WIB/DAQ “Interactions’’ Document

- Discussions with Alessandro, Giovanna and other DAQ groups, plus Marco and our WIB discussions make it clear that there are some things beyond logical and physics interfaces, and requirements, that need to be ironed out.

- Begun document on “interactions” between DAQ and WIB to serve as a reference for both consortia

- Started but many questions; help from Rivera and Van Berg, plus talks by Worcester and others on these calls, but need more….

Use Cases and Procedures for DAQ/CE Interactions for DUNE

January 16, 2020

1 Overview and Objectives

There are few systems within DUNE as tightly linked as the DAQ and the front-end ("cold") electronics (CE). A detailed interface document [?] between the DAQ and CE consortia already exists, focused primarily on the physical and logical interfaces between the two systems. Here, we aim to detail the "procedural interfaces" for several critical use cases. While it is possible—likely, even—that some of these procedures will evolve between now and the start of DUNE, this document will serve as a reference for development of both systems between now and then.

As the DAQ/CE interface document describes, the front end electronics interacts with the DAQ in four distinct ways: through the data path at 10 links per APA directly to FELIX with an existing well-defined data format; through a 1 Gbps ethernet link that will provide the interface to the DAQ Control, Configuration, and Monitoring (CCM) processes; through slow control instrumentation that will provide control over local power in the Warm Interface Board and will provide environmental monitoring; and through the DUNE timing system that will provide both the universal clock and commands that are synchronous to that clock.

Use Cases

- Cold Start
- FE Intial or “Startup” Calibrations
- FE Period Calibrations (pedestals, gain)
- Diagonistics/Debugging
- WIB Firmware updates
- Resynchronization
- Commissioning
- Standalone testing

Writing down the high-level procedures will also force us to make decisions and agree on things like granularity, WIB tagging of data and clocks, etc.

Others…?

Brief comment on granularity of *periodic calibrations*

Assumptions:

- We want a steady-state frequency for a full module of ~1/month
- End-to-end time for calibration data is ~15 minutes
- Reconstruction/analysis will eventually have to deal with missing channels, FEMBs, and APAs
- (Cosmic rays are an exception---we want the entire track because they are used as calibration sources).
- But reconstruction and analysis of physics data will *always require a vertex*
- Low-energy events (solar, supernova νs, and radiologicals) are (therefore) invisible if interaction or decay occurs in a dead region of 1 FEMB or larger

Brief comment on granularity of *periodic calibrations*

- From standpoint of high-energy physics (atmospherics, NDK, beam events) impact scales only as *exposure,* because vertices are point-like.
- Therefore for a fixed duration of calibration run (e.g., 15 minutes) and a fixed number of channels to calibrate, *granularity does not matter* for high-energy events or solar neutrinos or radiologicals
- For cosmic rays, any overlap is problematic…but arguably a smaller offline region is better since the fraction of track lost is smaller and so might be better even though probability of overlap is higher---need a real study to know, but probably a small effect

Brief comment on granularity of *periodic calibrations*

Supernovas: Granularity can matter because burst detection looks for correlated signals across detector

Simple burst requirement is signal rate above background fluctuations, S/sqrt(B)

Turning off elements of detector for calibrations scales both by ε so scaling of threshold is sqrt(ε).

For 1 entire APA, we therefore increase the threshold by 0.3%, and for one FEMB we increase it by 0.02%.

This is a tiny effect and can be mitigated by temporarily adjusting the threshold

Is there another argument that says we should be more granular than 1 APA for these calibrations?