

DAQ development and planning for ProtoDUNE VD Operations

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DUNE DAQ Operations Meeting
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Overall timelines and EHN1 plans

- NP02 filling is complete!
- Due to the recent safety incident at CERN, we are still not able to do work directly in EHN1
 - This delays a lot of the initial commissioning tasks
- There is no firm timeline as to when work can resume
 - And when it does, what additional restrictions there will be
- However, we need to do what DAQ development and integration work we can remotely
 - BDE and PDS systems are running
 - Timing units, DAQ servers, CTB, etc. should all be up

General contours of the run

ProtoDUNE VD/NP02 in 2025

Perspectives for NP02 Operation at Neutrino Platform

- January (<2 weeks)*: preliminary tests of all PD modules before and just after filling was completed (and paused).
- March (2 to 4 weeks)*: **Detector(s) Activation/Commissioning** [PDS: C&M&PMT - in Series (after) HV, TPC/CRP, and in Parallel at some point] and **PDS-DAQ integration** — *it will take all time needed*.
 - A detailed commissioning Plan is being developed
- April-September*: (minimum) SIX months NP02 continued Operation currently envisaged
- Request to SPSC for Beam Time (LE-charged ptcl. H₂/NP02 Tertiary beam) submitted:
 - Proposed total of 6 Weeks Beam Time - in 3 blocks of 2 Weeks each w/ Beam, and two weeks w/out beam in between. Under evaluation request to postpone start of beam time in (late) June
 - NP02 Operation (6 Months: April-Sept) to be organized in “dedicated Run periods” - including (and culminating with) the H₂/NP02 Beam Physics Runs
 - **The list of the Runs&Tasks and the Agenda is under construction** - Inputs from all relevant parties - DUNE Consortia (HV, TPC/CRP/TDE-BDE, **PDS**, DAQ, CALCI) and Physics Coordinators and also Grp.s involved with specific instrumentation in NP02 (e.g PMT array, PurMon, Calibration Sources, Purification Methods, ...)

From Flavio, at Collab Meeting

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Overall timelines and EHN1 plans

- Have been thinking in terms of three main phases for completion of various milestones:
 - ‘Very near-term’, to close out v5.2.1 and bring things to a baseline operating state for v5 in NP02
 - ‘Initial commissioning tasks’, significantly focusing on work to do with data from NP02, particularly with cathode HV on
 - ‘Final integration and commissioning tasks’, propelling us to operating the full detector and being ready for ‘physics’ data and a beam run
 - Note: completion of milestones means work is being done earlier to support that
- Goal of this talk is to try to outline and propose the sequencing of various work along those phases
 - Discussion is very welcome here
 - Feedback on additional tasks, when to target them, release organization, etc. are all welcome
- Importantly, I am not talking about other work that is and needs to be going on to support PRRs in parallel

Very near-term milestones: v5.2.1

- We need to close out the v5.2.1 patch release
 - Main goal of this patch was to integrate PDS (DAPHNE + SSP calibration) into v5 line
 - Progress has been slow due to lack of experts from PDS available to help, but that is moving forward
 - Significant progress on configuration updates needed for NP02 last week by Marco and Manuel

Marco and Manuel are continuing testing and final developments ~now, and so we should be able to close this this week

- Demonstrate running of (at least self-triggered) FELIX-based DAPHNE in v5.2.1 on NP02
 - Includes running of SSP module, as default will now be to always include SSPs in run (with an explicitly disable of the LED calibrations in most cases)
- All configurations updated for current setup at NP02
- Stretch goal: add configs for full streaming and demonstrate they work

Very near-term milestones: CCM/operations

- Initial deployment of v5 configuration management tools
 - Experts met last week to hash out lessons learned from initial practice and workflows
 - Concluded that git-based merges are likely to create consistent conflicts in cases with changes made to similar files (... likely)
 - E.g. case came up with enable/disable of TPG
 - Exploring an update to further abstract 'configuration generation actions' that take base configuration data and make necessary changes
 - E.g. define an action for enable_TPG config that uses "oks_enable_tpg"
 - This mirrors the approach of the "user-interface" config tools that Henry has been working on
 - Aim to keep general structure of storing configs in repositories
 - Marco continuing to take the lead on development here

Very near-term milestones: CCM/operations (2)

