
DAQ / Electronics / Analyzer Task List

(DRAFT)

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Feb 25, 2022

VTP / F250 / TM Firmware / Trigger (Reminders)

- VTP (5+1 modules ordered May 2020)
 - Cluster trigger based on 3x3 groups, with 1 row shared between crates
 - Logic signals emitted by each VTP will be OR'd in NIM to form NPS trigger
 - » CODA trig: HMS .AND. (.OR. of NPS)
 - » Timing latency on VTP triggers deterministic to <12ns
 - Define/update VTP data payload
 - » cluster charge, timing?
 - » cluster crystal list to be used to sparsify F250 waveform readout
- F250 FADC (51 modules from FE/PD pool)
 - Hi-res timing required (< 1ns)
 - » Preserve multi-hit/ch output
 - QDC data, Scaler data
 - Full waveforms (25 samples)
 - » Compressed?
 - VTP info used to sparsify F250 readout channels to those in a 5x5 cluster(s) centered on the 3x3 'trigger' cluster(s)
- TI/TM modifications (if needed?)
 - must support 5 NPS crates + 3 HMS crates
 - maintain six L1 trigger inputs on primary TM
- CODA / HMS trigger assumptions
 - 'Standard HMS' NIM triggers will be available
 - » $\frac{3}{4}$, EL_{real} , EL_{clean} , ...
 - NPS + HMS trigger made in NIM
 - » NPS + HMS $\{\frac{3}{4}, EL_{foo}\}$
 - » NPS VTP latency is NOT a problem
- NPS detector assembly and full DAQ chain readout tests to be done in EEL space Spring/Summer 2022

FE/DAQ group reports 'first draft' of needed firmware complete

NPS DAQ Challenges (Reminders)

- Most work driven by requirement to handle high-rate kinematics + waveform output
 - 13 kHz HMS (DIS) triggers (+ background)
 - » need NPS trigger (→ VTP firmware)
 - » need 'Event-Blocking' enabled
 - 'high' multiplicity in NPS (75+ crystals)
 - waveform output for participating crystals is a 'Must' (~25 samples/ch)
- Pending issues
 - VTP firmware development
 - » 3x3 crystal cluster triggers
 - » Emit logic-out for NIM trigger with HMS
 - » 'sparsify' F250 readout (only store waveforms from 5x5 clusters centered on 3x3 'trigger' cluster)
 - Analyzer support for VTP payload
 - Analyzer support for Event-Blocking mode
 - » 'Unblock' in secondary ROL?
 - may be simplest? no analyzer changes needed [Moffit?]
 - » 'Unblock' at analyzer? [Bob M]
- Firmware questions wrt VTP/F250s
 - Hall B firmware has compression, but removes features to achieve this
 - » need to ensure necessary timing, QDC, scaler(?) data still present
 - May require upgrading HMS F250 firmware as well
 - » need to address knock-on changes to CRLs and analyzer assumptions for HMS
 - Or lossless compression in 2nd stage ROL + libCoda mod?
 - » no F250 firmware change, no decoder changes
- Firmware / DAQ questions have been discussed with FE Group
 - No “show-stoppers” but requires development resources be allocated to this project
- Updates to Hall C analyzer software
 - Non-trivial work here!

