

Study of high spatial resolution MRPC for muon tomography

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The muon tomography system built with the 2-D readout high spatial resolution Multi-gap Resistive Plate Chamber (MRPC) detector is a project of Tsinghua University. In 2013 we have developed a prototype of muon tomography system named TUMUTY, and we now try to use more large sensitive scale position resolution MRPC to upgrade the system. The sensitive area is more than 1m² and it has 864 readout strips. The readout pitch is set to 2.54mm and strip width is 1.1mm for both X and Y dimension. Because of the low rate muon at sea level and big mounts of readout strips of the system, an encoding readout method based on the fine-fine configuration is used to reduce the number of the readout electronics and thus reducing the complexity and the cost of the system. The fine-fine geometry consists of two sets of readout channels, A and B. All of the even strips are connected to A and the odds to B. This paper study the 12 MRPC's performance under the encoding readout. The cosmic test shows MRPCs have a working point at 8100V to 8200V when the working gas consists of 95%Freon, 5%SF₆ and 5%*i*-C₄H₁₀. The efficiency is around 97% and the cluster size is about 3.6. An X-ray machine is used to measure the spatial resolution. The X-ray beam is collimated with the slotted tungsten and lead bricks. The slotted 2 mm thick tungsten plate is located above and below the lead bricks with a width of 126 μm. The X-ray generator is placed 50 cm above the MRPC and only 81th and 82th strip can be irradiated by the collimated X-ray. The rest area of MRPC is protected by 3mm thick lead plate. The test result shows that the detector's position resolution are all below 800um and some detector can even reach 500um. All of these results show that MRPC is a good choice for high precision muon imaging system.

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