ILC Polarized Electron Source

Annual DOE HEP Program Review
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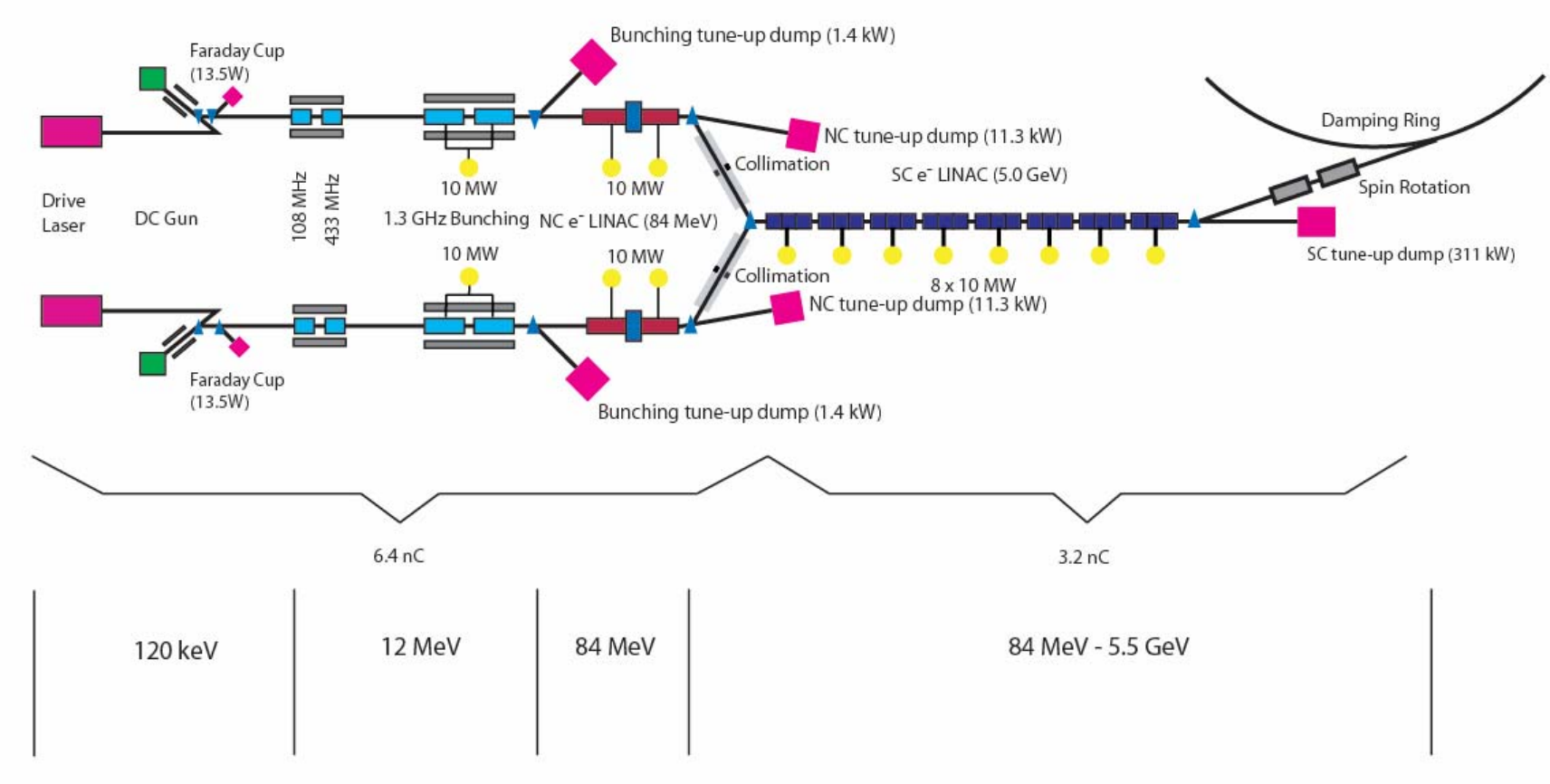
Overview

