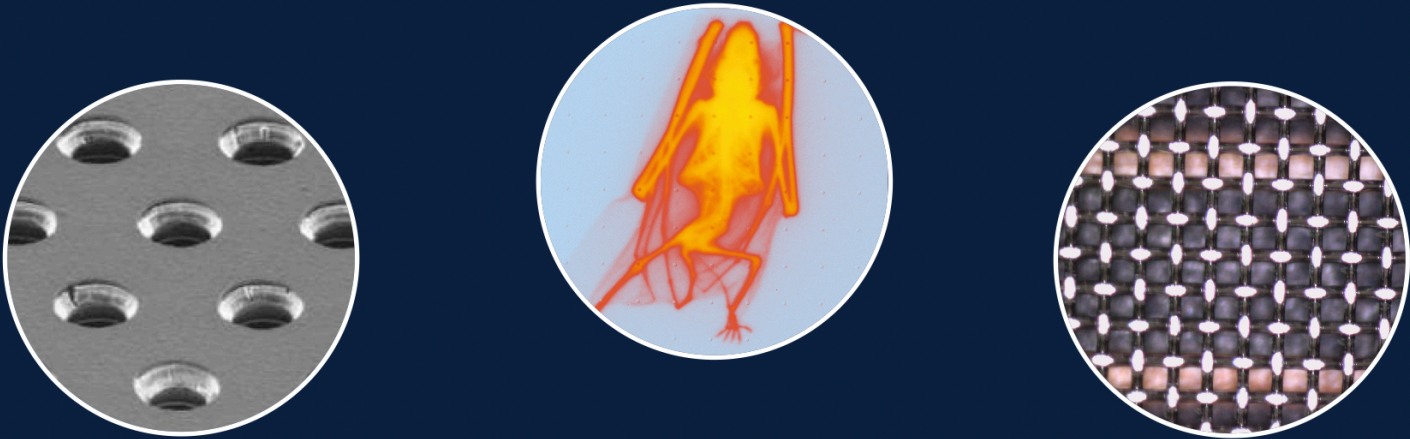
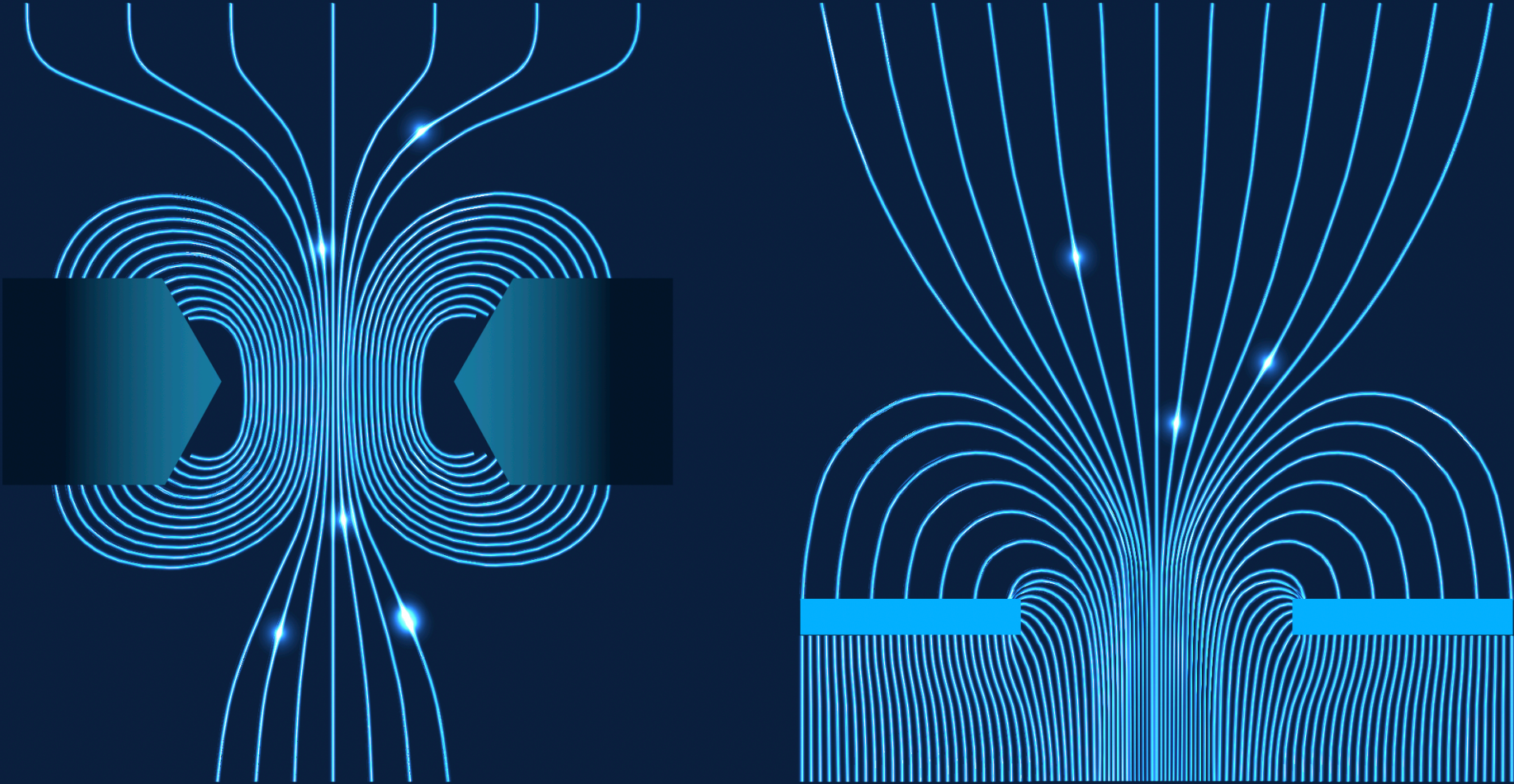
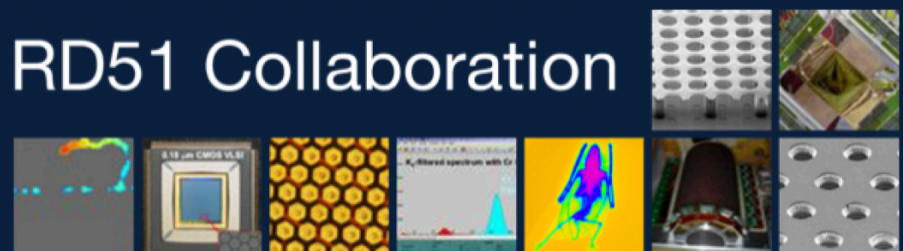


