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 9th, 2024

    - DUNE-CE and DUNE-VD-PD Power Turned ON

- June 5, 2024

    - ICEBERG Filled with 60" of Liquid Ar

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ICEBERG Cryogenic

ICEBERG LAr Lifetime

200 micro sec

DUNE-CE-Interlock & PTCv4

ICEBERG: DUNE-CE in Cold Ar Gas
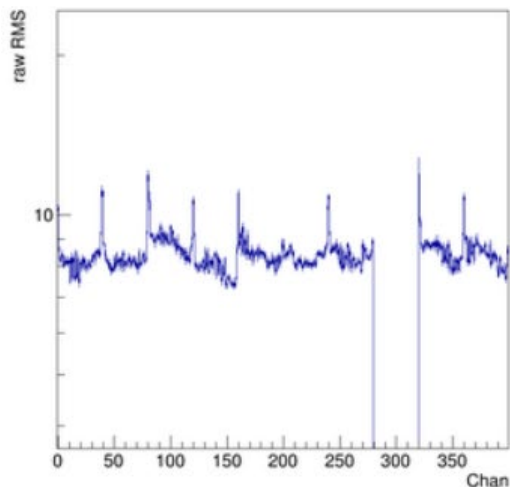
DUNE CE Data
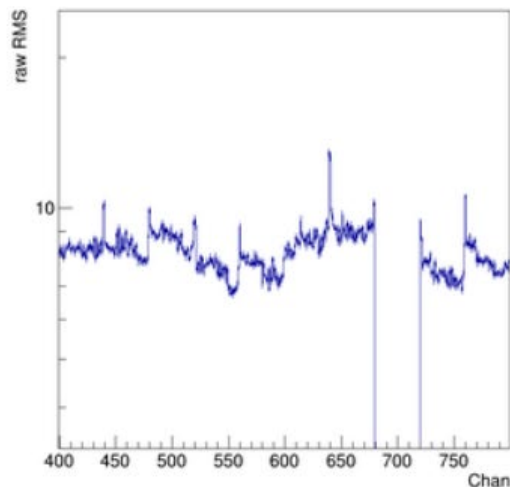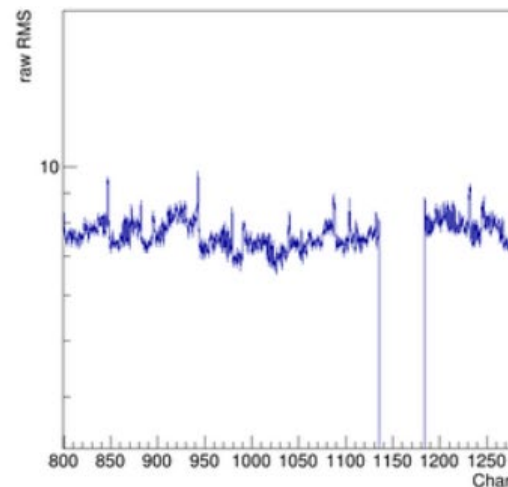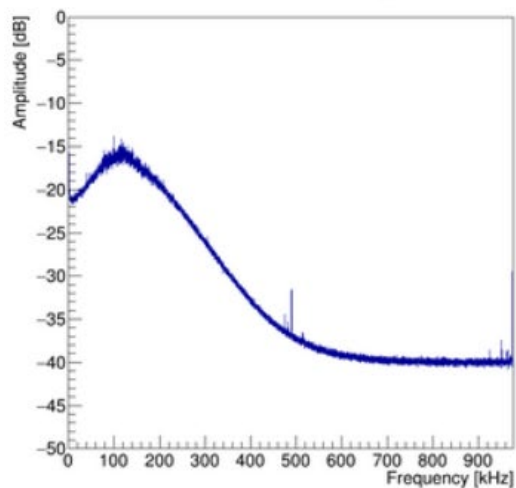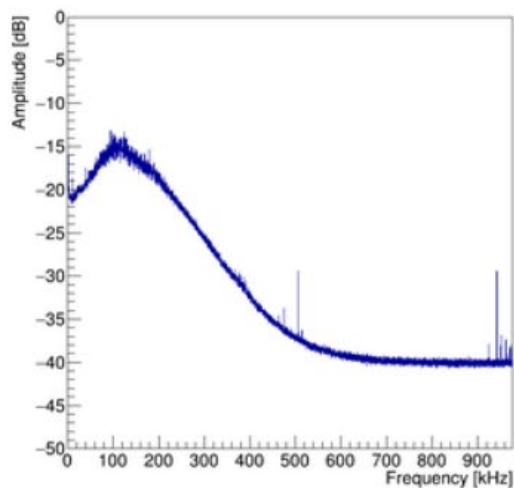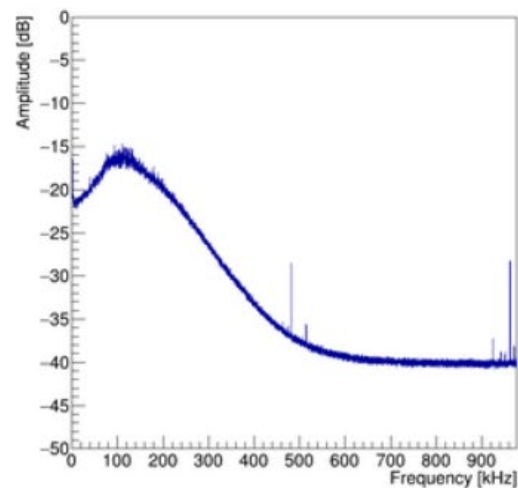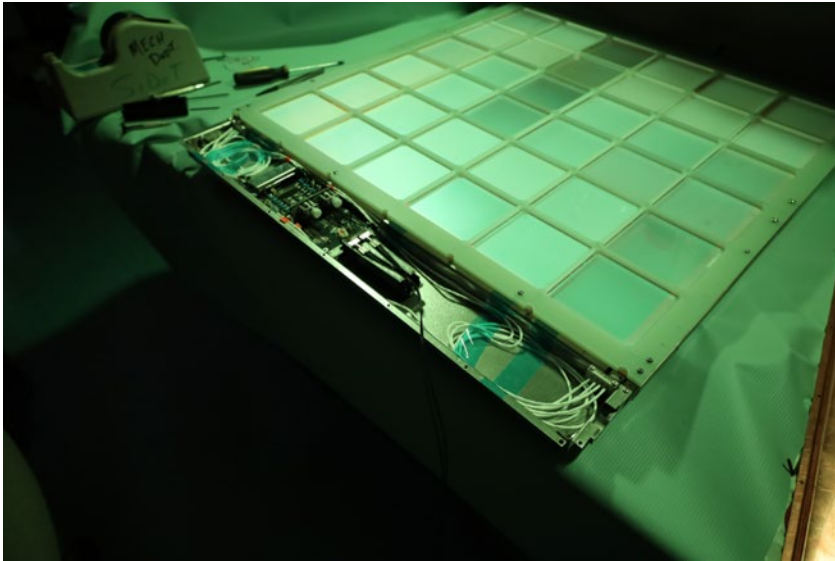
ICEBERG: X-ARAPUCA

