

# DRD1

## 2<sup>nd</sup> Collaboration Meeting

**Anna Colaleo, Beatrice Mandelli, Eraldo Oliveri, Leszek Ropelewski, Maxim Titov, Piotr Gasik**

CERN, June 17-21, 2024

# Outline

- **Agenda of the Meeting**
- **Topical Workshop on Electronics for Gaseous Detectors**
- **Special Session on Funding Schemes**
- **Collaboration Board**
- **DRD1 Logo**
  
- **2024 Gaseous Detector Conferences and DRD1 school**
- **In memoriam Atsuhiko Ochi 2024**

# Agenda of the Meeting

<https://indico.cern.ch/event/1413681/>

Please register if you haven't done so yet, especially if you will attend in person.

# Agenda

A full week for the community to present and share their **scientific and technological research activities and achievements**

## Agenda organized by Working Groups

[WG1: Technological Aspects and Developments of New Detector Structures, Common Characterization and Physics Issues](#)

[WG2: Applications](#)

[WG3: Gas and Materials](#)

[WG4: Modeling and Simulations](#)

[WG5: Electronics for gaseous detectors](#)

[WG6: Production and Technology Transfer](#)

[WG7: Collaboration Laboratories and Facilities](#)

[WG8: Knowledge Transfer, Training, Career Promotion](#)

## Additional Sessions

- Work Packages Parallel Sessions (closed, Monday Morning)
- Topical Workshop on Electronics for gaseous detectors (Wednesday)
- Status update on the US RDC6 (Friday Morning)
- R&D Funding Schemes Session (Friday Afternoon)

<https://indico.cern.ch/event/1413681/timetable/?view=standard>

# Agenda

# Status update on RDC6 (US)

Fri 21/06

08:00	Status update on RDC6 (US)	Sim Vahanan et al.
08:30 - 08:50	4D/5D CO <sub>2</sub> - Safe Cure, CERN	08:30 - 08:50
09:00	Status & plans of the M4 Test Beam	Vergine Topolitski et al.
09:50 - 09:05	4D/5D CO <sub>2</sub> - Safe Cure, CERN	09:50 - 09:05
09:05 - 09:20	DRD1 program of the StrawTrackerRD setup	Vozhnan Mikhomogov
09:20 - 09:35	4D/5D CO <sub>2</sub> - Safe Cure, CERN	09:20 - 09:35
09:35 - 09:50	µGroove results from April Test Beam	Yi Zhou
09:50 - 09:35	4D/5D CO <sub>2</sub> - Safe Cure, CERN	09:50 - 09:35
09:50 - 09:50	DRD1 tracker	Lucian Scharenberg
09:50 - 10:05	4D/5D CO <sub>2</sub> - Safe Cure, CERN	09:50 - 10:05
10:00	MPGD-Calo studies	Anna Stamenou
10:05 - 10:05	4D/5D CO <sub>2</sub> - Safe Cure, CERN	10:05 - 10:05
10:05 - 10:20	picocommeter	Max Krausseder et al.
10:20 - 10:35	4D/5D CO <sub>2</sub> - Safe Cure, CERN	10:20 - 10:35
10:35 - 11:00	EUROLAB	4D/5D CO <sub>2</sub> - Safe Cure, CERN
10:40 - 11:00	Coffee Break	4D/5D CO <sub>2</sub> - Safe Cure, CERN
11:00	Working Group B: Knowledge Transfer, Training, Career Promotion	Alessandro Passeri, Prof. Elisabetta Baracchini, Florian Maximilian Brunbauer, Mauro Iodice
11:00 - 12:00	4D/5D CO <sub>2</sub>	11:00 - 12:00
12:00	Plenary Session (End)	Anna Colares, Enaldo Oliveira, Leszek Rogalski, Maxim TITOV, Piotr Gask
12:00 - 10:35	4D/5D CO <sub>2</sub> - Safe Cure, CERN	12:00 - 10:35
13:00	Discussion on R&D Funding schemes	Giuseppe Ianni, Inad Laitshch
14:00 - 15:30	4D/5D CO <sub>2</sub> - Safe Cure, CERN	14:00 - 15:30

## WG7

## WG8

# Topical Workshop on Electronics for Gaseous Detectors

Wed 19/06

09:00	Introduction to the workshop	Michael Lupberger
09:00 - 09:05	31/9-004 - IT Amphitheatre, CERN	09:00 - 09:05
09:05 - 09:25	New ASICs for MPGDs	Gianni Mazza et al.
09:25 - 09:45	31/9-004 - IT Amphitheatre, CERN	09:25 - 09:45
09:45 - 09:45	Timepix4 and pixel ASIC design challenges	Xavi Llopert Cudde
09:45 - 09:45	31/9-004 - IT Amphitheatre, CERN	09:45 - 09:45
09:45 - 10:05	ASIC design challenges with a focus on precise timing	Gianni Mazza et al.
10:00	Development of a new ASD-ASIC for drift-tube and straw detectors	Olivier Kormer et al.
10:05 - 10:20	31/9-004 - IT Amphitheatre, CERN	10:05 - 10:20
10:20 - 10:40	MPGD electronics from RD to the ATLAS NSM	George Alivisatos
10:40 - 10:40	31/9-004 - IT Amphitheatre, CERN	10:40 - 10:40
10:40 - 11:10	Coffee break	31/9-004 - IT Amphitheatre, CERN
11:10	Short status on DRD7 ADC & TDC activities	Mark Stott et al.
11:10 - 11:30	31/9-004 - IT Amphitheatre, CERN	11:10 - 11:30
11:30 - 11:50	RPC physics and performance vs. low discrimination threshold	Roberto Caroselli
11:50 - 12:05	31/9-004 - IT Amphitheatre, CERN	11:50 - 12:05
12:05 - 12:25	Development of self-triggered drift-tube chambers	Davide Cleri
12:25 - 12:25	31/9-004 - IT Amphitheatre, CERN	12:25 - 12:25
12:25 - 12:25	Electronics for DLNE	Roberto Poff
12:25 - 12:25	31/9-004 - IT Amphitheatre, CERN	12:25 - 12:25
12:25 - 12:50	First data with the uROC concentrator for VMM front-ends	Alexandru Ristau et al.
12:50 - 12:50	31/9-004 - IT Amphitheatre, CERN	12:50 - 12:50
14:00	BOM for eFEC backends	Jose Francisco Toledo Alamos et al.
14:00 - 14:15	31/9-004 - IT Amphitheatre, CERN	14:00 - 14:15
14:15 - 14:30	Update on eFEC backend project	Hans Müller
14:30 - 14:30	31/9-004 - IT Amphitheatre, CERN	14:30 - 14:30
14:30 - 14:55	SALSA: a new versatile readout chip for MPGDs	Damien Weyer et al.
14:55 - 15:10	31/9-004 - IT Amphitheatre, CERN	14:55 - 15:10
15:10 - 15:40	Readout links on SALSA	Inaki Mandujano
15:40 - 15:40	31/9-004 - IT Amphitheatre, CERN	15:40 - 15:40
15:40 - 16:10	iPBST and Versatile link overview	Stefan Billewiel
16:10 - 16:30	31/9-004 - IT Amphitheatre, CERN	16:10 - 16:30
16:30 - 16:50	Coffee break	31/9-004 - IT Amphitheatre, CERN
16:50 - 17:10	OMS RPC link card	Dr Behzad Boghatai et al.
17:10 - 17:10	31/9-004 - IT Amphitheatre, CERN	17:10 - 17:10
17:10 - 17:10	The ALTIROC ASIC	Nathalie Seguin-Morou
17:10 - 17:10	31/9-004 - IT Amphitheatre, CERN	17:10 - 17:10
17:10 - 17:10	Electronics requirements for a low-energy nuclear physics TPC	Daniel Babin et al.
17:10 - 17:10	31/9-004 - IT Amphitheatre, CERN	17:10 - 17:10

