Gun & Laser Status

Joe Grames

Updates

- G0 Tiger Laser
- High Polarization Photocathodes
- Mott polarimeter
- Injector Test Stand G0 Beamline

Upgrades to G0 Tiger Laser

Tiger laser was returned to Time-Bandwidth, Inc. for upgrades to help improve functionality in the tunnel.

Replace Melles-Griot 3 W pump with a Jenoptic 5 W pump:

- improved reliability
- increased output power (although not needed)
- begin 2nd run with a fresh pump laser

Adding remotely controlled pico-motors:

- pump laser steering mirrors for power optimization
- birefringent filter to tune wavelength for peak polarization

Serial communication to read laser parameters and measured phase noise.

The return date is mid-July.

Summer Plans for the Tiger laser

When the Tiger returns to Jlab it will be moved to the ITS laser room in the Test Lab for July and August testing:

- Parity laser studies for G0 & HAPPEx2 (Pockels cell, IA, PZT)
- Testing new remote controls and communications

The laser will be installed during the September shutdown (and not removed).

A second Tiger laser has been ordered from Time-Bandwidth and is expected to arrive in late September. This will be our “hot spare”.

Tunnel Operations Issues

Remote control and readback should improve performance tracking and optimization.

Although effort has been taken to minimize dust and particulates an access may be required every 2-3 weeks to clean the cavity optics.

The G0 laser runs CW. We also use a pockels cell to create machine safe low duty factor beam. During the summer we will test a new fast HV switch and fast switching RTP Pockels cell to create equal peak current in both pulsed and CW modes. This will benefit Ops.

High Polarization Photocathodes

Both guns have high polarization strained GaAs photocathodes from Bandwidth Semiconductor:

- Beam polarization is 75-80%
- QE starts at ~0.15% (1 uA/mW)
- Laser power starts @ >200 mW

In September we will re-activate cathodes as needed and plan to have both guns ready for G0 (gun2 photocathode same as before).

Depending upon gun current, gun vacuum and available laser power, a "spot move" may be required. Avoiding the electrostatic cathode center provides 4-5 spots over the unanodized 5mm active area. During last G0 run we ran from about one spot per month.

The analyzing power of this cathode was about 5% (Aug. '02).

