Development of a 1 GS/s High-Resolution Sampling ADC System

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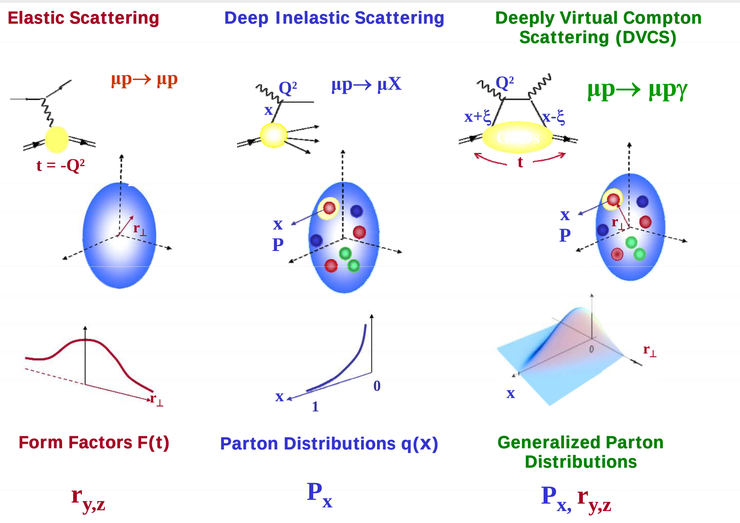
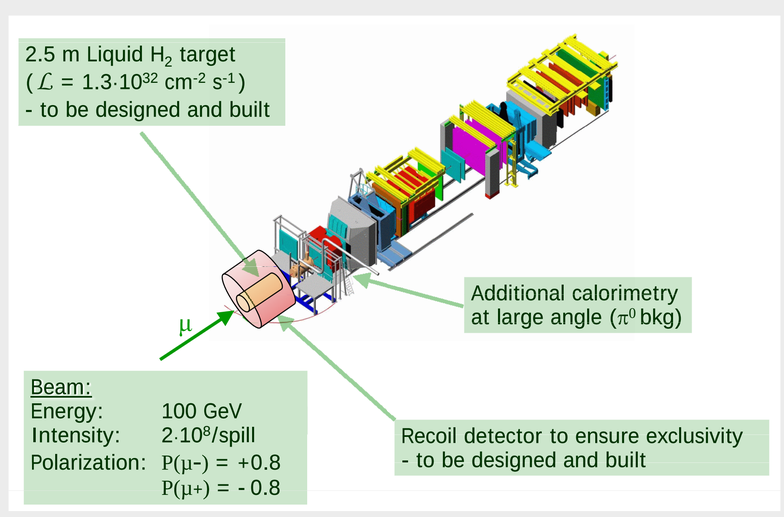
The COMPASS Experiment @ CERN

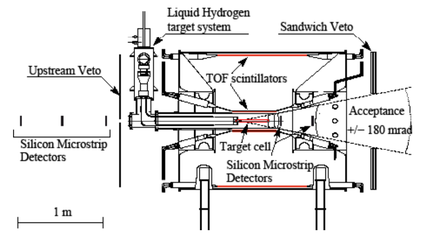
Generalized Parton Distributions

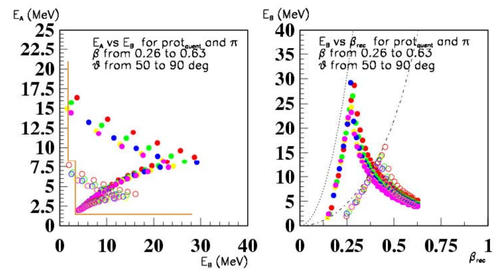




Recoil-Proton Detector

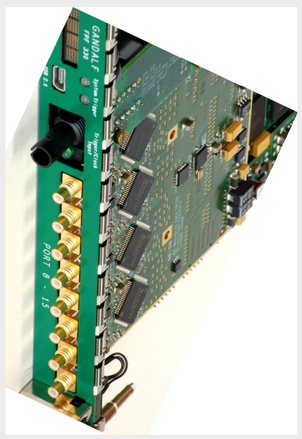
Used for
- particle identification
- charged veto
- trigger decisions

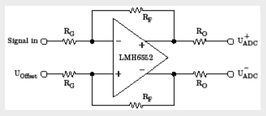




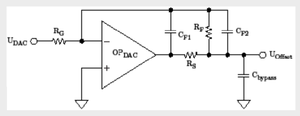
Make use of correlation between amplitudes and time-of-flight of two rings of scintillation counters

Analog Input



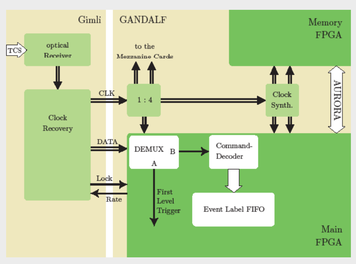


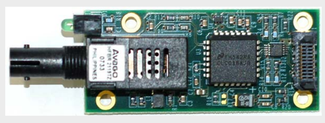
- Single ended DC-coupled inputs
- Input impedance 50 Ω
- Dynamic range 4 V
- Bandwidth 500 MHz



