

EHN1 ProtoDUNE Cryostat update

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Change in cryostat dimension

- We were asked at the BNL engineering meeting to evaluate using the same size cryostat for protoDUNE as WA105.
- ProtoDUNE cryostat dimensions were
 - 8874 mm length (X – beam direction).
 - 7826 mm width (Y – drift distance).
 - 8073 mm height (Z – cryostat inner height).
- WA105 cryostat dimensions are
 - 8548 mm length (X – beam direction).
 - 8548 mm width (Y – drift distance).
 - 8550 mm height (Z – cryostat inner height).
- Delta for ProtoDUNE
 - -326 mm length (X – beam direction).
 - +722 mm width (Y – drift distance).
 - +477 mm height (Z – cryostat inner height).

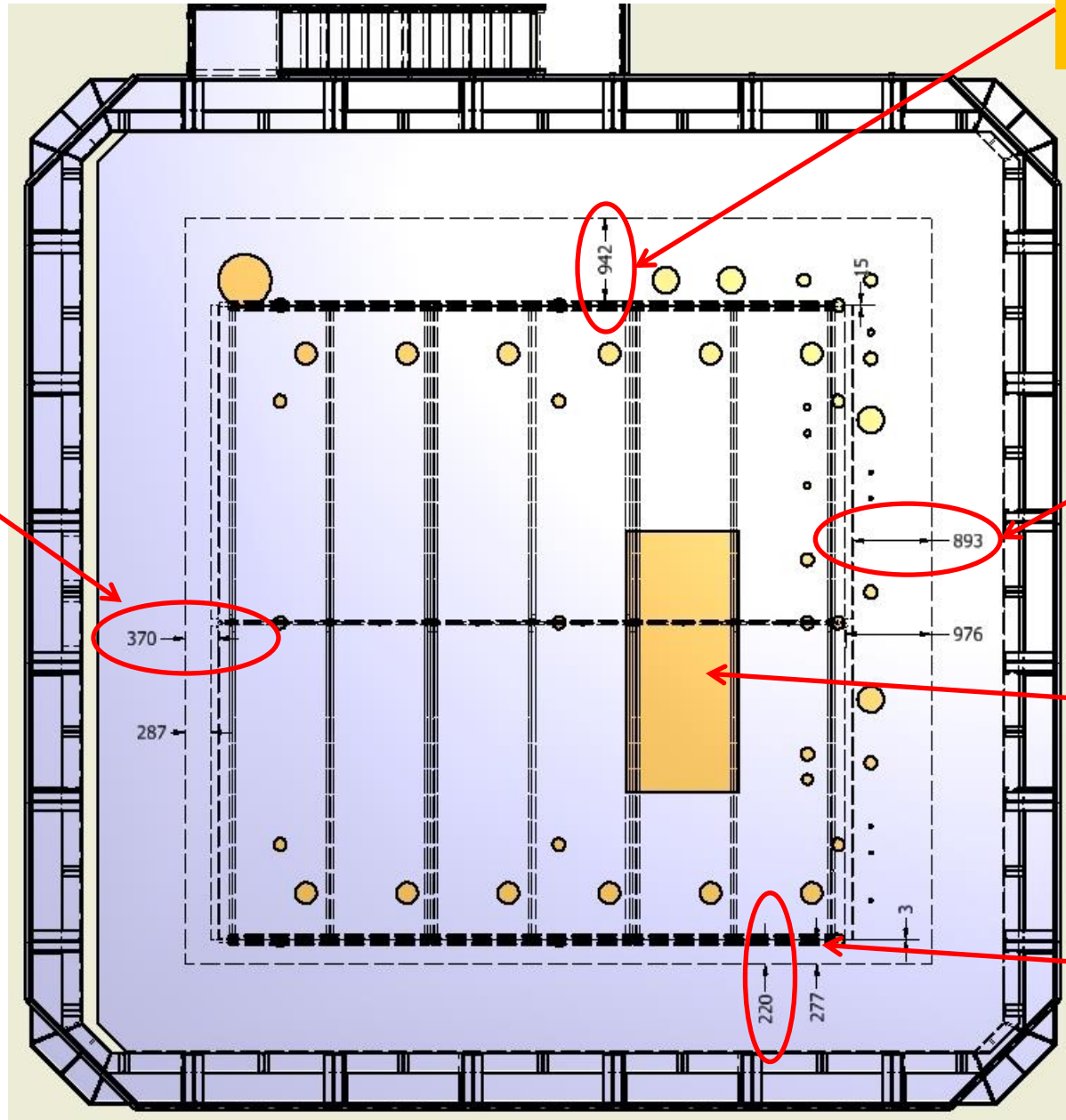
Assumptions for new layout

- Maintain 150 mm from outer most wire layer on one row of APAs to the tip of the membrane knuckle height (220 mm from membrane flat).
- Maintain distance of CPA/HV from membrane wall on beam entrance end of cryostat (370 mm from membrane flat).
- Position the TPC vertically in the liquid as close as possible to that planned for the far detector. This will be finalized with the design of the TPC support.
- Installation hatch will not cut the major beams on the top exoskeleton. This will be perpendicular to the rails that support the TPC inside the cryostat.
- Maximum diameter of feed thru tube is ~ 250 mm.
- HV for the cathode will be fed from one end only.
