The support structure below the buffer vessel demands a higher number of PMTs below the vessel than above. The PMTs are of the type 9354KB of Electron Tubes Ltd. (or a comparable type of

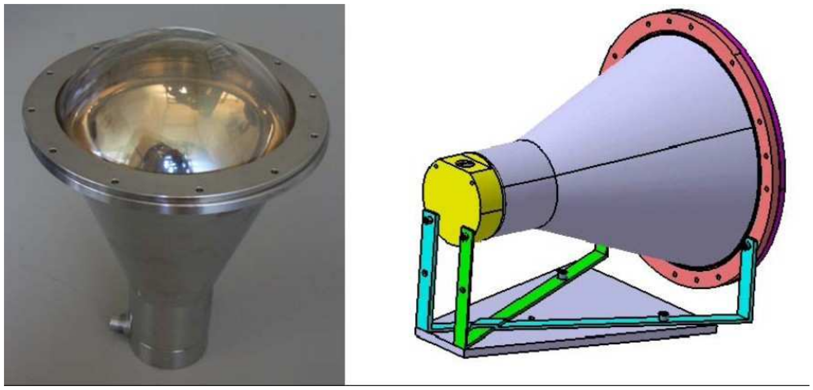

Figure 56: PMT encapsulation and mounting (Drawing P. Guillouët)

another manufacturer). The active diameter of the blue-green sensitive photocathode is 190 mm. The PMTs can be encapsulated in a stainless steel chassis (Figure 56), where the Borexino encapsulation design with PET pressure membrane can be used with small modifications. Encapsulating the PMTs has the advantage that no leaks in the vicinity of the connector and/or the voltage divider can occur and mechanical forces on the PM glass tube are minimized. In case of a broken tube, the risk of contamination of the veto liquid and impact on other tubes is reduced. An additional μ-metal shielding inside the steel chassis suppresses the magnetic field of the Earth. An alternative PMT encapsulation design similar to the inner detector is under investigation.

With 78 PMTs of this type, the effective coverage amounts to 0.6% of the total surface area of the veto detector. To increase the light collection, almost all surfaces in the veto detector will be painted white or covered with a reflective coating (diffuse reflection). Compared to a stainless steel surface, this improves reflectivity by more than a factor of two. Where applicable, TiO_2 based white paint will be spray-painted onto the steel surfaces after welding the pieces together. The side walls of the veto cylinder, the floor, the bottom side of the lid and parts of the vessel support can be treated in this way. Because of the limited space between buffer and veto vessel, it is not feasible for the buffer vessel which has to be welded on site. For this reason, highly reflective sheets of Tyvek (e.g. type 1073B or similar) will be attached to it after the three parts of the buffer are welded together. Tyvek was tested and used in Super-Kamiokande, Borexino and in the KamLAND experiment. Its diffuse reflectivity for visible light exceeds 90%. With an estimated optical attenuation length of several meters, multiple reflections are highly probable, increasing the light collection efficiency by roughly one order of magnitude. This is especially important for the detection of proton recoils.

Figure 59 illustrates the simulated light collection inside the veto region (for details on the simulations see below). The plot shows the average number of hit veto PMTs for a 5 MeV positron generated at random positions inside the veto. This energy corresponds to the projected energy threshold of the veto system. The lower light collection efficiency in the region below the buffer vessel is due to the support structure that creates shadow effects there.