DRD1 overview: Toward the Global South

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on behalf of the DRD1 collaboration

RPC2026 - XVIII Conference on Resistive Plate Chambers and related detectors

Rio de Janeiro (Brasil
Sept. 14-18 2026

Detectors for all seasons

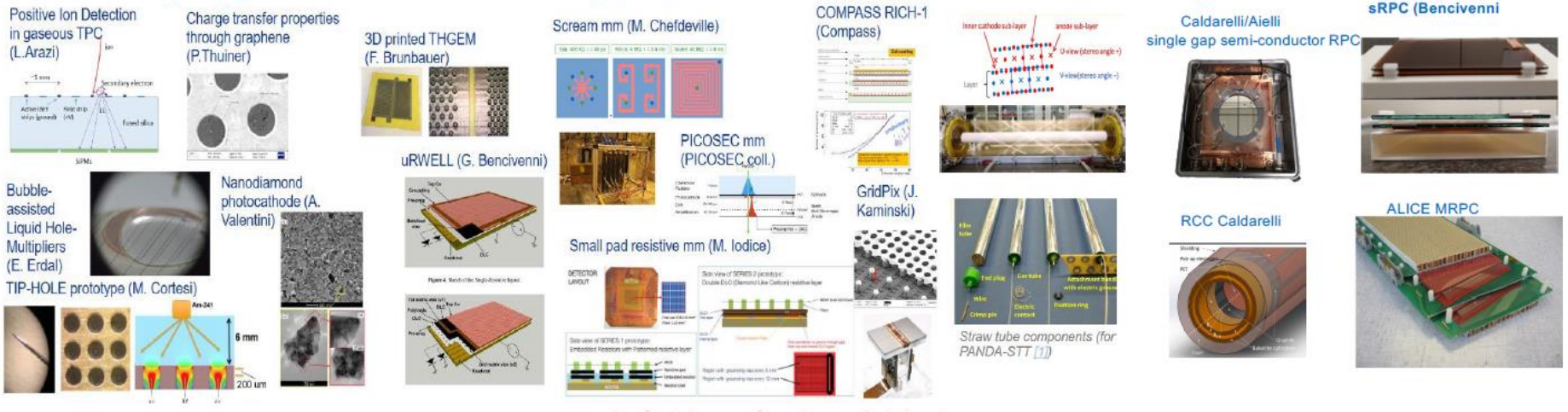
Phasing out of gaseous detectors has been predicted many times:

Many times this prediction was proved to be wrong!

Thanks to their versatility, their possibility to provide **sub-mm spatial resolution**, and **tens of ps timing resolution** over surfaces of the several hundred of square meters and more, they are an essential component of the present of future particle physics experiments.

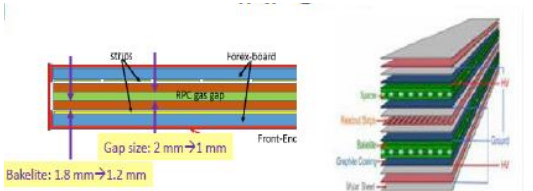
- ✓ Thanks to their simplicity, they also feature important applications beyond HEP
- ✓ Since the beginning of 2000s, a we assisted to a real boost in new types, applications, materials, and technologies of gaseous detectors.

Pioneering Approach: New technologies, Materials, Architectures, and Hybrid Technology

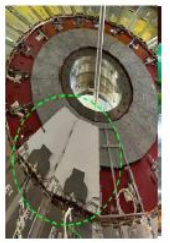


The Renaissance of Gaseous Detectors

DRD1 was born during the «Renaissance» of Gaseous Detectors: when many experiments were planning and building the upgrade for the HL-LHC phase.



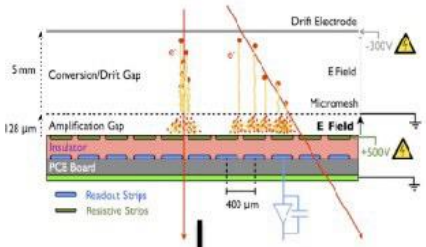
ATLAS BIS7&BIS8 and CMS RE3/1 & RE4/1



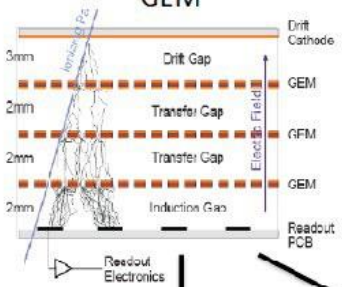
Gaseous detectors will play a major role in HL-LHC:

- ✓ enhancing Muon Tracking and Triggering with MPGDs, iRPC
- ✓ new Generation TPCs with MPGDBased, Readouts@ALICE/T2K

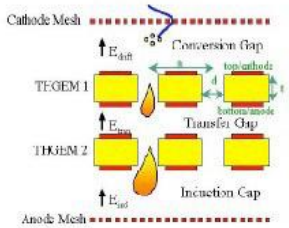
MicroMegas (MM)



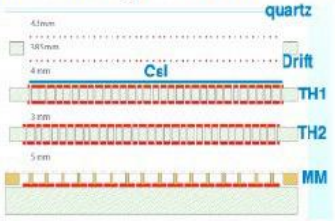
GEM



THGEM

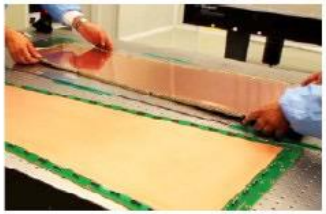


Hybrid design THGEM + MM

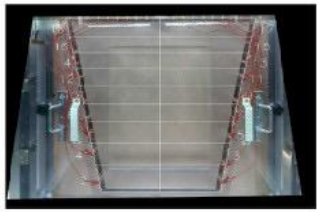


ATLAS new small wheels

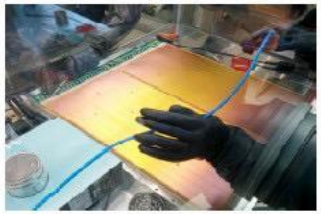
CMS GEM



ALICE TPC upgrade



COMPASS RICH



DRD1 collaboration act of birth

DRD1 was born with the spirit of creating an environment where gaseous detector experts from different communities could share knowledge and tools.

It brings together experts in:

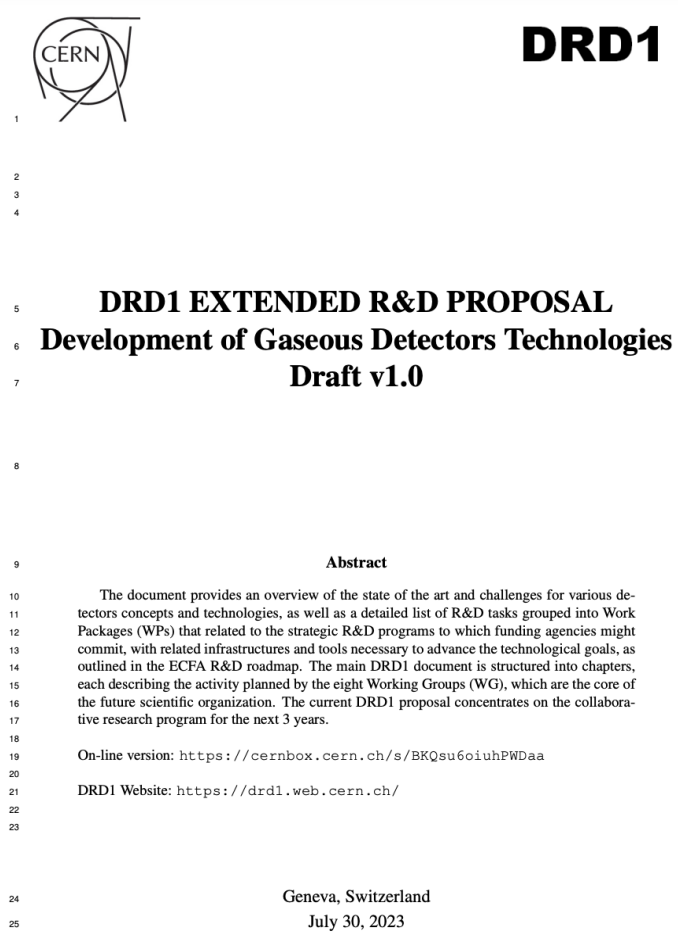
- Micro-Patter Gasesous Detector (MPGDs)
- Resistive Plate Chambers (RPCs)
- Time Projection Chambers (TPCs)
- Wire Chambers, and so on...

From accelerator experiments to cosmic rays experiments, and beyond.

Q4-2022/Q1-2023	Q2-2023
▪ Formation of the DRD1 proposal team ▪ Collection of interest from the institutes (survey) ▪ 1st Workshop and shaping the direction of RD.	▪ **Writing the proposal** (scientific and organization) that includes conclusion and feedback from the workshop and survey ▪ Collect feedback by institutes in contact with their funding agencies about the best funding schema ▪ 2nd Community Workshop

«Preliminary» phase

First draft submitted to DRDC on July 31st 2023



CERN

DRD1

DRD1 EXTENDED R&D PROPOSAL
Development of Gaseous Detectors Technologies
Draft v1.0

Abstract

The document provides an overview of the state of the art and challenges for various detectors concepts and technologies, as well as a detailed list of R&D tasks grouped into Work Packages (WPs) that related to the strategic R&D programs to which funding agencies might commit, with related infrastructures and tools necessary to advance the technological goals, as outlined in the ECFA R&D roadmap. The main DRD1 document is structured into chapters, each describing the activity planned by the eight Working Groups (WG), which are the core of the future scientific organization. The current DRD1 proposal concentrates on the collaborative research program for the next 3 years.

On-line version: `https://cernbox.cern.ch/s/BKQsu6oiuhPWDaa`

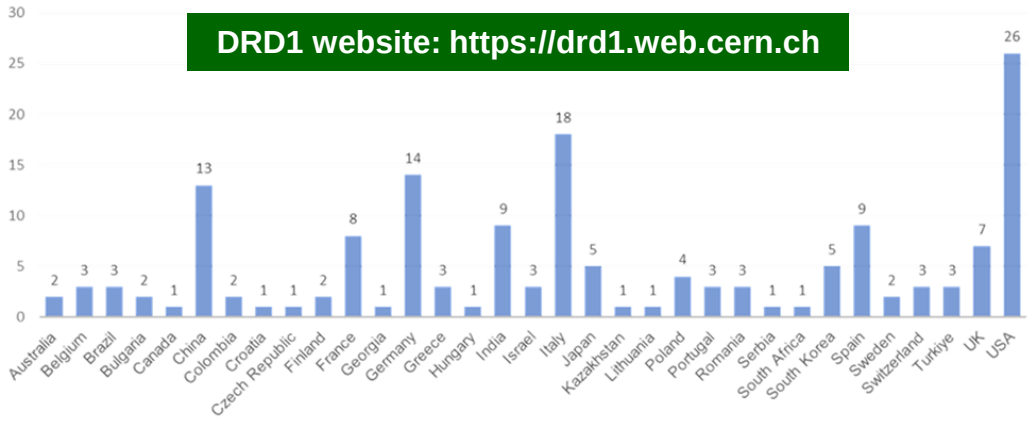
DRD1 Website: `https://drd1.web.cern.ch/`

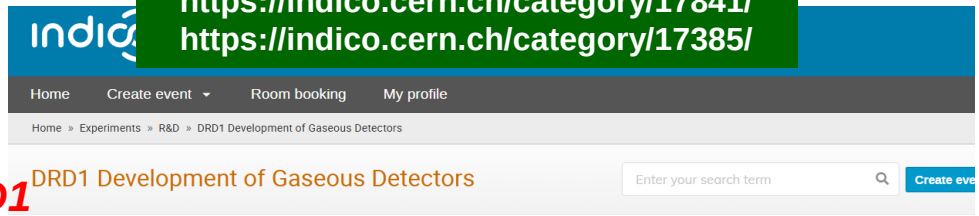
Geneva, Switzerland
July 30, 2023

https://cernbox.cern.ch/s/BKQsu6oiuhPWDaa

DRD1: a large and diversified community

- **133 Institutes (DRD1 MoU Annexes 1 & 2)**
- **More than 30 Countries,**
- **More than 700 members**



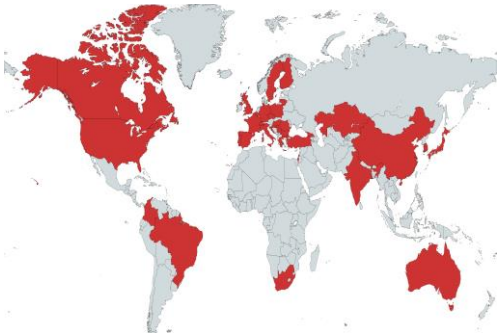


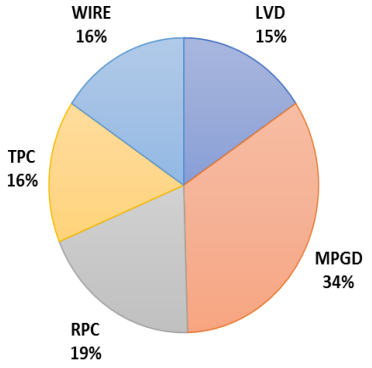
DRD1 Collaboration Meetings in 2024 – 2026:

