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Prototype of Industrialized RPC for J-PARC E50 experiment

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We build up a small 250mmx250mmx24mm prototype RPC to test the possibility of the industrialized construction in order to reduce the man power and increase the stability during the mass construction. The concept of sensitive volume of SHiP RPC is adopted to our design with some modifications. The sensitive volume is composed of a 8mm-thick acrylic frame, two 8mm-thick PCB boards, and a single-stack-multi-gap RPC structure. Two 8mm-thick PCBs server as the end caps of the 8mm-thick acrylic frame to enclose the gas-tight sensitive volume by O-ring with two feed-troughs of gas. Compared to the design of SHiP RPC which hardly seal the sensitive volume with glue, we utilize O-ring to create the gas tight space which is more industrial and convenient way. In addition, we use two 8mm-thick PCBs instead of acrylic plates as the caps of sensitive volume reduce the material of active area particles pass through. The 8mm thick PCB is a multi-layer structure serve as the electrode, read-out strips, shielding plane. The electrodes are directed printed on PCB which is known as carbon-less electrodes. The carbon-less electrodes has been practiced and used in CMB experiment and it provides an industrialized way produce electrodes. Compared to the traditional electrodes made by carbon paint or carbon tapes, it is much cheaper and straight-forward. The difference between our design and CBM design is that both our electrode and readout strip are printed on one PCB, not separated like CBM RPCs. Furthermore, an extra shielding layer is designed in the PCB to prevent the noise from the environment to interfere the signals of readout strips. The read-out is 20mmx20mm strips with readout on both end. Both HV and FEE are directly connected to the outer surface of PCB which is decoupled from the gas volume. It makes the work of assembling, repair, and replacement of FEE much easier. Inside the gas-tight sensitive volume, it houses a one-stack RPC with ten gas gap defined by eleven 400um-thick alkali-free glass separated by 260um nylon fishing line with 200mmx200mm active area. The prototype will be equipped with low-jitter and high-gain FEE and tested with cosmic ray. The salient features of this prototype are to be implemented in constructing the RPCs for TOF and position measurement in the J-PARC E50 experiment.

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