## WG4

Thu 20/06

09:00	WG4 News	Maryna Boyceva
09:00 - 09:20	13/2-005, CERN	09:00 - 09:20
09:20 - 09:50	Modelling and extraction of MPD1234 cross-sections	Marek Mieling van Rijn et al.
09:50 - 09:50	13/2-005, CERN	09:50 - 09:50
10:00 - 10:20	Integration of CUDA code to run GeField++ on GPUs (To be confirmed)	Tom Heep
10:20 - 10:20	13/2-005, CERN	10:20 - 10:20
10:30 - 11:00	short break - coffee	13/2-005, CERN
11:00 - 11:20	Charge spreading in resistive Micromegas for the T3KIND30 TPC	Shyam Joshi
11:20 - 11:40	13/2-005, CERN	11:20 - 11:40
11:40 - 12:00	Contribution 5 (15' + 5')	13/2-005, CERN
12:00 - 12:20	Contribution 6 (15' + 5')	13/2-005, CERN

## Collaboration Board

13:00	Collaboration Board	Anna Colares
13:00 - 14:30	13/2-005, CERN	13:00 - 14:30
14:30 - 17:30	Working Group 6: Detector production	Alain Delbart, Fabien Jourdain, Gabriel Charlot, Giuseppe Ianni, Rui De Oliveira
17:00 - 17:30	13/2-005, CERN	17:00 - 17:30

## WG6

## WG2

Tue 18/06

09:00	Introduction	09:00 - 09:20
09:20 - 09:45	Nanodosimetry	Antonio Rudolfi et al.
09:45 - 10:10	Development of RPC technology for Muon Tomography and neutron Detection	Alberto Bianco et al.
10:10 - 10:10	4D/5D CO <sub>2</sub> - Safe Cure, CERN	10:10 - 10:10
10:10 - 10:40	Performances of a Boron-coated GEM detector for thermal neutrons at the ISIS Neutron and Muon Source	Stephane Canciani
10:40 - 11:00	Assessment of a space and energy resolved diagnostic based on GEM detector technology on MAST-U	Gabriel Crof
11:00 - 11:25	4D/5D CO <sub>2</sub> - Safe Cure, CERN	11:00 - 11:25
11:25 - 11:55	Newel method for in-situ drift velocity measurement in large volume TPCs	4D/5D CO <sub>2</sub> - Safe Cure, CERN
11:55 - 11:55	4D/5D CO <sub>2</sub> - Safe Cure, CERN	11:55 - 11:55

## WG3

14:00	Introduction	Alessandra Pastore et al.
14:00 - 14:10	31/62/1-401, CERN	14:00 - 14:10
14:10 - 14:40	Set-ups for gas properties characterization	Filomena Pinto dos Santos
14:40 - 14:40	31/62/1-401, CERN	14:40 - 14:40
14:40 - 15:05	Studies on absorption of methane with zeolite material	Francesco Anguilli
15:00	Irradiation effects on GEM detectors operated at RUN1 and RUN2 at the LHCb experiment	Marco Pölz Lener
15:05 - 15:30	31/62/1-401, CERN	15:05 - 15:30
15:30 - 16:00	Coffee break	31/62/1-401, CERN
16:00 - 16:25	Studies of RPCs with gallium-arsenic electrodes	Alessandro Rocchi
16:25 - 17:20	31/62/1-401, CERN	16:25 - 17:20
17:20 - 17:45	Raspberry PiCO and IoT for RPC chamber slow control	Laurent Mirabito
17:45 - 18:10	31/62/1-401, CERN	17:45 - 18:10
18:10 - 17:15	Stability study of GEM detector and Performance study of a new RPC prototype	Dr Sakir Bhasia
17:15 - 17:15	31/62/1-401, CERN	17:15 - 17:15

Mon 17/06

10:00	WP4	Francisco Garcia et al.
10:00 - 12:00	4D/5D CO <sub>2</sub> - Safe Cure, CERN	10:00 - 12:00
10:00 - 12:00	WP7B	Inad Laitshch
10:00 - 12:00	4D/5D CO <sub>2</sub> - Safe Cure, CERN	10:00 - 12:00

## Work Packages Parallel Sessions (closed)

14:00	Plenary Session (Introduction)	Anna Colares, Enaldo Oliveira, Leszek Rogalski, Maxim TITOV, Piotr Gask
14:00 - 14:20	62-024 - BE Auditorium Meyrin, CERN	14:00 - 14:20
14:20 - 14:45	First results of the cylindrical µGroove prototype for STCF inner tracker	Yi Zhou
14:20 - 14:45	62-024 - BE Auditorium Meyrin, CERN	14:20 - 14:45
14:45 - 15:00	Progress on fine granularity resistive Micromegas and preliminary results of the capacitive sharing technique	Mikola Bilgic
15:00	The MEG II Drift Chamber	Marco Chappini
15:00 - 15:35	62-024 - BE Auditorium Meyrin, CERN	15:00 - 15:35
15:35 - 16:00	Straw Technologies and Perspectives	Tomur Elnik
15:35 - 16:00	62-024 - BE Auditorium Meyrin, CERN	15:35 - 16:00
16:00	Coffee break	62-024 - BE Auditorium Meyrin, CERN
16:00 - 16:30	62-024 - BE Auditorium Meyrin, CERN	16:00 - 16:30
16:30 - 16:55	Comparative study of resistive MPGDs with VMM3a/SRSreadout	Daria Zavanetto
16:30 - 16:55	62-024 - BE Auditorium Meyrin, CERN	16:30 - 16:55
16:55 - 17:20	Charge spreading in resistive Micromegas for the T3KIND30 TPC	Shyam Joshi
16:55 - 17:20	62-024 - BE Auditorium Meyrin, CERN	16:55 - 17:20
17:20 - 17:45	The SHIP experiment and the MRPC technology	Alberto Bianco
17:20 - 17:45	62-024 - BE Auditorium Meyrin, CERN	17:20 - 17:45
17:45 - 18:10	Latest news from PICOBEC	Alisah Pandey
17:45 - 18:10	62-024 - BE Auditorium Meyrin, CERN	17:45 - 18:10

## WG1

<https://indico.cern.ch/event/1413681/timetable/?view=standard>

PLEASE NOTE...