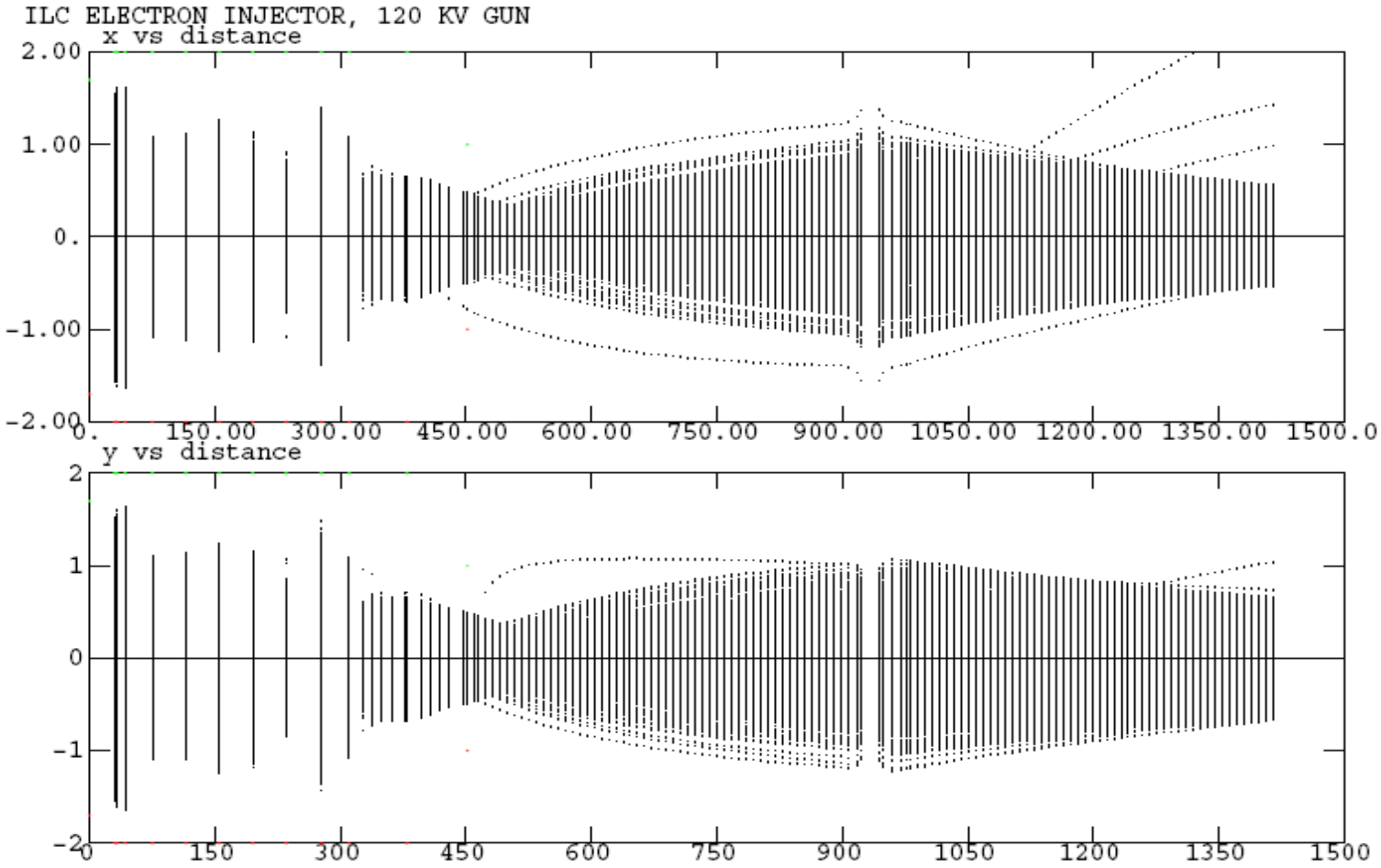
- Layout – based on ILC source requirements
- Beam line optics design
- Current R&D Program

