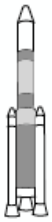

CALOR 2024

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

Monday 20 May 2024 14:30 (20 minutes)

The LUXE experiment is designed to explore the strong-field QED regime in interactions of high-energy electrons from the European XFEL in a powerful 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.

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