Stefan Schmitt

TPOL DAQ upgrade

— status and recent activities —

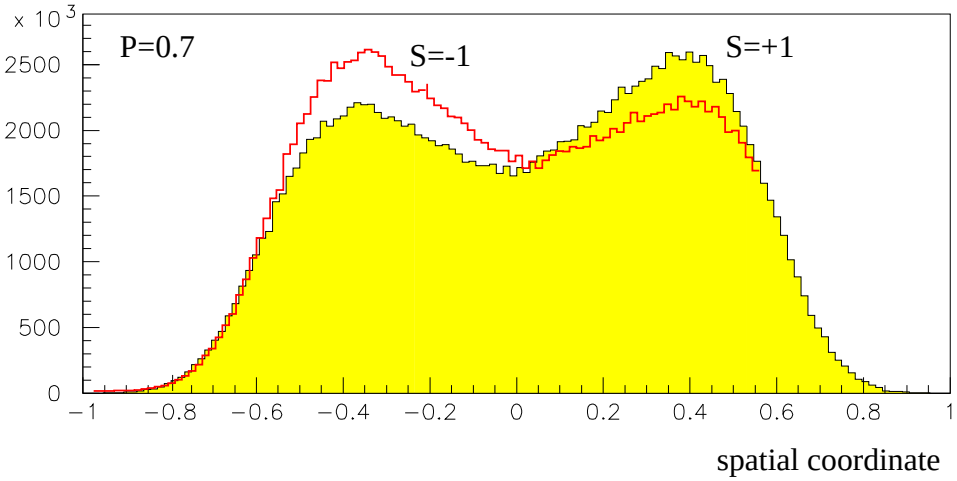
- Introduction
- Operation of the new DAQ system during the last months
- DAQ hardware status
- DAQ software status

Measurement of the polarization with the TPOL

The polarization is calculated from the spatial asymmetry of back-scattered Compton photons. The initial photons are taken from a continuous laser (10W).

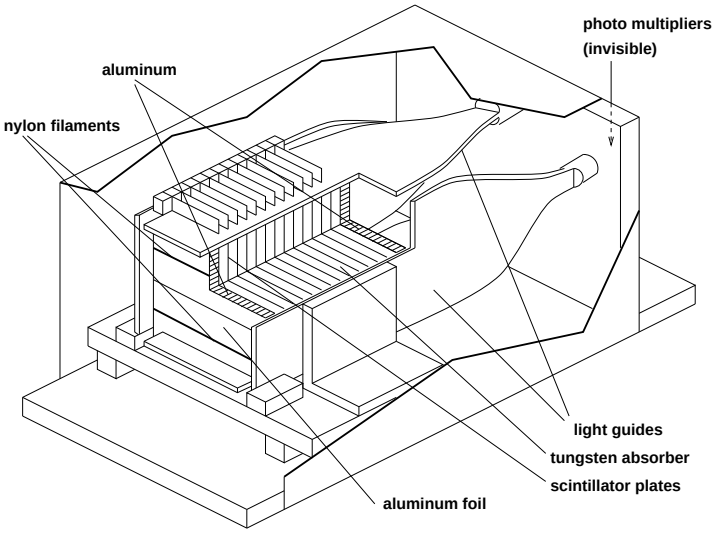
$\rightarrow$ one back-scattered γ in 200 bunch crossings.

$\rightarrow$ trigger rate up to $50 - 100\,\mathrm{kHz}$, depending on the HERA bunch currents.



The TPOL detector

- Twelve layers of tungsten and plastic-scintillators
- Two optically isolated halfs (up, down)
- Readout with four wavelength-shifters and photo multipliers (up, down, left, right)
- Up and down channels for energy and vertical position measurement
- Left and right channels for trigger and calibration



Transverse polarimeter upgrade projects

- New data acquisition based on the electronics developed for the new H1 luminosity system.

  $\rightarrow$ bunch identification, improved monitoring and calibration, higher trigger-rates, no dead-time (pipelines!)

- Position-dependent detector in front of the TPOL to support the calibration (transformation of energy-asymmetry to spatial coordinate currently is the dominating systematic uncertainty).