& WG and WP DRD1 Scientific Activities :

General Meetings	8 events
Working Groups	154 events
Work Packages	51 events
Collaboration Board Meetings	11 events
Management Board Meetings	19 events
Scientific Coordination Board	11 events
Technical Coordination	2 events
Resources Board Meeting	1 event
Other meetings	1 event
DRDC Review Meeting	3 events

Countries of DRD1 Institute (in 2023)





DRD1 scientific organization

ECFA Scientfic Goals

Gaseous

DRDT 1.1 Improve time and spatial resolution for gaseous detectors with long-term stability

DRDT 1.2 Achieve tracking in gaseous detectors with dE/dx and dN/dx capability in large volumes with very low material budget and different read-out schemes

DRDT 1.3 Develop environmentally friendly gaseous detectors for very large areas with high-rate capability

DRDT 1.4 Achieve high sensitivity in both low and high-pressure TPCs

Working Groups (WGs)

DRDTs

Working Packages

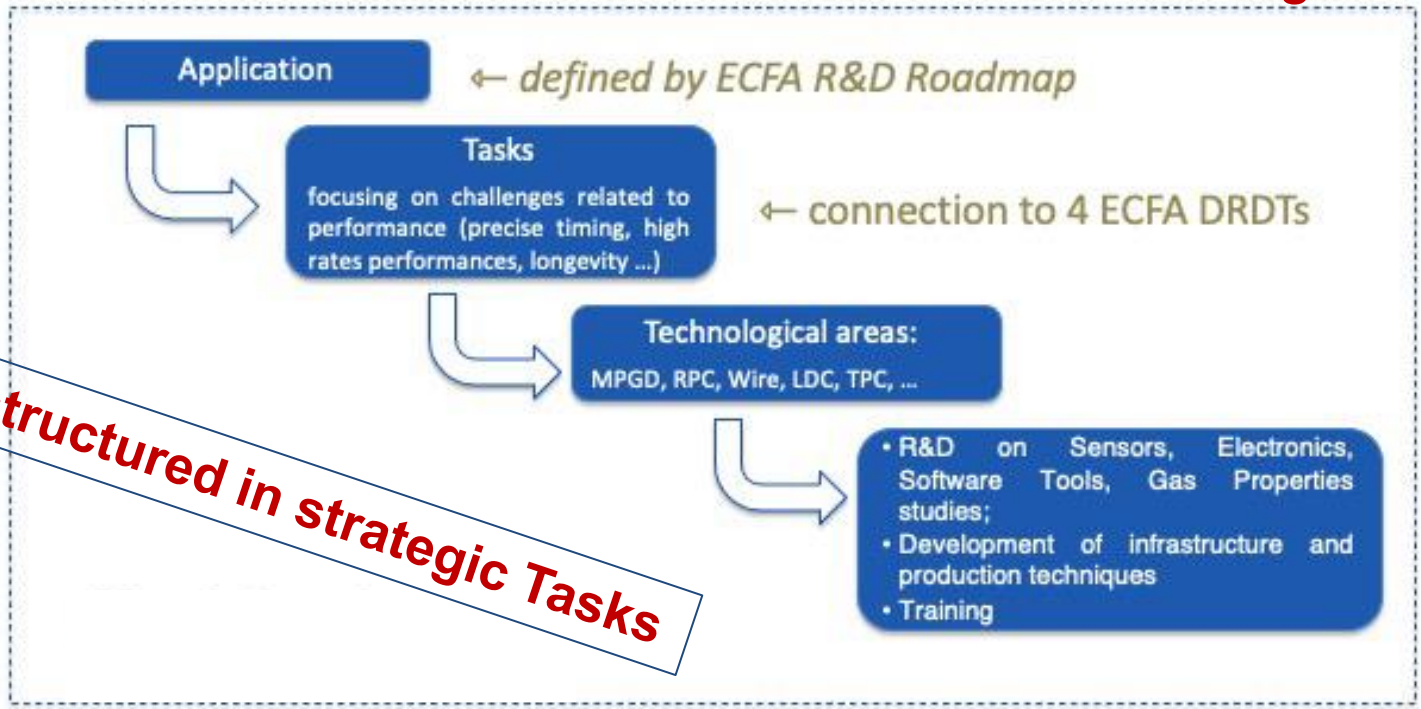
1.1	1.2	1.3	1.4	
●		●		Trackers/hodoscopes
●	●	●		Drift chambers
●	●	●		Straw chambers
●	●	●	●	Tracking TPCs
●		●		Calorimetry
●	●	●		Photon detection (PID)
●		●		Timing detectors
●	●	●	●	Reaction/decay TPCs
●		●		Beyond HEP

WG1	WG2	WG3	WG4	WG5	WG6	WG7	WG8
Technologies	Applications	Gas and material studies	Detector physics, simulations and software tools	Electronics for gaseous detectors	Detector production	Common test facilities	Training and dissemination

Strategic R&D=Work Packages

Group together institutes research interests around **Applications** with a focus on a **specific task(s)** devoted to a specific challenge (Detector R&D theme), typically related to specific **Detector Technologies** and to the development of **specific tool or infrastructure**

Work Package



WPs are structured in strategic Tasks

Most WPs are **ready for endorsement or preparing for endorsement:** interested institutes are drafting documents with detailed information about milestones, deliverables over the years and available/needed resources for the R&D program accomplishment.

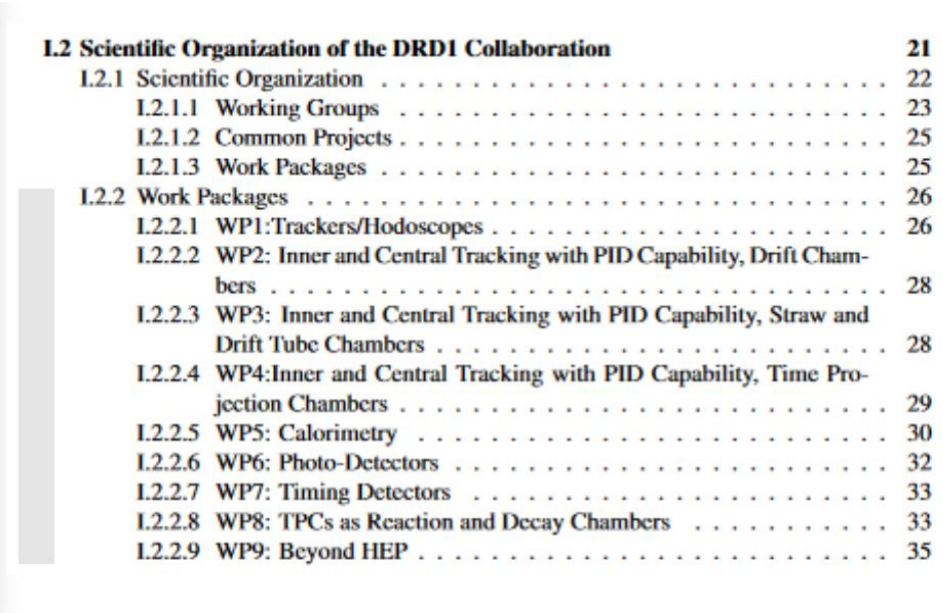
DRD1 Work Packages

First 9 DRD1 WPs established at the time of the DRD1 proposal approval

- **2024-2025: scientific activities organized within a WP framework**
  - WP meetings
  - Workshops
- **Resource planning**
  - Existing resources used for the ongoing activities
  - Application for resources
- **Endorsement procedure**
  - Preparation of the WP endorsement procedure within WPs

– First endorsements started!

WP ID	Title	Annex	Ready for endorsement
WP1	Trackers, hodoscopes, large area muon systems	6.3	✓
WP2	Drift chambers	6.4	✓
WP3	Straws and drift tubes	6.5	✓
WP4	Tracking TPCs	6.6	
WP5	Gaseous calorimeters	6.7	
WP6	Gaseous photon detectors	6.8	
WP7	Timing detectors	6.9	✓
WP8	Reaction/decay TPCs	6.10	
WP9	BHEP applications	6.11	✓

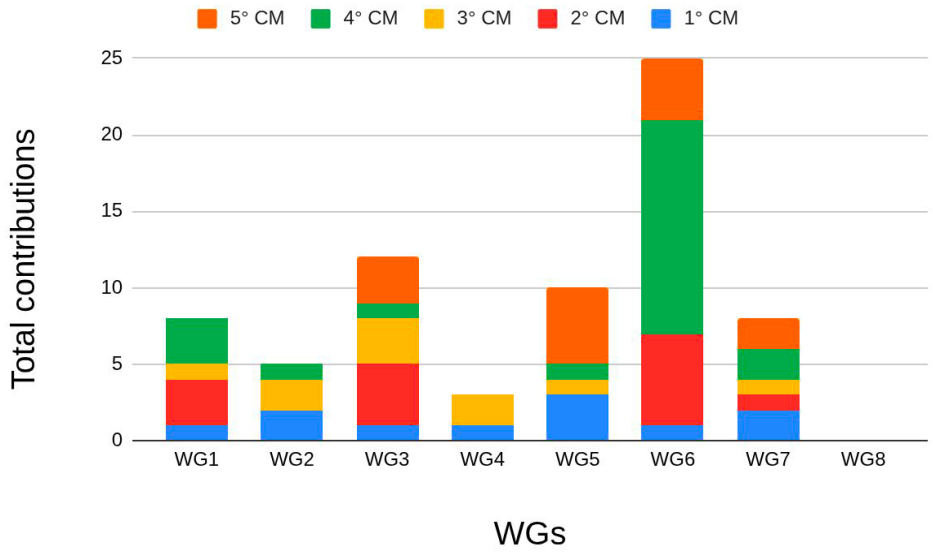


WP1 Tasks

Just an example from the nine WPs

8 tasks define the WP1. From the proposal up to now, an update of the task activities has occurred to include new feedback from institutes during the WP1 workshops.

- **1st DRD1—WP1 Workshop, March 7, 2024**
- **2nd DRD1—WP1 Workshop, November 14, 2024**
- **3rd DRD1—WP1 Workshop, September 25, 2025**



Many WP1 contributions in DRD1 WG sessions

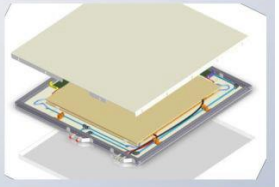
- New RPC and TGC structures
- New Resistive MPGD Structures
- New Front-End Electronics
- Optimization of Scalable Readout System
- Eco-friendly gases
- Manufacturing
- Longevity on large detector area
- New Detector Structures

READY FOR ENDORSEMENT

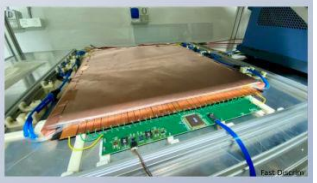
WP1 activities: RPC and TGC structures

Status of the art of the R&D, and plans

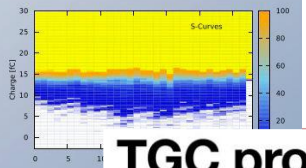
A double-gap glass RPC (1.4 mm gas gap and 1.1 mm glass electrode thickness) was tested with a new readout electronics **based on FATIC2 chip** adapted for RPC signals TDC time resolution **~ 100 ps**



Preliminary calibration (S-Curves and threshold scans) of the new electronics was performed at INFN RPC Lab with low charge thresholds (DRD1 WP7B)



➢ **Plan:** fine tune the electronics integration and perform dedicated performance studies with cosmics muons. The detector will be operated with the CMS standard gas mixture and few ecofriendly mixture candidates



➢ For 2025, requested to INFN: a CAEN PicoTDC for timing measurements and an additional MFC to test the detectors with 4 primaries gaseous mixtures → ecofriendly candidates

WP1 T1 STATUS AND PLANS: D1.2

Overview of project:

- instrument ceiling of ATLAS cavern with RPC-based tracker (~2500 m2)
  - → unique sensitivity to long-lived particles at EW scale

State of the art:

- constructed prototype using ATLAS BIS7 technology, looking at cost-effectiveness (focus on gas gap materials)

Plans for 2024:

- survey of HPL manufacturers / low resistivity

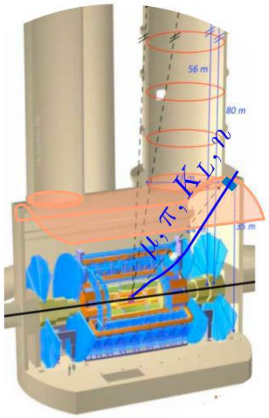
Milestone:

- pre-production construction end of 2025

Deliverable:

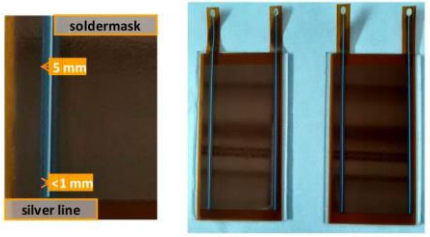
- alternative gas-gap materials / manufacturer with proven stability (irradiation)

Resources are confirmed as per table

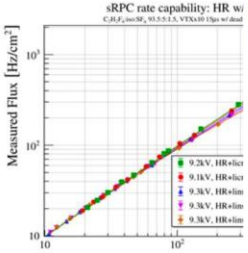


WP1 – T1: High-rate layout

A measurement of the rate capability *(defined as the radiation flux corresponding to an efficien*
of a preliminary **high-rate layout (*introducing two conductive lines for fast current evacua***
performed by irradiating the detector with a 5.9 keV X-ray gun with a 5.9 mm spot size comparable with
conductive grid realized on the DLC (**1.6 GOhm/sq**).



