

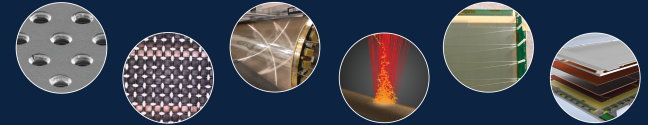
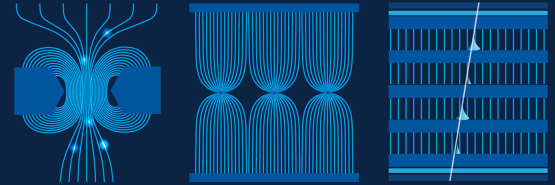
DRD1 Gaseous Detector School 2024

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

DRD1 Gaseous Detectors School

CERN

November 27 - December 6, 2024



Scientific program

- Gaseous detector physics
- Gaseous detector technologies
- Readout technologies
- Simulation, modelling and reconstruction
- Manufacturing techniques
- Applications of gaseous detectors

The school consists of academic lectures and hands-on laboratory exercises.

The lecture program will cover MPGD, MRPC and wire-based detector technologies.

Lecture sessions are open to the community and can be followed in-person or by remote connection.

School website and registration

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

Application deadline: July 31, 2024

Free registration for students.

Students are invited to present a poster in a dedicated session.

Contact: drd1-school@cern.ch

DRD1



General

Wed, November 27 - Fri, December 6 at CERN

- Single school for 2024 combining MPGD, RPC, Wire technologies
- Targeted at students / young researchers / DRD1 community

- Morning: lecture program
- Afternoon: lab exercises
- Length: 10 days: Wed-Fri

- **Applications are open now**

- Regular meetings with tutors/lecturers - communicated to DRD1-WG8 mailing list
- 6 meetings so far focused on school organisation

Lessons learned from RD51 MPGD School

- Extend to additional detector technologies
- Keep lectures / exercises balance
- More time for simulation exercises
- Additional student groups
- Dedicated Q&A time with lecturers
- Time for working on presentations within lab groups

Important Dates

Deadline for applications: July 31, 2024

Student selection: August by selection committee (volunteers among lecturers)

Notification of acceptance: Beginning of September

Lab book: finalise by end of October

School draft schedule

	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri
9:00 - 10:00	Introduction	MPGD technologies	Signal induction	Work in lab groups (analysis, preparing presentations)	Social event	Gas detector physics : stability	Manufacturing MPGD (40min) RPC (40min) Wire (40min)	Electronic readout	Lab session 8	Applications in HEP MPGD (40min) RPC (40min) Wire (40min)
10:00 - 11:00	Gas detector physics	M(RPC) technologies	Data analysis and reconstruction techniques			Modelling OR GAS		Electronic readout		
11:00 - 11:30	Break	Break	Break	Visits		Break	Break	Break		
11:30 - 12:30	Modelling	Wire-based detectors	Gas properties / alternative gases / gas systems - OR MODELLING	Lunch break		Gaseous detectors for future TPCs (challenges / example project)	Applications beyond HEP (nuclear,neutrino)	Optical readout and pixellated detectors	Lunch break	Applications beyond fundamental research (medical, ...)
12:35 - 13:00	Q&A session (25min, optional) / Lunch break	Q&A session (25min, optional) / Lunch break	Q&A session (25min, optional) / Lunch break			Q&A session (25min, optional) / Lunch break	Q&A session (25min, optional) / Lunch break	Q&A session (25min, optional) / Lunch break		Q&A session (25min, optional) / Lunch break
13:00 - 14:00										
14:00 - 18:00	Lab session 1	Lab session 2	Lab session 3	Lab session 4		Lab session 5	Lab session 6	Lab session 7	Lab session 9	Work in lab groups
18:00 - 21:00						Student poster session		Social dinner		

Lectures

- **Introduction - historical overview:** Fabio Sauli
- **Gas detector physics 1:** tbc
- **Gas detector Physics 2:** Piotr Gasik
- **Signal induction :** Werner Riegler
- **MPGD technologies:** Esther Ferrer Ribas
- **M(RPC) technologies:** Rinaldo Santonico
- **Wire-based detector technologies:** Peter Wintz
- **Gas requirements and choice:** Marcello Abbrescia
- **Data analysis and reconstruction :** Theo Alexopoulos
- **Manufacturing techniques**
 - **MPGD:** tbc
 - **RPC:** tbc
 - **Wire-based detectors:** Gabriel Charles
- **Modelling and Simulation 1&2:** Piet Verwilligen & tbc
- **Electronic readout 1:** Michael Lupberger
- **Electronic readout 2:** R. Cardarelli
- **Optical and hybrid readout techniques:** Davide Pinci
- **Applications in HEP**
 - **MPGD:** Paolo Iengo
 - **RPC:** Imad Laktineh
 - **Wire-based detectors:** Margherita Primavera
- **Gaseous detectors for future TPCs (challenges):** Diego Gonzales Diaz
- **Applications in fundamental research beyond HEP:** Marco Cortesi
- **Applications beyond fundamental research:** Jona Bortfeldt

Lecture program

Open to DRD1 community (in-person or via Zoom)

Please register on school website.

