

R&D at ICEBERG

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SPPM Meeting for ICEBERG

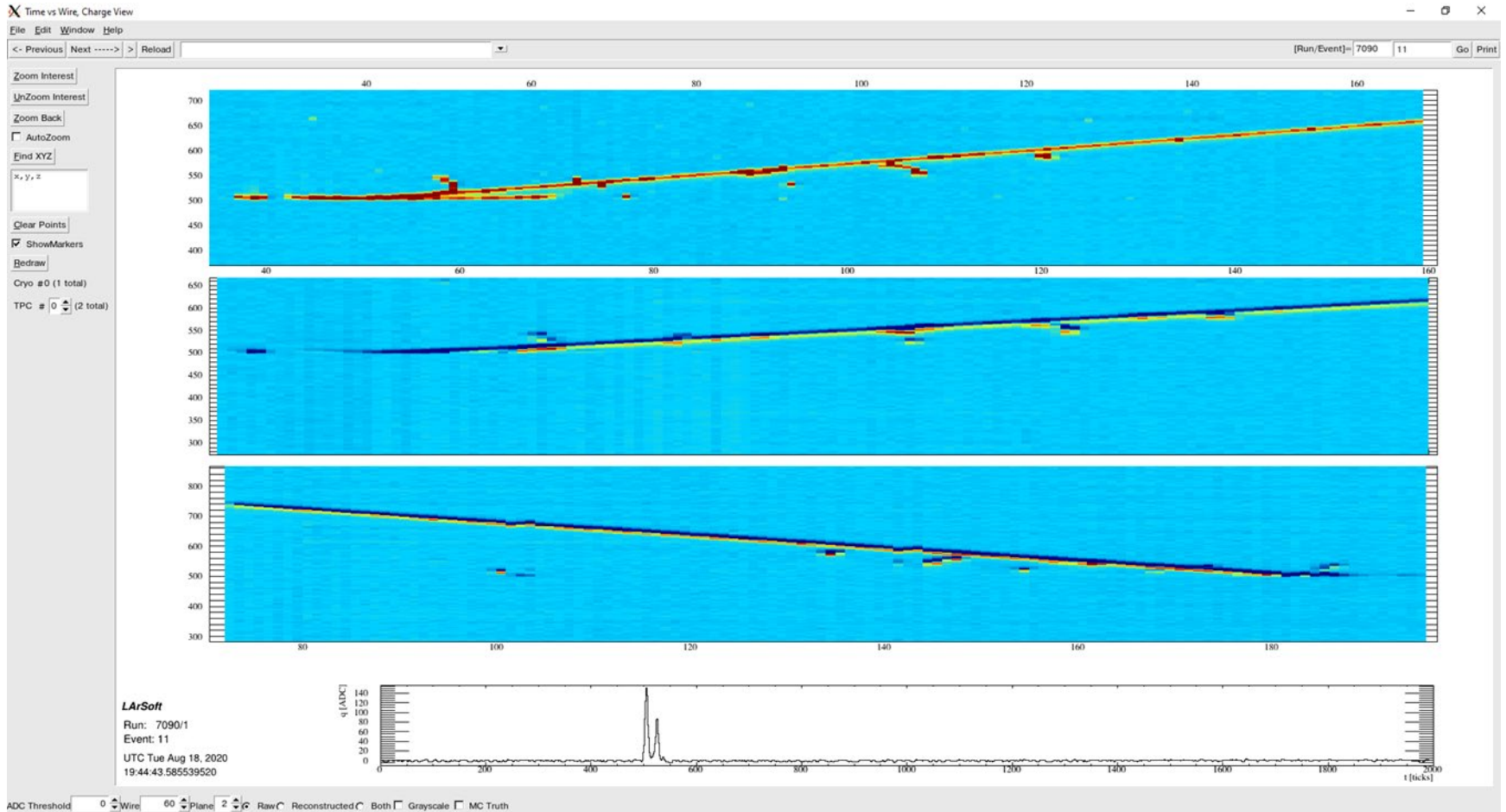
06/28/2023

ICEBERG TPC

- ICEBERG is an integrated system build by Fermilab and DUNE.
 - To test the DUNE Cold Electronics and Photon Detector
 - Test facility for integration of DUNE CE, PD, DAQ and Slow Control.
- ½ DUNE Anode Plane Assembly (APA) 1280 channels.
 - 10 Front End Mother Board
- 1/6 DUNE APA Wire length
- Two cathode Planes and 1” spacing Field Cage
 - Two Drift Volume of 30 cm each
 - 500 v/cm field gradient
- 2 Slots for Photon Detectors



