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Induced signals in particle detectors with resistive elements: modelling novel structures

Novel particle detector structures are proposed regularly, mixing old and new ideas, with resistive detectors widening the landscape of possible configurations. In this talk an accurate and universal way of calculating the signals induced in structures with restive elements using an extended form of the Ramo-Shockley theorem is applied to several detector configurations.

For detector geometries containing resistive materials, the time dependence of the signals is not sully given by the movement of the charges in the drift medium but also by the time-dependent reaction of the resistive materials. With COMSOL Multiphysics, the needed dynamic weighing potentials can be obtained numerically. This, coupled with Garfield++ and a general-purpose circuit simulation program (e.g., SPICE) to describe the front-end electronics, allows for the targeting of a universal simulation toolkit for the microscopic modelling of the signal induction in particle detectors. In this talk, we present the application of these tools to study not only the signals induced in a variety of Micro Pattern Gaseous Detectors (MPGDs) but also for Multigap Resistive Plate Chambers (MRPCs) and solid-state detectors. In addition to deepening the understanding of existing structures, these studies are important for the design and optimization of the next generation of particle detectors and their application to specific needs driven by HEP experiments and other applications.

Primary experiment

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