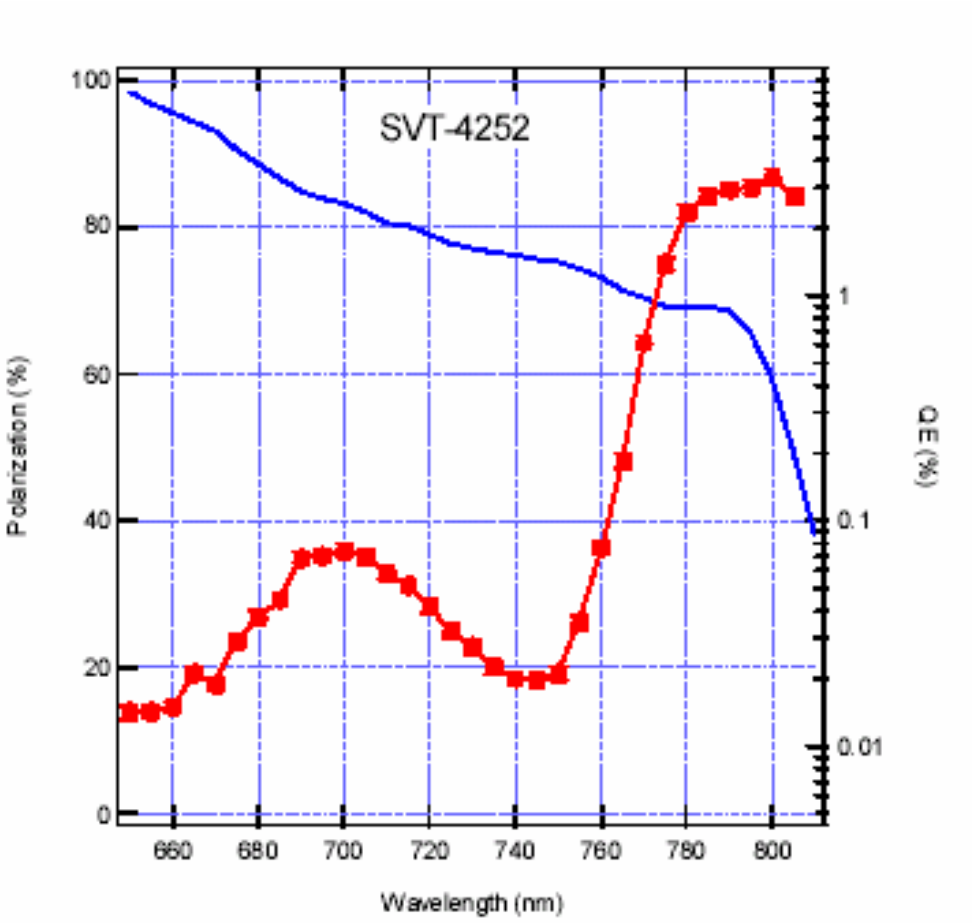
New High Polarization Photocathode

SVT Associates is working with SLAC to grow high polarization superlattice photocathodes.

The cathodes are promising, offering polarization ~85% with a QE of ~1% !

But, note that choosing a "designer cathode" also requires matching the laser wavelength. There is a cost (time and dollars) for engineering and modifying the G0 laser to do this.

We would need to purchase this option from Time-Bandwidth (~$15k). We need to order this now.



From talk M. Woods (SLAC)

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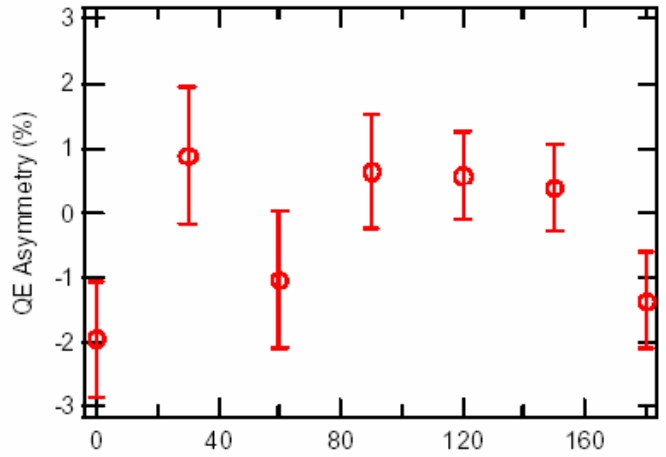
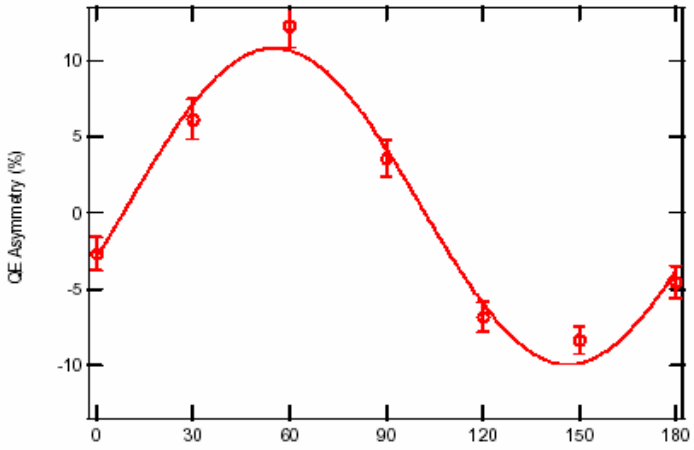
SVT-4182 (High-gradient-doped superlattice GaAs/GaAsP)

- QE Asymmetry measurement in Cathode Test Lab
  - The polarization is changed by liquid crystal retardator.

$$\text{Asym} = (QE_{\uparrow} - QE_{\rightarrow}) / (QE_{\uparrow} + QE_{\rightarrow})$$



SVT-4182 (High-gradient-doped superlattice GaAs/GaAsP)