Welcome RD51 MPGD School



November 27 - December 1, 2023



Overview

Regular school focused on MPGDs and techniques of MPGD development

- **Sharing knowledge** and expertise about MPGDs
- Establishing **good practices** and approaches for common tasks and measurements in studying and developing detectors
- Applications of MPGDs

Lecture topics

- **Gas detectors physics**

- Historical introduction: MWPC to MPGD
- Energy Loss: Coulomb Interactions
- Drift and Diffusion of Charges
- Avalanche multiplication
- Gas properties

- **MPGD technologies**

- Detector geometries
- Resistive elements
- Beyond working point physics
- Discharges and mitigation in gaseous detectors
- State-of-the-art MPGDs (high rate, precise timing, resistive elements)

- **Readout technologies**

- Electronic readout
- RD51 SRS readout demonstration
- Optical & hybrid readout

- **Simulation and modelling**

- Signal formation
- Modelling approaches
- Simulation frameworks & tools

- **Manufacturing techniques**

- Photolithography / etching / drilling
- Advanced pattern techniques and additive manufacturing

- **Applications**

- High Energy Physics
- Applications beyond HEP
- Beyond fundamental research

Schedule

	Monday	Tuesday	Wednesday	Thursday	Friday
8:00 - 9:00	Registration				
9:00 - 10:00	Introduction: Gas detectors (F. Sauli)	Gas detector physics 2: beyond working point physics (P. Gasik)	Modelling and Simulation 1 (R. Veenhof)	Electronic readout techniques (M. Lupberger)	MPGDs in HEP applications (P. Iengo)
10:00 - 11:00	Gas detector physics 1 (F. Sauli)	MPGD technologies 2: State-of-the-art MPGDs (E. Oliveri)	Modelling and Simulation 2 (P. Verwilligen)	RD51 SRS readout demonstration (M. Lupberger)	Applications beyond HEP: nuclear physics, dark matter searches, neutrino physics (M. Cortesi)
11:00 - 11:30	Break	Break		Break	Break
11:30 - 12:30	MPGD technologies 1 (E. Ferrer Ribas)	Manufacturing techniques (R. De Oliveira)	ATLAS visits	Optical & hybrid readout techniques (D. Pinci)	Applications beyond fundamental research (J. Bortfeldt)
12:30 - 13:00	MPT visit	Group photo + MPT visit	MPT visit	MPT visit	MPT visit
12:30 - 14:00	Lunch break	Lunch break	Lunch break	Lunch break	Lunch break
14:00 - 18:00	Lab session	Lab session	Lab session	Lab session	Lab session
18:00 - 21:00		Student poster session			

Lectures

Time for questions after all lectures
If lecturer agrees also during lectures

From Zoom: please raise hand and wait to be called

Lectures may be recorded and made available to registered participants
Q&A after lectures will not be recorded

Coffee breaks upstairs (behind cafeteria) at 11:00
Please be on time to restart at 11:30



Lab schedule

Small groups: 4 students each

Split in 6 groups, each group will perform 5 different lab exercises

Lab 1 Detector assembly	Lab 2 Detector operation	Lab 3 Detector characterisation	Lab 4 Readout techniques	Lab 5 Detector simulations
Survey of different MPGD technologies with microscope, electrical testing of amplification structures, assembly of detector stack	Familiarity with typical lab instrumentation, gas systems, HV supplies, readout chains, signal shapes, basic operation and readout	In-depth detector characterisation, voltage scans of drift/transfer/amplification fields, effect of change of operating conditions	Electronic and optical readout techniques, e.g. tracking, imaging, basic reconstruction	Introduction to Garfield++ based simulation, basic modelling, electric field map, microscopic tracking

Lab book describing lab exercises:
<https://indico.cern.ch/event/1239595/attachments/2600086/4803190/LabBook-RD51MPGDSchool.pdf>

