Linear Accelerator Acceptance and Commissioning Rotation

Resident: ______________________________________

Rotation staff mentor/advisor: Kwok Lam, Don Roberts, and Choonik Lee

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 linac acceptance and commissioning. These are considered the minimum standards. Resident should complete the list of assignments during his/her rotations. The goal of this rotation is for residents to understand the process of installing a new linac, including selection and performance specification, acceptance testing, and commissioning.

Contents Outline

Knowledge Factors
- Reading assignments on the following topics:
  - Specifying a new linear accelerator
  - Linear accelerator commissioning

Practical Factors
- Perform the process of selecting a new linear accelerator and writing specifications as part of the purchase process.
- Learn about room design and shielding calculations.
- Understand how to select the equipment utilized for testing.
- Learn how to perform radiation surveys.
- Learn how to acceptance test a linear accelerator.
- Learn how to commission a treatment planning system for a linear accelerator.

Where possible, the resident will participate in all aspects of the acceptance of a new linear accelerator as part of this rotation. If a linac is not installed during a resident’s training, this material will be covered in a combination of didactic and “lab” exercises.
Reading list:

2. AAPM Task Group #40, “Comprehensive QA for Radiation Oncology.”
3. IPSM Report No.54, “Commissioning and Quality Assurance of Linear Accelerators”
8. C.J. Karzmark and Robert J. Morton, *A Primer on Theory and Operation of Linear Accelerators in Radiation Therapy*
11. Sample request for proposal (RFP).

Knowledge Factors

Review and demonstrate an understanding of existing documentation on specification and selection of a linear accelerator, including ancillary imaging systems

Review a recent acceptance test procedure for a linac. Demonstrate an understanding of the purpose for each test and how the test is performed.

Demonstrate an understanding of the difference between acceptance and commissioning, and be able to describe the requirements for both.

Demonstrate an understanding of the distinctions between data for beam fitting and data for commissioning of treatment planning systems.

Discuss the necessary data required to commission IMRT/VMAT.

Discuss the acceptance and commissioning tests performed on ancillary imaging systems.

Demonstrate an understanding of the process of setting the treatment beam isocenter and its relationship to the gantry’s mechanical isocenter, and on-board imaging system isocenter.

Demonstrate an understanding of the scope and accuracy requirements for commissioning algorithms prior to use for patient care.

Demonstrate an understanding of the connectivity requirements of linacs to txmt simulators, on-board imaging systems, record and verify systems, and electronic medical records systems.
Demonstrate an understanding of flatness and symmetry for photon and electron beams.

Define how the testing of an algorithm is related to the algorithm type.

Create a report documenting an aspect of treatment planning system commissioning for clinical use.

Demonstrate an understanding of photon and electron dose calculation algorithm (CVSP, AAA, CC, Pencil beam, eMC)

Create a test methodology and define the dataset required to perform the test procedure for the calculation algorithm commissioning.

Perform the test calculations according to the procedure which was designed, and analyze the results.

Define a dataset and experimental conditions for the required measurements.

Perform measurements with the appropriate detectors and compare results with calculations. Measurement acquisition may involve support from others in the department (faculty, other residents, physics assistants).

Practical Factors

The resident, with the approval of his/her rotation mentor, will select one section of the specifications of a previous linear accelerator’s request for proposal (RFP) to update for new technology.

Perform and/or discuss the purpose of a treatment unit head wrap.

Performed a radiation survey on an existing linear accelerator, including a partial head leakage test and prepare a survey report. The resident will discuss the appropriate techniques and equipment used for such surveys.

Select testing protocol(s) in the acceptance procedure that is(are) different from routine QA protocol (annual QA, monthly QA etc.) and perform the test(s).

Able to setup the Wellhofer blue phantom for scanning, select the correct detector for measurement type, and use the effective point of measurements correctly.