- Initial deployment of v5 configuration management tools
 - Hope that implementing the previous slide will lead to a stable set of deployable tools that demonstrates:
 - Ability to add new / remove session configurations
 - Ability to make changes to “defaults” and base configuration data sets and stably propagate those to runnable session configurations
 - Ability to execute verification/validation on session configurations and alert user if problems
 - Also need clear instructions for how to deploy this and use these features in NP02

Very near-term milestones: operations

- Update standard monitoring runs in NP02 to use v5
 - We are still running out of v4-based lines for basic monitoring runs
 - Need to create tmux sessions, shifter instructions, basic setup scripts for v5-based releases at NP02
 - Largely exists, but corralling information
 - This should include getting basic DQM tools fully updated for working with v5 in their current best state
 - These should be updated on the wiki and we should be able to instruct people to begin to use them
 - This will no doubt require some more careful attention to slack channels to assist detector experts
- Hardware assignments update
 - Review and assign servers / resources for NP02, NP04, and coldboxes
 - Update configurations, and have identified backups with configurations prepared
 - Need to followup on coldbox runs, including laying of new fiber down to NP02 trench

Wes (trying) to take the lead on both of these items

Initial Commissioning: TP Format

- We need to decide on and plan implementation of any data format change ASAP
 - Doing this before ProtoDUNE-VD is taking physics data very advantageous for consistent offline production workflows
 - Questions:
 - Do we want to implement the reduction in size of TPs proposed by A. Oranday et al.? (*I think this is yes...*)
 - Do we need separate TPC and PDS TP formats? (*My understanding is no...*)
 - If we make a change in format, need to plan and execute an integration strategy
 - Demonstrate DAQ online software can run and produce new TPs / write new TPs in tpstreams, etc.
 - Marking files as 'test' and not for offline production...
 - Demonstrate that DAQ data-readers and tools can read the new format (and know what to do with the old)
 - Document and help offline update decoding and analysis tools to new format
 - Providing a tagged version of updated formats libraries likely useful here...

Initial Commissioning: TPC TPs

- Should focus on a commissioning effort for TPC TPs using the bottom CRPs
 - Same electronics as NP04
 - Do we want to wait for HV for this? (*Probably...*)
 - Walk forward in steps, perhaps like ...
 - Demonstrate TP generation with SimpleThreshold on collection
 - Demonstrate TP generation with AbsRunningSum on collection, then add induction
 - Identify stable running configuration(s)
 - Vary trigger record rate to check stability at low and high rates
 - Show ADCSimpleWindow TA/TC chain using TPC data can produce TPC triggers
 - At that point, have what we likely need for setting stable config for operations of CRPs
 - Additional tests
 - Other trigger algs that we want to be able to test?
 - Note: we don't have to do this at the beginning of the run, and could request dedicated time later

Initial Commissioning: PDS TPs

- The primary goal for PDS triggering in NP02 is to make available PDS TPs to the system
- Initial commissioning of PDS TPs should show we can ...
 - Translate DAPHNE self-triggered frames to TPs in readout applications
 - See those TPs in both trigger records and TP streams
- PDS group has expressed a high interest in triggering on PDS TPs
 - A demonstration this can be done in ProtoDUNE-VD sounds reasonable ...
 - Not clear if there are specific datasets they need that could/must come from PDS software triggering
 - For initial commissioning: likely sufficient from DAQ side to show that PDS TPs can flow to higher-level trigger applications, and that we can do something like a pre-scale trigger to trigger on them
 - Leave further algorithm integration for later activities, driven by PDS team developments

Initial Commissioning: CTB and CIB

- Continuing work to update v4 interfaces to v5 that will be used in ProtoDUNE-VD
 - CTB
 - Initial meeting with Marco, James, and Ben to go over translation of configuration information
 - Want to demonstrate a first iteration with minimal changes to schema that exercise CTB functionality in v5
 - E.g. using CTB-driven random triggers
 - Will use that to evaluate any other schema updates, and set stage for integrating other trigger types (beam, CRT? [see next slide...])
 - CIB
 - Laser calibration system to be same interface, so this should be a 'simple' update
 - Need to demonstrate we can run this in v5 prior to laser calibration runs (timeline for that unknown)

Initial Commissioning: CRT

- There are two CRT systems intended for use in NP02
 - Bern/CAEN system (point-of-contact José Soto)
 - Grenoble system (p.o.c. Jean-Sebastien Real)
 - Discussions on interfaces for timing, triggering, and software have been going on but need renewed urgency
 - Likely triggering could be via simple HSI devices, but need to verify soon if any CTB support might be needed
 - Need to also understand with run coordination and detector groups what the needs for CRT triggering are
- In initial commissioning period, we should finalize the plan and push to have all DAQ interfaces ready
 - Document what the CRT integration plan is for timing, trigger, DAQ data, and control
 - Have CRT data formats defined and in DAQ release (and available to offline)
 - Provide skeleton code for CRT software interfaces (readout, control)
 - Have timing and trigger interfaces installed and initial connections demonstrated
 - If CTB interfaces needed, then likely more work required ...

