

# ICEBERG: Status and Plan

DUNE Collaboration Meeting, May 2024

Shekhar Mishra

Neutrino Division, Fermilab

05/23/2024

---

# ICEBERG TPC: In the cryostat



- April 25, 2024
  - ICEBERG TPC Lifted and placed in ICEBERG Cryostat
  - All sub-system checkout
- April 26, 2024
  - ICEBERG Internal Filter Installed on Top Plate after the TPC in the cryostat
  - Attach all the pipes for fill, including additional ground cables
- April 29, 2024
  - Vacuum Pull started
- May 6, 2024
  - Cryogenic fill starts, May 6,2024 (AM)
- May 9<sup>th</sup>, 2024
  - DUNE-CE and DUNE-VD-PD Power Turned ON
- June 5, 2024
  - ICEBERG Filled with 60" of Liquid Ar

# ICEBERG Cryogenic

Current Time: 2024-06-05 01:38:40 PM    Logged In: mishra

**Iceberg**

**Fermilab**

Iceberg Cryogenics    Overview

**Analog Input**

PT-517A Cryostat Ullage Pressure

Realtime    Last: 10    Hours

Actual Value    Simulate    Acknowledge Alarms

LN2 Supply    Vent    PT-590V 2.4E-3 Torr

PCV-591N 77.72 %    FCV-501N 3.89 %    A 2.91 %

TE-513N 95.15 K    PT-517A 10.59 PSI(g)

PT-518A 10.61 PSI(g)    PT-510N 16.99 PSI(g)    LT-502N 9.35 % LN2

PT-561V 1.7E-3 Torr    LT-515A 60.05 % LAR    PT-530V 3.7E0 Torr

TE-581A 91.05 K    TE-570A 90.85 K    TE-568A 98.05 K

TE-582A 91.58 K    TE-548A 91.65 K    TE-571A 91.25 K

TE-547A 92.15 K    TE-583A 91.68 K

PT-562V 2.0E-3 Torr    Ambient TT-5501 19.81 °C

Relative Humidity AT-5501 36.25 %

Dew Point TY-5501 4.41 °C

PT-544A 0.65 PSI(g)    LT-579A 26.81 % LAR    EP-545A Open

DCPS1 PMon 0.00 W    DCPS2 PMon 0.00 W

**Analog Input**

LT-579A Internal Filter LAR Level

Historical    [Jun 5, 2024]

Actual Value    Simulate    Acknowledge Alarms

**Process Control Object**

**COND Condenser**

Setpoint Jump	Enable	Disable	Setpoint Ramp	Enable	Disable
Jump Status	Disabled		Ramp Status	Disabled	
Jump	1 PSI		Ramp Rate	1 PSI/hr	
Jump Target	9 PSI(g)		Ramp Target	9 PSI(g)	
Jump Delay	1:00:00				
Jump Time	1:00:00				

When enabled, setpoint jumps by a fixed amount on a period interval until it reaches the target