- Add a TCO through the side wall for personnel access to the inner volume during installation. This will be welded closed.
- Maximum size of installation hatch 1340 mm x 2980 mm.
- Secondary/emergency egress manhole diameter 609 mm.

Preliminary roof penetrations list

- 3 support points for each row of APAs at 3.6 and 2.5 m drift distances – Total 12.
- Cable feed thru. The current design utilizes a 14” flange, which is larger than the 260 mm maximum diameter. We doubled the number for each APA due to this. Total cable feed thrus – 12. This number could be reduced from 12 to 8 with an alternate design of feedthru.
- Support points for CPA row – total 3. (Note – we may need to add one to this to have two points of support on each side of the hatch).
- HV feed for CPA – total 1.
- Purity monitor – assuming 1 not shown in current layout. Possibly located near or through the manhole.
- Camera – assuming the cameras will be mounted to cryogenic pipes or other structures similar to 35t. The cables can likely be accommodated through the planned cable feed thrus.
- Laser calibration ports – none shown. Assuming we will need 2 ports in each drift field for a total of 4. Locations in line with the end cap field cage. Location in y direction TBD.
- Calibration fibers from CPA – 1 shown in line with the supports for the CPA rail. Position in x needs to be determined.
- Current total – 34 penetrations in roof for TPC.

