

Imaging for radiation therapy treatment planning has different goals than diagnostic imaging. Quality assurance (QA) of imaging devices (CT, PET, MR) which are used for radiation therapy imaging will therefore have different or additional goals compared to QA for diagnostic imaging purposes. Use of PET and MR imaging in radiation therapy is constantly increasing and reliable performance of these imaging modalities is important to avoid potentially significant errors.

Quality assurance for CT scanners used for radiation therapy scanning is relatively well established and defined. This process remains to be adequately defined for PET and MR scanners that are used for treatment planning. Evaluation of image quality of CT, PET, and MR scanners is generally adequately addressed by procedures which were established for diagnostic imaging. Design of QA protocols for radiation therapy scanning should be founded on procedures which are used for diagnostic imaging. Evaluation of mechanical accuracy and image spatial integrity is unfortunately not a major concern in diagnostic imaging and these parameters are often not sufficiently addressed in diagnostic QA protocols. All three imaging modalities have multiple potential sources of spatial and geometric errors and understanding of these parameters is necessary for design of an effective quality assurance program. The design of QA programs for these devices will be affected by the location of individual scanner and distribution of its utilization for diagnostic and radiation therapy imaging. Scanners which have dual purpose (diagnostic and treatment planning imaging) should have a QA program designed jointly by diagnostic and radiation therapy physicists to ensure that the program meets the needs of both groups.

The quality assurance for these imaging modalities in the radiation therapy goes beyond the QA of the scanners and should include evaluation of implementation of images in the treatment planning process. This should include evaluation of data transfer, image registration, potential degradation in image quality, image distortions, and evaluation of process for delineation of tumor and normal structure volumes. MR and PET images can contain biologically active regions which may not correlate with any readily visible anatomic features. Correct identification and use of these regions in the treatment planning process should be a major concern of the QA program.

This lecture will provide an outline and description of QA program for CT, PET, and MR scanners used in radiation therapy. The fundamental goals of such program will be described and information which can be used for establishment institution specific QA programs will be provided.

#### Educational Objectives:

- 1.) Describe goals of QA programs for CT, PET, and MR scanners used for radiation therapy imaging
- 2.) Describe QA process for individual imaging devices
- 3.) Describe a concerns for verification of correct implementation of these imaging modalities in the treatment planning process