

DUNE-SP

Technical Integration

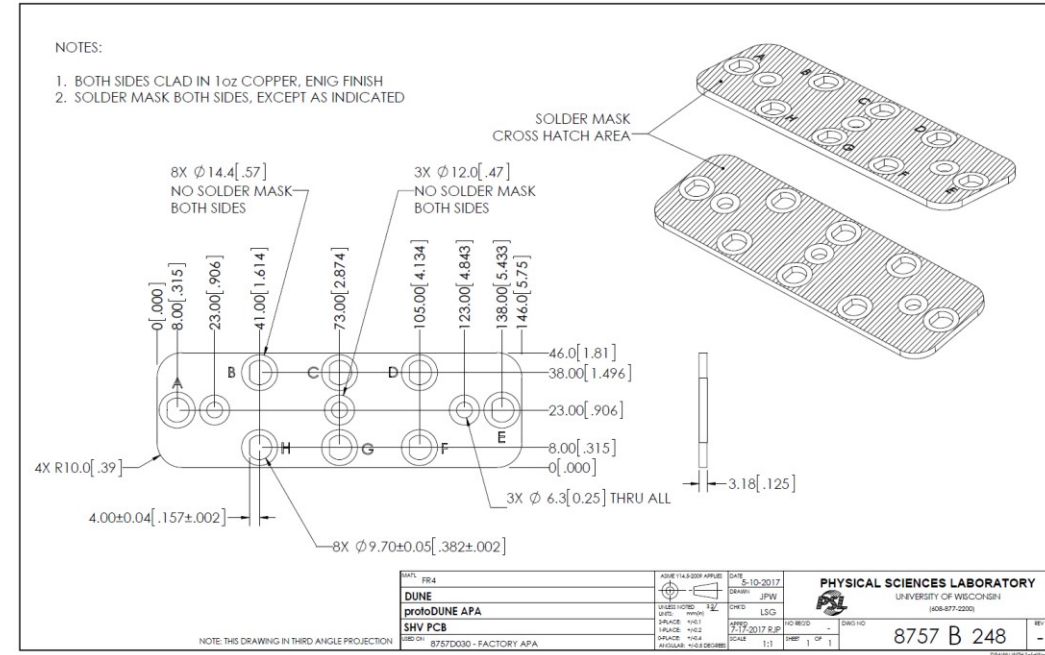
- Proposed SHV Panel for DUNE
- APA / TPC CE Interface: 8760450

June 4, 2020

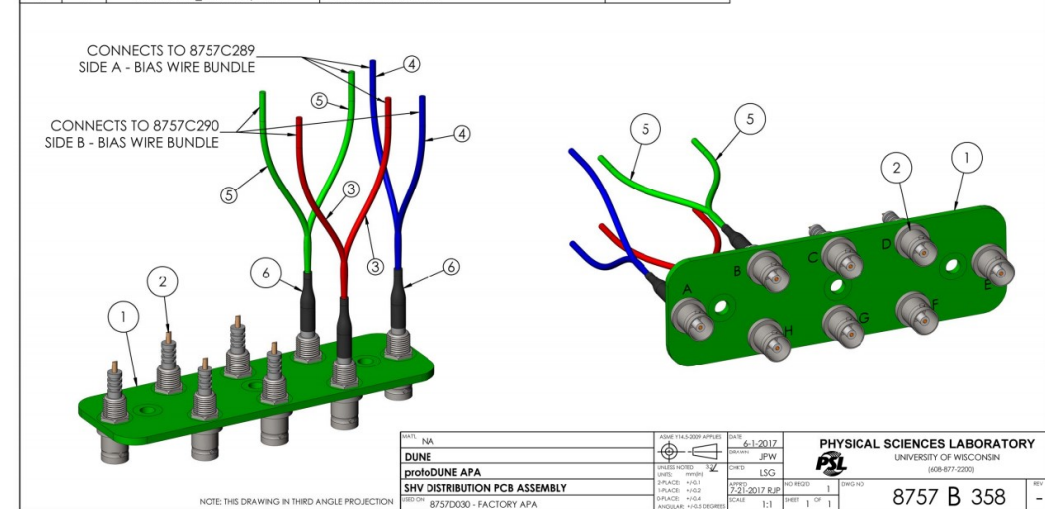
KDZ

protoDUNE SHV Panel

- 1/8" thick G10/FR4
- Eight connectors
- Fastened to the head tube at three locations. 40mm standoffs
- Access to connectors (3" protoDUNE APA frame) was not plentiful
- Referring to this as a PCB is not technically true

