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V1725 MIDAS DAQ Status

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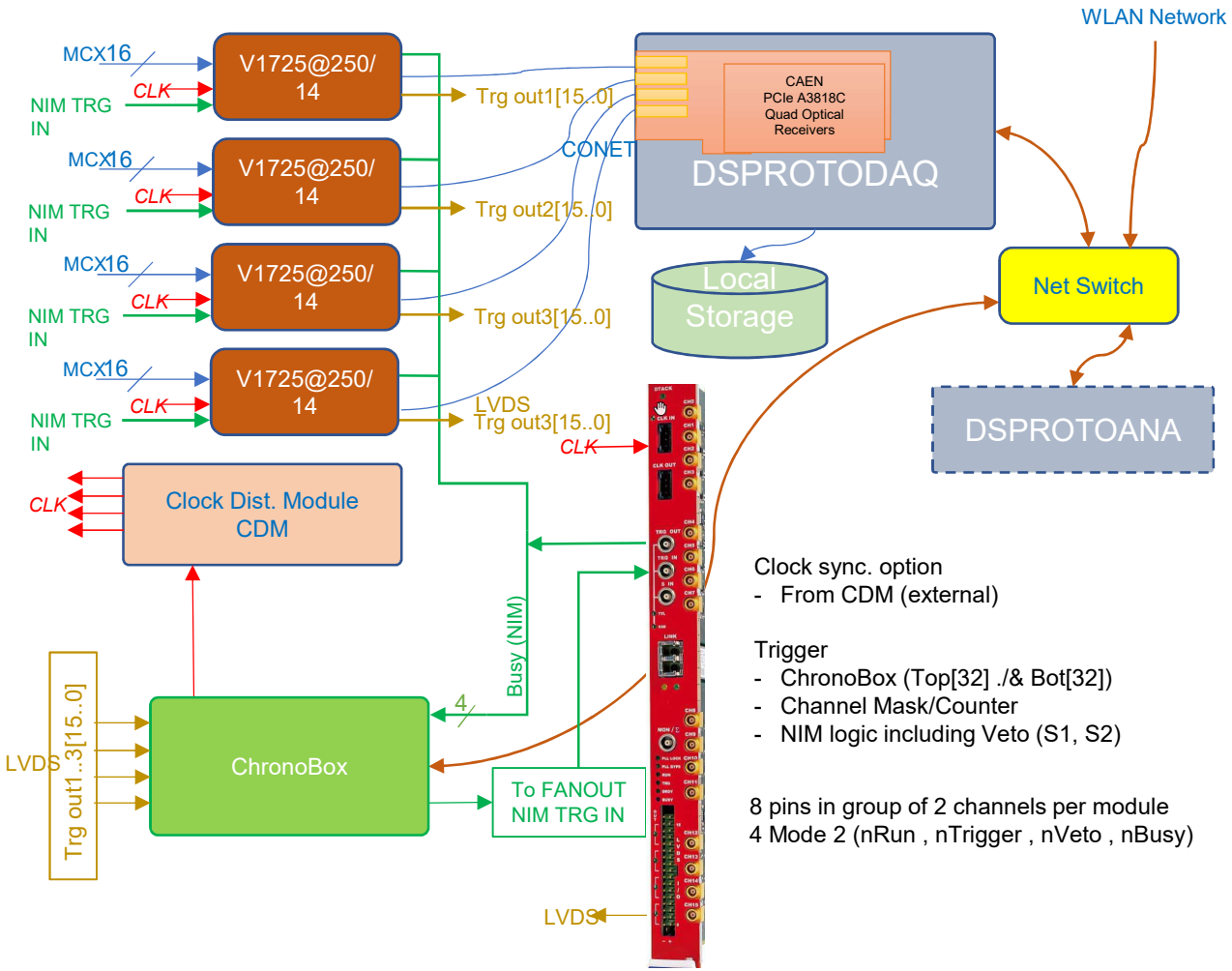
Hardware Architecture



Clock sync. option
- From CDM (external)

Trigger
- ChronoBox (Top[32] ./& Bot[32])
- Channel Mask/Counter
- NIM logic including Veto (S1, S2)

8 pins in group of 2 channels per module
4 Mode 2 (nRun , nTrigger , nVeto , nBusy)

Applications running on DSPROTODAQ

Midas frontend: V1725 readout
Midas data server (mserver)
Midas web server (mhttpd)
Midas data logger (mlogger)
Midas data monitor (mdsproto, root based)

Applications running on DSPROTOANA

Root
Online/Offline data analyzer (root based)
Custom package

System:
- Running Mode : Event-by-Event
- Up to 64 inputs
- Midas event composed of data collected after global trigger generation.
- Each event composed of 4 Midas banks (one per module) AND one ChronoBox bank.