≈20 lectures of 1h each

Time for discussions and questions



Lectures will be recorded and available on Indico agenda

Registration to event necessary for download

Lab exercises

Lab 1 MPGD assembly	Lab 2 RPC assembly & operation	Lab 3 Wire assembly and straw tube operation	Lab 4 Characteris ation of drift tube detectors	Lab 5 MPGD characteris ation	Lab 6 RPC characteris ation	Lab 7 Readout techniques	Lab 8 Simulation 1 - Basic modelling	Lab 9 Simulation 2 - Advanced techniques
Survey of different MPGD technologies under microscope, testing components, assembly triple GEM / MM or μ RWELL	Assembly of HPL plates elecgtrodes RPC, basic volt-ampereometric characteristic recording	Singe straw assembly, operation of wire-based detector	Characterization of a drift tube operating with a gas mixture in helium atmosphere, gas gain measurements	Characterisation of triple GEM / MM / μ RWELL, drift scan, gain curve, transfer efficiency, signals with current and charge preamps	Characterisation of two small RPC detectors - efficiency measurement with scintillator setup	Electronic multi channel readout (delay line readout?), Optical readout with camera	Interactive Garfield exercises with Google Collab	

Lab schedule

	Session 1	Session 2	Session 3	Session 4	Session 5	Session 6	Session 7	Session 8	Session 9
Group 1	Lab 1: MPGD Assembly	Lab 2: RPC Assembly	Lab 8: Simulation 1	Lab 9: Simulation 2	Lab 3: Wire assembly and straw tubes	Lab 4: Drift tube characterisation	Lab 5: MPGD characterisation	Lab 6: RPC characterisation	Lab 7: Readout techniques
Group 2	Lab 1: MPGD Assembly	Lab 2: RPC Assembly	Lab 8: Simulation 1	Lab 9: Simulation 2	Lab 3: Wire assembly and straw tubes	Lab 4: Drift tube characterisation	Lab 5: MPGD characterisation	Lab 6: RPC characterisation	Lab 7: Readout techniques
Group 3	Lab 2: RPC Assembly	Lab 1: MPGD Assembly	Lab 8: Simulation 1	Lab 9: Simulation 2	Lab 7: Readout techniques	Lab 3: Wire assembly and straw tubes	Lab 4: Drift tube characterisation	Lab 5: MPGD characterisation	Lab 6: RPC characterisation
Group 4	Lab 2: RPC Assembly	Lab 1: MPGD Assembly	Lab 8: Simulation 1	Lab 9: Simulation 2	Lab 7: Readout techniques	Lab 3: Wire assembly and straw tubes	Lab 4: Drift tube characterisation	Lab 5: MPGD characterisation	Lab 6: RPC characterisation
Group 5	Lab 8: Simulation 1	Lab 9: Simulation 2	Lab 1: MPGD Assembly	Lab 2: RPC Assembly	Lab 6: RPC characterisation	Lab 7: Readout techniques	Lab 3: Wire assembly and straw tubes	Lab 4: Drift tube characterisation	Lab 5: MPGD characterisation
Group 6	Lab 8: Simulation 1	Lab 9: Simulation 2	Lab 1: MPGD Assembly	Lab 2: RPC Assembly	Lab 6: RPC characterisation	Lab 7: Readout techniques	Lab 3: Wire assembly and straw tubes	Lab 4: Drift tube characterisation	Lab 5: MPGD characterisation
Group 7	Lab 8: Simulation 1	Lab 9: Simulation 2	Lab 2: RPC Assembly	Lab 1: MPGD Assembly	Lab 5: MPGD characterisation	Lab 6: RPC characterisation	Lab 7: Readout techniques	Lab 3: Wire assembly and straw tubes	Lab 4: Drift tube characterisation
Group 8	Lab 8: Simulation 1	Lab 9: Simulation 2	Lab 2: RPC Assembly	Lab 1: MPGD Assembly	Lab 5: MPGD characterisation	Lab 6: RPC characterisation	Lab 7: Readout techniques	Lab 3: Wire assembly and straw tubes	Lab 4: Drift tube characterisation

