

# R&D on Micropattern Gas Detectors Convenors Report

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## MPGD Collaboration: Motivation and Main Objectives

1. Technology-oriented collaboration
2. Share common infrastructure (e.g. test beam and **radiation hardness** facilities, detectors and **electronics** production and test facilities),
3. Share investment of common projects (e.g. **technology development**, electronics developments, submissions/production)
4. Develop common test and quality standards
5. Setup a common maintainable **software** package for gas detector simulations
6. Optimize communication and sharing of knowledge/experience/results
7. Collaboration with industrial partners

## Implementation

1. Scientific Workshop
2. Conveners Committee
3. Questionnaire Survey
4. Scientific Advisory Committee
5. Proposal Editorial Board
6. Draft of the proposal and MoU
7. Collaboration Meeting

## Workshop on Micropattern Gas Detectors: Towards RD51 Collaboration

2-Day Workshop at CERN, Geneva, September 10-11 2007  
(initiated and organized by L. Ropelewski and C. Joram (CERN))

<http://indico.cern.ch/conferenceDisplay.py?confId=16213>

1. Review present technologies and experimental results (~ 100 participants registered, 40 talks)
2. Initiate discussion on the need and way to setup collaboration
3. Technology-based (MPGD) vs. Application-based (e.g. LHC, ILC) Collaboration



- Many successful applications in a large variety of experiments (HEP, Astrophysics, Nuclear Physics, Industrial and Medical Applications)
- Ongoing R&D Efforts are widely spread over the many particle physics labs:
  1. steer ongoing R&D activities and facilitate exchange results (working groups)
  2. share resources, develop common infrastructure
  3. allows to search/apply for (inter-)national funding (collaboration effort)

# Micro Pattern Gas Detectors. Towards an R&D Collaboration.

from **Monday 10 September 2007 (09:00)** to **Tuesday 11 September 2007 (18:00)** at CERN ( **AB Auditorium Meyrin** ) chaired by: **Leszek Ropelewski** support: **Christian Joram@cern.ch**

**Description:** A workshop on micro pattern gas detectors will be held at CERN.

The workshop may lead to the formation of an official R&D collaboration (probably RD51) on micro pattern gas detectors.

The goal of such a collaboration would be to bundle and coordinate detector development and simulation work, which is currently being performed in numerous groups at universities and research institutes. The collaboration will allow to:

- structure, coordinate and focus ongoing R&D efforts
- share knowledge, experience and infrastructure, agree on common test and quality standards
- coordinate widespread simulation efforts towards setting-up a common maintainable software package for gas detector simulations
- share investment of common projects (e.g. larger mask sets for GEMs)

This is expected to lead to:

- an improved understanding of operational parameters (gas, fields, readout structures, MC simulations),
- optimized detector performance,
- optimized readout electronics and readout integration with detectors,
- new detector concepts,
- progress in technological and economical aspects (base materials, fabrication methods, industrialization and cost effectiveness).

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## Monday 10 September 2007

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### 09:00->10:30 State-of-the-art of micro pattern gas detectors (Overview)

09:00	Introduction to the workshop (00) ( Slides ) ( PDF )	Lucie Linssen (CERN)
09:10	Current trends in Micro Pattern Gas Detectors development (25) ( Slides )	Maxim TITOV (Freiburg University)
09:35	Latest progress with Micromegas (20) ( Slides ) ( PDF )	Ioannis Giomataris (Centre d'Etudes de Saclay (CEA-Saclay))
09:55	GEM and other charge multipliers with VLSI pixel read-out (20) ( Slides )	Ronaldo Bellazzini (INFN Pisa)
10:15	GEM at CERN (15) ( Slides ) ( PDF )	Leszek Ropelewski (CERN)
10:30	coffee	

