

Nov 18, 2021 Electronics Integration Meeting

Attendees:

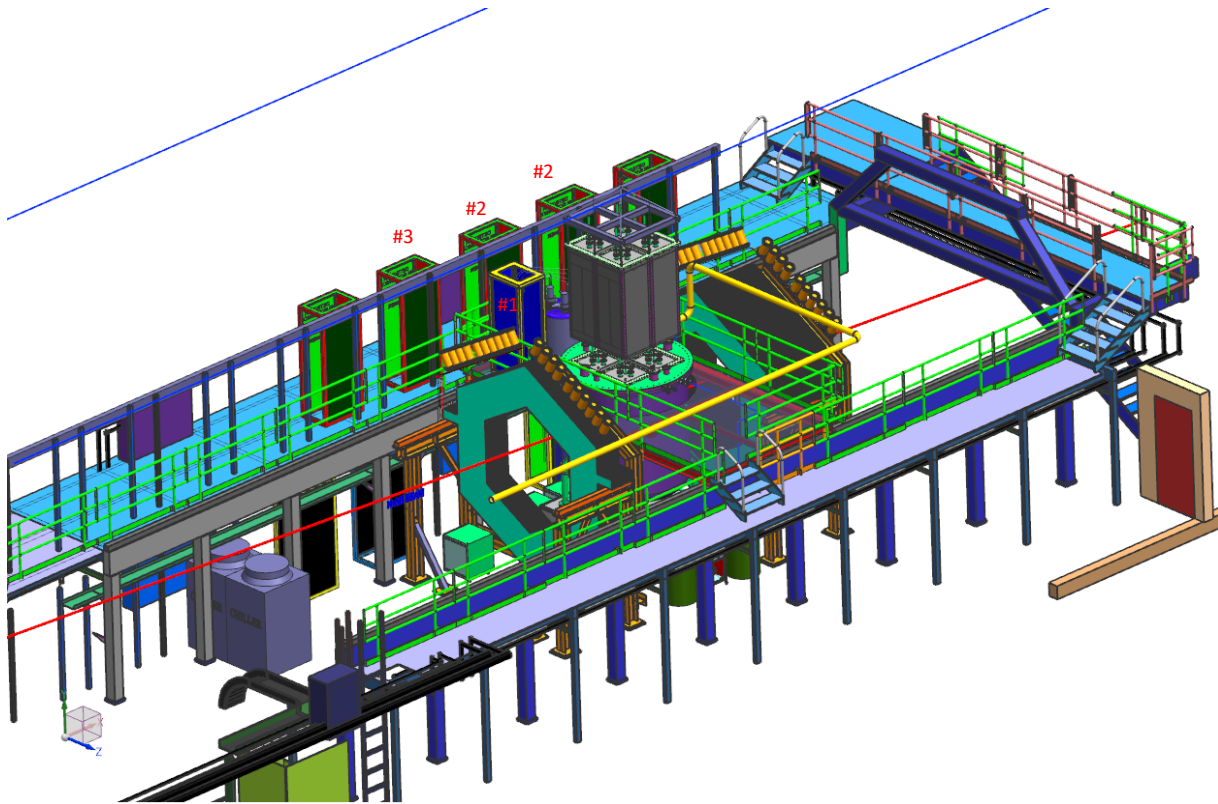
Everardo, Nikolay, Sasha, Faiza, Matt, MinJeong, Cindy, Jeremy, Alan, Andrew, Lane, Howard, Abbey, Linda, Steve, Armin, Donatella, Ann and Ting