Operation of the new DAQ during the last months

The new DAQ system was running in parallel to the existing system (using the same input signals) during the last months

+ System running very stable (several weeks without restarting any process)
+ Online-polarization measurement in agreement with the old system within $1 - 2\%$
+ Stable online-calibration
+ Per-bunch polarization measurement with the TPOL
+ JAVA-based TPOL monitor
+ Integration of online per-bunch measurements into the H1 data ($\rightarrow$ Igor Cheviakov)
+ Successful operation in conjunction with a silicon-detector and a scintillating fiber in front of the TPOL calorimeter for some HERA fills

- The hardware was only a **prototype** of the final design:

  slow ADC, no flexibility in the readout, relatively large dead-time (no pipeline), low signal-amplitudes

  → Polarization measurement had significantly larger statistical errors than the old system

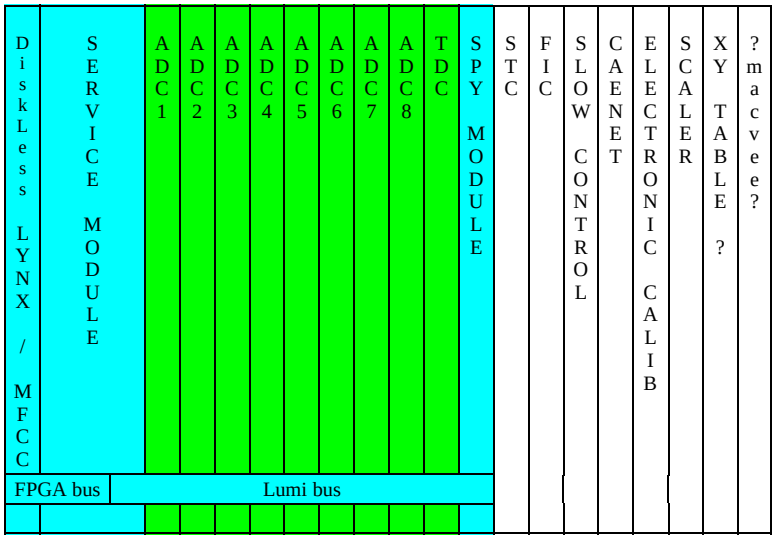
  → Some modifications to the software will be necessary to integrate the final hardware components

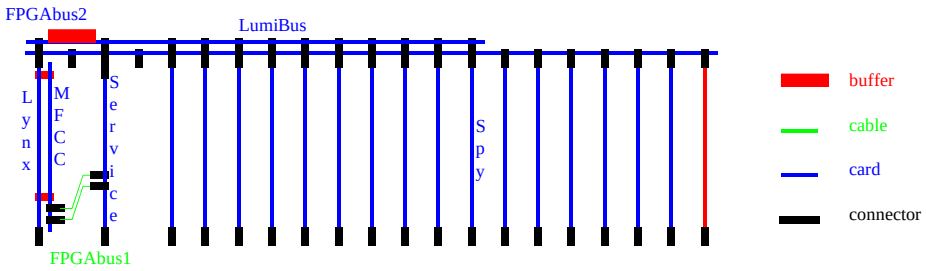
- Since the system was only operated in a parasitic way, all slow-control units were steered by the old system

  → To be done over the shutdown: move slow-control units and auto-pilot functionality to the new DAQ system (laser, calorimeter-positioning, collimators, light-polarization, ...)

DAQ hardware status

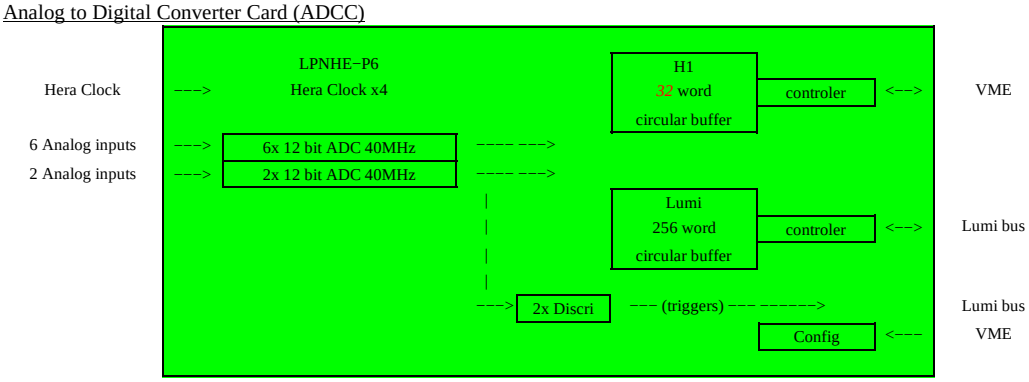
- New TPOL electronics: copy of the new H1 luminosity system
- Final electronics (for the TPOL and the H1 lumi system) will be ready by end of March 2001 (parts of it might be ready earlier).



