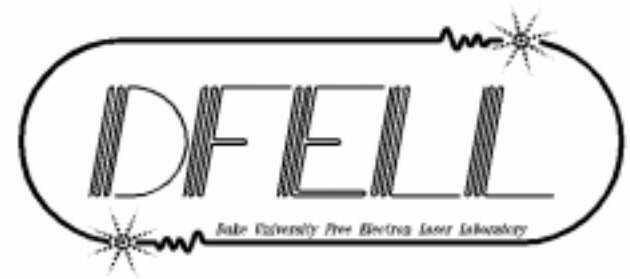

Duke FEL Laboratory Control Systems

Steven Hartman
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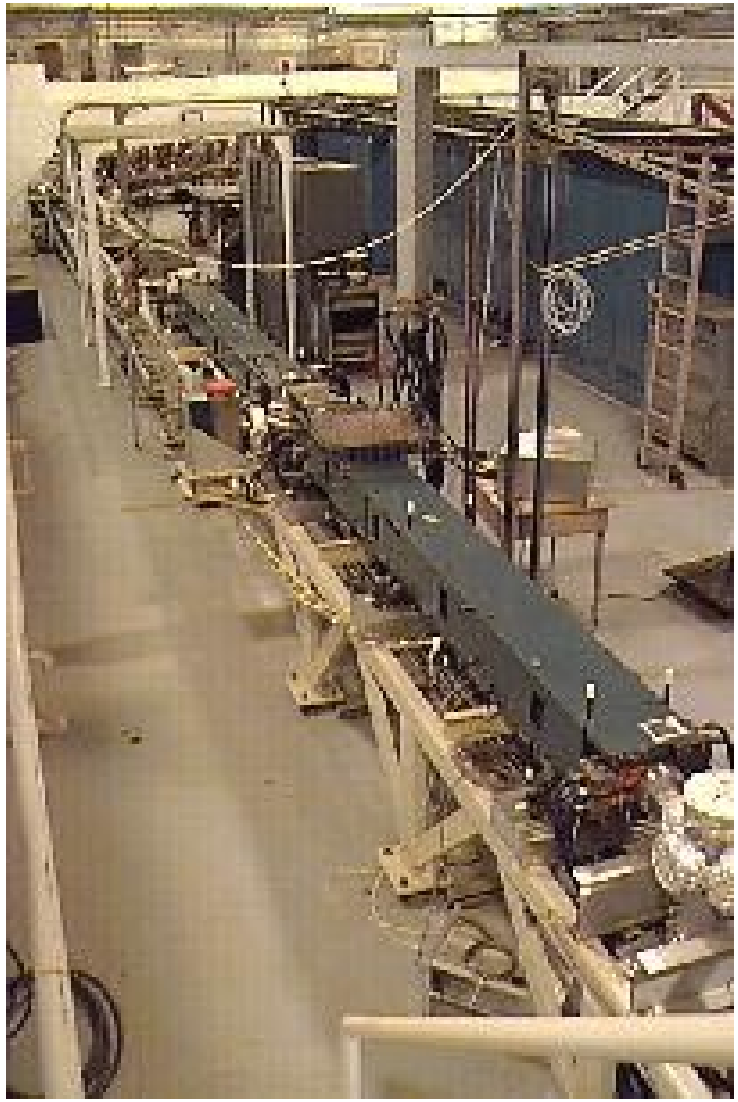
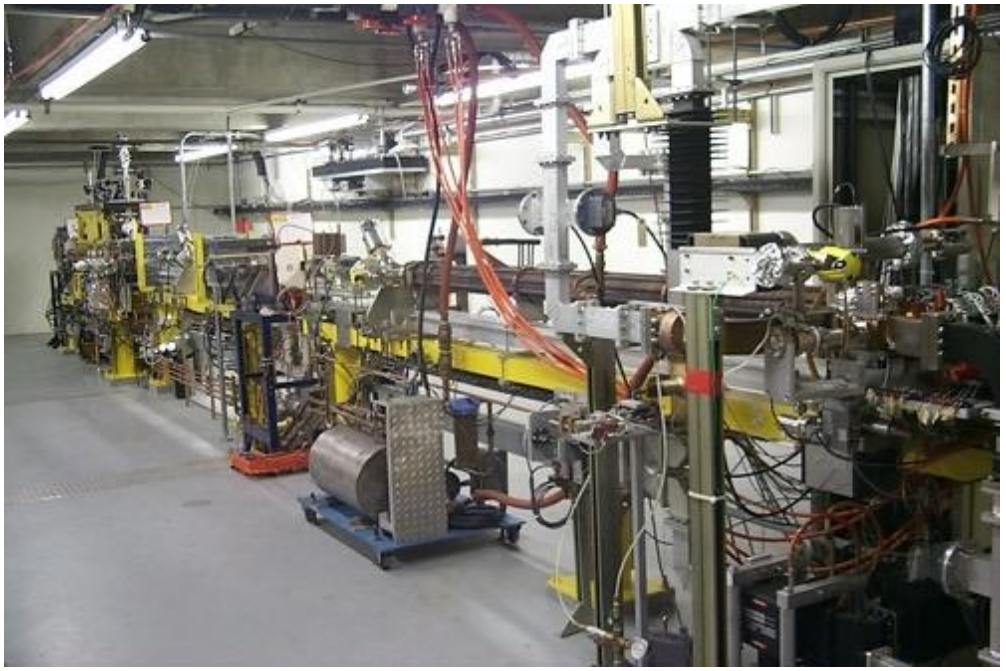
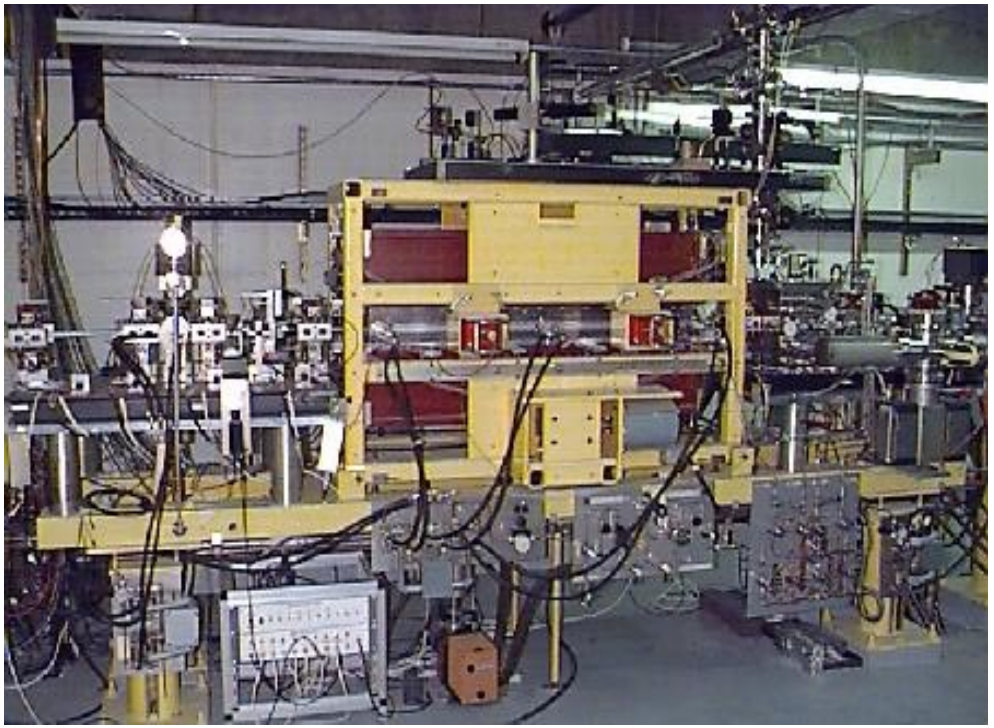




