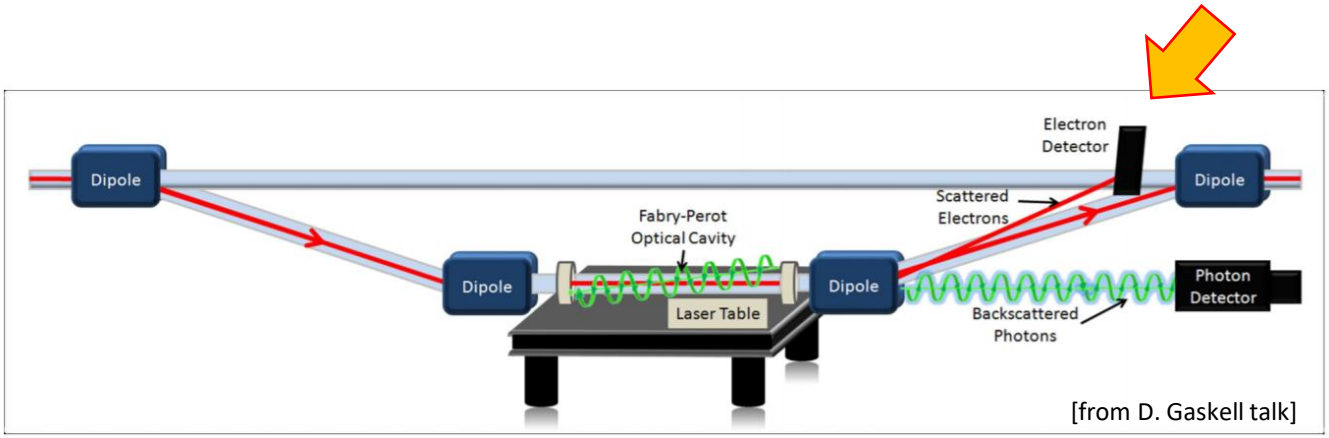
DAQ: status of the Hall A Compton (e^- detector)



[from D. Gaskell talk]

Marco Carmignotto, Joshua Hoskins, Alexandre Camsonne

(thanks to Bryan, William, Ben, and Dave Gaskell!)

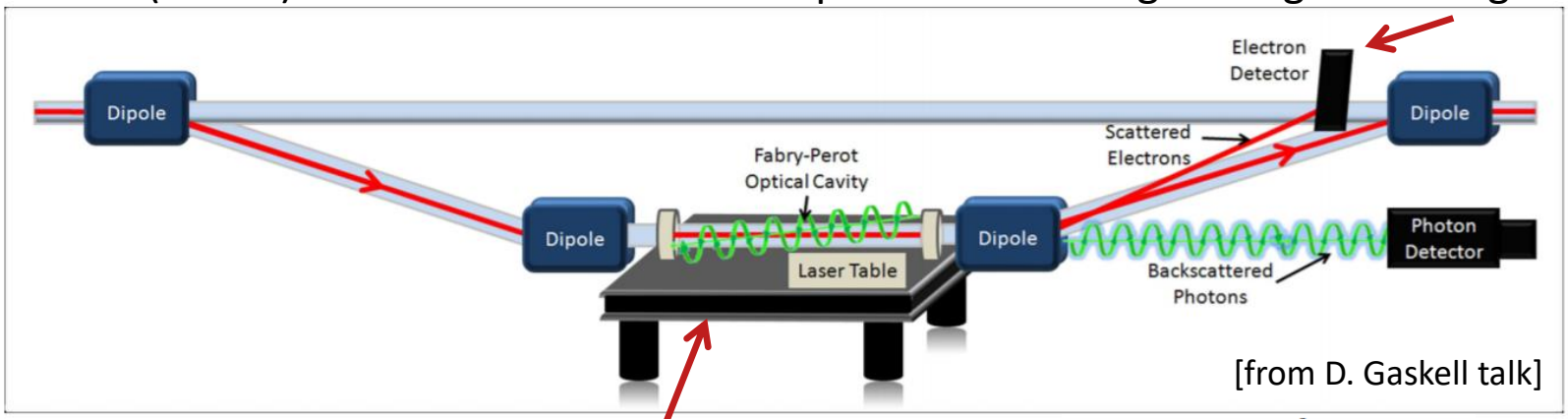
Outline

- Brief description of Compton polarimeter
- Upgrades for 12 GeV run
- Conceptual design of the electron detector
- Trigger formation – VETROC
- Readout system
- Status of ongoing tests

