Model of a cable routing for the $\overline{\text{P}}$ANDA-EMC forward endcap*

C. Schnier†[1], *M. Albrecht*[1], *M. Fink*[1], *F.-H. Heinsius*[1], *T. Held*[1], *T. Holtmann*[1], *M. Kümmel*[1], *B. Kopf*[1], *S. Leiber*[1], *P. Musiol*[1], *M. Pelizäus*[1], *J. Pychy*[1], *T. Schröder*[1], *C. Sowa*[1], *M. Steinke*[1], *T. Triffterer*[1], *and U. Wiedner*[1]

[1]Ruhr-Universität Bochum, Germany

Introduction

The forward endcap of the $\overline{\text{P}}$ANDA-EMC [1] will contain 768 Vacuum Photo Tetrodes (VPTTs) and 6176 Avalanche Photodiodes (APDs) for the measurement of scintillation light. The forward endcap will be cooled down to $-25\,^{\circ}\text{C}$ to increase the scintillation light output. A charge integrated low noise preamplifier is directly attached to each single VPTT and APD.

For supply and readout each VPTT (APD) photodetector preamplifier unit has to be equipped with 6 (8) cables.

The units are connected with 17 cm long cables to printed circuit boards [2], which are mounted on an aluminium backplate. The available electronics space inside the forward endcap is just 33 mm and the only available cable feedthroughs are located at the border of the backplate because of contiguous detectors. This space is needed for the different cables from single units and also for other components like temperature sensors and light fibres. To ensure a suitable way of cable positioning, a cable routing model has been developed.

Cable Routing Model

Short ways between the photo detectors and the readout electronics are provided with the cable routing model of the forward endcap. In addition to this, the cable routing accords with the mounting sequence of the photodetector units from the inner to the outer side avoiding numerous cable crossings.

The foreseen cables fulfill the requirements on electrical properties as well as radiation hardness. Through maximizing the number of grouped cables it is possible to decrease the number of rectangular feed-through holes, which simplifies the insulation procedure. For this, the design of the backplate was used, which provides more space between each unit at the border than in the middle. Overall about 8500 cables and more than 15400 light fibres have to be routed outside the insulated volume.

The cable routing model allows the use of the available space outside the endcap by 36 well positioned feed-through holes, which are correlated with the location of readout electronics to decrease cable length. The chosen routing of VPTT units allows the full utilization of needed readout electronics with just a minumum of extra cables and cable crossings inside the forward endcap.

Further Development

Due to the fact that the forward endcap will be cooled down to $-25\,^{\circ}\text{C}$, the cable feed-through holes will be insulated [3], which reduces the possible hole size down to a height of 15 mm. The holes in the cable feed-through frame at the border of the backplate have to be vacuum tight to avoid formation of ice. Therefore a method of durable bonding is under investigation.

Figure 1: Routing scheme of the backplate part for one half of the forward endcap.

References

[1] $\overline{\text{P}}$ANDA-Collaboration, EMC Technical Design Report, 2008.

[2] C. Schmidt et al., "On VPTTs and signal cables and connectors", talk, $\overline{\text{P}}$ANDA XLIX Collaboration Meeting.

[3] S. Leiber et al., "Development of the Insulation for the $\overline{\text{P}}$ANDA-EMC forward endcap", GSI Scientific Report 2014.

* Work supported by BMBF and EU
† E-mail: cschnier@ep1.ruhr-uni-bochum.de

DOI:10.15120/GR-2015-1-MU-HADRONS-23