Today's Agenda

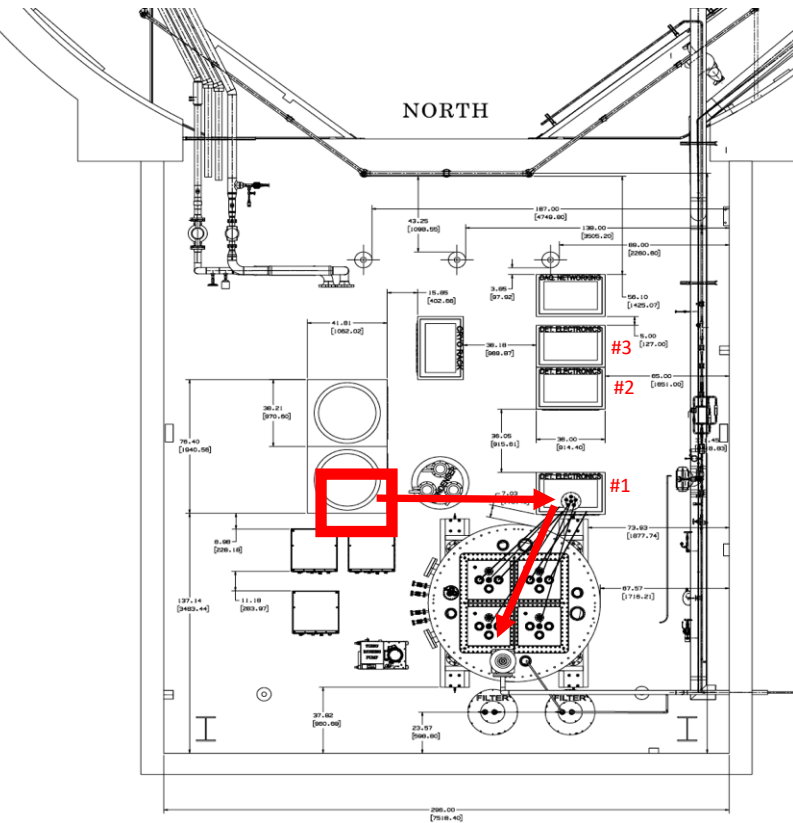
- 2x2-Minerva electronics installation and checkout
 - AC work for 3-phase 208V
 - Steve showed a plan for adding panels to provide power to MINERvA LI and readout racks
 - Steve will follow with Min Jeong and Geoff's suggestion to get the correct location of LI and readout racks
 - LI and DAQ rack preparation and ORC
 - MTM board need documentation from PPD EE department.
 - Howard also in discussion with Jaimeson about the need to use BiRa RPS
 - Determine if minerva power supply needs to be monitored. Jamieson connected power supply to BiRa RPS for monitoring, but nobody looked at the monitoring.
 - DAQ preparation: Lab F test and underground installation
- Plan of 2x2 electronics installation
<https://docs.google.com/document/d/108YiWsxR8tAlwCeTk4bcPesEkfv10gV/edit?usp=sharing&oid=113166743918724173073&rtpof=true&sd=true>
- AOB: DC PS for light readout VGA + siPM bias
 - New LRO design has single 120VDC/0.75 → DAC-PS → VGA and siPMs
 - 50-100V is required, a supply wit maximum 120V will be good
 - Each TPC needs 100mA.
 - For four TPC, we can do four PS or a 1-to-4 splitter
 - Sasha/Nikolay suggests to use TTI PLH 120-P with 120VDC/0.75A
 - VME crates for new electronics needs 5-row bus with 5th row provides +5V
 - Linda to check the crates we reserved for 2x2

