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A Read-out System for the PANDA MVD Prototypes

Status Update @PANDA LXI

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JDRS: Jülich Digital Readout System for the MVD

Configuration and Lab Tests Environment

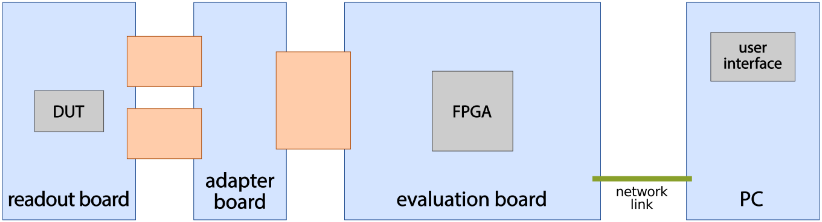
Threshold Studies

Beam Time Preparation

Summary

JDRS: Jülich Digital Readout System

The basic components



Data conversion and communication with the PC:

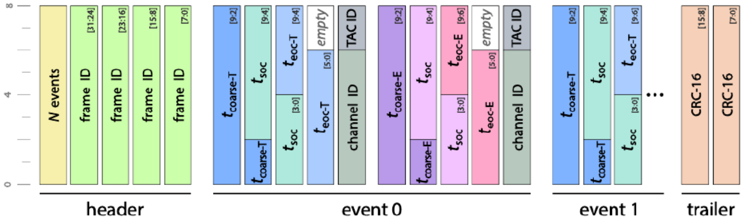
- DUT: ToPix, PASTA
- evaluation board: Xilinx ML605 (Virtex-6 FPGA)
- firmware: VHDL

Configuration and data handling:

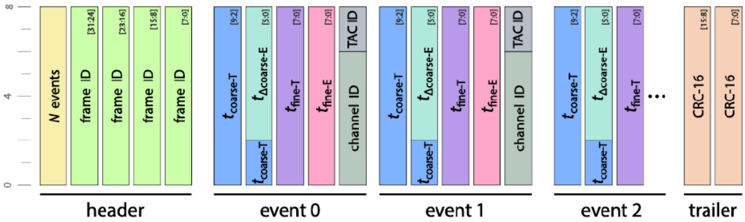
- PC
- software: C++
- MVD Readout Framework (MRF)
- Qt-based GUI

Data Format

Full mode: two words per event.



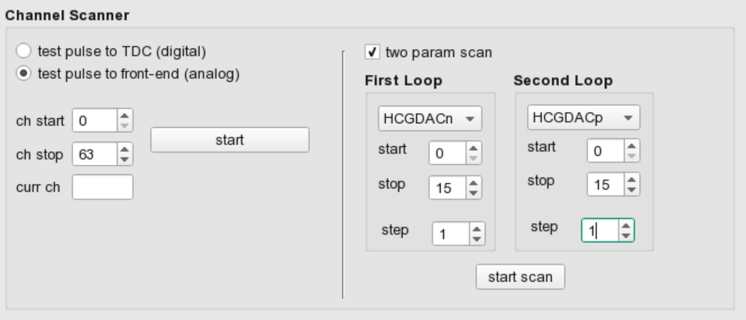
Compact mode: one word per event.



Channel Scan

- PASTA has 46 global and 22 local free parameters.
- Automatize the measurements for the optimization of such parameters.

1. Define the type of injection.
2. Scan a user define range of channels.
3. Choose up to two parameters to sweep.



Load and save settings

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Settings (e.g. configuration data) are stored in files *.json*
→ Qt offers support for JSON

- easy access to the key-value pairs in the files
- human readable format

```
"BLR_Ib": 30,
"BLR_Vcas": 26,
"CB_Ib1": 14,
"CB_Ib2": 21,
"CB_Vbias": 10,
"CSA_Ib1": 13,
"CSA_IbSF": 23,
"Comp_Vb": 31,
"Comp_Vcas": 31,
"HCGDAC+": 7,
"HCGDAC-": 0,
...
```

Online Monitoring

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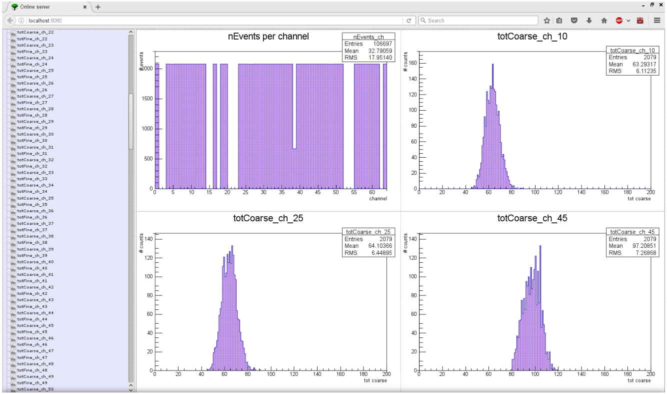
The data is decoded online and stored into text files, together with the current configuration.

The results are published on a web server using the *THttpServer* class from ROOT.



The histograms are saved into *.root* files $\rightarrow$ the status can be reloaded.

