Preliminary Installation Plan at SURF

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Conceptual Design Review for Bottom CRP Electronics (FD2-VD)
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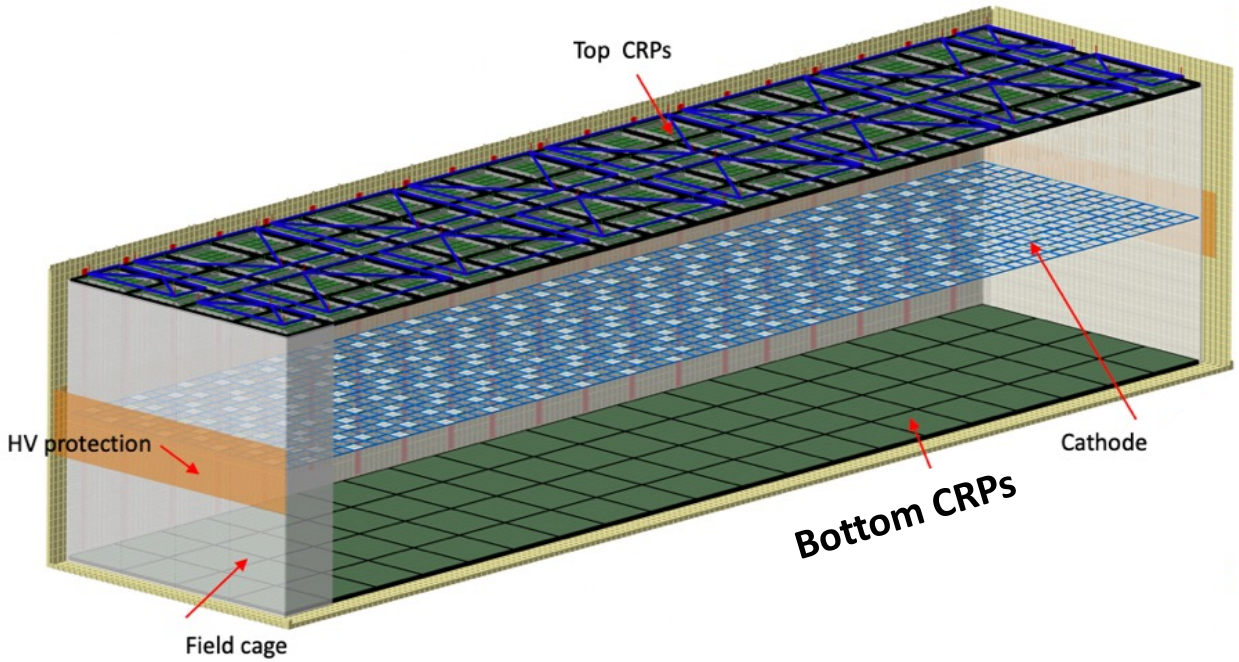
BERKELEY LAB

DUNE

Bottom Cold Electronics

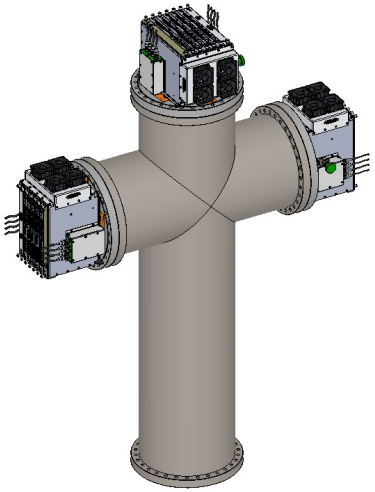


Scope:

- Responsible for the electronics to read out 80 CRPs at the bottom of the cryostat
- Penetration and warm electronic crates
- Power supplies (including bottom CRP bias and FC termination) and DDSS

General Installation Sequence

1) **Detector Mezzanine:** Install power supplies and detector safety system in the racks