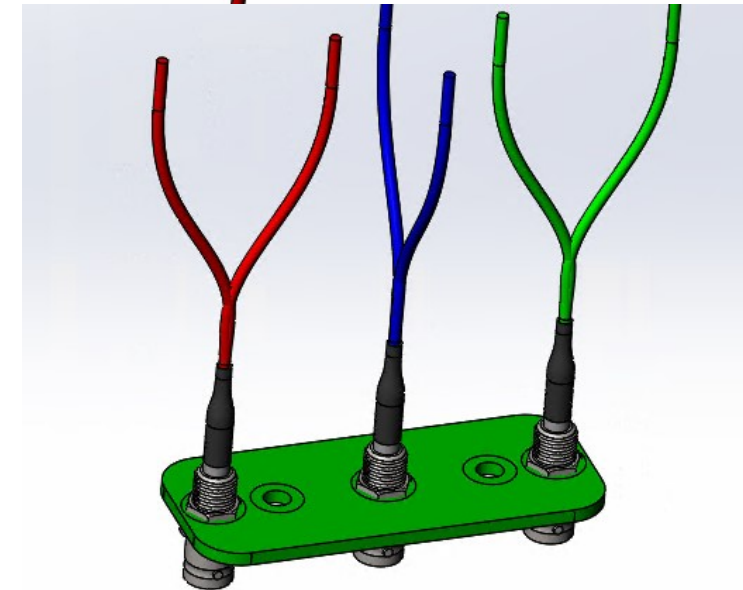
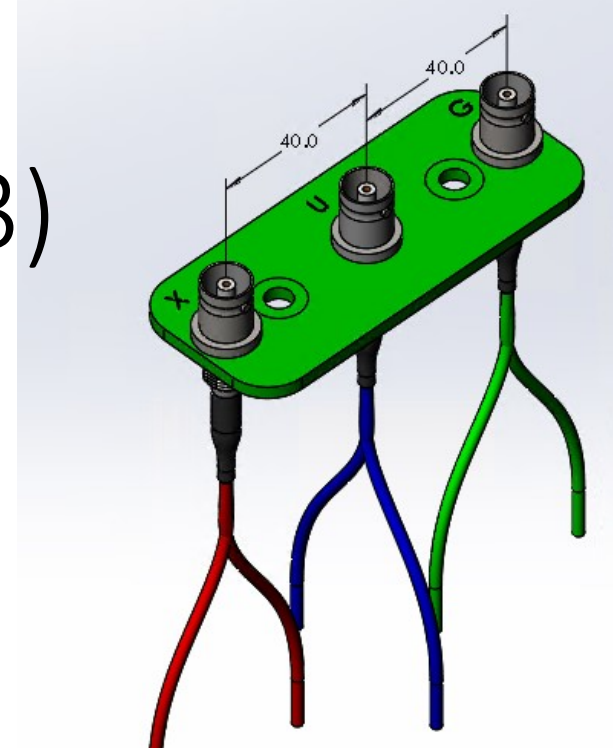


ITEM NO.	QTY.	PART NUMBER	DESCRIPTION	CONNECTION POINT ON PCB
1	1	8757B248	SHV PCB	
2	8	AMP-TE_51494-2	SHV BULKHEAD SOLDER JACK	
3	2	CNC TECH_3239-20-0500-004-1-TS	WIRE, HOOK-UP, 20 AWG, 3KV, 160°C, RED	H
4	2	CNC TECH_3239-20-0500-005-1-TS	WIRE, HOOK-UP, 20 AWG, 3KV, 160°C, BLUE	A
5	2	CNC TECH_3239-20-0500-007-1-TS	WIRE, HOOK-UP, 20 AWG, 3KV, 160°C, GREEN	B
6	3	RAYCHEM_NT-MIL-1/4-0-5P	HEAT SHRINK TUBING	

