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Single particle detection for medical applications

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A Low Gain Avalanche Detector (LGAD) was used to characterize a linear accelerator (LINAC) used for radiotherapy at St. Luke Hospital in Dublin. The LINAC, manufactured by ELEKTA, can produce an electron beam with energies between 5 and 15 MeV in pulses of ~ 2 ns with a substructure of 3 GHz. A tungsten target is used to produce up to 10^{11} photons/s mm² X-rays (bremsstrahlung) that are used for the treatment. The X-ray beam is contaminated with electrons produced by interaction with air. We characterized the beam using a fast detector sensitive to single photons and electrons. A permanent magnet was used to study the energy spectrum of the electrons directly produced by the LINAC and produced by the interactions with air, while a set of absorbers were used to simulate interactions in the human body.

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