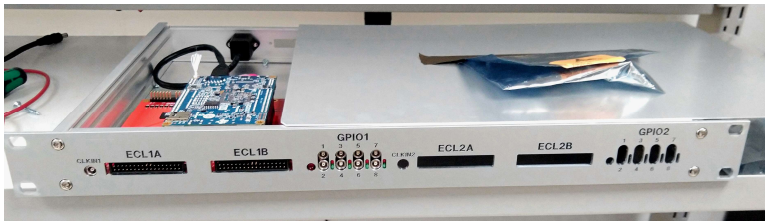
- Each V1725 bank is composed of N samples for each channels in ZLE format.
- ChronoBox bank composed of Global trigger timestamp AND trigger primitive mask, counters.

- HW clock Synchronized across all 4 V1725 + ChronoBox
- Timestamps across banks are checked

Hardware Status

- Four V1725 connected to A3818 optical card.
- Using CDM (Clock Distribution Module) to provide external clock to all V1725s.
- One ChronoBox for Trigger Configuration/Control/Monitoring

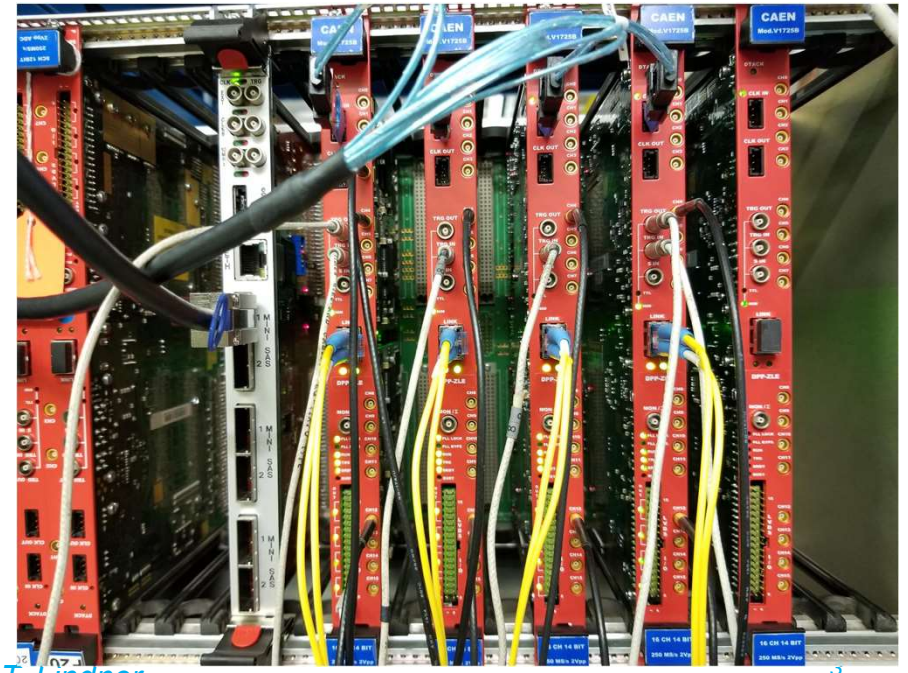
ChronoBox CDM V1725s



TTL Clock to CDM (Out)
Global Trigger (Out)