Near Term Tasks Now-January

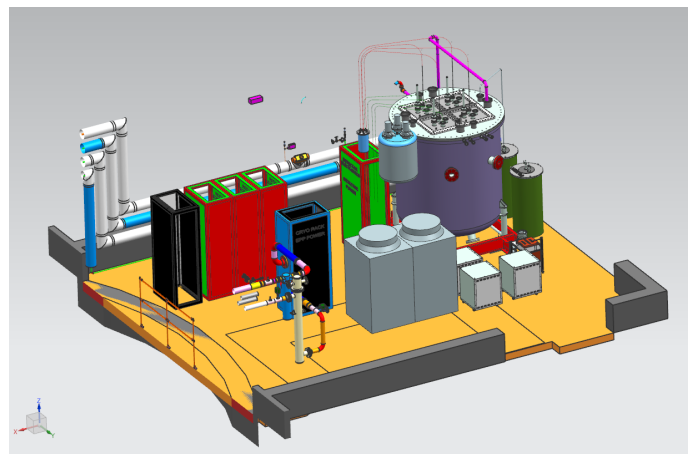
- Specify and procure 120V/1A DC PS, MPOD mini-crate and MPOD MPV 80xx (Linda/Jeremy/Dubna)
- Finish pORC for on-detector electronics: HV filter, RPi, slow control (Lane/Andrew)
 - Need to figure out building AC situation in the LArTF garage
- Prepare three racks at NDOS (Joe H/Linda/)
 - Off-detector electronics from module-0 goes to NDOS for SEDR and ORC
- Complete DAQ servers and networking installation and ORC (Geoff)
- Rack builds documentation and fill the racks with components (Jeremy/Linda)
- System schematics diagram for the three racks (Jeremy/Linda)
- Start cabling design and install for Rack 3 (Jeremy/Linda/Lane)
 - Developing cable naming scheme
- Complete SEDR and pORC for Rack 3 (Jeremy/Lane/Linda) (Dec-Jan)
 - Spellman_eSL50(?), RPi boxes, DC for RPi,
 - Use R&S HMP4040 for Pacman and fans for single TPC module if needed
- Complete SEDR and pORC for Rack 2 (Jan-Feb)
 - ADC and 120V/0.75A DC PS
- Start SEDR for Rack 1 (Feb)
 - HV filter box, two VME crates and new electronics
- Rack builds for purity monitor (Jan-Feb)



Need to update the picture: number of racks on upper catwalk to be defined.



Module 0 to be placed in the location marked as red box.
This is for cabling purpose only



(Need to update this picture: can only fit two red colored racks there)

2x2 Electronics Installation Tasks

(Preparation for underground operation with four TPCs)