The implementation of **conductive lines** on the DLC **introduces some instability at higher voltage,** sensibly reducing the plateau

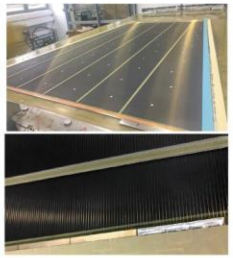


Rate capability of ~1 kHz/c

TGC production and testing

Cathode board spraying with graphite

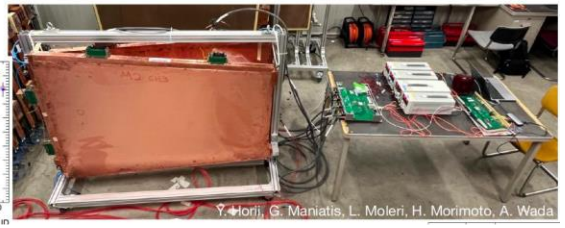
Wire winding and soldering



Single gap assembly

- Decades long experience at WIS developing, producing and testing TGC chambers for ATLAS
- Joint effort with Japanese groups from the electronics side

Cosmic ray test of EIL4 triplet with new ATLAS readout system

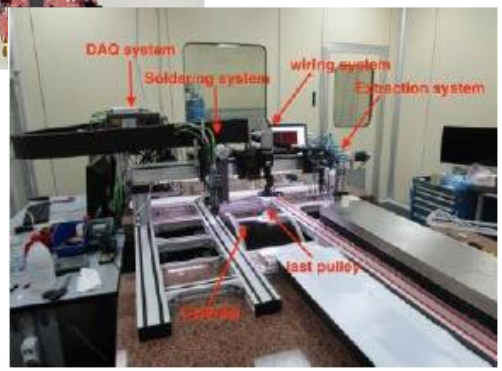


WP2: Drift chambers

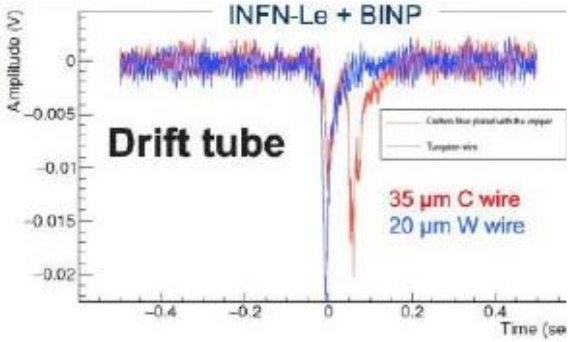
DRD1 does not prioritize technologies!

WP2 Tasks

- Development of a front-end ASIC for cluster counting
- Development of a scalable multichannel DAQ board
- Mechanics: new wiring procedures and new endplate concepts
- Increase rate capability and granularity
- Consolidation of new wire materials and wire metal coating
- Study ageing phenomena for new wire types
- Optimisation of gas mixing, purification, and recirculation systems



READY FOR ENDORSEMENT



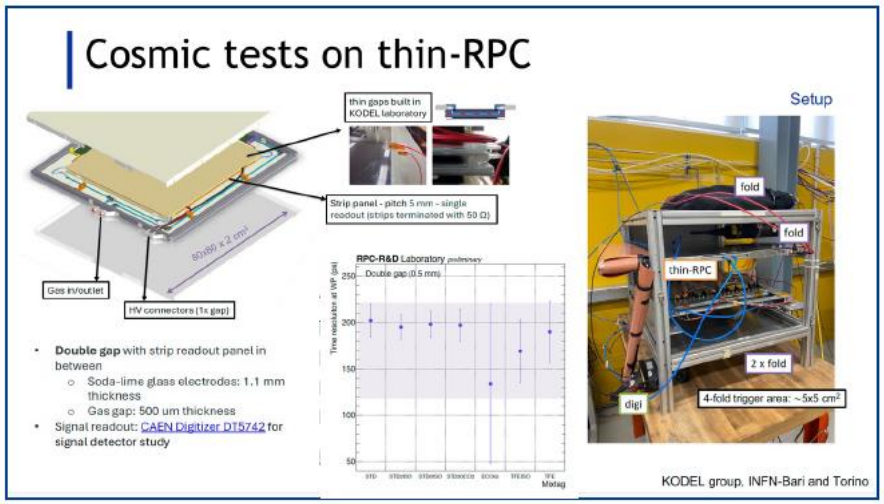
wiring

…and so ON!

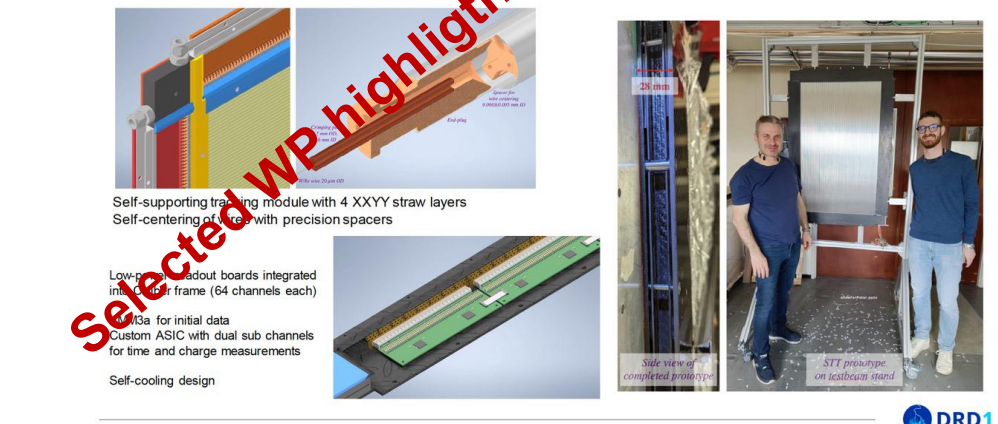
Literally hundreds of presentations on the work DONE!

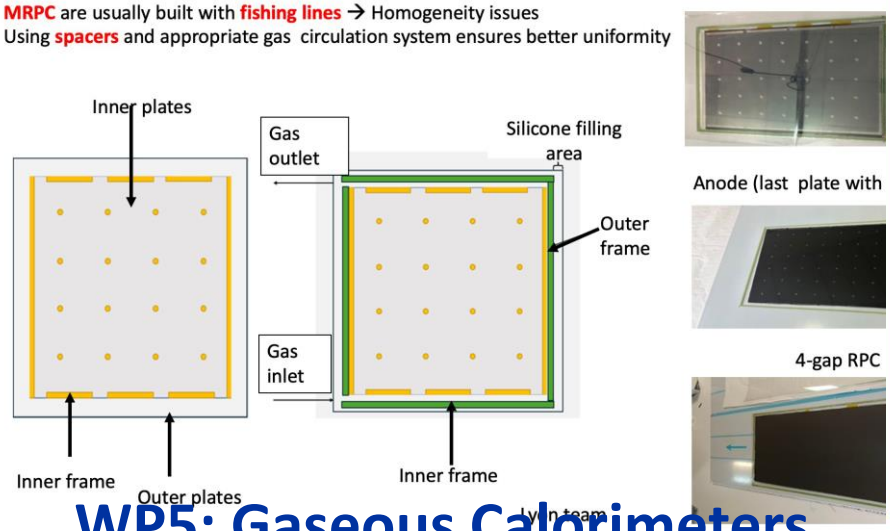
Selected WP highligths

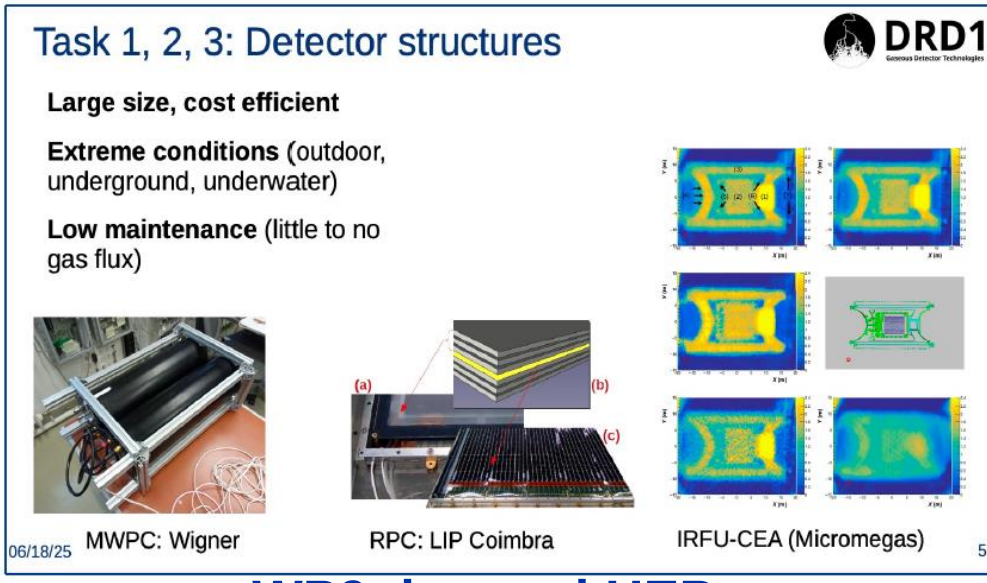
WP7 timing detectors



WP3: Straw and Drift Tube Technologies







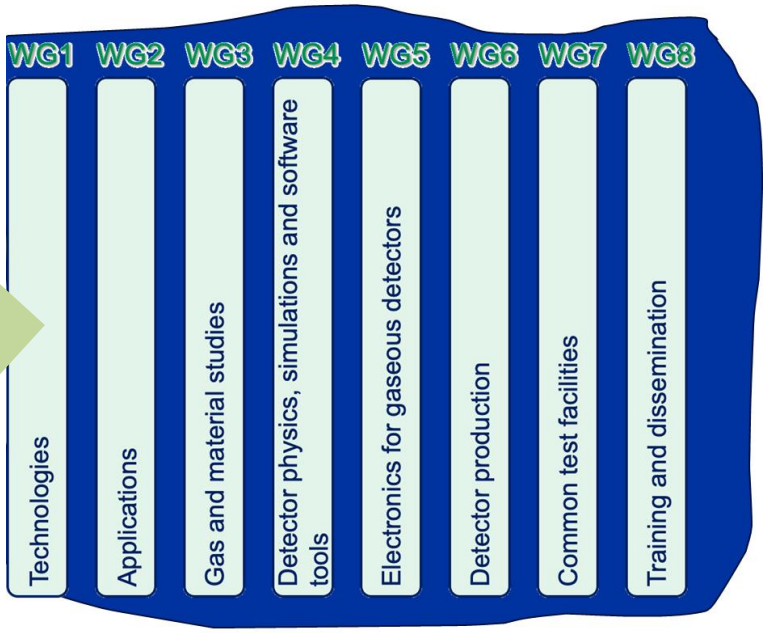
WP5: Gaseous Calorimeters

WP9: beyond HEP

DRD1 structure: Working Groups

DRD1 is a community-driven collaboration: the idea is to share common infrastructures (labs, workshops), common R&D tools (software and electronics), and to create the right environment for cross-exchange of knowledge and techniques on gaseous detectors.

DRD1 Is also organized in eight Working Groups (WGs): they provide the framework for sharing knowledge, expertise, and efforts, and support strategic detector R&Ds, facilitating the establishment of joint projects between institutes.



DRD1 structure: Working Groups

Each of the eight Working Groups is guided by 3-5 conveners from different gaseous detector technologies:

- New challenge for the community
- New opportunity for the community

Open and filled with cross-fertilization among different technologies

Approximate number of components

	Scientific scope	Members
WG1	Technologies	~80
WG2	Applications	~70
WG3	Gas and Material studies	~80
WG4	Detector physics, simulations and software tools	~190
WG5	Electronics for gaseous detectors	~60
WG6	Detector production	~50
WG7	Common test facilities	~110
WG8	Training and dissemination	~110

- ✓ Typically 2-4 meeting per year/per WG
- ✓ Presentation of the activities to the collaboration at large during Collaboration Meetings

Different ideas.
Common progress.

WG methodology: common goals

Activity of the WGs develops around common goals, agreed after consulting the community.