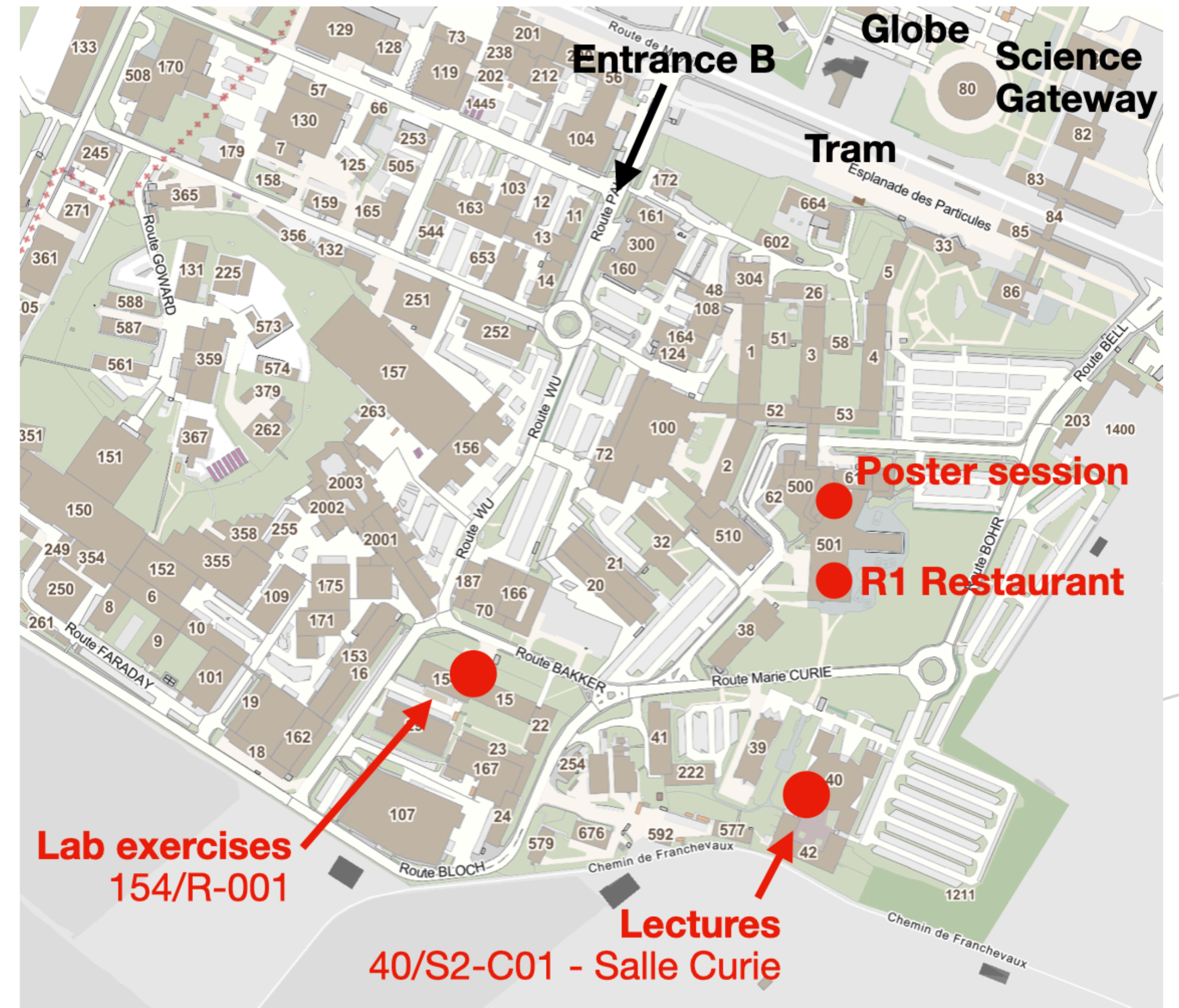
	Monday	Tuesday	Wednesday	Thursday	Friday
Group 1	Lab 1 Location E	Lab 2 Location A	Lab 3 Location B	Lab 5 Location H	Lab 4 Location D
Group 2	Lab 1 Location F	Lab 2 Location B	Lab 3 Location A	Lab 5 Location H	Lab 4 Location C
Group 3	Lab 1 Location G	Lab 2 Location D	Lab 4 Location D	Lab 3 Location A	Lab 5 Location H
Group 4	Lab 2 Location A	Lab 1 Location E	Lab 4 Location C	Lab 3 Location B	Lab 5 Location H
Group 5	Lab 2 Location B	Lab 1 Location F	Lab 5 Location H	Lab 4 Location D	Lab 3 Location A
Group 6	Lab 2 Location D	Lab 1 Location G	Lab 5 Location H	Lab 4 Location C	Lab 3 Location B

Lab exercises - logistics

Meeting point for all labs: GDD lab 154/R-001
Tutors will meet you there and take you to the location for lab exercise

