PROTODUNE-SP DAQ

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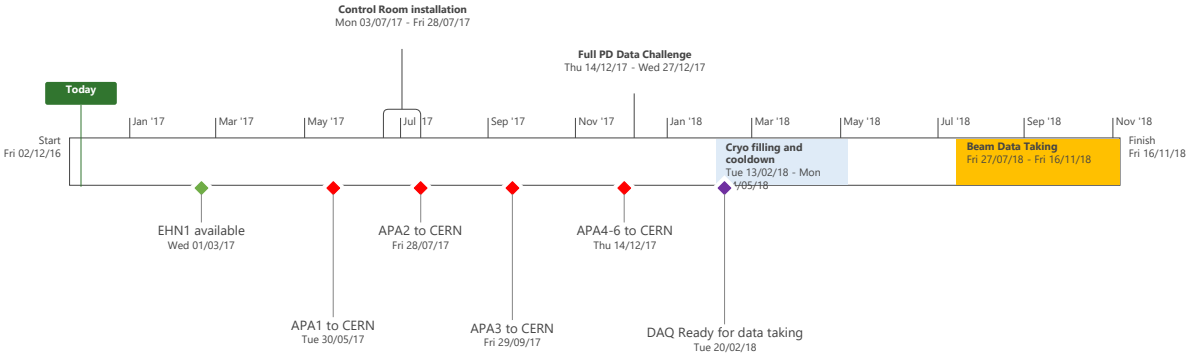
PROTODUNE DAQ

- Design Review on Nov. 3-4 2016
  - Outcome was positive - no fundamental flaws in the design
  - Some constructive criticism to track the progress of the project
    - Organigram
    - A series of milestones/project management
  - These have been implemented and are indeed helping us keep track of things
  - Critical items were identified - noise, EHN1 readiness, manpower...
- One of the recommendations of the review was preparation of a vertical slice in advance of EHN1 occupancy...

EXPANDING/CHANGING REQUIREMENTS

- Prior to the review, there were a couple of loose ends/new items
  - (of which the reviewers were made aware)
  - As an outcome we aim to integrate the following into the DAQ readout
- **pLAPPD** - time of flight detector for beam instrumentation
  - Separate from rest of Beam Instrumentation
  - Integration with timing system, artDAQ necessary
- **CRT** - Cosmic Ray Tagger
  - Integration with timing system to be ironed out
  - Long readout latency problematic
- Trigger system designed to receive inputs from these systems.

CERN PLANNING



CERN PLANNING

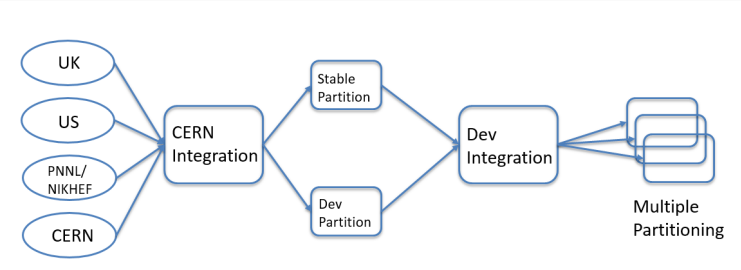
- Original plan was to install directly in EHN1, but this will not be ready until Mar/Apr++
- The first APA for testing is to arrive shortly after.
- In order not to suffer any delay, we decided to **install a small slice in a test area first**
  - Space in 4-S-001 kindly provided by ATLAS
- Need to start purchasing some items soon - need to finalise DAQ budget asap

VERTICAL SLICE

- Plan to have a partial DAQ at end of January
- Profit from the Collaboration Meeting and some colleagues who have offered to stay a bit longer.
- Eventually this must evolve to a full slice in preparation for the Cold Box testing
- January Test Plans
  - COB $\rightarrow$ PC
    GOAL : data capture / verification
  - WIB $\rightarrow$ COB $\rightarrow$ PC
    GOAL : WIB data reception on RCE
  - Timing system + COB $\rightarrow$ PC
    GOAL : Connectivity tests
  - SSP ...