  - Photocathode R&D
  - Laser development program

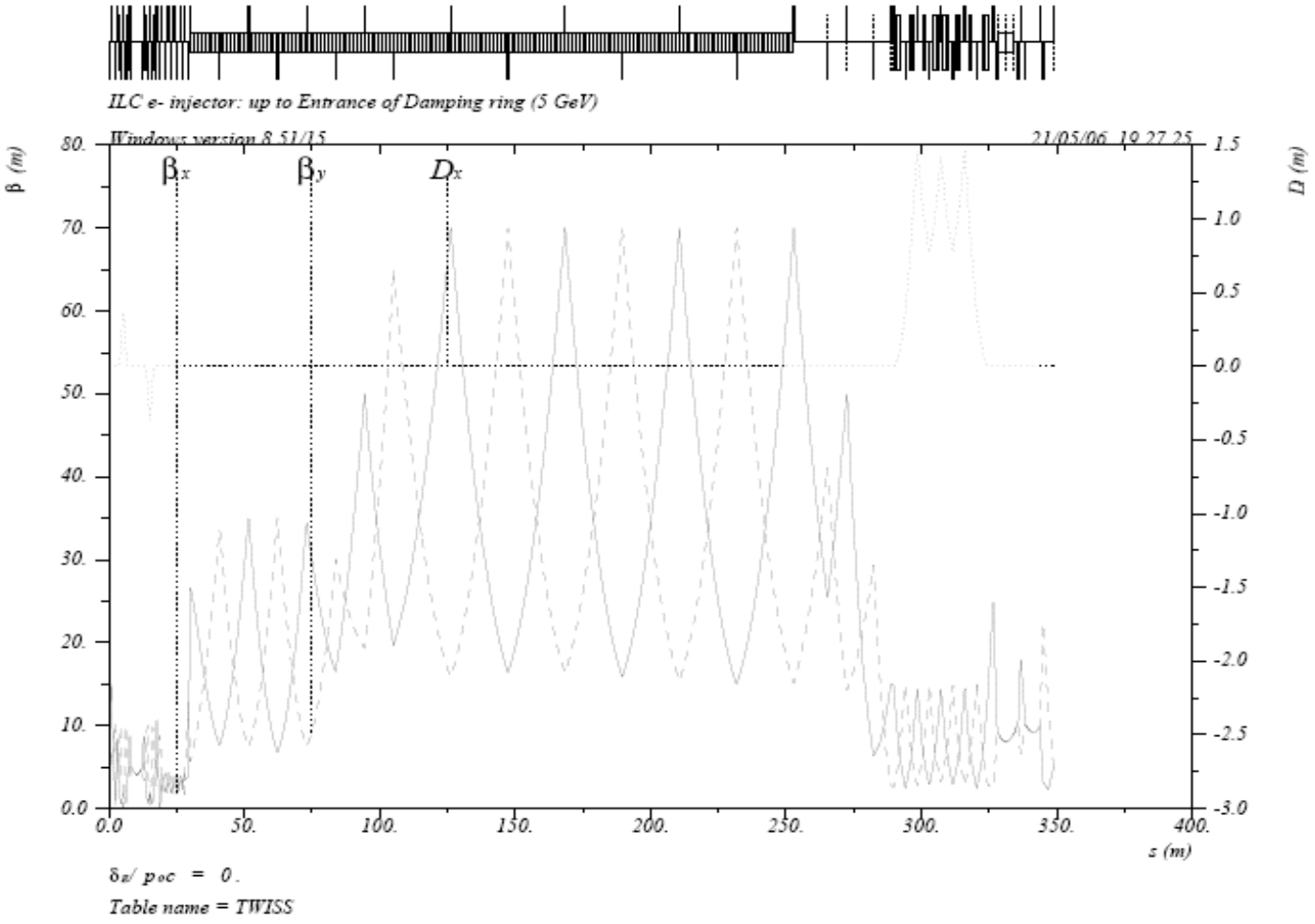
Polarized Electron Source Schematic Layout



