

Physics and Applications of High Brightness Beams



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Demonstration of Autonomous Emittance Characterization at the Argonne Wakefield Accelerator

Transverse beam emittance plays a key role in the performance of high brightness accelerators. Characterizing beam emittance is often done using a quadrupole scan, which fits beam matrix elements to experimental measurements using first order optics. Despite its simplicity at face value, this procedure is difficult to automate due to practical limitations. Key issues that must be addressed include maintaining beam size measurement validity by keeping beams within the radius to diagnostic screens, ensuring that measurement fitting produces physically valid results, and accurately characterizing emittance uncertainty. We describe a demonstration of the Bayesian Exploration technique towards solving this problem at the Argonne Wakefield Accelerator, enabling a turnkey, autonomous quadrupole scan tool that can be used to quickly measure beam emittances at various locations in accelerators with limited operator input.

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