

Helical tomotherapy using the Hi-ART II is analogous to helical CT imaging where the gantry and the couch are in simultaneous motion. Hence, beam delivery is continuous over all 360° in transverse planes about the patient. Temporal beam modulation is achieved by using a binary multi-leaf collimator. In addition to its ability to deliver IMRT, the Hi-ART II has the ability to obtain helical megavoltage CT (MVCT) images. These MVCT images have adequate spatial and contrast resolution for image guidance, and also for identification of many soft-tissue structures. The incorporation of daily three dimensional soft-tissue imaging into the radiotherapy process also enables dose recalculation and periodic evaluation of the treatment delivery during a course of radiotherapy. Hence, the subsequent treatment delivery can be modified using a systematic feedback of the geometric and dosimetric information in the previous fractions. This requires many components as feedback, including CT guidance to achieve soft tissue localization, dose recalculation, dose accumulation, treatment evaluation, re-contouring, and re-optimization.

This lecture will provide an overview of the physical characteristics of the Hi-ART II, acceptance testing and commissioning, image quality tests, image registration, basic quality assurance, and an overview of clinical applications. Finally, system limitations and future developments will be addressed.

Educational objectives

1. Understand the basics concepts of helical tomotherapy
2. Understand the basic QA requirements and system limitations association with helical tomotherapy
3. Understand the workflow and issues related to clinical applications of helical tomotherapy, including acquisition, reconstruction, registration and patient alignment.
4. Understand the possibilities of daily soft-tissue imaging for patient alignment and evaluation of treatment accuracy