When enabled, setpoint ramps at a fixed rate to the target

Acknowledge Alarms

**Process Control Object**

**FILT Internal Filter**

Stop    Run    Interlocks: Good

Off    Open valve EP-545A    Turn off heater HTR-549A

No criteria

Empty    Close valve EP-545A    Turn on heater HTR-549A    150.00 W

or    Time reached    0 of 240 s

Filter empty    26.81 < 6.00 % LAR

Cool    Turn off heater HTR-549A

Time reached    0 of 240 s

Fill    Open valve EP-545A

or    Time reached    0 of 500 s

Filter full    26.81 > 26.00 % LAR

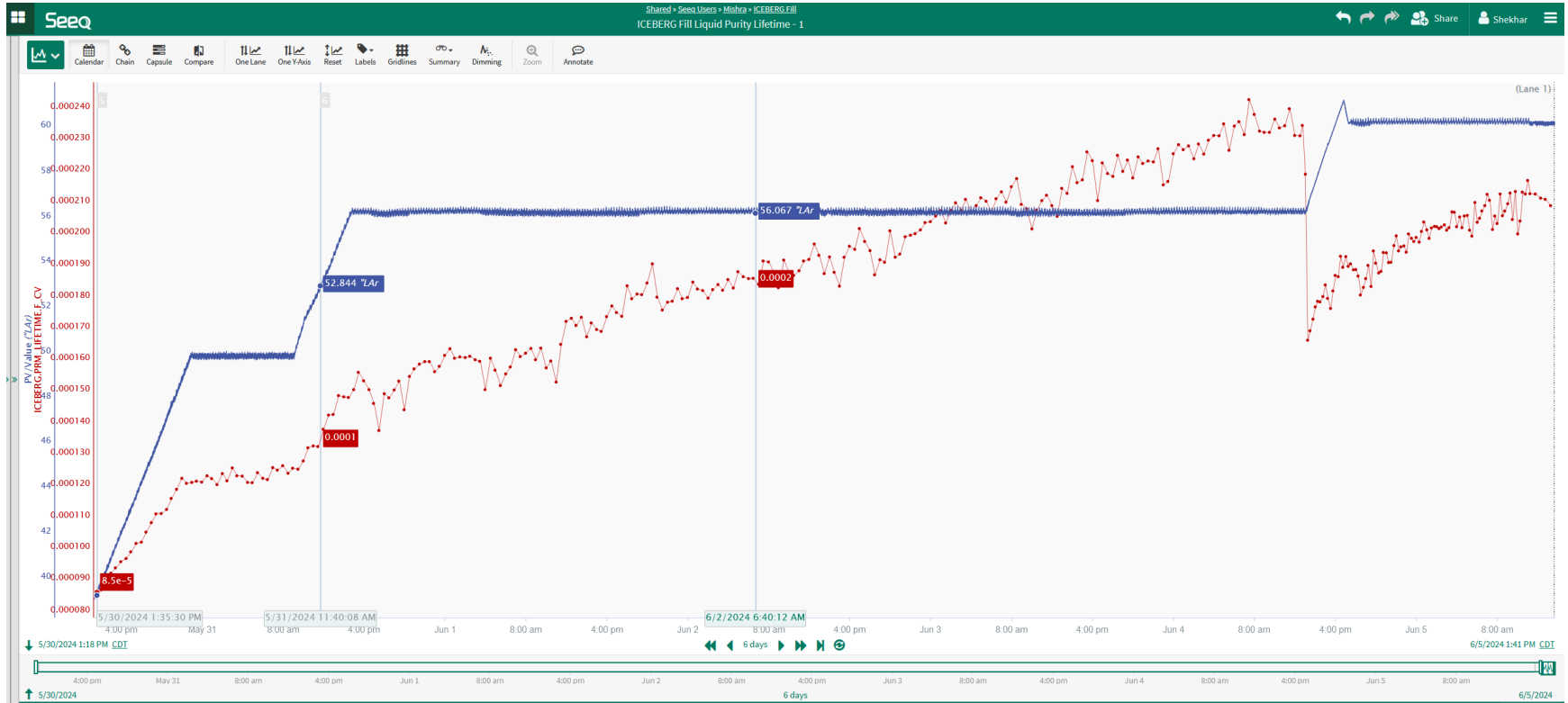
Cycles Since Last Regen    727    Input Simulated   

