Transmission Compton Polarimeter DAQ

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Overview

- The Compton transmission polarimeter requirements

- The hall A Compton polarimeter
  - Counting DAQ
  - Flash ADC integrated method

- The JLab Flash ADC

- Timeline

- Conclusion

The transmission Compton polarimeter

- High rate to reach statistics in reasonable time
- Multiple methods of measurement for
  - systematics checks
  - Handling background

- Solution proposed is to used the Jlab Flash ADC to implement different methods used in the Hall A Compton polarimeter

The Hall A Compton polarimeter
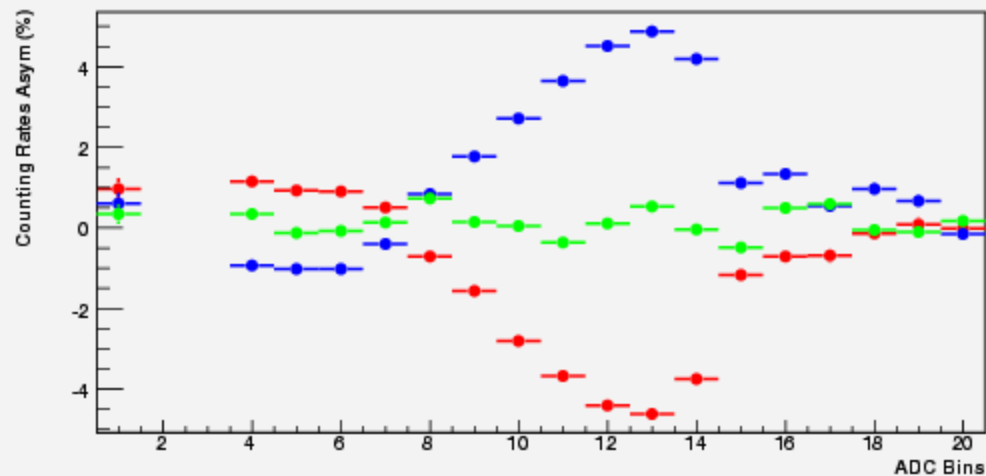
- Used for parity experiments
  - Counting DAQ
    - VME based using FADC
    - Rates up to 100 KHz
    - Running since about 199
    - Pipelined and buffered system
    - On CPU online histogramming
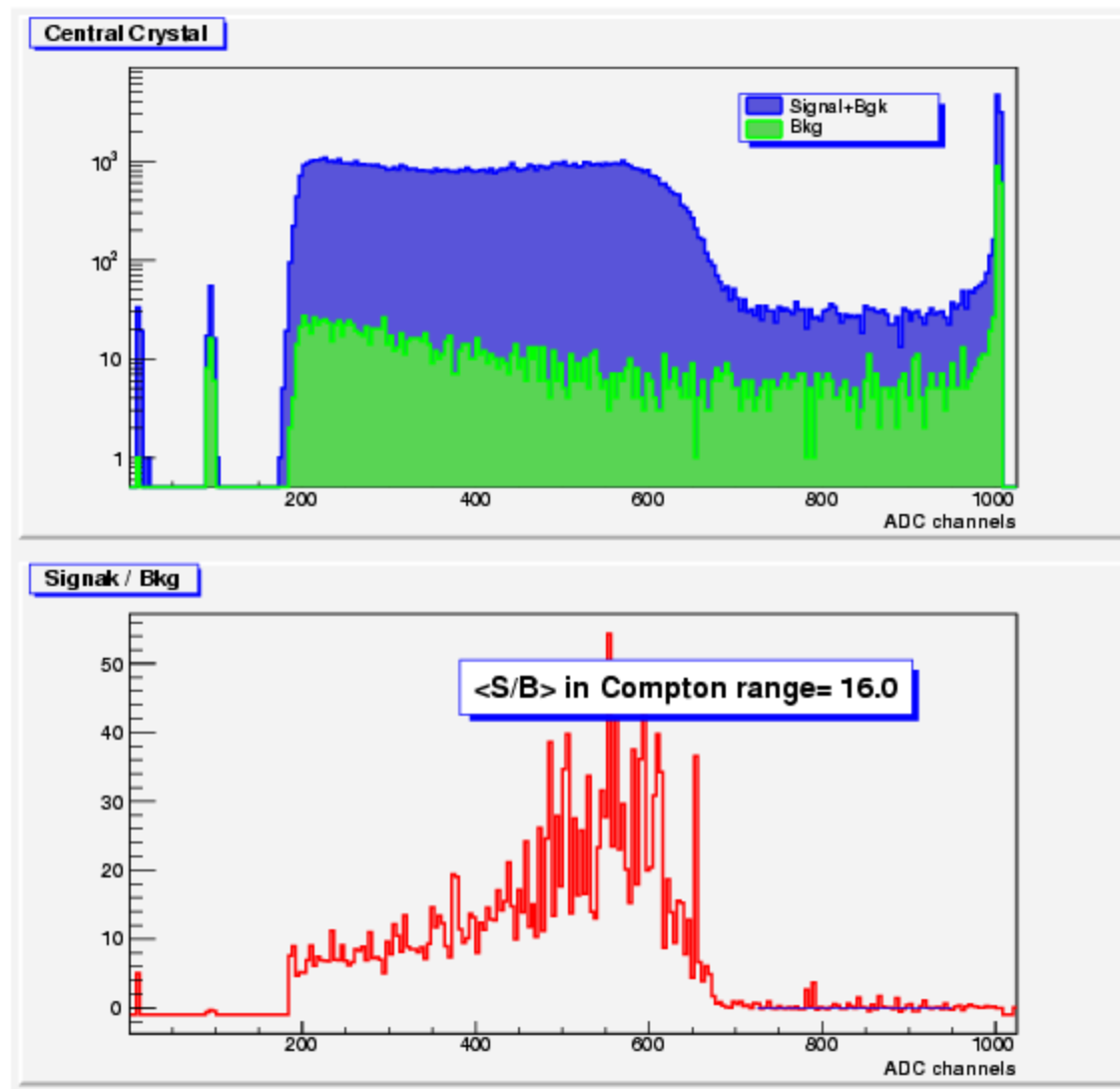
Example of Photon data
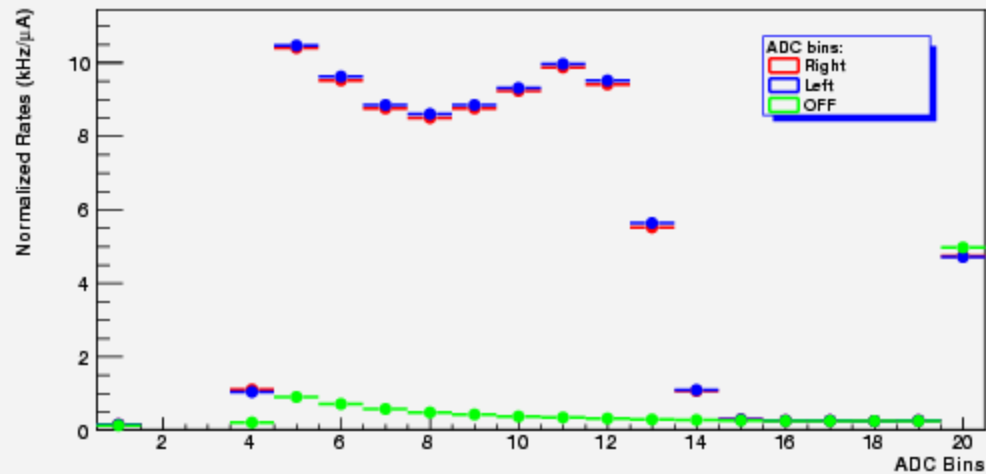
# Example of Photon data

