BROOKHAVEN NATIONAL LABORATORY
NATIONAL SYNCHROTRON LIGHT SOURCE

MEMORANDUM

DATE: 25 September 2000

TO: Sam Krinsky, Richard Osgood, Peter Paul

CC: NSLS Management Group, FEL Project Team

FROM: William S. Graves, Richard Heese, Erik D. Johnson

SUBJECT: **DUV-FEL Project Report; Period ended 22 September 2000**

Work in Progress:

The mirrors, waveguide, and bolometer detector were installed for measuring the radiation from the COUR undulator. Some shielding and testing work remains to be done on the detector as well as connections and testing of the stepper motor drives for the undulator. This work is planned for the week of September 25.

The planned work on the laser revealed that the intensity structure in the UV beam can be greatly reduced by adjusting the operating parameters of the laser. In this way the fluctuations were driven to below 5%. While the resulting beam energy of 70 μJ is about a third of the maximum we routinely get in the UV (220 μJ), it is more than adequate for our present requirements. An alternative approach to clean up the mode structure using a spatial filter is also being pursued in parallel.

With respect to the electron beam measurements, the conclusion from the trim magnet spectrometer testing is that the energy from the photo-injector stands at 4.6 MeV for 7.8 MW Rf power to the gun. Some emittance measurements were made at both high and low energy without optimization. In each case the pulse length of the laser stimulating the cathode was 5 ps.

Beam Energy [MeV]	Charge [pC]	Emittance [π mm-mrad normalized]
81	50	10.9
197	50	6.8
197	150	20.4

The low energy measurement was at the pulse compressor. High-energy measurements were taken after all four sections, but with different lattice settings. In fact the low charge measurement had minimal quad strength, and the high charge measurement was made with a lattice more like our intended operational parameters. Part of the emittance growth is likely to be due to quadrupole misalignments that we know exist and can be corrected. This group of measurements is best regarded as our starting point for further optimization.

Also during this period, the concrete shielding configuration for the undulator was reviewed and approved for installation.

Work Planned for Next Week(s):

In performing the beam studies and modeling, it was determined that the cathode plate is tilted relative to the gun axis. The plate contacts the gun body at the top and has a 0.013" gap at the bottom. To correct the tilt, the gasket will be replaced and the cathode reinstalled focusing on keeping the gap uniform rather than matching the torque on the bolts. This will also provide an opportunity to center the gasket, which may have been responsible for the tilt in the first place.

Since the machine will be down for much of the week for this work, we will also install the newly fabricated trim magnet to provide a permanent independent energy measurement tool for the photo-injector. The COUR stepper motor installation should be completed, and the shielding requirements for the detector evaluated.

To allow the installation of the south concrete shielding wall for the undulator, one of the NISUS power supplies will be moved. Most of the shielding blocks will be brought into building 729 and installed during the next few weeks. The goal is to place as much of the shielding mass as possible to get the settlement out of the way by the time we need to use the electron beam in the undulator. The current shielding enclosure and interlocks around the linac are not being modified in any way at this time, so the operation has no impact on the SAD agreements in place.

Management:

Plant engineering is evaluating alternative (less costly) plans to extend building 729 to the west. This would provide additional space for the experimental equipment after the wiggler. This expansion, should it come to pass, needs to be factored into the various planning activities that are now underway for FEL operations.