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Development of Hybrid Gaseous Detectors

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Gaseous detectors play a vital role in particle physics experiments, especially in collider detectors, where they are used in trackers, muon chambers, and calorimeters. However, future advancements face challenges due to limitations on traditional detector gases, driven by regulatory and environmental concerns. To overcome this, our team developed the concept of “hybrid gaseous detectors”. This innovative approach involves shifting part of the electron multiplication process from the gaseous medium to a high secondary electron emission yield solid-state layer applied directly to the anode surface inside the detector. By doing this, we can reduce the operating voltage and the gas flow rate significantly as well as enable the utilization of alternative, more sustainable gas mixtures. The concept was first tested on Resistive Plate Chambers (RPCs) and showed promising results. We extended the hybrid design to drift tubes by coating the central anode wire. Recently, we developed hybrid RPCs with optical readout where the chambers also have SiPMs integrated. Here, we report on the development of hybrid gaseous detectors and discuss future directions which involve optimizing the coating materials, expanding to other detector types, and exploring new use cases.

Primary experiment

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