✚ (one slide about the status of the HCAL/SBS daq – VETROC + VTP)

Overview of Hall A Compton setup

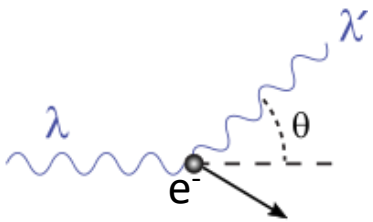
Non-invasive (online) method to measure beam polarization at high energies and high currents



1W laser system: use of Fabry-Perot cavity leads to several kW of polarized light

Interaction:

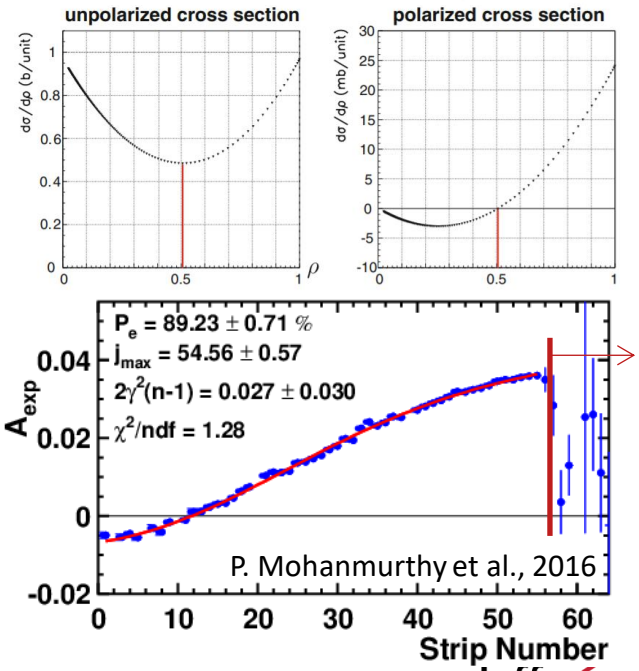
Polarized photon with long. polarized electron Compton scattering



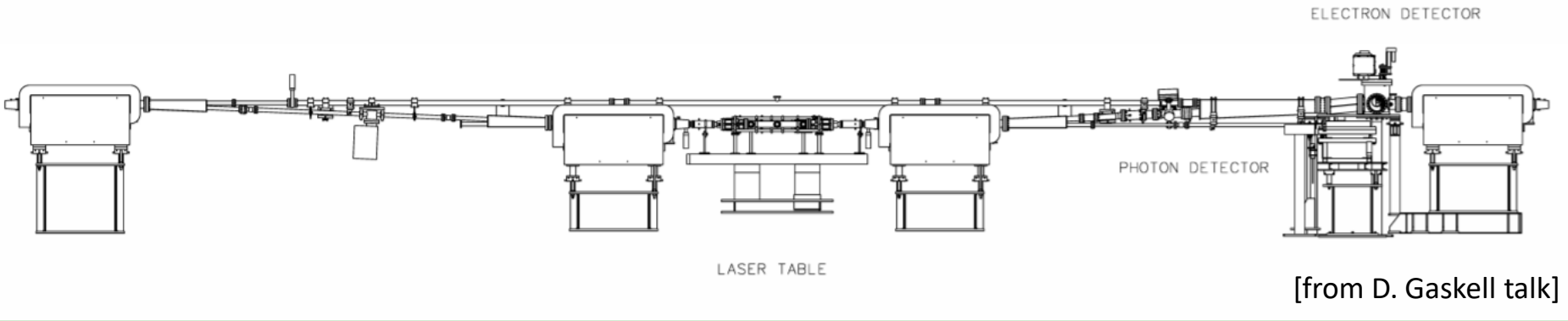
Asymmetry measurement:

$$A = \frac{N^+ - N^-}{N^+ + N^-}$$

$$\sigma = \sigma_0 + P_e^{long} P_\gamma \sigma_p$$



12 GeV – Compton Upgrade



[from D. Gaskell talk]

