MPGD Overview and Future

Ideas for an open discussion

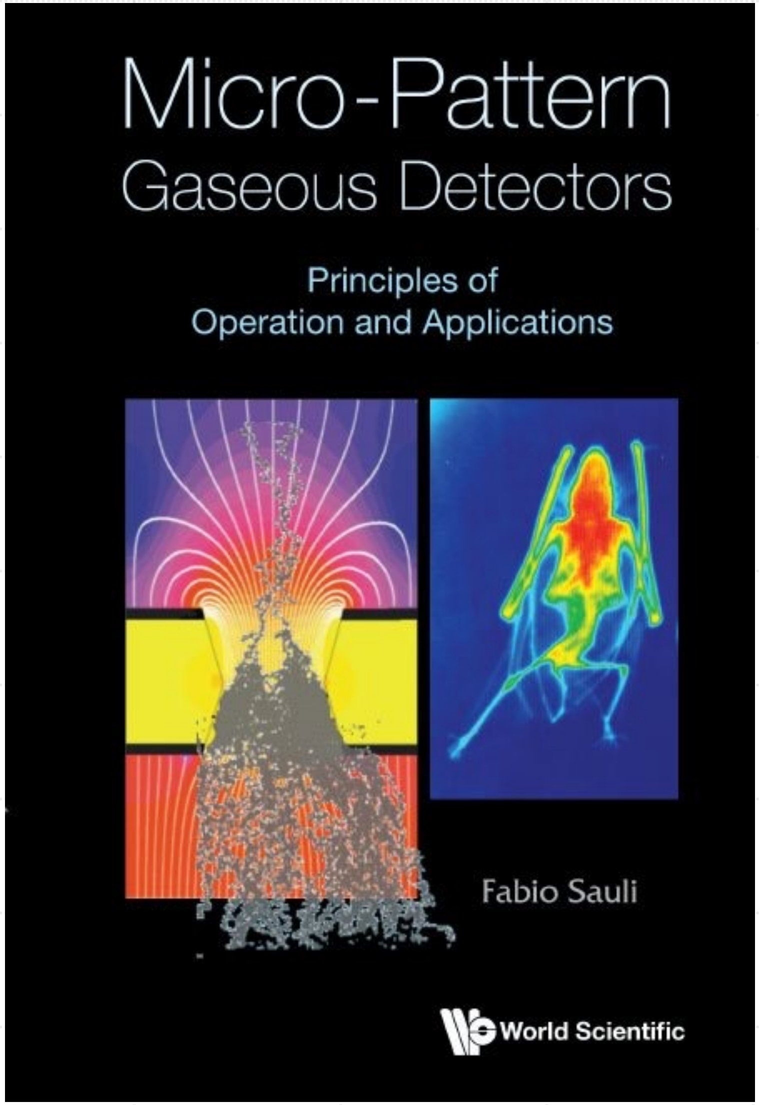
Disclamer

Parliamo (principalmente) di MPGD senza perché negli ultimi anni è quello che abbiamo imparato a fare ma non è detto debba essere sempre così

