The Beams and Applications Seminar Series

Development of high brightness, high repetition rate injectors for new generation ERL and linac based light sources at STFC Daresbury laboratory

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Bldg. 401, Room B2100
Friday, Oct 15, 2:00 PM

Host: Kathy Harkay

Abstract: Accelerator drivers for modern Energy Recovery Linac (ERL) and FEL-based light sources demand electron injectors which deliver high brightness bunches with charge levels in the 100s of pC scale, at repetition rates from 1 MHz to 1 GHz or higher, corresponding to average currents varying from 0.1 to 100 mA. The combined parameters of these injectors are significantly beyond the current state-of-the-art. STFC Daresbury Laboratory operates a photoinjector development programme which is concentrated in the following specific areas:

•Operation and upgrade of the ALICE ERL photoinjector
•Investigation of the physics of photoemission, primarily in III-V and eventually in $X_nY_{3-n}Sb$ photocathodes
•Design of new electron injectors for ongoing and future ERL and FEL projects.

Accelerators and **L**asers **I**n **C**ombined **E**xperiments (ALICE) is a 35 MeV ERL at Daresbury Laboratory. The ALICE photoinjector gun is a variant of the JLab IR-FEL photoinjector, operating at 350 kV DC with a GaAs cathode, and is currently the subject of an upgrade. The focus of this upgrade is an extreme high vacuum photocathode preparation facility incorporating a load-lock system designed at DL which will be integrated with the ALICE photoinjector in 2011. The new load-lock system can accommodate up to six photocathodes, and has been successfully commissioned during 2010. It permits the activation and rapid transfer of photocathodes between the load-lock system and ALICE photoinjector gun.

Investigation of photoemission physics is concentrated on measurements of emitted electrons, particularly their energy spectrum as a function of photocathode electron affinity. A deeper understanding of this physics could potentially allows optimisation of the photocathode preparation procedure for emission of high brightness, short electron pulses.

Our design of new electron sources is concentrated on the development of a high repetition rate SRF photoinjector and a thermionic injector. The SRF photoinjector has been designed for ongoing NLS-type (Next Light Source) projects. It is based on a 1½ cell SRF gun operated with a Cs_2Te photocathode, and is potentially able to deliver high brightness 200 pC electron bunches at a repetition rate of 1 MHz. The thermionic injector is planned to be a gate-modulated CeB_6 electron gun accompanied with a multi-stage compression scheme.

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