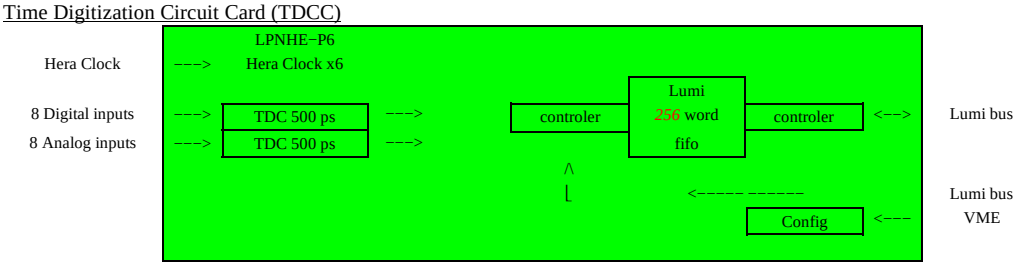


Cards

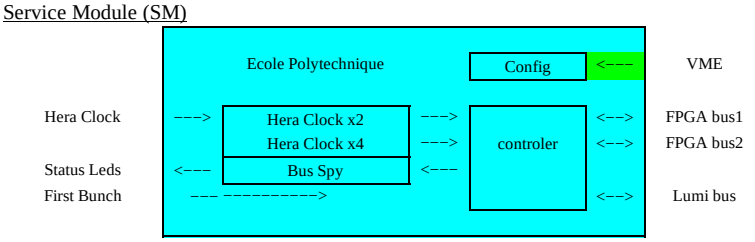
Analog to Digital Converter Card (ADCC)



Time Digitization Circuit Card (TDCC)



Service Module (SM)



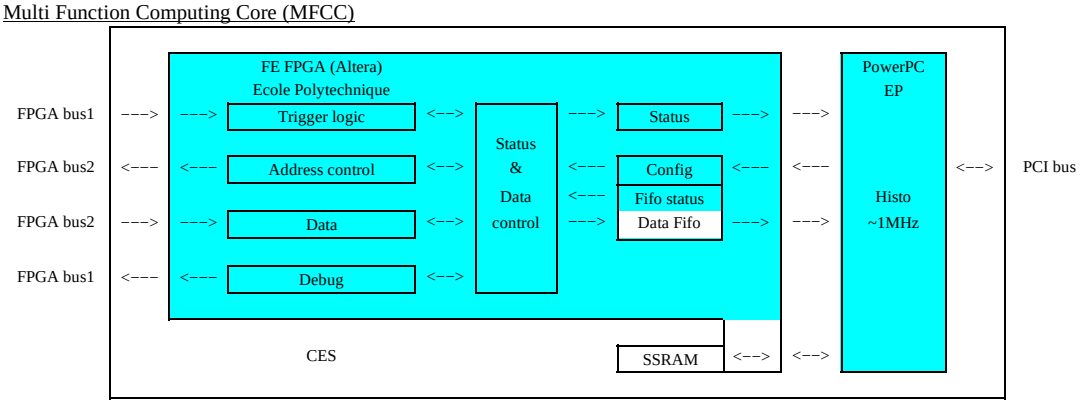
Spy Card (SC)

See ”Carte Espion” doc on the web (http://polywww.in2p3.fr/grpelec/h1/h1_lumi/src/espion1.ps)

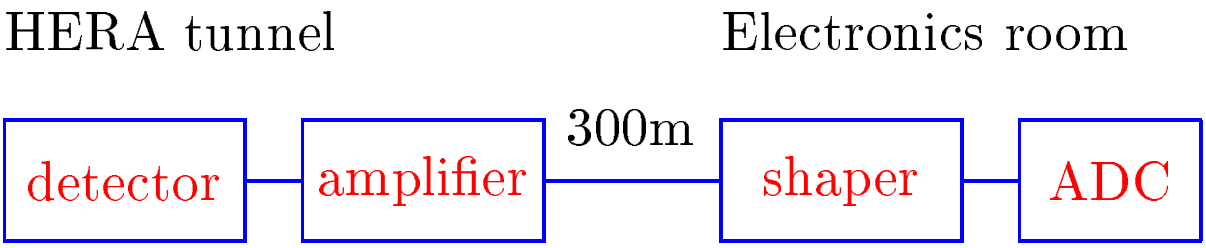
Specific Back−Plane (BP)

See ”Fond de Pannier” doc on the web (http://polywww.in2p3.fr/grpelec/h1/h1_lumi/src/shema.ps)

Multi Function Computing Core (MFCC)



Analog electronics



It might be necessary to have additional cable connections from the detector to the electronics (due to increased functionality of the electronics in the tunnel)

→ Consider to have additional cables or to move parts of the electronic to the first floor (close to HERA-B).

DAQ software status

- Successful operation during the last months

  ... but Trigger-rate limited to 35 kHz

  Read event: 14μs Unpack TDC: 3μs

  Fill histograms: 8μs

  $\rightarrow$ the concept is working, but the prototype-hardware is too slow. 100 kHz will not be a problem with the new system (configurable readout, fast FIFO access, ...)