Micro-Pattern Gaseous Detectors
Principles of Operation and Applications

https://doi.org/10.1142/11882 | December 2020

By: [Fabio Sauli](#) (*CERN, Switzerland)*



Micro-Pattern Gaseous Detectors
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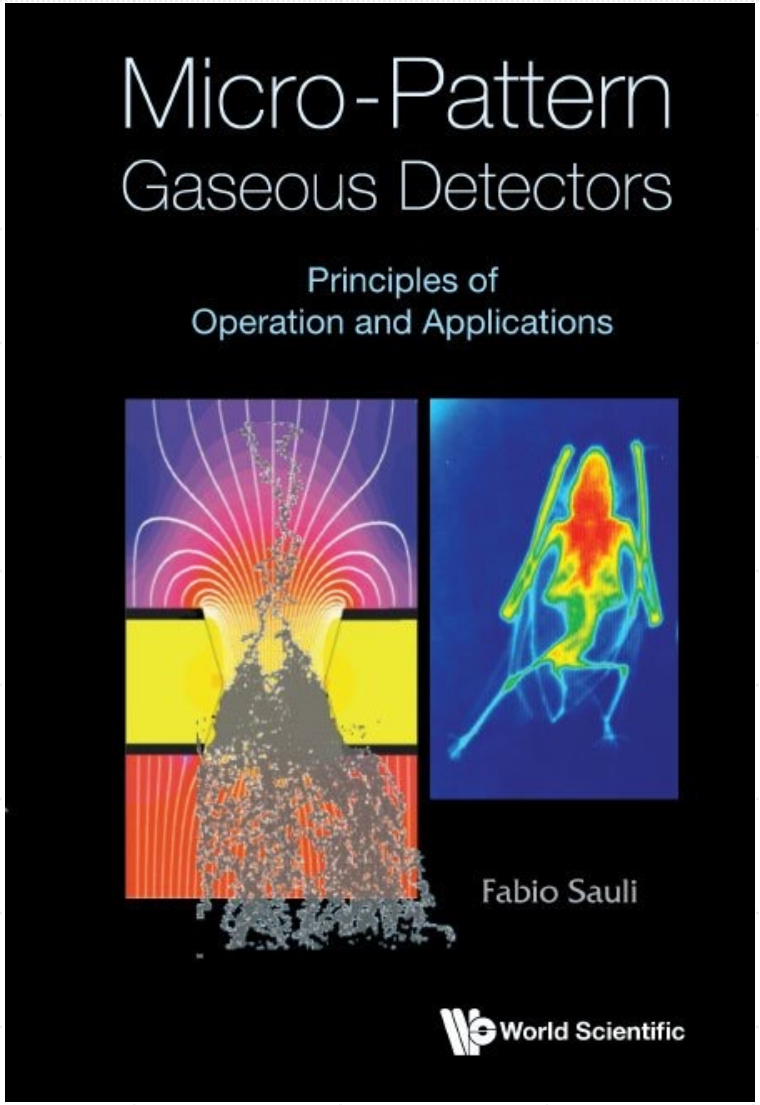
- Chapter 1: One Century of Gaseous Detectors
- Chapter 2: Micro-Strip Gas Counters
- Chapter 3: Micro-Pattern Gas Detectors
- Chapter 4: Micromegas
- Chapter 5: Gas Electron Multiplier
- Chapter 6: MPGD Readout of Time Projection Chambers
- Chapter 7: UV Photon Detection and Localization
- Chapter 8: Advanced Micro-Pattern Devices
- Chapter 9: Neutron Detectors
- Chapter 10: Cryogenic and Dual-Phase Detectors
- Chapter 11: Optical Imaging Chambers
- Chapter 12: Future Challenges and Prospects