### 11:00->13:00 State-of-the-art of micro pattern gas detectors (GEM and THGEM)

11:00	GEM detectors for high rate tracking (20) ( Slides ) ( PDF )	Bernhard Ketzer (Institut fuer Theoretische Physik)
11:20	GEM, applications in synchrotron radiation experiments and tracking in high energy physics (20) ( Slides )	Lev Shekhtman (Budker Institute of Nuclear Physics (BINP))
11:40	Latest progress in developing GEM-like detectors with resistive electrodes (20) ( Slides ) ( PDF )	Vladimir Peskov (Pole Universitaire Leonarod de Vinci)
12:00	Recent advances in THGEM detectors at Weizmann (20) ( Slides ) ( PDF )	Marco Cortesi (Weizmann Institute of Science)
12:20	Recent developments on MHSPs and GEMs in gaseous cascade multipliers for ion back-flow suppression (20) ( Slides ) ( PDF )	Joao F.C.A. Veloso (Univ Aveiro)
12:40	GEM detectors activity at Laboratori Nazionali di Frascati of INFN (20) ( Slides ) ( PDF )	Matteo Alfonsi (Laboratori Nazionali di Frascati (LNF))
13:00	Lunch	

### 14:00->15:30 State-of-the-art of micro pattern gas detectors (Micromegas)

14:00	Micromegas TPC readout R&D (20) ( Slides ) ( PDF )	Paul Colas (DAPNIA)
14:20	MPGD readout TPC using the charge dispersion signal (20) ( Slides ) ( PDF )	Alain Bellerive (Carleton University)
14:40	Large size bulk Micromegas (15) ( Slides ) ( PDF )	Alain Delbart (DAPNIA - Centre d'Etudes de Saclay (CEA-Saclay))
14:55	Micromegas performance and ageing studies (20) ( Slides ) ( PDF )	David ATTIE (CEA/DAPNIA/SPP)
15:15	R&D on Micromegas for an upgrade of ATLAS Muon System for the SLHC (15) ( Slides ) ( PDF )	Joerg Wotschak (CERN)
15:30	coffee	

### 16:00->17:00 State-of-the-art of micro pattern gas detectors

16:00	Two-phase avalanche detectors based on gas electron multipliers (20) ( Slides ) ( PDF )	Alexei Buzulutskov (Budker Institute of Nuclear Physics), Lev Shekhtman (Budker Institute of Nuclear Physics (BINP))
16:20	MPGD for Active Target Detectors in low energy nuclear physics (20) ( Slides ) ( PDF )	Joel Pouthas (Institut National de Physique Nucleaire (IN3P3))
16:40	Development of Micro Pixel Gas Chamber based on printed circuit technology and its applications (20) ( Slides ) ( PDF )	Toru Tanimori (Department of Physics, Kyoto University)

### 17:00->19:05 Electronics for micropattern gas detectors

17:00	Micro Pattern Gas Detectors characteristic and front-end electronics requirements (20) ( Slides ) ( PDF )	Werner Riegler (CERN)
17:20	MEDIPIX/TIMEPIX - Pixel electronics for MPGD (20) ( Slides ) ( PDF )	Michael Campbell (CERN)
17:40	Electronics for TPC readout with MPGD (20) ( Slides ) ( PDF )	Luciano Musa (CERN)
18:00	The AFTER-based MPGD-TPC readout electronics (15) ( Slides ) ( PDF )	Pascal Baron (CAE Saclay)
18:15	VFAT and discharge protection chip (15) ( Slides ) ( PDF )	Walter Snoeys (CERN)
18:30	Multichannel readout electronics for MPGD, based on different types of IDEAS chips (20) ( Slides ) ( PDF )	Nail Malakhov (Ohio State University)
18:50	R&D on ASIC for GEM (15) ( Slides ) ( PDF )	Giulietto Felici (Laboratori Nazionali di Frascati (LNF))
20:00	Workshop dinner	

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### 09:00->09:50 State-of-the-art of micropattern gas detectors (pixel readout)

09:00	GRIDs - latest progress (20) ( Slides ) ( PDF )	Jan Timmermans (NIKHEF)
09:20	Experience with 3-GEM configurations using the TimePix (20) ( Slides ) ( PDF )	Uwe Renz (University of Freiburg)
09:40	MPGD activities - plans in Bonn (10) ( Slides ) ( PDF )	Klaus Dash (Bonn Univ.)