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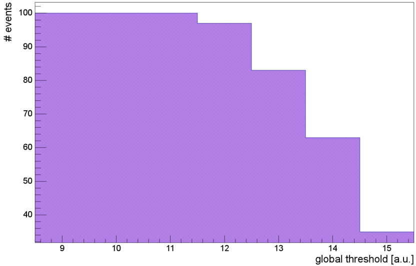
Threshold determination

Amplitude incoming signal $>$ threshold $\longrightarrow$ signal detected

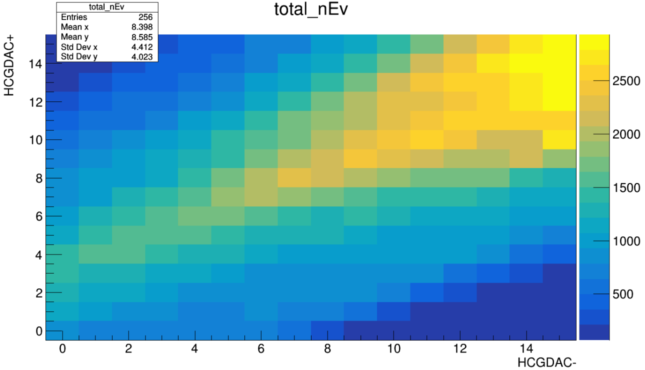
- Global threshold: $\Delta_{th} = HCGDAC + -HCGDAC-$
  $\longrightarrow$ midvalue of an interval with predefined amplitude.
- Local threshold: fine tuning.
- Sweep over Δ_{th} at fixed pulse amplitude $\rightarrow$ expected: S-curve shape.



- S-curve structure only for some channels
  $\longrightarrow$ box distribution even for small amplitudes.
- Different optimal values for different channels.

Threshold distribution

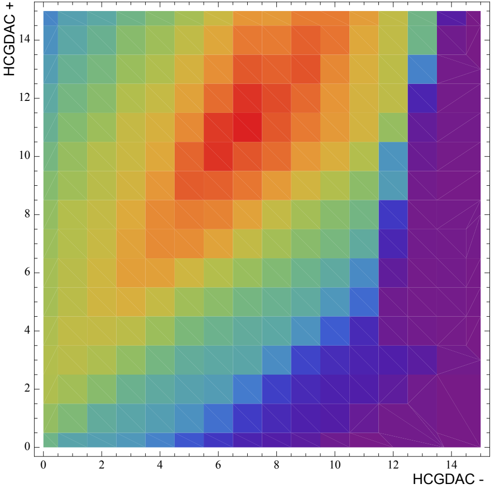
Find the combination of HCGDAC+ and HCGDAC- to maximize nEv.
Fixed pulse amplitude.



- High number of counts for "unphysical regions" (i.e., HCGDAC+ < HCGDAC-).

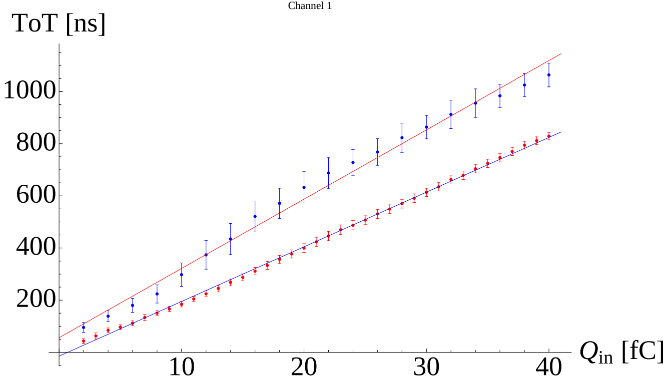
Threshold distribution - LabView system

Different behavior w.r.t. what observed with the other DAQ system (LabView based).



ToT Linearity

Differences also in the behavior of the time over threshold VS injected charge.



blue points: JDRS
red points: LabView system

DAQ system comparison

Comparison between the two DAQ system, connected to the same hardware:

- overall agreement (e.g., responsive/unresponsive channels);
- slight deviations in the trends (e.g., thresholds settings and some config values).

Systematic verification is now ongoing to find out the cause of the observed discrepancies between the two systems.

- Input and output signals:
  → missing termination resistors for some LVDS signals in JDRS;
  → gated slow control clock in LabView DAQ (not working for JDRS); → slow clock 10 MHz in JDRS but 5 MHz in LabView system.
- Configuration data:
  → same data strings.
- Sequence of commands:
  → configuration commands sent with different order.

Beam time preparation

- One week of beam time scheduled for the past May.
- The idea was to connect the JDRS to the Strip telescope for tracking purposes.
- Synchronization needed between the two system.

The beam time has been cancelled due to technical problems @COSY.
The JDRS is, in principle, ready to go under beam together with the Strip telescope, when a new slot for the MVD will be allocated.

Synchronization

The strip telescope DAQ requires:

1. a one clock cycle long signal from the JDRS to synchronize in time with it;

   PASTA foresees two reset modes that can be enabled via the GUI:
   - internal counter reset (one clock cycle);
   - full reset, including configuration (two clock cycles).

   $\Longrightarrow$ use PASTA's partial reset signal as synchronization for the telescope DAQ.

2. a three clock cycle long signal to request and store the current timestamp;

   $\Longrightarrow$ generate such signal and send it to both PASTA and the strip DAQ.
   $\Longrightarrow$ both systems record the timestamp: offline check on the measured times.

Summary & Outlook

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New features in the JDRS since last presentation at the Collaboration Meeting:

- possibility to choose between full and compact mode decoding;
- possibility to choose among all the configuration parameter for a scan;
- manage configuration files;
- store configuration information together with data;
- online monitoring;
- synchronization with telescope.

- Main functionalities needed for the test of the 1st. release of PASTA are now included in the JDRS.
- The system is flexible enough to allow various kind of lab measurements.
- The JDRS is ready to work under beam in sync with the strip telescope.
- Ongoing study to understand the accuracy of the results, by comparison with the LabView system.