

The Theory and Operation of Computer-controlled Medical Linear Accelerators

Computer control pervades modern delivery of therapeutic radiation beams. As delivery becomes increasingly automated through the widespread implementation of dynamic IMRT under control of Record-and-Verify systems, the physicist or engineer is faced with increasing need to understand how linear accelerator control is achieved, and in some instances how this integrates with other systems involved in treatment delivery.

An examination of the control system design philosophy with respect to safety and functionality is offered for each of the three major original equipment manufacturers (OEMs) of medical linear accelerators.

A comparison of three approaches in energy and mode selection is instrumental in delineating the hardware-software relationship with regard to equipment safety.

Examination of beam and dose-rate control subsystems for the three major OEMs is valuable in understanding design implications with respect to Intensity Modulated Radiation Therapy (IMRT) delivery.

Educational Objectives:

1. Understand the basic computer control system architecture utilized by the 3 OEMs in medical linear accelerators.
2. Understand how mode selection is achieved under computer control for the three OEMs in medical linear accelerators.
3. Understand how beam control is attained via computer control for each of the three OEMs in medical linear accelerators.
4. Gain insight into how fundamental accelerator design dictates various aspects of computerization of medical linear accelerators.
5. Gain insight into how fundamental accelerator design impacts the design and implementation of IMRT on a particular linear accelerator platform.