Please read lab book before the exercise of the day

Please bring your laptop with you
(required for Lab 5 - Simulation, useful for other labs)



Lab exercises - safety

Safety rules

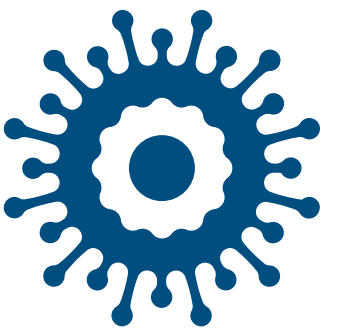
GDD Lab 154/R-007 is Supervised Radiation Area

- Strictly no food / no drinks
- No access for pregnant women



Covid

Masks / disinfectant will be available outside of GDD lab



Dosimetry

- Tutors handle sources
- All tables equipped with active dosimeter



Group photo

Group photo will be taken on Tuesday, 12:30 after lectures
Meeting outside of lecture room



Student poster session

Poster session will take place on Tuesday from 18:00 - 21:00 in building 500 Mezzanine (500/1-201)
Drinks and light snacks will be available



Please bring your printed poster to the poster session

If available, please send a PDF copy of your poster to rd51.mpgdschool@cern.ch
to be uploaded on the Indico agenda

Visit program

Visits to ATLAS cavern and MicroPattern Technologies workshop are organised

Places limited and no further places available

Grouping given on practical information sheet

ATLAS cavern

Wednesday, November 29

11:00, 11:40, 12:20

Please wear closed shoes

MPT Workshop

One group per day, 12:30

Meeting point outside of lecture room

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CERN Science Gateway

New visitor center with self-guided exhibitions and activities, no reservation required

<https://visit.cern/>

Possibility to visit before/after ATLAS cavern visit or on your own schedule incl. on weekend



Student presentations



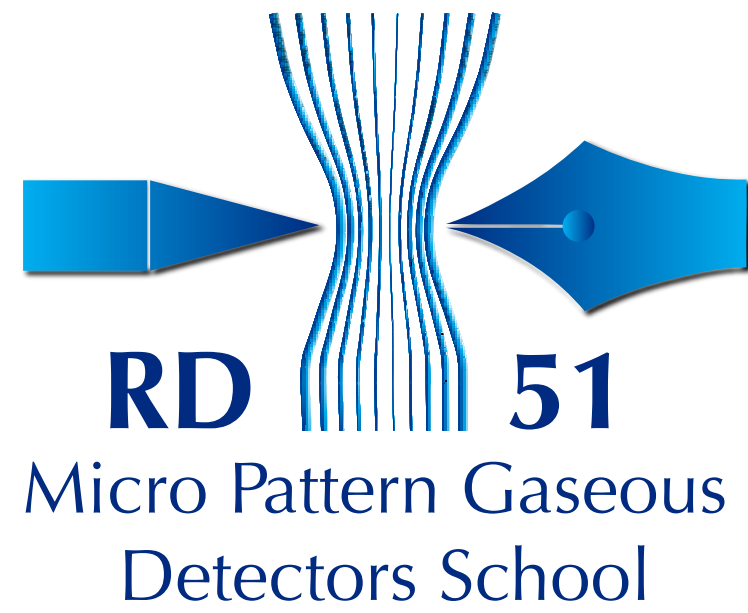
Students are invited to give 10min presentations during WG8 session of RD51 Collaboration Meeting (<https://indico.cern.ch/event/1327482/>) on Friday, Dec 8

Content

Presentation should explain the setup and experimental methods of one of the lab exercises
Can contain results obtained during the exercise as well as additional analysis performed.
Some open questions and further analysis are given in the lab book.

Each group can present one lab exercise during the meeting

Ideally, we aim to cover all different lab exercises. Please let us know at the end of the school which two exercises you found most interesting to plan which lab group covers which exercise.



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rd51.mpgdschool@cern.ch