Res...    Input Error   

Auto Mode    Semi-Auto    Manual Mode    Ack Alarms

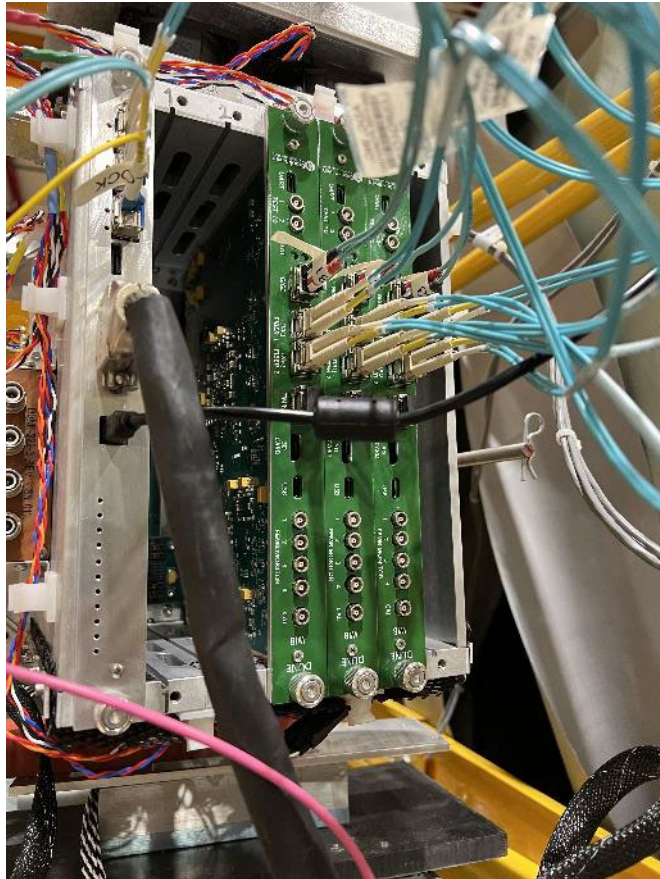


# ICEBERG LAr Lifetime



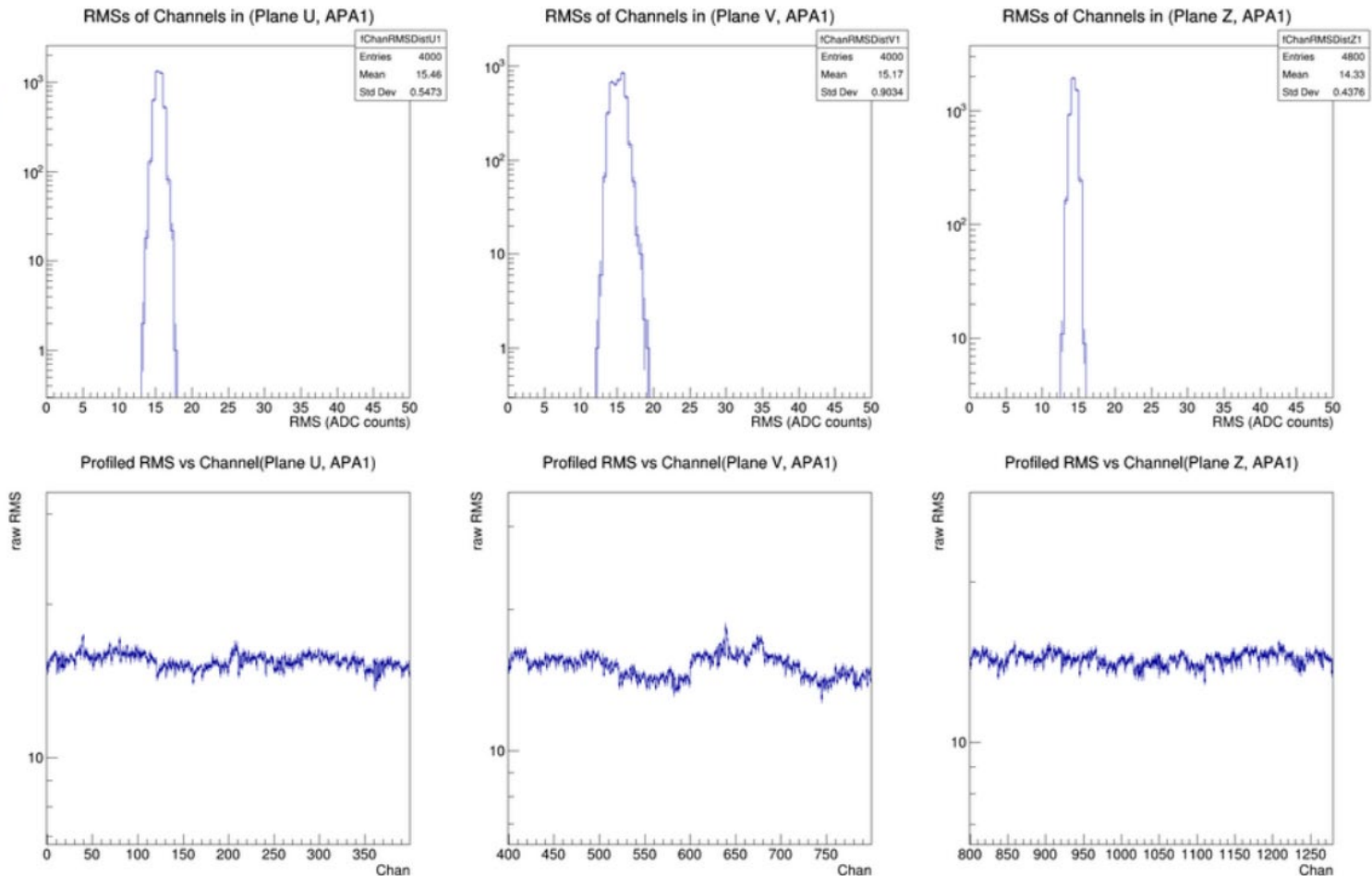
200 micro sec

# DUNE-CE-Interlock & PTCv4



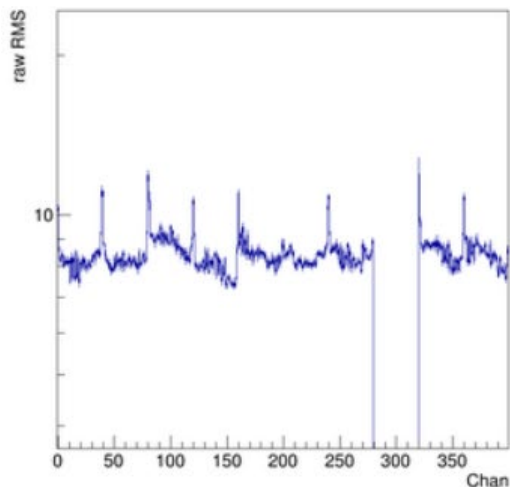