# Topical Workshop on Electronics for Gaseous Detectors

Wednesday, June 19, full-day

# Topical Workshop on Electronics for Gaseous Detectors

- **Wednesday, 19 June, 31/3-004 - IT Amphitheatre**



- **Organizers:**

- Hans Muller (University of Bonn),
- Lucian Scharenberg (CERN, University of Bonn),
- Marco Bregant (Universidade de Sao Paulo),
- Maxime Gouzevitch (Centre National de la Recherche Scientifique),
- Michael Lupberger (University of Bonn),
- Sorin Martoiu (Horia Hulubei National Institute of Physics and Nuclear Engineering)

# Topical Workshop on Electronics for Gaseous Detectors

## **New ASICs for MPGDs**

*Gianni Mazza* (Universita' e INFN Torino (IT))

## **Timepix4 and pixel ASIC design challenges**

**Xavi Llopart Cudie** (CERN)

## **ASIC design challenges with a focus on precise timing**

*Gianni Mazza* (Universita' e INFN Torino)

## **Development of a new ASD-ASIC for drift-tube and straw detectors**

*Oliver Kortner* (Max-Planck-Institut fuer Physik, Werner-Heisenberg-Institut)

## **MPGD electronics from R&D to the ATLAS NSW**

*George Iakovidis* (Brookhaven National Laboratory)

## **Short status on DRD7 ADC & TDC activities**

*Marek Idzik* (AGH University of Science and Technology)

## **RPC physics and performance vs. low discrimination threshold**

*Roberto Cardarelli* (INFN e Universita Roma Tor Vergata)

## **Development of self-triggered drift-tube chambers**

*Davide Cieri* (Max Planck Society)

## **Electronics for DUNE**

*Roberto Petti* (University of South Carolina)

## **First data with the uROC concentrator for VMM front-ends**

*Alexandru Rusu* (OAK RIDGE National Laboratory), *Dorothea Pfeiffer* (CERN)

## **SOM for eFEC backends**

*Jose Francisco Toledo Alarcon*, *Jose Francisco Toledo Alarcon* (Valencia Polytechnic University)

## **Update on eFEC backend project**

*Hans Muller* (University of Bonn)

## **SALSA: a new versatile readout chip for MPGDs**

*Damien Neyret* (CEA/IRFU, Centre d'etude de Saclay Gif-sur-Yvette, Université Paris-Saclay)

## **Readout links on SALSA**

*Irakli Mandjavidze* (Université Paris-Saclay)

## **IpGBT and Versatile link overview**

*Stefan Biereigel* (CERN)

## **CMS RPC link card**

*Dr Behzad Boghrati*, *Behzad Boghrati* (Institute for Research in Fundamental Sciences)

## **The ALTIROC ASIC**

*Nathalie Seguin-Moreau* (OMEGA - Ecole Polytechnique - CNRS/IN2P3)

## **Electronics requirements for a low-energy nuclear physics TPC**

*Daniel Bazin* (FRIB/MSU), *Marco Cortesi* (Facility for Rare Isotope Beams, Michigan State University)



# Special Session on Funding Schemes

Friday, June 21, 2pm CEST

# Discussions on Funding Schemes

- **Dedicated meeting organized by Imad Laktineh and Pino Iaselli on the different funding schemes that the members of the collaboration could look for to support their R&D development**
- **Friday 21<sup>st</sup> of June, 40/S2-C01 - Salle Curie, CERN**



# Collaboration Board

Thursday, June 20, 1pm CEST (Institute Representatives)

# Collaboration Board

**Meeting: Thursday 20/06, 1pm CEST – All institute Representatives, CB Chair, Spokespersons**



## Agenda:

- DRD1 Organization:
  - Endorsement of Management Roles:
    - CB Deputy Chair, CB Secretary
    - 3 MB Members Nominated by Spokespersons, Technical Coordinator, Resource Coordinator and Deputy, GLIMOS, MB Secretary
    - Working Groups Coordinator, Work Packages Coordinator, Working Group Conveners, Work Package Leaders and Work Package Project Leaders, SCB Secretary
  - Decision on renewability of the 2 years mandate of SPs and CB Chair (once or not renewable)
- MoU Status
- Common Funds
  - Support to common activities
  - Invoice to RD51 members

# Technology Representative Members in the DRD1 Management Board (Elected)

## MPGD

Amos Breskin

[Israel, Weizmann Institute of Science]

Paul Colas

[France, Inst. of Research into the Fundamental Laws of the Universe, CEA, Uni. Paris-Saclay]

Mauro Iodice

[Italy, INFN Sezione di Roma Tre]

## RPC

Marcello Abbrescia

[Italy, INFN Sezione di Bari, Università di Bari and Politecnico di Bari]

Giuseppe Iaselli

[Italy, INFN Sezione di Bari, Università di Bari and Politecnico di Bari]

Michael Tytgat

[Belgium, Vrije Universiteit Brussel]

## Wires & Drift Chambers

Gabriel Charles

[France, Université Paris-Saclay]

Nicola De Filippis

[Italy, INFN Sezione di Bari, Università di Bari and Politecnico di Bari]

Peter Wintz

[Germany, Forschungszentrum Jülich GmbH and Ruhr-Universität Bochum]

## TPC

Diego Gonzalez Diaz

[Spain, Inst. Galego de Física de Altas Enerxías / Uni. de Santiago de Compostela]

Jochen Kaminski

[Germany, Physikalisches Institut, University of Bonn]

Thorsten Lux

[Spain, Institut de Física d'Altes Energies]

Total Number of Voting Institutes: 89 out of 165

Institutes per Technologies: MPGD (53), RPC(39), W&DC(26), TPC(34)

# Technology Representative Members in the DRD1 Management Board (Elected)

- **Congratulations to the newly elected representatives.**
- **We sincerely congratulate all colleagues who were nominated and ran in the elections. The support from the community was well distributed among all of them.**

# DRD1 Logo

Deadline for submission **TOMORROW June 18, 2024, 12:00pm CEST (noon)**

# DRD1 Logo call and Selection

To find a logo for the DRD1 collaboration, we are calling for submissions of logo ideas / designs.

If you would like to submit a proposal, you can upload an image here: <https://indico.cern.ch/event/1424745/registrations/106501/>

**Deadline for submissions: TOMORROW June 18, 2024, 12:00pm CEST (noon)**

An electronic vote on the submitted logo proposals will be organized soon after.

**Please, contact WG8 Conveners if you need more info.**

**DRD1** <sup>TM</sup>





# 2024 Gaseous Detector Conferences and DRD1 School

# 2024 Gaseous Detector Conferences



[RPC2024 - 16th International Conference on Resistive Plate Chambers and Related Detectors \(Santiago, Spain, 9–13 September 2024\)](#)

Registration is open until July 15th, 2024:  
<https://rpc2024.tufabricadeventos.com/>

Deadline for abstract submission 2024.07.01  
<https://indico.cern.ch/event/1354736/abstracts/>

PLEASE  
NOTE...

[MPGD2024 - 8th International Conference on Micro Pattern Gaseous Detectors \(Hefei, China, 14-18 October 2024\)](#)

Registration is open:  
<https://mpgd2024.aconf.org/register.html>

Deadline for abstract submission 2024.06.24  
[https://mpgd2024.aconf.org/call\\_for\\_paper.html](https://mpgd2024.aconf.org/call_for_paper.html)

PLEASE  
NOTE...

