UCLouvain

lphys2233b

2023

Experimental methods in fundamental physics - Advanced detection methods

5.00 credits	25.0 h + 5.0 h	Q2

Teacher(s)	Bruno Giacomo ;Cortina Gil Eduardo ;
Language :	English
Place of the course	Louvain-la-Neuve
Prerequisites	Having followed LPHYS2102 is an asset
Main themes	Advanced detection methods and experiment design in fundamental physics.
Learning outcomes	
Evaluation methods	Evaluation of reports written by the students on projects concerning real systems for particle detection in a laboratory. Evaluation of an oral interrogation on the projects and the subjects treated in the teaching unit.
Teaching methods	1. Theory classes and exercises. - Lectures in auditorium. - Resolution of problems . 2. Laboratory sessions (7.5h). Mandatory presence at the following laboratories : • Large-area cosmic ray detector ; • Silicon sensors characterization ; • Construction of an RPC detector. Writing of a report on a laboratory of the student's choice.
Content	1. Signal formation : general case. 2. Tracking detectors. a. Large area counters: hodoscopes. b. Magnetic spectrometers : magnets, resolution. c. Gas position detectors : MWPC, drift detectors, jet chambers, TPCs, RPCs. d. Solid state position detectors : silicon detectors, scintillation fiber detectors. e. LAr TPCs. Double phase TPCs. 3. Calorimetry. a. Electromagnetic calorimeters. b. Hadronic calorimeters. c. Low temperature calorimeters. Bolometers. 4. Particle identification. a. Muon detectors. b. Cerenkov detectors : threshold, differential, RICH. c. TRD detectors. d. Time of flight. e. dE/dx. 5. Complex detector study : journal club like approach. a. Collider : CMS, DELPHI. b. Fixed target : NA62. c. Astroparticle : AMS-02, Auger. 6. Auxiliary systems. a. Low and high voltage systems. b. Gas systems. c. Cooling systems. d. Mechanical supports. e. Cabling. 7. Nuclear electronics. 8. Introduction to detection methods used in gravitational wave physics

Bibliography	C. Grupen, B. Schwartz, “Particle Detectors” (2nd edition). D. Green, “The Physics of Particle Detectors”. R. Fernow, “Introduction to Experimental Particle Physics”. C. Leroy, P.G. Rancoita, “Principles of Radiation Interaction in Matter and Detection”. S. Tavernier, “Experimental Techniques in Nuclear and Particle Physics”.
Other infos	This partim counts for 5 credits and can be taken separately from the full course
Faculty or entity in charge	PHYS

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Physics	PHYS2M	5		🔍