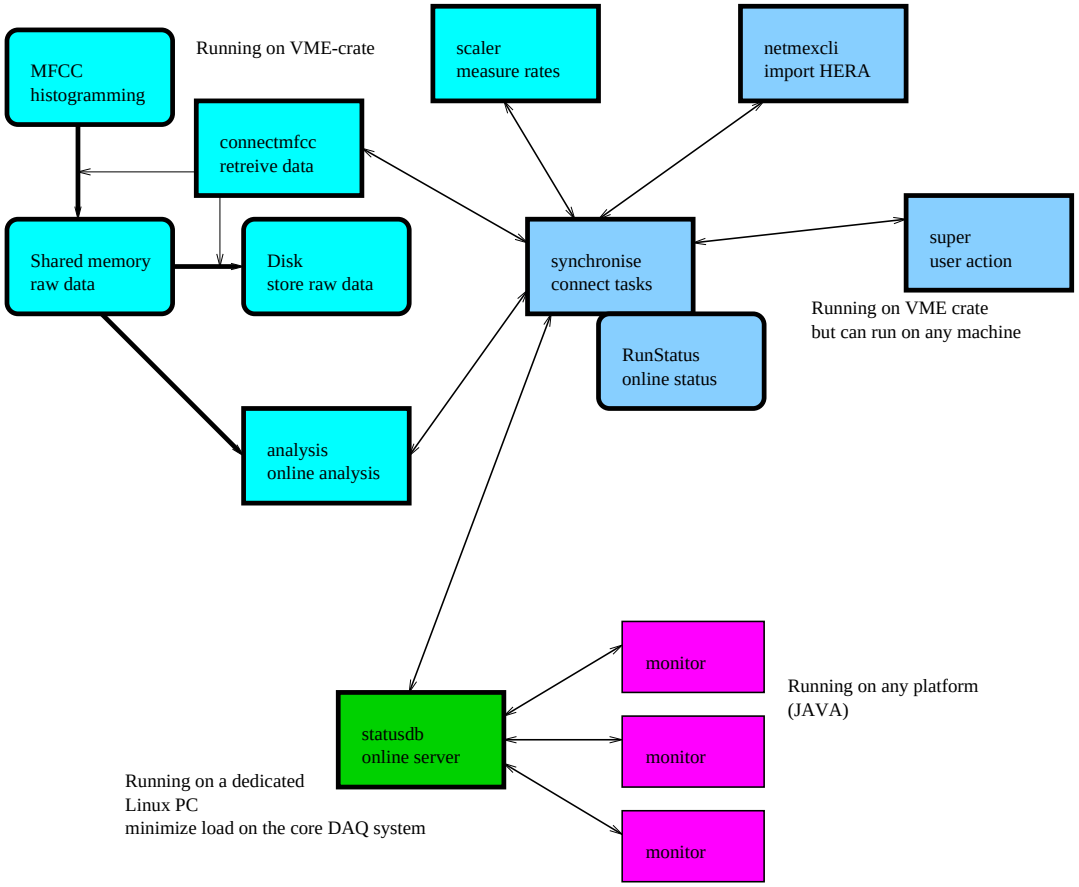
- Next steps
  - Include slow-control components

    $\rightarrow$ RS232 driver already written and tested

    estimated time: 2 months
  - New readout hardware

    start: early next year

DAQ programming concept



- Connect individual parts by TCP/IP (UDP for the "monitor"). Synchronisation of individual tasks based on the exchange of messages.
- Monitoring server on a dedicated machine
- Some parts are still missing (NETMEX server, slow control units, autopilot,...)

Data format: what is stored?

- The "raw" data are histograms, stored on a per-minute basis (as for the current system)
- All "standard" TPOL histograms are available on a per-minute basis, including all monitoring/calibration histograms
- All histograms come in two versions: colliding/non-colliding bunches
- In addition two-dimensional histograms energy vs. asymmetry are stored for every single bunch, but with coarse binning
- Online-Status information (calibration, HERA, trigger rates, ...) is included
- Currently a special data-format is favored (compressed, network byte-order, number of histograms not fixed)

  $\rightarrow$ 1 Mbyte of data per minute

  For comparison: the same data takes 10 Mbyte in HBOOK-format $\rightarrow$ this is not an option.

Some open questions

- How/where to store the raw data
- How/where to store the online-data (if at all)
- HERMES: should the old system be kept alive? Does it still work without having slow-control? What about the new analog signals?
- NETMEX server, online display: which information should be available online?
- Offline polarization analysis: how to provide the "best" polarization measurement to all users?

Summary

- New TPOL DAQ is working (even with the slow prototype hardware)
- Per-bunch polarization measurement (online) has been achieved with the TPOL

Outlook

- Define (and implement) how and where to store the data and how to access the raw data and the "final" polarization numbers
- Integration of the slow-control system (start now)
- Installation of the final hardware components (March 2001)