

Online Software Filtering – Using Penn Trigger Board

The Penn Trigger Board acts as the hardware trigger in the system

- Provides flexibility
- Configurable logic using external counters

Our ambition is to write all 35t data to disk during running

It will be very useful to be able to produce separate “enriched sample” data files

- Allows quasi-online (nearline) analysis of subsets of the data
- Can be used for online monitoring purposes
- Easier assessment of trigger types
 - Quicker turn around in trigger alterations / improvements

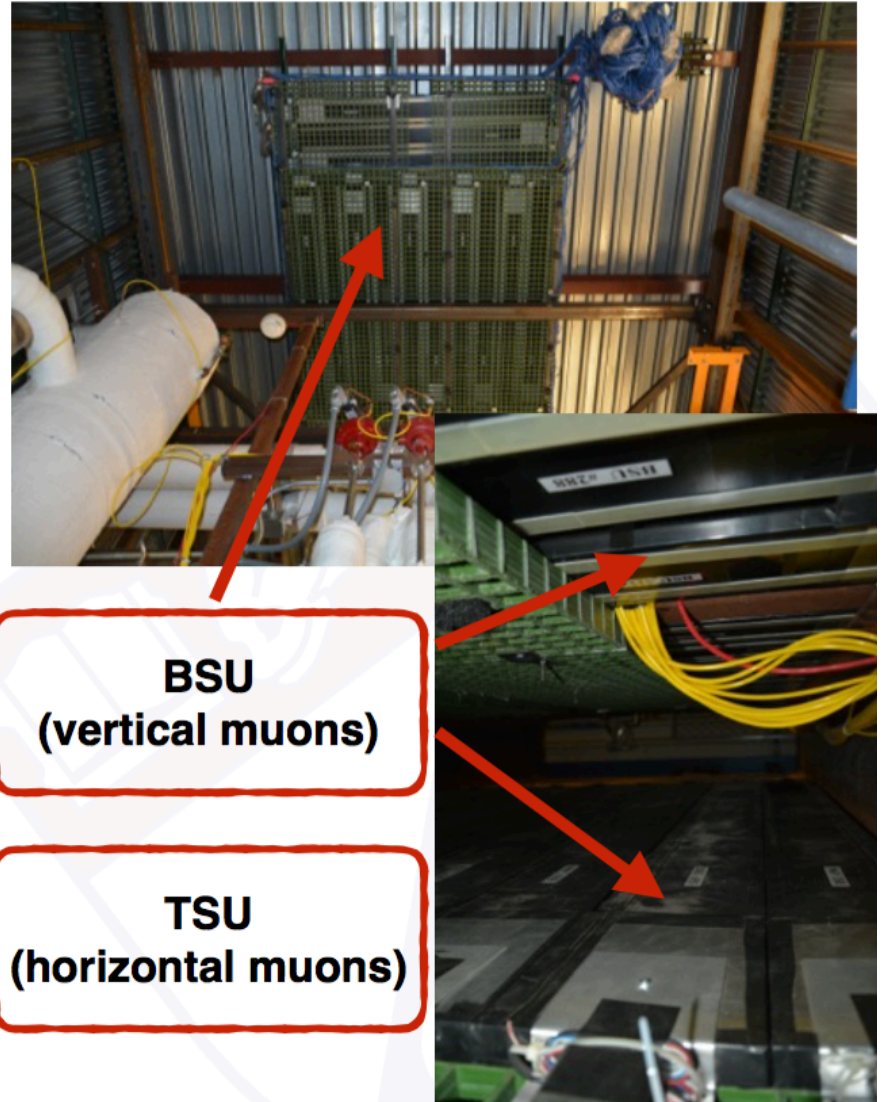
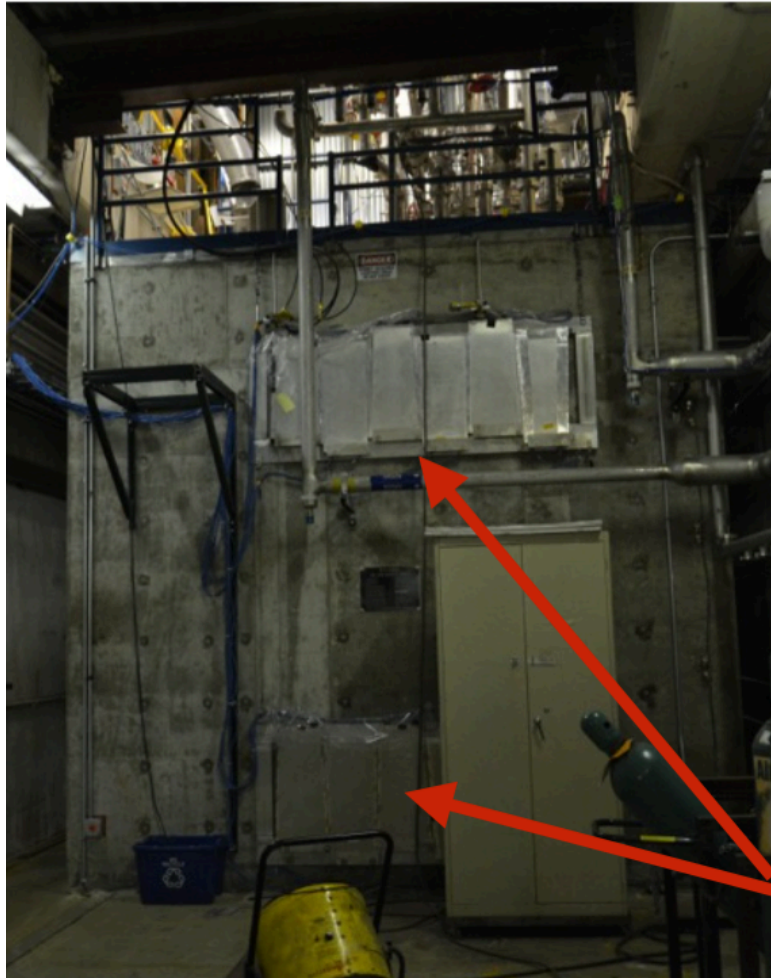
Examples:

