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## A cylindrical $\mu$ RGroove detector for the super tau-charm facility

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The Micro-Resistive Groove ( $\mu$ RGroove) is a single-stage MPGD featuring a groove amplification pattern. When developed into a cylindrical structure, it requires only two cylinders (electrodes) with independent support foams, offering advantages such as a simple structure, easy installation, and high mechanical strength. Additionally, the cathode of  $\mu$ RGroove can serve as a 1D readout strip (X-strip). With just one additional 1D readout (V-strip) located at the bottom of the amplification structure, 2D position resolution can be achieved. This geometry avoids the induced charge-sharing effect, increases the signal amplitude, and helps reduce the material budget. In this study, we present the design and production of the cylindrical  $\mu$ RGroove, with the first prototype having an effective area of 131 mm in diameter and 100 mm in length. This includes its detachable mechanical structure, low-mass type electrode design, vacuum gluing process, and reversible installation method. The total material budget of the sensitive area is  $\sim 0.23\% X_0$ , and it can achieve an energy resolution of  $\sim 26\%$  and a maximum effective gain of  $\sim 10000$ . The induced signal amplitudes on the X and V readout strips are roughly the same. Further beam test were conducted by 150GeV/C muons at the CERN-SPS beamline. Preliminary results show a detection efficiency  $>95\%$  and a spatial resolution of  $<100\mu\text{m}$  for vertically incident particles. Results of  $\mu$ TPC mode and oblique incident particles are still under analysis. Due to its low mass, good spatial resolution, and high rate capability, the cylindrical  $\mu$ RGroove could be an ideal solution for the inner tracker in STCF experiments.

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