**Questions from the APA Review Committee 7/13/16**

1. What, if any, are the electrical specs for the ground mesh (equal-potential variances across the surface of the mesh, resistance of connection to APA ground point)? **Can tolerate voltage swings of few 10s of volts. There will be a ground connection every meter, via conductive epoxy.**
2. Are there provisions to test this mesh's effectiveness at a series of frequencies or a frequency spectrum? **No**
3. The grounding attachment point, from the APA frame to the flange feed-through, appears to be the mounting brackets for the CE enclosures. Are these connections configurable? **Clarify**
4. How far along is the bias voltages' design? Are the board connections/connectors chosen? **Yes**, **connection is SHV on one end, and single-ended wire on other (filter-end). No, design is not done yet. Have concepts in hand for board connections (e.g. “daisy-chain”).**
5. Can the cable connections to the CE enclosures (shielded, metal shell D-sub, for an example) be placed on the outside of the enclosure and the enclosure be treated as a serviceable unit? **Present design is serviceable. Cable should be relatively easy to remove in current design (remove cover plate of box, and then few cable clamp screws). Data cable is not compatible with D-sub…connector is chosen for compatibility with high-speed cable.**
6. Do the wire combs that are used for stabilizing the wires extend down to the wire mesh? **Yes. Combs are glued to mesh.**
7. Why is 1 mA leakage current (assuming between the wire and the APA frame) acceptable? At 10 Meg-ohm isolation (stated in the spec), this current should be less than 100 nA. **Typo. Thanks for finding. Should be 0.5 nA. This number needs to be measured in cold.**
8. Are any of the bias filter caps electrolytic? **No.**
9. When (month and year) will a full size Photon Detector assembly be test fit into an APA frame?  (Slide in, bolted in, PD wire connection made inside the tube)?  The process prototype frame that we saw only had side guide rails (not fully attached) and no prototype PD. **We have mockup hardware on both sides of interface (e.g. PD and guide rails). A complete PD module has been inserted into a prototype frame (at CSU). Cable insertion will be tested…we have to check with CSU for date of this activity.**
10. Will an assembly of a full size photon detector be Cryo tested in a frame or frame mock up prior to CERN?  I note that for 35t modules, there were some thermal contraction issues and small parts of the PD broke off and were trapped inside the APA’s forever.  (I think the PD in that case was attached at both ends.) **Question likely more targeted to PD group.**
11. Will the six APA’s (UK and U.S.) be identical?  Same dimensions, features and thicknesses and materials? **Yes**
12. There is a right and left side to an APA because of the side attachment features (pins and slots) and alternating PD slots.  Is the top head beam symmetric so that the Field cage, cold electronics mounting brackets, etc. can be attached to either side?  Are the features at the bottom also symmetric for attaching the field cage, etc.? **Yes. At some point it will have a “handedness” due to cable routing, etc…**
13. How do we get to production rates down from of 1 APA every 2mths to 1APA every 2 weeks for the DUNE project? **Gaining experience, increasing automation in fabrication and testing, parallelization when possible, more process carts…**
14. When will the Cryo cold test procedures/design be available? **This Fall.**
15. Is it possible repeat (a significant fraction of) electrical tests after the cold test? **Yes**
16. Can you envisage a procedure to validate the use of a given material inside the fiducial volume from the radiopurity point of view? **Yes. Can approach this via simulation. Also will have “coupon” samples stored.**
17. Mesh connection should be low impedance – I think we have agreed to silver epoxy connections every meter **We agree.**
18. CR Board is not finalized yet.  This board should be reviewed prior to production along with all ground and wire bias jumper wires. **We agree.**
19. All components on CR board should be documented and proved tested/reliable in cold. **We agree.**
20. Complete schematic of wire bias filter board should be provided – should be reviewed before production.  **We agree.**
21. Low impedance connection of APA frame to CE box should be documented/described **We agree.**
22. Cable tray should have a mechanical mock-up to show that cables fit. **CE group is planning mockup of this tray.**
23. Can you provide an example of the procedures and travel documents that will be adopted during the APAs production, assembly and test? This will include the materials certificates? **Yes. Material certificates will be catalogued and referenced in travelers.**
24. Can you specify what are the acceptance conditions upon APAs delivery to CERN? **We have more work to do on this.**
25. Can you provide the cleaning and handling (related to cleaning) procedures during assembly, testing and installation? **Component cleaning procedures from MicroBooNE are available, and are available to help develop similar plan for portoDUNE. Needs more work.**
26. Materials samples have to be stored for radio-impurities contamination. A database of materials contamination should be produced. The specifications for welding should explicitly exclude the use of Thorium tips. **We agree**
27. Can you update and expand the list of requirements for physics? **We are working on updating the requirements.**
28. Provide a FEA analysis documentation for the APA structural elements following the Eurocode 3 (similar to the ANSI 360) showing compliance for the stresses in the beams, the wires, the bolts and the welds including the interface equipment for all load cases including the transport, installation (crane and rails transport), cool down , pressure test and operation. Seismic need to be clarified from CERN side. **Will consult with CERN to determine what additional FEA is required.**
29. On which standards are based the manufacturing controls (especially the welds)? **We will investigate standards and choose one appropriate to follow.**
30. Could they provide the materials material properties certificates from the manufacturer? What are the temperature effects on the material properties? Is that measured and documented? **A database of material certificates will be kept. Temp. effects for some common materials (304SS, FR4) is available. Cryogenic temp. effects for some materials needs to be tested. We may need some clarification here.**
31. The equivalence between ProtoDUNE and Dune structural configuration should be demonstrated. **The support point and load cases for protoDUNE APAs were developed for DUNE. Some clarification may be needed here.**
32. The maximum deformations of the wires and the frame should be provided. All the tolerances should be added (including the ones coming from the supporting structures (cryostat and supporting cage) to check that the final positioning in operational configuration is not exceeded the requirements. **Based on analysis done to-date, we do not anticipate any problems with these unique load cases. We recognize that various operational scenarios (e.g. filling) need to be considered and have FEA performed. Proper documentation will be provided.**
33. All the installation and fabrication process documentation should be reviewed by (even internal) safety independent process and safety documentation should be presented. All transporting / handling tool should be certified by independent body. **We agree.**
34. The wires should be shocked protected during transport and decoupled from the possible transport vibrations. This should be documented. **We agree.**
35. Who is globally doing configuration control, i.e. interfaces and envelopes control to make sure that there are no interference or interfaces issues? **Installation and Integration group. There is an integrated model that is used now to verify there are no interference/interface issues.**
36. I know this is under discussion currently, but how do we make sure that the manufacturing process will be identical in UK and in US? What are the UK limits of responsibilities? **This is a fairly new development. We are just getting started working on the plans to integrate UK/US efforts.**
37. Which institution is designing the lifting fixtures that will be used at CERN? What is the process for approving these lifting fixtures? **PSL and Rochester (Bob Flight). Exact procedure has not yet been documented, but it will include load testing and proper documentation. Requirements from CERN will be investigated.**
38. What is the planned process for obtaining a sign-off from affected system managers prior to making major APA procurements? **We have started developing a formalized process that will lead to a sign-off between system managers.**