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Characterization of Electron Beam Transverse Emittance at PAL-eLABs Using the Quadrupole Scan Technique

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The dynamics of charged particle beams in an accelerator can be understood by examining their behavior in phase space, where particles are distributed according to their position and momentum. The emittance, defined as the area (or volume in higher-dimensional cases) of phase space, is a key parameter in characterizing beam quality. For instance, transverse emittance has a significant impact on the lasing performance at Free-Electron Laser (FEL) facilities. Therefore, measuring emittance is crucial for understanding the properties of an accelerated beam and evaluating its quality.

Various instruments have been developed to determine beam emittance, including the slit-scanner, the pepper-pot device for single-shot measurements, the virtual pepper-pot for higher-dimensional cases, and the quadrupole magnet scan technique. The quadrupole magnet scan method involves varying the field strength of a quadrupole magnet while using a screen monitor to measure changes in the transverse beam distribution. This method is both simple and convenient for emittance measurement.

In this study, we utilized the quadrupole magnet scan technique to characterize the emittance of an electron beam generated by the photoinjector at PAL-eLABs., a small-scale yet versatile accelerator R&D facility located at the Pohang Accelerator Laboratory (PAL).

Paper submission Plan

Best Presentation

Yes

Contribution track

ICABU WG2. Beam Physics, Diagnostics & Novel Techniques

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