UCLouvain

lphys2235

2026

Advanced detection and simulation method in HEP experiments

5.00 crédits	25.0 h + 5.0 h	Q2

Enseignants	Bethani Agni ;Cortina Gil Eduardo ;
Langue d'enseignement	Anglais > Facilités pour suivre le cours en français
Lieu du cours	Louvain-la-Neuve
Préalables	LPHYS2102: Ionizing Radiation Detection and Nuclear Instrumentation
Thèmes abordés	Advanced (astro-)particle detectors – Experiment design in (astro-)particle physics – Triggering, data acquisition and computing systems. Simulation tools: GEANT4.
Acquis d'apprentissage	**A la fin de cette unité d'enseignement, l'étudiant est capable de :** 1 **Contribution of the teaching unit to the learning outcomes of the programme (PHYS2M and PHYS2M1)** 1.3,1.4,1.5, 1.6, 2.2, 2.3, 2.4, 2.5, 5.1, 5.3, 6.1,6.2,6.3,6.4,7.1,7.3 , 8.1,8.2 **Specific learning outcomes of the teaching unit** 2 1. Explain and discuss in detail the advanced experimental techniques of complex systems used in HEP experiments: detection techniques in (astro-)particle physics ; simulation ; trigger, data acquisition and computing systems; 2. Explain and discuss advanced nuclear electronics techniques 3. Conceive a detector setup for basic fundamental physics measurements. 4. Setup and carry out a small-scale experiment. 5. Develop a software project within an existing framework aiming at simulating an experimental setup in which particles propagate through matter.
Contenu	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, IceCube 6. Auxiliary systems a. Low and High Voltage systems b. Gas systems c. Cooling systems d. Mechanical supports e. Cabling 8. Trigger and Data Acquisition Systems

	9. Simulation of particle propagation in matter
Bibliographie	1. Kolanowski, Wermes, “Particle Detectors” Oxford 2. McGregor, Shultis, “Radiation Detection: Concepts, Methods and Devices” CRC 3. C. Grupen, B. Schwartz, “Particle Detectors” (2nd edition) 4. R. Fernow, “Introduction to Experimental Particle Physics” 5. S. Tavernier, “Experimental Techniques in Nuclear and Particle Physics”
Faculté ou entité en charge:	PHYS

Programmes / formations proposant cette unité d'enseignement (UE)

Intitulé du programme	Sigle	Crédits	Prérequis	Acquis d'apprentissage
Master [60] en sciences physiques	PHYS2M1	5		🔍
Master [120] en sciences physiques	PHYS2M	5		🔍