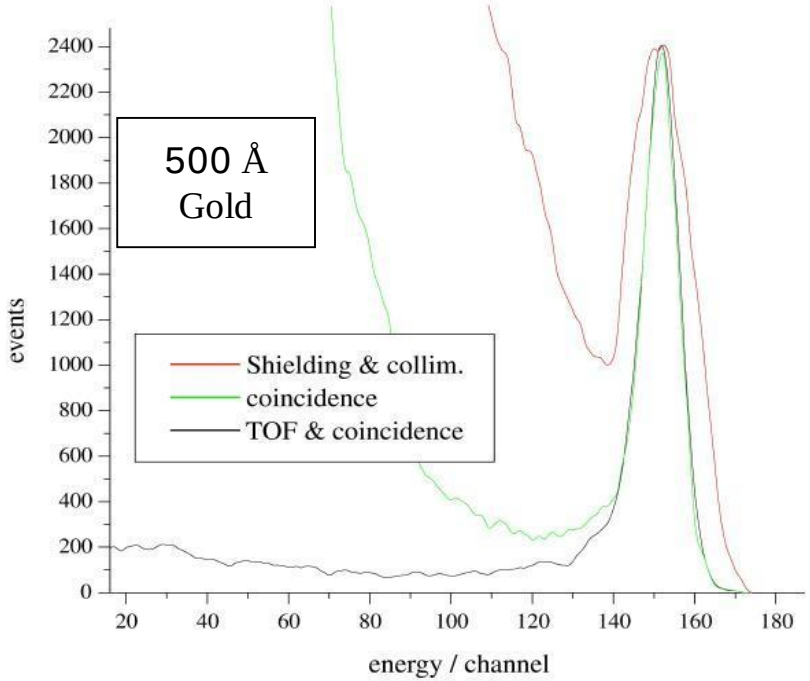


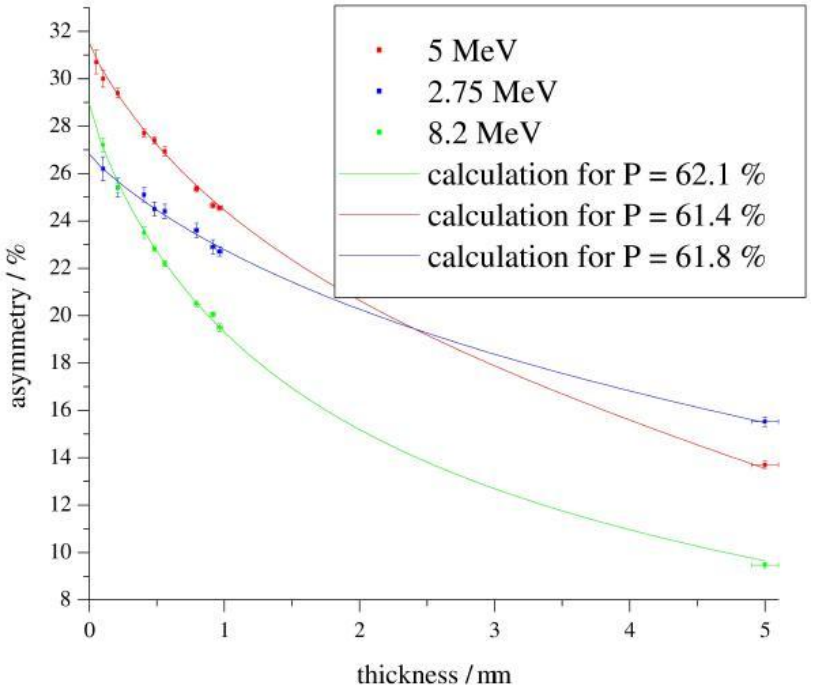
SVT-3982 (High-gradient-doped strained GaAsP)

Injector Mott Polarimeter Status

Brief history of the 5 MeV Mott polarimeter:

- Mott polarimeter was constructed and commissioned in the mid-90's.
- Used by HAPPEx with 4-5% absolute uncertainty.
- Late 90's improved elastic signal detection and foil extrapolation model
- Uncertainty: experimental (0.5%) + theoretical Sherman function (1%) => 1.1%





Injector Mott Polarimeter Status

The polarimeter has been little used the last 3 years.

