

FABIO SAULI

LIST OF MAJOR ACHIEVEMENTS 13/12/2021

Full details on:

<http://fabio.home.cern.ch/fabio/> under CURRICULUM

Joined Charpak group in 1979 and contributed to the development of the multiwire proportional chamber (MWPC) and other wire-based gaseous detectors: Drift Chambers, Multistep Chambers, Cherenkov Ring Imaging (RICH), digital radiography systems.

In 1998 developed the Gas Electron Multiplier (GEM), a powerful member of the Micro-Pattern Gaseous Counters family, providing high-rate detection of ionization with sub-mm accuracy (F. Sauli, GEM: A new concept for electron amplification in gas detectors, [Nucl. Instr. Meth. 386\(1997\)531](#)).

The unique feature of GEM is to provide preamplification and transfer of ionization charge, permitting to cascade two or more stages reaching very large gains while preserving the energy and space resolution of single-stage devices.

Multi-GEM chambers were first used for the [COMPASS](#), [LHCb](#) and CMS [TOTEM](#) trackers at CERN, where they are still operational after 20 years. The GEM-based [Hadron Blind Detector](#) at RHIC (BNL) is operational since 2003. Cylindrical GEM detectors are used in the [KLOE-2 tracker](#) at the INFN Frascati electron accelerator, the [BONUS radial TPC](#) at Jefferson Lab, [BESIII](#) at IHEP Beijing.

Due to their performance, reliability and low cost, GEM-based systems are replacing MWPCs in several large size setups: [ALICE TPC](#), CMS [high- \$\eta\$  muon](#) detector, [COMPASS RICH-2 upgrade](#) at CERN.

In a coarser version named [Large Electron Multiplier \(LEM\)](#) or [ThickGEM](#) the device is used in [dual-phase Time Projection Chambers](#) to extract electrons from liquid argon, aiming to the detection of rare events.

GEMs are used as charge amplifiers in numerous applications: [fast digital radiography](#), [proton radiography](#), [dose monitoring in proton beam therapy](#), [X-ray polarimetry IXPE satellite mission](#), [energy-dispersive X-ray fluorescence analysis](#), [fusion plasma diagnostics](#), [high-rate neutron radiography](#) and [thermal neutron detection](#). A GEM electrode is part of the [JEM-X](#) X-ray telescope on-board of the INTEGRAL satellite mission.

As against electronic signals recording, [optical imaging of scintillation with GEM](#) amplifiers is a promising on-going development for moderate rate, high resolution [radiation imaging](#), low cost [TPC-like imagers](#) of complex or [low rate events and medical imaging](#), [dark matter searches](#).

Implementation and performances of the quoted applications are documented in Sauli's review articles and recent books: Gaseous Radiation Detectors and Micro-Pattern Gaseous Detectors (see bibliography).

Adjunct professor at Bicocca University (Milano) and Northeastern University (Boston). Doctor Honoris Causa Univ. Haute Alsace (Mulhouse). Provided tutorials and dedicated courses at Workshops and Schools (including several ICFA instrumentation Schools).

FABIO SAULI

## SELECTED PUBLICATIONS

Full list on:

<http://fabio.home.cern.ch/fabio/> under PUBLICATION

## BOOKS

F. Sauli and others: Gas Detectors Handbook ([in preparation](#))

F. Sauli: Micro-Pattern Gaseous Detectors ([World Scientific, January 2021](#)).

F. Sauli: Gaseous Radiation Detectors, Fundamentals and Applications. [Cambridge University Press, Cambridge \(2014\)](#)

## SPECIAL TOPICAL VOLUMES

F. Sauli, Editor: A RICH legacy, T. Ypsilantis Memorial Volume ([Nucl. Instr. Meth. A970, August 1, 2020](#))

R. Klanner and F. Sauli, Editors: Silicon Photomultipliers: Technology, Characterization and Applications. [Nucl. Instr. Meth. A926 \(2019\) 1-152](#)

F. Sauli, Editor: Radiation Imaging Techniques and Applications, [Nucl. Instr. Meth. A878 \(2018\) 1-258](#)

F. Sauli, Editor.: Instrumentation in High Energy Physics. [World Scientific, Singapore \(1992\)](#)

## REVIEW ARTICLES

F. Sauli, Micropattern gaseous detectors in high-energy and astroparticle physics, International Journal of Modern Physics A [IJMPA \(2021\) 2130016](#).

F. Sauli, The Gas Electron Multiplier (GEM): Operating Principles and Applications, [Nucl. Instr. and Meth. A805\(2016\)2](#)

F. Sauli, Gas Electron Multiplier (GEM) Detectors: Principles of Operation and Applications, [Comprehensive Biomedical Physics Vol.8\(2014\)367](#)

F. Sauli, Novel Cherenkov photon detectors, Invited Paper at the 5th Workshop on RICH Detectors, RICH04 (Playa del Carmen, Mexico, Nov. 30-Dic. 5, 2004). [Nucl. Instr. and Meth. A553\(2005\)18](#)

F. Sauli, Progress with the Gas Electron Multiplier, 2nd Workshop on Advanced Transition Radiation Detectors for Accelerator and Space Applications (Bari, Sept. 4-7, 2003), [Nucl. Instr. and Meth. A522\(2004\)93](#)

F. Sauli, From bubble chambers to electronic systems: 25 years of evolution in particle detectors at CERN, [Phys. Rep. 403-404\(2004\)471](#)

## RECENT PUBLICATIONS

F. Sauli, L. Ropelewski, P. Everaerts, Ion feedback suppression in Time Projection Chambers, [Nucl. Instr. Meth. A560\(2006\)269](#)

M. Bucciantonio and F. Sauli, Proton computed tomography, Modern Phys. Lett. A Vol.30, No 17(2015)1540024

F. Garcia, F.M. Brunbauer, L. Lisowska, H. Muller, E. Oliveri, D. Pfeiffer, L. Ropelewski, J. Samarati, F. Sauli, L. Scharenberg, A.L.M. Silva, M. van Stenis, R. Veenhof and J.F.C.A. Veloso, Optical readout studies of the Thick-COBRA gaseous detector. [JINST 16 \(2021\) T01001](#)

F. Sauli, A rich legacy. Special NIMA Issue in memory of Thomas Ypsilantis . [Nuc. Instr. and Meth. A970\(2020\)163440](#)

A.P. Marques, F.M. Brunbauer, H. Muller, E. Oliveri, D. Pfeiffer, L. Ropelewski, J. Samarati, F. Sauli, J. Sharenberg, M. va Stenis: Minimizing distortions with sectorized GEM detectors, [Nucl. Instr. and Meth. A961\( 2020\)163673](#)

T. Maltsev, F. Sauli and L. Shekhtman, Study of discharge properties in cascaded Gaseous Detectors, MPGD 2019 (La Rochelle, 5-10 May 2019) [J. Phys. Conf. Ser. 1498 \(2020\)012033](#)

F. Sauli, Six Concepts in Search of an Author, [Instruments 3\(2019\)51](#)

F.M. Brunbauer, E. Olivieri, F. Resnati, L. Ropelewski, F. Sauli, P. Thuiner, M. van Stenis, The planispherical chamber: A parallax-free gaseous X-ray detector for imaging applications, [Nucl. Instr. and Meth. A875\(2017\)16](#)