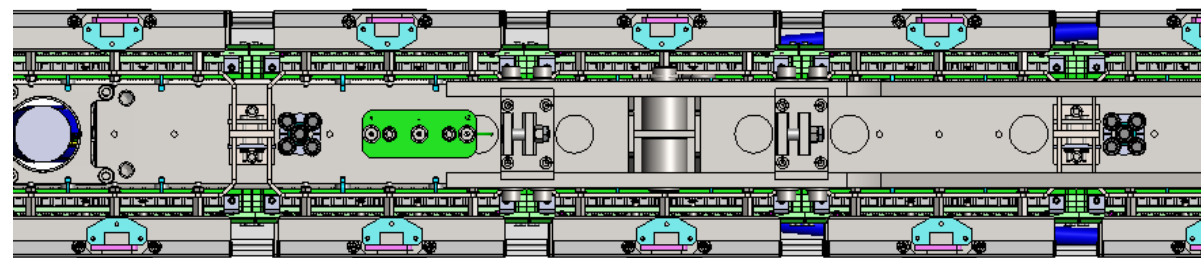
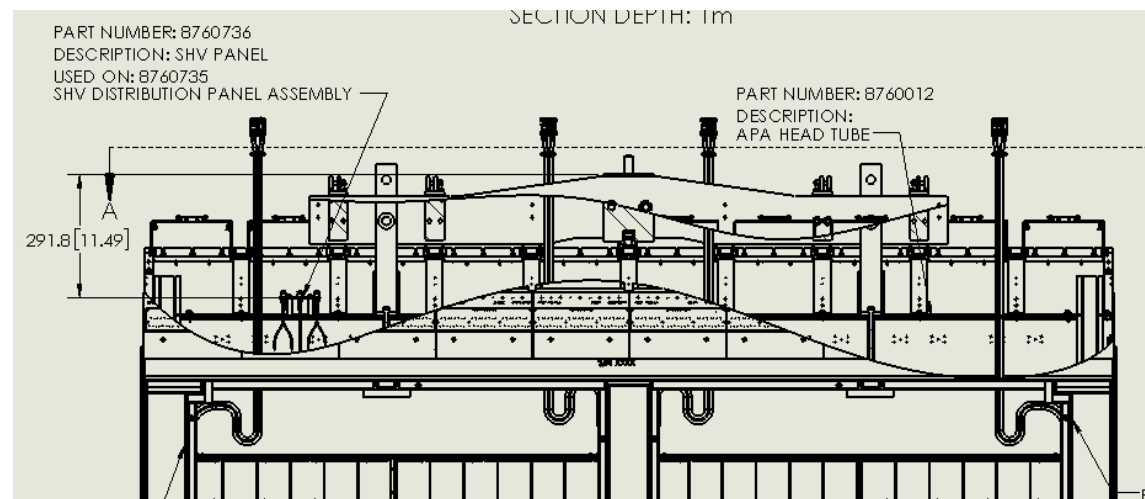
