DUNE-DAQ in ICEBERG for Run 9

Bonnie King Ron Rechenmacher DUNE DAQ Meeting July 15 2024 July 29 2024



Contents

- Description of ICEBERG at PAB Noble Liquid Test Facility
- Computing setup
- Tales from DUNE-DAQ deployment
- Data transfer
- Pocket
- Justintime
- Runservices
- Run plan and goals
- data
- FELIX and DAPHNE
- Future plans
 - TPG
 - PD trigger





ICEBERG at **PAB**

Integrated Cryostat and Electronics Built for Experimental Research Goals

 ICEBERG is a 3000L cryostat at the Noble Liquid Test Facility AKA PAB
 June 26 Commissioning meeting with status and plots
 ICEBERG e-Log: https://dbweb8.fnal.gov:8443/ECL/ dune/E/index
 Wiki: https://wiki.dunescience.org/wiki/IC
 EBERG WIB-Ethernet DAQ





ICEBERG at **PAB**

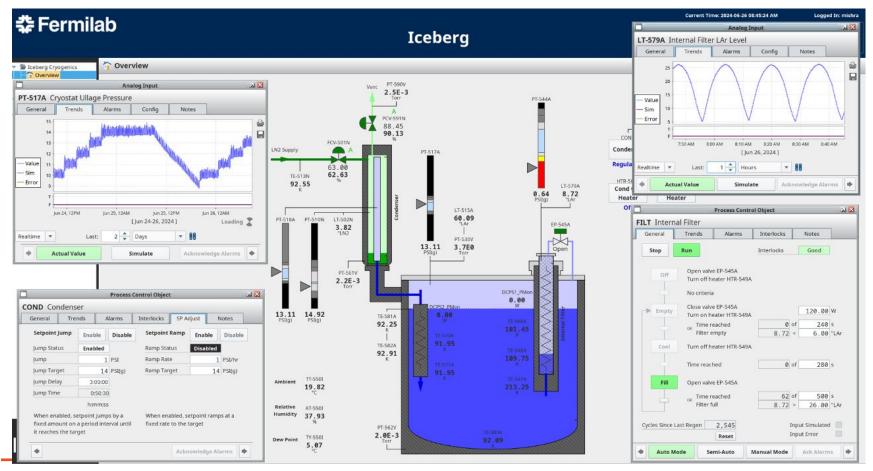
ICEBERG has a TPC with smaller APAs

- 3 WIBs and 10FEMBs
 - 4/4/2
- Available triggers:
 - Timing Logic Unit
 - Cosmic Ray paddles
 - (no beam)
- Used to characterize cold electronics and opportunisitically by the DAQ
- Now in/completing Run 9





ICEBERG at PAB







Computing setup

3 servers:

- iceberg03.fnal.gov
 - Ethernet readout
 - PowerEdge R750 Server (210-AYCG)
 - 356 (8x32GB) RDIMM, 3200MT/s, Dual Rank 16Gb BASE x8 (370-AGDS)
 - 2xIntel Xeon Gold 5317 3G, 12C/24T, 11.2GT/s, 18M Cache
 - NVIDIA Ampere A100
- iceberg01.fnal.gov
 - FELIX readout for DAPHNE v2
 - Pocket
 - Slow Controls (EPICs)
 - Intel Xeon 4216 16-Core 2.10GHz 22MB
 - 192GB DDR
 - 2xIntel 665p 2 TB Solid State Drive M.2 2280 Internal PCI Express NVMe
 - RAID10
 - FELIX readout BNL-712
- protodune-daq02.fnal.gov
 - Old 35T server



Run Plan and goals- From S. Mishra

- 1. Measure Individual Channel Linearity (INL) using pulser data.
- 2. Determine the precision of individual channel gain (LArASIC + ColdADC; e-/LSB) using pulser data.
- 3. Measure and decide the optimal gain setting: 14 mV/fC or 7.8 mV/fC
- 4. Determine optimal baseline for collection plane: 200+mV
- 5. Study shaping time effect on ENC (1 µsec vs 2 µsec)
- 6. Measure cross talks.
- 7. Determine optimal ColdADC Vref settings.
- 8. Learn to use particle interaction in LAr to determine absolute calibration of the
- TPC + Electronics response (MeV/LSB-tick)
 - 1. MIP dE/dX
 - 2. Michel electrons
 - 3. Ar-39