2) **On top of cryostat:** Install penetration spool pieces and crosses

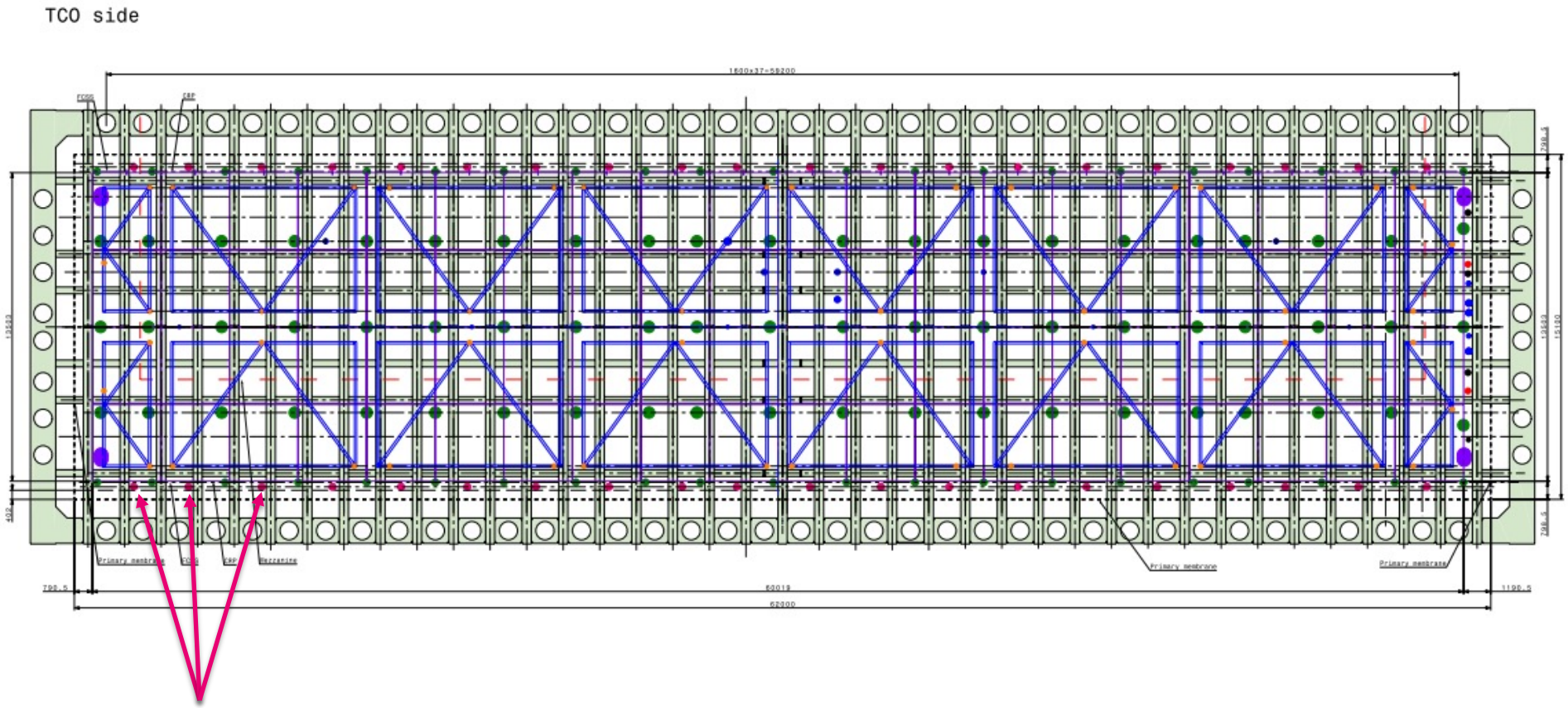
3) **On top of cryostat:** Install warm interface crates, WIBS, and PTC. Connect warm cables and fibers

4) **Inside the cryostat:** Install cold cables inside the cryostat. Connect cold cables to the feedthrough flange

