

The process of purchasing an accelerator starts with evaluation of specifications, performance requirements, and clinical needs by the facility physicist, radiation oncologists, and clinical engineers. Manufacturer and vendor information and performance standards established by national and international agencies (as well as information from other users of the equipment) are used to create written specifications for acceptance testing of the equipment. Site visits may also be needed in order to evaluate equipment performance. Those involved with evaluating equipment and establishing performance requirements should collectively recommend which equipment is selected.

The process of acceptance testing should proceed along the lines of the written specifications and the purchase agreement with the manufacturer. The process must include evaluation of radiation leakage, safety interlocks, mechanical and radiation isocenter tolerance limits, dosimetric characteristics, and software functions. The acceptance testing data are subsequently used to establish a baseline for the tolerance limits and action levels for routine quality assurance procedures.

Commissioning of the linear accelerator includes comprehensive measurements of dosimetric parameters needed to validate the treatment-planning system(s) for all clinical applications that are planned for that machine. The model-based dose-calculation algorithms (convolution/superposition) require much less measured data than correction-based algorithms (equivalent TPR/TAR etc.). Irrespective of the dose-calculation algorithm, it is essential to have a minimum dataset that includes percentage depth dose, isodose distribution, and output characterization for a series of field sizes. The transmission factor for all treatment accessories and dose calibration for all clinical modes is also required for meterset calculations. It is imperative that the measured dosimetric characteristics of the commissioned linear accelerator are compared with published data on the same make and model, if available. AAPM has several task group reports on special topics such as Total Body Irradiation, Intra Operative Radiation Therapy, Total Skin Electron Therapy, Accelerator Safety, Stereotactic Radiosurgery, and Accelerator Code of Practice that are helpful in commissioning special procedures.

Learning Objectives:

1. Learn to develop equipment specifications, the acceptance testing protocol, and the purchase agreement.
2. Learn to interpret acceptance testing results.
3. Data collection for dosimetric commissioning of the accelerator.