# DRD1 Gaseous Detector School

The DRD1 Gaseous Detectors School will take place at CERN from November 27th to December 6th, 2024. The program will consist of both theoretical lectures and hands-on laboratory exercises. The school focuses on state-of-the-art gaseous detector technologies and is targeted at students and young scientists.

More information can be found on the school website:

<https://indico.cern.ch/e/drd1school2024>

**Applications for the school are open from now until July 13 via the school website.**



The poster features a dark blue background with white and light blue text and graphics. At the top, the title 'DRD1 Gaseous Detectors School' is centered, followed by 'CERN' and the dates 'November 27 - December 6, 2024'. Below this, there are three large diagrams: a central one showing a detector cross-section with particle paths, and two others showing detector array layouts. A row of six circular images shows various detector components and materials. At the bottom, there are two columns of text: 'Scientific program' listing topics like physics, technologies, simulation, and manufacturing; and 'School website and registration' providing the website URL, application deadline (July 31, 2024), and contact information. Logos for DRD1, CERN, and a QR code are at the bottom right.

# In memoriam Atsuhiko Ochi 2024

# Atsuhiko Ochi 1969-2024

A brilliant and passionate detector and experimental physicist, Atsuhiko Ochi passed away on April 29, 2024, at the age of 54. He was an enthusiastic physicist and a source of innovative ideas at the forefront of radiation detectors. His outstanding contribution to the development of new Micro Pattern Gaseous Detectors is recognized worldwide. Atsuhiko was also a distinguished lecturer of physics, whose inexhaustible passion, dedication, and remarkable character captivated not only us but also the many students he mentored.

Atsuhiko began his research at the Tokyo Institute of Technology, initially focusing on studying large-area avalanche photodiodes as fast photon and soft X-ray detectors. In 1998, he defended his Ph.D. thesis, "Study of MicroStrip Gas Chamber as a Time-Resolved X-ray Area Detector," earning the 2nd High Energy Physics Young Researcher's Award from the Japan Association of High Energy Physicists. In 2000, alongside Toru Tanimori, he introduced the micro pixel chamber (micro-PIC), a new gaseous detector for X-ray, gamma-ray, and charged particle imaging. It was fully developed using printed circuit board technology and was free of floating structures like wire, mesh, or foils, featuring a pin-shaped anode surrounded by a ring-shaped cathode.

In 2001, Atsuhiko moved to Kobe University, where he joined the ATLAS experiment and devoted his efforts to commissioning the ATLAS TGC chambers. Atsuhiko was in charge of integrating the front-end electronics on the KEK TGC detectors and of detector quality assurance and control. Later, at CERN, he led the acceptance quality control of the detectors. Atsuhiko could always merge his love for experiments with his passion for new ideas. Along with his group in Kobe, while making significant contributions in ATLAS to the design and construction of the new large resistive micromegas for the Muon New Small Wheel (NSW), he conducted R&D studies focused on the use of sputtered layers of diamond-like carbon (DLC) as resistive elements to quench discharges. In this context, he played a crucial role in connecting with the Japanese industry. Atsuhiko was among the first to test it with micromegas, apply it to his micro-PIC detector, and pioneer its use as electrodes for the novel Resistive Plate Chambers he proposed for the MEG II experiment. He supported the use of DLC in the final TPC Micromegas of the Near Detectors of the T2K experiment while serving as a liaison person with BE-Sput company in Kyoto. Nowadays, DLC is the predominant approach in most new resistive MPGD detectors.

Atsuhiko's expertise in gaseous detectors, particularly in MPGD technologies, grew increasingly relevant globally. In his research, Atsuhiko always placed great emphasis on mentoring his students and providing them with access to a worldwide community of experts, facilities, and experiments. He consistently and meticulously shared all relevant research conducted by Japanese colleagues, ensuring proper visibility and recognition for his community. This aspect has been crucial in the context of the international RD51 collaboration on MPGD technologies. Within the collaboration, Atsuhiko played a significant role in its formation and in serving the community as a Management Board Member, Collaboration Board Chair, and Scientific Secretary. Starting in 2016, he was responsible for the Common Projects of the collaboration. Atsuhiko organized MPGD2011, which was the first conference held in Asia as part of the international series. During the transition from the MPGD-based RD51 collaboration to the upcoming DRD1, which encompasses a broader scope of technologies and applications, Atsuhiko made a crucial contribution by maintaining strong ties with the Asian community.

Atsuhiko's vibrant enthusiasm and infectious smile leave an irreplaceable void. His departure is a profound loss, leaving behind a loving wife and two children. We extend our deepest condolences to his family during this difficult time.

*His colleagues and friends*

***"We need new 'eyes' to catch a glimpse of science's frontier." (Atsuhiko)***



## A new design of the gaseous imaging detector: Micro Pixel Chamber

Atsuhiko Ochi<sup>a,\*</sup>, Tsutomu Nagayoshi<sup>a</sup>, Satoshi Koishi<sup>a</sup>, Toru Tanimori<sup>b</sup>,  
Tomofumi Nagae<sup>c</sup>, Mirei Nakamura<sup>c</sup>

<sup>a</sup> Department of Physics, Tokyo Institute of Technology, 2-12-1 Ookayama, Meguro, Tokyo 152-8551, Japan  
<sup>b</sup> Kyoto University, Kyoto 606-8502, Japan  
<sup>c</sup> High Energy Accelerator Research Organization (KEK), Tsukuba 305-0801, Japan

### Abstract

The novel gaseous detector “Micro Pixel Chamber (Micro PIC)” has been developed for X-ray, gamma-ray and charged particle imaging. This detector consists of double sided printing circuit board (PCB). The stable operation of Micro PIC is realized by thick substrate and wide anode strips. One of the most outstanding feature is the process of production and the cost. The base technology of producing Micro PIC is same as producing PCB, then detector with large detection area (more than 10 cm × 10 cm) can be made by present technology. Our first tests were performed using a 3 cm × 3 cm detection area with a readout of 0.4 mm pitch. The gas gain and stability were measured in these tests. The gas gain of 10<sup>4</sup> was obtained using argon ethane (8:2) gas mixture. Also, there was no discharge between anodes and cathodes in the gain of 10<sup>3</sup> during two days of continuous operation. Although some discharges occurred in the higher gain (approximately 10<sup>4</sup>), no critical damage on the detector was found. © 2001 Elsevier Science B.V. All rights reserved.

**Keywords:** Gaseous detector; Imaging; MSGC

# 2001

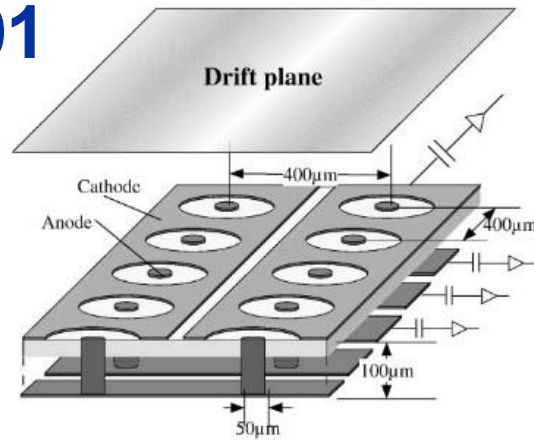


Fig. 1. Schematic structure of Micro PIC.