9. DUNE-FD2-PD: Integration of DAPHNE-V3 in Ethernet DUNE-DAQ

https://indico.fnal.gov/event/65338/ fro June 26 ICBERG Commissioning meeting



Tales from the deployment: expert parameters

- Types of runs configured:
 - Cosmic
 - LArASIC
 - All channels
 - Individual channels (for crosstalk detection)
 - WIB Pulser
 - More precise pulse control
 - Pulser runs use HSI periodic trigger
- These parameters weren't adjustable by the config generation scripts
- A set of pre and post config generation scripts were used to adjust parameters needed for the studies



Tales from the deployment: WIB Pulser

- Problems configuring WIB pulser, adjustments had no effect
 - Bug was identified in wib_server, parameters could only be changed for NP04 detector(s), fix to be implemented



Tales from the deployment - more

- V4.4.2 \rightarrow v4.4.3
- Initially 4.4.2
- missing/inconsistent data
- Shekhar magic shutdown
- Disable irqbalance service, implement cpu pinning
- 3 forms of running: cosmics, pulser, wibpulser
- tc_type_name discussions
 - "kDTSCosmic", "kDTSPulser"
 - offline_data_stream: "cosmics", "calibration"
 - $\rightarrow v4.4.3$



Data transfer

• Metadata creation script given to Shekhar, data is being duplicated to other disks, to be done



Pocket

- Pocket and daq-kube deployed without issue on iceberg01.fnal.gov
- Some manual edits to the np04-specific configs for kafka

Partition name dunecet-ic	eberg ~				≡ Subsystems Ξ	≡ Global	BB NP04 Network	■ NP04	品 Ethernet input
dunecet-iceberg 07/13 08:00	0 07/13 12:00 02	7/13 16:00 07/13 20:00	07/14 00:00 07/14	04:00 07/14 08:00	07/14 12:00 07/	14 16:00	07/14 20:00 07	/15 00:00	07/15 04:00
Current Status SHUTDOWN	Sending triggers at	App Fwk Error State	Run time	Run number	Trigger Status	<	Issued triggers	Writte sour	n TRs rce_id (
Trigger Rate		Data Writers Information		Message Reporting se [,]		applic≀ ⊽ trigger	message ⊽ End of run 15288		
 → 0.4 → 0.2 → 0.7/14 00:00 → 07/14 00:00 → 07/14 00:00 → 07/15 00:00 → 07/15 00:00 → 07/15 00:00 → 07/14 00:00 → 07/15 00:00 → 07/15 00:00 → 07/14 00:00 → 07/14 00:00 → 07/15 00:00 → 07/14 00:00 → 07/15 00:00 → 07/14 00:00 → 07/15 00:00 → 07/14 00:00		9 9 9 9 9 9 0 0 0 0 0 0 0 0 0 0 0 0 0		INFO 2024-07-14 10 INFO 2024-07-14 10 WARN 2024-07-14 10	0:35:10	timinghsi trigger ruicebera(: Exiting the read_hs Trigger is paused SourceID[subsysten		
				WARN 2024-07-14 10			SourceID[subsysten		



justintime

- Deployed justintime on iceberg01.fnal.gov with a copy of .hdf5 files on local NVMe disk
- Works out of the box for a basic sanity check, but additional plots are being generated separately using DUNEsw using SL7 container



runservices

- Currently using a simple script to generate run number and relying on configs saved on the file system
- Bonnie working on getting runregistry and runnumber microservices running in with Postgres for the ICEBERG environment



DEEP UNDERGROUND NEUTRINO EXPERIMENT

ահահահահահահա

-

ICEBERG: Cosmic Track X Time vs Wire, Charge View X File Edit Window Help [Run/Event]= 12979 3 Go Print <- Previous Next -----> > Reload Zoom Interest 120 180 200 7000 6500 6400 6400 6400 5500 5500 ահահահահահահա UnZoom Interest Zoom Back AutoZoom Find XYZ x,y,z