X-ARAPUCA Under the ICEBERG TPC
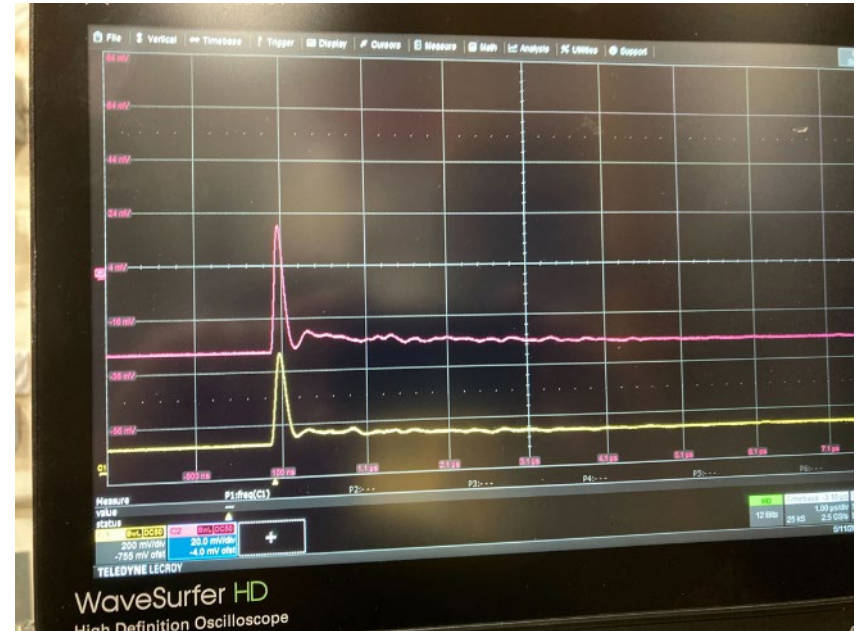
Detector is powered using PoF
Photon Signal from the detector.