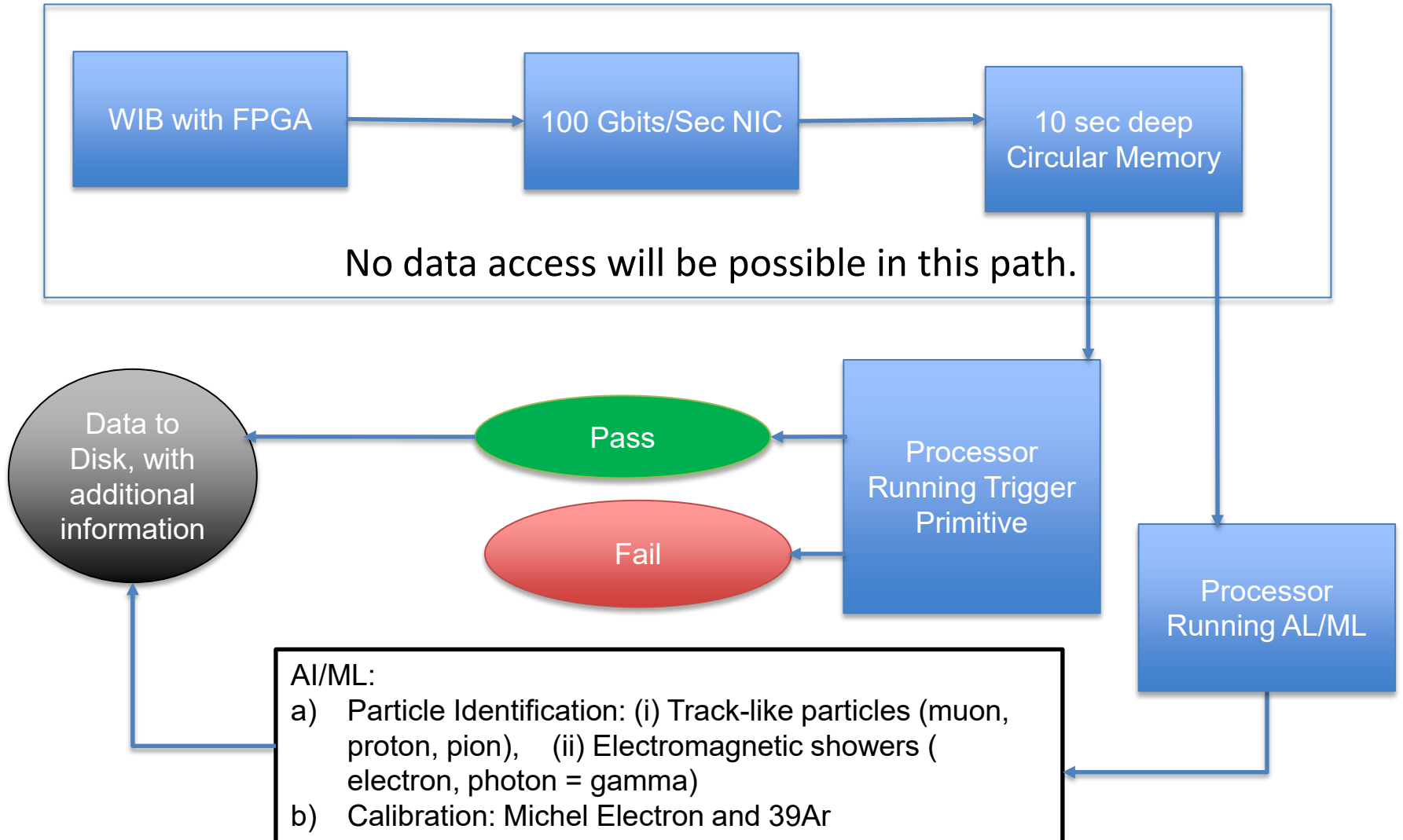
ICEBERG: Cosmic Track



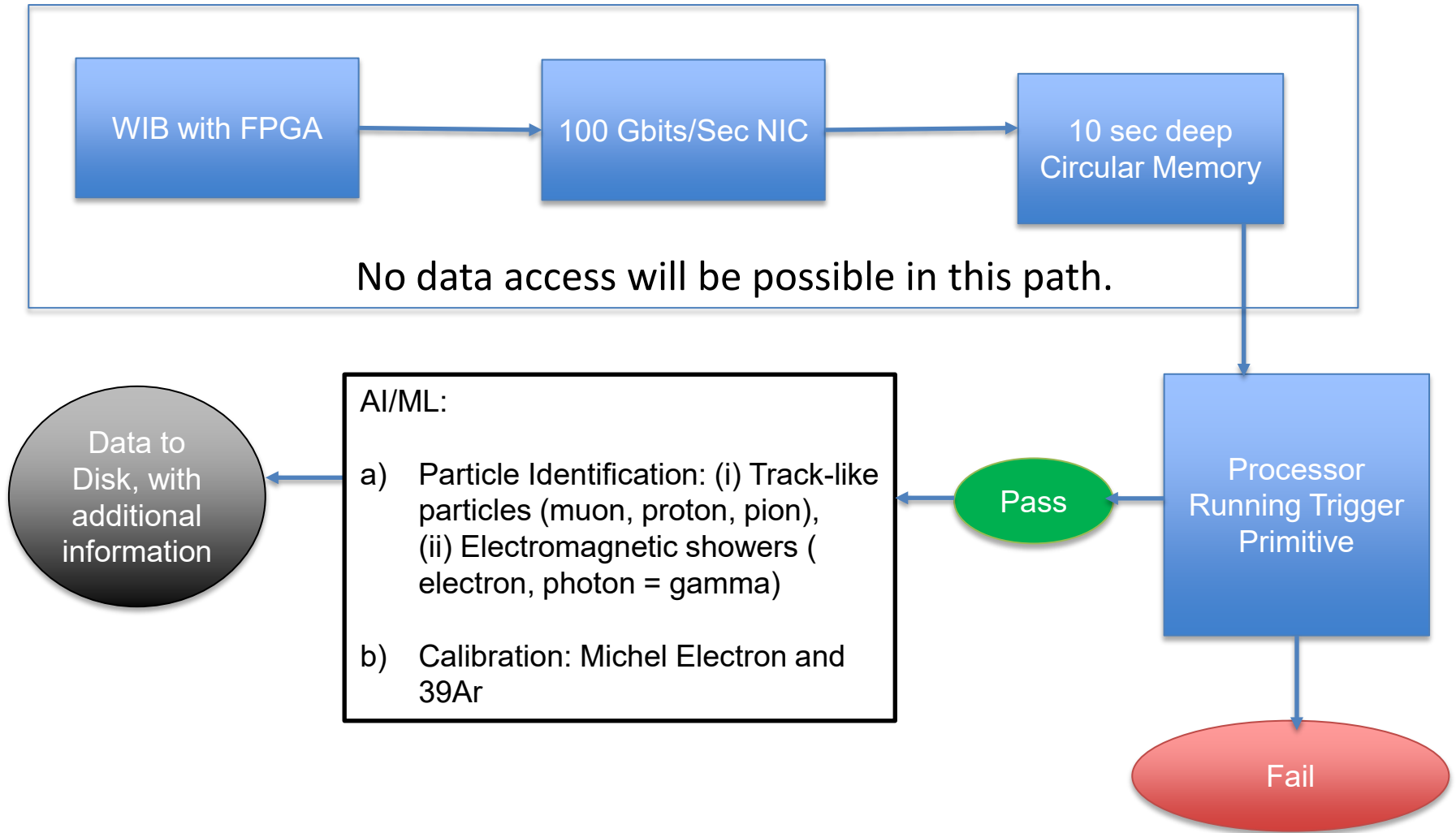
Physics Menu for AI @ ICEBERG

- Identify that within a time segment there are enough energy deposited on APA.
 - Particle Identification
 - Track-like particles (muons, protons, pions)
 - Electromagnetic showers (electrons, photons = gammas)
 - Calibration:
 - Michel electrons (coming from muon decay)
 - ^{39}Ar Beta Decay
 - Liquid Argon Lifetime using particle track