Want data driven quasi-online LAr purity monitor

- Need enriched sample of events containing particles travelling parallel to APA (i.e. select events hitting East Lower and West Upper counters)

Diffusion monitoring / analysis

- Need enriched sample of events travelling along drift direction (i.e. select events hitting North Upper and South Lower counters)

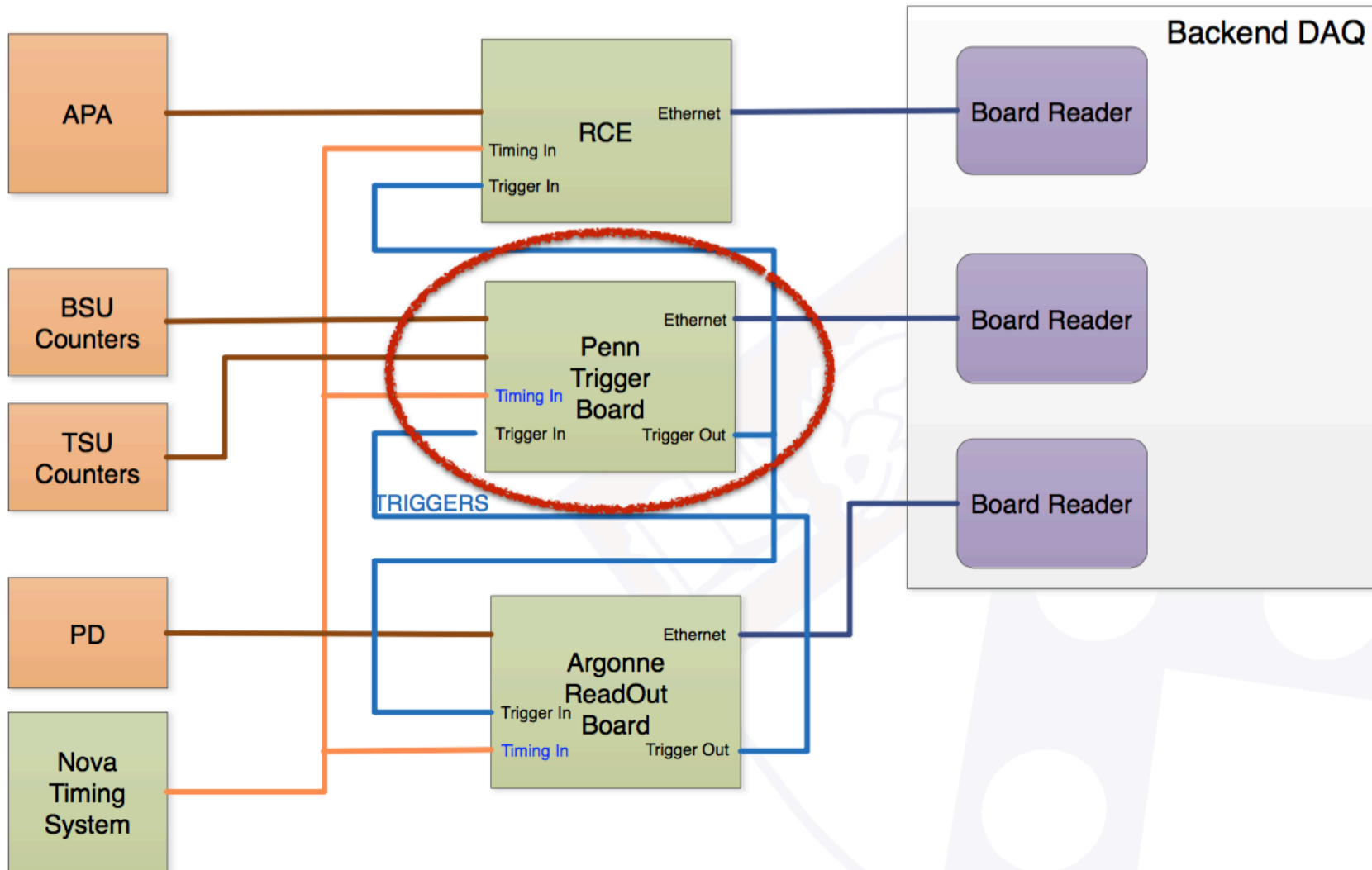


BSU
(vertical muons)

TSU