# ICEBERG: DUNE-CE in Cold Ar Gas

## icebergtpcmonitor

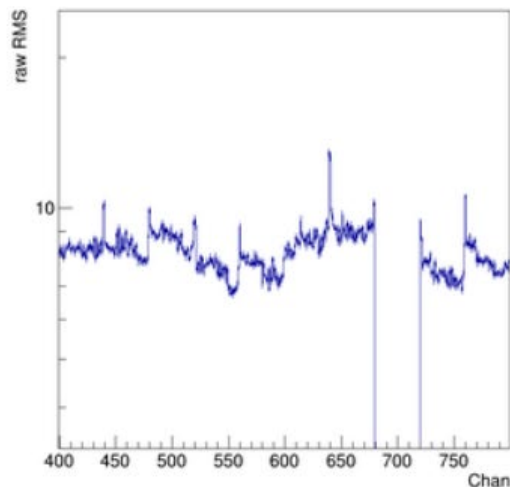


# DUNE CE Data

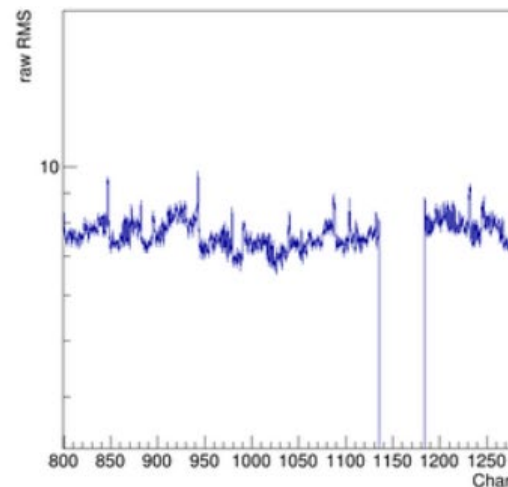
Profiled RMS vs Channel(Plane U, APA1)



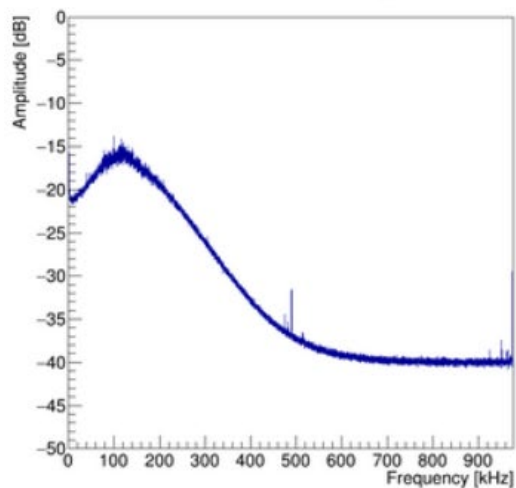
Profiled RMS vs Channel(Plane V, APA1)



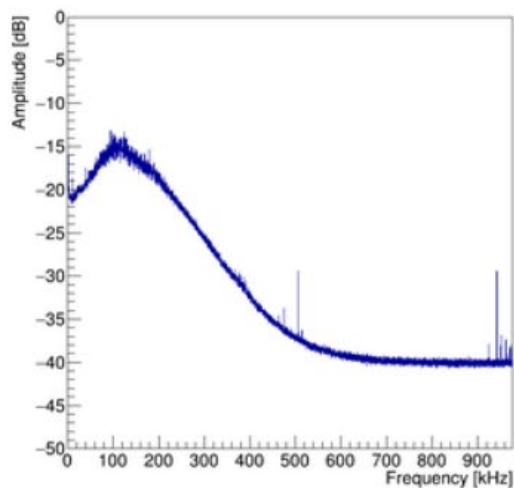
Profiled RMS vs Channel(Plane Z, APA1)