5) **Inside the cryostat:** Connect cold cables to the CRPs

Note: FEMBs will be mounted on the CRPs at the CRP Factories

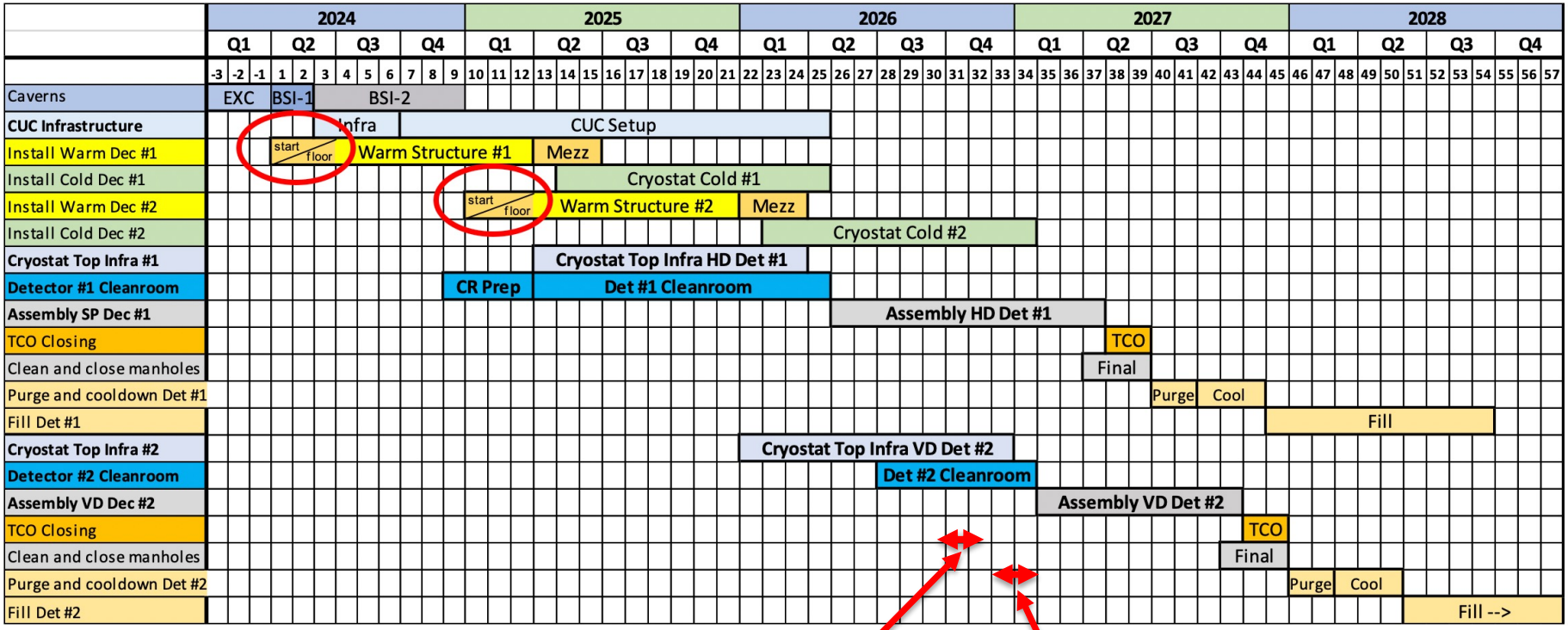
Cryostat Penetrations



- "Pink" dots are the penetration ports for the bottom CRP electronics. DN295 (14") conflat flanges
- 20 along the south wall and 20 along the north wall

Installation Schedule

- Had one round of meeting with the I&I team + lots of emails
- Also starting to use some Wed FD integration meeting slots to discuss FD2-VD installation issues