TPC location inside cryostat



942 mm is the clearance of the TPC from the membrane flat

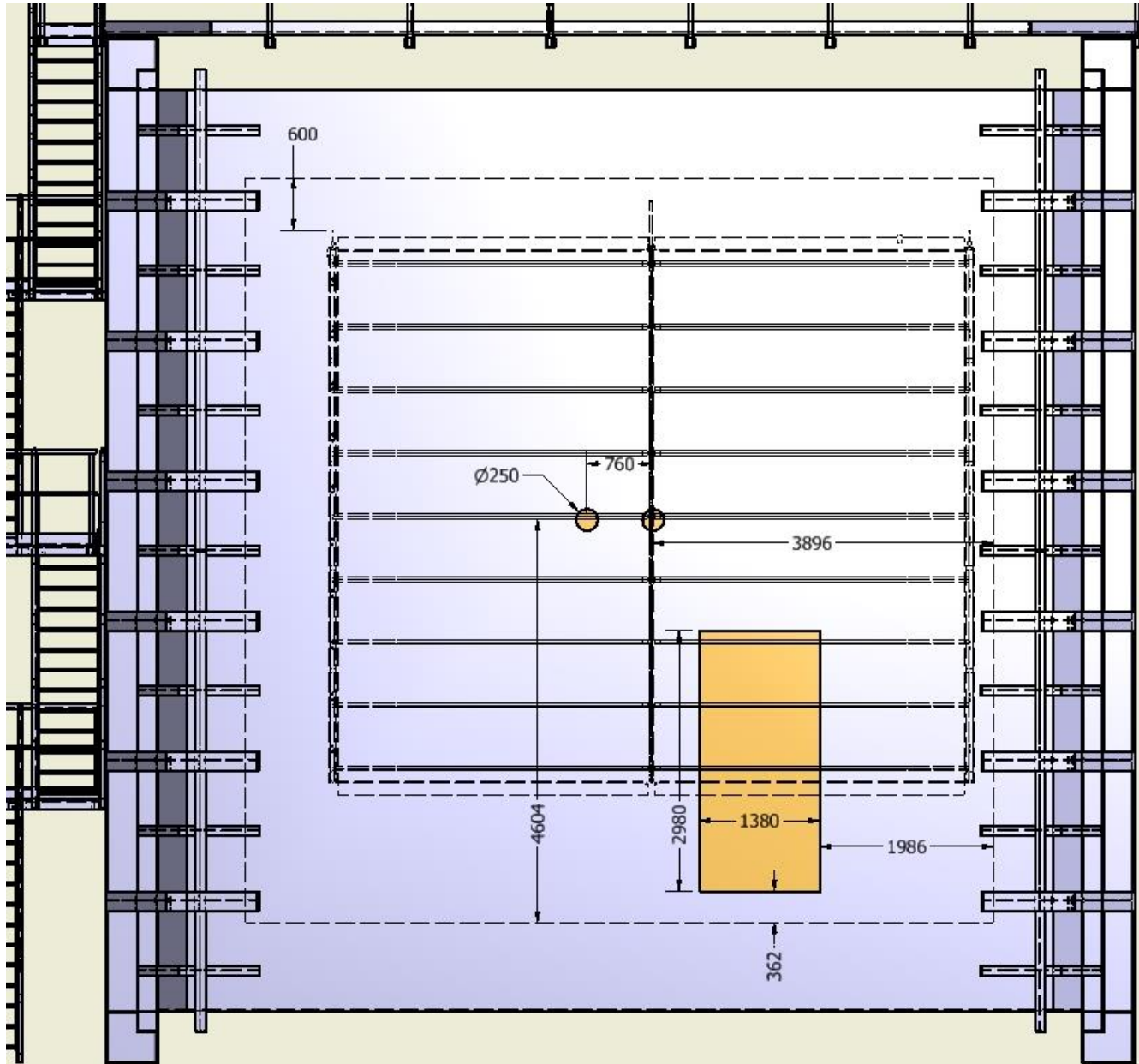
370 mm is the distance from the OD of the CPA frame to the membrane flat. This sets the X location.

893 mm is the clearance of the TPC from the membrane flat

Installation hatch location (1340 x 2980 mm)

220 mm is the distance from the outer most wire layer to the membrane flat. This sets the Y location.

Beam window and TCO



The vertical placement of the TPC needs to be set soon as this affects where the beam will enter the drift volumes. Current distance is 600 mm from membrane to top of electronics fin.

Based on the large gap between the TPC and the membrane on the left in this view, it may be better to have the TCO on this face of the cryostat. The access to close it will be better. We will discuss this change next week.

Summary

- This shows what penetrations are currently planned for the protoDUNE cryostat.
- All feed thrus are a warm design. There are no cold feed thrus planned.
- It is expected that some changes will be suggested by GTT after the design study is complete.
- What are the expected true position tolerances for the location of the feed thrus?
- We already have a short list of updates and plan to pass these onto the CERN cryostat group next week and during the engineering meeting Nov 9 to 12.
- Work is still needed with the cryogenics group to determine if any of the piping feed thrus interfere with the TPC.
- What else is missing?
- NOTE – we need a naming convention for the sides of the cryostat!

References

- Technical specification
 - <https://edms.cern.ch/document/1543254>
- PDF of current drawing file
 - <https://edms.cern.ch/document/1543241/1>