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Detector study of a Cherenkov detector for the strong-field QED experiment E320 at SLAC

A novel group of experiments will study strong-field quantum electrodynamics in the interactions of a beam of electrons with a high-intensity laser. Two such experiments are LUXE at DESY (Germany) and E320 at SLAC (USA). The spectrum of the electrons from this interaction needs to be characterized. The measurement is challenging since roughly 1010 electrons with energies up to 10 GeV arrive at the detection system within 100 fs. The electron pulse is usually fanned out with a dipole magnet that spatially spreads the electron energies.

We developed an electron detection system consisting of a Cherenkov counter with 32 detector channels, a scintillating screen, and a camera. The electrons first pass the screen, producing a scintillation flash recorded with a high-resolution camera. Behind the scintillating screen is a lattice of air-filled straws. The passing electrons produce Cherenkov light that is collected with silicon photomultipliers. The amplitudes of the collected light in both systems are proportional to the number of electrons, and the spatial distribution reveals the energy spectrum.

The goal for the summer student is to participate in the detector study. Measurements foreseen in June 2024 at the E320 experiment at SLAC can be examined. Additionally, data from tests of the detector prototype at the ARES facility at DESY can be analyzed, and Monte Carlo simulations of the detector can be performed.

Group

FH-FTX

Project Category

B1. Physics Data Analysis and Performance (software-oriented)

Special Qualifications

Basic programming skills (C++, Python)

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