(horizontal muons)

From Nuno Barros

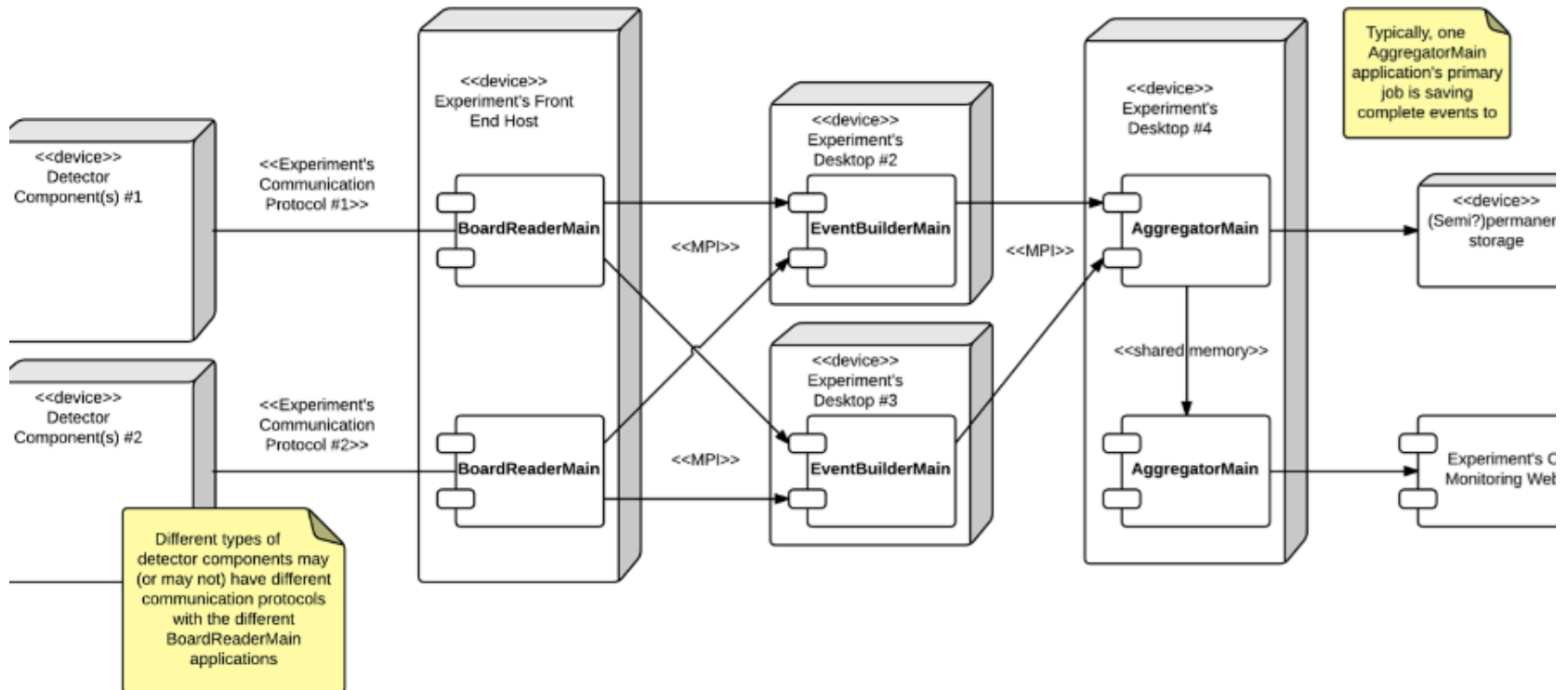
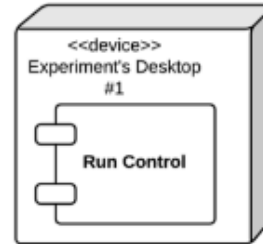
Penn Trigger Board



From Nuno Barros

Simple artdaq-based DAQ system
UML Deployment Diagram
J. Freeman, 10/13/14

Run Control, supplied by the experiment, communicates with the artdaq processes via XML-RPC (connections not explicitly shown)



From John Freeman

What information does the Penn Trigger Board give us?