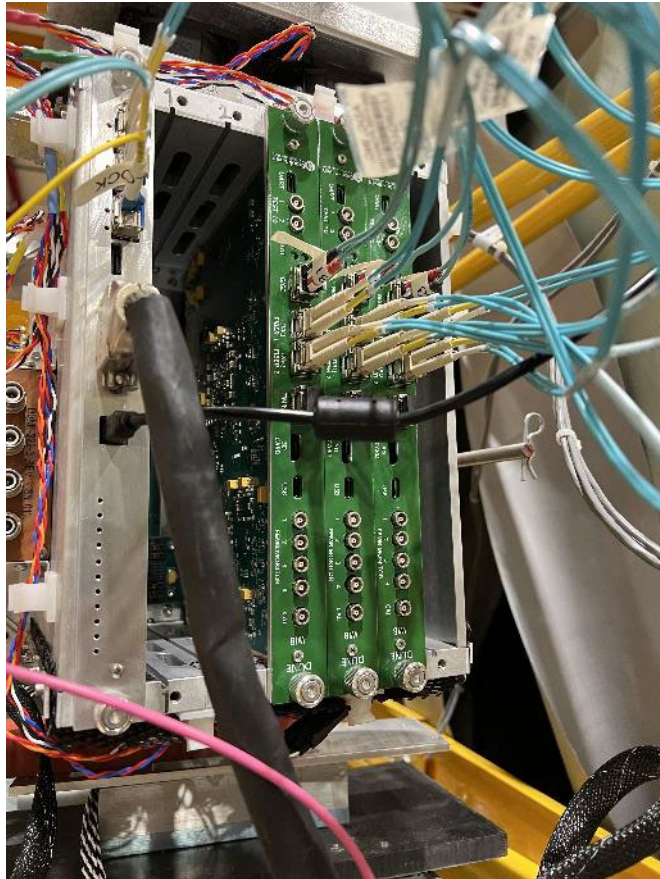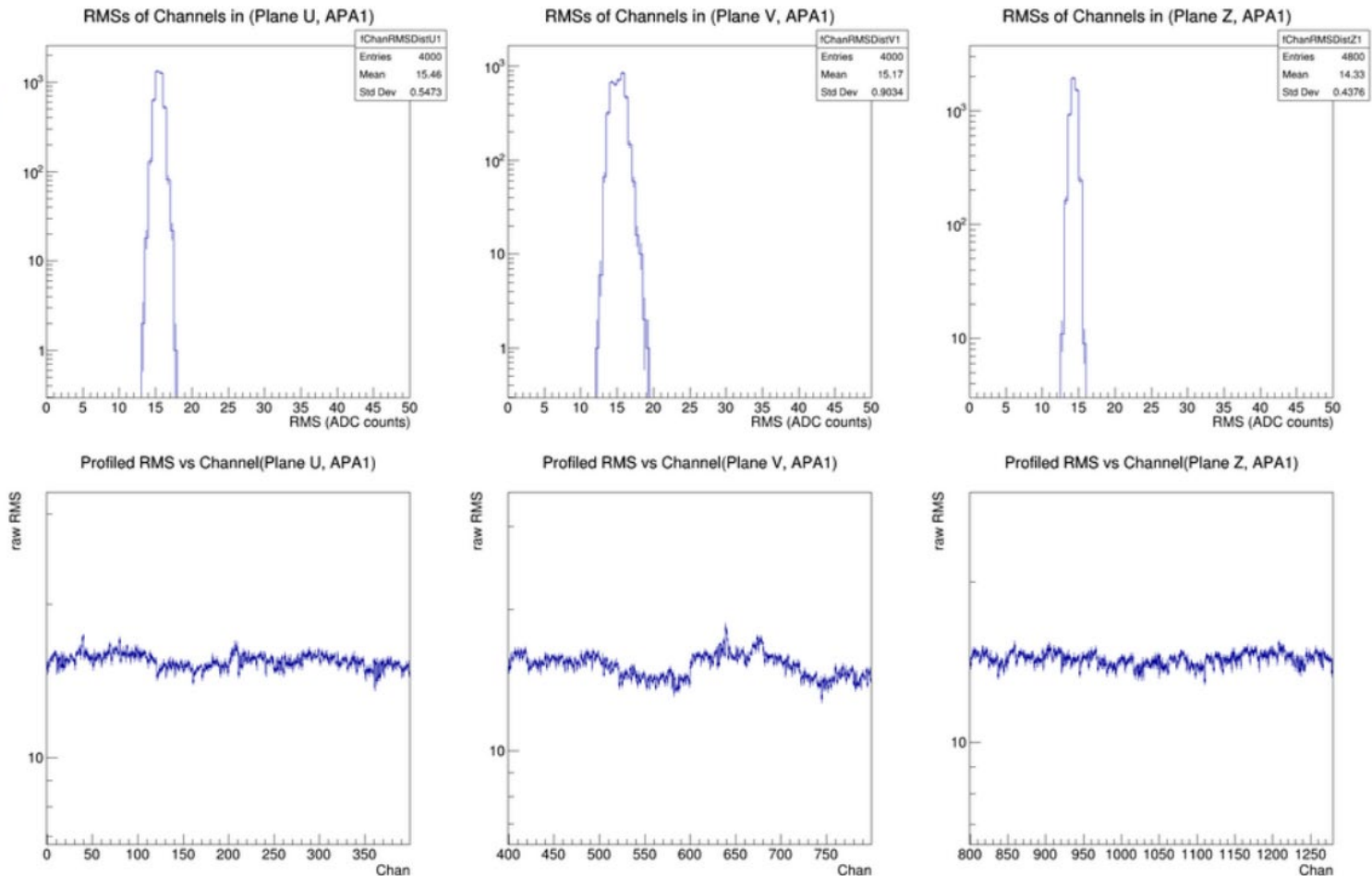
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DUNE-PD Data
