IRFU : Institut de recherche sur les lois fondamentales de l'univers

Saclay

DPhN/LSN

Développement d'un algorithme pour trouver les vertex déplacés pour l'expérience CLAS12

Spécialité Physique nucléaire

Niveau d'étude Bac+5

Formation Master 2

Unité d'accueil DPhN/LSN

Candidature avant le 05/06/2023

Durée 6 mois

Poursuite possible en thèse oui

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Résumé

The main objective of the internship is to implement an algorithm able to resolve displaced vertices. This algorithm will significantly improve the reconstruction of long-lived particles decaying a few centimeter away from the beam. It may even make possible the study of new physics channels, key to the understanding of the proton structure.

Sujet détaillé

Deep inelastic collisions of electrons off protons are the cleanest way to investigate the inner structure of nucleons and nuclei. With a 10.6 GeV electron beam colliding with protons at rest, the CLAS12 experiment aims at understanding how valence quarks and gluons (i.e. carrying more than 10% of the proton momentum) organize themselves to form a proton.
From these collisions, strange particles are sometimes produced: these strange particles are composed a strange quark and often have relatively long lifetime as they decay through the weak interaction. As the produced strange particles travel in the lab almost at the speed of light, their decay occurs a few centimeters away from the electron-proton collision site also known as vertex. As the reconstruction software assumes that all particles are coming from the beam, the 4-momenta of the decay products are misreconstructed and the strange particle consequently not detected.
The goal of the intenrship is to implement an algorithm able to find intersections (verticies) between the trajectory of particles and derive the 4-momenta of the particles at this intersection. With the correct momenta, the strange particle will be properly reconstructed and identified.
The student will have the opportunity to report in international meetings about his/her progress. If fast enough, this algorithm may become an official tool of the CLAS12 collaboration and lead to a technical publication.

Mots clés

Physique des particules, software, reconstruction de particules

Compétences

Logiciels

C++, Python, Java... choice is yours as long as the code is efficient and fast.

Development of an algorithm to find displaced vertices for the CLAS12 experiment

Summary

The main objective of the internship is to implement an algorithm able to resolve displaced vertices. This algorithm will significantly improve the reconstruction of long-lived particles decaying a few centimeter away from the beam. It may even make possible the study of new physics channels, key to the understanding of the proton structure.

Full description

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Keywords

Particle physics, software, particle reconstruction

Skills

Softwares

C++, Python, Java... choice is yours as long as the code is efficient and fast.