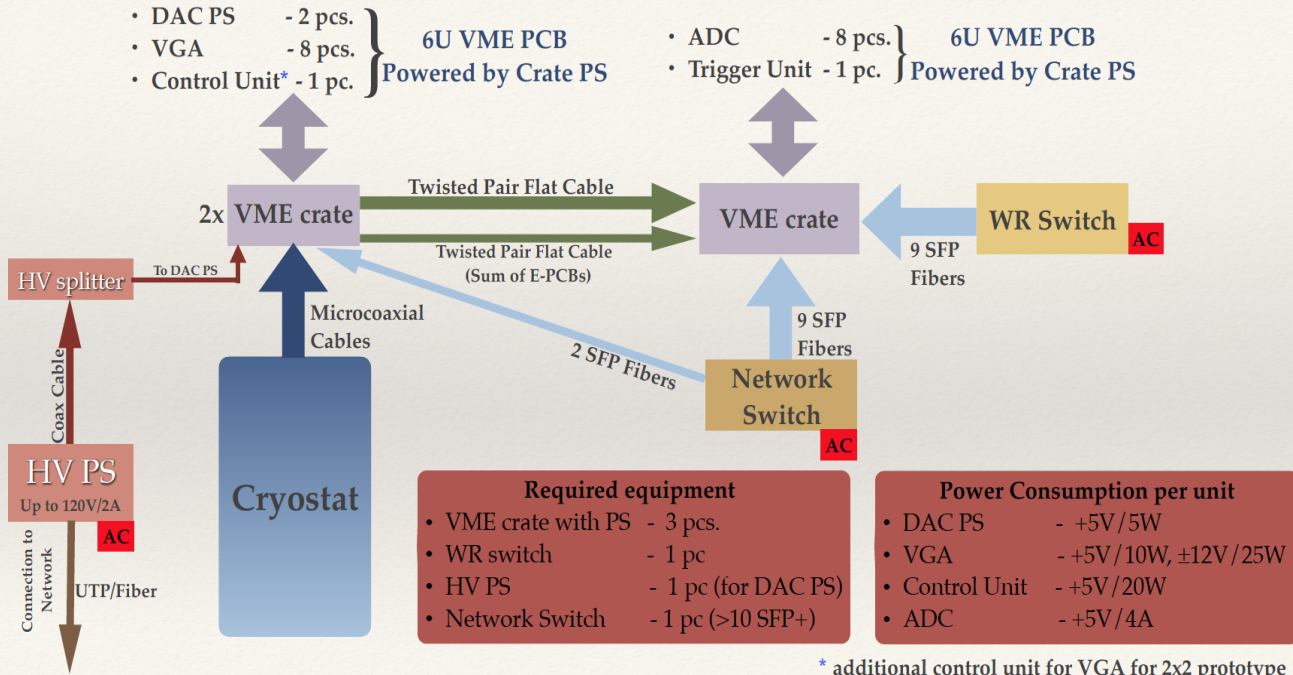
- On-detector electronics
 - Slow control boxes, Pacman, light and charge readout feedthrough, and Drift HV feedthrough
 - SEDR and pORC for slow control box (same for all TPC?)
 - **Need to complete pORC**
 - SEDR and pORC for Pacman boxes
 - pORC done for current version on module 0/1. New pORC for Pacman on module 2/3
 - SEDR for light and charge readout PCBs (same for all TPC?)
 - SEDR and ORC of drift HV feedthrough, PFD-4 HV filter box and HV Raspberry Pi
 - **ORC not completed yet for HV filter and RPi.**
 - SEDR not started for feedthrough
 - Acceptance test for each TPC modules share same electronics
 - (Cryogenics certification of drift HV feedthrough port, light/charge ports, slow control ports)
- Racks for Off-detector electronics
 - **Electronics needs to be inside a rack and gets power from switch boxes**
 - Light readout VGA/DAC PS/Control/ADC/Trigger and DC power supplier
 - To use new design for 2x2 operation in LArTF and MINOS starting with module-1 or modified module-0
 - **Replacing e-PCB or using adapter cart to be designed by Dubna/Bern**
 - **Dubna to delivery new electronics**
 - <https://edms.cern.ch/ui/#!master/navigator/project?P:100729005:100861770:subDocs>
 - <https://indico.fnal.gov/event/48671/contributions/214528/attachments/143402/181834/Design-I.pdf>
 - <https://indico.fnal.gov/event/48671/contributions/214529/attachments/143403/181392/Design-II.pdf>
 - Three VME crates for four TPC modules in 2x2 operation:
 - two crates with each have 8 VGA/2 DAC PS/1 VGA control board (x2 for four TPC total)/PS control unit
 - one crate has 8 ADC boards and 1 trigger board, WR switch,
 - **One 120V/2A DC power supplier for common siPM bias and VGAs**
 - Need more specification from Dubna; FNAL to procure
 - DAC PS for siPM bias and VGA for the new design based on AD5535B DAC chip
 - Why 120V DC?
 - Key feature of DC PS:
 - 1. low ripple; 2. switching frequency; 3. remote sensing; 4. interlock capability; 5. ease of interface with load; 6. networkability--SCPI via RS232--would need an interface; 7. still need a fanout?
 - Dubna group uses: GPR-730H10D: 300V/1A, low ripple 1mV at 5mA
 - <https://www.gwinstek.com/en-global/products/detail/GPR-H>
 - Bern has PLH 120-P with 120VDC/0.75A
 - <https://www.aimtti.com/product-category/dc-power-supplies/aim-plhseries>
 - Jeremy found: Keysight 1U module N6777A→150V/2A
 - <https://www.keysight.com/us/en/product/N6777A/dc-power-module-150v-2a-300w.html>
 - There is also APS-1721LS and APS-3103L for 0-120V/1A and 0-120V/3A
 - http://www.aktakom.com/products/index.php?SECTION_ID=494

