

ERL Injector Operations

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Cornell is developing a high brightness hard X-ray source based on an energy recovery linear accelerator (ERL). The electron beam generated in low emittance gun will be accelerated in superconducting RF cavities to an energy factor of 5 GeV to produce the X-ray beam in undulator magnets. After that, the electron beam energy is recovered while the electrons traverse the same cavities with a phase shift of 180 deg.

By using this technology, the electron beam passes the accelerator only a single time before it generates the X-ray beam and by this the beam emittance is not limited due to synchrotron radiation as it is the case in storage ring based light sources. As a consequence, the brightness of the X-ray beam is only limited by the emittance of the electron beam as it is generated in the electron gun - the key component of an ERL.

As a prototype for the ERL, we are currently commissioning a high current, low emittance electron gun capable of generating beam currents of up to 100 mA at sub-micron normalized beam emittances. The task of an REU student will be to participate in this commissioning process, which involves learning how to operate the machine as well as studying and optimizing its performance. This includes writing Matlab scripts to record data, automate measurements and perform data analysis. Among other things, the dependence of the beam emittance and the longitudinal bunch profile on various machine parameters could be studied. Computational skills are an asset.