8 2 Wire

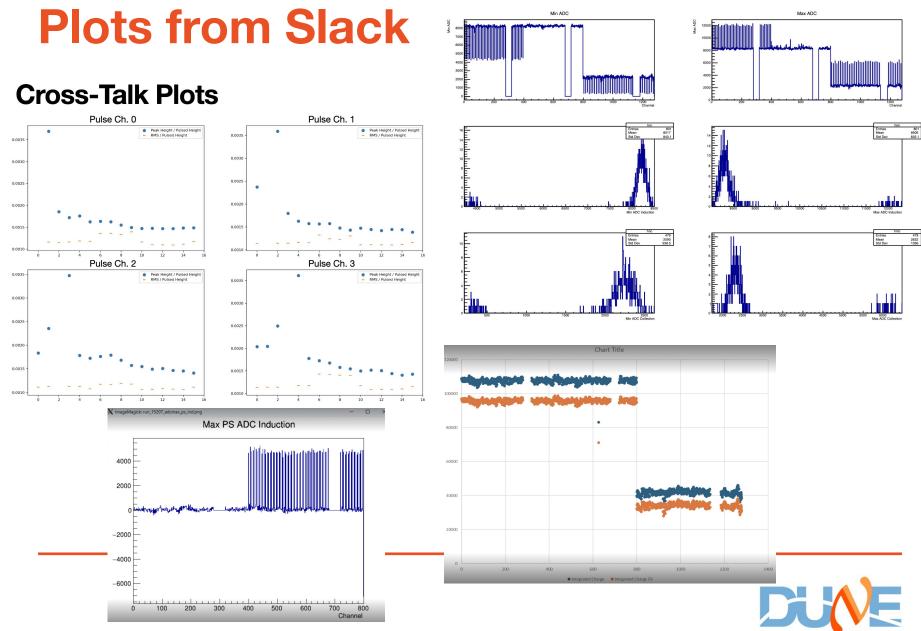
ADC Threshold

7200 Clear Points 7000 E ShowMarkers Redraw 660 Cryo #0 (1 total) 640 TPC # 0 🔶 (2 total) 620 6000 7000 6500 6600 6400 6200 12278 unintum in LArSoft Run: 12979/1 Event: 3 www.wherewerenewere and when manufacture and the second of the second s UTC Wed Jun 26, 2 02:56:51.891399424

163 Plane 2 C Raw Reconstructed Both Grayscale MC Truth

DUNE

DEEP UNDERGROUND NEUTRINO EXPERIMENT



DAPHNE v2 with FELIX

- Spy buffer data has been taken and analyzed
- Adventures connecting DAPHNE MTP-12 vs MTP-24
- Kernel module things
 - 5.14.0-284.25.1.el9_2.x86_64 works with patches from NP04
 - Have not succeeded in loading the kernel on 362 or beyond, freezing iceberg01 kernel
 - Known issue from ATLAS
- Now getting data with FELIX and DUNE-DAQ

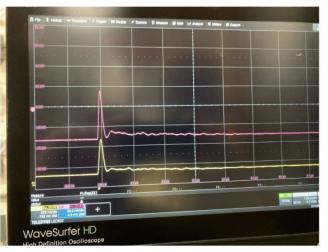


Future plans

DUNE-FD2-PD: Integration of DAPHNE-V3 in Ethernet DUNE-DAQ



X-ARAPUCA Under the ICEBERG TPC



Detector is powered using PoF Photon Signal from the detector.



PD Trigger

- CE has requested DAPHNE to HSI trigger
- DAQ says this is a good effort if driven by CE (?)



Trigger Primitive Generation

• Address after run 9



Other proposals and work in ICEBERG

- In-network compute with smart switches
- AI/ML work with nvidia
 - Some info here <u>https://indico.fnal.gov/event/65032/contributions/293465/attach</u> <u>ments/178634/243518/ICEBERG%7BStatus%20and%20Plan%</u> <u>20%28June%205%202024%29.pdf</u>
 - 0
 - Porting DUNE-DAQ to nvidia GH100 (ARM)?
 - Really means better understanding of the software system, performance, and plan