Counting method summary

- Pros
  - Energy dependence of the asymmetry

- Cons
  - Need calibration and/or simulation to understand energy response of the detector to extract the polarization
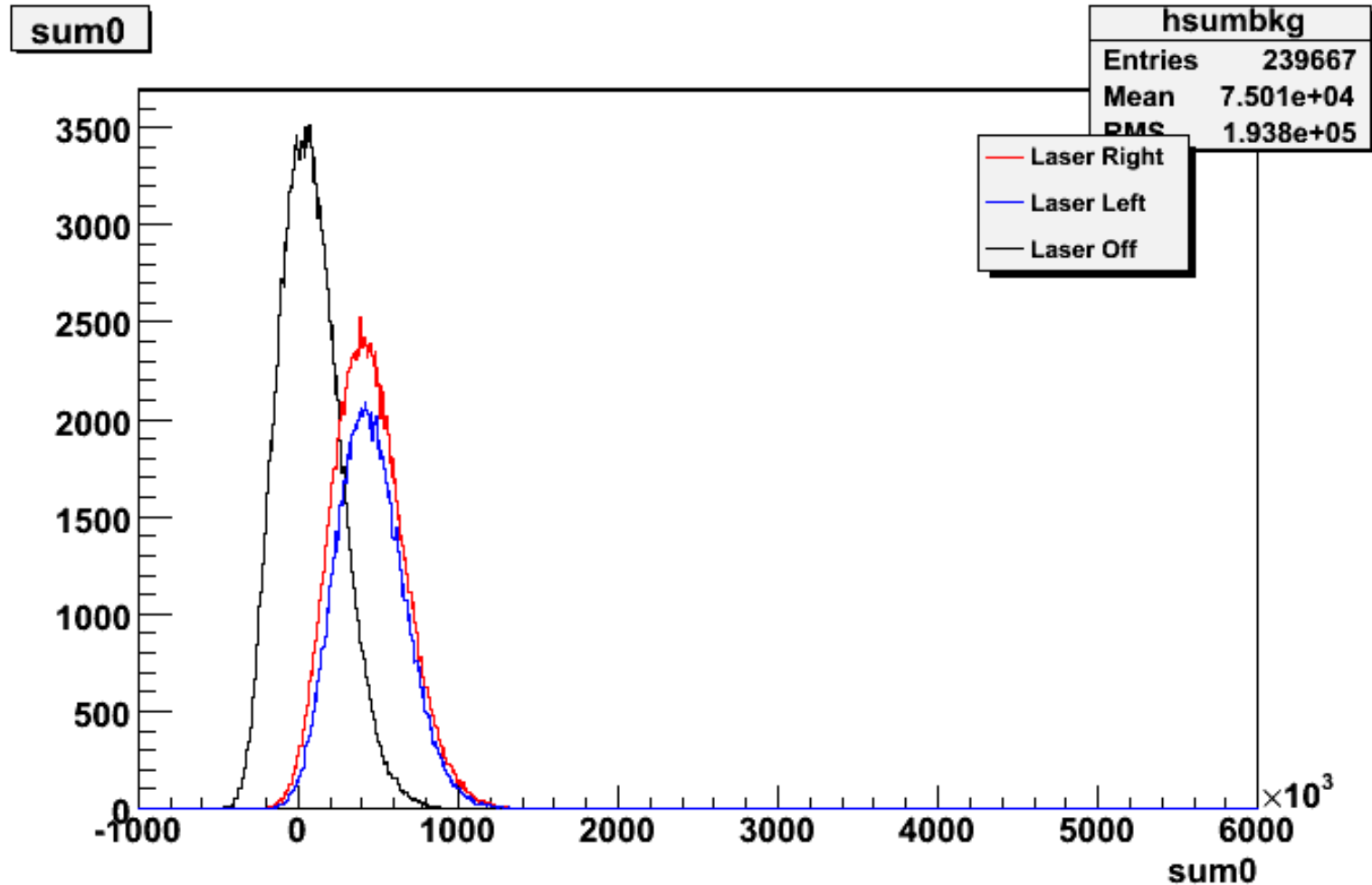
Integrating method

- SIS 3320
- Digital summing
  - Sum all the samples on helicity window
  - Integrated method

