Recommendation Table

**SBND TPC Technical Review**

**28-29 September, 2015**

| # | Recommendations | Assigned to | Status/Action | Date  Updated or Completed |
| --- | --- | --- | --- | --- |
|  | 1. **TPC Components – APA Frame** |  |  |  |
| 1. | Look into why the company promising +/-2mm is so different from the others. Are they believable? Or, are the other companies just being overly cautious? |  |  |  |
| 2. | Survey additional companies for the manufacture of the APA frame and attempt to identify manufacturers that have the capability to manufacture the frames within spec. Solicit recommendations from candidate companies about achieving the flatness spec. |  |  |  |
| 3. | Consider relaxing the flatness spec. Pursue the backup plans of leveling bars and/or shimming the geometry boards that define the wire planes |  |  |  |
| 4. | Develop flatness measuring tooling for the APAs. This tooling should be used to:  1. Ensure the flatness spec is met for each APA frame  2. Measure flatness deviation to develop a shimming plan for the geometry boards that define the wire planes |  |  |  |
| 5. | A hand calculation shows the deflection of the frame under its own weight when supported at the ends would be roughly 0.5mm. This is not a problem since the APA will be used vertically. It is important however that the group is clear about what they mean by flatness and have defined a reference support condition for measuring flatness |  |  |  |
| 6. | Reexamine the loading and constraint conditions in the FEA of the APA frame. Make sure they are realistic and accurately reflect the actual loading and constraint |  |  |  |
|  | **TPC Components – CPA Frame** |  |  |  |
| 7. | To fully define the design of CPA, complete investigation on planarity and integration with TPC cage. |  |  |  |
| 8. | Develop procedures for stretching mesh over frame and for QA of finished product to eliminate possibility of sharp/frayed edges. |  |  |  |
|  | **TPC Components – High Voltage Feed-through** |  |  |  |
| 9. | Prototypes must be tested extensively in pure, non-boiling LAr. Rather than building new facilities (e.g., at Yale), consider using existing cryogenic HV testing facilities at Fermilab and/or CERN. |  |  |  |
| 10. | A single requirement for the electric field should apply to all detector elements, including HV FT. |  |  |  |
|  | **TPC Components – Field Cage** |  |  |  |
| 11. | Pursue the alternate design. Make this baseline when appropriate |  |  |  |
| 12. | Clearly prototyping studies are on the critical path. A back-up solution based on a more classical implementation of the field cage with electrodes made of metallic tube rings (as in MicroBooNE and ICARUS) should be kept available |  |  |  |
| 13. | Whichever field cage design is chosen, a method for entering the TPC interior should be required. |  |  |  |
| 14. | The motherboard/field-cage-bracket design interfaces should be carefully coordinated. The possibility of mechanical interferences should be eliminated, either by modifying bracket design, or by modifying motherboard design, or both.  (This maybe should be a recommendation for interfaces between field cage and cold electronics). |  |  |  |
|  | **TPC Components – APA Wire Winding** |  |  |  |
| 15. | Develop tests and fixtures to qualify the precision of the wire placement for each facility. The tests and fixtures should be common between the two facilities. |  |  |  |
| 16. | Develop apparatus for measuring the anode wire tension to be used at both wire placement facilities and for use as spot checking APAs as they arrive for TPC final assembly. |  |  |  |
| 17. | The timeline proposed by the collaboration for prototyping, construction and assembly of both the wiring tooling and the quality monitoring systems has to be strictly followed – implement careful tracking of progress. |  |  |  |
| 18. | Tight quality assurance and quality control procedures should be put in place to avoid the minor overlaps and misalignments that may occur between adjacent geometry boards. |  |  |  |
|  | **TPC Assembly & Installation Process** |  |  |  |
| 12. | The engineers should satisfy themselves that the diagonal tension members will not cause warping of the APA. |  |  |  |
| 13. | Schedule meetings with alignment/metrology group to identify areas where their input may help inform procedures. |  |  |  |
| 14. | Plan to perform full sized tests of assembly steps, ideally in the space to be used for the final assembly. This may require development of mock ups of various components. |  |  |  |
| 15. | Develop inspection/qualification plans/tests for components before they are assembled into the TPC. Similar tests of the electronics and final cabling should be included prior to the TPC installation into the cryostat. |  |  |  |
| 16. | Develop plans for attaching the cryostat top outside of the D-Zero Assembly building. |  |  |  |
|  | **TPC Installation & Integration** |  |  |  |
| 17. | Review the process of transferring the TPC from being supported directly by the transport frame to being supported by the cryostat lid. Make sure the two sets of supports don’t interfere with each other and that no part of the TPC is ever unsupported. |  |  |  |
| 18. | Determine how the TPC will be brought from the assembly building to the detector building and then unloaded and installed while maintaining adequate cleanliness. |  |  |  |
| 19. | Check the process of removing the TPC from the transport frame at the detector building to make sure that it can be done with a single crane (or that a second is available if needed). |  |  |  |
| 20. | Careful communication between light detection system and TPC is encouraged, particularly in final design stages for LDS, where interfaces for installation and assembly will be critical. |  |  |  |
| 21. | Set up meetings with FNAL survey/alignment group to identify which parts of detector will need as-found survey vs. alignment help during assembly and installation. |  |  |  |
|  | **Electronics & Readout – Cold Electronics** |  |  |  |
| 22. | The main argument to adopt double flanges seems to be the issue of argon gas purity possibly impaired by a less than one meter length cables. Anyway the SBND has in argon gas phase a sizable amount of components that could be a source of pollution that will require recirculation in any case, in accordance with the results form other liquid argon TPC. In this perspective double flanges look as an overhead that could be a source of extra problems rather than a solution. The statement that double flange would relax tightness requirements ignores the back-diffusion effect that will allow oxygen contamination, even if reduced, that will limit electron lifetime. Not to mention the increased costs and number of connections that will be at least doubled. |  |  |  |
| 23. | In general the mechanics of the cold electronics (connectors, mezzanine boards, piggy-back etc.) looks rather complex and the number of connections are a potential cause of failures. (see also the previous recommendation). |  |  |  |
| 24. | A plan for board revision should be developed including additional boards from early revisions for testing by the data acquisition and slow monitoring groups.  Action? |  |  |  |
| 25. | Bring the plans for testing and qualification of all circuit boards to the same level. |  |  |  |
|  | **Electronics & Readout – Warm Electronics & Trigger** |  |  |  |
| 26. | The trigger strategy is well known and defined however the hardware implementation is not yet fully defined. In a liquid argon detector the light signal must play a fundamental role and this issue has not been described in any phase of this review |  |  |  |
|  | **Electronics & Readout – Infrastructure** |  |  |  |
| 27. | The guidelines, with special reference to the grounding layout, should be carefully implemented. |  |  |  |
| 28. | A dedicated group should be established to design and implement a slow controls and monitoring system |  |  |  |
|  | **Electronics & Readout – Data Acquisition** |  |  |  |
| 29. | A coordination effort is required for compatibility of programming languages used in different sections of DAQ. MicrobooNE experience is recognized to be a reference. The hardware implied is listed in detail. The list of people involved was also presented together with technical labor support from institutions/ Design reviews of board documentation (schematic, layout, manuals,..) is always a good idea. The project should decide at what level to require this review. |  |  |  |
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