2x16 LVDS (In)
Trigger
primitives

4xTTL (In)
Busy Modules

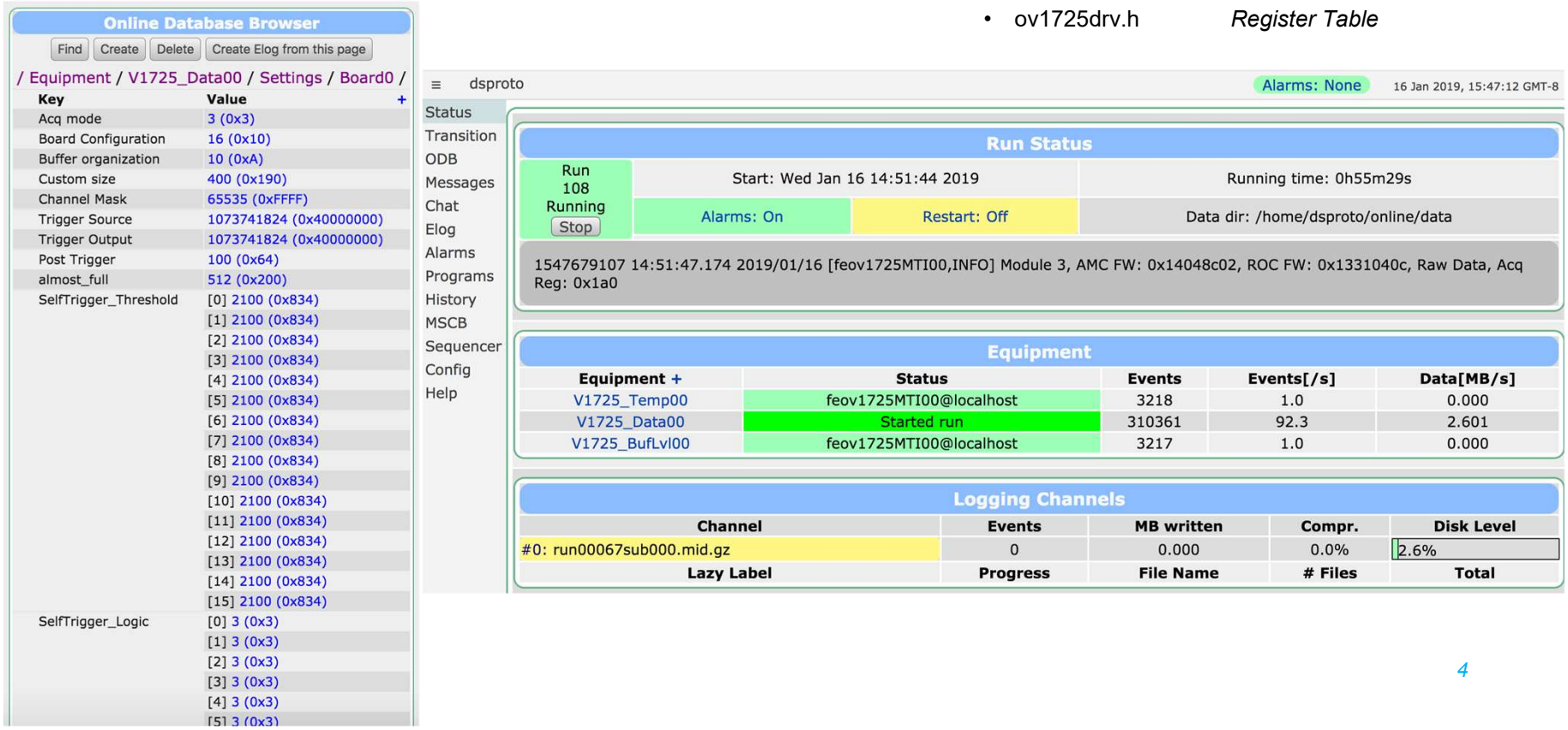


MIDAS DAQ programs

- Single MIDAS frontend controlling all 4 digitizers.
- Can see the MIDAS webserver: https://ds-proto-daq.triumf.ca/
- Currently just configure digitizer through setting ODB (MIDAS online database) keys.
- Can write custom MIDAS page for controlling digitizers later

[dsproto@ds-proto-daq dsproto_daq]$

- feoV1725.cxx: *Midas "frontend" Multi-Th.(4)*
- V1725.h: *Midas Module driver*
- v1725CONET2.cxx *Low Level driver*
- ov1725drv.h *Register Table*



Online Database Browser

Find | Create | Delete | Create Elog from this page

/ Equipment / V1725_Data00 / Settings / Board0 /

Key	Value
Acq mode	3 (0x3)
Board Configuration	16 (0x10)
Buffer organization	10 (0xA)
Custom size	400 (0x190)
Channel Mask	65535 (0xFFFF)
Trigger Source	1073741824 (0x40000000)
Trigger Output	1073741824 (0x40000000)
Post Trigger	100 (0x64)
almost_full	512 (0x200)
SelfTrigger_Threshold	[0] 2100 (0x834)
	[1] 2100 (0x834)
	[2] 2100 (0x834)
	[3] 2100 (0x834)
	[4] 2100 (0x834)
	[5] 2100 (0x834)
	[6] 2100 (0x834)
	[7] 2100 (0x834)
	[8] 2100 (0x834)
	[9] 2100 (0x834)
	[10] 2100 (0x834)
	[11] 2100 (0x834)
	[12] 2100 (0x834)
	[13] 2100 (0x834)
	[14] 2100 (0x834)
	[15] 2100 (0x834)
SelfTrigger_Logic	[0] 3 (0x3)
	[1] 3 (0x3)
	[2] 3 (0x3)
	[3] 3 (0x3)
	[4] 3 (0x3)
	[5] 3 (0x3)

dsproto — Alarms: None — 16 Jan 2019, 15:47:12 GMT-8

Status
Transition
ODB
Messages
Chat
Elog
Alarms
Programs
History
MSCB
Sequencer
Config
Help

Run Status

Run 108 Running — Stop

Start: Wed Jan 16 14:51:44 2019 | Running time: 0h55m29s

Alarms: On | Restart: Off | Data dir: /home/dsproto/online/data

1547679107 14:51:47.174 2019/01/16 [feov1725MTI00,INFO] Module 3, AMC FW: 0x14048c02, ROC FW: 0x1331040c, Raw Data, Acq Reg: 0x1a0

Equipment

Equipment +	Status	Events	Events[/s]	Data[MB/s]
V1725_Temp00	feov1725MTI00@localhost	3218	1.0	0.000
V1725_Data00	Started run	310361	92.3	2.601
V1725_BufLvl00	feov1725MTI00@localhost	3217	1.0	0.000