- Readout and analysis developed by CMU
- Lower statistics counting possible
  - Few waveforms recorded by
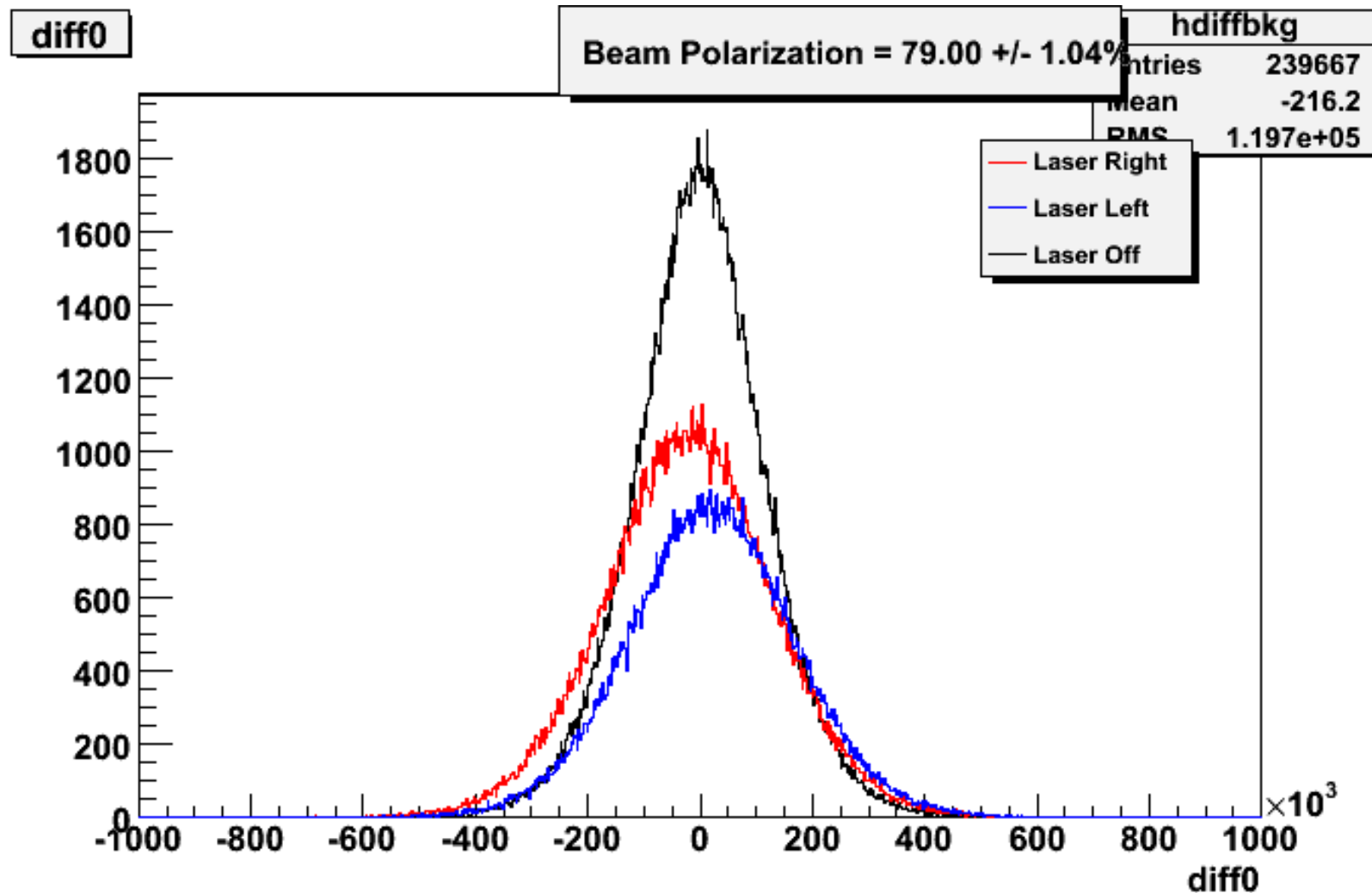 - Basic summing of integrated pulses

