

Proposal for Using the EUDET Testbeam at DESY

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Abstract

We plan to measure the performance of fully assembled sensor planes prepared for special calorimeters in the very forward region of the ILD detector. For this purpose the relatively high energy electron at DESY, equipped with EUDET infrastructure will be used.

1 Scientific Goal

In a collaboration of UST Cracow, TAU Tel Aviv and DESY Zeuthen fully assembled sensor planes for BeamCal and LumiCal, the two major detectors in the very forward region of the ILD detector, are developed.

The sensors, silicon for LumiCal and GaAs for BeamCal are investigated in detail in the laboratories in Cracow, Tel Aviv and Zeuthen. Parallel front-end and ADC ASICs are designed and produced in the responsibility of UST Cracow. In the last three months for the first time prototype sensor planes, consisting of large area sensors, are equipped with front-end ASICs. The tests and calibration measurements in the laboratory with test-pulses are successfully completed. The results correspond to the expectations from simulations.

The Testbeam at DESY will be used for a full system test and a detailed study of the performance of the system. To predict the impact point the MVD telescope will be used.

The measurement is planned for July 28 to August 12, 2010.

2 Technicalities

The sensor planes are equipped with front-end ASICs (fig. 1). The signal are then driven by an auxiliary electronics to a VME 500 Ms 8 bit flash ADC. The ADC readout is done via an optical link.

The following installations are foreseen:

1. The assembled sensor planes are encapsulated in a box. The box has thin windows for the beam. It is fixed on a remotely movable x-y table.

The x-y table will be positioned between the MVD sensor planes such that two sensor planes will be upstream and one downstream of the DUT. The computer for steering the x-y table will be prepared by us and installed in the area.

2. The readout of the DUT, prepared by us, and the readout of the MVD, prepared by the testbeam crew, are running on different computers. Synchronization of the triggered events will be done using time-stamping.
3. Inside the sensor box a temperature sensor is foreseen. This will be readout separately. The DAQ will be prepared by us.

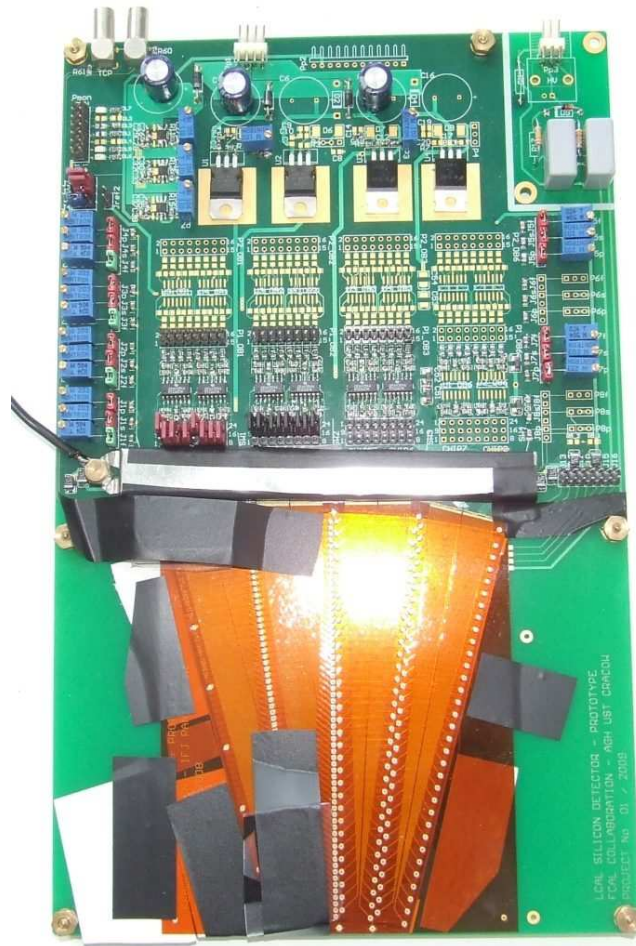


Figure 1: Assembled sensor plane.

2.1 Measurements Planned

For both sensor planes similar measurements are planned.

1. Response to MIPs on a larger number of pads to study the dependence of the signal size as a function of the pad positions. Pads near the front-end ASICs have only short copper strips for the connection to the ASIC, pads far away correspondingly longer connections. The impact of the strip capacitances on the signal size and shape will be investigated.
2. Effects of the sensor edges and non-metallised strips between the pads will be investigated.
3. The cross-talk between neighbor and non-neighbor readout channels will be measured.
4. Measurements will be done with different high voltage values to investigate their impact on the sensor size and shape.

3 Status of Preparation

Two sensor planes, one with a silicon and one with a GaAs sensor are ready for test .

The test-beam crew, mainly students from the universities, have been trained over the last 2-4 weeks for the participation of the measurements. The measurements will be supported by senior scientists from the participating labs. Threw shift crews are formed to ensure the full exploitation of the beam-time.

4 Transnational Access

The project leader is Marek Idzik from University of Science and Technology in Cracow. The local responsible is Sergey Schuwalow. Students are coming from Cracow (Szymon Kulis), Tel Aviv (Itamar Levy) and Brandenburg University of Technology (Sandro Kollowa). Konstantin Afanaciev from NCPHeP Univ. of Minsk will participate as an expert for the DAQ, being developed partly by him, and the GaAS sensors obtained from Russia. Erik Kielar is a senior scientist from INP PAS experienced in testbeam measurements. For the participants we ask to cover travel (for Sz.Kulis, K.Afanaciev, E.Kielar) and living costs for the whole period i.e. from 28 of july to 12 of august 2010 (for I.levy only 10 days). For Szymon Kulis travel cost is higher since he will bring by car part of the instrumentation.