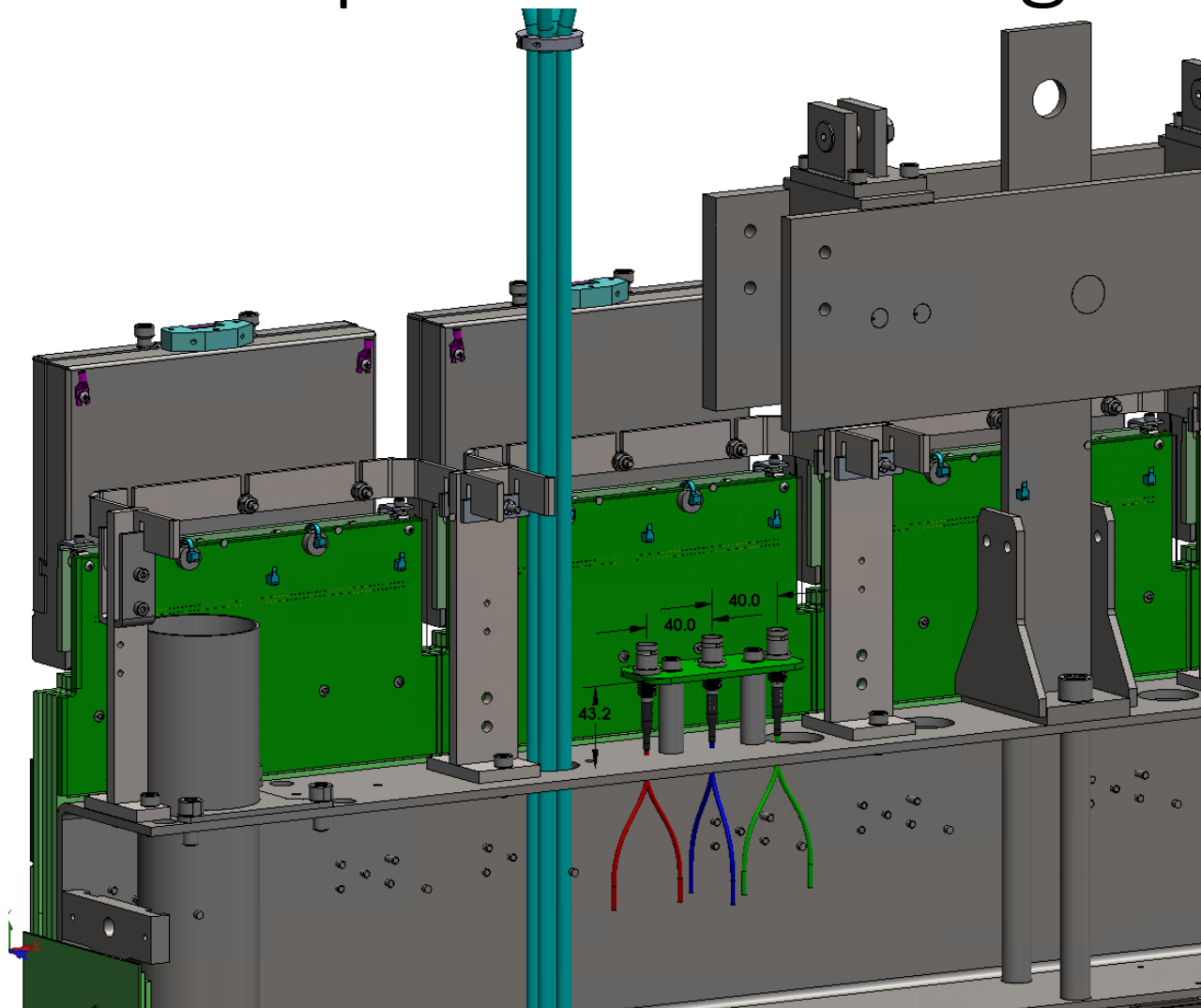


