Contribution ID: **93** Type: **Poster (Session B)**

Micro Pattern Gas Detector Technologies and Applications - the work of the RD51 Collaboration

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Driven by the availability of modern photolithographic techniques, the RD51 collaboration is developing a variety of new Micro Pattern Gas Detectors (MPGD). Developments cover Gas Electron Multipliers (GEM) and Micromegas, thick-GEM, resistive GEM (RETGEM) and novel micro-pattern devices. The aims of the collaboration are to facilitate the development of these advanced gas-avalanche detector technologies and associated electronic-readout systems, for applications in basic and applied research. Areas of activity include MPGD technology and new structures, device characterization, software and simulations, electronics, MPGD production, common test facilities, and applications of MPGD. By this coverage of all aspects of MPGD, RD51 aims to bring together leading experts in the field for the development of new technology and colleagues using this technology for a wide array of applications. This poster will illustrate the activities of the RD51 working groups, give information on regular workshops, and show examples of MPGD applications across a broad spectrum from particle and nuclear physics, astro-particle physics, medical imaging, and homeland security.

Summary (Additional text describing your work. Can be pasted here or give an URL to a PDF document):

RD51 –Micro Pattern Gas Detectors

The invention of Micro-Pattern Gas Detectors (MPGD), in particular the Gas Electron Multiplier (GEM), the Micro-Mesh Gaseous Structure (Micromegas), and more recently other micro pattern detector schemes, offers the potential to develop new gaseous detectors with unprecedented spatial resolution, high rate capability, large sensitive area, operational stability and radiation hardness. In some applications, requiring very large-area coverage with moderate spatial resolutions, more coarse Macro-patterned detectors, e.g. Thick-GEMs (THGEM) or patterned resistive-plate devices could offer an interesting and economic solution. The design of the new micro-pattern devices appears suitable for industrial production. In addition, the availability of highly integrated amplification and readout electronics allows for the design of gas-detector systems with channel densities comparable to that of modern silicon detectors. Modern wafer post-processing allows for the integration of gas-amplification structures directly on top of a pixelized readout chip. Thanks to these recent developments, particle detection through the ionization of gas has large fields of application in future particle, nuclear and astro-particle physics experiments with and without accelerators.
The world-wide collaboration, RD51, for R&D on MPGDs aims at efficient
coordinated effort to advance the development of MPGDs and associated technologies. The RD51 collaboration involves 298 authors, 57 Universities and Research Laboratories from 21 countries in Europe,America, Asia and Africa. All partners are already actively pursuing either basic- or application-oriented R&D involving a variety of MPGD concepts. The collaboration has established common goals, like experimental and simulation tools, characterization concepts and methods, common infrastructures at test beams and irradiation facilities, and methods and infrastructures for MPGD production. An intensified communication between the cooperating teams has been fostered in order to better understand and solve basic and technical issues and to solve common problems connected e.g. to detector optimization, discharge protection, ageing and radiation hardness, optimal choice and characterization of gas mixtures and component materials, availability of adequate simulation tools, optimized readout electronics and readout integration with detectors, as well as detector production aspects.

In this poster we will show details of the projects in progress in the working groups and illustrate the broad range of applications of MPGD's.

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