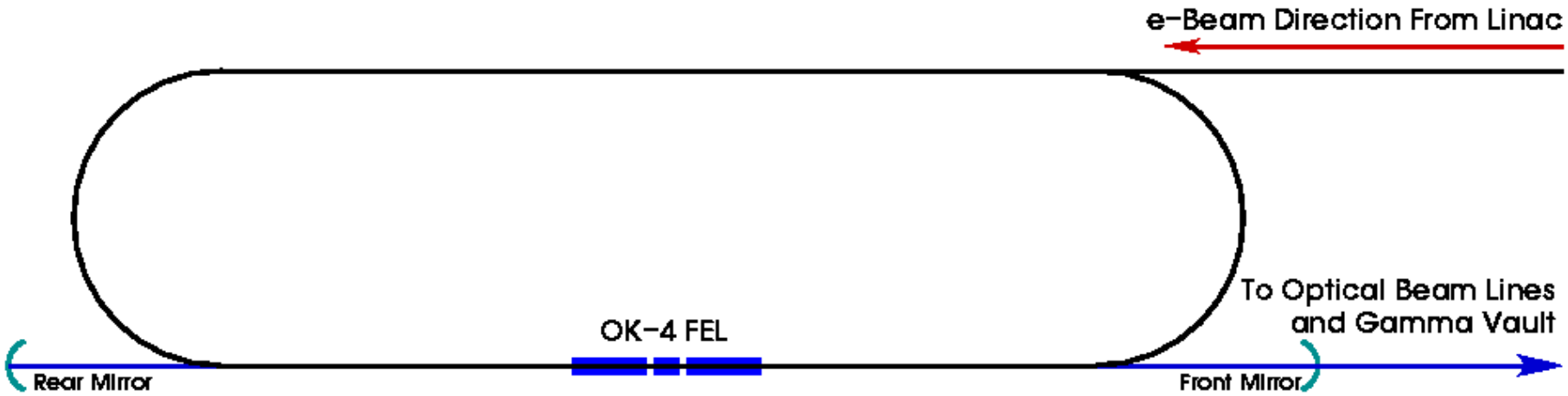
DFELL

Mark III FEL



- 40 MeV Linac
- Mid-Infrared FEL (2 – 9 μ)