Example from WG4

Reference	Description	Common Objective
D4.1.1	Garfield++ Modernization: Review Core Code (Multi-Thread, Heterogeneous Arch)	Core Code
D4.1.2	Garfield++ Modernization: Add Community Tools (Automatic Builds etc)	Software Tools
D4.1.3	Garfield++ Modernization: Review & Accelerate neBEM Code	New Release
D4.2.1	Garfield++ Framework Improvement: Recommended Set of Ion Mobilities	New Release
D4.2.2	Garfield++ Framework Improvement: Long-Term Solution for Magboltz	New Release
D4.2.3	Garfield++ Framework Improvement: Displays, Documentation, Examples	New Release

Table 14: WG4 - Common Objectives (4.1-4.2)

Garfield++ is a community built & maintained tool

- *Inherited from Wires & MPGD community*
- Interfaced with other community built tools such as neBEM, Magboltz, Degrad, Heed
- *Not the only code one can / should use to simulate!*

Reference	Description	Common Objective
D4.3a.1	Simulation of Large Charges and Space-Charge: Implement Space-Charge	Software
D4.3a.2	Simulation of Large Charges and Space-Charge: Implement Field-Update with neBEM	Software
D4.3a.3	Simulation of Large Charges and Space-Charge: Implement Clustering for Large Avalanches	Software
D4.3b.1	Simulation of Discharges: Use Code D4.3a to Simulate Different Geometries	Software, Validation
D4.4a.1	Simulation of Signals in Detectors with Resistive Elements: t-Dependent W-Fields with neBEM	Software
D4.4b.1	Simulation of Rate Capability in Detectors with Resistive Elements: Equivalent Circuits with ~~neBEM~~ spice	Software
D4.4b.2	Rate Capability Simulation in Detectors with Resistive Elements: Framework for Large-Size Detectors	Software
D4.4c.1	Dark Counting Rate and Ageing	Software
D4.5.1	Simulation of Large Gas Volumes (TPC)	Software
D4.6.1	Modelling and Simulation of Eco Gases	Software
D4.7.1	Measurements and Extraction of Penning Effect	Software
D4.8.1	Parameterized – Fast – Simulation	Software
D4.9.1	Simulation of Electroluminescence	Software
D4.10.1	Simulation of Negative Ions	Software
D4.11.1	Measurement of Ionization Quenching Factors for Low-Energy Nuclei	Software

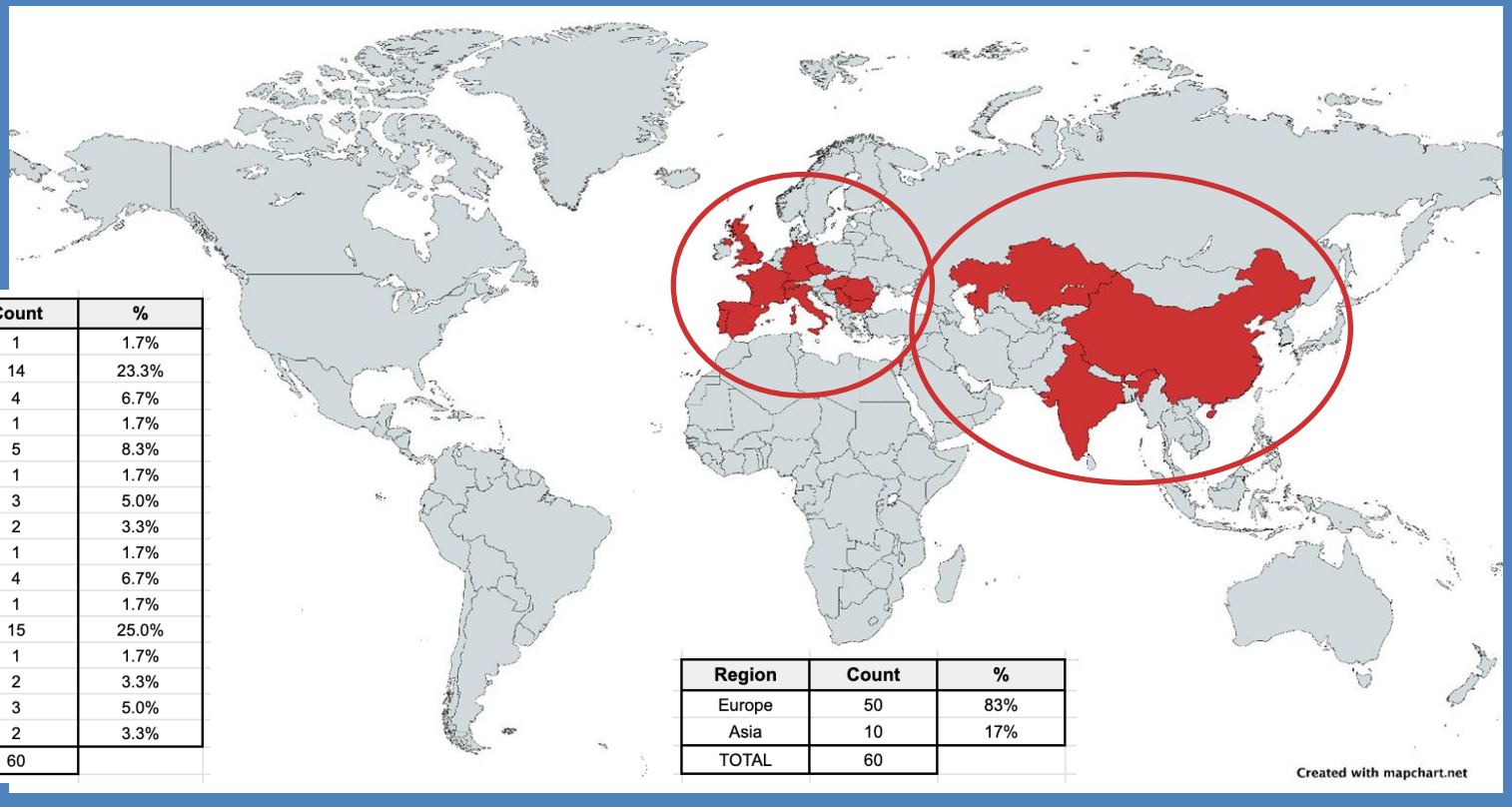
Table 15: WG4 - Common Objectives (4.3-4.11)

Disclaimer: being co-convener of WG4 the presenter is particularly fond of these topics (and expert in the activities of WG4).

Talks in WG4

- 60 Talks given in WG4 sessions of 7 collaboration meetings + WG4 Working meetings

Country	Count	%
BUL	1	1.7%
CHE	14	23.3%
CHN	4	6.7%
CZE	1	1.7%
ESP	5	8.3%
FRA	1	1.7%
GBR	3	5.0%
GER	2	3.3%
HUN	1	1.7%
IND	4	6.7%
ISR	1	1.7%
ITA	15	25.0%
KAZ	1	1.7%
POR	2	3.3%
ROM	3	5.0%
SER	2	3.3%
TOTAL	60	



Region	Count	%
Europe	50	83%
Asia	10	17%
TOTAL	60	

While we have contributions from Europe and Asia, we do not have them from the America.

There is plenty of room for contributions from the Global South!

WG5: Topical Workshop on electronics for gaseous detectors

18 contributions covering different electronics topics

https://indico.cern.ch/event/1413681/sessions/546964/#20240619

UNIVERSITÄT BONN

CONTRIBUTION FLASH: GIANNI MAZZA

ASIC developments for the AMBER MM experiment

Detector	MM	Straw	
Channels/ASIC	64	64	
Power/channel	≤5	≤10	mW
Input capacitance	≤150	20-100	pF
Input charge	1-100	1-1000	fC
Input impedance	tbd	tbd	Ω
Max rate	≤2	≤0.18	MHz
Peaking time	150	75-150	ns
Time resolution	1-2	≤1	ns
Charge resolution	tbd	10	bits
Gain	10	1	mV/fC
ENC @10 pF	500-1000		e⁻
ENC @150 pF	1000-2000		e⁻
ENC @60 pF		3000	e⁻
Threshold range	tbd	0-15	fC
Clock frequency	200	200	MHz

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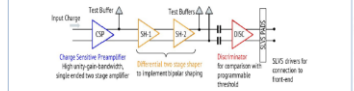
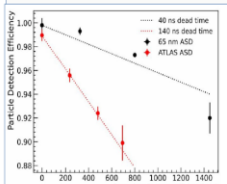
CONTRIBUTION FLASH: OLIVER KORTNER

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

New ASD chip in 65 nm CMOS technology



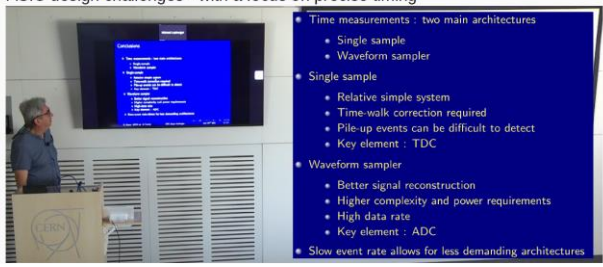


- Four-channel Amplifier Shaper Discriminator designed by the MPI for Physics and fabricated in 65 nm TSMC CMOS technology.
- Bipolar shaping selected to avoid baseline shifts at high background hit rates.
- Discriminator with LVDS output.
- Power consumption per channel 12.8 mW (61% lower than the power consumption of the ATLAS phase-II ASIC).
- 0.235 mm² area/channel.

UNIVERSITÄT BONN

CONTRIBUTION FLASH: GIANNI MAZZA

ASIC design challenges - with a focus on precise timing



- Time measurements : two main architectures
  - Single sample
  - Waveform sampler
- Single sample
  - Relative simple system
  - Time-walk correction required
  - Pile-up events can be difficult to detect
  - Key element : TDC
- Waveform sampler
  - Better signal reconstruction
  - Higher complexity and power requirements
  - High data rate
  - Key element : ADC
- Slow event rate allows for less demanding architectures

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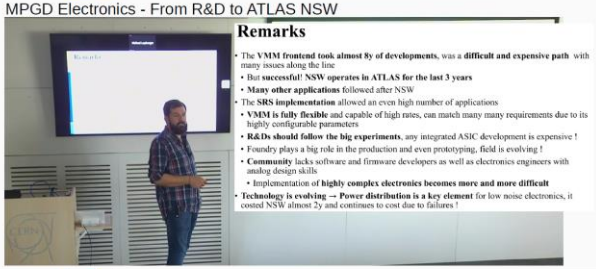
CONTRIBUTION FLASH: GEORGE IAKOVIDIS

MPGD Electronics - From R&D to ATLAS NSW



Remarks

- The **VMM frontend took almost 8y of developments**, was a **difficult and expensive path** with many issues along the line
- But **successful! NSW operates in ATLAS for the last 3 years**
- **Many other applications** followed after NSW
- The **SRS implementation** allowed an even high number of applications
- **VMM is fully flexible** and capable of high rates, can match many many requirements due to its highly configurable parameters
- **R&Ds should follow the big experiments**, any integrated ASIC development is expensive !
- Foundry plays a big role in the production and even prototyping, field is evolving !
- **Community** lacks software and firmware developers as well as electronics engineers with analog design skills
  - Implementation of **highly complex electronics becomes more and more difficult**
- **Technology is evolving → Power distribution is a key element** for low noise electronics, it costed NSW almost 2y and continues to cost due to failures !

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CONTRIBUTION FLASH: MAREK IDZIK

Short status on DRD7 ADC and TDC activities (plus few slides on front-end ASICs)

- Overview of DRD7.3a
  - "High performance TDC and ADC blocks at ultra-low power"
  - DRD7.3a is one of three DRD7.3 projects
  - DRD7.3 (4D & 5D techn.) is one of seven DRD7 packages

find the DRD7 proposal at 3rd meeting of the DRDC
https://indico.cern.ch/event/1406007/

- Few examples of existing low-power front-end ASICs (~DRD6)

AGH

Introduction to TDC&ADC in DRD7.3a

- Project Target and Vision:

High resolution (~10ps) TDC and medium-high resolution (10-14 bits) fast sampling (>40MSps) ADC blocks. High performance, especially ultra-low power consumption, should be confirmed with a very good Figure of Merit, compared to the state-of-the-art solutions in the same CMOS technology and with similar parameters

The ADC&TDC blocks in advanced CMOS technologies should be ready to be deployed as key components of SoC readout ASICs

- Contributors: AGH (PL), CEA IRFU (FR), CPPM (FR), DGIST (KR), ICCUB (ES), IP2I (FR), OMEGA (FR), SLAC (US), TU GRAZ (AT)

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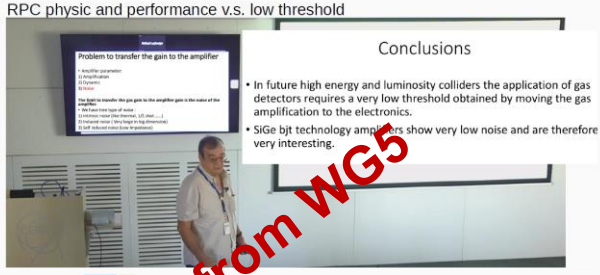
CONTRIBUTION FLASH: ROBERTO CARDARELLI

RPC physic and performance v.s. low threshold



Conclusions

- In future high energy and luminosity colliders the application of gas detectors requires a very low threshold obtained by moving the gas amplification to the electronics.
- SiGe bjt technology amplifiers show very low noise and are therefore very interesting.