### 09:50->10:30 Software tools for gas detectors studies

09:50	Software tools for MPGD simulations (20) ( Slides ) ( PDF )	Rob Veenhof (CERN)
10:10	GEANT4 and GEANT4 Collaboration (20) ( Slides )	John Apostolakis (CERN)
10:30	coffee	

### 11:00->13:00 Technological aspects of MPGD

11:00	MPGD technologies (20) ( Slides ) ( PDF )	Rui De Oliveira (CERN)
11:20	Large GEM detectors (20) ( Slides ) ( PDF )	Serge Duarte Pinto (CERN)
11:40	GEM detectors production and QC (20) ( Slides ) ( PDF )	Kari Kurvinen (Helsinki Institute of Physics HIP)
12:00	A test and certification of GEM foils produced by Tech-Etch (20) ( Slides ) ( PDF )	Nik Smirnov (Yale University)
12:20	Aging and radiation hardness of gas detectors (20) ( Slides ) ( PDF )	Mar Capceans Garrido (CERN)
12:40	The LCTPC Collaboration: some key aspects of activity (20) ( Slides ) ( PDF )	Klaus Dehmel (Dept of Physics and Space Sciences)
13:00	Lunch	

### 14:00->15:30 Forming an R&D collaboration

14:00	Experience from RD50 - R&D Collaboration on rad hard tracking detectors (20) ( Slides ) ( PDF )	Michael Moll (CERN)
14:20	Towards RD51 - organizational aspects (15) ( Slides ) ( PDF )	Christian Joram (CERN)
14:35	Future of the gas detectors (20) ( Slides ) ( PDF )	Harry Van Der Graaf (NIKHEF)
15:30	coffee	

### 16:00->17:00 Discussion: Next steps, sharing of tasks.

~100 registered participants  
40 presentations

## Micropattern Gas detectors: Towards RD51 Collaboration

Workshop delegated following persons (conveners) to continue effort towards Technology-oriented MPGD R&D Collaboration:

Alain Bellerive (Carleton University)  
Giovanni Bencivenni (INFN Frascati)  
Michael Campbell (CERN)  
Mar Capeans Garrido (CERN)  
Klaus Dehmelt (DESY)  
Leszek Ropelewski (CERN) -- chair  
Fulvio Tessarotto (INFN Trieste)  
Jan Timmermans (NIKHEF)  
Maxim Titov (CEA Saclay)  
Rob Veenhof (CERN)

- Prepare questionnaire to the interested institutes (Every institute to submit contact people(s), present work, resources, infrastructure, interest(s) in joint projects)
- Prepare Proposal Skeleton
- Selection of RD51 Scientific Advisory Board (A. Breskin, Y. Giomataris, F. Sauli)
- Formation of editorial team for proposal

## Questionnaire to the Institutes Interested to Participate in the RD51 collaboration:

1. Institute;
2. Contact person;
3. Current group research activities and projects/experiments involved;
4. Major field(s) of activities of your group within the RD51 among the topics:
  - Radiation hardness studies of MPGD (aging, material selection, outgassing, irradiation facilities etc...)
  - Basic MPGD Developments and evaluation (stability studies, optimization of operating parameters, geometry, intrinsic detector performance, test beam and test beam facilities);
  - Technological aspects of the MPGD (industrialization and manufacture of large size detectors, integration and large systems development);
  - Electronics Development (CMOS readout, MPGD ASICs, detector and electronic integration);
  - Software Development;
  - MPGD Developments for applications outside particle/nuclear physics (e.g. medical, industrial etc.);
  - Other(s)
5. For the field(s) of your activity, please specify available resources, instrumentation and infrastructure, which you would be willing to share within the RD51 collaboration;
6. For the field(s) of your activity, please specify which type of help you would be interested to receive from the RD51 collaboration;
7. In which areas will additional funding be helpful for your group and why?
8. Do you see an interest of your institute in the formation of a technology-based collaboration, where groups from other research fields could closely interact with high energy physics community? Could you specify in few a sentences why and which applications could gain from such a technology-based collaboration, in your opinion?