OK-4 Storage Ring FEL

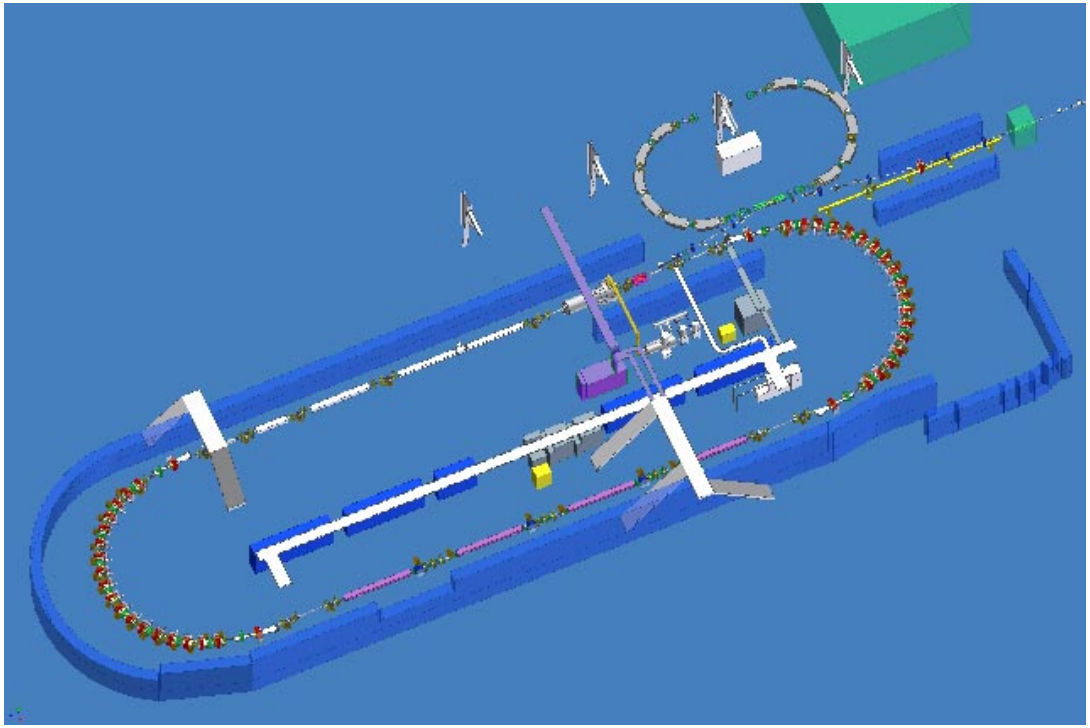


- Accelerator and FEL Physics
- Single-Bunch for FEL Lasing
- Multi-Bunch (60/64) for Spontaneous
- Two- or Four-Bunch for γ-ray Production (HIγS)
- 270 MeV Linac
- 1.2 GeV Electron Storage Ring
- Optical Klystron FEL

Control System Upgrade

- EPICS 3.11 to 3.13
- Physics Based Control Units: MeV, K_1, K_2, mrad.
- Ramp by energy at the IOC level.
- Lookup tables to convert from physics units to power supply settings for all Storage Ring magnets.
- Lookup tables provide compensation trim settings between magnets of same family.
- Independent readbacks for major power supplies using DCCTs and VME based NMR probes.
- Flexibility and control for physicists, but high usability for operators.

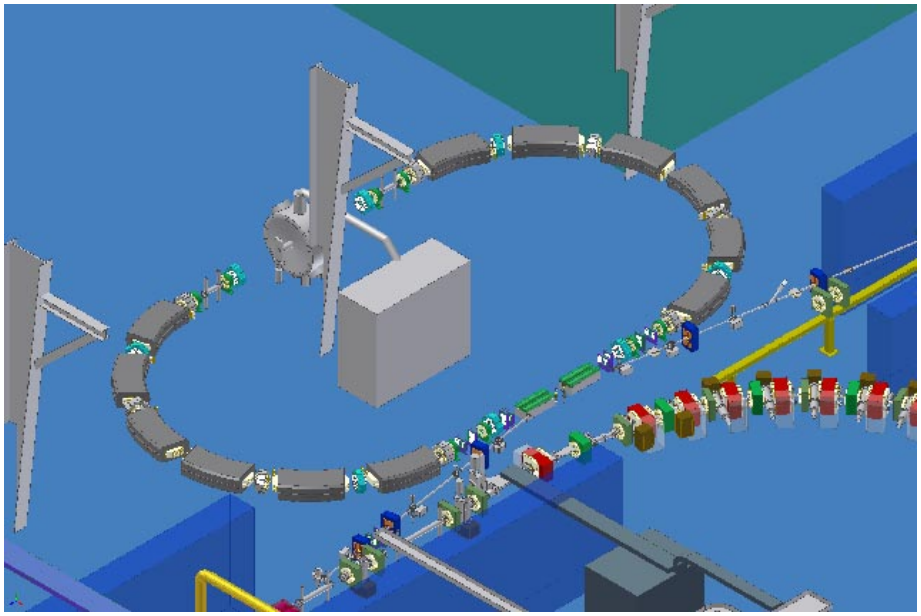
OK-5 FEL



- 24 meters long
- 4 Helical EM Wigglers
- 3 Bunchers
- Variably Polarized, Tunable Light Source, γ-Source
- Will be installed in south straight section.

