**DocDB 6727**

**DUNE Interface Document: DAQ/Single Phase Photon Detection System**

**Version 2.0, 7-31-18**

**Definition:** This document describes the interface between the DUNE single phase far detector DAQ and Single Phase Photon Detection System(PDS). This document describes the elements of the scope of each subsystem at the interface between them.

**Data Physical Links:** Data are passed from the PDS to the DAQ on optical links conforming to an IEEE Ethernet standard. The links run from the PDS readout system on the cryostat to the DAQ system in the Central Utilities Cavern (CUC).

**Data Format:** Data are encoded using a data format based on UDP/IP. The data format is derived from the one used by the Dual Phase TPC readout. Details will be finalized by the time of the DAQ TDR.

**Data Timing:** The data shall contain enough information to identify the time at which it was taken

**Data Volume:** The DAQ will have provision to receive up to 8GBit/s of data from the PDS per APA.

**Data Link Speed:** The PDS data for each APA may be transmitted either on multiple links following the 1000Base-SX standard (preferred) or a single link following the 10GBase-SR standard. In either case the fibre will be chosen to give sufficient margin for the distance from the cryostat to the CUC. Details will be finalized by the time of the DAQ TDR.

**Trigger Information:** The PDS may provide summary information useful for data selection. If present, this will be passed to the DAQ on the same physical links as the remaining data.

**Timing and Synchronization:** Clock and synchronization messages will be propagated from the DAQ to the PDS using a backwards compatible development of the ProtoDUNE Timing System protocol (See Dune docdb-1651 ). There will be at least one timing fibre available for each data link coming from the PDS.

**Power-on initialization and Start of Run setup:** The PDS may require initialization and setup on power-on and start of run. Power on initialization should not require communication with the DAQ. Start run/stop run and synchronization signals such as accelerator spill information will be passed by the timing system interface.

**Local Monitoring:** The PDS may require network connections for local monitoring and debugging. These are the responsibility of the PDS.

**Software:** There should be no software required for the PDS to DAQ interface. The definition of the data format should provide the required information.

**Interaction with other groups:** Related interface documents describe the interface between the CE and LBNF, DAQ and LBNF, DAQ and Photon and both DAQ and CE with Technical Coordination. The cryostat penetrations including through-pipes, flanges, warm interface crates and feedthroughs and associated power and cooling are described in the LBNF/PDS interface document. The rack, computers, space in the CUC and associated power and cooling are described in the LBNF/DAQ interface document. Any cables associated with photon system data or communications are described in the DAQ/Photon interface document. Any cable trays or conduits to hold the DAQ/CE cables are described in the LBNF/Technical Coordination interface documents and currently assumed to be the responsibility of Technical Coordination

**Integration:** Integration testing will include, but not be limited to, the following tests:

-Vertical slice testing at the CERN cold box and/or the Fermilab cold electronics test stand at PAB

-Integration testing at the ITF, including cold-box testing of all APAs with mounted PDs prior to installation in the far detector

-Continuous integration testing as APAs are installed into the FD cryostat. Ideally these tests will include weekly or by-weekly dark-operation tests of installed PDs through the DAQ.

 The DAQ consortia will provide hardware and software for a “vertical slice test” The PDS consortia will provide PDS emulators and PDS readout hardware for DAQ test stands. (The PDS emulator and PDS readout hardware may be the same physical object with different configuration). Responsibility for supply and installation of DAQ/PDS cables in these tests will be defined by the time of the DAQ TDR.

**Installation:** Responsibility for purchase of the DAQ/CE fiber is assigned to the DAQ . The installation of the DAQ/CE fibers is assigned to the TC team. Post-installation testing of the fibers is assigned to the DAQ..