Initial Commissioning: Offline Interfaces

- Dataflow interfaces
 - Data transfers are ongoing, and interfaces for offline metadata have been previously defined
 - Need to verify they are still valid with offline and review any new requests they/we might have
 - Also, make sure PDS TP stream files (if separate from TPC TP stream) are part of that
- CCM interfaces
 - Finish the conf_reader tools for extracting configuration information to offline – demonstrate that offline can read all necessary config info
 - As above, review with offline any new requests they/we might have

Initial Commissioning: Operations

- Calibration workflows
 - Both BDE and PDS have calibration runs that they apply in a loop via scripts that need updating to v5
 - For initial commissioning
 - With detector teams, develop base 'calibration' configuration that can be modified in a loop
 - Adapt v4 calibration scripts to v5 and demonstrate that calibration workflow scripts work and provide needed flexibility to detector teams
 - Develop additional utility functions/tools as needed
- Shifter interfaces
 - Shifter interface for config management system is fully integrated, and shifter workflows are all ready, tested, and documented
 - All drunc features necessary for shifters complete and stress tested for many run start/stops, reconfigurations, etc.
 - Calibration workflows may provide best stress test
 - Elog posting is working reliably and to correct elog
 - DQM/justintime instances are fully deployed with shifter instructions

Final commissioning: TDE

- TDE team will be focusing efforts on validation of the top CRPs once HV is on
- Once complete, we can expect intense integration effort with them, which we expect may take four weeks:
 - Initial readout integration established with TDE experts
 - Followup work on debugging and tuning of TDE readout, beginning DQM integration, etc.
 - Perhaps at this point testing TPs
 - System integration (timing, control, further readout debugging, DQM) with TDE experts
 - Followup work on debugging, finalizing configurations and software and tagging in release
- At soonest possible time, will be reestablishing TDE test crate to allow for some readout integration work to proceed before we reach this point

Final Commissioning: Operations

- With a complete system in place for TPC+PDS, we want to reserve time for system-level stress testing
 - Readout, dataflow, max trigger rate studies, data transfer challenges with offline, etc.
 - Continued stress testing and refinement on CCM tools responding to needs
 - We can anticipate doing what we can with bottom CRPs+PDS, and then repeat with all CRPs + PDS
- Beam instrumentation
 - Once we have the beam instrumentation in place, can then test with the CTB
 - Unclear if there will be opportunity for tests before the beam run starts – if not, of course some time needed at beginning of run to get in order
- Outstanding work
 - Likely final testing of interfaces and integration with other detector subsystems may be delayed to this time (e.g. CRT)

Review

- Very near-term
 - Finish DAPHNE/SSP interfaces and v5.2.1
 - Deploy initial configuration management tools
 - Transition to v5 for monitoring runs and update hardware resource plan
- Initial Commissioning
 - Finalize TP format
 - Integrate PDS TPs
 - Commission TPC TPs and trigger with bottom CRPs
 - Transition CTB to v5
 - Transition CIB to v5
 - Define and establish CRT interfaces in timing, trigger, and DAQ software
 - Verify and refresh as needed offline interfaces
 - Develop calibration workflows for BDE and PDS
 - Finalize shifter interfaces for NP02 running
- Final commissioning
 - TDE integration and commissioning
 - Final stress testing
 - Beam instrumentation integration (if possible ahead of beam)

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This is a lot of course.
Work for the
commissioning periods
of course needs to be
starting.

Organization going forward

- Will work with coordination team to develop the plan for releases
 - One note: unlike NP04 running, we want to avoid major schisms with the 'develop' branch
- We would like to aim for more regular DAQ-consortium-wide 'Operations' meetings to help keep everyone in the loop on activities
 - Have the usual status of EHN1 and discussion and planning of tasks
 - But also have opportunity to share commissioning work / results
- Also, huge thanks to Marco for agreeing to take on EHN1 DAQ Operations responsibilities!