4.5 In-tank cable plant

We describe here the cable runs to and from the in-tank components, primarily from a mechanical point of view. The remaining cabling is described in Secs. 3.5.4 and 6.8; all electrical considerations are described in the electronics section, Chapter 6. We concentrate on the connections to the 8-inch photomultiplier tubes. Where they differ, connections to the various calibration elements are discussed with the calibration systems themselves.

The in-tank cable run links the photomultiplier tubes to the preamplifiers, located in crates in the tank access area next to the tank access port. A single RG-58 cable both supplies high voltage to a PMT and carries the signal from PMT to preamp. As described in the previous section, we use a teflon-jacketed cable, Belden 88240, for compatibility with the mineral oil. This cable has the further advantage of being plenum-rated. It is thus suited for the run under the computer floor to the preamps. As most of the run is in the veto section of the tank, we use cable with a white jacket. The cable terminates at the preamp end in a SHV jack which mounts into a multi-connector block. The run from this connector is down the preamp rack and under the floor of the tank access area to the access portal of the tank.

The penetration of the tank wall is through airtight feedthroughs bolted to the flange on the tank's access portal (Sec. 3.2.4). The oil level in the access portal remains below these flanges – the seal is to maintain the nitrogen atmosphere in the tank. Each flange accepts four bundles of 98 cables. For mechanical reasons, each bundle is divided into two 49-cable sub-bundles, each with its own feedthrough. A feedthrough and the panel on which it mounts to a tank flange are shown in Fig. 4.14. The feedthrough is made of two aluminum plates with holes for the 49 cables. Captured between the plates on each cable is an o-ring, making a gas-tight seal.

To maintain uniformity in pulse shape from tube to tube, cables of a fixed length, 100 feet, were used for almost all channels, despite the disparity in the length of the cable runs to the top and bottom of the tank. (As a hedge, a few of the cables with the longest runs were cut to 110 feet. The excess can be removed if 100 feet suffices.) Since there is a lot of excess cable, and we do not want excessive slack that will block light collection in the tank, the each cable is captured in the feedthrough with only the length necessary to reach the PMT (with extra slack for splicing and rounded up to the next 5-foot increment) extending from the inner side. The bulk of the slack is thus gathered under the computer floor in front of the preamp racks.

The bundles were all fabricated in advance: the cables were cut to length, threaded through the feedthrough, captured with the appropriate lengths on either side, and labelled, and the SHV connector mounted and tested. Each bundle was then passed through the port in the tank as a unit. Once through the port, each bundle was strain-relieved at the bottom of the access portal in a heavy bar mounted on studs welded to the tank. From this corner, the cable