TIPP 2011 - Technology and Instrumentation for Particle Physics 2011

## Development of a Micro Pixel Chamber for the ATLAS upgrade

Atsuhiko Ochi<sup>1</sup>, Yasuhiro Homma, Hidetoshi Komai, Yuki Edo, and Takahiro Yamaguchi  
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### Abstract

The Micro Pixel Chamber ( $\mu$ -PIC) is being developed as a candidate for the muon system of the ATLAS detector for upgrading in LHC experiments. The  $\mu$ -PIC is a micro-pattern gaseous detector that doesn't have floating structure such as wires, mesh, or foil. This detector can be made by printed-circuit-board (PCB) technology, which is commercially available and suited for mass production. Operation tests have been performed under high flux neutrons under similar conditions to the ATLAS cavern. Spark rates are measured using several gas mixtures under 7 MeV neutron irradiation, and good properties were observed using neon, ethane, and CF<sub>4</sub> mixture of gases. Using resistive materials as electrodes, we are also developing a new  $\mu$ -PIC, which is not expected to damage the electrodes in the case of discharge sparks.

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**Keywords:** MPGD,  $\mu$ -PIC, HL-LHC, ATLAS, neutron, gaseous detector

# 2012

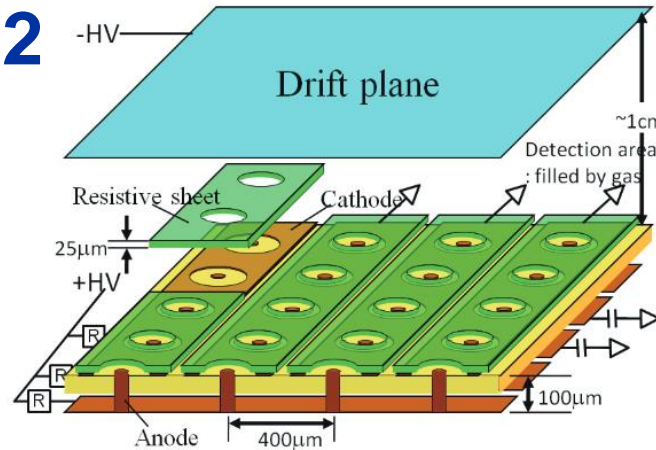


Fig. 9. Schematic structure of  $\mu$ -PIC with resistive cathodes. It has been developed in order to reduce damage to the readout electrodes caused by sparking, and is currently under tests.

# 2020

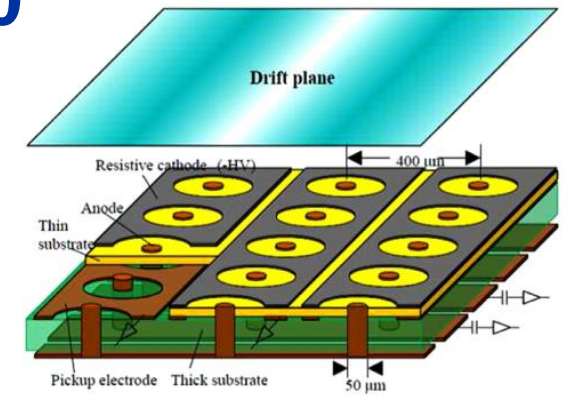


Fig. 2. Schematic view of resistive  $\mu$ -PIC [16]: Insulating layer is sandwiched between resistive cathode and pickup electrode.

## Development of the Micro Pixel Chamber with DLC cathodes

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### ARTICLE INFO

MSC:  
00-01  
99-00

**Keywords:**  
Gaseous detector  
Micro Pixel Chamber  
MPGD

### ABSTRACT

We developed a novel design of a Micro Pixel Chamber ( $\mu$ -PIC) with resistive electrodes for a charged particle tracking detector in high rate applications. Diamond Like Carbon (DLC) thin film is used for the cathodes. The resistivity can be controlled flexibly ( $10^{5-7} \Omega/\text{sq.}$ ) with high uniformity. The fabrication process was greatly improved and the resistive  $\mu$ -PIC could be operated with an area of  $10 \times 10 \text{ cm}^2$ . Resistors for the HV bias and capacitors for the AC coupling were completely removed by applying PCB and carbon sputtering techniques, and the resistive  $\mu$ -PIC became a very compact detector. The performance of our new resistive  $\mu$ -PIC was measured in various ways. Consequently, it was possible to attain high gas gain ( $> 10^4$ ), high detection efficiency, and position resolution better than 100  $\mu\text{m}$ . The spark probability was reduced, and the new resistive  $\mu$ -PIC was operated stably under fast neutrons irradiation. These features offer solutions for a charged particle tracking detector in future high rate applications.

# $\mu$ PIC Space Application (as one example)



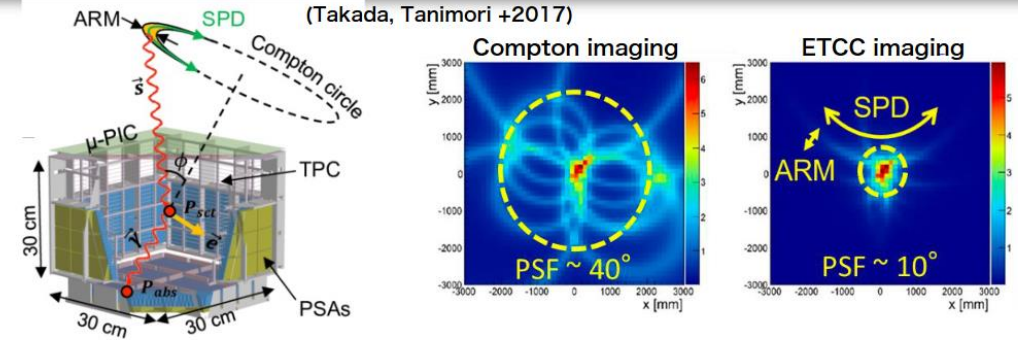
Toru Tamagawa (RIKEN)

MPGD 2022, Weizmann Institute of Science, Rehovot, Israel

Invited talk: MPGD in space applications

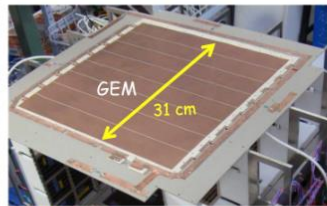
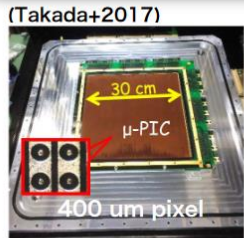


## 3.1 Compton gamma-ray detector



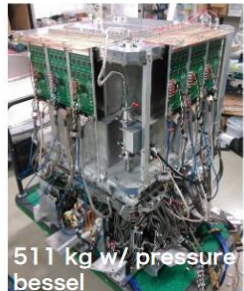
- SMILE: Balloon born gamma-ray observatory
- Open gamma-ray astronomy: detect nuclear gamma-lines from supernovae etc.
- This is the only mission that can track electrons and solve Compton kinematics.
- With the current technology, this cannot be achieved with semiconductors; **using MPGD is the only solution.**

