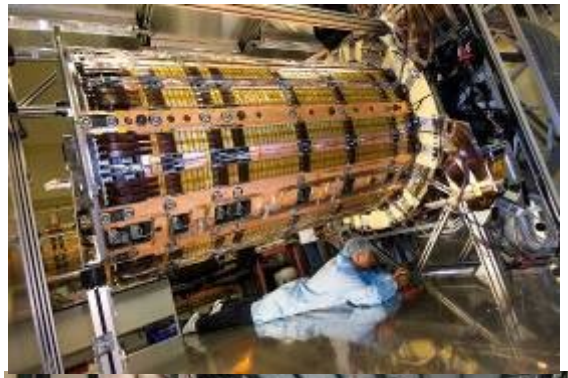
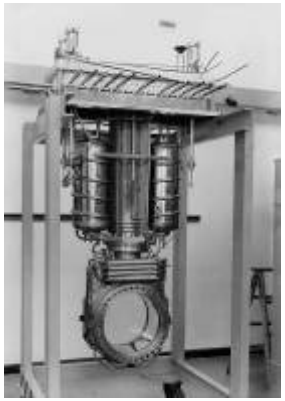
A short introduction to the

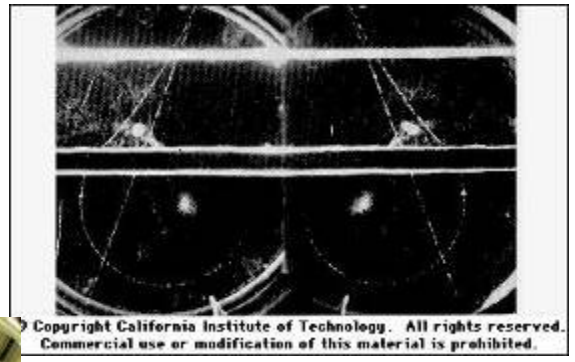
2023 Summer Student Labs

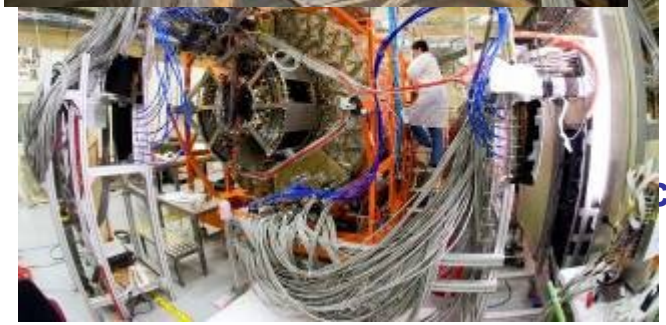
Niko Neufeld, CERN/EP

The Summer Student (Hardware) Labs



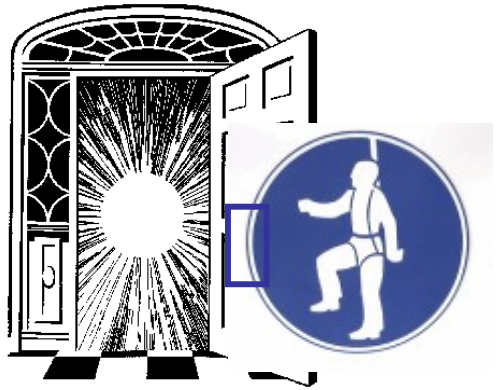






With the size of the experimental tools in high energy physics getting larger and more complicated, it is very hard in some short summer months to get a feeling of the different aspects of an experiment.

Step into our labs!



We would therefore like to invite you into some of our labs and try to show you in a few hours what we are doing there and why we are doing it.

Welcome!

As a Menu, we can offer:

- ROOT Summer Student Workshop (only two sessions left)
- Data Acquisition and Trigger
- Introduction to Silicon Pixel detectors
- MADgraph
- Web security pen-testing
- Introduction to Semiconductor Detectors for high-energy physics
- Characterisation of Scintillating Fibres
- Micropattern Gas Detectors (MPGDs)

https://indico.cern.ch/category/6274/

Root

Contact Persons: Axel Naumann, Lorenzo Moneta, Marta Czurylo, Vincenzo Eduardo Padulano

Tue 27.06. 14:00 – 17:00 (13-2-005)
Tue 28.06. 14:00 – 17:00 (IT amphitheatre)

You must bring your own laptop!

