

Design Review ProtoDUNE-DP:

Photon Detection System, Slow Control

24-25 April 2017

3.1 Findings

- The photon detection system is based on Hamamatsu 8'' photosensors already successfully used in LAr
- The base employs positive HV with PMT signals read-out after a splitter. This system has been proved (at room temperature) by Double Chooz and was tested before TPB coating at room and liquid nitrogen temperature by ProtoDUNE-DP.
- Two options (laser-based and led-based) for the light monitoring and calibration are still open and tests are ongoing.
- The PMT readout is based on an ASIC+FPGA card served by a commercial mezzanine optimized for FPGA-based carrier board that is in prototyping phase.
- The Slow Control component sensors and actuators have been designed. The home-made LEM HV distribution system employed in the 3x1x1 prototype is now the baseline solution. A commercial based backup solution is under investigation, too.
- The Q/A and installation of the PMT and Slow Control has been defined and is mostly driven by the schedule of the TPC installation.

3.2 Comments

- The lateral forces due to LAr convection in the filling and running phase are not fully understood and calculated. So, gluing of the PMT support on the membrane is mandatory and it is the baseline option for the Collaboration.
- The PMT signal readout system is complex and requires prototyping and development but it is scalable to DUNE. The first integration of the system with the DAQ will be tested not before January 2018.
- No direct tests of TPB thickness or quantum efficiency are foreseen after coating.
- Direct tests of the level meter, the adjustment system and other slow components will be available after the operation of the 3x1x1 detector

3.3 Recommendations

1. The specifications for the maximum weights and torque of the cable tray have to be calculated to properly dimension the PMT and Slow Control cabling
2. The possibility to perform thickness tests after the TPB coating employing ICARUS facilities at Padova should be investigated.
3. Finalize the design of the PMT attachment based on the cryogenic glue.