We are trying to turn this around:

1. Re-establish operability:

    Detector checkout & repair - Bogdan Wojtsekhowski

    Full time accelerator support - Sandy Roman

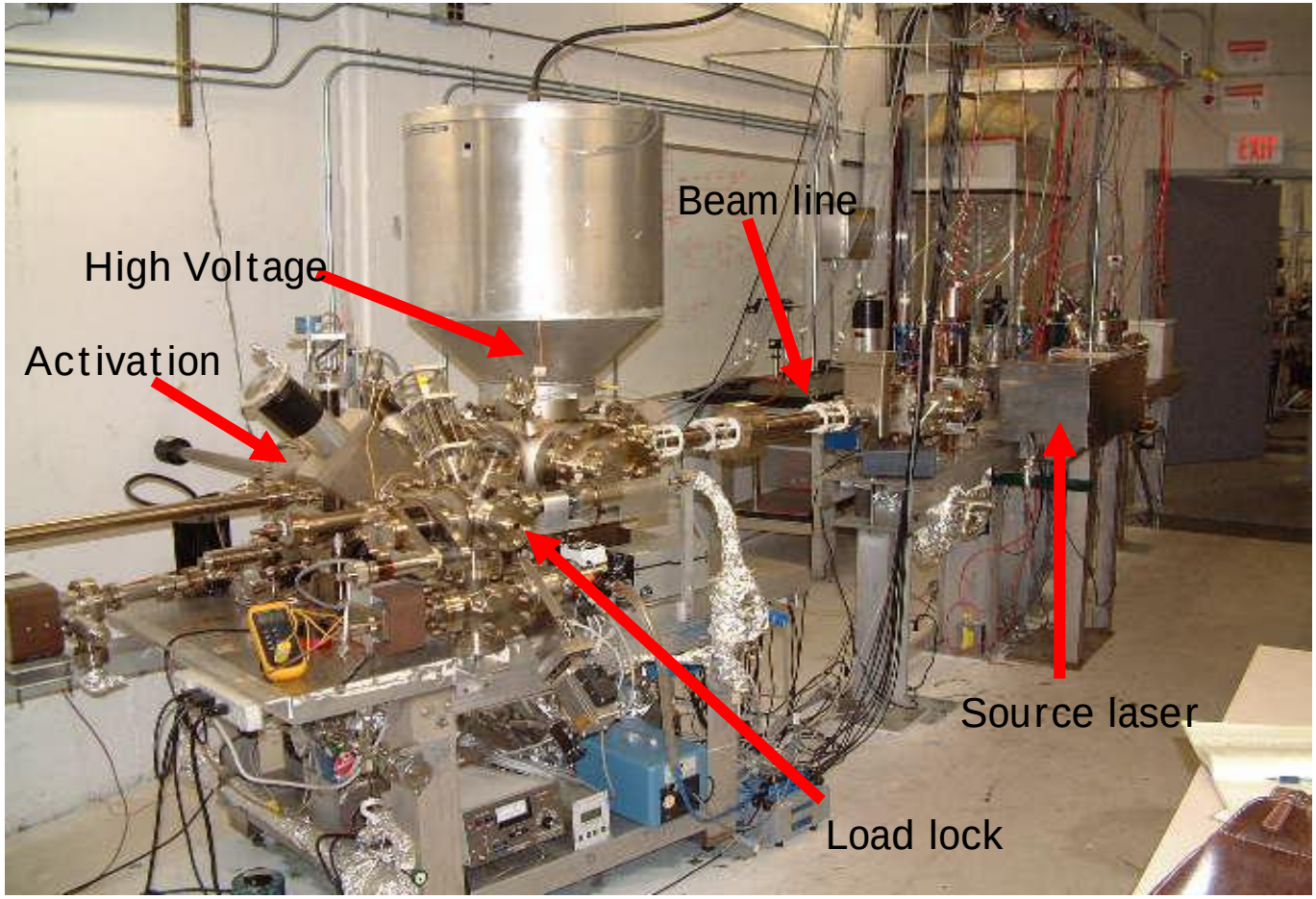
2. Consider upgrades to make the tool ready for the Physics program:

    Be compatible with delayed/random helicity modes.