Data Acquisition (and fun with bits lost and found).

Contact persons:

Flavio Pisani, Pierfrancesco Cifra, Eloïse Stein

Requirements: Some basic programming experiences would be good - but that should not deter anyone.

4 sessions with 4 students

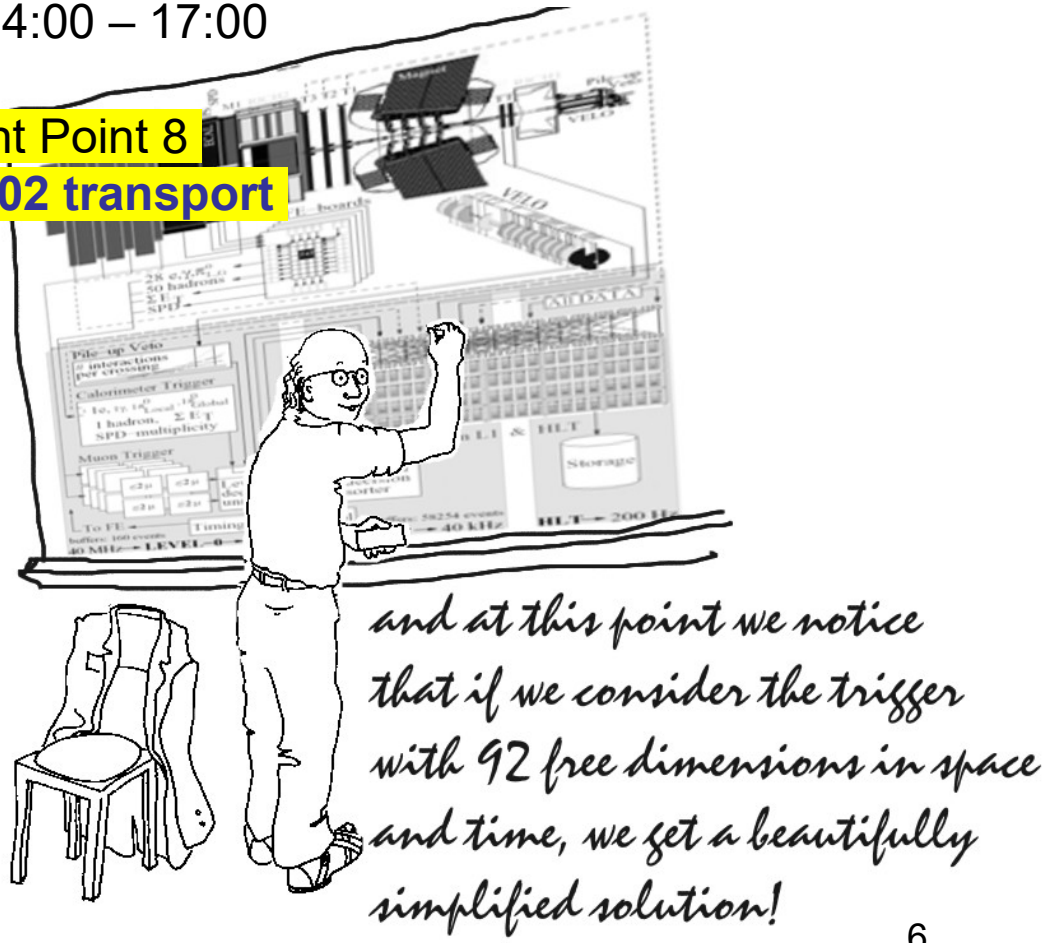
Time : one afternoon, 14:00 – 17:00

Dates : TBD

Place : LHCb experiment Point 8

Meeting at 13:45 in 2-R-002 transport will be provided!

Real data acquisition at 40 MHz. Follow the data through LHCb and try not to lose a single bit! From the front-end electronics, through the readout boards, the network, the farm to tape - and not back.