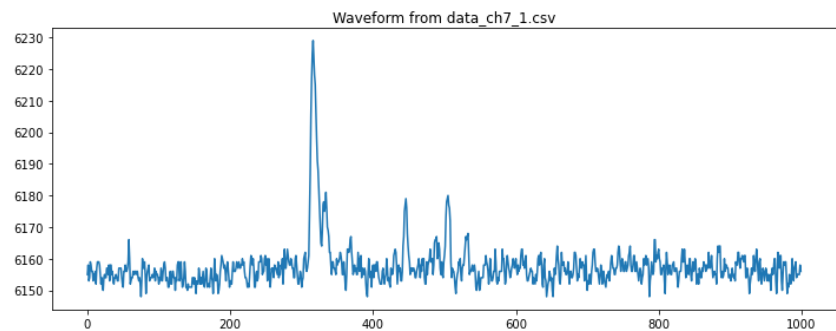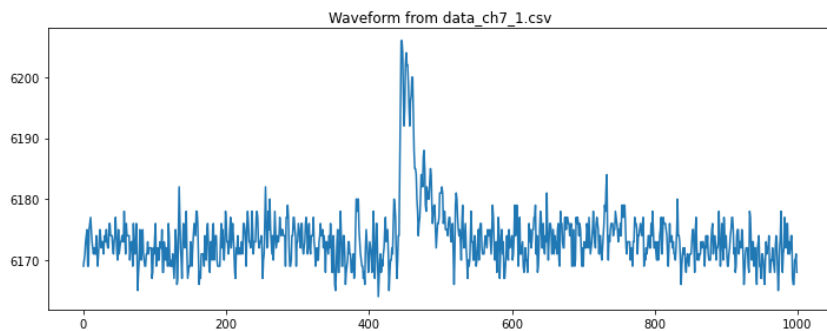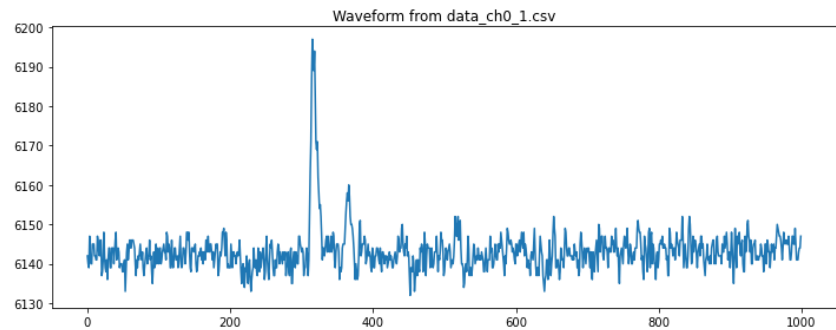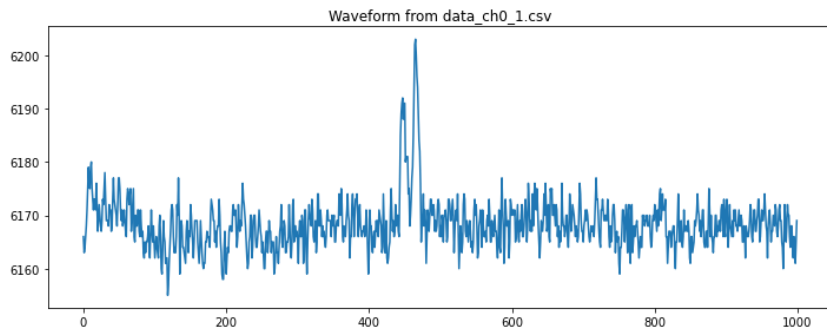
X-ARAPUCA VD

