

Test-beam measurements of instrumented sensor planes for a highly compact and granular electromagnetic calorimeter

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The LUXE experiment is designed to explore the strong-field QED regime in interactions of high-energy electrons from the European XFEL with an intense laser field. One of the crucial aims of this experiment is to measure the production of electron-positron pairs as a function of the laser field strength, where non-perturbative effects are expected to kick in above the Schwinger limit. For the measurements of positron energy and multiplicity spectra, a tracker and an electromagnetic calorimeter are foreseen. Since the expected number of positrons varies over five orders of magnitude, and has to be measured over a widely spread low-energy background, the calorimeter must be compact and finely segmented. The concept of a sandwich calorimeter made of tungsten absorber plates interspersed with thin sensor planes is developed. The sensor planes comprise a silicon pad sensor, flexible Kapton printed circuit planes for bias voltage supply and signal transport to the sensor edge, all embedded in a carbon fibre support. The thickness of a sensor plane is less than 1 mm. A dedicated readout is developed comprising front-end ASICs in 130 nm technology and FPGAs to orchestrate the ASICs and perform data pre-processing. As an alternative, GaAs are considered with integrated readout strips on the sensor. Prototypes of both sensor planes are studied in an electron beam of 5 GeV. Results will be presented on the homogeneity of the response, edge effects and cross talk between channels.

Collaboration

LUXE

Role of Submitter

The presenter will be selected later by the Collaboration

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