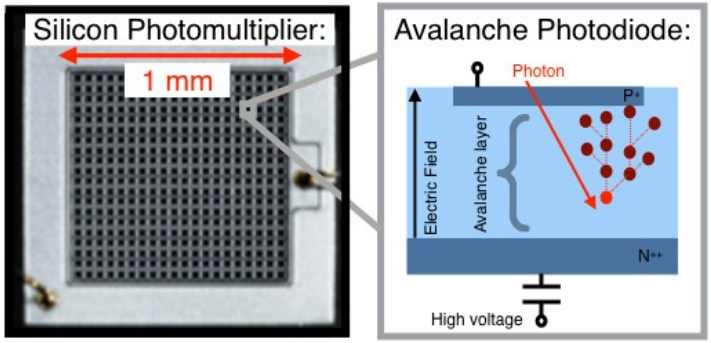


Silicon Pixel Detectors

Characterisation of Silicon Photomultipliers

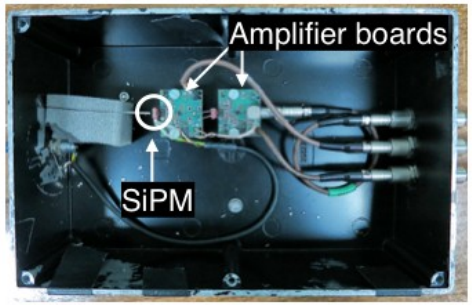
CLICdp
CLIC detector and physics study

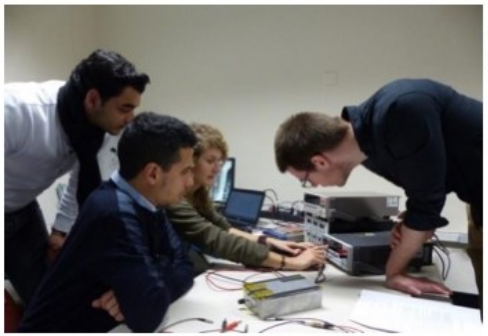
Silicon Photomultipliers (SiPMs) are in parallel connected Avalanche Photodiodes (APDs):

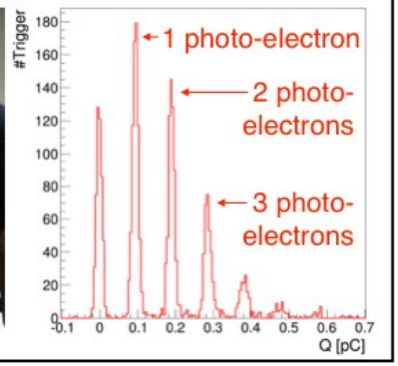


- Photon absorbed in the high-field layer of an APD creates avalanche:
  - → Very high gain of ~10^5
  - → Can measure single photons
- Readout signal of APD array proportional to number of incident photons:
  - → Can use device to measure energy in a sandwich calorimeter

High gain of SiPMs allows to measure discrete photo-electron spectrum (quantum effect) with this macroscopic device:







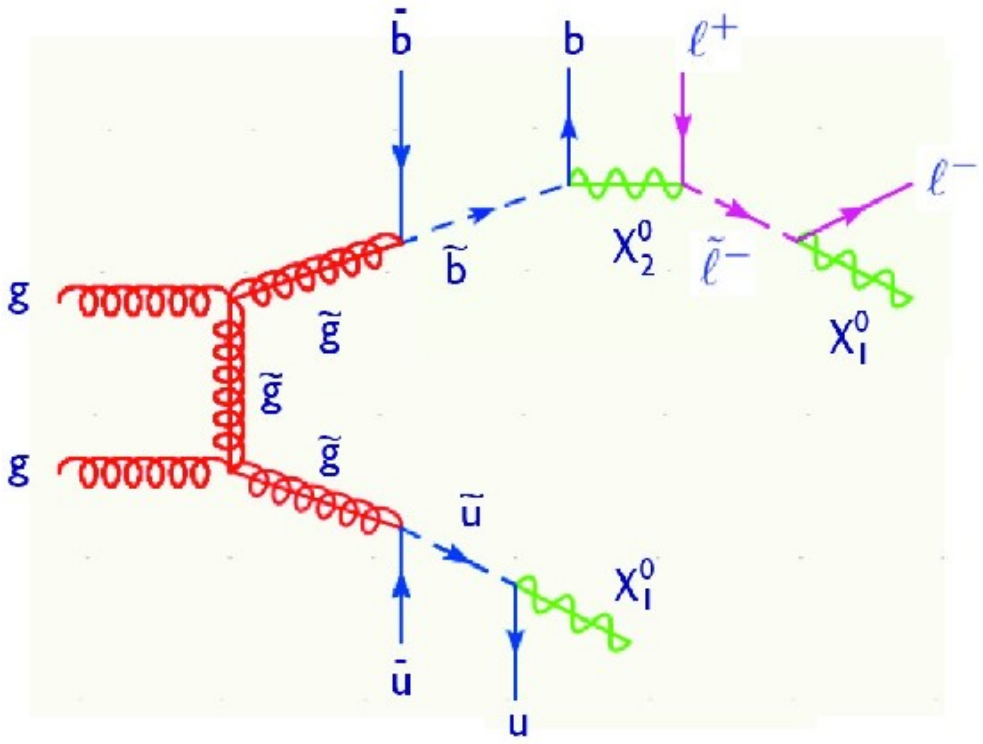
Students get the opportunity to **understand & measure the basic properties of SiPMs** such as the gain, using the single photoelectron spectrum