- 0…2 V programmable baseline offset with 16 bit DAC

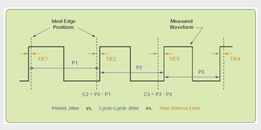
Experiment Clock & Trigger

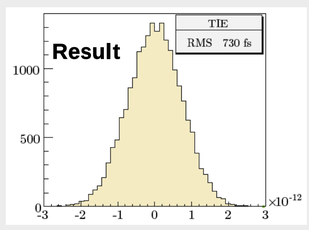


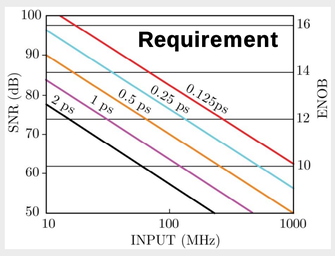


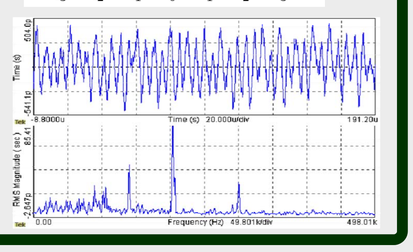
- Experiment clock
- Synchronization of front-ends
- Trigger distribution

Time interval error:



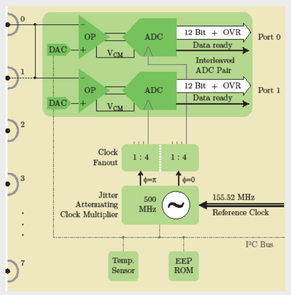


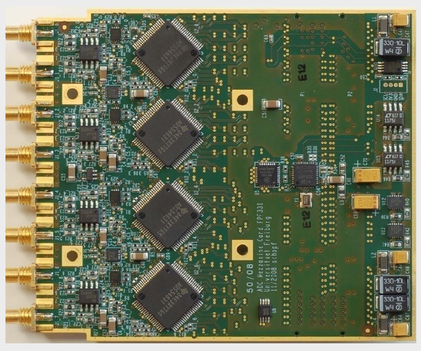


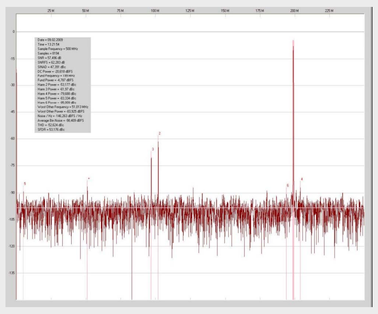


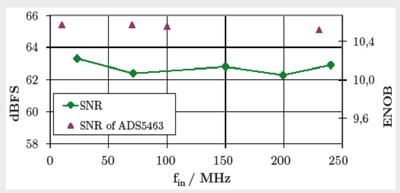
ADC Mezzanine Card

- 12 or 14 Bit digitization
- 8 channels 1 GS/s (interleaved)
- 16 channels 500 MS/s



