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Development of glass RPC for CMS muon upgrade

In the present CMS detector, all the muon stations are equipped with two kinds of muon detectors. Drift Tubes (DT) and Resistive Plate Chambers (RPC) detectors are used to ensure a good redundancy in the barrel region. In the endcap region, Cathode Strip Chambers (CSC) and RPC are used except in the stations of high eta region where only CSC detectors are present. To guarantee a redundancy in this region and improve the muon trigger efficiency it is planned to add new chambers during long shut-downs LS2 and LS3. The projected increase of the LHC luminosity up to 6x 1034 cm2s-1 during the HL-LHC phase suggests that new detectors with high rate capability are needed. Gaseous electron multiplier (GEM) detectors are proposed to equip the two first (GE1/1 & GE2/1) of these four stations. For the other stations (RE3/1 & RE4/1), several RPC technologies are proposed. Glass RPC is one of the proposed detectors. Tsinghua and IPNL proposed to design double-gap or multi-gap glass RPC with our newly developed low resistive glass. 144 GRPC will be produced for these two region. The new glass developed by Tsinghua University has a resistivity of the order of 1010 Ohm cm and a very high surface uniformity. A new prototype of mosaic high rate MRPC with an active area of 25 × 47 cm2 is developed and simulation result shows that the efficiency is higher than 90% in the joint area. Beam test results from HZDR confirmed the simulation result. ˜ 95% efficiency and 60 ps time resolution is achieved, meanwhile the cluster size is very small. Current shows linear relationship with the flux rate. And this prototype keeps the efficiency higher than 90% for flux up to 40 kHz/cm2 at least. Now we developed a 1 meter long full-size trapezoidal MRPC prototype for CMS muon upgrade. The detector consists of 5 gaps and width of gap is 0.25mm. The structure of the detector, cosmic test results and other performance will be discribed in this paper.

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