Silicon Pixel Detectors lab

- Short description: The students will learn about the basic principles of silicon detectors and perform measurements with hybrid pixel-detector assemblies.
- An introduction part will discuss the use of segmented p-n junctions coupled to dedicated readout circuits for the detection of ionising particles. The measurement programme includes electrical characterisations, calibration of the energy response using radioactive photon sources, as well as detection of minimum-ionising particles from cosmic rays and/or a radioactive electron source.
- August 3 and 4, from 9h00 to 12h30 and from 14h00 to 17h30 (4 sessions in total). Each session is for up to 4 students (2 groups per day)
- Place: bldg. 1-1-015
- Requirements:
  - Interest in silicon detector technology
  - The participants should have followed the detector lectures of the summer-student programme by Werner Riegler, or have equivalent prior knowledge
  - **The participants need a temporary personal dosimeter, see here: https://dosimetry.web.cern.ch/dosimeters/how-obtain-dosimeter**
- Tutors: Justus Braach, Eric Buschmann, Dominik Dannheim, Peter Svihra

MADGraph

- Dive into the world of Feynman-diagrams
- Understand how theoretical predictions for HEP experiments are made
- Organized by: Olivier Mattelaer and Valentin Hirschi , 2 sessions for 20 students each



N, Neufeld Sumlab Intro 2023

Web application
security penetration testing

Become a White Hat hacker ☺

Where: 513
Who: Sebastian Lopienski

Bring your own laptop!!

Introduction to Semiconductor Detectors for high-energy physics

This tutorial introduces high-energy physics and particle detectors to physics students with hands-on experiences.

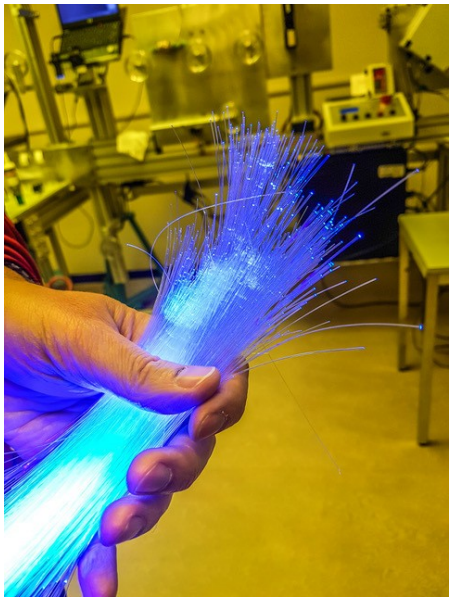
It familiarizes the students with concepts such as **MIP**, **charge collection**, **full depletion** and **charge sharing in strip detectors,** among others.

ALIBAVA SYSTEMS

The tutorial will be taught by Dr. Carmen Garcia, High Energy Physic Professor at CSIC (Spain). Hands-on exercises will performed with the **E**ducational **A**libava **Sy**stem **EASy** which is a **portable**, **compact** and **complete** system for microstrip sensor characterization for educational purposes.