- **Specify and procure DC power suppliers for Pacman and cooling fans**
 - Each TPC module needs 6 DC voltage input lines of LV (5V,6-7V, 24V)
 - 2 lines of 24V/1A for Pacman boards (two Pacman per TPC)
 - 2 lines of 6-7V/0.5A for 2 Pacman fans (one on each Pacman)
 - 2 lines for 5V/0.65A for slow control boxes (two slow control boxes per TPC)
 - Want separate LV lines for each device: total of 6 x 4 =24 lines for four TPC
 - Drift HV filter **monitoring RPi needs 5V/2A** DC input → total 25 LV lines
 - Need to find a DC power solution for total 24+1 outputs of low DC voltages
 - One R&S HMP4040 with 4-channel 0-30V/10A available
 - Looking MPOD option with MPV LV modules in a mini crate
 - three 8-channel **MPV 8030I** (0-30V/2.5A) modules? (\$15K)
 - Want separate DC source for different TPCs – Linda
- RPS and monitoring
 - ND RPS can directly connect to FIRUS. It does not have ethernet port though.
 - A separate BeagleBoone SBC as option (need a 3U space in the rack)
- **Drift HV system: Spellman, filter box, cables, Raspberry-Pi (RPi) for HV monitor, DC PS to RPi**
 - SLAC to delivery cables – sections between filter box and feedthrough
- **Three racks for off-detector electronics in LArTF**
 - Locations of the three racks shown in the pictures below
 - Rack 1 – the one closest to cryostat (**naming contest**)
 - Rack 2 – the one north of Rack 1 (**naming contest**)
 - Rack 3 – the one north of Rack 2 and south of DAQ server rack (**naming contest**)
 - All cable length and arrangement need also take consideration of MINOS placement
 - Talk to Min Jeong and Gary Smith to get the proper distance between racks
- **Rack assignment for off-detector electronics – for discussion only; need rack build design ASAP**
 - Rack 1: drift HV filter, two VME crates for light readout VGA/Control/DAC VME modules
 - Rack 2: common HV PS (120V/2A) and voltage splitter for siPM bias+VGA
 - Rack 2: 8-channel network switch for Pacman
 - Rack 2: one VME crate for 8 ADC +1 trigger boards, WR switch and other trigger cards
 - Rack 3: Spellman-50, RPi boxes, multi-channel DC PS for Pacman/fans/RPi
- **Rack building documentation** in DUNE docDB 20490 (**Jeremy**)
 - Rack protection system board: ND RPS
 - ND 120V/30A switch boxes (switch box-30) (BIRA switch box is backup option).
 - Electronics chassis should fit into 19" rack if possible (buy)
 - Power and current, rack space, heat load/cooling, accessibility
- **Refurbish racks**, install electronics crates/chassis and cabling
 - Work together electrical technicians from Linda's group
 - Rack refurbishing in NOvA NDOS building
 - Cabling and strain-relief designs no small feast
 - For our case, need to have cables work for both LArTF and MINOS setups
 - Ask/confirm with Min Jeong and Gary Smith for cable length requirement
- **SEDR and ORC** for each rack – guideline in DUNE docDB 16355