Focus on DAQ

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

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Status of Dataflow at ICEBERG
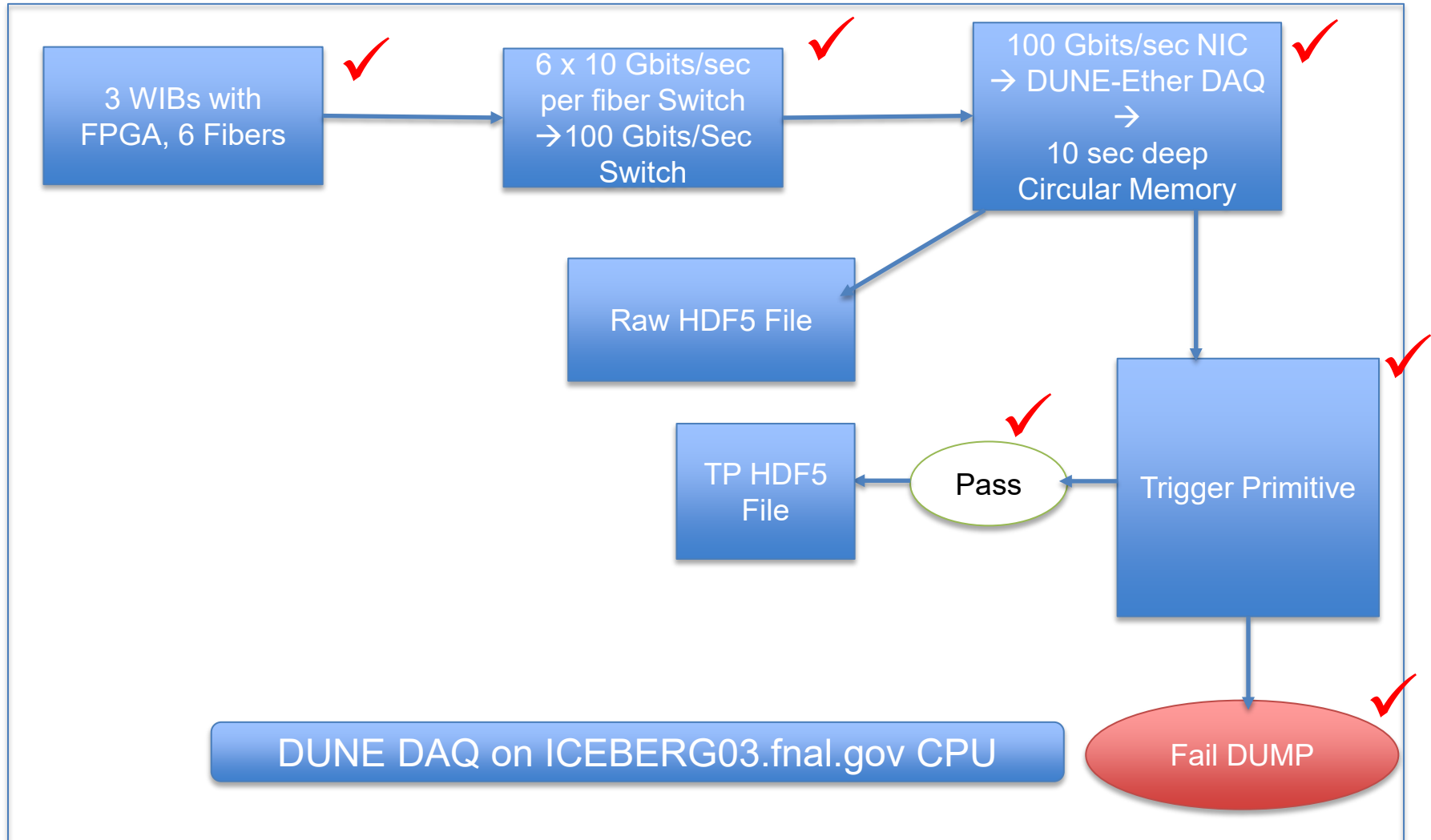
NVIDIA at ICEBERG

Fermilab at ICEBERG

3 WIBs with
FPGA, 6 Fibers ✓

6 x 10 Gbits/sec
per fiber Switch
→100 Gbits/Sec
Switch ✓

100 Gbits/sec NIC
→ DUNE-Ether DAQ
→
10 sec deep
Circular Memory ✓

CPU

Raw HDF5 File

AI/ML:

a) Particle Identification: (i) Track-like
particles (muon, proton, pion),
(ii) Electromagnetic showers (
electron, photon = gamma)

b) Calibration: Michel Electron and
39Ar

TP Data

Pass ✓

Trigger Primitive ✓

Fail DUMP ✓

DUNE DAQ on ICEBERG03.fnal.gov GPU

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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 μsec vs 2 μsec)

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

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Summary

- ICEBERG is getting ready for Run 9

- All Electronics, DAQ and Analysis are ready

- LAr Fill continues

- 1st 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 13rd, But we may not empty ICEBERG at that time.