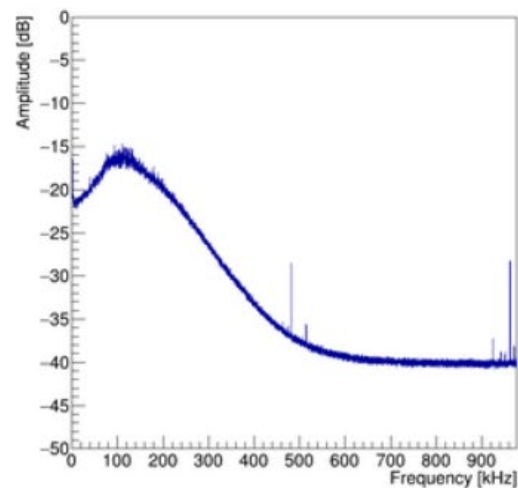
Profiled FFT FEMB\_02



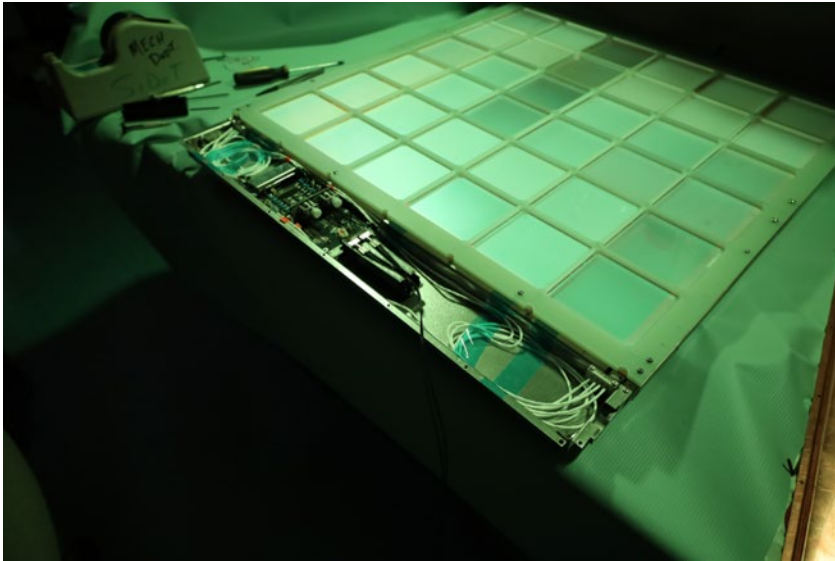
Profiled FFT FEMB\_03



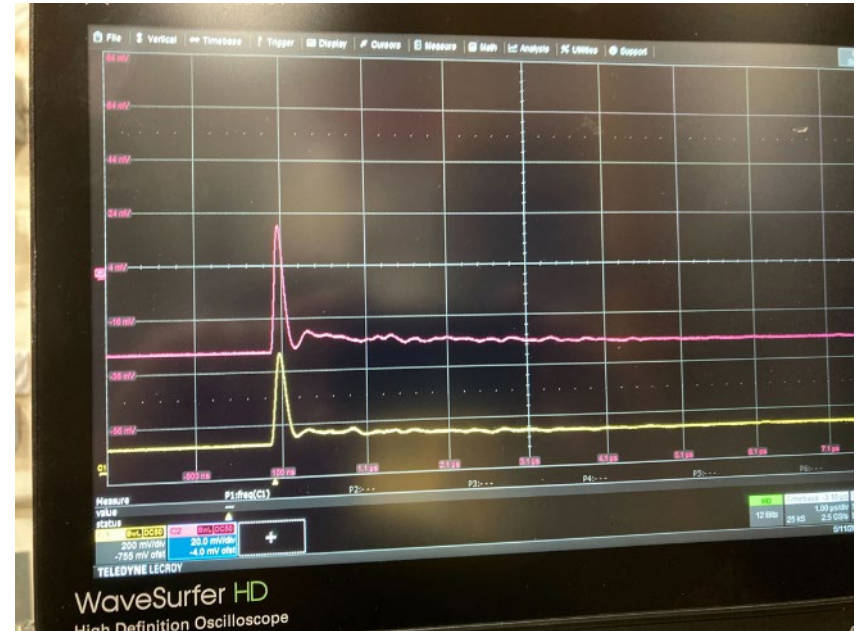
Profiled FFT FEMB\_04