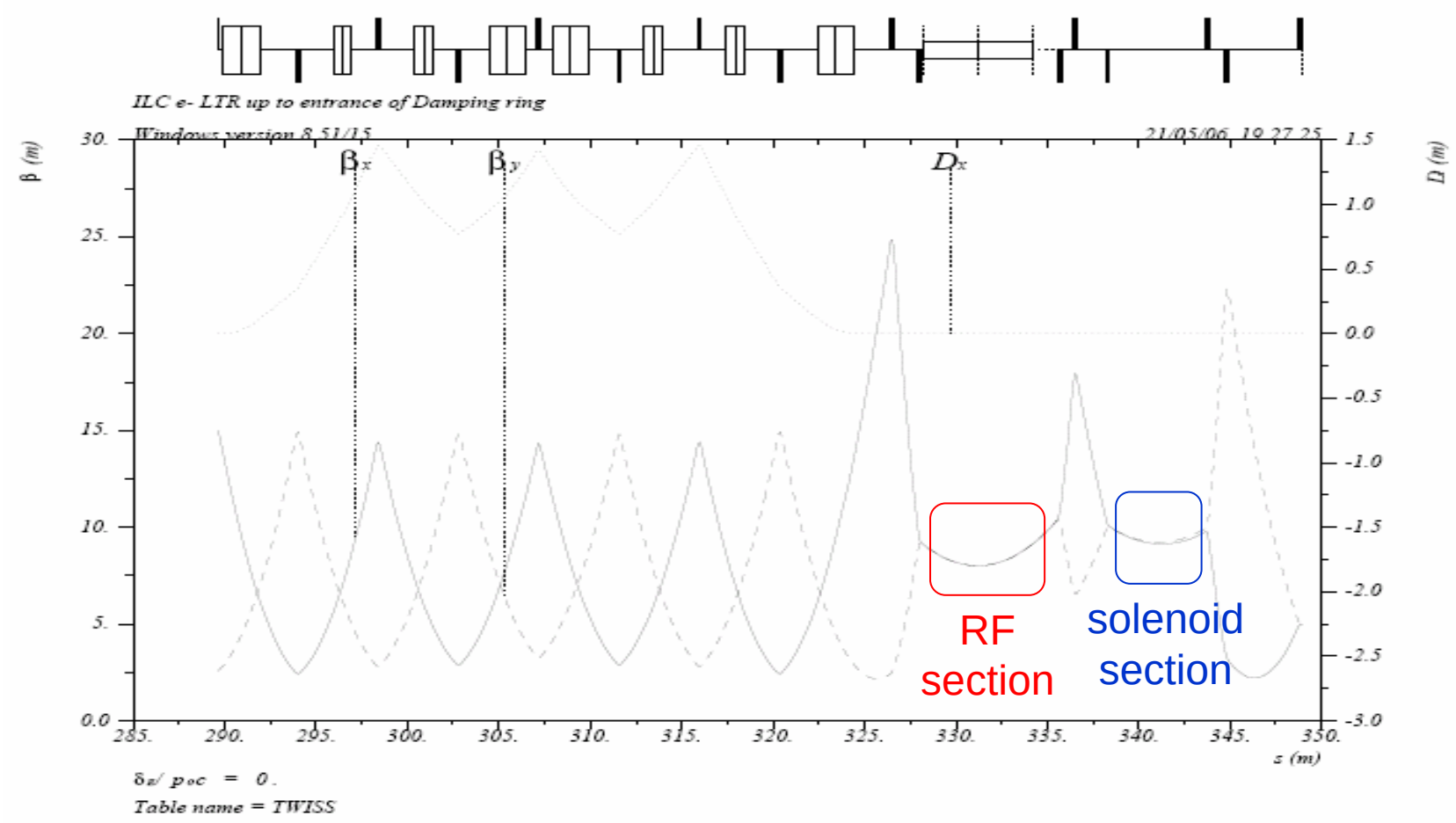
Beam Line Optics Design : 120 keV to 84 MeV



Beam Line Optics Design : Electron Booster Linac (5 GeV)

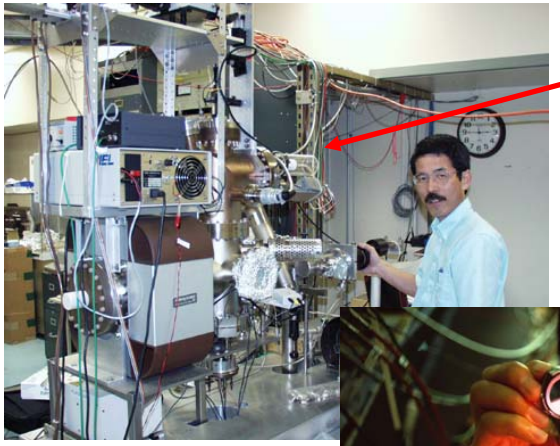


Beam Line Optics Design : Linac to DR Transfer Spin Rotation and Energy Compression

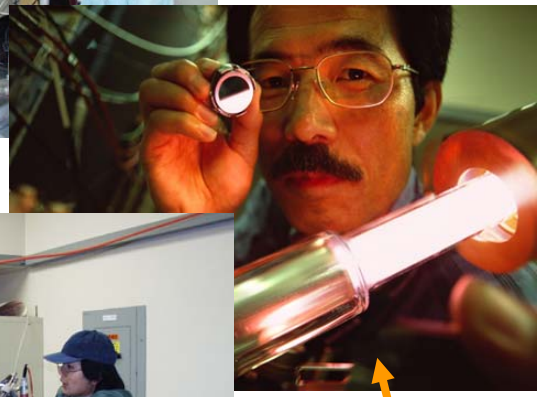


Photocathode R&D program at SLAC

- SLAC has a long history of cathode development for polarized electron beams
- Collaboration with industry using DOE's SBIR program – currently 'development of gridded photocathodes for improved QE and Polarization' with Saxet Inc.
- Collaboration with universities through 'Polarized Photocathodes Research Collaboration – PPRC'
- Participation of many SLAC support groups, e.g. Surface and Materials Science Group, Vacuum Group