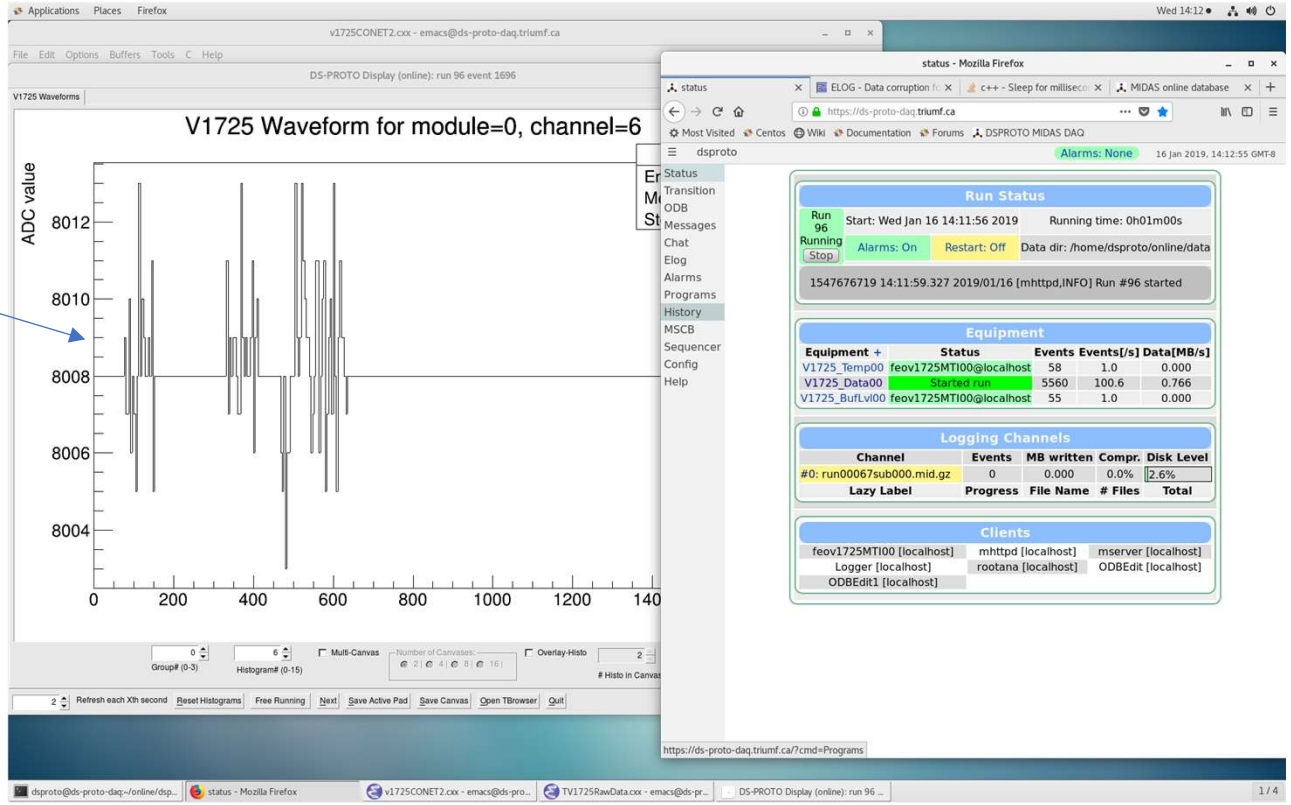
Logging Channels

Channel	Events	MB written	Compr.	Disk Level
#0: run00067sub000.mid.gz	0	0.000	0.0%	2.6%
Lazy Label	**Progress**	**File Name**	**# Files**	**Total**

Analyzers / Online Monitor

- Have simple online display which shows the waveforms online.
  - Can also be run offline on MIDAS files.
- Only waveforms for now. More plots can be added later.

ZLE waveform.
ZLE threshold low so just triggering on noise.



dsproto-analyzer

[dsproto@ds-proto-daq dsproto_analyzer]$
ana.cxx midas2root.cxx
anaDisplay.cxx
TAnaManager.cxx