Questionnaire answers help to shape Future Scientific Program and Strategy (important for proposal writing):

Technological Developments

Experimental Studies, Stability, Performance Evaluation

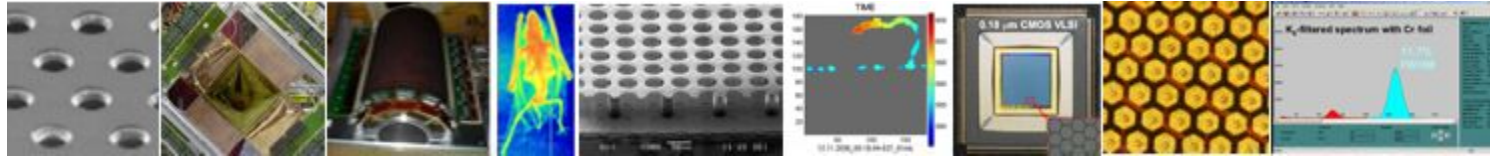
Developments of Radiation Hard Technologies

Detector Simulations

Electronics Developments



Prototype Working Groups (Scientific Organization)



RWTH Aachen (Germany)  
**NIKHEF** Amsterdam (Netherlands)  
 University of Texas Arlington TX (US)  
 INP NCSR Demokritos Athens (Greece)  
 Universities of Aveiro and Coimbra (Portugal)  
 IFAE Barcelona (Spain)  
 INFN Bari (Italy)  
 Bonn University (Germany)  
 PTB Braunschweig (Germany)  
 Eotvos University Budapest (Hungary)  
 Uludag University Bursa (Turkey)  
 INFN Cagliari (Italy)  
 MIT Cambridge MA (US)  
 Carleton University and TRIUMF (Canada)  
 AGH UST Cracow (Poland)  
 GSI Darmstadt (Germany)  
 PGE and Panalytical Eindhoven (Netherlands)  
 Ecole des Mines Superior St. Etienne (France)  
 LNF-INFN Frascati (Italy)  
 University of Freiburg (Germany)  
 C-RAD Imaging AB Frösön (Sweden)  
 CERN TS-DEM Geneva (Switzerland)  
**CERN** PH Geneva (Switzerland)  
 ATLAS Upgrade Coll. Geneva (Switzerland)

Athens Demokritos, Athens National Technical University, Athens University, Brookhaven National Laboratory, Bucharest NIPNE, CERN, Harvard University, Naples, Petersburg NPI, University of Science and Technology of China, University of South Carolina, Thessaloniki Aristotle University, Washington University

Geneva University (Switzerland)  
 CEA **SACLAY** Gif sur Yvette (France)  
 LPSC Grenoble (France)  
 DESY FLC Hamburg (Germany)  
 HIP Helsinki (Finland)  
 Saha Institute Kolkata (India)  
 Florida Institute of Technology Melbourne FL (US)  
 University of Montreal (Canada)  
 Technische Universität München (Germany)  
 Yale University New Haven CT (US)  
 TERA FOUNDATION Novara (Italy)  
 Budker Institute Novosibirsk (Russia)  
 IPN CNRS-IN2P3 Orsay (France)  
 INFN Pisa and University of Siena (Italy)  
 University of Sheffield (UK)  
 Technical University Prague (Czech Republic)  
 Weizmann Institute Rehovot (Israel)  
 INFN and University of Trieste (Italy)  
 Brookhaven National Laboratory Upton NY (US)  
 University of Victoria and TRIUMF (Canada)  
 SMI Vienna (Austria)  
 University of Zaragoza (Spain)

~ 50 Institutions declared interest  
 in the MPGD R&D Collaboration

<http://mpgd.web.cern.ch/mpgd/>

## R&D Proposal

# Development of Micropattern Gas Detectors Technologies

**Editors:** Alain Bellerive (Carleton University), Michael Campbell (CERN), Mar Capeans (CERN), Paul Colas (CEA Saclay), Rui de Oliveira (CERN), Werner Riegler (CERN), Leszek Ropelewski (CERN), Fulvio Tessarotto (INFN Trieste), Maxim Titov (CEA Saclay) and Rob Veenhof (CERN)

1. Motivation, Main Objectives and Summary
2. Current Trends in Micropattern Gaseous Detectors
3. Applications (HEP, Astrophysics, Nuclear Physics, Industrial and Medical Applications)
4. Future Research Program and Strategy (**Technologies, Stability, Simulations, Electronics**)
5. Technological and System Aspects of MPGD Developments
6. Basic MPGD Experimental Studies and Evaluation
7. Development of Radiation Hard Technologies
8. Detector Simulation
9. MPGD Electronics Developments
10. Collaboration with Industrial Partners
11. Resources and Infrastructure
12. Beam and Irradiation Facilities at CERN
13. Scientific Organization and Work Plan
14. Summary and Outlook