2 sessions: July 11th and 12th

Characterisation of scintillating fibres



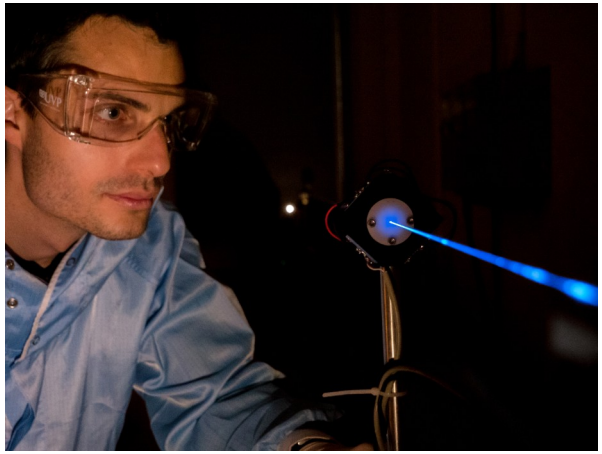
- Measure the attenuation length of a scintillating fibre
- Measure emission spectrum of a scintillating fibre and the wavelength dependence of the attenuation length
- Demonstration of Scintillation Light Yield measurement with a SiPM
- Visit of scanner for fibre diameter and cladding quality

Contact: Sune Jakobsen

Date and time: 8/8 10/8 14/8

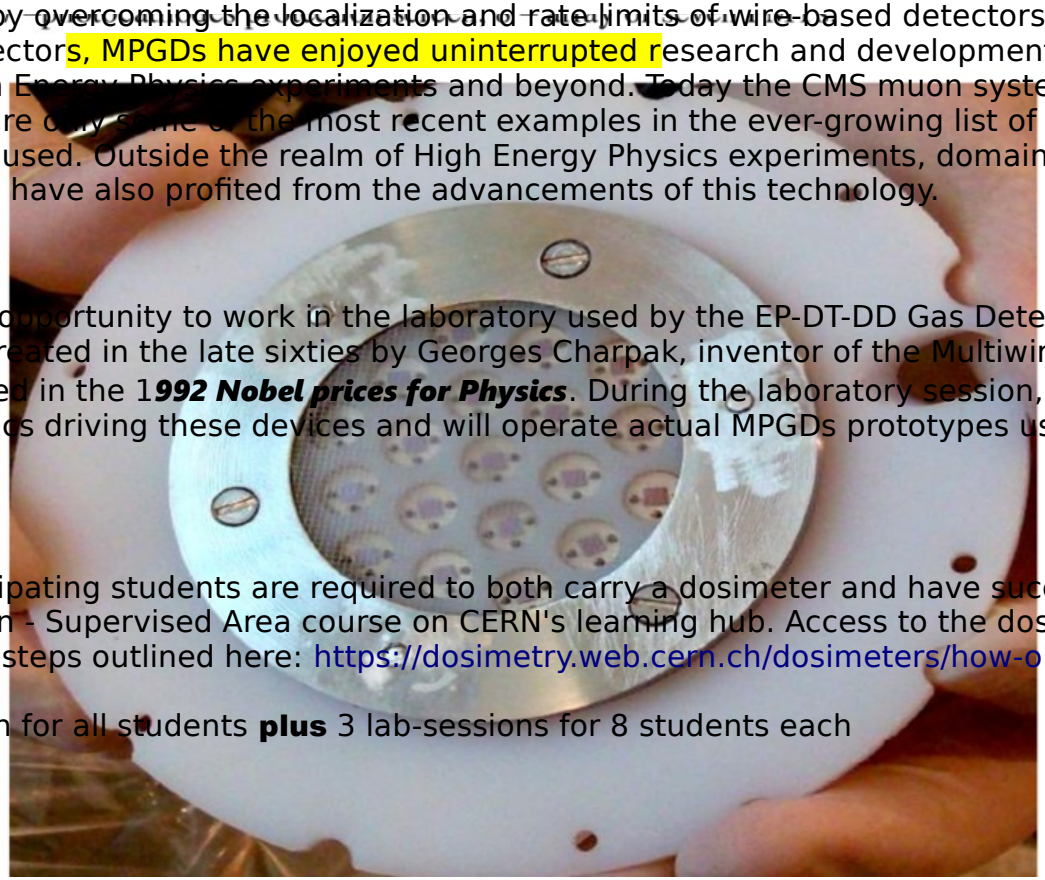
Total students: 9 students – 3 groups of 3 students

Location: 304/1-004



Micropattern Gas Detectors

In 1988 a new family of gaseous detectors, so-called Micropattern Gas Detectors (MPGDs), started to be conceived, motivated by overcoming the localization and rate limits of wire-based detectors. Building on the rich history of gaseous detectors, MPGDs have enjoyed uninterrupted research and development since and are now an integral part of High Energy Physics experiments and beyond. Today the CMS muon system, ATLAS New Small Wheel and ALICE TPC are only some of the most recent examples in the ever-growing list of applications where this type of detector is used. Outside the realm of High Energy Physics experiments, domains such as (medical) imaging and dosimetry have also profited from the advancements of this technology.



