Contribution ID: **77** Type: **Poster Presentation**

Energy spectrum measurement system based on dipole magnet and faraday cup

Thursday, 12 September 2024 16:00 (1h 30m)

The accurate measurement of electron beam energy spectrum is an important index to evaluate the quality of electron beam injector. Energy spectrum analysis system based on dipole magnet is widely used in beam measurement, but its measurement accuracy is more dependent on the resolution of the fluorescent screen. On the other hand, as for the beam with a long tail which commonly exists in thermionic injectors, it is challenging to capture the tail particles in the low-energy portion of the spectrum due to their low energy and proportionate contribution after passing through the dipole magnet. Consequently, conventional measurements reliant on fluorescent screens, struggle to capture the tail particles as light signals, thereby diminishing the measurement accuracy of the low-energy segment of the beam spectrum. To address this, we propose integrating a slotted adjustable Faraday cup associated with a conventional energy analysis system to achieve precise spectrum measurements. This paper presents the physical design of the system through theoretical derivation and simulation, validates the system through virtual testing methods, and ultimately offers practical guidance for engineering applications.

Footnotes

Funding Agency

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Session Classification: THP: Thursday Poster Session

Track Classification: MC1: Beam Charge and Current Monitors