Example from WG5

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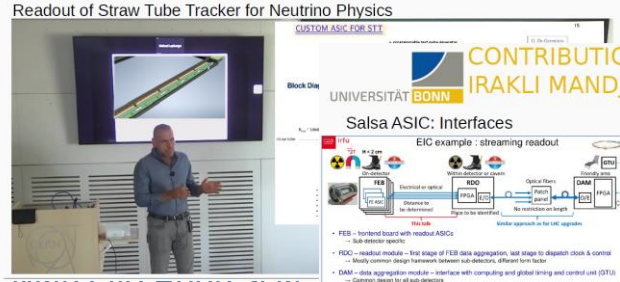
CONTRIBUTION FLASH: ROBERTO PETTI

Readout of Straw Tube Tracker for Neutrino Physics



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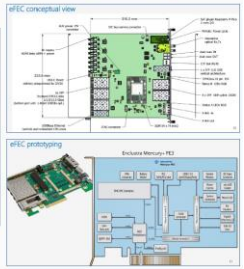
CONTRIBUTION FLASH: CURRO (JOSE FRANCISCO TOLEDO ALARCON)

Contribution to SRSe design – the eFEC module



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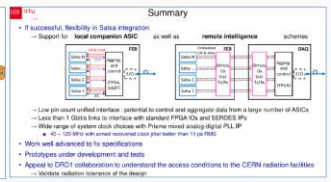
CONTRIBUTION FLASH: IRAKLI MANDJAVIDZE

Salsa ASIC: Interfaces



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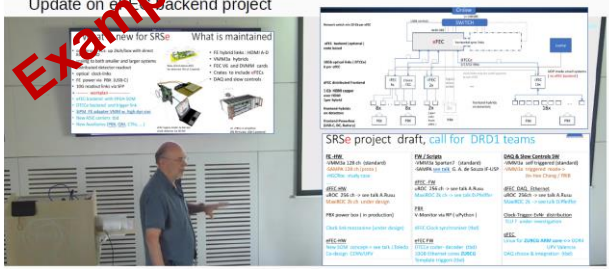
CONTRIBUTION FLASH: HANS MÜLLER

Update on eFEC backend project



WG7: common test facilities

- *Common Laboratory: GDD (CERN, EP-DT-DD)*
- *Common DRD1 Test Beam campaigns at EHN1/SPS Semi-permanent installation (H4):*

2024: 3 DRD1 test-beam campaigns (8/8/5 setups)

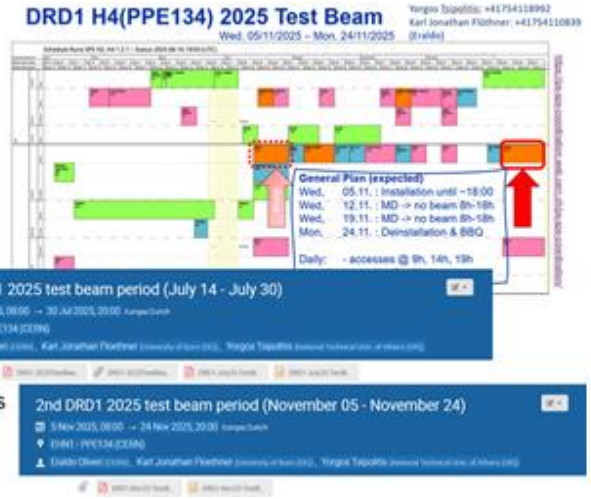
2025: 2 DRD1 test-beam campaigns (13 /17 setups)

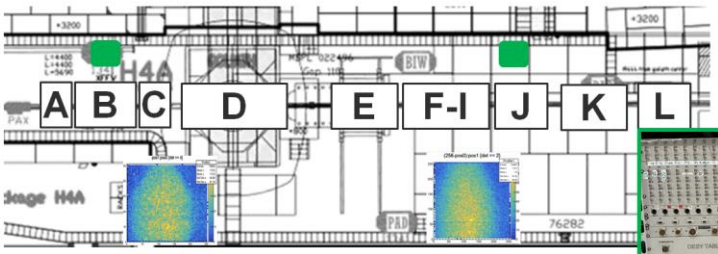
2026: 2 DRD1 test-beam campaigns (May & July)

DRD1 test beam campaigns

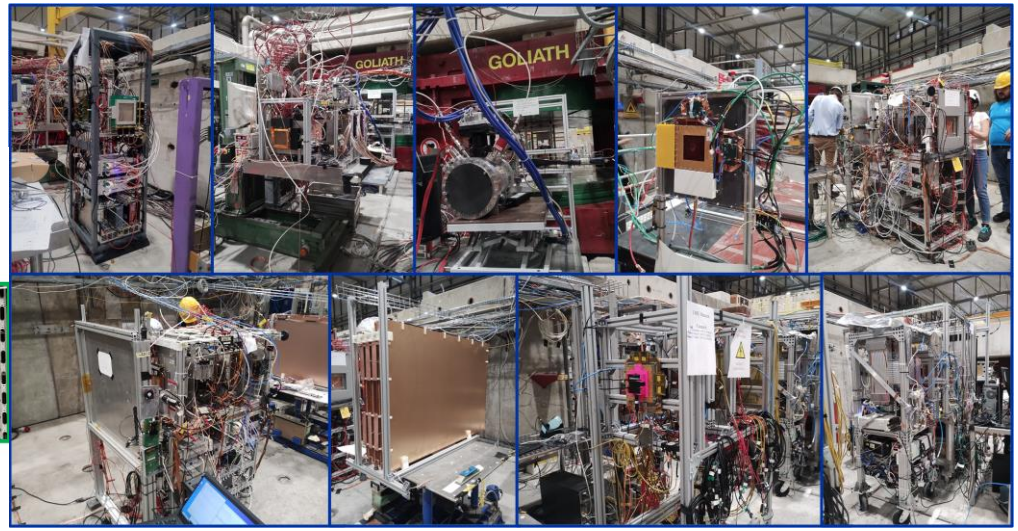
Two test beam campaigns in 2025

- Mon. 14/07/2025 – Wed. 30/7/2025 (13 groups)
  - Thanks for the great collaboration of all participants (e.g. the complete dismounting worked within 4h)
  - More information on Indico*: https://indico.cern.ch/event/1578401/
  - Some visual impressions on the next slide
- Wed. 05/11/2025 – Mon. 24/11/2025
  - Reaching the limit of PPE134 with potential 17 setups
  - More information will be gathered on Indico*: https://indico.cern.ch/event/1599108/





A: DRD1 telescope B
B: PICOSEC
C: PARASITIC: minicatus
D: USTC (uRGroove)
E: DUNE Bologna group - INFN Section of Bologna
F: MWPC-Tracker-VMM
G: *GEM-TPCs – not ready*
H: INFN Bari RPC group
I: DRD1 telescope A
J: LMU Munich
K: PARASITIC: straws
L: HYDRA tracker (TU Darmstadt)



WG8: DRD1 Communication resources

DRD1 Bulletin

Regular newsletter containing announcements, upcoming events, communications from WGs, job opportunities, etc.

DRD1 Forum

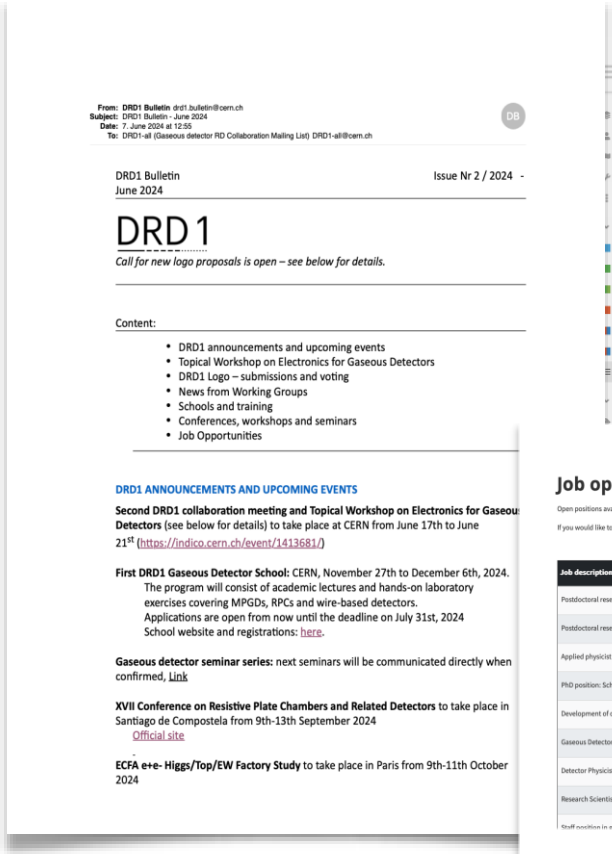
https://drd1-forum.web.cern.ch

Exchange about common questions, used by multiple WGs e.g. for test beam preparation, simulation activities.

DRD1 Website

https://drd1.web.cern.ch

Updated lists of collaboration events, WG/WP descriptions and contacts, job opportunities in DRD1 institutes, training opportunities.



From: DRD1 Bulletin drd1.bulletin@cern.ch
Subject: DRD1 Bulletin - June 2024
Date: 7. June 2024 at 12:55
To: DRD1-all (Gaseous detector RD Collaboration Mailing List) DRD1-all@cern.ch

DRD1 Bulletin — Issue Nr 2 / 2024 -
June 2024

DRD 1

Call for new logo proposals is open – see below for details.

Content:

- DRD1 announcements and upcoming events
- Topical Workshop on Electronics for Gaseous Detectors
- DRD1 Logo – submissions and voting
- News from Working Groups
- Schools and training
- Conferences, workshops and seminars
- Job Opportunities

DRD1 ANNOUNCEMENTS AND UPCOMING EVENTS

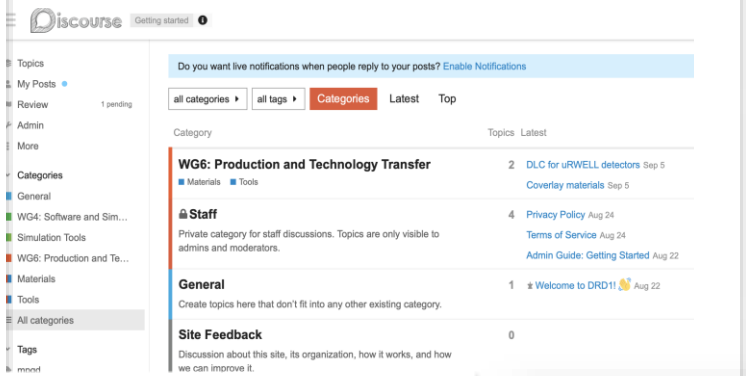
Second DRD1 collaboration meeting and Topical Workshop on Electronics for Gaseous Detectors (see below for details) to take place at CERN from June 17th to June 21st (https://indico.cern.ch/event/1413681/)

First DRD1 Gaseous Detector School: CERN, November 27th to December 6th, 2024.
The program will consist of academic lectures and hands-on laboratory exercises covering MPGDs, RPCs and wire-based detectors.
Applications are open from now until the deadline on July 31st, 2024
School website and registrations: here.

Gaseous detector seminar series: next seminars will be communicated directly when confirmed, Link

XVII Conference on Resistive Plate Chambers and Related Detectors to take place in Santiago de Compostela from 9th-13th September 2024
Official site

ECFA e+e- Higgs/Top/EW Factory Study to take place in Paris from 9th-11th October 2024



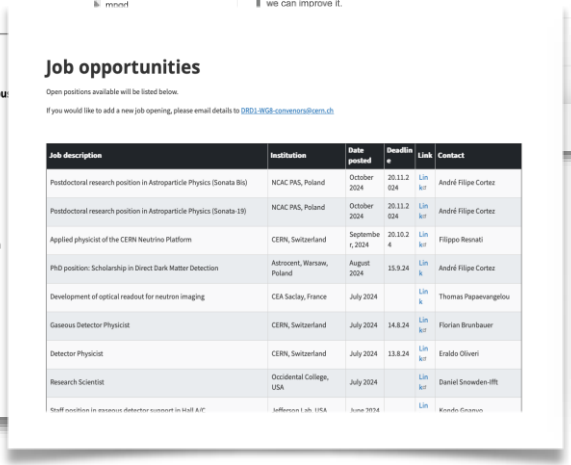
Discourse — Getting started

Topics
My Posts
Review (1 pending)
Admin
More
Categories
General
WG4: Software and Sim…
Simulation Tools
WG6: Production and Te…
Materials
Tools
All categories
Tags

Do you want live notifications when people reply to your posts? Enable Notifications

all categories | all tags | Categories | Latest | Top

Category	Topics	Latest
WG6: Production and Technology Transfer — Materials, Tools	2	DLC for uRWELL detectors Sep 5; Coverlay materials Sep 5
Staff — Private category for staff discussions. Topics are only visible to admins and moderators.	4	Privacy Policy Aug 24; Terms of Service Aug 24; Admin Guide: Getting Started Aug 22
General — Create topics here that don't fit into any other existing category.	1	Welcome to DRD1! Aug 22
Site Feedback — Discussion about this site, its organization, how it works, and how we can improve it.	0	

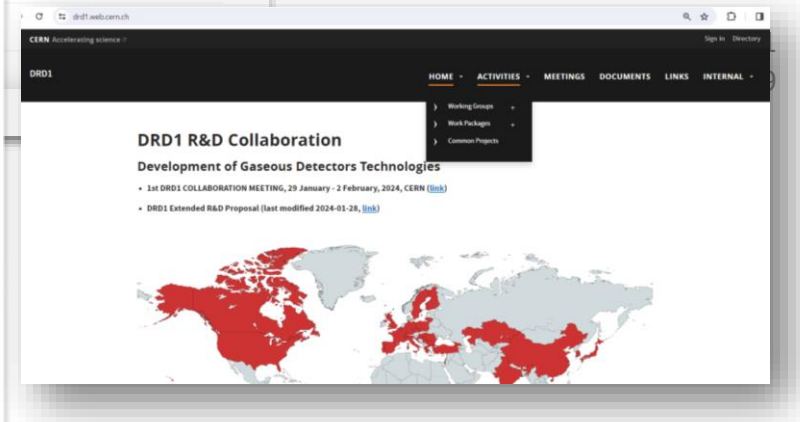


Job opportunities

Open positions available will be listed below.