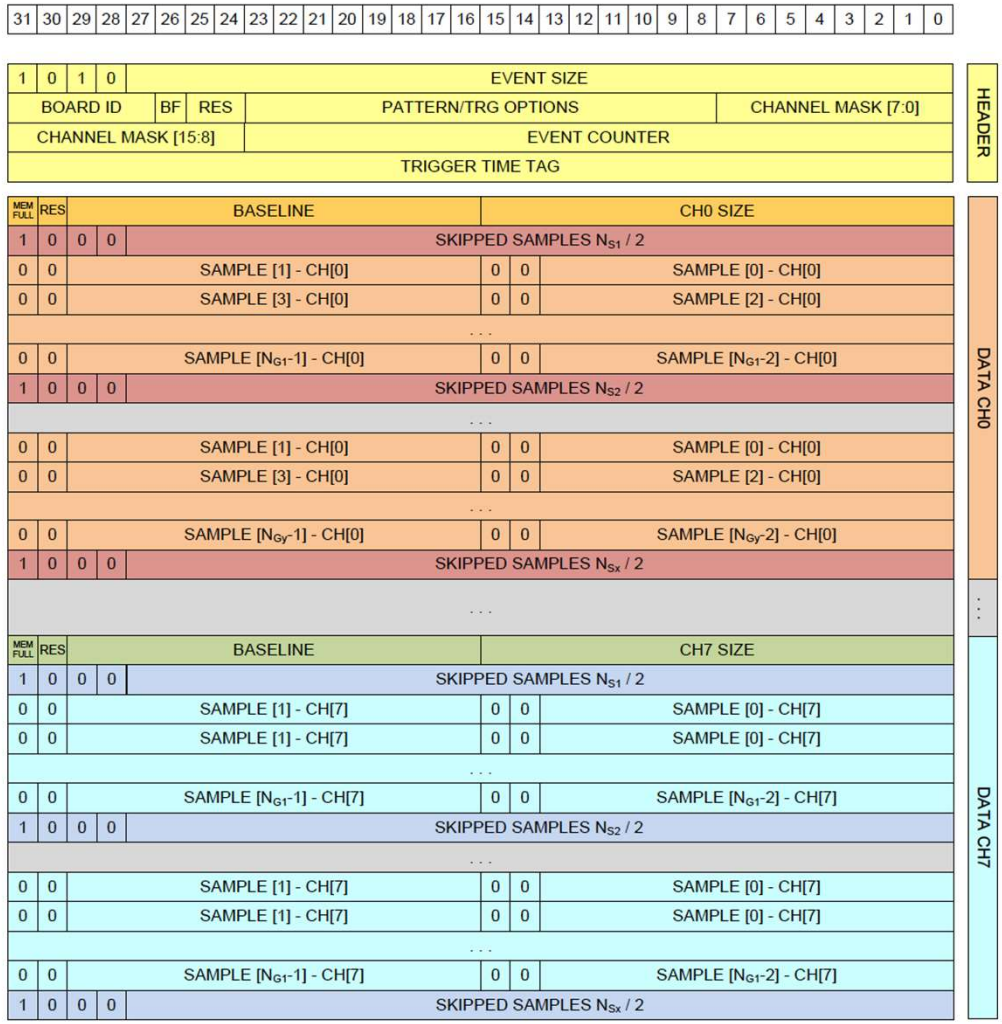
TV1725Waveform.cxx
TV1725Waveform.h

TV1725RawData.cxx
TV1725RawData.h

Data Format / midas2root conversion

- MIDAS program stores the data in the same raw format as V1725 produces.
  - Note that V1725 calculates baseline on the fly and stores it in bank.
- Expect that we have a program that converts MIDAS files into ROOT files.
- Relatively easy to write once you have ROOT format defined. Can provide examples.

V1725 ZLE Data Format



Data Dump

Four Midas banks (one per module)
Add one for the ChronoBox

```
- MIDAS revision: Thu Aug 30 08:28:51 2018 +0200 - midas-2017-07-c-251-gc30d565f on branch develop
----------------------- Event# 1 -----------------------
Evid:0001- Mask:0002- Serial:82195- Time:0x5c3fb8f4- Dsize:34296/0x85f8
#banks:4 - Bank list:-W200W201W202W203-

Bank:W200 Length: 27740(I*1)/6935(I*4)/6935(Type) Type:Unsigned Integer*4
   1-> 0xa0001b17 0x000770ff 0xff014113 0xcdc8c34d 0x090102d1 0x090108fd 0x09030902 0x09080909
   9-> Evt sze        ch msk   msk  evtc   time stamp bline chsze  data  data   data data  …
  17->
  25->
  33-> 0x08fd08fa 0x080708ee 0x035c062d 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
  41-> 0x80000029 0x08da08c1 0x08d608e2 0x08e108e8 0x08f208f7 0x090408fe 0x090e08fe 0x091b0909
  49-> Skip   sze   data data   data data   …
  57->
  65->
  73-> 0x09060901 0x08f2090a 0x08f408f6 0x08fe08ff 0x08ec08fc 0x08e408f0 0x08e708eb 0x08e108f2
  81-> 0x8000001f 0x08e408f0 0x08f908fb 0x08ef0904 0x08f308fa 0x08f60908 0x08e808eb 0x08fb08ef
  89-> 0x08fb0904 0x08fd08fc 0x090a090c 0x090008f7 0x090c08ff 0x09030907 0x090d090c 0x0911090b
  97-> 0x090c0906 0x090a090d 0x090e0905 0x09110915 0x090e090e 0x09040909 0x09070904 0x09060915
 105-> 0x09190914 0x09100909 0x090e0909 0x09170909 0x090c091d 0x09140907 0x09010903 0x08fd08ff
 113-> 0x0907090a 0x090708ff 0x08fa08f3 0x090e08fb 0x08fc0908 0x09090906 0x80000003 0x08ef08f6
 121-> 0x08ff0903 0x09030902 0x090008fb 0x090308f3 0x08f40908 0x090008fe 0x08f60907 0x08fe0900
 129-> 0x08fb08fb 0x08ff08f9 0x08f108ec 0x090408f6 0x08fb08fb 0x08fe0906 0x08fa08f8 0x08e708f0
 137-> 0x08f608f6 0x090408fe 0x08f908fc 0x08fe0903 0x08fc08f7 0x08fc0903 0x090f0907 0x08ee08f7
 145-> 0x08f908f6 0x08f908fc 0x08f508fb 0x090b08eb 0x090608fc 0x08fa08f7 0x08e608f9 0x08ee08f1
 153-> 0x08ff08f4 0x090908f2 0x08e90907 0x09040901 0x08fd08fd 0x08fa0908 0x08f808ec 0x08f608f2
 161-> 0x090508ff 0x08fd08fb 0x08f808fc 0x08f50901 0x0909090b 0x08ff0910 0x08ff0901 0x08fe08fd
 169-> 0x09000900 0x09050906 0x09050905 0x0908090a 0x091108fc 0x090a0905 0x08fd08f5 0x08ff08fd
 177-> 0x08fb08fe 0x08f50906 0x0903090a 0x08f60900 0x08f40902 0x09150904 0x0916090d 0x09070900
```