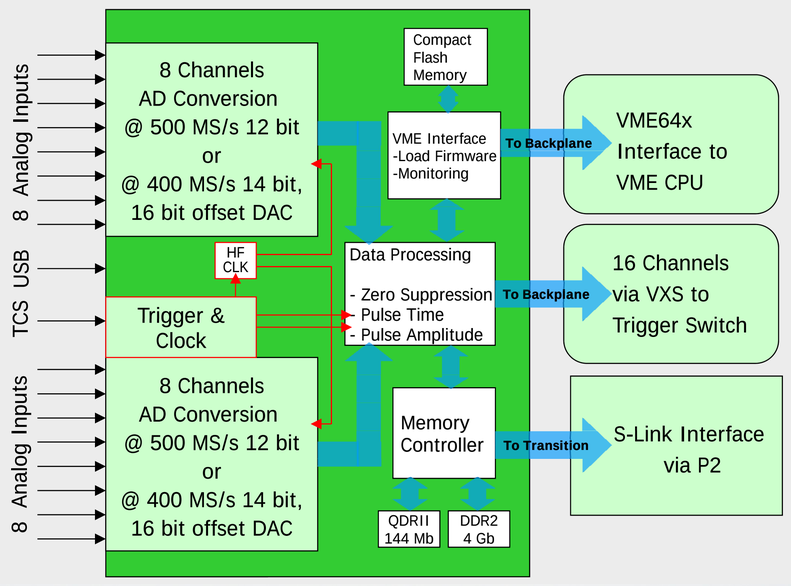


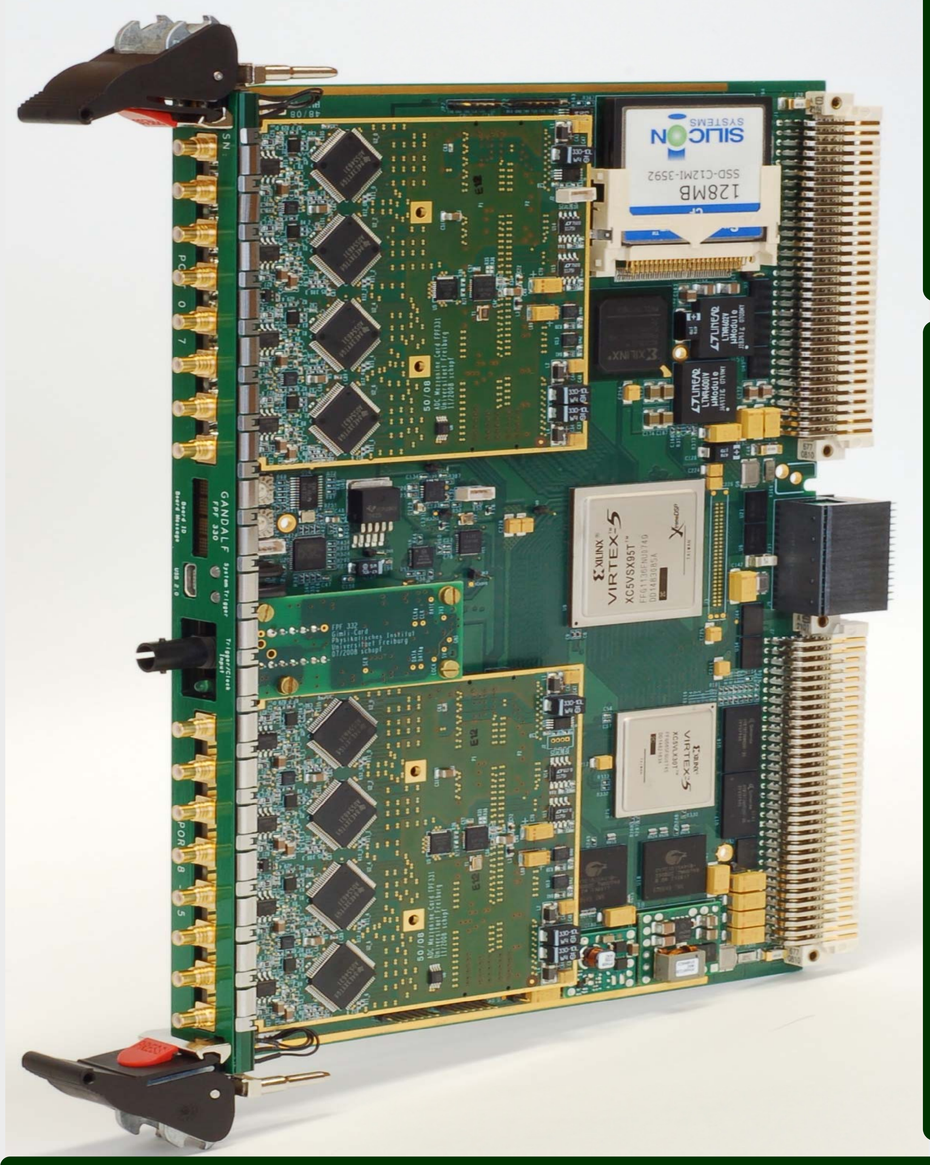




Digitization error as function of analog input frequency

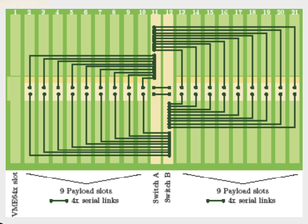
The GANDALF Readout System

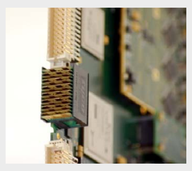




Backplane I/O

- VME64x
  - Configuration
  - Monitoring
- VXS
  - 16 high speed connections to trigger electronics

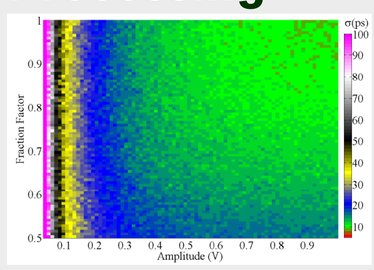


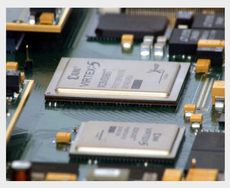


- Data I/O optional via
  - S-Link
  - Ethernet
  - VME64x (640 Mbit/s block r/w)
  - USB 2.0

Data Processing

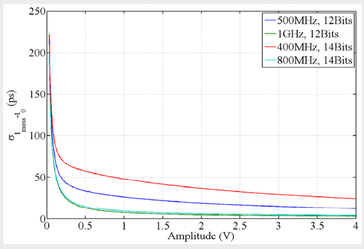
Time resolution as function of pulse amplitude and constant fraction:





- Online zero suppression
- Pulse analysis
- Pulse time
- Pulse amplitude
- Disentangle Pile-up pulses

Time resolution as function of pulse amplitude:



- The GANDALF Readout System – a versatile and highly cost efficient digitization tool for nuclear, particle and atomic physics experiments
- System applications as:
  - self-triggered high-resolution sampling ADC
  - 128 ch TDC (100 ps)
  - 128 ch Scaler (250 MHz)
  - 128 ch Trigger Matrix Board