# ICEBERG: X-ARAPUCA



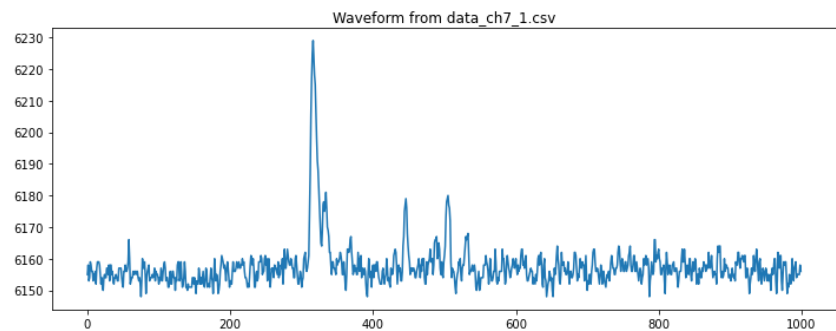
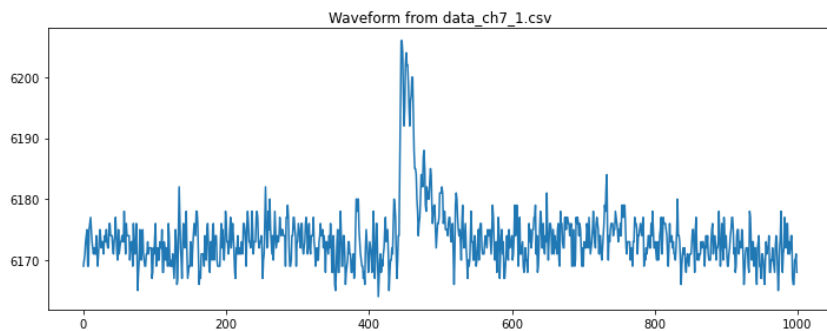
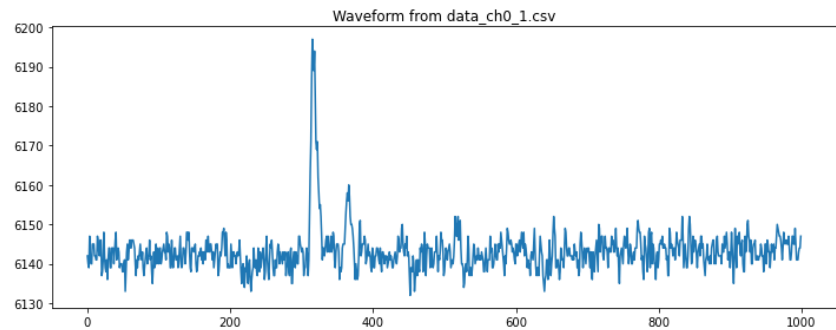
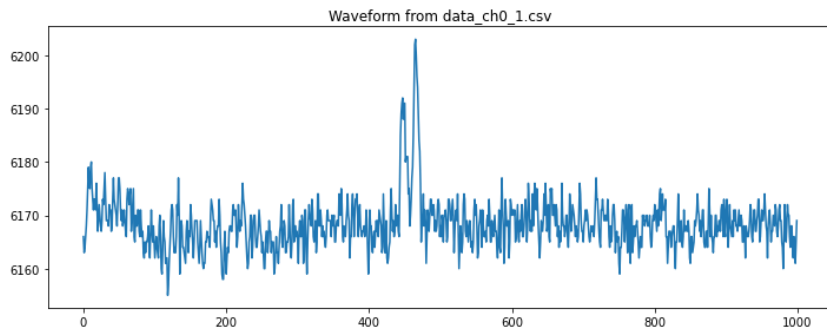
X-ARAPUCA Under the ICEBERG TPC



