PHYS-440

Particle detection

Haefeli Guido

Cursus	Sem.	Type
Ing.-phys	MA1, MA3	Opt.
Physicien	MA1, MA3	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	During the semester
Workload	120h
Weeks	14
Hours	**4 weekly**
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

The course will cover the physics of particle detectors. It will introduce the experimental techniques used in nuclear and particle physics. The lecture includes the interaction of particles with matter, scintillators, gas detectors, silicon detectors, detectors for particle ID and photo-detectors.

Content

Interaction of particles in matter: ionization (Bethe-Bloch formula), interaction of electrons and photons (electromagnetic showers, radiation length and critical energy).
General characteristics of detectors: linearity, efficiency, resolution and Fano factor.
Gas detectors: ionization, proportional and Geiger-Muller counters, multiwire proportional, drift and time-projection chambers, micro-pattern gas detectors.
Semiconductor detectors: pn junction, silicon and germanium diode detectors, silicon microstrip and pixel detectors.
Scintillators: organic and inorganic scintillators, wavelength shifters and light guides.
Photodetectors: photomultipliers, solid state photodetectors as SiPMs.
Applications: momentum measurement in magnetic fields, calorimetry, particle identification.

Learning Prerequisites

Recommended courses

Elementary particle I, knowledge in nuclear and particle physics

Learning Outcomes

By the end of the course, the student must be able to:

- Categorize processes
- Describe energy deposite processes
- Quantify availabe signal

Transversal skills

- Communicate effectively with professionals from other disciplines.

Teaching methods

Slides, blackboard and exercises in class

Assessment methods

Semester work report evaluation 2/3 and presentation 1/3

Supervision

Office hours	No
Assistant.e.s	No
Forum	No
Others	During exercises and at office if requried

Resources

Bibliography

K.Kleinknecht: Detectors for Particle Radiation, Cambridge
W.R.Leo: Techniques for Nuclear and Particle Physics Experiments, Springer

Ressources en bibliothèque

- Find the references at the Library

Moodle Link

- https://go.epfl.ch/PHYS-440