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ChronoBox Code

- The ChonoBox is configured as a Trigger Distribution Module (TDM)
- Generate the 50MHz global clock, send the clock to the CDM
- 4 x 8 pairs LVDS trigger primitive inputs.
- Counter on each inputs for:
  - Over-threshold counter
  - Over-Threshold within the required multiplicity
- Constructs 2 Groups (Top & Bottom) individual channel assignment.
- Constructs V1725 Top <AND'd or Or'd> Bottom decision
- Combines V1725 trigger <with> Module busy <with> external trigger
- Trigger suppression based on deadtime parameter

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ChronoBox Code

- Count of BUSY signal high-transitions
- Count of OVER-THRESHOLD high-transitions, per channel
- Count of TOP decision high-transitions
- Count of BOTTOM decision high-transitions
- Count of DECISION high-transitions
- Count of ACCEPTED triggers
- Count of DROPPED triggers
- Count of DROPPED triggers due to BUSY
- Count of DROPPED triggers due to DEADTIME > 0

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Code Repositories

- DAQ, Analyzer and Firmware code available here:

https://bitbucket.org/ttriumfdaq/dsproto_daq/

https://bitbucket.org/ttriumfdaq/dsproto_analyzer

https://edev-group.triumf.ca/fw/exp/darkside/prototype

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Backups

Data Monitoring

dsproto-analyzer

[dsproto@ds-proto-daq dsproto_analyzer]$
ana.cxx midas2root.cxx
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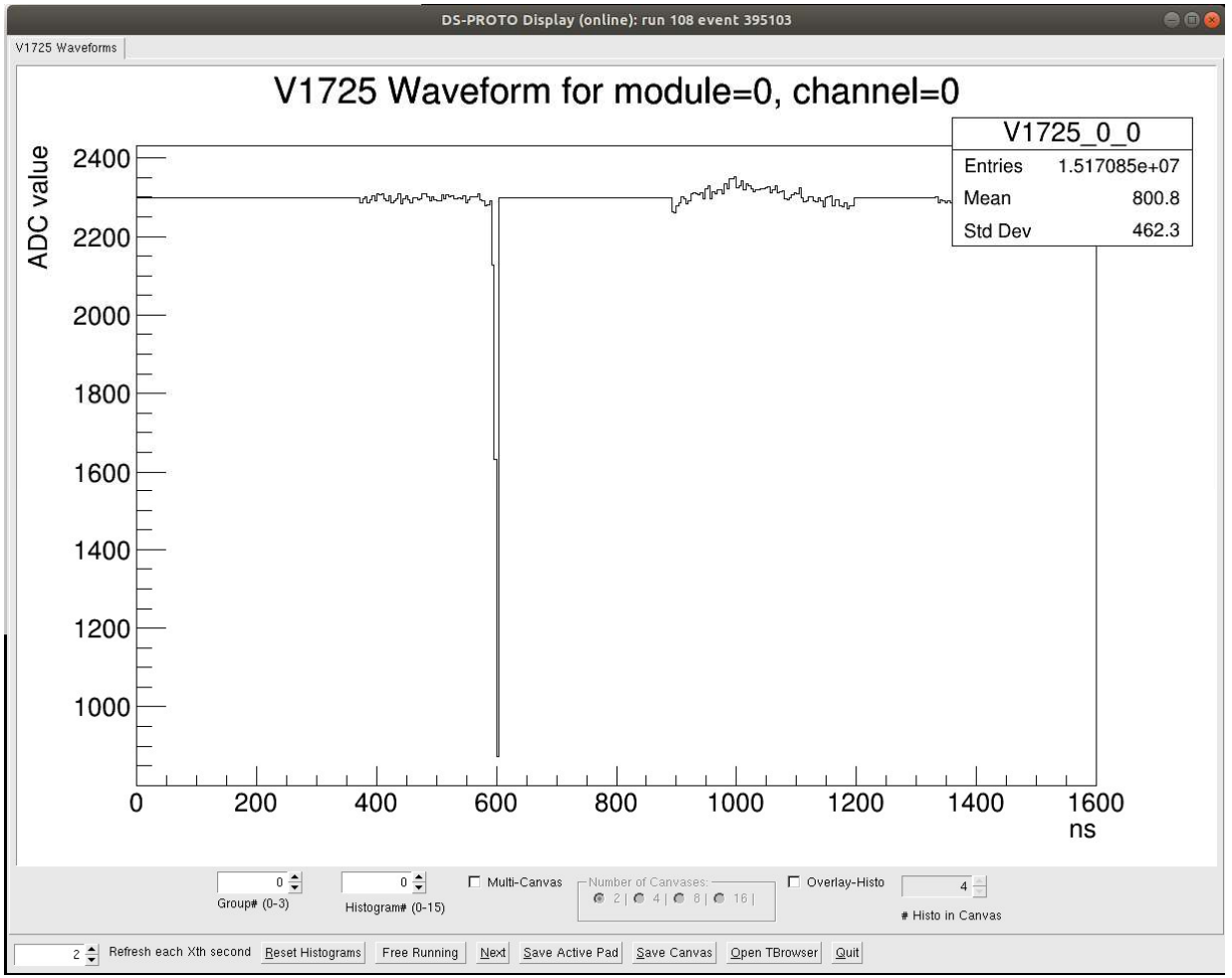
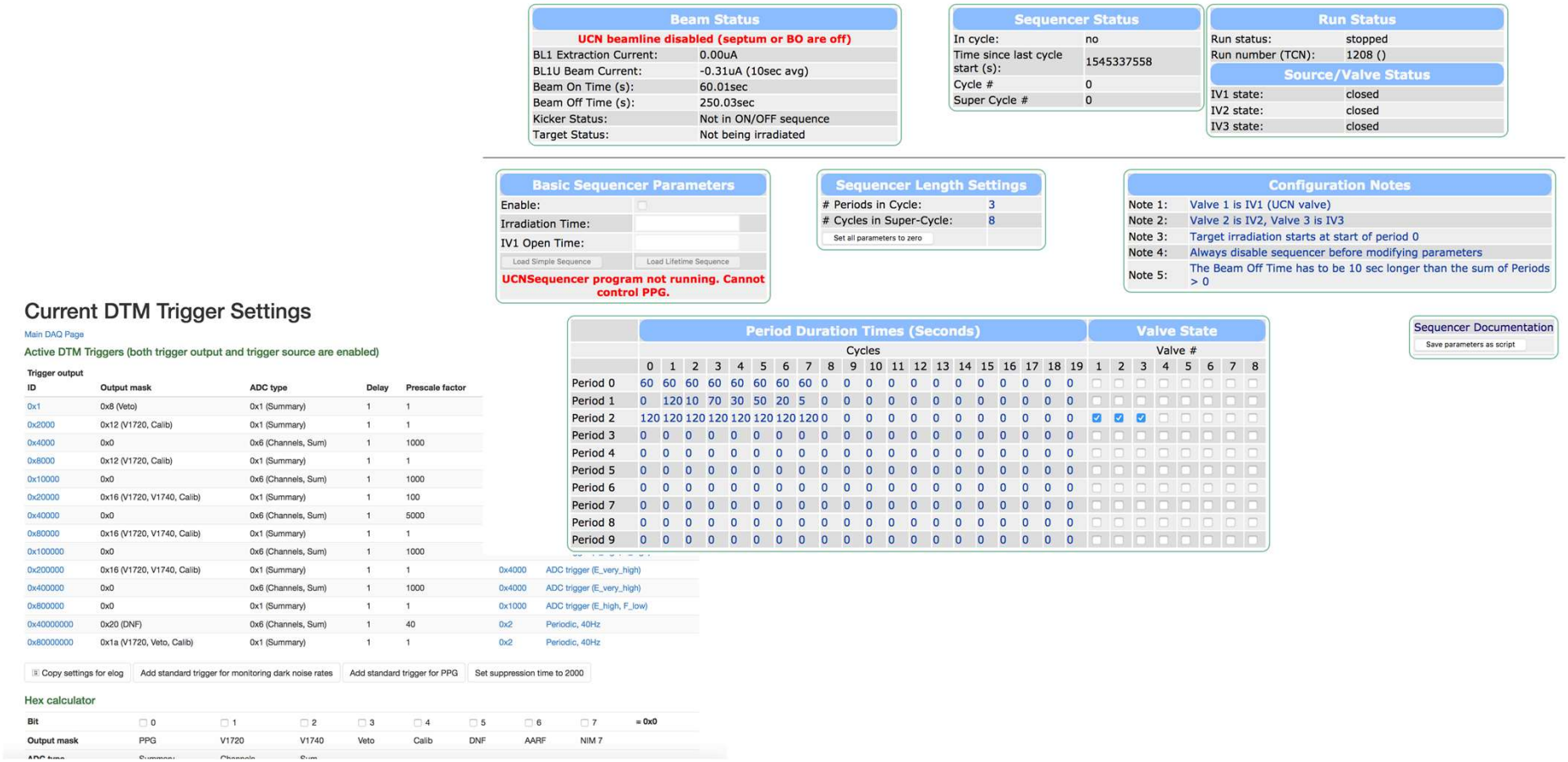


Example Custom MIDAS pages

- Relatively easy now to create webpages for reading and writing ODB keys.