Proposed SHV Design for DUNE (1/3)

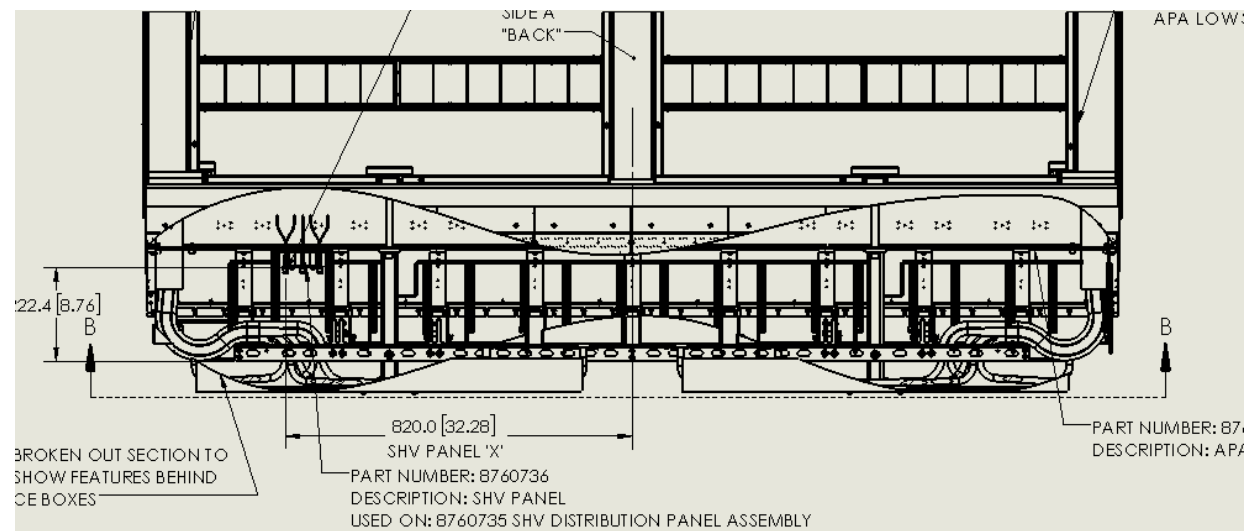
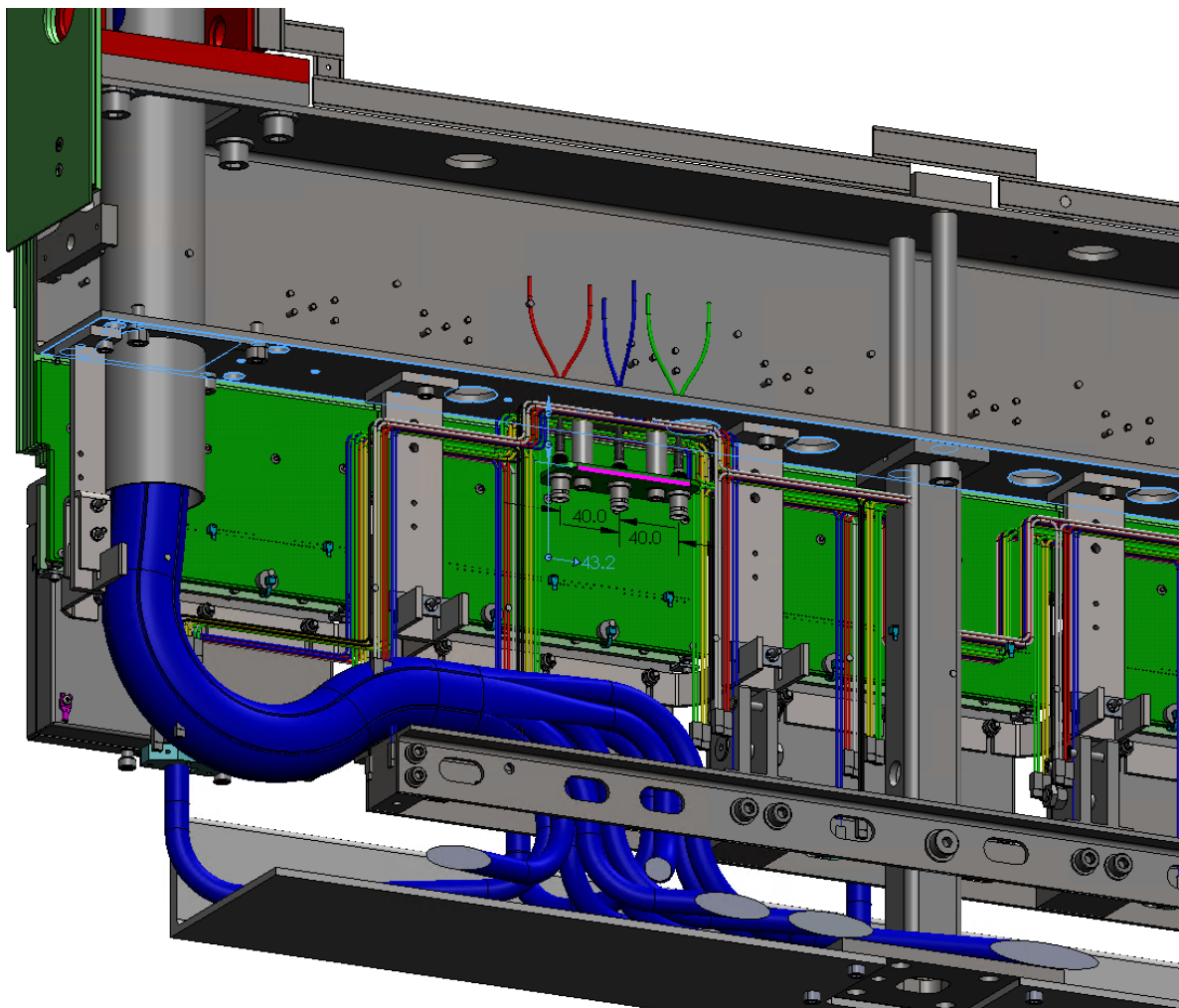
- Maintain material and thickness
- Reduce connector quantity to three
 - X, U, G
 - No FC Terminations board on APA
 - No active diverters
- Increase the spacing between connectors
- All connectors in line and centered between CE boxes
- Two connections to the head tube (reduced from three)
 - Shift the board away from PD cable pass through
- Move SHV board closer to the high slot side tube to facilitate distribution of cables
- Optimize the height of the standoffs (away from head tube)
 - Work with CE (Thanks, Manhong)
- Everything above **does not** require changes to the head tube



