Contribution ID: **926** Contribution code: **MOPL111** Type: **Poster Presentation**

An iterative algorithm to estimate the energy spectrum of an electron beam from PDD curves

Monday 8 May 2023 16:30 (2 hours)

Electron beam central-axis percentage depth dose (PDD) curves in water phantom are routinely employed to evaluate the electron beam energy at the phantom surface, in particular the mean and most probable energies from the values of R50 (half-value range) and Rp (practical range). However, these two quantities are not enough to evaluate important details of the energy distribution, such as the FWHM (Full Width Half Maximum) and the possible presence of a low-energy tail. This paper presents a numerical method that allows estimating the shape of the energy spectrum from a PDD curve. The algorithm uses a database consisting of a set of depth dose curves for monochromatic beams computed by FLUKA in the range 0.1-6.0 MeV by steps of 0.1 MeV and, using an adaptive iterative Monte Carlo process, reconstructs the incident energy spectrum by minimizing the distance between the measured PDD and the computed one. Applications of a MATLAB code based on this algorithm to simulated and real measurements of electron beams done at APAM lab (ENEA Frascati) are presented. This approach represents a strong simplification with respect to energy analysis based on the use of a magnetic spectrometer.

Funding Agency

Footnotes

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Session Classification: Monday Poster Session

Track Classification: MC1: Colliders and other Particle Physics Accelerators: MC1.A08: Linear Accelerators