Grouping of different labs in half week to make it easier for tutors to attend

All groups have MPGD and RPC assembly and simulation exercises in first half

2 desks of each lab needed (can be identical or different activities)

Lab book

- In preparation
- Some MPGD exercises identical to RD51 MPGD School
- New exercises already defined at different stages



Examples from lab book

Lab 2: RPC Assembly

Lab. 2 - RPC assembly

- This experience could focus on the assembly of two different RPCs, both based on HPL bakelite electrodes
 - 1) one dummy RPC consisting just of HPL plates, spacers, frame, glue, graphite spray (no gas flush, it will stay off) → it's mainly to appreciate the simplicity of the detector design and the required materials
 - 2) one small RPC in a pre-existing polycarbonate structure → this can be fixed and switched-on after the assembly → volt-ampereometric characteristic will be measured

Lab 3: WIRE ASSEMBLY AND STRAW TUBE OPERATION

Straw Exercises (8 Students)

- 1) Single straw assembly (x) 1h, 2 persons
 - Cut a straw (10cm, short length = 5cm)
 - Clean, remove the straw (if necessary)
 - Insertion of the electrode, fuse, wire, graphite (filling)
 - Preparation of the electrodes
 - Discharge and wiring of the straw
 - Measurement of the current
- 2) Straw operation (1) 1h, 2 persons
 - Construction of the straw detector with the high-voltage supply
 - Connection to the electric connection with the high-voltage supply
 - Avoid signal correction to amplifier (NIM-nim), discriminator
 - Trigger condition for the trigger
 - Installation to the DAQ system
 - Operation of the operation on the detector
 - Investigation with the detector in Lab (in 1.1m straw, paper)
 - Operation of the detector in the detector (in the detector)
 - Operation of the detector in the detector

Equipment needed: 2 tubes, 300V source, scintillator, NIM unit, DAQ system, high voltage supply, gas panel (for straw tubes), NIM unit, gas panel (for straw tubes), NIM unit, gas panel (for straw tubes), NIM unit, gas panel (for straw tubes).

LAB 4: DRIFT TUBE CHARACTERISATION

Figure 1: Setup overview
Figure 2: Tube assembly
Figure 3: Scintillator detector and collection circuit
Figure 4: Scintillator detector
Figure 5: Representation of the scintillation

Lab book also needed equipment and if you will bring it help to collect:

- High voltage power supply

LAB 6: RPC Characterisation

Lab. 6 - RPC characterization

- Characterization of two small RPC detectors with the same layout
 - Trigger system will consists of other two small RPC or two scintillators (TBD)
- Measure the detector efficiency as a function of the applied voltage
- Estimate the intrinsic RPC time resolution by measuring the time of flight of cosmic muons
- Study the charge distributions as a function of the applied voltage (in avalanche and streamer mode regime)

Events

- Student poster session (students are invited to present their own projects / research / experience)
- Presentations by lab groups (possibly in DRD1 Collaboration Meeting WG8 session, tbc)
- Social event on Sunday
- Visits



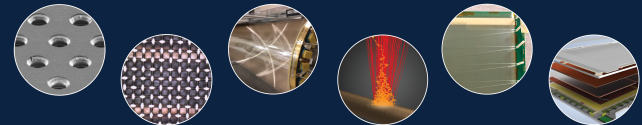
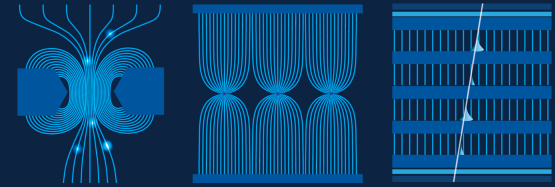
Poster

- School poster available online:
<https://indico.cern.ch/event/1384298/attachments/2874346/5033293/DRD1School-Poster.pdf>
- Printed copies available now, please contact us if you want some copies
- **Please spread the word!**

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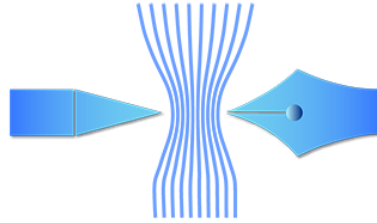
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DRD1





Interested to join as tutor?

Follow school preparation?

WG8 mailing list

<https://e-groups.cern.ch/e-groups/EgroupsSubscription.do?egroupName=drd1-wg8>