Detector is powered using PoF  
Photon Signal from the detector.



# DUNE-PD Data

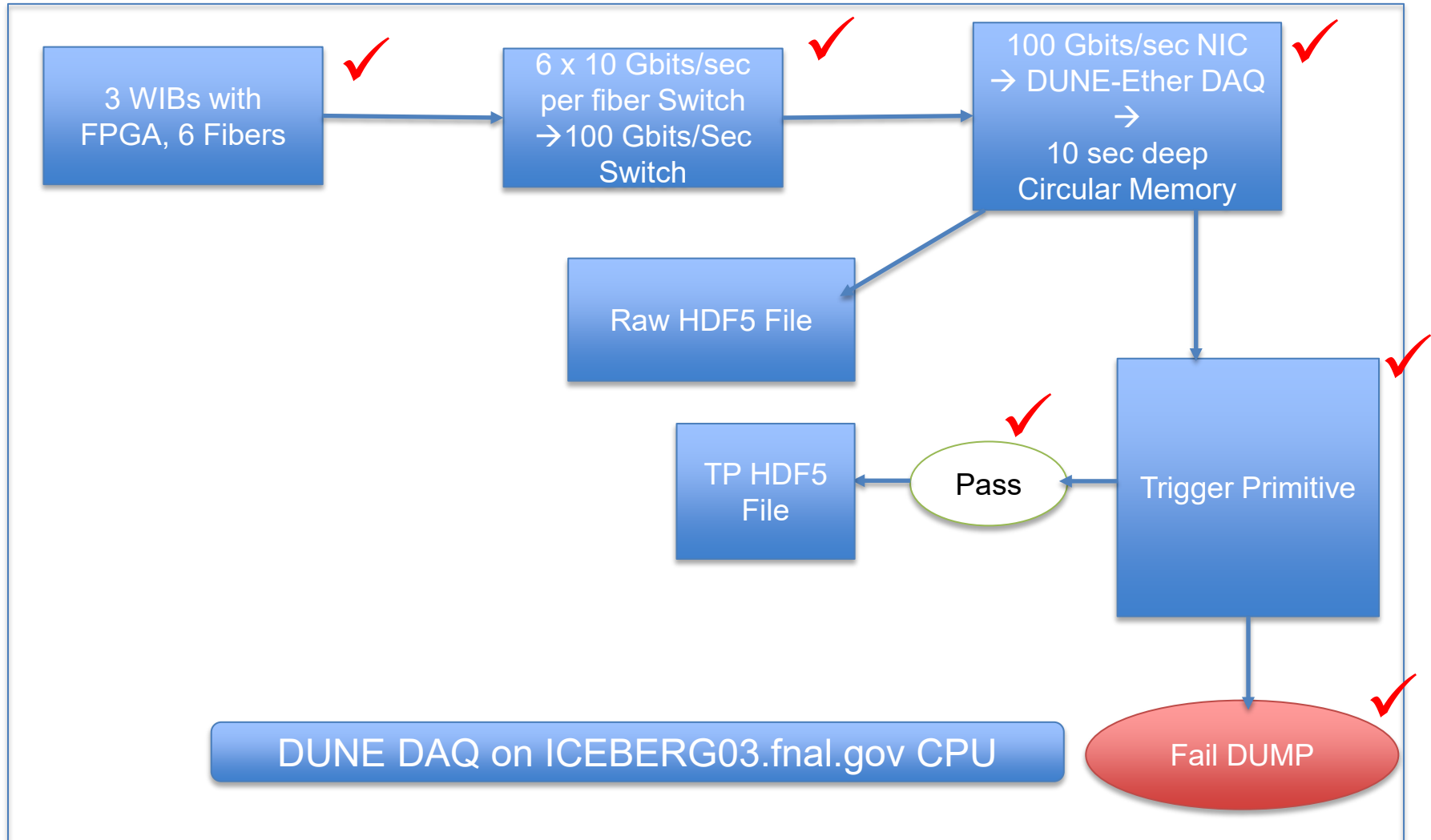


X-ARAPUCA VD

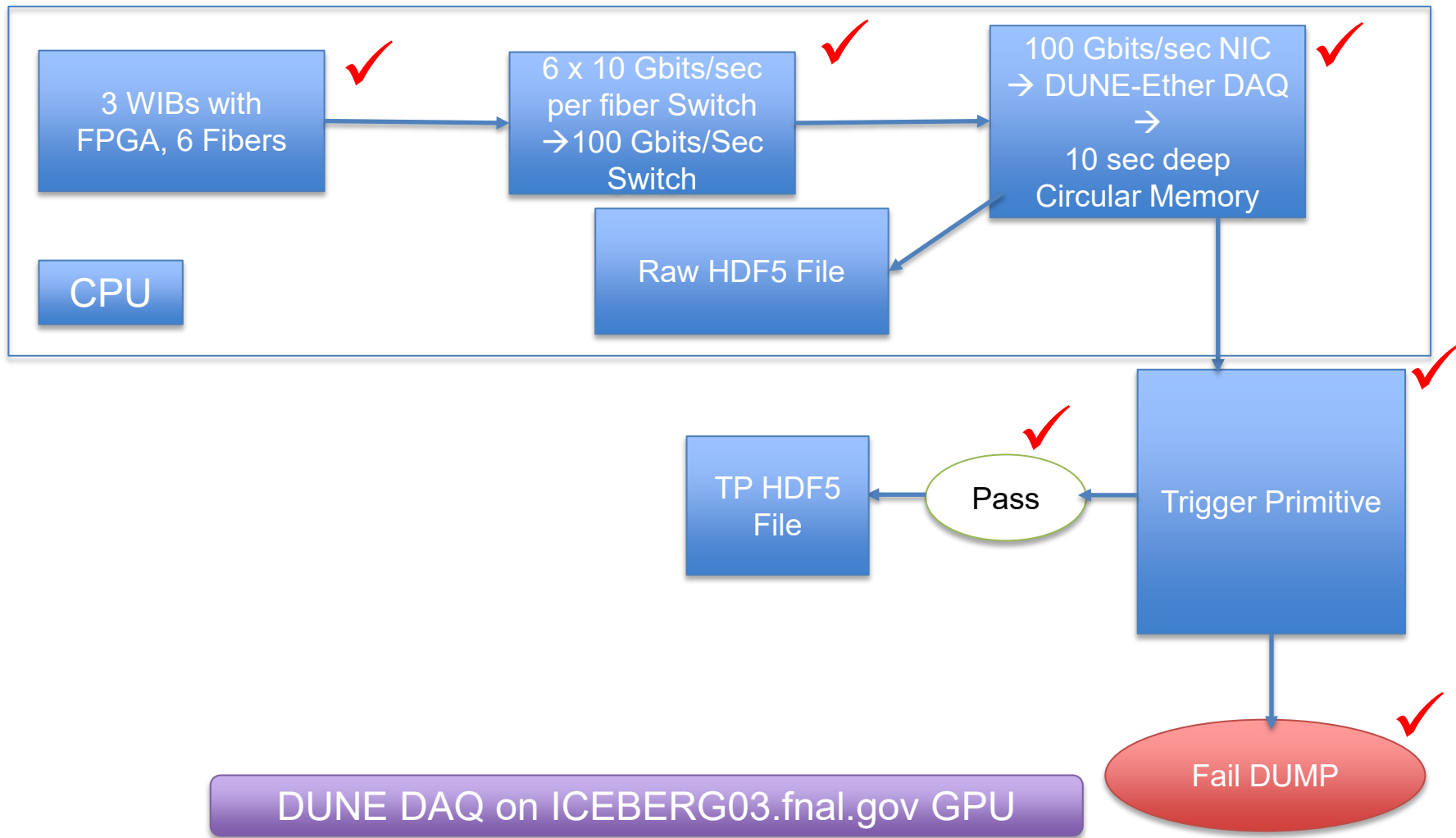
# Focus on DAQ

- Now that Hardware is ready and data is flowing, we need to focus on DAQ.

