2 Fabrication of T-counters

The configuration of a T-counter is shown in Fig. 1. The counter was cut of Bicron BC404 scintillator plate of 7 mm thickness. The plastic profile is trapezoidal with a 7.5^o bevel to pack closely with its neighbours with an average gap of 0.5 mm (compared to 4.5 mm in the old counters). The counter length is 520 mm, largest width is 119.3 mm, smaller width is 117.5 mm. 17 grooves run along the slab with 6.9 mm spacing.

Instead of using a wrapping material for a reflector we applied a novel technique: a scintillator was etched by a chemical agent that resulted in the formation of a micropore deposit over the plastic surface, following which the diffuse film is fixed in a settling tank. The deposit thickness depends on the etching time. An advantage of this approach over the commonly used white diffuse papers is the almost ideal contact of the reflector with the scintillator. It was found impractical to shield the grooves during etching. After etching a scintillator, including the grooves, the white deposit inside the grooves was removed by scraping along the groove profile. Then the groove surface was polished using a thick thread and a polishing compound (tooth paste).

Multi–clad BCF–92 fibers of 1 mm diameter were employed for waveshifting readout. They have a decay time of around 3 ns and the re–emitted light spectral peak at 500 nm (green light). Bicron optical epoxy cement BC-600 was used as an optical couplant between the fibers and a scintillator. Gluing was done in two steps. First, the grooves were filled with the glue and the fibers were inserted. In second step, the glue was applied over the fibers to top up remaining gaps.

Tyvek reflector sheet was put over glued fibers. The assembled counter was wrapped in an aluminum foil for mechanical protection and light isolation. The thickness of all assembled counters was measured to be 7.75 ± 0.25 mm, where 0.75 mm comes from wrapping and the protrusive fibers. Measured thicknesses of all counters are shown in Fig. 2.

17 fibers of 4.8 m length are glued over the counter length. It was found later that the actual number of glued fibers for a few counters is 16, as was specified initially. The fibers are protected from breaking outside the counter with a soft foam plate of 5 mm thick. The short plastic sleeves are put over fibers from the counter edge, and the sleeves are fixed to the foam plate shaped as a trapezium. The fibers then are combined into a bundle inside a black flexible tube. At both ends the bundle is glued into rectangular connectors made of lucite, and finally, the fiber ends have been polished.

General view of T-counters as well as the details of them can be seen at
http://www.phy.bnl.gov/ kmarat/ or
http://www.phy.bnl.gov/e949/detector/tracking/rs/t-counter/e949.html