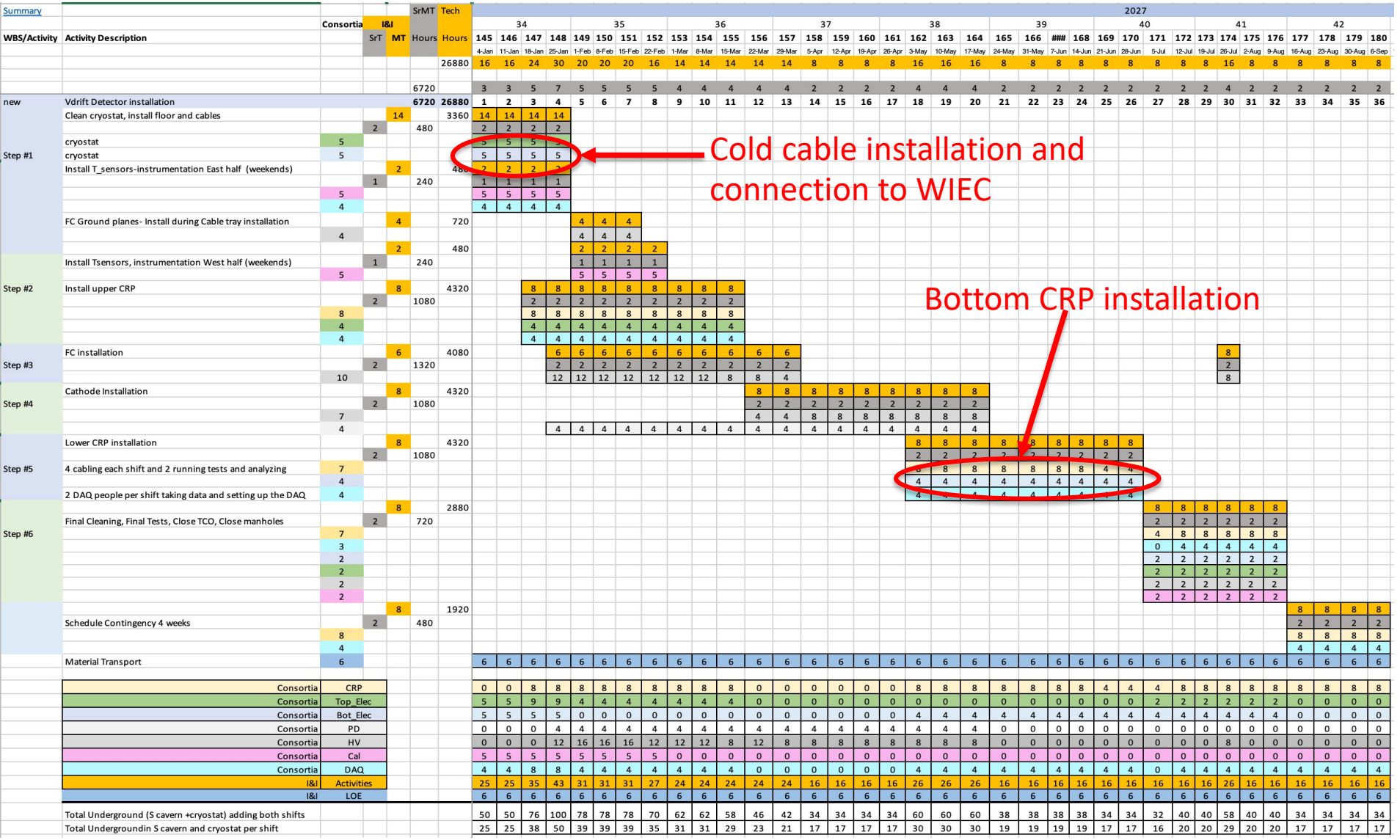


Power supplies and DDSS installation

Feedthrough and warm electronics installation

Installation Schedule (Inside Cryostat)

Still refining CE labor resources and schedule



Predessors for Installation Inside the Cryostat

Predecessors:

General

- Cryostat roof finished (walking surface done)
- Detector mezzanines in place
- Cryostat penetrations welded and leak tested.
- Detector racks, power to racks, and safety system in place.
- Power and fibers for the WIEC in cable trays. (in parallel to T_elec work)
- DAQ ready to readout the WIEC.
- Cryostat false floor installed in parallel to the cables in the cryostat
- WIFI inside cryostat

Bottom Electronics specific

- All Bottom Electronics parts are underground or in the SDWF
- The connection to the DAQ is fully tested with WIEC
- All test equipment and software is available.
- All cables are available and underground or in the SDWF

Integrated Floor and Cold Cable Installation

- Each sheet of floor is 9.842'(3m) long. Work row by row and complete all work before going to the next row. Two floor installation teams (4ea.) can be working at the same time one on beam right and one on beam left. The cryostat is 15m wide so assume 14m (45') is covered. The floor is 11+ 4 foot sheets wide so assume 12 sheets. On each side of the initial 2 sheet wide floor path you need ~5 sheets.
- Installation process (crew of 4 per side):
  - Clean floor under plywood (remove plastic cover and wipe down with alcohol?) - 30 min
  - Install floor cable tray 3 sections - 30 min
  - Install false floor 5 sheets - assume 1 hours.
  - Clean walls and roof – assume 2 hours
  - Install wall cable tray – assume 1 hour
    - Assume connections at top and bottom only
  - Install short cables for top CRP – assume 1 hour
  - Install cables and fibers in cable trays wall and floor. – assume 4 hours.
  - 10 hours total per 9.4' (3m) area over half the cryostat width. PD will add time if on the wall.