Cathode Test System



Atomic Hydrogen Cleaning

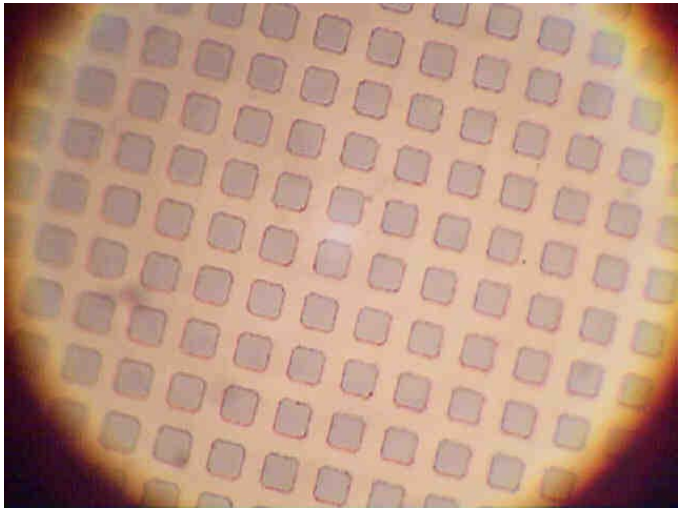
Photocathode R&D: Improve Quantum Efficiency and Polarization

Example : Biased photocathodes

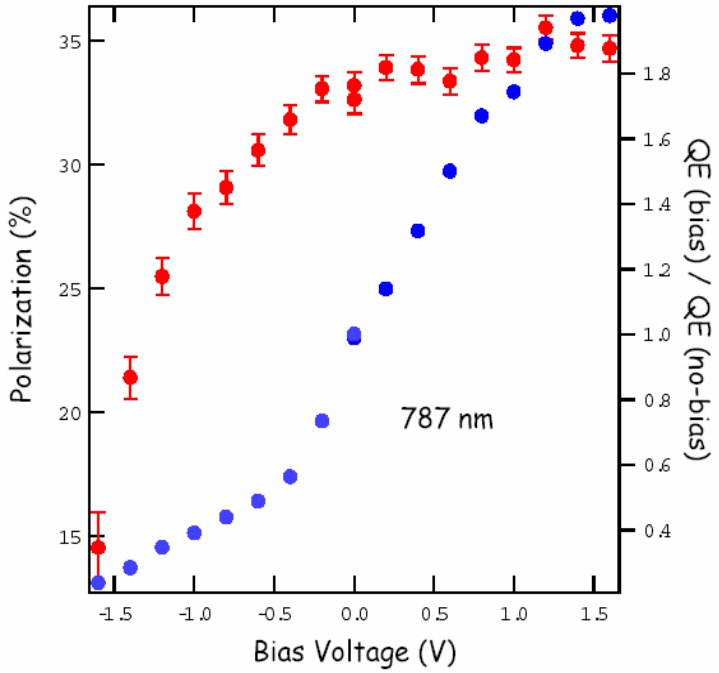
Positive bias

- Larger NEA → higher QE
- Faster electrons → higher polarization

Bias voltage supplied by photolithographically deposited tungsten grid.



Thin unstrained GaAs



Injector Test Facility – Integrated Photoinjector Test Lab

Existing Facilities:

- Laser Development Lab
- Gun Development Lab
- Cathode Test Lab
- High Voltage Test Facility

