

Cockcroft Institute Colloquium

Sources of Emittance in Photocathode RF Guns

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Abstract

Advances in electron beam technology have made possible innovative radiation sources for basic research and applied science. The recent successful operation of the first of the x-ray free electron laser at SLAC is both the first demonstration of a SASE FEL at hard x-ray wavelengths as well as a reliable production facility of x-ray beams for studies in the materials and biological sciences. The electron source for this facility is the photocathode RF gun. This seminar discusses the sources of emittance in the photocathode RF gun and is motivated by the desire to further understand and improve the beam from this type of electron source. The reduction of beam quality due to fundamental cathode photoemission physics, space charge effects close to the cathode and optical distortions introduced by solenoid fields are discussed and analytic relations for these phenomena are derived and compared with numerical simulations.