Separate crew of T_Elect. people can cable and test WIEC in parallel. Will be 1 day behind.

- Before covering the bottom cable tray with false floor, CE crew will test all cable connection with FEMBs and readout using WIECs on top of the cryostat (~2 hrs per CRP)
- 1.25 shift per row and 20 rows gives 25 shifts + additional time for testing and debugging

Labor Resource Needs (very preliminary)

~Week#-16 to -13 (power supplies and DDSS installation) :

- I&I technicians 3 people working day shift (transporting pallets)
- Bottom Electronics 6 people working 2 shift (3 per shift)
  - Assumes two teams of 2 people installing modules and 1 person setting up and testing
- I&I cabling technicians laying cables (cryostat to mezzanine)
  - Team of 3 people on day shift

Week#-4 to -1 (feedthrough and WIEC installation on roof):

- I&I technicians 8+2 persons/week working on 2 shifts (5/shift)
- Bottom Electronics 8 persons /week working on 2 shift (4/shift)
  - Two mechanical and two scientists → 4 per shift

Week# 1-4 (installation of cold cables inside cryostat and connection to WIEC):

- I&I technicians 14+2 persons/week working on 2 shifts (8/shift)
- Bottom Electronics 10 persons /week working on 2 shift (5/shift)

Week# 18+ (during Bottom CRP installation):

- 8 Bottom Electronics people for FEMB cabling and testing (2 CRP in parallel and 2 shifts)

Crane drivers inside the S cavern 6 persons/week working on 2 shifts
Surveyors 2 persons/week working 40h/week

Bottom CRP Installation

- Reference installation schedule assumes long cold cables are connected directly to the FEMBs inside the cryostat
- Need to coordinate with CRP Consortia on:
  - Design of the lifting fixture (CRP needs to be about 2m above floor during cable connection
  - False floor is already removed so CRP needs to cantilever off the lifting fixture
  - Needs to test FEMB connections after completing cable connections and also again after CRP is placed on the support stands and aligned
- As mentioned in earlier talks, exploring the option of a patch panel on the side of the CRP. In this scheme, final cable connections could be made after CRP is positioned on the support stands on the cryostat floor membrane

Interface with Other Subsystems

- Calibration installation will start on week #1
- Top CRP installation will start on week #3
- Ongoing testing and integration with DAQ
- Outstanding interface questions:
  - PDS feedthrough flange location and how many?
  - Is Bottom CE penetration also be used to support Field Cage?
  - Connection for Field Cage termination

Other Issues:

- Procedure and area for rework (e.g. replacing FEMBs)
- CRP acceptance test at SURF? Need to coordinate with CRP Consortium
- SDWF storage planning
- Define testing plan for the various installation stages
- Need to hash out all the installation details!!!

Review Charge Questions

1. Are the requirements documented? Are they reasonable?

   High level requirements are documented and we believe they are reasonable. We are still defining and refining some lower level requirements

2. Is the scope understood? Is there a team in place? Which institutions are interested?

   - Scope of bottom CRP CE is well defined with exception of potential interface changes with PDS and Field Cage (See Marco's talk on Interfaces)

   - Yes, a team is in place. See the Overview talk for the list of institutions

Review Charge Questions

3. Is there a reasonable plan for R&D and prototyping?

   - Bottom CRP CE benefits greatly from the R&D work done for FD1-HD

   - In addition, CRP system integration tests using the Cold Box and NP02 cryostat are planned

   - Other R&D are in progress to address some design issues (e.g. patch panel for CRP cables, CE box design, etc.)

   - We believe that a bottom CRP test in the nominal facing up configuration and on the support stands to validate the design is important before we start production. Not yet in the testing plan, but we are starting the discussion now with the CRP Consortium and others about it

Review Charge Questions

4. Is the design concept reasonable and feasible? Have appropriate mechanical and electrical calculations been performed?

- Piggyback off the knowledge from FD1. Keeping the design changes relative to FD1-HD to a minimum

- Cable rating calculations have been done for FD1. Using the same hardware and similar length cables. Should revisit again for FD2. Expect the same conclusions

- CRP mechanical analysis has been done by the CRP Consortium

- Structural analysis on the penetration is being done for FD1-HD. For FD2-VD, need to understand better the interface with the PDS and HVS Consortia before we proceed with possible design modifications (if needed) mechanical analysis