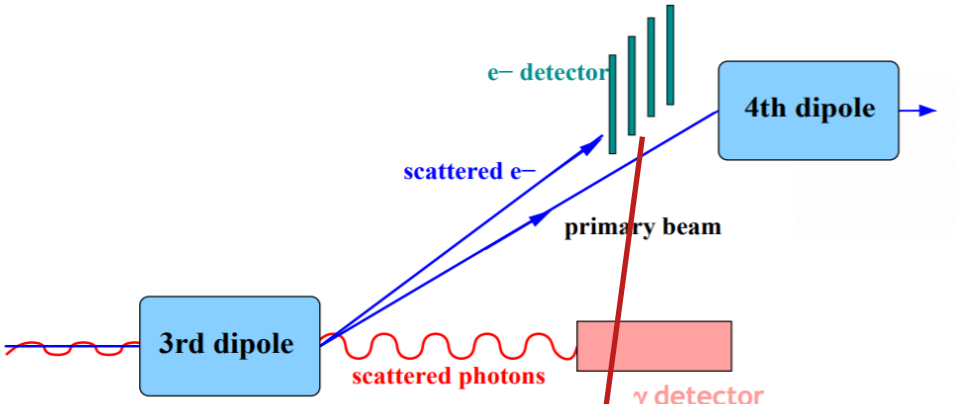
Higher electron energy requires change of configuration:

- Dipole height adjusted
- New vacuum chambers fabricated and installed
- Laser table height adjusted (new legs)
- New electron detector chamber fabricated

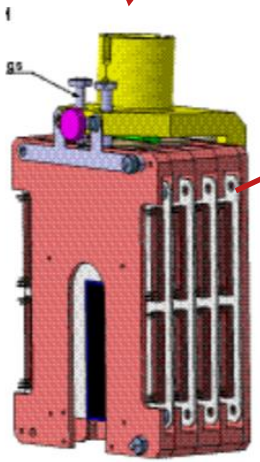
Additional improvements:

- Optimizations of photon detector
- Improvements of electron detector
- **<u>Ongoing upgrade of readout system + tests at EEL - VETROC</u>**

Electron detector



[by S. Escofier]



[by Alex Camsonne]

Electronics:

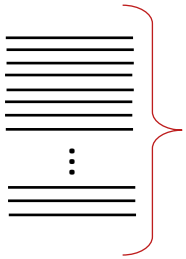
→ Local (really close to beam) electronics:

- Signal amplifiers
- Digitization

→ More remote readout electronics:

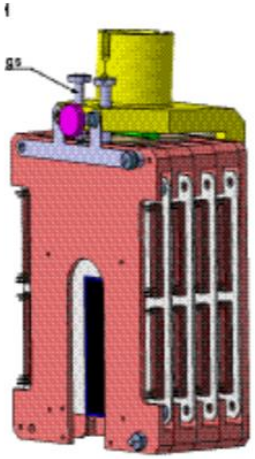
- VETROC – 3 modules
- VME TI/CPU

4 planes of microstrip detectors



192 channels per plane

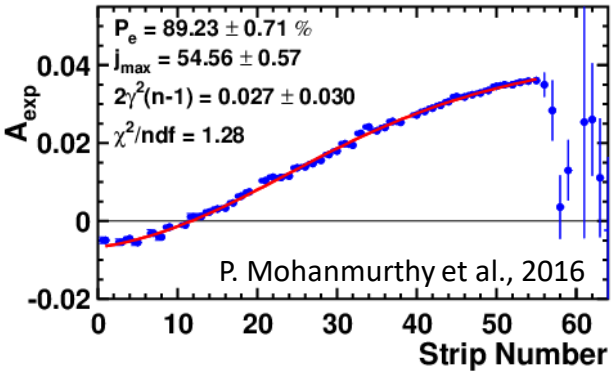
Data taking


[by Alex Camsonne]