APA TESTING PLANS

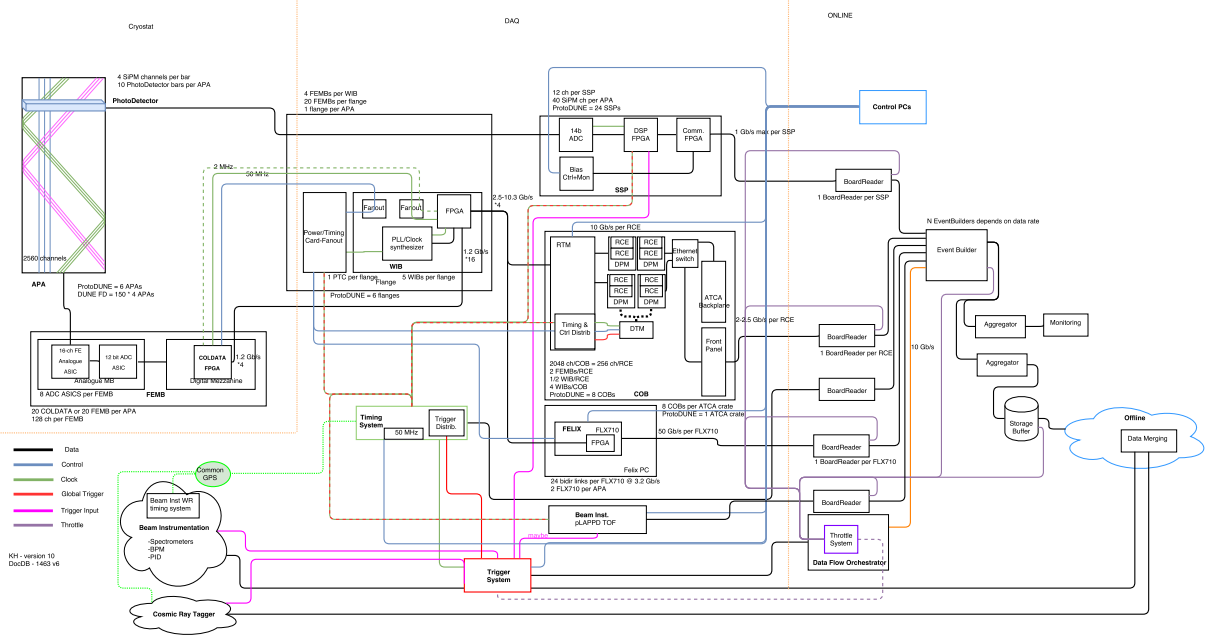
- We want to have a user operable DAQ for the APA testing
  - This may not be day 1, but shortly after
- This “cold box DAQ” should be stable - once working, we won’t touch it.
- We’ll create a separate DAQ development branch, and do all our upgrades there.
- Eventually, we’ll merge the two after the APA testing



QUESTIONS

- What are the requirements of this Cold Box DAQ?
  - required bandwidth/rates
  - required storage
  - accessibility
  - infrastructure (logging, DBs, etc.)
- Does APA testing include Photon detectors on the same timeline?
- In general, DAQ will try to provide a complete/stable service
  - We have an extremely busy year ahead, will do our best to maintain strong communication
  - If unsure who to contact for DAQ issues - contact myself or Giovanna
  - And if you think it's a DAQ issue and it's not, don't worry, we'll let you know

BACKUP


Cryostat
DAQ
ONLINE
4 SiPM channels per bar
10 PhotoDetector bars per APA
PhotoDetector
2560 channels
APA
ProtoDUNE = 6 APAs
DUNE FD = 150 * 4 APAs
4 FEMBs per WIB
20 FEMBs per flange
1 flange per APA
2 MHz
50 MHz
Power/Timing Card-Fanout
Fanout
Fanout
FPGA
PLL/Clock synthesizer
WIB
1.2 Gb/s *16
2.5-10.3 Gb/s *4
1 PTC per flange
5 WIBs per flange
Flange
ProtoDUNE = 6 flanges
12 ch per SSP
40 SiPM ch per APA
ProtoDUNE = 24 SSPs
14b ADC
DSP FPGA
Comm. FPGA
Bias Ctrl+Mon
SSP
1 Gb/s max per SSP
Control PCs
BoardReader
1 BoardReader per SSP
N EventBuilders depends on data rate
Event Builder
10 Gb/s per RCE
RTM
RCE
DPM
Ethernet switch
ATCA Backplane
Timing & Ctrl Distrib
DTM
2048 ch/COB = 256 ch/RCE
2 FEMBs/RCE
1/2 WIB/RCE
4 WIBs/COB
ProtoDUNE = 8 COBs
COB
Front Panel
2-2.5 Gb/s per RCE
BoardReader
1 BoardReader per RCE
10 Gb/s
Aggregator
Monitoring
Aggregator
Storage Buffer
Offline
Data Merging
16 ch FE Analogue ASIC
12 bit ADC ASIC
Analogue MB
8 ADC ASICS per FEMB
FEMB
COLDATA FPGA
Digital Mezzanine
1.2 Gb/s *4
20 COLDATA or 20 FEMB per APA
128 ch per FEMB
Timing System
50 MHz
Trigger Distrib.
8 COBs per ATCA crate
ProtoDUNE = 1 ATCA crate
FELIX
FLX710
FPGA
50 Gb/s per FLX710
Felix PC
24 bidir links per FLX710 @ 3.2 Gb/s
2 FLX710 per APA
BoardReader
1 BoardReader per FLX710
BoardReader
Beam Inst. pLAPPD TOF
Throttle System
Data Flow Orchestrator
Data
Control
Clock
Global Trigger
Trigger Input
Throttle
Common GPS
Beam Inst WR timing system
Beam Instrumentation
-Spectrometers
-BPM
-PID
Cosmic Ray Tagger
Trigger System
KH - version 10
DocDB - 1463 v6