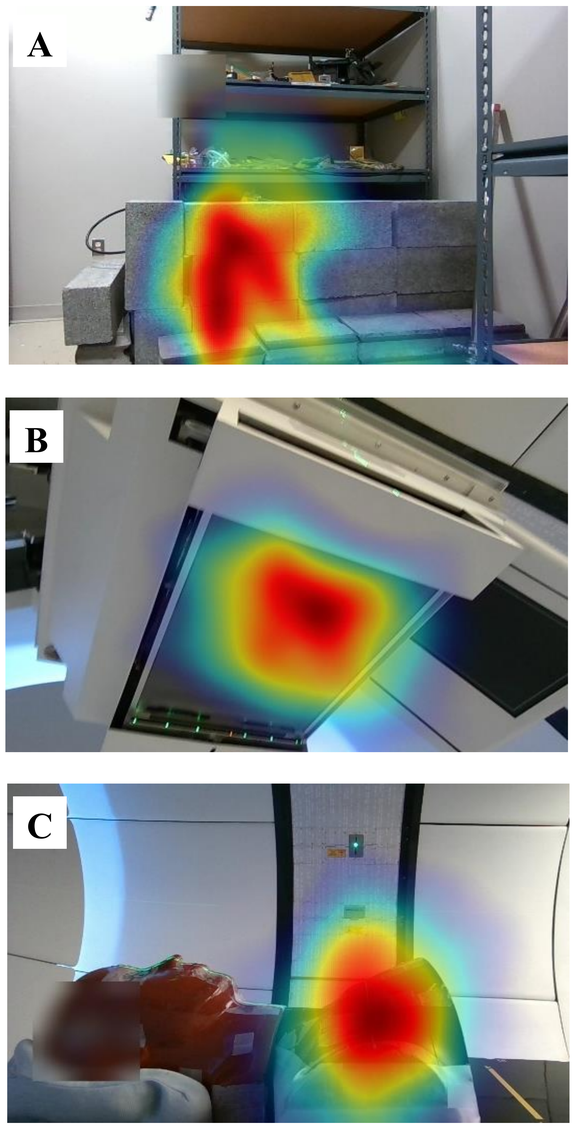
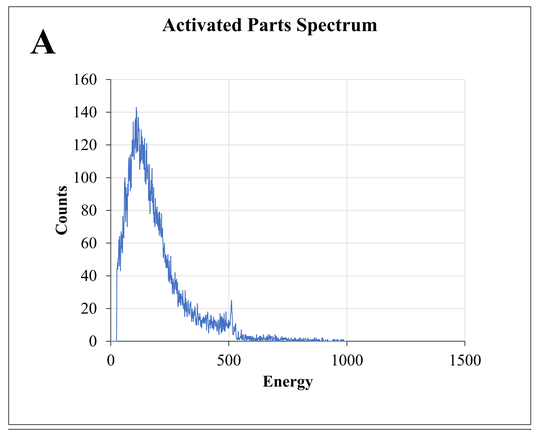
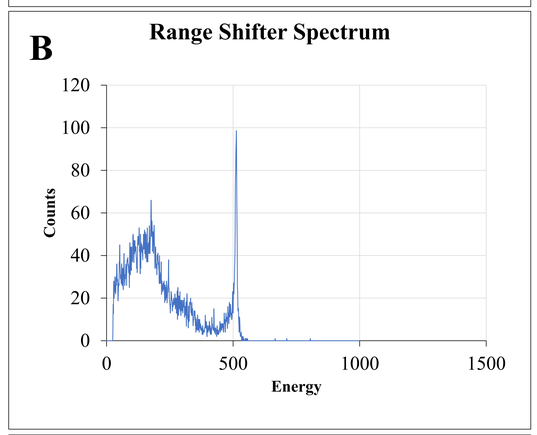


Figure 2: A*) RAVIN CAM radiation intensity heat-map overlay identifying activated materials in the radioactive materials room following proton therapy delivery. Post-irradiation RAVIN CAM image of proton-activated components showing localized hotspots consistent with beam path on (B) a 5-cm range shifter and (C) a Rando phantom.*

DISCUSSION

- The handheld system's overlay images facilitated rapid identification and preliminary spectral characterization of activation zones.





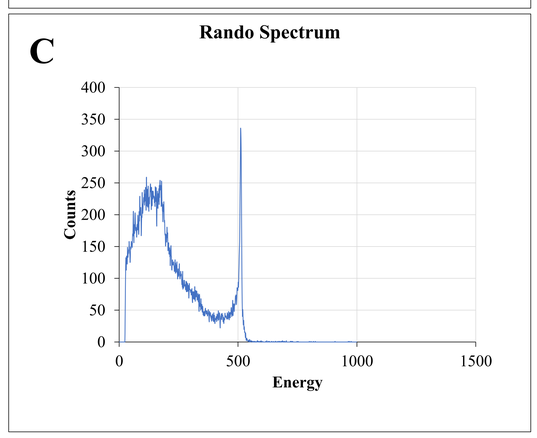


Figure 3: *A) RAVIN CAM energy spectrum of activated materials in the radioactive materials room following proton therapy delivery. Energy spectrum of post-irradiation RAVIN CAM images of proton-activated components showing localized hotspots consistent with beam path on (B) a 5-cm range shifter and (C) a Rando phantom.*

CONCLUSIONS

The RAVIN CAM demonstrates promise as a tool for post-proton delivery activation surveys in a clinical area. Its imaging capabilities may enhance traditional survey techniques by providing spatial maps, preliminary isotope and visual information.

© Poster Template by Genigraphics® 1.800.790.4001 www.genigraphics.com