Students will have the opportunity to work in the laboratory used by the EP-DT-DD Gas Detectors Development (GDD) team; a group created in the late sixties by Georges Charpak, inventor of the Multiwire Proportional Chamber, which resulted in the 1***992 Nobel prices for Physics***. During the laboratory session, the students will be introduced to the physics driving these devices and will operate actual MPGDs prototypes used for various R&D purposes.

Requirement: all participating students are required to both carry a dosimeter and have successfully completed the Radiation Protection - Supervised Area course on CERN's learning hub. Access to the dosimeter can easily be achieved following the steps outlined here: https://dosimetry.web.cern.ch/dosimeters/how-obtain-dosimeter

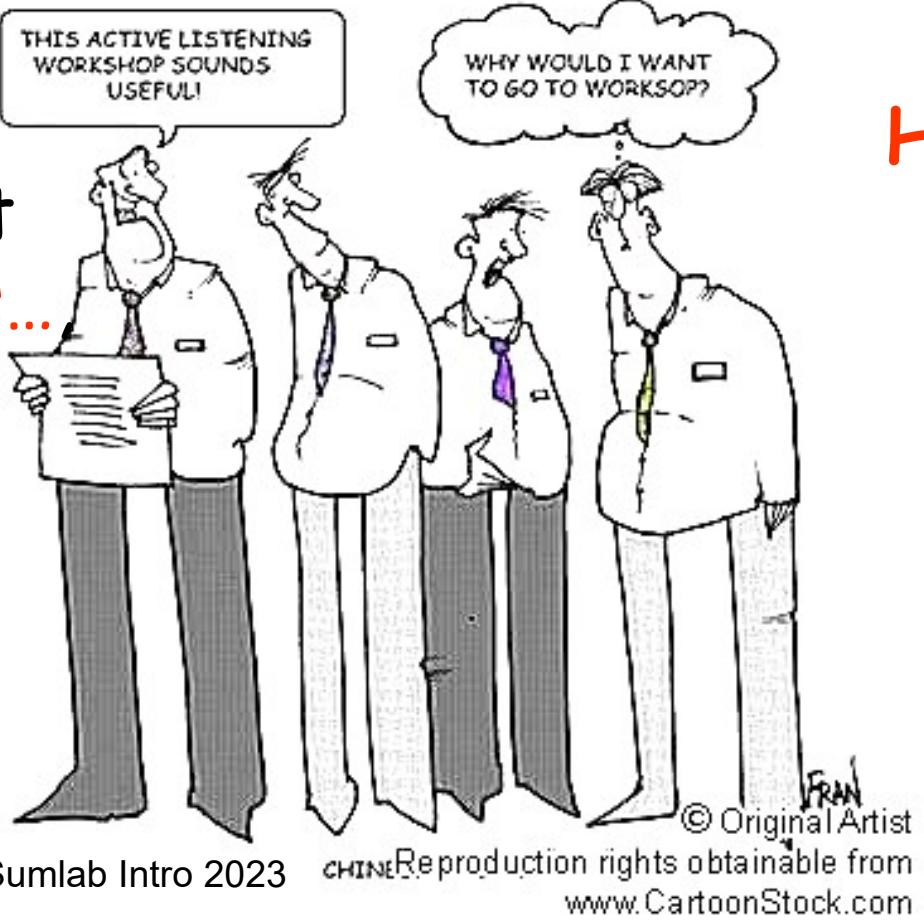
1 common intro session for all students **plus** 3 lab-sessions for 8 students each

What you have to do:

① Check and decide which are interesting for you:

1) Sign up https://indico.cern.ch/category/6274/ - **first come first served!**
2) If you were able to register successfully you will receive a confirmation email from the Summer Student Team

② Try not to forget your rendez-vous…



③ **Have fun!**