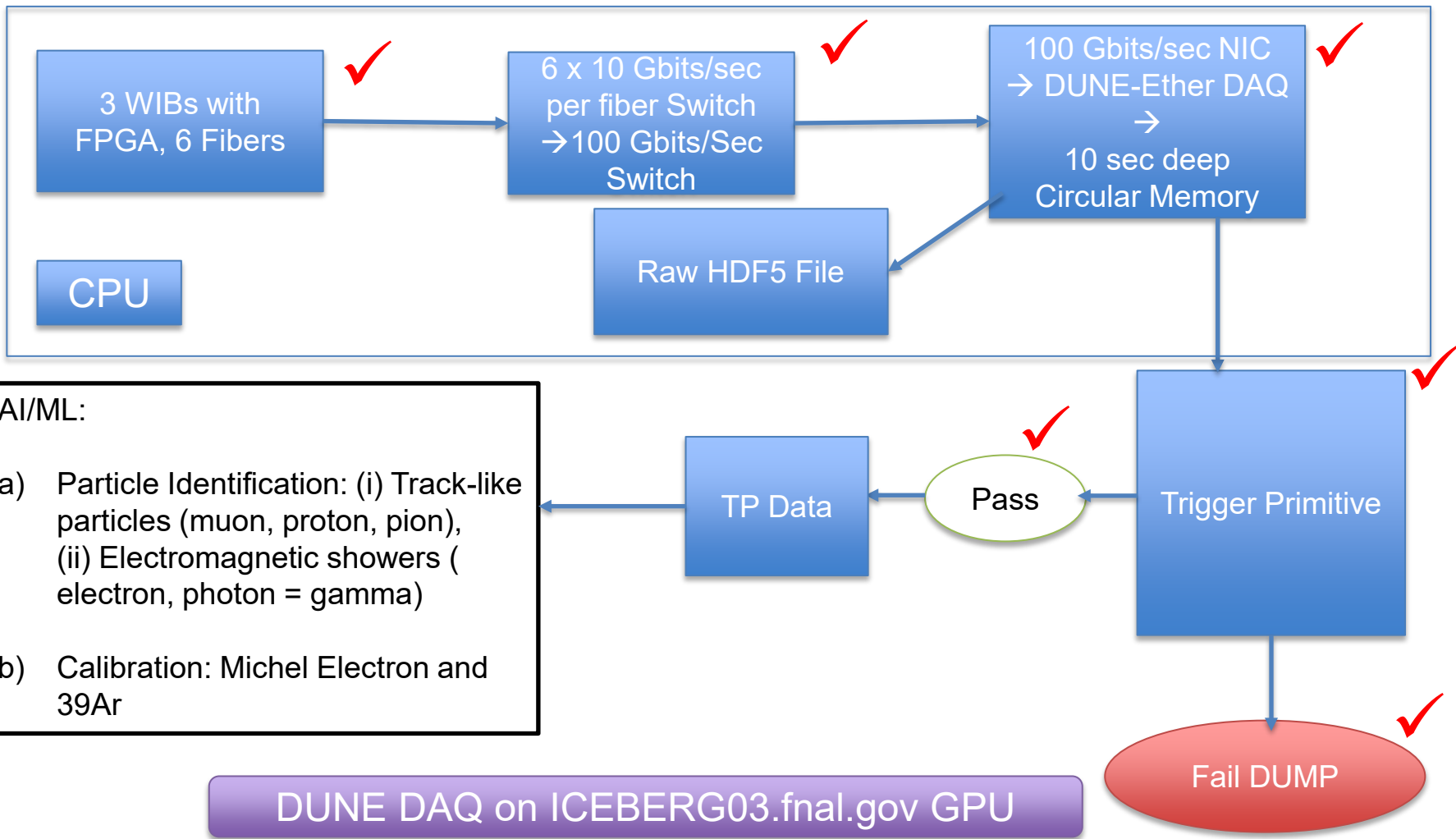
# Status of Dataflow at ICEBERG



# NVIDIA at ICEBERG



# Fermilab at ICEBERG



# ICEBERG: Calibration

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  $\mu$ sec vs 2  $\mu$ sec)
6. Measure cross talks.
7. Determine optimal ColdADC  $V_{ref}$  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
- ....

# Summary

- ICEBERG is getting ready for Run 9
- All Electronics, DAQ and Analysis are ready
- LAr Fill continues
- 1<sup>st</sup> focus of the study will be calibration
- Due to manpower limitations, we will
  - Calibration Studies during daytime
  - Cosmic Runs in night (S/N Studies)
- Current Run is planned to end July 13<sup>rd</sup>, But we may not empty ICEBERG at that time.