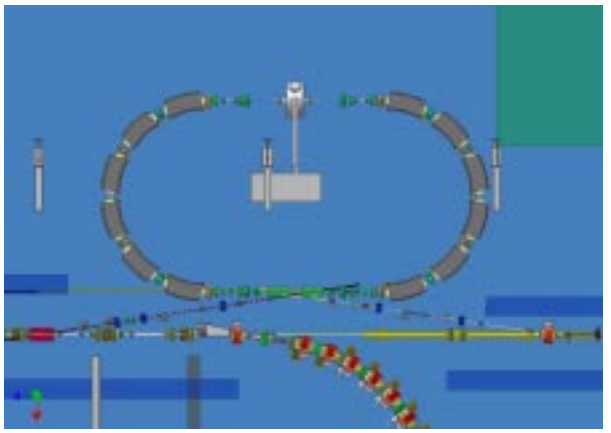
1.2 GeV Booster

Average Beam Current	100 mA
Circumference	31.902 m
RF Freq	178.547 MHz
Bunches	8 – 19
Energy Rise Time	1 – 2 s
Damping Time	3.15/1.58 ms



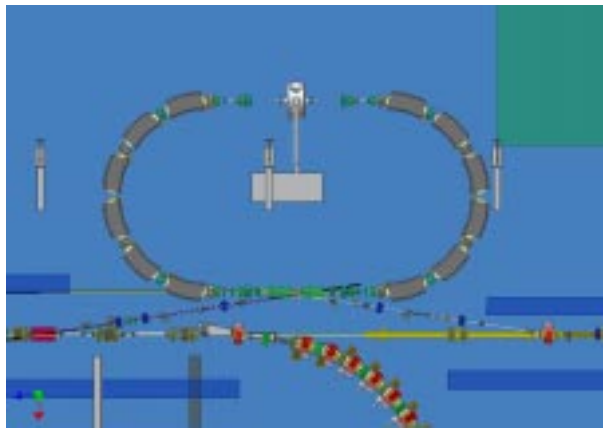
- Ramp Energy from 270 MeV to SR Operation Energy.
- Top-off Injection for HIγS Loss Mode.
- Single Bunch Injection: from any bunch, to any bunch.
- Replace lost electrons up to 4.3 nC/sec.
- Scheduled for 2005.

Booster Control Requirements

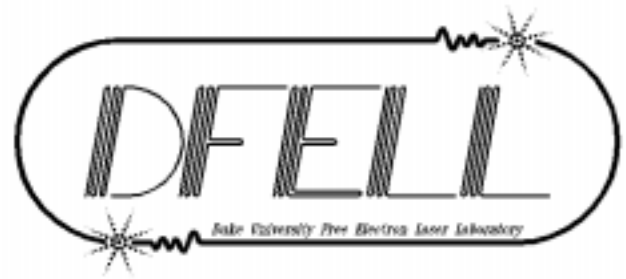


- Ramp to match any ring energy: 270 – 1200 MeV (within 0.1%).
- Top-Off injection for HIγS loss mode.
- Injection, Ramp, Extraction: goal of 95% efficiency.
- Single bunch injection capability: From any of Booster's 19 bunches to any of Storage Ring's 64 bunches.
- Modifications to injection straight section.
- New RF system for Storage Ring. Existing RF system used for Booster.

Booster Control System



- Single power supply for all dipoles (12) and quadrupoles (16). Individual sextupole, orbit and trim power supplies.
- 0.2 sec Injection, 1 – 2 sec Ramp up, 0.8 sec Extraction, 0.5 sec Ramp down.
- Single Bunch Extraction: 11 ns kicker pulse duration.
- Picosecond timing resolution integrating Linac, Booster and Storage Ring.
- Fast Diagnostics and Instrumentation.
- Turn-Key Operation.



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