- Trigger Payloads

Penn Board has decided that there is a “trigger”, this details the cause:

SSP, RCE combinations, Calibration, Muon Counter combinations

- Counter Payloads

Mask for the counters currently “on” (have crossed threshold)

Great! We can use this information to create data streams...

Penn Trigger Board Information

trigger words

TYPE	Value	Data type	Description/Content of rest of Payload
	00000	Calibration	DAQ requested calibration pulse/ID of the pulsed systems
	01000	SSP	Trigger-in induced by the SSP/none
	00001		
	...	RCE	Trigger-in induced by the RCE (1 bit per unit)
	00111		
	10000	Muon pannels	Counter trigger pattern ID

Stored in the highest bits of the 32-bit word.

From Nuno Barros

Muon trigger pattern words

TYPE	Value	Description
	1000	any BSU counter in the RM1-16 series in coincidence with any BSU counter in the CL1-13 (trig A)
	0100	any TSU counter from the NU1-6 series in coincidence with any TSU counter from the SL1-6 series (trig B)
	0010	any TSU counter from the SU1-6 series in coincidence with any TSU counter from the NL1-6 series. (trig C)
	0001	any TSU counter from the EL1-10 series in coincidence with any TSU counter from the WU1-10 series. (trig D)

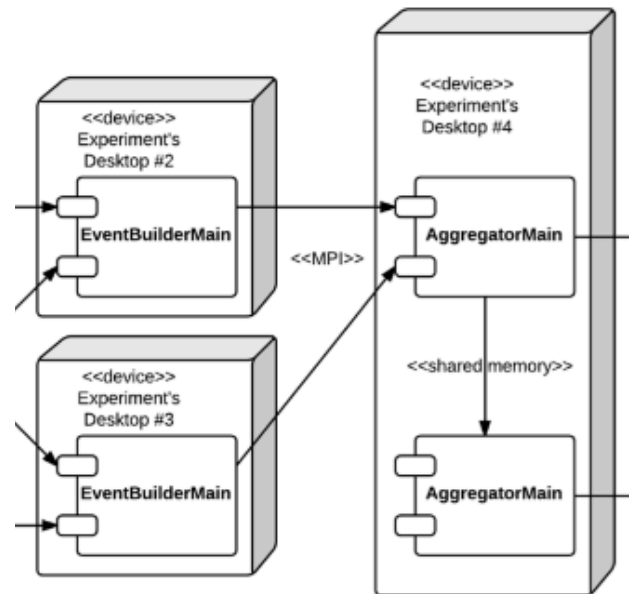
Stored in the highest bits of the 27-bit remainder after the trigger ID word.

From Nuno Barros

FCL Configurable ART Producer modules run as part of the Event Builder

Very lightweight (single bit inspection) ART Filter Modules run in the Aggregator

- Inspect Penn Trigger Board data
- Select events on trigger type
- Insert Boolean to be used for streaming



- Multiple output “streams” (files)
- Each stream selects on a different Boolean produced in the event builder

lbne-raw-data -> feature/penn-board-reader

Added Penn Trigger Board unpacking structures (bit fields etc.)

- Trigger Words, Muon Trigger Patterns, Counter Payloads

Some additional getter functions to increase access speed

- All the above should simplify unpacking for Online monitoring / conversion to offline objects

lbne-art-daq -> feature/trigger-penn_board

PennBoardTrigger.fcl

```
-----  
FilterOnTriggerType: true  
TriggerType: 0x10  
#0x00==calibration  
#0x01, 0x02, 0x03, 0x04, 0x05, 0x06, 0x07==rce  
#0x08==ssp  
#0x10==muon  
FilterOnTriggerPattern: true  
TriggerPatternBit: 26  
#26==bsu_rm_cl  
#25==tsu_nu_sl  
#24==tsu_sl_nu  
#23==tsu_el_wu
```

PennBoardTrigger_module.cc

```
-----  
myTrigger->trigger_type == fTriggerType  
  
this_trigger_pattern.test(fTriggerPatternBit)
```

Implement Boolean inspection to run in Aggregators

- Should be trivial – get, isValid, value

Talk to ART-DAQ people about using ART's built in "TriggerResults" object

- Might be faster – don't know how to use it though

Get hold of some more useful Penn Trigger Board data

Get feedback from this group on useful data stream ideas

- Which event samples do we want separated, etc...