Beam Status

UCN beamline disabled (septum or BO are off)	
BL1 Extraction Current:	0.00uA
BL1U Beam Current:	-0.31uA (10sec avg)
Beam On Time (s):	60.01sec
Beam Off Time (s):	250.03sec
Kicker Status:	Not in ON/OFF sequence
Target Status:	Not being irradiated

Sequencer Status

In cycle:	no
Time since last cycle start (s):	1545337558
Cycle #	0
Super Cycle #	0

Run Status

Run status:	stopped
Run number (TCN):	1208 ()

Source/Valve Status

IV1 state:	closed
IV2 state:	closed
IV3 state:	closed

Basic Sequencer Parameters

Enable:
Irradiation Time:
IV1 Open Time:
Load Simple Sequence | Load Lifetime Sequence

UCNSequencer program not running. Cannot control PPG.

Sequencer Length Settings

# Periods in Cycle:	3
# Cycles in Super-Cycle:	8

Set all parameters to zero

Configuration Notes

Note 1:	Valve 1 is IV1 (UCN valve)
Note 2:	Valve 2 is IV2, Valve 3 is IV3
Note 3:	Target irradiation starts at start of period 0
Note 4:	Always disable sequencer before modifying parameters
Note 5:	The Beam Off Time has to be 10 sec longer than the sum of Periods > 0

Current DTM Trigger Settings

Main DAQ Page

Active DTM Triggers (both trigger output and trigger source are enabled)

Trigger output ID	Output mask	ADC type	Delay	Prescale factor		
0x1	0x8 (Veto)	0x1 (Summary)	1	1		
0x2000	0x12 (V1720, Calib)	0x1 (Summary)	1	1		
0x4000	0x0	0x6 (Channels, Sum)	1	1000		
0x8000	0x12 (V1720, Calib)	0x1 (Summary)	1	1		
0x10000	0x0	0x6 (Channels, Sum)	1	1000		
0x20000	0x16 (V1720, V1740, Calib)	0x1 (Summary)	1	100		
0x40000	0x0	0x6 (Channels, Sum)	1	5000		
0x80000	0x16 (V1720, V1740, Calib)	0x1 (Summary)	1	1		
0x100000	0x0	0x6 (Channels, Sum)	1	1000		
0x200000	0x16 (V1720, V1740, Calib)	0x1 (Summary)	1	1	0x4000	ADC trigger (E_very_high)
0x400000	0x0	0x6 (Channels, Sum)	1	1000	0x4000	ADC trigger (E_very_high)
0x800000	0x0	0x1 (Summary)	1	1	0x1000	ADC trigger (E_high, F_low)
0x40000000	0x20 (DNF)	0x6 (Channels, Sum)	1	40	0x2	Periodic, 40Hz
0x80000000	0x1a (V1720, Veto, Calib)	0x1 (Summary)	1	1	0x2	Periodic, 40Hz

Copy settings for elog | Add standard trigger for monitoring dark noise rates | Add standard trigger for PPG | Set suppression time to 2000

Hex calculator

Bit	0	1	2	3	4	5	6	7	= 0x0
Output mask	PPG	V1720	V1740	Veto	Calib	DNF	AARF	NIM 7	
ADC type	Summary	Channels	Sum						

Period Duration Times (Seconds) / **Valve State**

	Cycles 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Valve # 1	2	3	4	5	6	7	8
Period 0	60	60	60	60	60	60	60	60	0	0	0	0	0	0	0	0	0	0	0	0	☐	☐	☐	☐	☐	☐	☐	☐
Period 1	0	120	10	70	30	50	20	5	0	0	0	0	0	0	0	0	0	0	0	0	☐	☐	☐	☐	☐	☐	☐	☐
Period 2	120	120	120	120	120	120	120	120	0	0	0	0	0	0	0	0	0	0	0	0	☑	☑	☑	☐	☐	☐	☐	☐
Period 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	☐	☐	☐	☐	☐	☐	☐	☐
Period 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	☐	☐	☐	☐	☐	☐	☐	☐
Period 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	☐	☐	☐	☐	☐	☐	☐	☐
Period 6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	☐	☐	☐	☐	☐	☐	☐	☐
Period 7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	☐	☐	☐	☐	☐	☐	☐	☐
Period 8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	☐	☐	☐	☐	☐	☐	☐	☐
Period 9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	☐	☐	☐	☐	☐	☐	☐	☐

Sequencer Documentation

Save parameters as script