Example of integrated Compton method
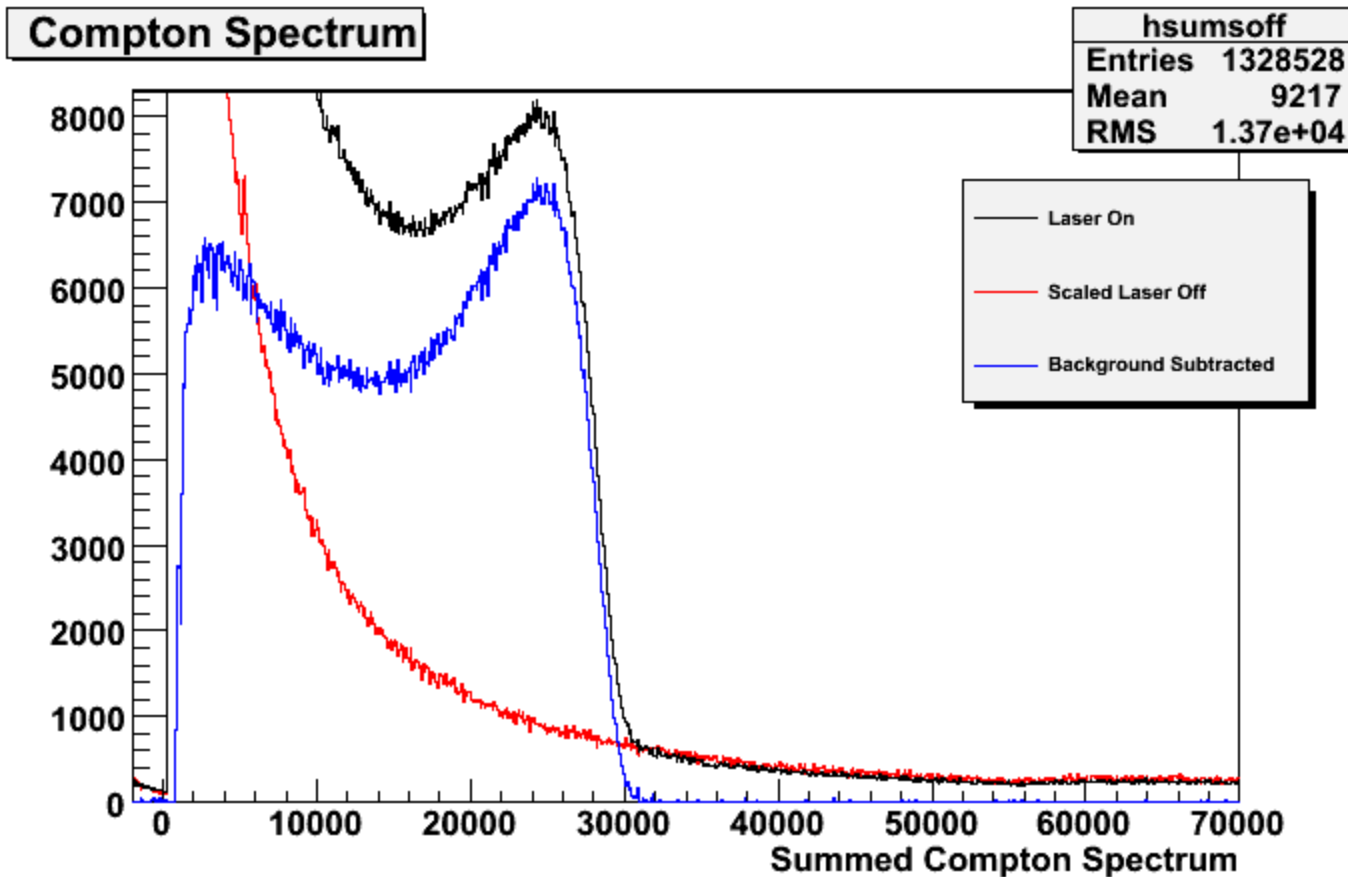
Example of integrated Compton method

Example of integrated Compton method

Integrating method

- Pros
  - simple
  - Calibration not critical
  - Can run a virtually as high rate as the detector can stand as long as it stays linear

