



University of Michigan
Department of Radiation Oncology
Division of Radiation Physics

Imaging Rotation

Resident: _____

Rotation staff mentor/ advisor: James Balter, supplemental
mentors: Dale Litzenberg, Don Roberts, Joann Prisciandaro,
Adam Johansson

Rotation Dates: _____

A medical physics resident in radiation oncology at the University of Michigan will be expected to demonstrate the following competencies associated with imaging. These are considered the minimum standards. The resident should complete the list of assignments during his/her rotations.

Contents Outline

Knowledge Factors

- List of reading assignments
- Read and understand TG-58
- Read and understand TG-75
- Read and understand TG-104
- Read and understand TG-128
- Read and understand TG-147
- Read and understand TG-179

Practical Factors

- Perform CT daily, monthly and annual QA
- Perform MRI daily QA
- Perform CBCT QA
- Perform ultrasound measurement of prostate phantom
- Observe PET/SPECT imaging
- Perform Calypso calibration and demonstrate proficiency using system

Knowledge Factors – List of reference

Short list of useful references (this is by far not a comprehensive list):

- ACR MRI Phantom QA Procedure
- AAPM TG 132 draft
- AAPM Task Group #58 - Clinical use of electronic portal imaging
- AAPM Task Group #75 - The management of imaging dose during image-guided radiotherapy
- AAPM Task Group #104 - The Role of In-Room kV X-Ray Imaging for Patient Setup and Target Localization

- AAPM Task Group #179 - Quality assurance for image-guided radiation therapy utilizing CT-based technologies
- AAPM Task Group #147 - Quality assurance for non-radiographic radiotherapy localization and positioning systems
- AAPM MR Task Group #1 – Acceptance Testing and Quality Assurance Procedures for Magnetic Resonance Imaging Facilities
- AAPM Task Group #128 – Quality assurance tests for prostate brachytherapy ultrasound systems
- AAPM Task Group #142 – Quality assurance of medical accelerators (imaging sections)
- Introduction to the Science of Medical Imaging (Bryan)
- The Essential Physics of Medical Imaging (Bushberg *et al.*)

Knowledge Factors – General Imaging

Discuss and demonstrate an understanding of the general principles of image quality

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Discuss and demonstrate an understanding of contrast agents for medical imaging

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Discuss and demonstrate an understanding of image registration techniques (e.g., rigid and deformable registration), and image features on which registration can be based (e.g., landmarks, segments, intensities).

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Discuss and demonstrate an understanding of IT architecture for imaging

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Knowledge Factors – Radiography/Fluoroscopy

Demonstrate an understanding of TG-58

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Demonstrate an understanding of TG-75

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Demonstrate an understanding of TG-104

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Discuss and demonstrate an understanding of detector technology for on-board MV and kV imaging, as well as measures of image quality.

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Knowledge Factors – CT/CBCT

Demonstrate an understanding of TG-179

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Discuss and demonstrate an understanding of the basic principles of CT (slice thickness, pitch, kVp, mAs, contrast, 4D gating, difference between CT sim and diagnostic CT).

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Discuss and demonstrate an understanding of CT reconstruction methods

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Discuss and demonstrate an understanding of imaging protocols for CT

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Discuss and demonstrate an understanding of image artifacts in CT

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Discuss and demonstrate an understanding of dose minimization techniques in radiography

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Discuss and demonstrate an understanding of detector technology for CT

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Discuss and understand the major subsystems of a CT simulator.

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Discuss and demonstrate an understanding of CT-ED curve generation

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Discuss and demonstrate an understanding of CTDI.

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Discuss and demonstrate an understanding of CT number/Hounsfield units.

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Knowledge Factors – MRI

Discuss and demonstrate an understanding of the basic principles of MRI

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Discuss and demonstrate an understanding of the uses of MRI in radiation oncology.

Signature / Date

Discuss and demonstrate an understanding of the advantages and disadvantages of treatment planning using MRI

Signature / Date

Discuss and demonstrate an understanding of MRI imaging protocols

Signature / Date

Discuss and demonstrate an understanding of the types and causes of distortion in MRI

Signature / Date

Knowledge Factors – PET/SPECT

Discuss and demonstrate an understanding of the basic principles of PET

Signature / Date

Discuss and demonstrate an understanding of the basic principles of SPECT

Signature / Date

Discuss and demonstrate an understanding of radioisotopes used for nuclear imaging

Signature / Date

Discuss and demonstrate an understanding of the uses of nuclear imaging in radiation oncology

Signature / Date

Discuss and demonstrate an understanding of QA for PET-CT and SPECT-CT simulators

Signature / Date

Knowledge Factors – Ultrasound

Discuss and demonstrate an understanding of TG-128

Signature / Date

Discuss and demonstrate an understanding of the basic principles of ultrasound imaging

Signature / Date

Discuss and demonstrate an understanding of the uses of ultrasound in radiation oncology

Signature / Date

Discuss and demonstrate an understanding of methods of QA for ultrasound probes

Signature / Date

Knowledge Factors – Other non-radiographic systems

Discuss commonly used non-radiographic localization systems (e.g., radiofrequency beacon tracking, surface camera).

Signature / Date

Discuss and demonstrate an understanding of the basic principles of radiofrequency beacon tracking.

Signature / Date

Discuss and demonstrate an understanding of the basic principles of surface camera tracking.

Signature / Date

Knowledge Factors – Deformable Image Registration

Demonstrate understanding of fundamental elements of deformable alignment and their uncertainties/evaluation methods

Signature / Date

Practical Factors – in-room radiographic imaging

Perform daily, monthly, and annual QA for OBI

Signature / Date

Perform daily, monthly, and annual QA for MV EPID

Signature / Date

Practical Factors – CT/CBCT

Perform an acceptable subset of daily, monthly, and/or annual QA for the CT scanner

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Demonstrate and obtain competency for CBCT alignment.

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Practical Factors – MRI

Perform weekly QA for the MRI scanner

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Observe MRI simulation for brain

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Observe MRI simulation for abdomen

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Practical Factors – Ultrasound

Perform ultrasound measurement of prostate phantom

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Practical Factors – PET/SPECT/Nuclear Medicine

Observe PET OR SPECT procedure

Signature / Date	

Observe Radiopharmaceutical production

Signature / Date	

Practical Factors – Deformable Image Registration

Observe/perform deformable alignment (H/N or liver)

Signature / Date	