If you would like to add a new job opening, please email details to DRD1-WG8-convenors@cern.ch

Job description	Institution	Date posted	Deadline	Link	Contact
Postdoctoral research position in Astroparticle Physics (Sonata Bis)	NCAC PAS, Poland	October 2024	20.11.2024	Link	André Filipe Cortez
Postdoctoral research position in Astroparticle Physics (Sonata-19)	NCAC PAS, Poland	October 2024	20.11.2024	Link	André Filipe Cortez
Applied physicist of the CERN Neutrino Platform	CERN, Switzerland	September, 2024	20.10.24	Link	Filippo Resnati
PhD position: Scholarship in Direct Dark Matter Detection	Astrocent, Warsaw, Poland	August 2024	15.9.24	Link	André Filipe Cortez
Development of optical readout for neutron imaging	CEA Saclay, France	July 2024		Link	Thomas Papaevangelou
Gaseous Detector Physicist	CERN, Switzerland	July 2024	14.8.24	Link	Florian Brunbauer
Detector Physicist	CERN, Switzerland	July 2024	13.8.24	Link	Eraldo Oliveri
Research Scientist	Occidental College, USA	July 2024		Link	Daniel Snowden-Ifft



drd1.web.cern.ch

CERN Accelerating science

DRD1 — HOME | ACTIVITIES | MEETINGS | DOCUMENTS | LINKS | INTERNAL

Working Groups
Work Packages
Common Projects

DRD1 R&D Collaboration

Development of Gaseous Detectors Technologies

- 1st DRD1 COLLABORATION MEETING, 29 January - 2 February, 2024, CERN (link)
- DRD1 Extended R&D Proposal (last modified 2024-01-28, link)

DRD1 Scientific Coordination Board

The *SCB* serves as a *cross-coordination board* within DRD1. It plays a pivotal role in *overseeing the execution of DRD1's scientific programs* as outlined by the CB:

Foster collaboration between DRD1 Working Groups (WG) and Work Packages (WP)

SCB Composition:

- Working Groups Coordinator
- Work Packages Coordinator
- WG Conveners
- WP Leaders
- WP Project Leaders
- Spokespersons
- Technical Coordinator and Deputy
- Resource Coordinator
- Linkpersons to the other DRDs
- CB Chair/Deputy
- MB/SCB secretary (tbd)

multiple SCB meeting every year

- ***Discussion of WG activities***
  - Overview of the program and people participating
  - How the activities are organised
  - Status of the activities
  - Common objectives
  - ***Synergies between WGs and WPs***
- ***WP feedback to WGs***
  - How WPs see cooperation with different WGs
  - Support the WPs expect from WGs
  - What is the support the WP can provide to foster WG activities

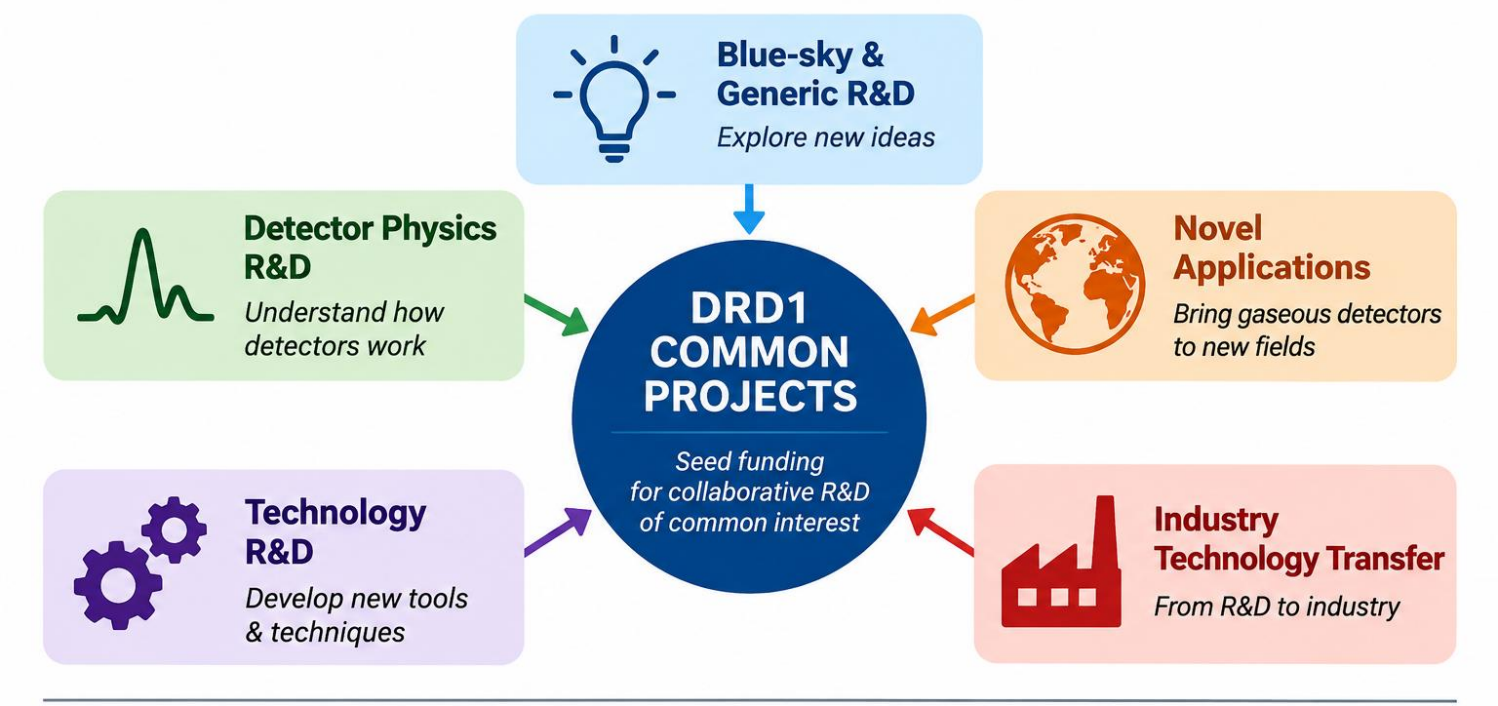
DRD1 Common Activities: 2025/26

Highlighted activities supported by available common resources in 2025

Common Developments	
Gas and Material Studies	Gas and material properties studies. Eco-friendly mixtures. Outgassing and ageing studies.
Gas systems control and monitoring	Development of gas mixers, monitoring and calibration units for laboratory use.
Modelling and simulations	Training, measurements of gas parameters relevant for simulation (in synergy with WG3), access to computing hardware, services and software licenses
Electronics	Common developments on FE ASICs, DAQ and Instrumentation
Common Facilities	
Detector Manufacturing and Workshop	Common equipment, test new manufacturing techniques, training and transfer to industry
Common Laboratory and Test Beam	Common Test Beams (semi-permanent installation at CERN/SPS), support for common test and characterization (in synergy with WG3) laboratories.
Common Projects	
Blue-sky and Generic R&D	Project involving at least three DRD1 members in areas of common interest to the DRD1 community
Detector physics R&D	
Novel Applications	
Technology R&D	
Industry Technology Transfer	
Scientific Network	
Collaboration Meetings and Topical Workshops	Three collaboration meetings per year, with one of them held outside CERN. Ad-hoc topical workshops extended to other communities.
Conferences and awards	Support to gas detector conferences and workshops.
Schools and training	DRD1 Gaseous Detector School, knowledge and training dissemination initiatives.

DRD1 common projects

The DRD1 Common Project Funding is designed to support project costs in areas of shared interest within the DRD1 community, in five main fields.



The DRD1 Common Projects are not meant to cover R&D activities where other funding schemes are better suited, such as:

- Strategic R&D (covered by the Work Package activities)
- Project-driven R&D (covered by the projects or experiments)

First DRD1 commond project funded

WEIZMANN INSTITUTE OF SCIENCE

DRD1

Common project: Development of Prepreg with Controllable Resistivity

Luca Moleri
on behalf of Oliver Kortner (MPI) and Rui De Oliveira (CERN EP-DT-EF)

DRD1 collaboration meeting, Warsaw - 10/10/25

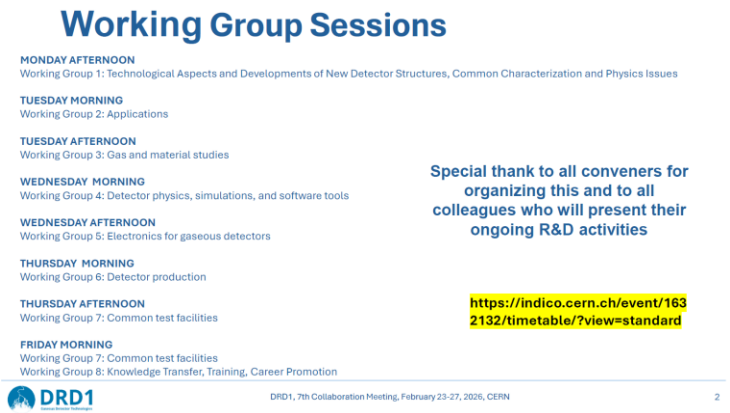
Prepreg (*pre-impregnated composite fiber*):
The resin can include additives (e.g., carbon black, CNTs, graphene, or metal particles) to impart controlled electrical conductivity or static dissipation.

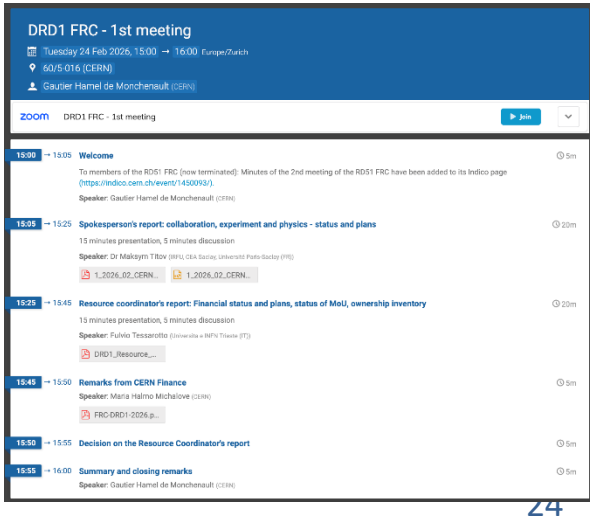
Advantages	Limitations
• Resistivity tunable by additives • Cheap • Easy to scale up • Standard PCB substrate • Robust against aging, discharges, radiation • Mature technology used in most gaseous detectors	• Resistive tunability not commercially available • Nontrivial surface and bulk properties of a composite material • Handling and storage conditions before curing • Complex process requiring industrial equipment (dispersion of additive in resin, fiber impregnation, curing under pressure and heat)

DRD1 collaboration meetings

Baseline: Three DRD1 Meetings per year

1st Collaboration Meeting (CERN), Jan. 29-Feb. 2, 2024: https://indico.cern.ch/event/1360282/
2nd Collaboration Meeting & Topical workshop of Electronics for Gaseous detectors (CERN), Jun. 17-21, 2024: https://indico.cern.ch/event/1413681/
3rd Collaboration Meeting (CERN), Dec. 9-13, 2024: https://indico.cern.ch/event/1442324/
4th Collaboration Meeting & Topical workshop on Detector Manufacturing and Production (CERN), Feb, 24-28, 2025, https://indico.cern.ch/event/1489983/
5th DRD1 Collaboration Meeting and Topical Workshop Towards Sustainable Gas Mixtures for Future Detectors (CERN), Jun. 16-28, 2025, https://indico.cern.ch/event/1543925/
7th DRD1 Collaboration Meeting (CERN), Feb. 23-27, 2025, https://indico.cern.ch/event/1632132/





DRD1 collaboration meetings outside CERN

First DRD1 Collaboration Meeting outside of CERN:
Oct. 6-10, 2025: *Astrocent & Nicolaus Copernicus Astronomical Center, Polish Academy of Sciences, Warsaw*