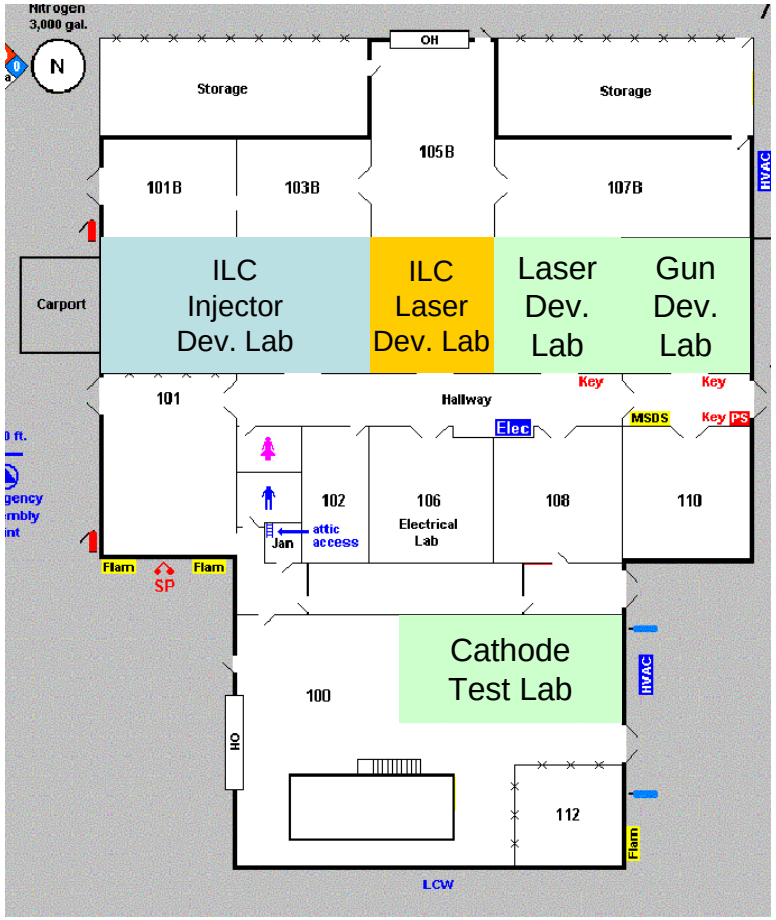
Facilities in Preparation (this FY):

- ILC Laser Development Lab

Future Facilities:

- ILC Injector Development Lab

Upgraded Injector Test Facility



High Voltage Test Facility

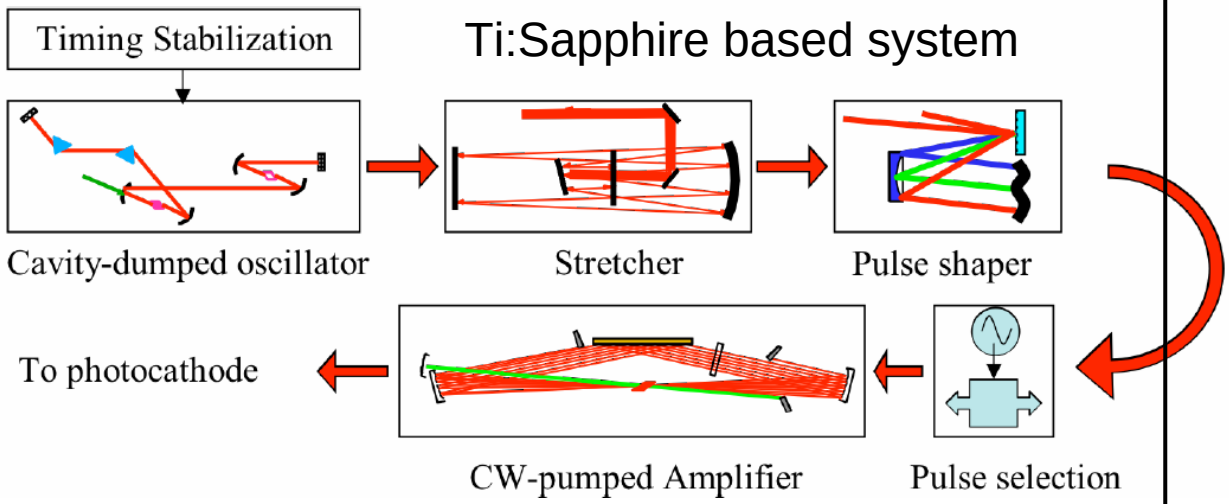
Proposed Laser System

Requirements based on ILC parameters and photocathodes for polarized electrons:

Challenge: Pulse train amplification at 3 MHz (6 MHz for upgraded ILC) using Ti:Sapphire
→ no commercial or demonstrated solution → R&D REQUIRED

Wavelength:	800 nm → matching of GaAs bandgap
Energy:	~ 5 micro Joules
Pulse format:	2 ns pulse at 3 MHz, 1 ms burst

Approved SBIR (phase I) with Kapteyn Murnane Laboratories, Inc.



Outlook for FY 07

- Laser System Development and integration into Injector Test Facility
  - Laser transport to ITF Gun → generate ILC beam, demonstrate polarized electron pulse train generation with GaAs cathodes
- Continue Photocathode R&D
  - Further improvement of polarization and QE
  - Upgrade lab equipment - next generation cathode test system
  - New photocathode material
- Gun R&D
  - new electrodes for polarized gun
  - Improved HV design