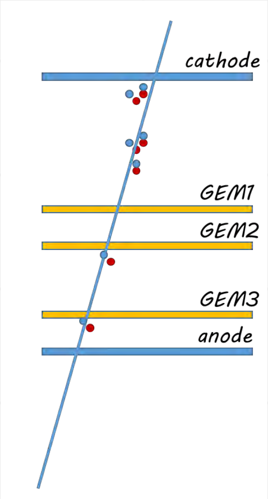


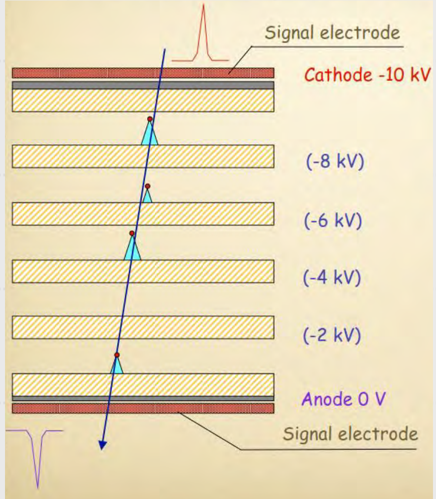
Future Challenges and Prospects

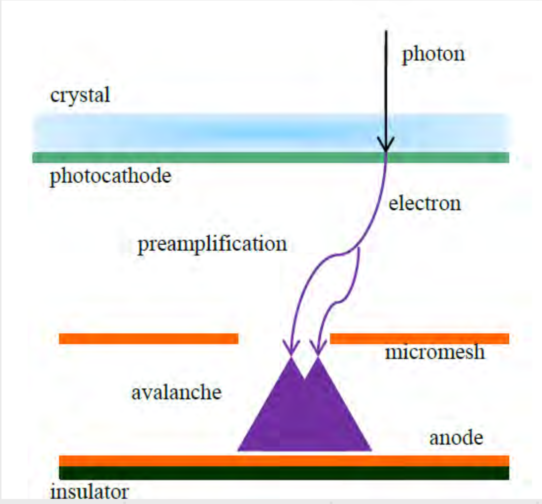
- The development in recent years of innovative gaseous detectors has been largely motivated by the demanding requirements of particle physics experimentation: high radiation fluxes, better position and multi-track resolution, survivability in hostile environments. The variety of conception of the new generations of devices partly fulfils the needs of existing experiments; further improvements are certainly crucial to allow operation at higher rates and particle multiplicities. The long-established competition with sensors exploiting solid state technologies, silicon micro-strips and pixel detectors has been a motivating factor for many innovative developments of gas-based devices, their lower intrinsic resolution rewarded by lesser costs and easier manufacturing, permitting to realize large experimental structures. While antagonist, gaseous detectors have largely profited from the implementation of high-density sensing electronics used for the readout of silicon devices, compensating with high gains the lower ionization yield. However, their intrinsic resolution remains limited by statistical dispersions due the distance between ionization clusters, electron collection time and diffusion in the gas. Use of fast gases and high drift fields can improve the time response, which remains however limited to several nanoseconds, marginal to disentangle events produced by high-luminosity colliders.

Going Faster

- Optimization: geometry, gas mixture, electric fields (e.g. LHCb GEM)
- Fast Timing MPGD or MRPC: multi gap resistive detectors
- Optical readout: Picosec

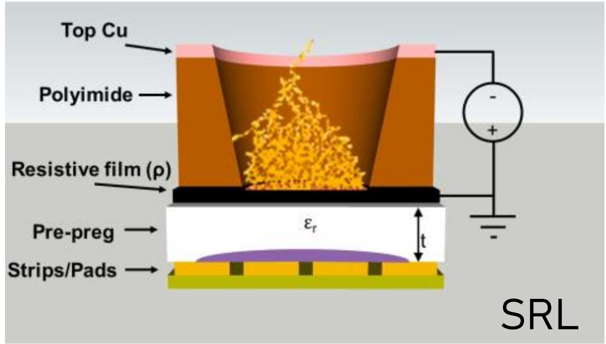


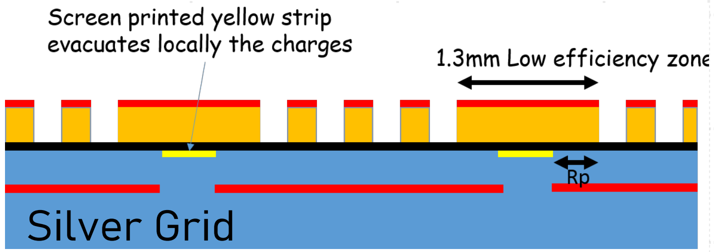


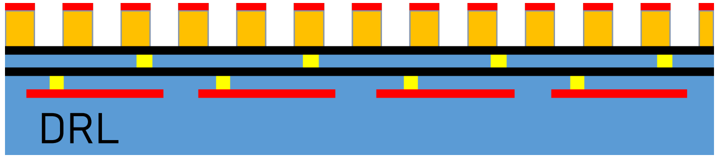


Going Harsher

- The challenge is to cope spark protection resistive technology and high-rate capabilities
- Find electrical solutions to evacuate the space charge







Going Bigger

- Performance homogeneity → R&D
- Scalability → Technology Transfer
- Supporting structures → material choice
- Electronics to cope with large capacitance → optimization and integration

Networking

ECFA
European Committee for Future Accelerators

COLLABORATION AGREEMENT

CONCERNING

THE ACQUISITION OF A MAGNETRON SPUTTERING DEPOSITION FACILITY

(THE "AGREEMENT")

