General Physics and QA Rotation

Resident: ____________________________

Rotation staff mentor/advisor: Kwok Lam, Don Roberts, Ben Rosen, and Alex Moncion

Rotation duration: 2 months
Rotation Dates: ____________________________

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

Contents Outline

Knowledge Factors
- Read and understand material in Karzmark’s primer book on Linacs
- Read and understand dosimeter chapter in Metcalfe
- Read and understand interactions of ionizing radiation in books by Khan and Attix
- Read and understand TG-40, TG-142, and TG-179
- Read and understand TG-21 and TG-51
- Read and understand TG-61
- Read and understand TG-66

Practical Factors
- Daily linac/CT QA
- Monthly linac QA
- Monthly CT QA
- Independent linac operation and safety training (KLL)
- Independent CT operation
- Transfer DICOM images from scanner
- Use machine log program
- Manage machine malfunctions, calling Varian, and coordinating with FSE
- Determine the tests needed before a linac is released for treatment after malfunctions
- Swap and QA MLC motors (needs a sign-off)
- Understand and be able to perform post-repair QA (needs a sign-off)
- Perform a TG-51 electron/photon protocol

Progress Review
- Two weeks
- One month
- Two months
Knowledge Factors – List of reference

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

- C.J. Karzmark and Robert J. Morton, *A Primer on Theory and Operation of Linear Accelerators in Radiation Therapy*
- AAPM Task Group #40, “Comprehensive QA for Radiation Oncology.”
- AAPM Task Group #142, “Quality Assurance of Medical Accelerators.”
- AAPM Task Group #179, “Quality Assurance for image-guided radiation therapy utilizing CT-based technologies.”
- AAPM Task Group #21, “A protocol for the determination of absorbed dose from high-energy photon and electron beams.”
- AAPM Task Group #61, “AAPM protocol for 40 – 300 kV x-ray beam dosimetry in radiotherapy and radiobiology.”
- AAPM Task Group #66, “Quality assurance for computed-tomography simulators and the computed-tomography-simulation process.”
- “Ion chamber dosimetry instrumentation, beam scanning systems and calibration phantoms for radiation dosimetry”, L. Humphries and J.A. Purdy.

Knowledge Factors

Demonstrate an understanding of detectors (e.g., theory of operation and limitations, Al2, diode, scintillator, AmoSi)

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Demonstrate an understanding of TG-66 and the proposed QA tolerances

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Demonstrate an understanding of TG-40 and the proposed QA tolerances

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Demonstrate an understanding of TG-142 and the proposed QA tolerances

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Demonstrate an understanding of TG-179 and the proposed QA tolerances

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 Demonstrate an understanding of TG-21

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Demonstrate an understanding of TG-51 and addendum

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Successfully performed a TG-51 hand calculation

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Demonstrate an understanding of TG-61 and the proposed QA tolerances

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Demonstrate an ability to draw a block diagram of a linac and explain the functions of each major subsystem

Demonstrate an understanding of the theory of machine operation and components

Demonstrate an understanding of interaction of radiation in matter

**Practical Factors – Two Week Mark**

Observe and demonstrate an understanding of daily linac QA.

Perform daily QA and review results

**Practical Factors – One Month Mark**

Observe monthly linac QA

Observe daily CT QA

Observe monthly CT QA

**Practical Factors – Two Month Mark**

Independently perform monthly linac QA

Successfully performed TG-51 hand calculations and measurements - photons

Successfully performed TG-51 hand calculations and measurements - electrons

Demonstrate an understanding of machine malfunction management and QA checks to release the machine for clinical use.

Complete linac safety and competency

Cleared for clinical coverage shifts

Demonstrate an understanding of the CT scanning protocols

Successfully scan a phantom and send to Eclipse

Under the supervision of faculty, able to set/adjust output on a linac

Independently perform monthly linac QA

Perform progressive annual tasks under direct or general supervision of faculty

Able to identify energy problems; beam on target position and angle problems from scan/profiler data

Last updated: Nov 2022 (BSR/AM/DAR/KLL)