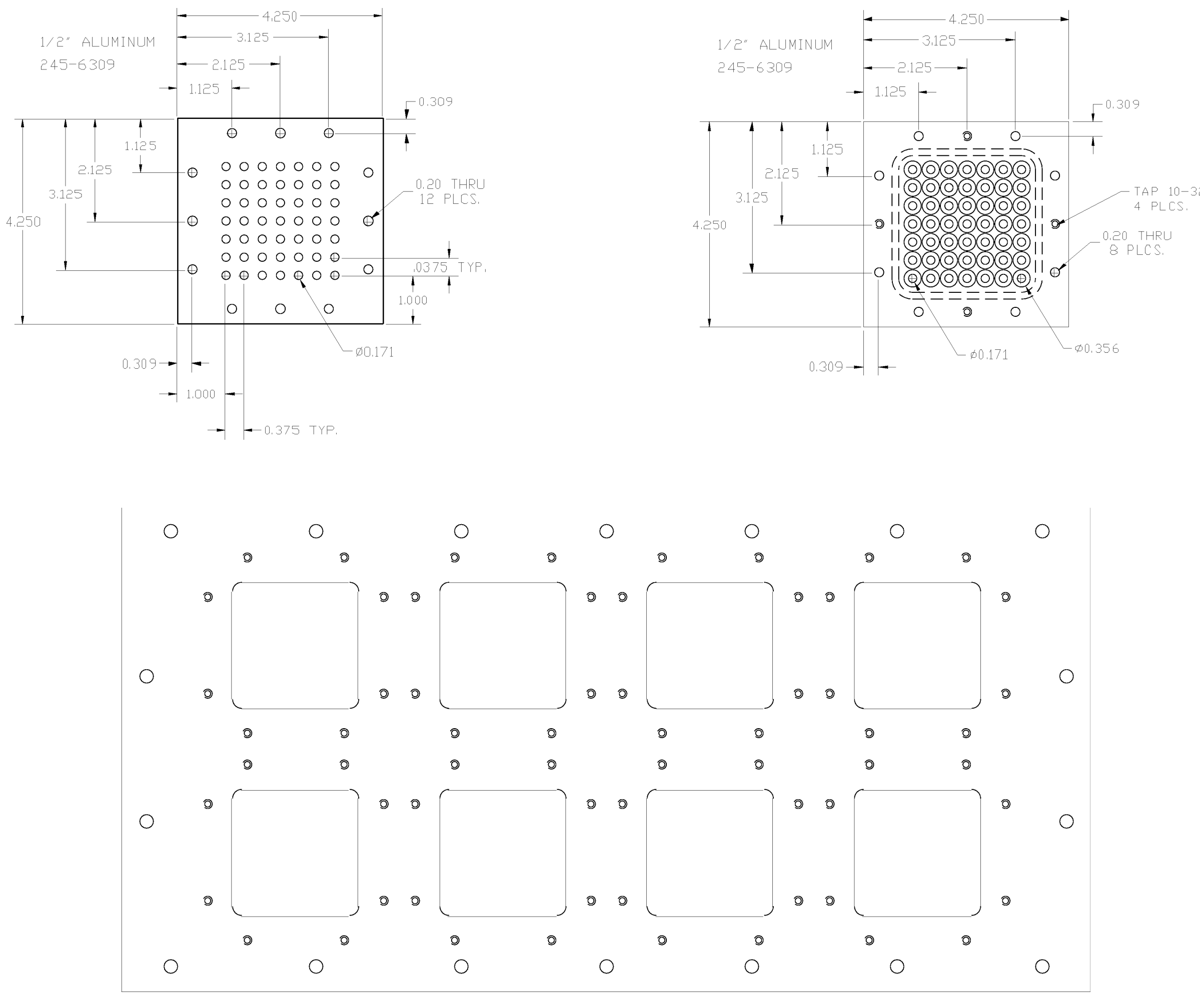

Figure 4.14: Cable feedthrough and mounting panel.

bundles run down the tank wall, held in place by steel straps spanning pairs of studs on the wall. Each cable bundle serves the main and veto PMT's in a vertical slice of the tank from top to bottom. At a horizontal row of main or veto PMT's, cables are peeled from the nearest bundle and routed to each PMT. Cables for the main PMT's cross the veto region and penetrate the optical barrier through pairs of holes near the center of each panel. We simply let each cable run from the tank wall directly to its hole in the optical barrier, except where this path would drape the cable directly in front of a veto PMT. After passing through the optical barrier, the cable is spliced to the 5-foot piece of cable that is permanently attached to the PMT base. The splice is made with a coaxial splice kit (Raychem B-202-81, formerly D-150-0071). This system was used in LSND and found to be very reliable. To seal out oil, the splice is covered with a length of $\frac{3}{8}''$ teflon shrinktube (SPC Technology SST-024), which shrinks onto o-rings on either side of the splice.

As each splice is made, it is tested. Prior to splicing, a pulser is connected to the cable at the preamp end and the reflection (at about 370 ns) is observed on the scope. Since the bases are back-terminated, the disappearance of the reflection indicates both that the splice is good and that the labels at the two ends of the cable match.

4.6 PMT preparation

After the PMT's have the bases attached, are tested, and are assigned to a location in the tank, they are prepared for installation. This process consists of these steps for each tube:

- It is washed in a mild solution of detergent and distilled water, then rinsed in clean distilled water, then allowed to dry for 24 hours. The main purpose is to remove the scintillator-doped oil residue from LSND.
- New tubes are mounted in stands. Old tubes destined for the main tank are re-mounted in stands. The centering clips that hold the neck of the tube are not installed until after dipping.
- It is dipped in black Master Bond EP21LV encapsulant from the base up to the bottom of the globe. This is to protect the oil from the components of the base and vice versa and may also serve to attenuate any light generated by breakdown in the dynode structure of the tube. Old tubes were already coated in black Hysol. This was found to contaminate mineral oil (Sec. 4.4), so the old tubes are also dipped in Master Bond.
- Veto tubes are removed from their stands and mounted in veto mounts.
- Main tubes have the centering clips attached around the tube neck. A stripe of Master Bond is run down the neck of the tube over the silicone rubber