

DL DAQ/SlowCtrl/Rates

Jan C. Bernauer

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Center for Frontiers
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RBRC
RIKEN BNL Research Center



**Stony Brook
University**

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Slow Ctrl

Suggestion: Use system we employed in OLYMPUS and MUSE

- » EPICS based
- » PSQL database + python datapump + flask web gui
- » Data also streamed into DAQ

MUSE

Beamline Devices Trigger Rates Voltages Alarms Tools
Overview Beam Profile BH SPS VETO BFM BM CALO

Log in

Last update: Mon May 29 2023 13:35:56 GMT+0400 (Eastern Daylight Time)

ALARM present. [Click here to check alarm overview page.](#)
Minor: 17 Major: 1 Total: 18 Alarms present.

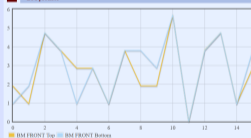
Beam Hodoscope profiles



SPS profiles



BM profiles



CALO profile

20.9	76.7	189.8	489.6	48.4	184.1	155.6	49.3
84.9	26.6	232.5	198	54.1	73.1	10.4	256.2
18.9	12.3	27.5	69.3	311.2	36.9	204	49.3
55	75.9	296.4	51.2	198.3	84.9	117.7	17.1
18	26.6	320.7	238.7	412.1	70.1	73.9	192.3
59.7	91.9	57.8	12.2	188.5	78.6	14.2	23.7
120.3	215.1	95.7	84.3	36.1	39.2	14,447	29.4
103.4	135.7	89.2	217	76.9	30.4	90.1	29.4

GEM DAQ

- » Components: $8+5=13$ APV cards per plane.
- » MPD4 digitizer: up to 15 APV cards per MPD
- » Standard readout via VME
- » Can do 1, 3 or 6 frames
 - » 3 frames gives us time resolution, probably good to reduce multi-hit confusion

Data rates / speeds

- » At MUSE: $120 \mu\text{s}$ for 4 APV 6 frames = 12kByte/Event \rightarrow 100 MByte/s (2x data reduction with firmware upgrade possible)
- » Time dominated by VME transfer.
- » Assume: 1 MPD / plane, 3 frames, all channels
 - » 78 kByte per event.
 - » 100% dead at 1250 Hz if read out via one crate (but larger data block might improve speed)
 - » 2.5kHz with better packing
- » We expect 200 Hz for 13@31, 700Hz for 17@55.
 - » Not crazy bad, but not ideal.
 - » This assumes **trigger-level single bunch resolution**, no additional background!

Alternative readouts

Alternative readout options:

- » Split into multiple MPD4 (-> 5kHz @2, 10kHz@4, but need more VME CPUs)
- » Use Fiber interface
 - » Aurora protocol (implemented, need VTP?, 2.5Gbit/s per MPD) 31kHz, need special electronics
 - » Direct ethernet (not implemented, 1 GBit/s or maybe 2.5 GBit/s?) 12.5kHz/31kHz, only need ethernet cards

Disk requirements

We will save about

- » 7.6 MByte/s for 13@31 (26 TB for 1000h. Small raid?)
- » 26 MByte/s for 17@55
- » 38 MByte/s for 1kHz (130TB for 1000h. Biggish raid)

This is for uncompressed but word-packed data.

Busy / synchronization

Need to distribute trigger to MPD4

- » Must have fixed latency $< 4 \mu s$

Fully locked or free running?

- » Free running:
 - » MPD4 can raise busy flag if FIFO is above threshold
 - » Generate MIDAS event for each fully read event
- » Fully locked
 - » Not sure if we can use the busy. Threshold=1?
 - » Need trigger to set busy until MPD4 can set busy. Wait for busy or fixed time.

Software

- » Will use **MIDAS** for DAQ
- » Strongly suggest to use **COOKER framework** for analysis:
 - » Used in OLYMPUS, MUSE, J-PARK, and DL
 - » Can read MIDAS files (even compressed with xz), map to root file
 - » Break down analysis into independent plugins – decouple development of different aspects
 - » Thin framework on top of root

What we already have for cooker

- » Analysis configuration via XML based init file
- » Run database (postgresql)
- » Can chain plugins, can split to run in parallel, compatible with clusters
- » Command line and GUI versions. Can visualize event per event.
- » Handling of MC weights etc.
- » Have code for
 - » Mapping
 - » **GEM analysis**
 - » MC integration, generators
 - » Slow Ctrl
 - » many more