Asymmetry measurement:

$$A = \frac{N^+ - N^-}{N^+ + N^-}$$

(counting hits in each channel)



Forming trigger:

3/4 planes with hit

Current idea:

- Each plane (192 channels) goes to a VETROC
- Each VETROC output the OR of all channels
- External 3/4 coincidence + strip matching

Data:

Read 1 bit/channel (hit/no_hit) ➔ 24 bytes/VETROC = 72 bytes/event

1 bit for helicity (+/-)

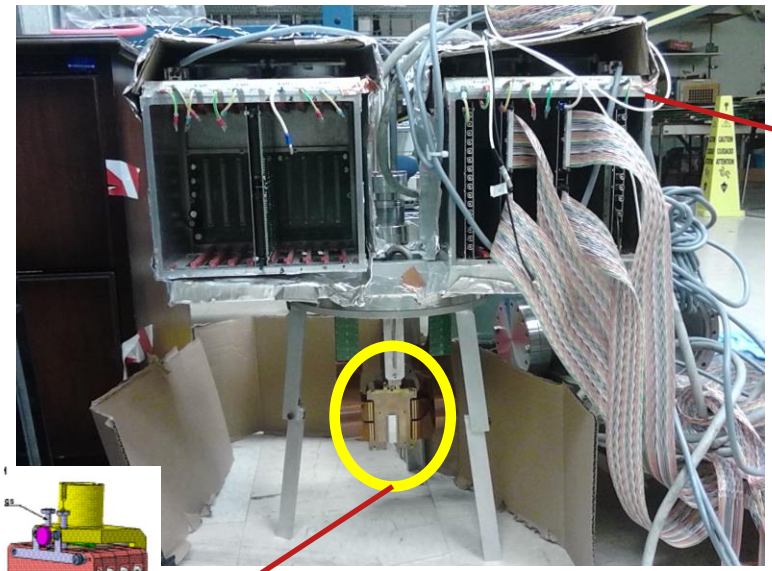
Rates:

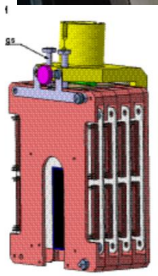
few hundred kHz ➔ several MB per second

Options:
- If only few channels fire per event, save fired channel numbers instead.
- Open wider window and count hits per strip every beam polarity flip

Ongoing tests at EEL-126

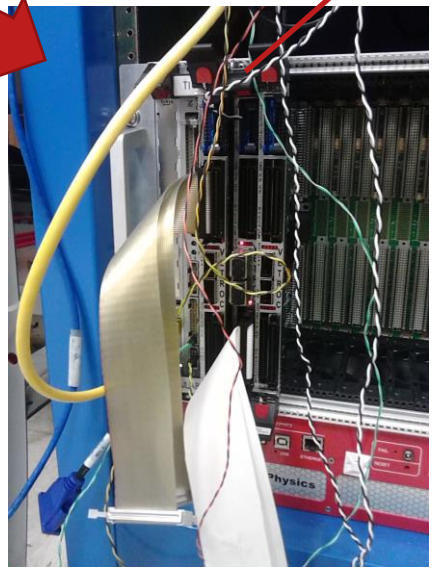
Tests ongoing at EEL:





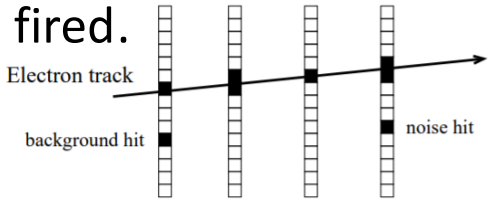
- Signal amplifiers
- Digitization

- VETROC – 4 modules
- VME TI/CPU



Test status

- We have a test bed set up in the EEL working with VETROC.
- Initial tests of DAQ seems to be good (VME64x crate and TI), though there was an issue found by Bryan in the libraries adding a 125 MHz clock as an option (we had inconsistent times being measured).
- The libraries were recompiled with the 250MHz option and basic tests of VETROC show consistent results now.
- Talked with William, and he would be able to program VETROC to:
  - Create an “OR” of all input channels (as output).
  - Data as one bit per channel, to check which strips fired.
  - Track reconstruction to create a trigger?

