

Optical Method For Mapping The Transverse Phase Space Of A Charged Particle Beam

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Abstract

We are developing a new method to map the transverse phase space of a charged particle beam using optical beam-produced radiation. The technique is analogous to the standard “pepper pot” collimation technique that is commonly used to measure emittance. However, our optical method does not suffer from the complexity and limitations of the pepper pot, which are exacerbated at high energies. Many types of radiation can be used for phase space mapping. To demonstrate the method, we have used optical transition radiation (OTR). The OTR is first imaged onto a mask of apertures, which break up the image into *optical beamlets*. The angular distribution of the OTR from each beamlet is analyzed to measure the beam divergence and trajectory angle as a function of position within the image. This data can be used to map out the transverse phase space of the beam. We present the results of time integrated phase space mapping performed on the Naval Postgraduate School’s 100 MeV linac beam.