## 3.2 SMILE2+ and future

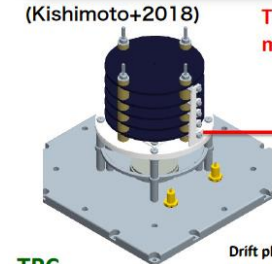


$\mu$ PIC 400 um pixel  
Thick-foil LCP GEM P: 140um, D:70um, T: 100um  
Gas 2 atm  
Ar 95% + CF<sub>4</sub> 3% + iC<sub>4</sub>H<sub>10</sub> 2%

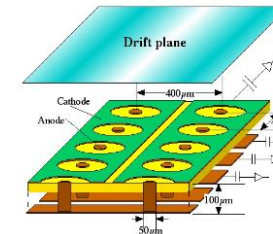
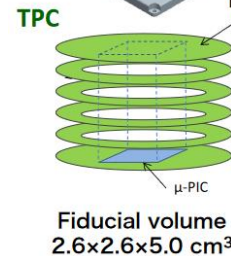
- SMILE2+ successfully detect gamma-ray excess from the galactic center (Takada+2022).
- Upgrade and the next fly scheduled in Australia in 2026.



## 5.2 PS-TEPC and moon exploration

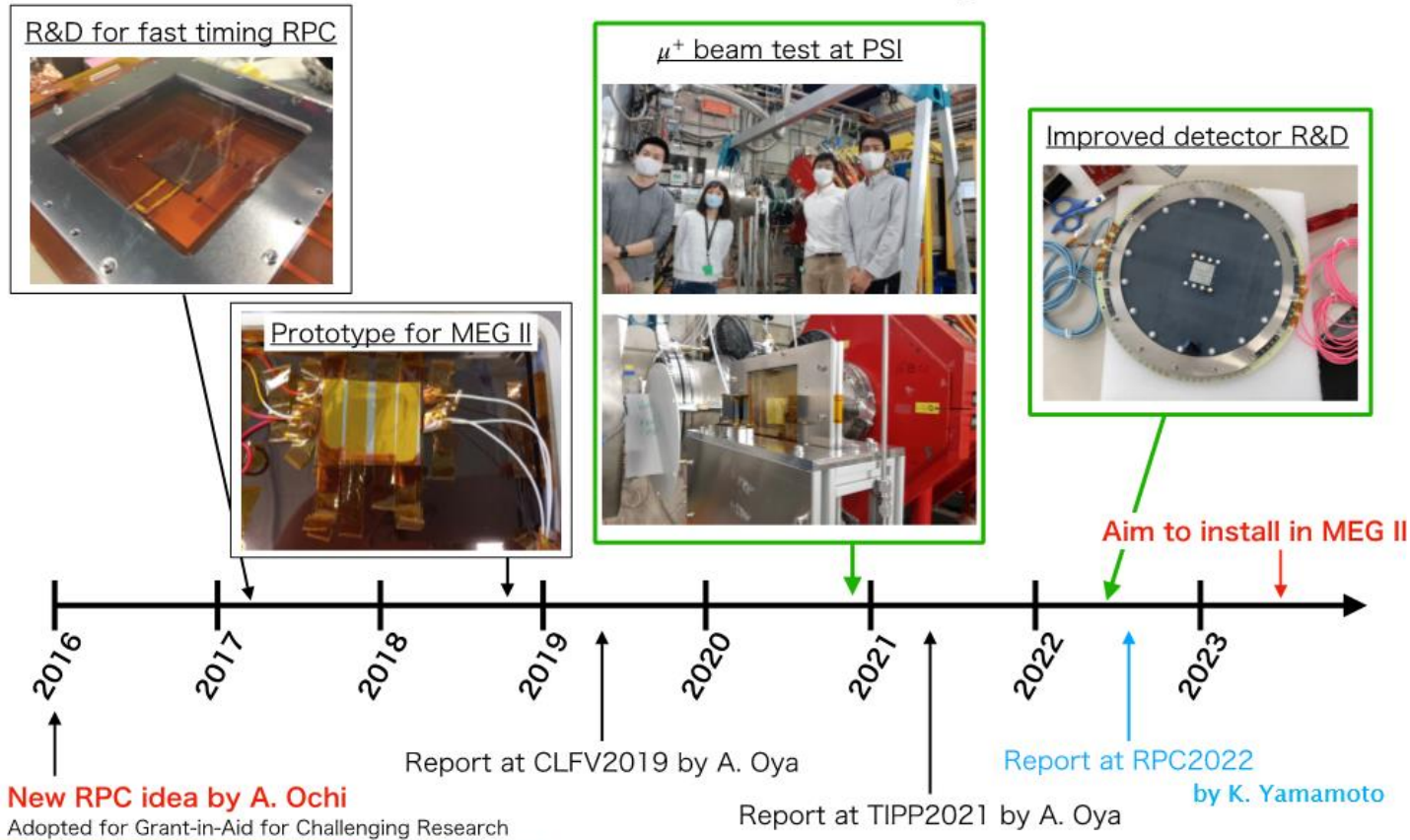


Time projection chamber using micro-pixel chamber ( $\mu$ -PIC)  
A: 64 x C: 64 strips  
Readout 16 x 16ch



- Not integrated, but event by event.
- Spatial resolution, species.
- Tissue-equiv gases and plastics
- MPGD can play an important role.
- Planned to be installed on the Moon Gateway after 2027.

# Resistive Plate Chambers with DLC



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Full Length Article

**Prototype study of 0.1%  $X_0$  and MHz/cm<sup>2</sup> tolerant Resistive Plate Chamber with Diamond-Like Carbon electrodes**

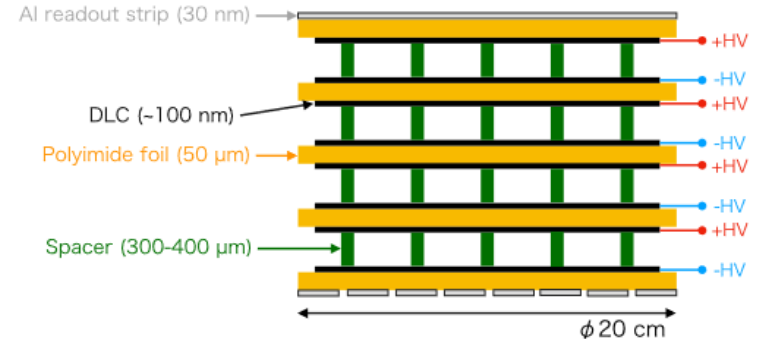
Kei Ieki<sup>a</sup>, Weiyuan Li<sup>b</sup>, Atsuhiko Ochi<sup>c</sup>, Rina Onda<sup>b</sup>, Wataru Ootani<sup>a</sup>, Atsushi Oya<sup>b,\*</sup>, Masato Takahashi<sup>c</sup>, Kensuke Yamamoto<sup>b</sup>

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**ARTICLE INFO**      **ABSTRACT**

**Keywords:**  
RPC

**ABSTRACT:** A novel Resistive Plate Chamber (RPC) was designed with Diamond-Like Carbon (DLC) electrodes and performance studies were carried out for 384 $\mu$ m gap configuration with a 2cm  $\times$  2cm prototype. The use of thin films coated with DLC enables an ultra-low mass design of less than 0.1%  $X_0$  with up to a four-layer configuration. At the same time, 42% MIP efficiency, and 180 ps timing resolution per layer were achieved in a measurement performed under a 1 MHz/cm<sup>2</sup> non-MIP charged particle beam. In addition, we propose a further improved design for a 20cm-scale detector that can achieve 90% four-layer efficiency in an even higher 4 MHz/cm<sup>2</sup> beam. In this paper, we describe the detector design, present the results of performance measurements, and characterize the rate capability of the DLC-based RPCs with a performance projection for an improved design.



