Invited lecture

DEVELOPMENT OF AN OUT OF VACUUM SOLUTION FOR PARTICLE DETECTOR ELECTRONICS USING COMMERCIAL CAD SOFTWARE

Goran Mladenovic[1]

[1]University of Belgrade, Faculty of Mechanical Engineering, 11000 Belgrade, Serbia

**Corresponding author e-mail: gmladenovic@mas.bg.ac.rs*

Abstract

The development of an Out of Vacuum (shortly named: “OoV”) solution for particle detector electronics, as a part of the upgrade of the ATLAS Forward Proton (AFP) detector, is presented in this paper. The AFP detector is housed on a flange inside a Roman Pot (RP) station that comes very close to the beam of the LHC during data taking when there are interactions/collisions at Point 1. In order to minimize multiple scattering, the RP bottom side/window separating the detector from the bream is made very thin (200 μm) and hence, in order to protect it from ultra high primary vacuum of the LHC, it is kept in a secondary vacuum. However, some particle tracking detector electronics, in particular MCP-PMT (Micro Channel Plate Photomultiplier Tube) was proven to show strong deterioration or even malfunction under vacuum. Hence, the flange needed to be modified in order to allow operation in ambient air. The new design also includes a quartz window, serving also as the interface between the LQ bars channeling light produced by Cherenkov radiation in secondary vacuum and the MCP-PMT in air on the other side. The quartz window is mounted on an MCP-PMT holder and fixed between the spacer and a nut from the upper side, as well as with an O-ring from the bottom side, making it much less mechanically stressed due to pressure differences. It is also possible to adjust the height and angle of the MCP-PMT holder by means of four high precision screws. Bellow is used as the interface between the MCP-PMT holder and the flange, allowing sealing and vertical adjustment. There are two O-rings mounted on the bellow; one between the flange from the upper side and second on the MCP-PMT holder on the bottom side. The MCP-PMT itself is mounted Inside the MCP-PMT holder, kept in place using also the cable holder with heat conducting pads. The holder is also kept in place by means of four clamps from the outer side. An FEA analysis was conducted as well based on the designed CAD model. After verification, first prototype was made, which was used for extensive testing of proper sealing. After an official review by CERN experts, the solution was approved for installation.

Keywords

OoV solution, MCP-PMT, AFP

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