- Cons
  - Integrated asymmetry
  - Can be sensitive to background
  - Need very good linearity of the system
  - Signal must be large enough to overcome pedestal noise and non linearities (can have to push on the detector)
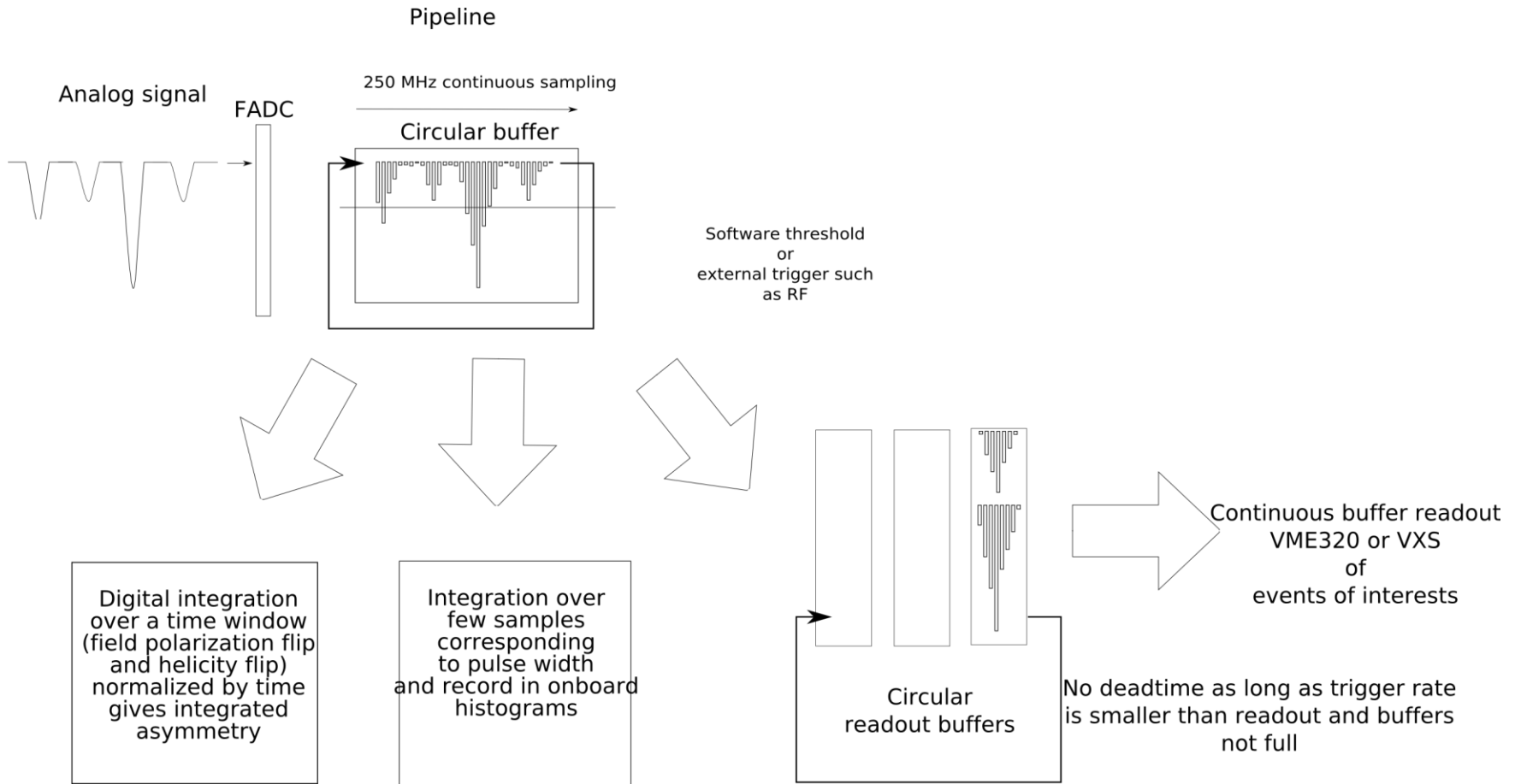
JLAB FADC

- Jlab FAC 250
  - 250 MHz 12 bit
  - Developed for Hall D calorimeter :
    - 8 uS look back
    - VME320
    - Summing capability on VXS

  - Modified firmware version already in use for Hall A moller

Implementation for the Compton transmission polarimeter

- Upgrade the Moller version to integrated the methods implemented separately in the Hall A Compton

- Implement the current integrating method

- Add on board histogramming / or modify readout for high statistics histogramming

- Schedule tight but no major development foreseen and possibility of on CPU histogramming as fall back

Electronics diagram

Pipeline

Analog signal

FADC

250 MHz continuous sampling

Circular buffer

Software threshold
or
external trigger such
as RF

Digital integration
over a time window
(field polarization flip
and helicity flip)
normalized by time
gives integrated
asymmetry

Integration over
few samples
corresponding
to pulse width
and record in onboard
histograms

Circular
readout buffers

Continuous buffer readout
VME320 or VXS
of
events of interests

No deadtime as long as trigger rate
is smaller than readout and buffers
not full

Timeline

- Need to have baseline functionality to work for the 6 months down
  - New FADC procured
  - Need to have test setup
  - Test with detectors

Conclusion

- A FADC based DAQ for the Compton is possible using methods already used

- Testing started with Mott polarimeter

- Implementation of on board histogramming is an updated version of the Moller