**Fig. 1.** Concept of Resistive Plate Chamber with DLC-based electrodes for the MEG II experiment. The high voltages are applied independently to each layer. The number of layers is limited because of the requirement of less than 0.1%  $X_0$ .



# ATLAS Muons System: TGCs and Resistive MMs

REVIEW OF SCIENTIFIC INSTRUMENTS 77, 10E709 (2006)

## Thin gap chamber performance tests under several MeV neutron sources

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EPJ Web of Conferences 174, 03001 (2018)  
MPGD 2015

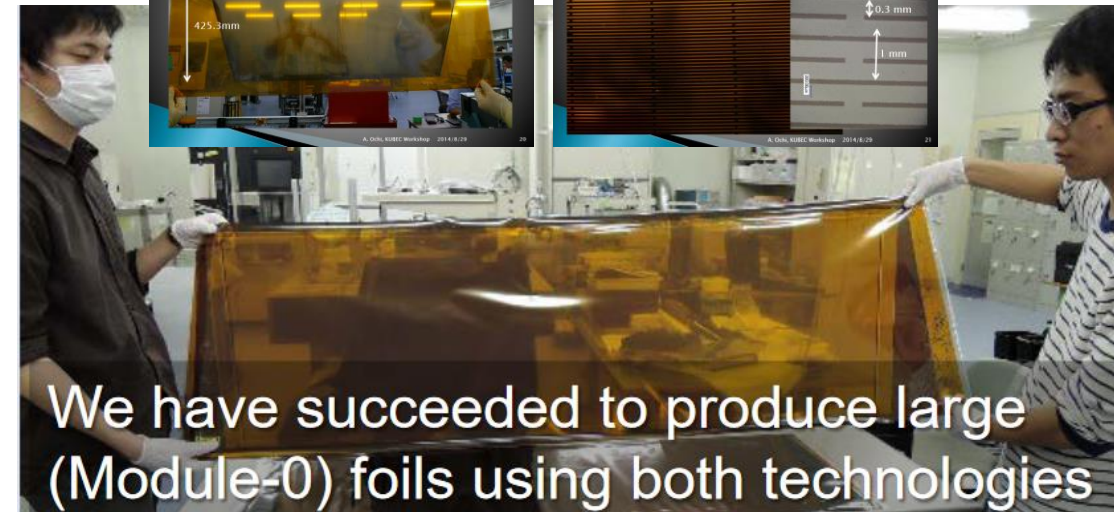
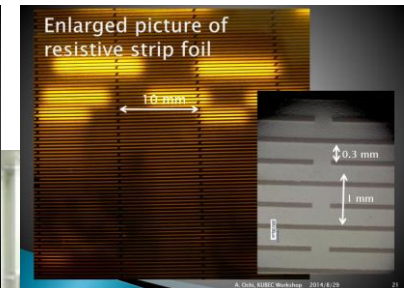
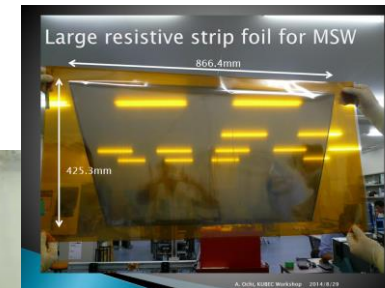
<https://doi.org/10.1051/epjconf/201817403001>

## Development of large area resistive electrodes for ATLAS NSW Micromegas

Atsuhiko Ochi<sup>1,a</sup>, on behalf of the ATLAS Muon Collaboration

<sup>1</sup>Kobe University, Kobe 657-8501, Japan

**Abstract.** Micromegas with resistive anodes will be used for the NSW upgrades of the ATLAS experiment at LHC. Resistive electrodes are used in MPGD devices to prevent sparks in high-rate operation. Large-area resistive electrodes for Micromegas have been developed using two different technologies: screen printing and carbon sputtering. The maximum resistive foil size is  $45 \times 220$  cm with a printed pattern of  $425\text{-}\mu\text{m}$  pitch strips. These technologies are also suitable for mass production. Prototypes of a production model series have been successfully produced. In this paper, we report the development, the production status, and the test results of resistive Micromegas.



We have succeeded to produce large (Module-0) foils using both technologies

# RD51/DRD1

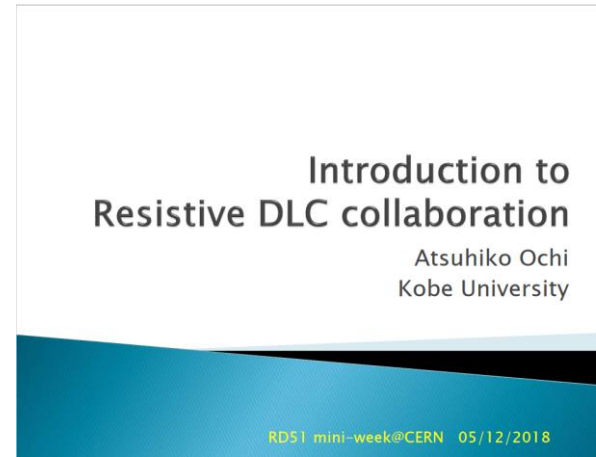
Atsuhiko played a significant role in the formation of the RD51 Collaboration.

He served the community as:

- **Management Board Member**
- **Collaboration Board Chair**
- **Scientific Secretary**
- **Responsible for the Common Projects**

Atsuhiko participated to the organization of **MPGD2011 in Kobe**, which was the first conference held in Asia as part of the international series.