Proposed SHV Design for DUNE (2/3)



Proposed SHV Design for DUNE (3/3)



EDMS 2088736, ICD APA & TPC CE

view.

It should also be noted that inside the clean room and the cryostat it is very difficult to rotate the APAs around their vertical axis. As discussed below in Section 11 (Naming convention for APAs, FEMBs, and wires), the APAs should be installed in the cryostat all with the same orientation (the SHV board of both the upper and the lower APA should be on the east side of the detector). This requires that when the APAs are installed in their support frame they have an orientation that is consistent with this specification and that the orientation of the APAs inside the transport box is easily identifiable from the orientation of the box itself (possibly using cover panels with different colors). The APA group is responsible for defining the exact orientation of the APAs inside the support frame, of the support frame inside the transport box, and for marking the transport box in such a way that the transport team of the JPO can deliver the transport box in the right orientation inside the clean room.

9 Detector safety system action matrix

11 Naming convention for APAs, FEMBs, and wires, APA orientation

The APA consortium on one side, the TPC consortium and the offline reconstruction and analysis group have used a different convention for the numbering of the FEMBs and of the wires of the ProtoDUNE APAs. This was an unfortunate consequence of the limited amount of time available during the planning and construction of ProtoDUNE. The APA and TPC consortium agree that it is desirable to have a single naming convention for APAs, FEMBs, and wires for DUNE. The two consortia will work together with Technical Coordination and with the offline and online groups responsible for simulation, reconstruction, analysis, and triggering to define this unique naming convention prior to the beginning of the construction of the first DUNE APA. A recommendation should be presented to the technical and executive board prior to July 2020.

From the point of view of cabling, it is desirable to have all the APAs installed all with the same orientation inside the cryostat. In order to balance the number of SHV wires in the different conduits, the TPC electronics consortium requires that the SHV boards of all the upper and lower APAs are located on the east side of the detector (i.e. the SHV board for the lower APA is vertically aligned with that of the upper APA).

12 Future improvements to this interface document

Future versions of this interface document should include the following:

14

1

Project Document No:2088731

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- Add an interface drawing detailing the conduits inserted in the APA side tubes.
- Decide whether the fabrication of the cable grip supports should be a responsibility of the APA or of the TPC consortium.
- The naming convention for APAs, FEMBs, and wires should be included in this interface document (or alternatively a document discussing the naming convention should be linked from this document). Add drawings indicating the naming convention and the position of the APAs inside the cryostat.
- Channel numbers should be added to the drawing of the interface card between the CR board of the APA and the FEMB. A table should be provided that includes the map between the channel numbers on the interface card and the wire number on the APA (ground grid, U, V, X).
- The maximum voltage and current limits should be provided for the wire bias voltages. The maximum voltage ripple of the bias supplies is an internal requirement of the TPC electronics consortium, but it should be mentioned for completeness.
- Once the cable routing tests at CERN in the cold box and/or in a cryostat are completed, mention explicitly the maximum cable cross section that is allowed.
- Add commissioning plan in EDMS and reference it from this interface document.
- Define the action matrix of the DUNE detector safety system on the bias voltage supplies.
- Add a reference to [8760450 Interface APA SHV v3.PDF](#) in the section about the naming convention. This drawing should be updated to include the FEMB numbering scheme.

Drawing 8760450

- What information can be observed here?
 - FEMB numbers
 - Key APA features
 - Beam direction
 - Location of SHV panel
- Expect this to be uploaded to EDMS within a week
- Wire # and Pin # will be handled elsewhere