AIOnEdge Dataflow in DUNE-DAQ



TP/AI Dataflow in DUNE-DAQ



DUNE-DAQ @ ICEBERG

- Iceberg03.fnal.gov
 - PowerEdge R760 Server: Dual Intel Xeon Gold 6426Y 2.5G, 16C/32T, 16GT/s, 38M Cache, Turbo, HT (185W) DDR5-4800 (3)
 - 256GB RDIMM, 4800MT/s
 - NVIDIA Ampere A30, PCIe, 165W, 24GB Passive
 - Intel E810-CQDA2T G1 Dual Port 100GbE QSFP28 Precision Timing Adapter, PCIe
- Ethernet DUNE-DAQ 100 Gbits/sec
 - DUNE-DAQ will run on Alma Linux 9.2
 - Essentially to move away from legacy software
 - Implement latest AI software, **which does not build on SL79**
 - DUNE-DAQ with 10 DUNE-FEMB, 3 DUNE-WIB3 (+on Test Bench 4 FEMBs and 1 WIB)
 - Upgrade PTC
 - Interface with DUNE Safety system

Request: DUNE-DAQ V4.X

- DUNE-DAQ-4.X needs to be installed on iceberg03
 - WIB-Ethernet Version
 - Timing Integration
- DUNE-DAQ-4.X needs to be configured in dunecet account
 - We want to use the integrated software
 - There are home/user grown software in use at CERN this should be integrated if the current DQM and online analysis with dunesw.
- 1st use of DUNE-DAQ at ICEBERG will be in integration of DUNE-CE Safety system.
 - This is integration of PTC signal with DUNE-Controller with PLC to DUNE ISEG and MPOD units.
 - EPICS (iceberg01.fnal.gov) ← This is a standalone
 - Tape back up of hdf5/configuration files ← Is implemented for root
 - CVFMS support ← This is/being implemented

Request: DUNE online and offline

- DUNEsw (LArsoft + DUNEsw) is build and supported only on SL7.9
 - ICEBERG uses this for both online and offline data analysis using Alma.
 - Next data run is in Sept 2023
- We need DUNEsw (+LArsoft) to work on AL 9.2.
- AI software also uses LArSoft and DUNEsw
 - The R&D project to implement AI OnEdge (not on the offline data, which could be handled on multiple OS)
 - We need to build Spack library for LArSoft and DUNEsw on AL9.2
 - We need to compiling and build the AI package
- Many “Products” used in LArSoft are available in SPACK
 - They have been installed on iceberg03
 - Fnal_art is also working on this for SBND and have most of the package.py
- **This needs urgent support from computer professional**

Request: AiOnEdge

- We are planning to use larcv2/larcv3 for the 1st implementation of AI at ICEBERG.
 - This is also being developed for SBND and ICARUS
 - We have the software running on `wc.fnal.gov` and on `iceberg03.fnal.gov`
 - Both have GPUs and uses ICARUS MC file.
 - We cannot give it an ICEBERG input file because we cannot rebuild the software which requires LArSoft and DUNEsw to be rebuild with Larcv.
- We will need support from DUNE-DAQ group in providing a hook to data path in the server memory.
 - In principle this is already done for trigger primitive.

ICEBERG Work Plan

- June 2023: Install and Configure icebeg03.fnal.gov
- July 2023:
 - Integration of DUNE-DAQ with the ICEBERG Infrastructure
 - Start building LArsoft and DUNEsw in Spack
 - Continue work on larcv2/larcv3
- August 2023:
 - Install FEMB/WIB/PTC at ICEBERG
 - Integration of ICEBERG with DUNE-CE Safety Interlock
- September 2023:
 - Install 10 FEMB/ 3 WIBs, 100 Gbits/ switch
 - Integrate with DUNE-DAQ
 - Build LArsoft and DUNEsw in Spack
 - Data Access for AL/ML software OnEdge