MAR07-2006-002696

Abstract for an Invited Paper
for the MAR07 Meeting of
the American Physical Society

Energy Recovery LINAC: Experimental Challenges

JOEL BROCK, Cornell University

ERL projects are ongoing at JLab, Daresbury, KEK and Cornell. Here, we describe the experimental challenges of using high-coherence and ultra-fast pulses from the Cornell ERL and illustrate some potential opportunities. The Cornell ERL is designed to run in several different modes. In the hi-flux mode, the ERL runs at 5 GeV and 100 mA. Many experiments, such as inelastic x-ray scattering are photon-starved. In the high-coherence mode the ERL runs at 25 mA and the transverse emittances could be as low as 8 pm. The beam size will be at its smallest under this operating condition and an average spectral brightness as high as 10^{23} (standard units) is predicted. We expect to produce a round (3 micron diameter) source for imaging and coherence experiments on individual biological cells. In the ultra-fast mode, the repetition rate is reduced from 1.3 GHz to 1 MHz, the bunch charge is increased to 1 nC per pulse, and the natural 2 ps bunch length is compressed to less than 100 femtoseconds. We will present opportunities for x-ray experiments on a single atom as well as the challenges in x ray optics, other experiments, and beam control issues when making a 1 nm focused x-ray beam size.