    Augment Ops support/documentation (less of an expert's tool).

    Be "Spin Dance ready", particularly for machine energy measurements.

JLab's First Load-Locked Polarized Electron Gun Injector Test Stand, March 2003



JLab's 100 kV Load Locked Polarized Electron Gun

Gun Features:

- Photocathodes can be swapped within 12 hours. No more bakeouts and related 3 day downtime.
- No cesium in high voltage chamber. This eliminates field emission and subsequent photocathode death.
- No reason to vent the gun. As a result, better vacuum and gun lifetime.

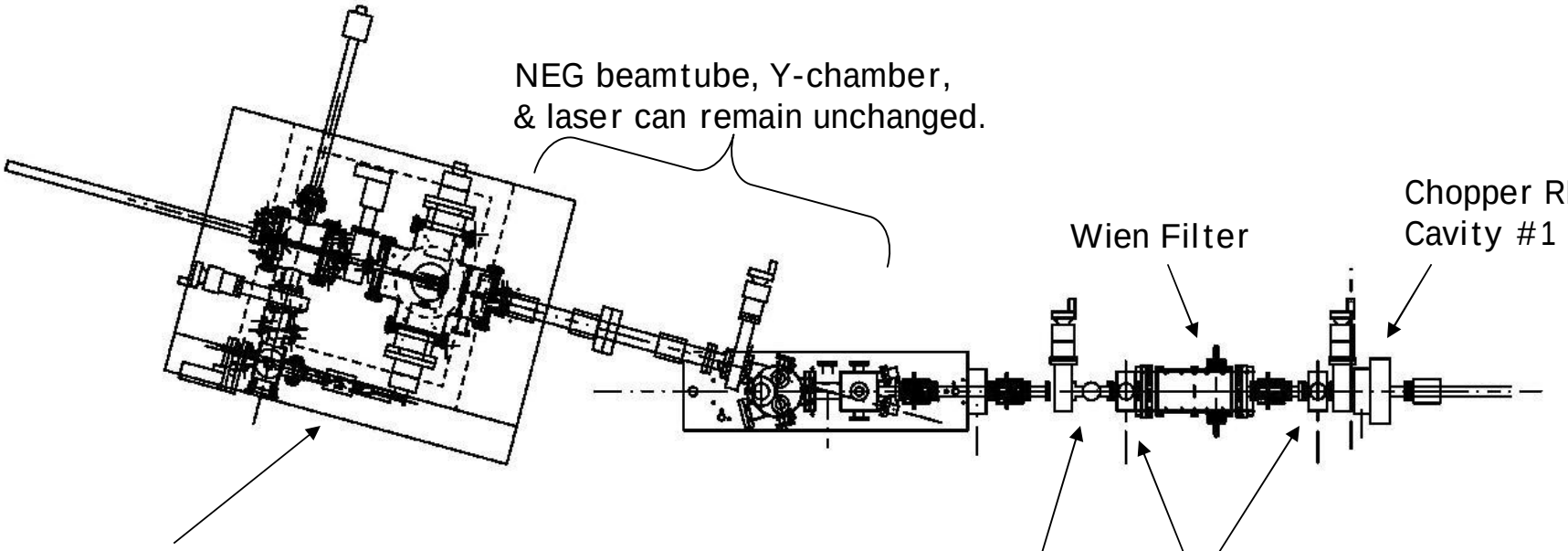
Commissioning Underway at Test Cave:

- Lifetime studies at high current - Summer.
- Upgrades & tests for the load-lock gun - early Fall.
- Characterize beam properties at high bunch charge (i.e., g0 beam development) – late Fall.

G0 Beamline Testbed

Goal #1: improve transmission (chopper) while operating w/ lower prebuncher gradient.
Goal #2: develop solution without CEBAF downtime.

Reduce length of 100 keV section of beamline (artifact of T-Gun).
Cannot sacrifice vacuum quality of gun !



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