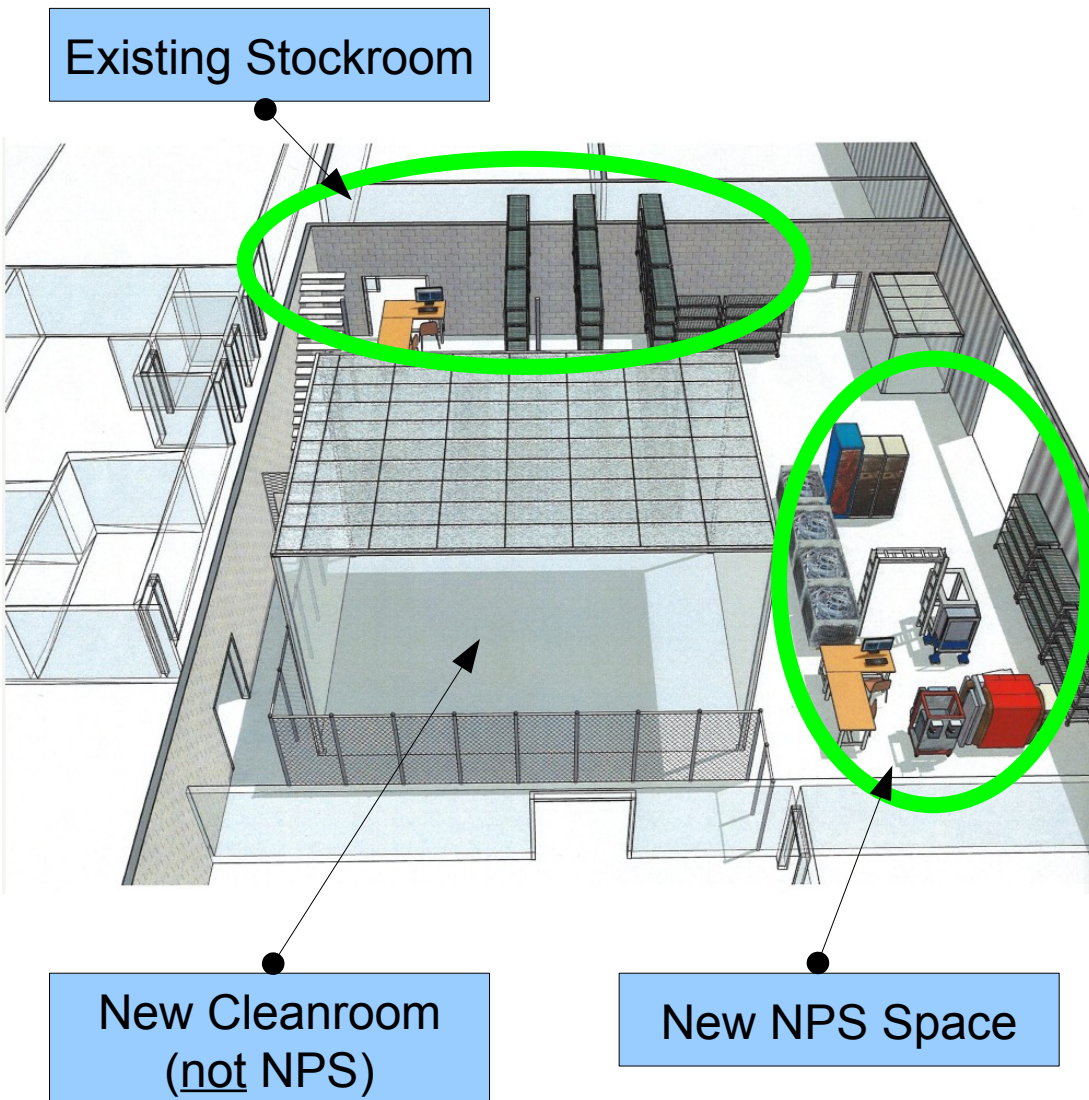
Short List (HW / DAQ)

- Goals
 - As complete a test of the entire NPS readout system as possible in EEL
 - » ~75% of full readout
 - Includes high rate (low FADC threshold) and cosmics cluster trigger testing
- All DAQ hardware / cables are available now
 - Use 'cdaq13' HW as DAQ host
 - Have a 'front-end' computer with large display available
- First stage goal will be FADC hookup and low-level readout for crystal installation
 - 1–2 rows of crystals
 - Waveform ('diagui') output
- Tests:
 - HV cabling and control SW
 - DAQ signal cabling
 - LED pulser HW and control SW
 - Thermal HW and controls
 - CODA 3.0 config
 - » Throughput
 - » Stability
 - » Run in 'Blocked' Mode
 - Test new VTP firmware
 - Test new FADC firmware
 - Test new TI/TM firmware
 - Test Cluster trigger
 - » Use LED board
 - » Cosmics?
 - Analyzer support for above
 - » Unblocking
 - » VTP/FADC payload changes
 - » *Etc.* (see next slide)

Analyzer Questions

- Analyzer Updates (Hall C)
 - Integrate DVCS software into hcana
 - Waveform analysis?
 - Cluster algorithm tuning?
 - Decoder updates for VTP, F250 mods
 - Solve, Implement, and Test “Data Unblocking” feature
- Establish the ‘online GUI’ plots
 - Start with “checkout displays” desired for initial assembly
 - » QDC, TDC, Scaler information
 - Waveform display
- Analyzer performance / throughput?
 - Merge multi-threaded podd with hcana?
 - » Unsure of status/readiness/practicality?
- Do we still have a lead developer on analyzer software?

NPS Detector Layout in EEL Building



- Space will become ready for occupancy in late-Apr
- “To do” list
 - Need to design/build cable bridge
 - Unbox and bundle signal cables
 - NPS detector assembly timeline / personnel
 - Stage/Test DAQ