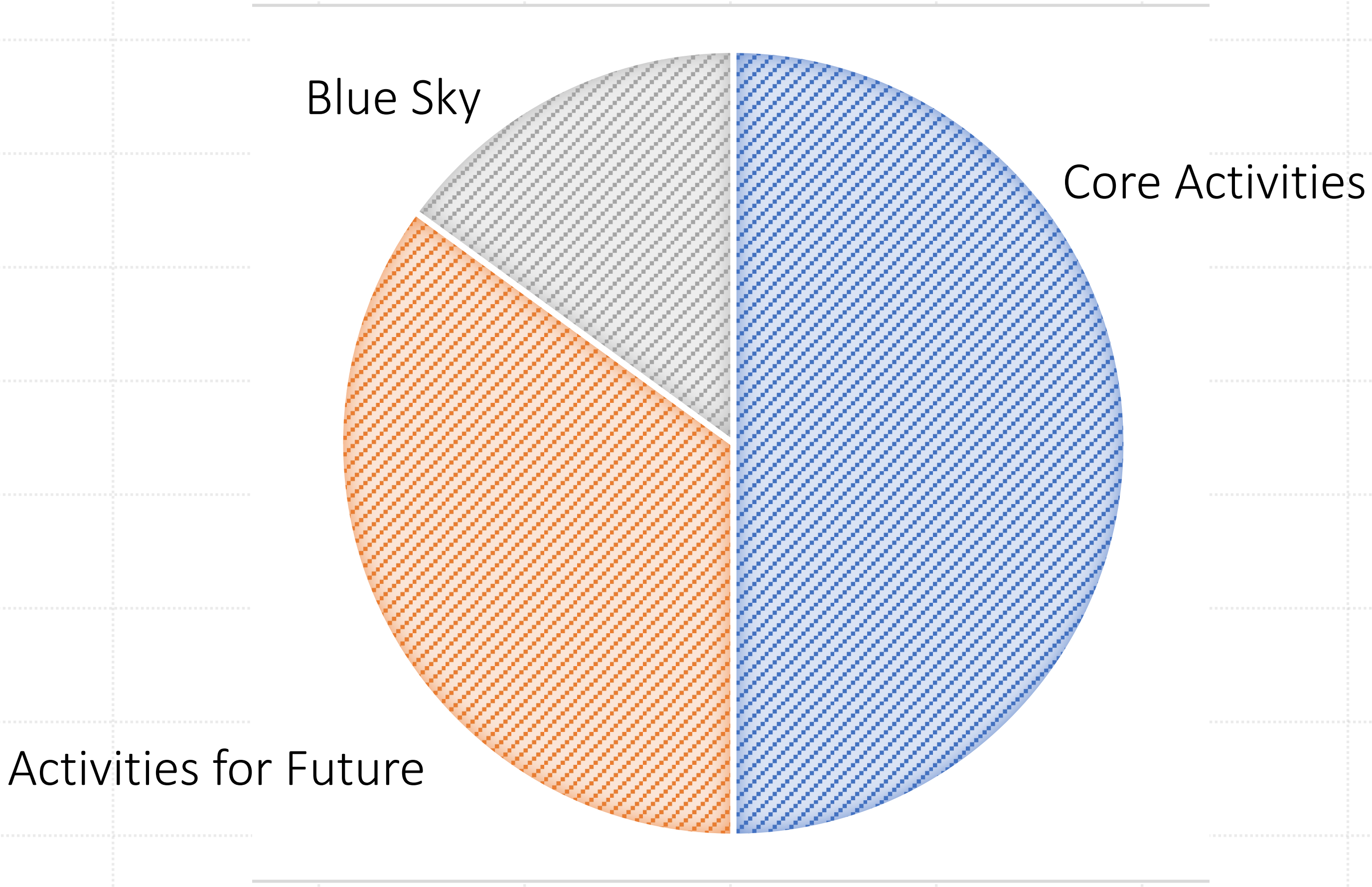
BETWEEN: THE EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH ("CERN"), an Intergovernmental Organization having its seat at Geneva, Switzerland, duly represented by Manfred Krammer, Head of the Experimental Physics Departments,

AND: THE ISTITUTO NAZIONALE DI FISICA NUCLEARE ("INFN"), a public research body dedicated to fundamental research under the supervision of the Ministry of Education and Research of the Italian Republic, having its seat in Frascati (Rome), Italy, duly represented by Antonio Zoccoli, President,

AIDA innova

Our current involvement

- Development of the BESIII Tracking System
- Study for the IDEA Muon and pre-Shower Systems
- Development of next generation ASIC chip
- Detector Calibration and Simulation
- Software Reconstruction Algorithms
- …


Blue Sky
Core Activities
Activities for Future