One out of the three yearly collaboration meetings is outside CERN

- ✓ **Expanding DRD1 Scientific Network:** community of experts exchanging knowledge, providing critical peer review, inspiring each other, and sparking new collaborations, exploring new solutions or other ways
- ✓ **Support to DRD1 Local Institute:**

DRD1 collaboration meetings outside CERN

Second DRD1 Collaboration Meeting outside of CERN:
Jun. 29 – Jul. 3, 2026: *Laboratory of Instrumentation and Experimental Particle Physics (LIP) and Physics Department of the University of Coimbra*

https://indico.cern.ch/event/1662850/

8th DRD1 Collaboration Meeting

- ✓ 165 partecipants
- ✓ 66 contributions
- ✓ ALL sessions broadcast on ZOOM
- ✓ **LOTS of exciting scientific discussions**

Fostering young researchers: DRD1 schools

Organized in the framework of the WG8 activities, with the help of local organizing committes:

DRD1 goal was to move the schools outside CERN

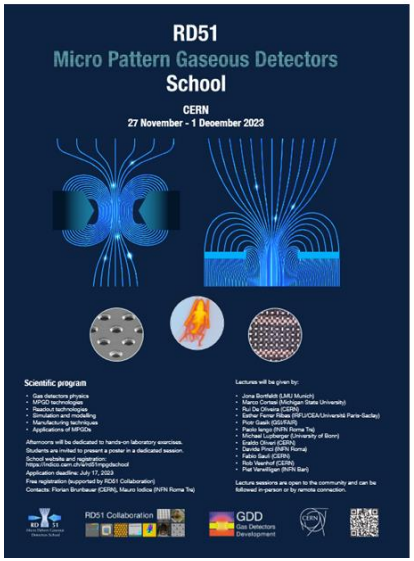
2026: 3rd DRD1 School, FRIB facility, US, July 8-17: https://indico.cern.ch/event/1572535/ → first DRD1 School in the US

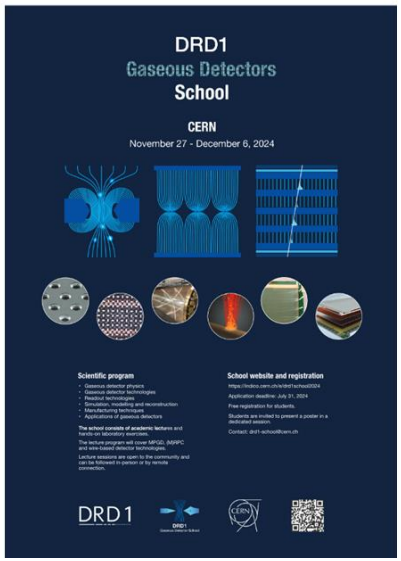
2026: DRD1 Topical School "Gaseous Detector Simulation", Bari, Italy, May 18-22: https://indico.cern.ch/event/1606443/overview

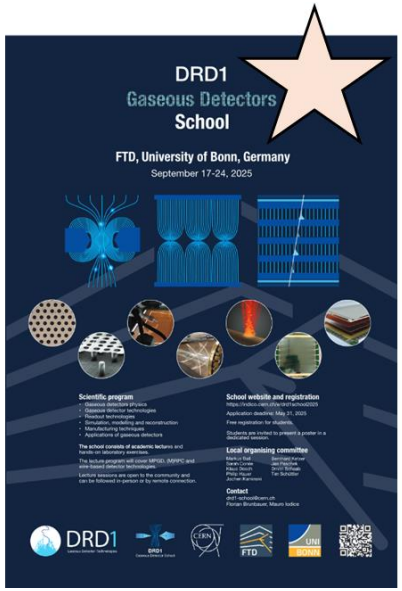
2025: 2nd DRD1 School, FTD, Univ. Bonn, Germany, Sep. 17-24, 2025: https://indico.cern.ch/event/1384298 → first DRD1 School outside CERN

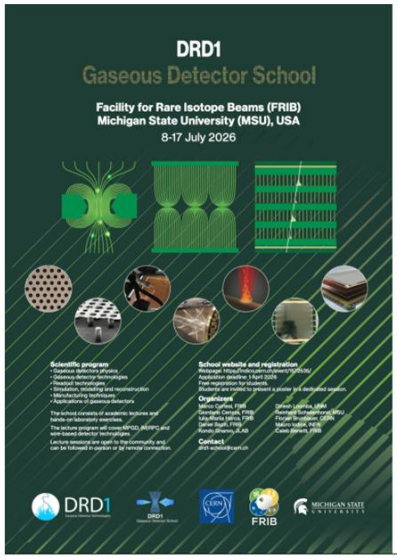
2024: 1st DRD1 School, CERN, Nov. 27 – Dec. 6: https://indico.cern.ch/event/1384298

2023: RD51 MPGD School CERN, Nov. 27 – Dec. 1: https://indico.cern.ch/event/1239595





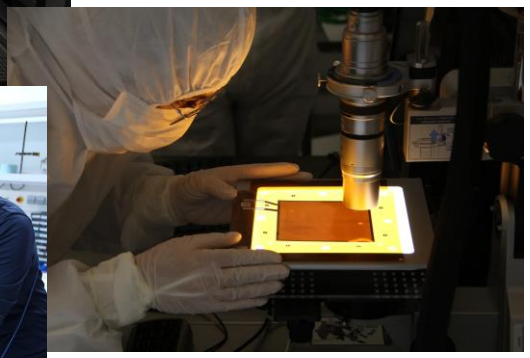




2025 DRD1 Detector school@FTD

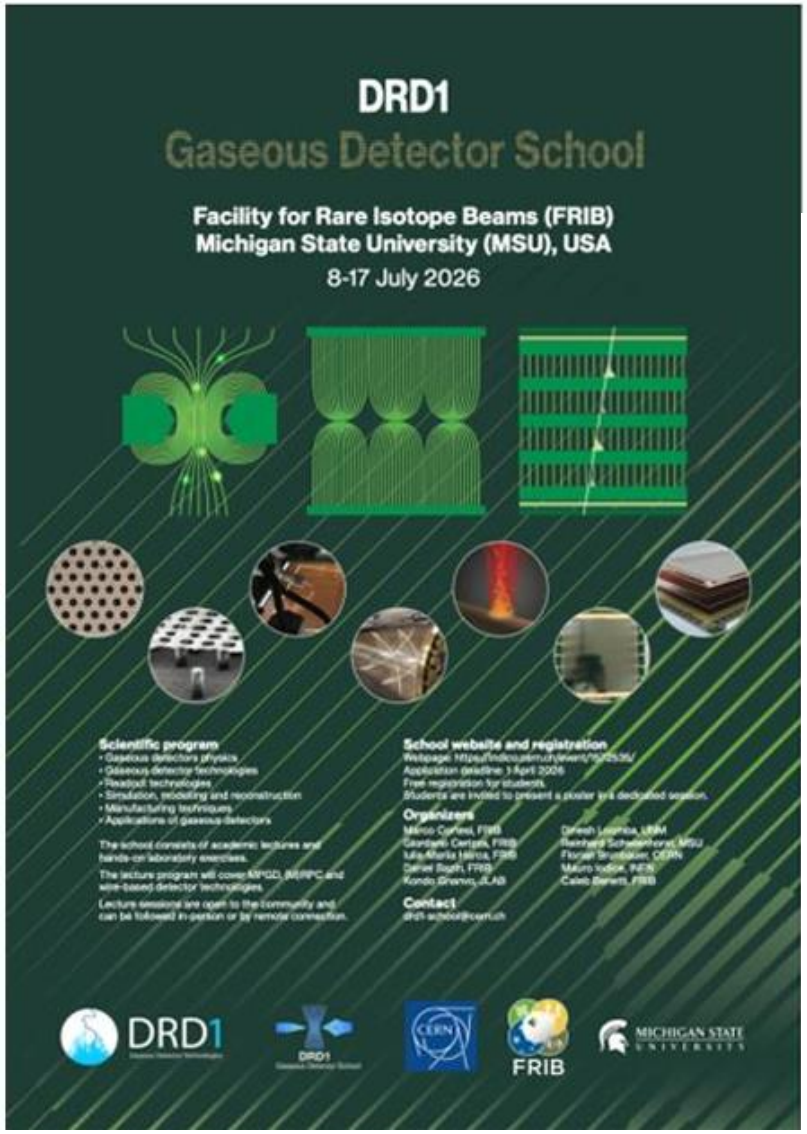
DRD1 Detector Schools are structured in:

- **Morning lectures** by world experts in the field offering an overview on gas detectors physics, technologies, simulation and modelling, readout approaches, manufacturing techniques and applications,
- **Hands-on exercises** on various technologies in the afternoons, with an emphasis on methodologies.



The target audience are **PhD students and young scientists** working on gaseous detectors.

2026 DRD1 Detector school@FRIB



8–17 Jul 2026

https://indico.cern.ch/event/1572535/

Facility for Rare Isotope Beams (FRIB), Michigan State University

1. Welcome and Introduction to FRIB safety rules
08/07/2026, 09:00

2. Introduction to Gaseous Detectors
Fabio Sauli
08/07/2026, 10:00

3. Gaseous Detector Physics
Fabio Sauli
08/07/2026, 11:30

4. Q&A, section and discussion
08/07/2026, 12:30

6. Wire-Based Detectors
Junjie Zhu (University of Michigan)
09/07/2026, 11:30

7. Q&A, section and discussion
09/07/2026, 12:30

13. MPGD Technologies
Nilanga Kumara Liyanage (The Virginia of University)
10/07/2026, 09:00

14. Signal Induction
Werner Riegler (CERN)
10/07/2026, 10:00

15. Gaseous Detector Stability
Piotr Gasik (GSI - Helmholtzzentrum fur Schwerionenforschung GmbH (DE))
10/07/2026, 11:30

8. Q&A, section and discussion
10/07/2026, 12:30

16. Simulations
Antonello Pellecchia (Universita e INFN, Bari (IT)), Riccardo Farinelli (INFN Bologna (IT
11/07/2026, 09:00

17. Simulations
Antonello Pellecchia (Universita e INFN, Bari (IT)), Riccardo Farinelli (INFN Bologna (IT
11/07/2026, 12:30

18. Simulations
Antonello Pellecchia (Universita e INFN, Bari (IT)), Riccardo Farinelli (INFN B
11/07/2026, 14:30

19. Time Projection Chamber (TPC)
David Nygren
13/07/2026, 09:00

20. Electronics Readout technologies
Giordano Cerizza (Facility for Rare Isotope Beams @ Michigan State University)
13/07/2026, 10:00

21. Gas properties and systems
Marcello Abbrescia (Bari Physics Department and INFN)
13/07/2026, 11:30

9. Q&A, section and discussion
13/07/2026, 12:30

22. RPC Technlogy
Giulio Aielli (INFN e Universita Roma Tor Vergata (IT))
14/07/2026, 09:00

23. Detector for Heavy-ion Diagnostics/PID
Elena Rocco (GSI Helmholtzzentrum für Schwerionenforschung GmbH)
14/07/2026, 10:00

24. MPGD applications in HEP
Klaus Dehmelt (Thomas Jefferson National Accelerator Facility)
14/07/2026, 11:30

10. Q&A, section and discussion
14/07/2026, 12:30

25. Wire-Based Detector applications in HEP
15/07/2026, 09:00

26. M(RPC) applications in HEP
Dr Alexandre Camsonne
15/07/2026, 10:00

27. Optical Readouts
Dinesh Loomba
15/07/2026, 11:30

11. Q&A, section and discussion
15/07/2026, 12:30

28. Applications to neutrino and rare event search
Sven Vahsen (University of Hawaii (US))
17/07/2026, 09:00

29. Application to Nuclear physics
Yassid Ayyad (Universidade de Santiago de Compostela)
17/07/2026, 10:00

30. Application beyond fundamental research
Guy Garty (Columbia University)
17/07/2026, 11:30

2026 DRD1 Simulation school

- ✓ School focused on simulation of state-of-the-art gaseous detector technologies: MPGD, (M)RPC, TPC, Wire-based dets.
- ✓ Provide understanding of fundamental principles underlying the simulation of GD
- ✓ **42 Students & Post-Docs who already followed the DRD1 Detector School**

Lectures:

- Physics Modelling & MC Methods
- Interaction of Radiation w. Matter
- Finite Element Method
- Electron Transport in Gases
- Signal Induction & Processing

Exercises:

- Physics Modelling & MC Methods
- Finite Element Method
- LXCAT & Magboltz
- Signal Induction
- Full Detector Exercise with GARFIELD++
  - MPGD, RPC, TPC, Wire detectors