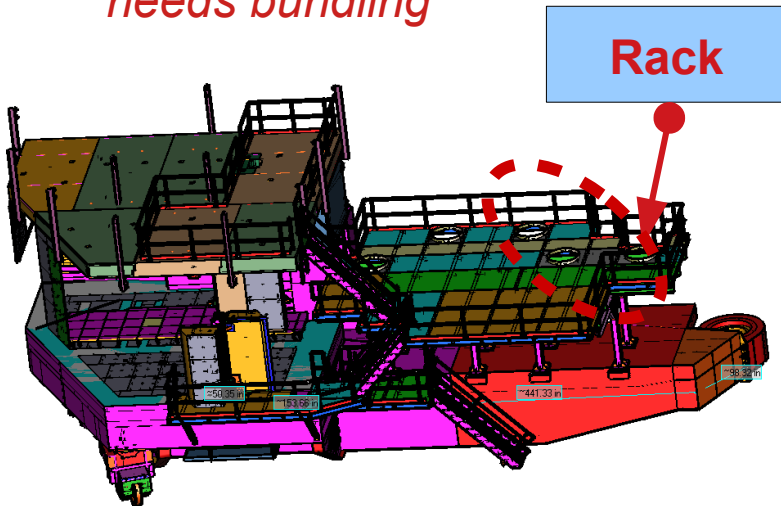
Done

NPS Detector Slow Controls

- NPS detector will need additional instrumentation for **Thermal Monitoring/Control** and **LED system**
- Thermal Monitoring/Control
 - Model after Primex/HyCal/ComCal
 - Only local control needed
 - » Remote monitoring is straight forward
 - Brad will be JLab point of contact for integration / EPICS
 - » **DSG support in place**
 - » **Good progress on all items**
- Existing EPICS Archiver and Alarm Handler software used for automatic signal logging/ monitoring
- Thermal Monitoring/Control Notes
 - **Rough Channel/Function List:**
 - » Readbacks for chiller/air-handler at minimum
 - Status, in/outflow temps, etc
 - **Internal air temp readback(s)**
 - **Multiple detector temp readbacks (few dozen ch)**
 - » Several locations in crystal mount / HV divider region
- LED controls (**JLab FE Group**)
 - **Controller/driver design complete**
 - » Design finalized (William Gu)
 - **Some issues with prototypes in 2021**
 - » Revised boards arrived recently and are looking good

Signal/HV/LED Cable Runs

- Plan is for a single 84" tall, 19" standard width rack to be placed near the pivot
 - Planned to go on the upper, power supply deck
- Cable path, cable supports details near final (Paulo, Brad)
- Rack at pivot is BNC:BNC patch for 1080+20 RG-58 cables *only*
 - *Cables in-hand and labeled; needs bundling*
- Other cables will follow the same path past the rack to the NPS, but with **no** patch panel:
 - 30+2 multi-conductor HV
 - » Assem. and QA testing complete (DSG)
 - 60+2 80-wire ribbon cables for LEDs
 - » Need to buy/assemble when LED board final (ie. spring 2022)
 - » Not expensive or long-lead, but on the 'Follow-up' list (Brad)
 - Heavy-gauge grounding cable(s)
 - » Necessary to establish/ensure clean detector ground
 - » Isolation pads for NPS
 - Plan in place with Paulo
 - » *Discussed with J. Segal who will do the ordering*
 - *Not long-lead; on 'Follow-up' list (B)*



Cable Bundle Summary

- This covers cables run between SHMS detector hut to NPS detector
 - Signal, HV, LED cables
 - All cables follow same run
 - » Cables are ~150' long
 - » Patch panel rack for signal cables is intended to be roughly half way
- Cable bundle cross section and weight estimate (above cables)
 - ~120 in² (cross section area)
 - ~50 kg/m; ~33 lbs/ft
- *NOT* considered in this document (but not forgotten)
 - Thermal monitoring readout & Temperature control systems
 - » Heat exchanger plumbing, control lines, etc
 - Paulo, DSG, and Brad have a plan.
 - » Still to be detailed.

DAQ/HV/Cable Status Summary

- Support hardware staging (Brad)
 - Patch panel, NPS→DAQ cabling
 - » 2200 signal cables in-hand *but need bundling*
 - » Patch panel rack *needs assembly*
 - Parts in-hand.
 - HV Crates (Brad + DSG)
 - » Procurement complete; QA issues with CAEN (2021) have been resolved. Ready to go.
- Slow Controls
 - LED Control (DSG + FE Group)
 - » Driver board design complete; fabrication near complete
 - » Control GUI is *TBD*
 - » Need 60x new ribbon cables
 - “Integrated” NPS slow controls display is making good progress (DSG)
- DAQ HW Procurement (Brad)
 - Completed (all in-hand)
- DAQ Firmware/SW Devel. (FE Group)
 - VTP, F250 modifications
 - 3.5 person-months
 - » Initial drafts of firmware complete; will test and iterate in Spring/Summer
- Analyzer (Hall C) (*Do we have a Plan?*)
 - *Integrate DVCS software into hcana*
 - *Decoder updates for VTP, F250 mods*
 - *Solve, Implement, and Test “Data Unblocking” feature*
 - *Merge multi-threaded podd with hcana*
 - » *Unsure of status/practicality?*
 - *Do we still have a lead on this?*
- Full DAQ integration and Testing (Brad)
 - *Planned to start in ~May 2022*