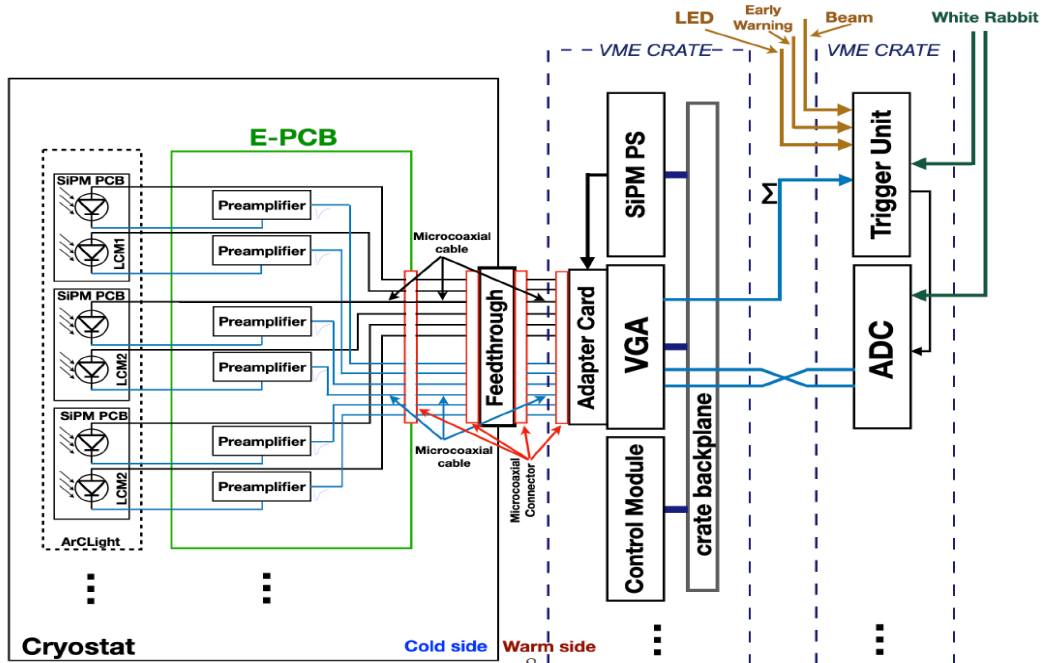
- The scope of review includes custom-made components, cables, and connections
 - Need both documentation and sample of component for the review
 - Can start documentation as soon as possible
 - Prefer to start the process before final component production as there are chances modifications are needed
 - We should work together with subsystem lead/expert on design documentation and SEDR request documentation to Linda (Guideline in page of DUNE docDB 16355)
 - Linda will help you to request ORC committee review
 - ORC guideline: <https://fermipoint.fnal.gov/service/tsworc/SitePages/Home.aspx>
 - Need to address committee comments before safety walk through
- Networking and PCIe cards
 - A managed network switch already in LArTF (Geoff)
 - This is suitable for RPi,Tinker,HV/DC PS etc.
 - Likely need small an un-managed switch for Pacman (Geoff)
 - ADC readout at LArTF will be done using PCIe SFP+ card
 - To test dual and quad 10GPbs with SFP+ NIC
 - Need to purchase the PCIe cards with FY22 money
 - Intel x710: <https://lenovopress.com/tips1229-intel-x710-10gbe#specifications>
- HV feedthrough installation and cabling
 - More detail to work out with Min Jeong and SLAC group
- DAQ server setup and test
 - Two DAQ servers and one gateway for LArTF (Geoff)
 - Need to install QA/QC testing program and analysis code
 - Need to install DAQ code, starting with Bern's standalone CRO and LRO codes?
 - Will start to contact SCD (Kirk Biery) for DUNE-DAQ support similarly to ICEBERG
 - Need to work on DAQ integration: full artDAQ? miniDAQ?
- Detector control and monitoring integration (→ non-expert operation)
 - Spellman-50 with Ethernet port (new from Bern operation):NET-SNMP→EPICS/IGNITION
 - Tinker board: python
 - Light readout HV: Net-SNMP
 - Pacman monitor and control?
 - Pacman cooling fan needs monitoring
 - Reading FPGA core temperature (suggested by Armin)
 - R&S HMP4040 for Pacma: NET-SNMP
 - MPOD LV MP8xxx DC power cards control and monitoring: Net-SNMP
 - RPS monitoring
 - For ND RPS box, use BeagleBoone SBC as monitoring tool like uBooNE/mu2e?
 - For BiRA RPS: to use RS232 port and pySerial to EPICS/IGNITION (Minerva)
 - RPS monitoring and FIRUS connection
 - Gizmo: EPICS/IGNITION
 - Cryogenic control: PLC with IGNITION protocol
 - Purity monitor: control and monitoring with LabView and IGNITION
 - Beam status monitoring

- Trigger (→ NuMI and BNB beam)
 - Design scheme to be based on ADC trigger board and white rabbit
 - P7 of Nikolay's talk <https://indico.fnal.gov/event/48671/contributions/214529/attachments/143403/181392/Design-II.pdf>
 - Beam clock and timing from ICARUS WR network
 - Donatella's talk in <https://indico.fnal.gov/event/46334/>
 - Work with Donatella and Dubna group to set up WR switch
 - Measure time differences between MI60, ICARUS and LArTF
 - Time stamp: GPS? computer timing?
 - What about cosmic ray trigger? Or self-trigger from LArPiX?
- Online and database → remote room operation
 - Data stream: do we merge CRO and LRO streams
 - Data storage and data format for LArSoft off-line analysis
 - Run control, "control room" computing
 - NearLine monitoring
 - Database need for online and offline needs (to be defined)
- Other tasks
 - Grounding monitoring: Gizmo
 - Purity monitor DAQ
 - TPC and Minerva DAQ --> ArTDAQ, common time stamp
 - DAQ integration with Minerva tracker
 - Cosmic ray trigger

2x2 readout (Mod1-4)



SiPM readout and Trigger (2x2)



VME crate with new Light readout electronics



PS control

VGA control

PS bias

4 VGA

3 ADC