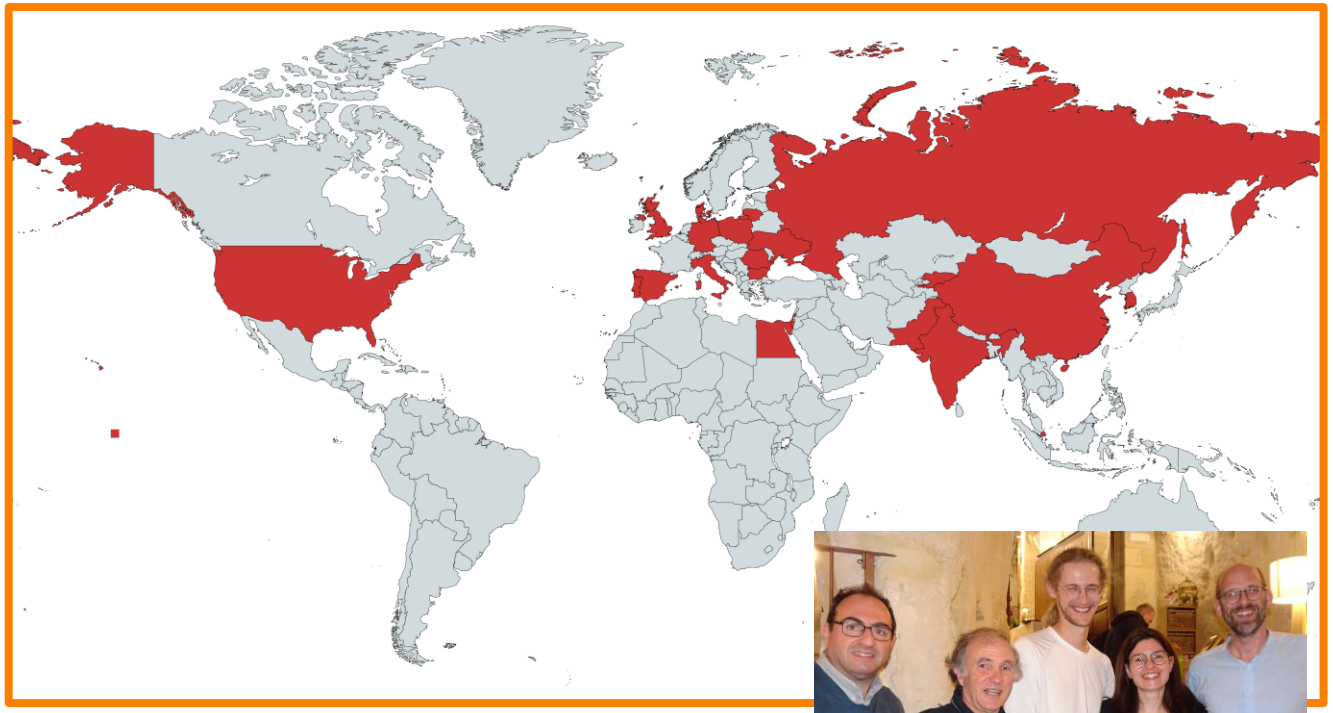
GDSimS2026: students

	Institute Country	42	%
1	Bulgaria	1	2,4%
2	China	2	4,8%
3	France	1	2,4%
4	Germany	3	7,1%
5	India	2	4,8%
6	Israel	3	7,1%
7	Italy	17	40,5%
8	Lithuania	2	4,8%
9	Poland	4	9,5%
10	South Korea	1	2,4%
11	Spain	2	4,8%
12	Switzerland	1	2,4%
13	United Kingdom	2	4,8%
14	United States	1	2,4%

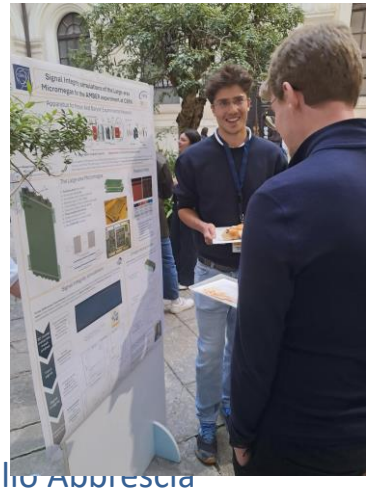
	Europe	33	79%
	Asia	8	19%
	America	1	2%

	All Students	42	
	Female	15	36%
	Male	27	64%

	Nationality	42	%
1	Bulgaria	1	2,4%
2	China	2	4,8%
3	Denmark	1	2,4%
4	Egypt	1	2,4%
5	Germany	3	7,1%
6	India	2	4,8%
7	Israel	1	2,4%
8	Italy	13	31,0%
9	Kyrgyzstan	1	2,4%
10	Lithuania	1	2,4%
11	Pakistan	4	9,5%
12	Poland	1	2,4%
13	Portugal	1	2,4%
14	Romania	1	2,4%
15	Russia	1	2,4%
16	Singapore	1	2,4%
17	South Korea	1	2,4%
18	Spain	3	7,1%
19	Ukraine	1	2,4%
20	United Kingdom	1	2,4%
21	United States	1	2,4%



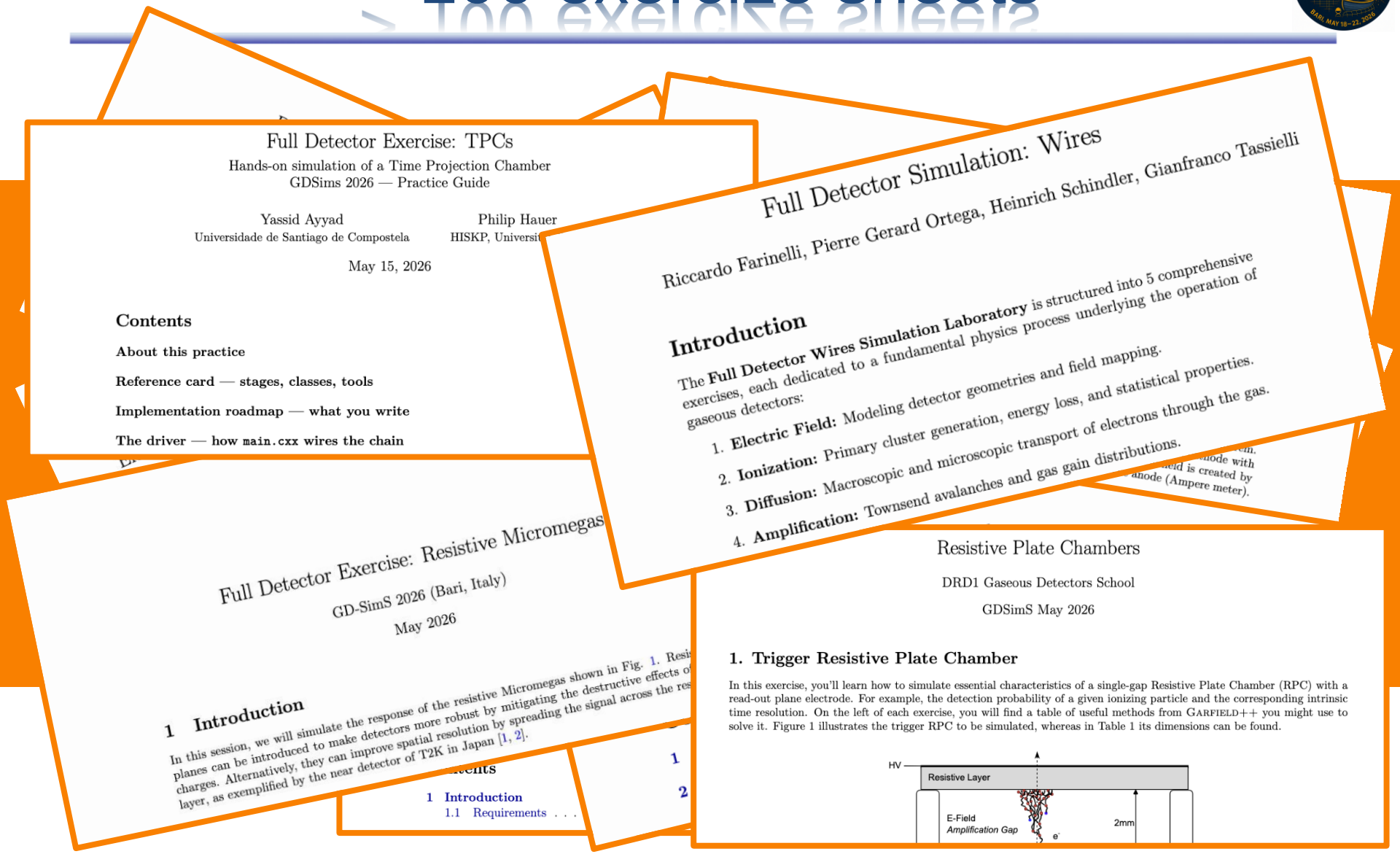
42 registrations – 36% women & 64% man – 60% EU 30% Asia



Best Poster Awards was published on the website of the journal "Instruments", by MDPI: https://www.mdpi.com/journal/instruments/announcements/16681

instruments
an Open Access Journal by MDPI

> 100 exercize sheets



Full Detector Exercise: TPCs

Hands-on simulation of a Time Projection Chamber
GDSims 2026 — Practice Guide

Yassid Ayyad
Universidade de Santiago de Compostela

Philip Hauer
HISKP, Universi

May 15, 2026

Contents

About this practice

Reference card — stages, classes, tools

Implementation roadmap — what you write

The driver — how main.cxx wires the chain

Full Detector Simulation: Wires

Riccardo Farinelli, Pierre Gerard Ortega, Heinrich Schindler, Gianfranco Tassielli

Introduction

The **Full Detector Wires Simulation Laboratory** is structured into 5 comprehensive exercises, each dedicated to a fundamental physics process underlying the operation of gaseous detectors:

1. **Electric Field:** Modeling detector geometries and field mapping.
2. **Ionization:** Primary cluster generation, energy loss, and statistical properties.
3. **Diffusion:** Macroscopic and microscopic transport of electrons through the gas.
4. **Amplification:** Townsend avalanches and gas gain distributions.

Full Detector Exercise: Resistive Micromegas

GD-SimS 2026 (Bari, Italy)

May 2026

1 Introduction

In this session, we will simulate the response of the resistive Micromegas shown in Fig. 1. Resi
planes can be introduced to make detectors more robust by mitigating the destructive effects o
charges. Alternatively, they can improve spatial resolution by spreading the signal across the res
layer, as exemplified by the near detector of T2K in Japan [1, 2].

1 Introduction
1.1 Requirements . . .

Resistive Plate Chambers

DRD1 Gaseous Detectors School

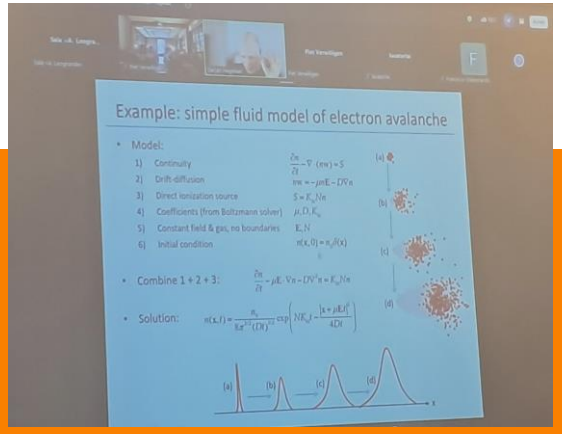
GDSimS May 2026

1. Trigger Resistive Plate Chamber

In this exercise, you'll learn how to simulate essential characteristics of a single-gap Resistive Plate Chamber (RPC) with a read-out plane electrode. For example, the detection probability of a given ionizing particle and the corresponding intrinsic time resolution. On the left of each exercise, you will find a table of useful methods from GARFIELD++ you might use to solve it. Figure 1 illustrates the trigger RPC to be simulated, whereas in Table 1 its dimensions can be found.

https://indico.cern.ch/event/1606443

A collaborative effort: DRD1 spirit



Again: being one co-organizer of the school, I am bit biased on it!

Marcello Abbrescia

DRD1 Awards 2026

This program aims to support, ***foster and provide larger visibility to R&D and "blue-sky" researchers in the field of gaseous detector for particle physics, and beyond.*** DRD1 is an equal opportunity community that values diversity and promote inclusion, and for these reasons we strongly encourage applications from underrepresented groups in the field.

PhD Thesis Award

For exceptional contributions to developments in the field of gaseous detectors. The PhD must have been completed within 2 years of the time of the closing of the call and have already been defended.

Early Career Scientist Award

For outstanding scientific developments in the field of gaseous detectors. The PhD of the nominee must have been completed within the last 7 years (excluding demonstrated career interruptions) at the time of the closing of the call

Exceptional Contributions to the DRD1 Collaboration Award

Selected based on contributions to DRD1 goals and missions, by the committee (not by nomination). There is no constraint on the career stage for this category.

Conclusions and outlook

Partecipation of Institutions to the DRD1 activities is:

- ✓ an opportunity for the Institutions
- ✓ a resource for DRD1

DRD1 does NOT prioritizes technologies:

- ✓ The blue sky R&D of today can be the main stream of tomorrow
- ✓ R&D on experiments at accelerators, for cosmic rays, and beyond

Maximum flexibility:

- ✓ Institutes can contribute in the topic they prefer
- ✓ Institutes are encouraged to actively contribute
- ✓ There is no «strategic» direction on the single Institutes

Thank You!