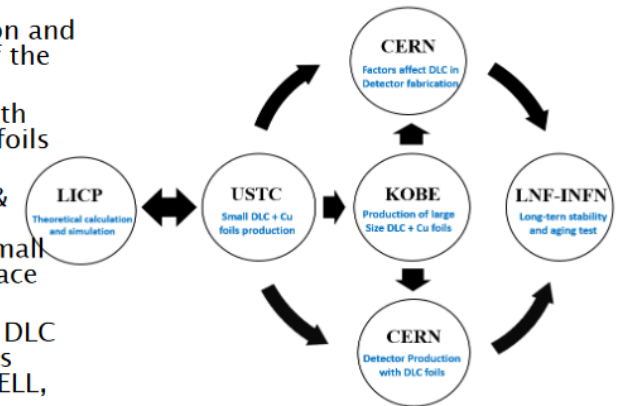
During the **transition to DRD1** Atsuhiko has been very **active** and made a crucial contribution by **maintaining strong ties with the Asian community and in particular with Japan.**



[https://indico.cern.ch/event/761831/contributions/3236762/attachments/1765980/2867435/DLC\\_CP\\_Intro\\_ochi\\_181205\\_v2.pdf](https://indico.cern.ch/event/761831/contributions/3236762/attachments/1765980/2867435/DLC_CP_Intro_ochi_181205_v2.pdf)

## DLC Common project (2018–)

- ▶ LICP: on the basis of theoretical calculation and simulation, give USTC team a guidance of the work
- ▶ USTC: produce different bare DLC foils with different surface resistivity and also DLC foils with Copper coating (DLC+Cu)
- ▶ Kobe University: produce large size DLC & DLC+Cu foils in order to study the reproducibility of the process tuned on small prototypes and the uniformity of the surface resistivity of the DLC
- ▶ CERN: study the behavior and changes of DLC properties under manufacturing processes foreseen for MPGD construction (i.e.  $\mu$ RWELL, resistive GEM and THGEM)
- ▶ LNF-INFN: study stability of bare DLC properties under current drawing on bench (w/irradiation)
- ▶ CERN: produce detectors with DLC foils
- ▶ LNF-INFN: perform aging and spark test of DLC based detectors (with different radiation)



# RD51/DRD1 Link with Detector R&D in Japan

## MPGD Activities in JAPAN

(Not even a complete list)

- Structure studies
  - GEM (Gas electron multiplier)
    - @Many institutes ... KEK, RIKEN, JAEA, U. Tokyo, Kyoto U., Saga U., TIT, Kinki U., TUAT ...
  - THGEM, Capillary plate,
    - Yamagata U., TMU, U.Tokyo, AIST
  - MicroMEGAS
    - Kobe U., U. Tokyo
  - $\mu$ -PIC (Micro Pixel Chamber)
    - Kyoto U., Kobe U., ICRR, KEK, J-PARC
- Material studies (Substrate (conventional, polyimide))
  - LCP (Liquid crystal polymer)
    - KEK, RIKEN, U.Tokyo, (SiEnergy co.)
  - Glass
    - U.Tokyo, Yamagata U. AIST
  - PTFE, Ceramic
    - Tokyo IRI, RIKEN
- Resistive electrodes
  - Organic material
    - KEK
  - Sputtering carbon/metal
    - Kobe U.
  - Carbon loaded Epoxy
    - Kobe U., U. Tokyo
- Applications
  - Particle physics (Acc./ Non Acc.)
    - Kobe U. KEK, Kinki U. Saga U.
  - Neutron imaging
    - Kyoto U., KEK
  - Nuclear physics
    - TIT, U.Tokyo., JAEA, Tsukuba U., RIKEN
  - Astrophysics
    - Kyoto U., RIKEN
  - Gas Photomultiplier
    - Yamagata U, TMU, ICRR
  - X/gamma ray imaging
    - Kyoto U., KEK, AIST
  - Medical imaging
    - Kyoto U.

A.Ochi RD51 2022/6/16

2

## Detector R&D in JAPAN

Atsuhiko Ochi  
Kobe University

5th MPGD Conference at Philadelphia, 24/05/2017

### Detector R&D platform

- ▶ Detector R&D platform supported by KEK-IPNS Instrumentation Technology Development Center(ITDC)
- ▶ There are three platform groups. Platform-C group is a collaboration for common technologies for MPGD, gas/liquid TPC (active-medium TPC)
  - Platform-A : Photo-sensor, scintillator, Platform-B : Silicon detector
- ▶ Group is active to promote joint research, utilize a common equipment for R&D and share information
  - For example, HV modules, waveform digitizer, X-ray generator can be utilized



Web site:  
<https://wiki.kek.jp/display/rdtpc/RD+Platform+C+Home+Page>

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8

### MPGD annual workshop in JAPAN (2004~)

- ▶ Many institutes started the MPGD studies in this century
- ▶ December 2004, First MPGD workshop held in Kyoto
- ▶ The workshop held once every year now
  - More than 70 participants have joined for each workshop.

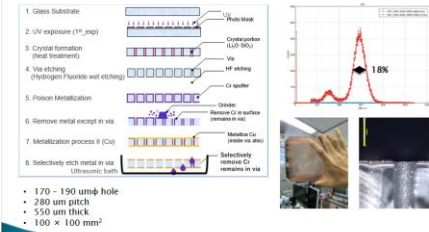


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7

### The new Glass GEM

T.Fujiwara (AIST)

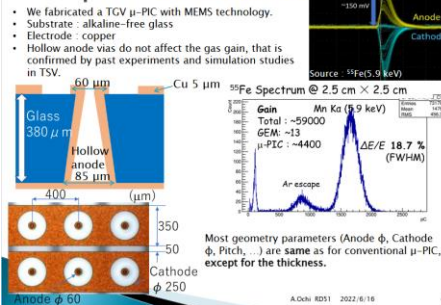


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3

### TGV $\mu$ -PIC

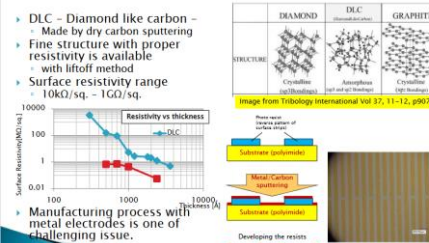
A.Takada (Kyoto Univ.)



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4

### - Resistive electrodes : DLC -



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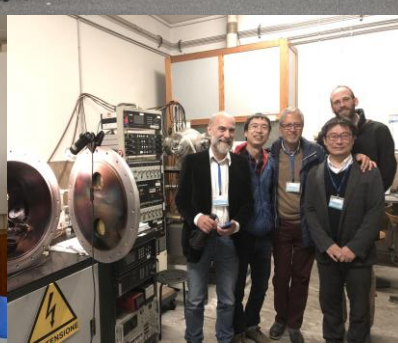
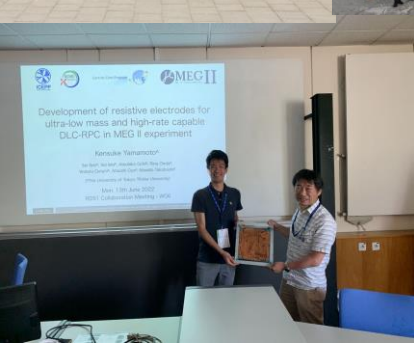
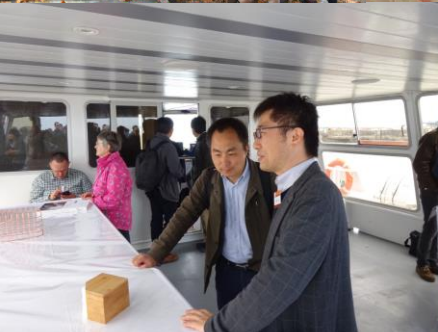
5



MPGD 2009 - Kolympari, Crete



MPGD2011 and 8th RD51 Collaboration Meeting  
29 August - 3 September 2011  
Kobe, Japan





**Special Thanks to Veronique** Wedlake (CERN EP-DT) for the help in the organization of the meeting and for the current support as DRD1 secretariat

**Wishing everyone a productive and insightful meeting**

**DRD1**

<https://drd1.web.cern.ch/>