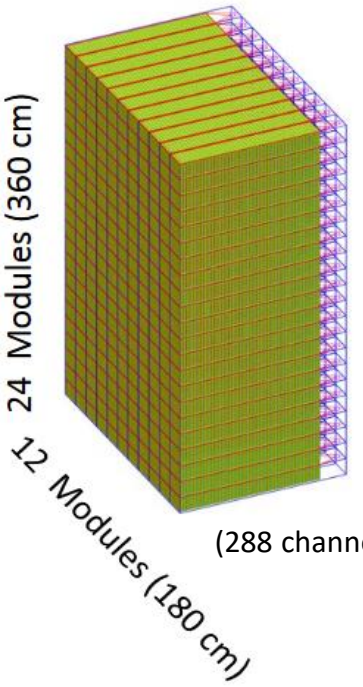


- Integration of amplifier/digitizer to VETROC to be tested with cosmic rays.

More details: http://hallaweb.jlab.org/equipment/daq/compton_vetroc.pdf

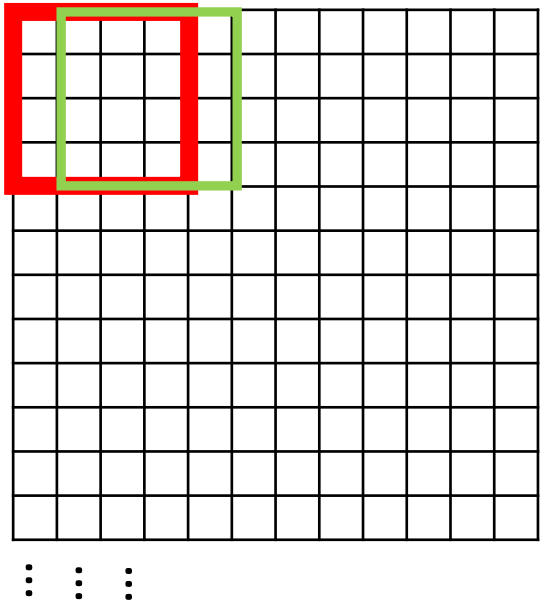
BRIEF UPDATE ON SBS/HCAL STATUS

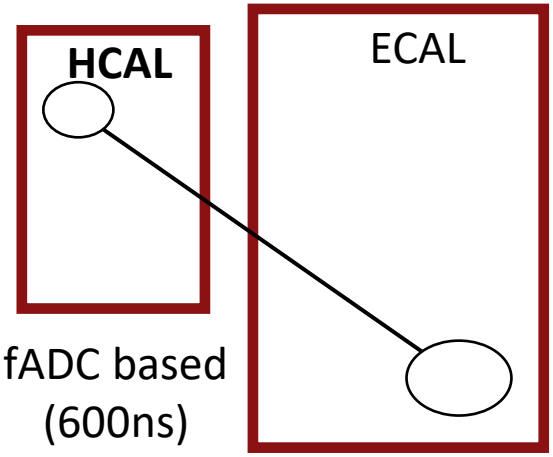
HCAL design:

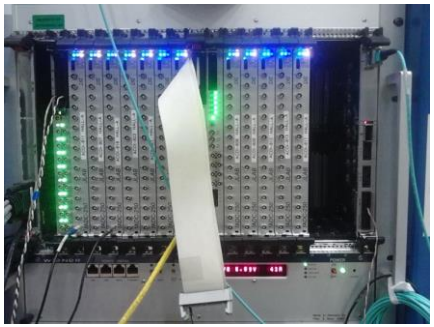


(288 channels)

Trigger: Cluster identification ✚ Correlation with other detector







Status:

- Read calorimeter blocks in 18 fADCs ✓
- Form clusters and in VTP to create level 1 trigger ✓
- Read 2nd calorimeter clusters ID with VETROC (200 bits) ✓
- Level 2 trigger from HCAL/ECAL correlation
  - Read VETROC data into VTP
  - Look for correlation from lookup table

next

(thanks to Ben and Bryan)