ATLAS Planar Senors Tests Using the EUDET Telescope - TA Users Report

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Abstract

The EUDET telescope enables in depth studies of new sensor prototypes for the ATLAS Insertable B-Layer. In this memo the experience of the ATLAS PPS group with the EUDET telescope is summarised. No final results are given in this reports as the analysis is still ongoing.

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1 Introduction

The ATLAS collaboration is currently planning to add an additional pixel layer to the current pixel system. This additional layer (Insertable B-Layer - IBL) will be installed in 2-5 years from now, depending on the LHC schedule. Main reasons for such an additional pixel layer are the tracking robustness, the luminosity effects, and the tracking precision. A detailed description and technical design of this project can be found here [1].
In 2010 a number of test beam were done using the EUDET telescope. In this memo it is shown, that the full analysis of this data samples can be done using the EUTelescope software provided by the EUDET group.

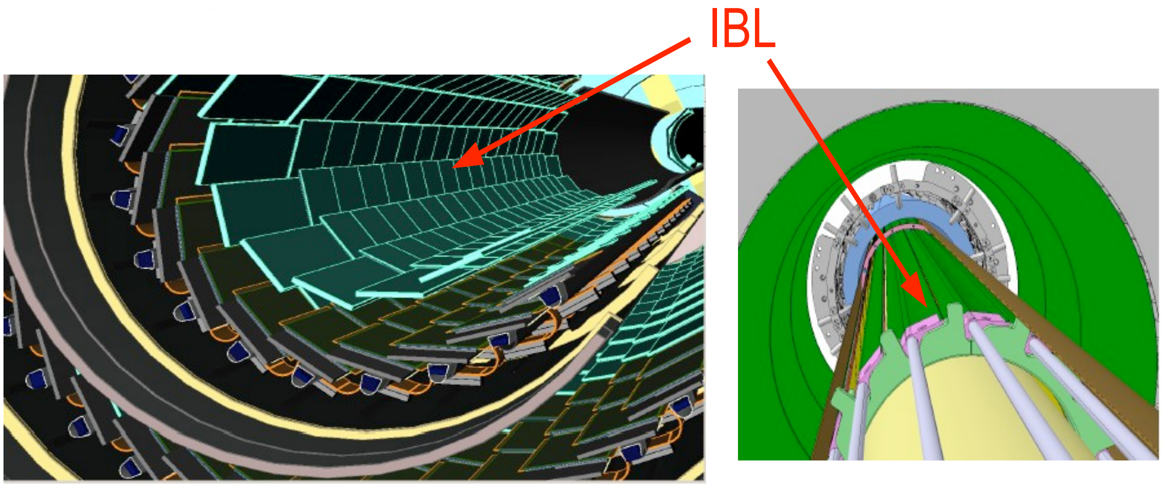


Figure 1: 3D drawing of the IBL inserted in ATLAS. left: configuration of the modules. Right: new beam pipe with the IBL attached.

2 The Planar Pixel Sensors

Three different sensor technologies are candidates for the baseline sensor technology for the IBL: the planar pixel sensor (PPS), the 3D Silicon sensors and CVD Diamond sensors. The sensors tested during this study are the PPS sensors. Within the R&D project on Planar Pixel Sensor Technology for the ATLAS inner detector upgrade, the use of planar pixel sensors for highest fluences as well as large area silicon detectors is investigated. The main research goals are optimizing the signal size after irradiations, reducing the inactive sensor edges, adjusting the readout electronics to the radiation induced decrease of the signal sizes, and reducing the production costs.

3 Test Beam Samples and Data Taking

During the PPS test beam at the SPS beam at CERN up to 8 devices under test (DUTs) were put into the EUDET telescope. Usually 4 DUTs between the two telescope arms and another 4 were placed behind the telescope. In Figure 2 a picture of the overall test setup is shown.

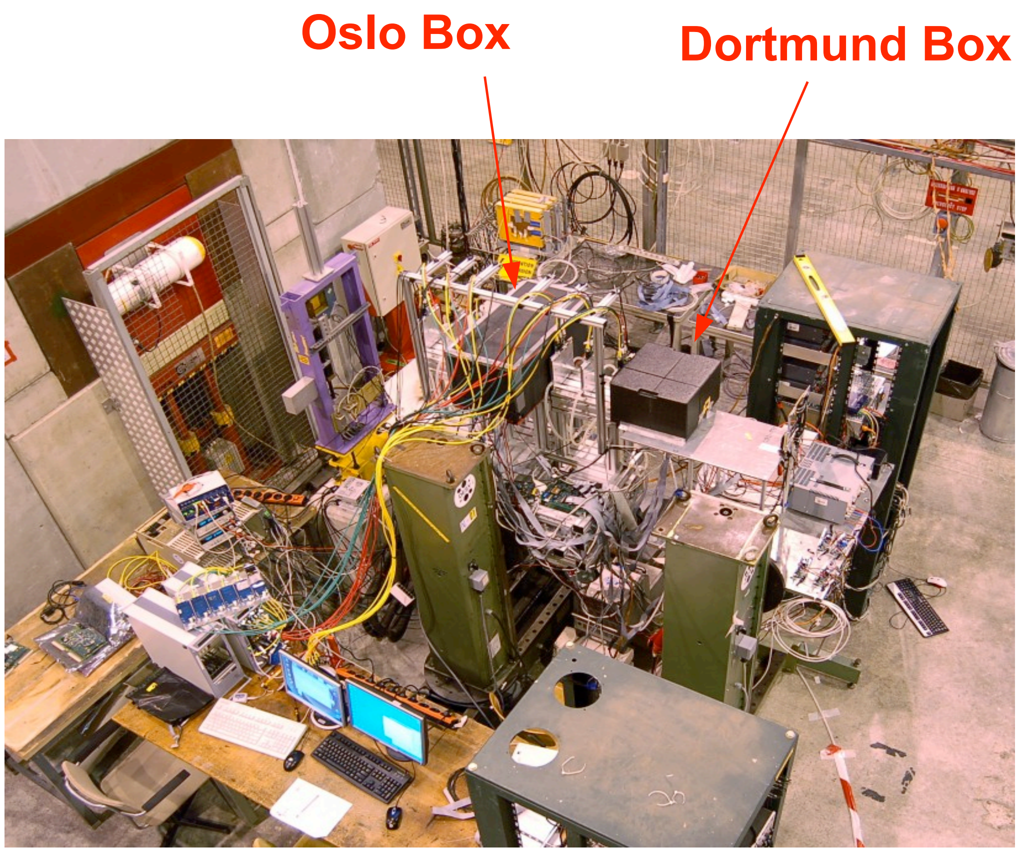


Figure 2: The EUDET telescope during the ATLAS Pixel test. Up to 8 DUTs were placed into the system, 4 in the Oslo box between the two telescope arms, another 4 in the Dortmund Box behind the telescope.2

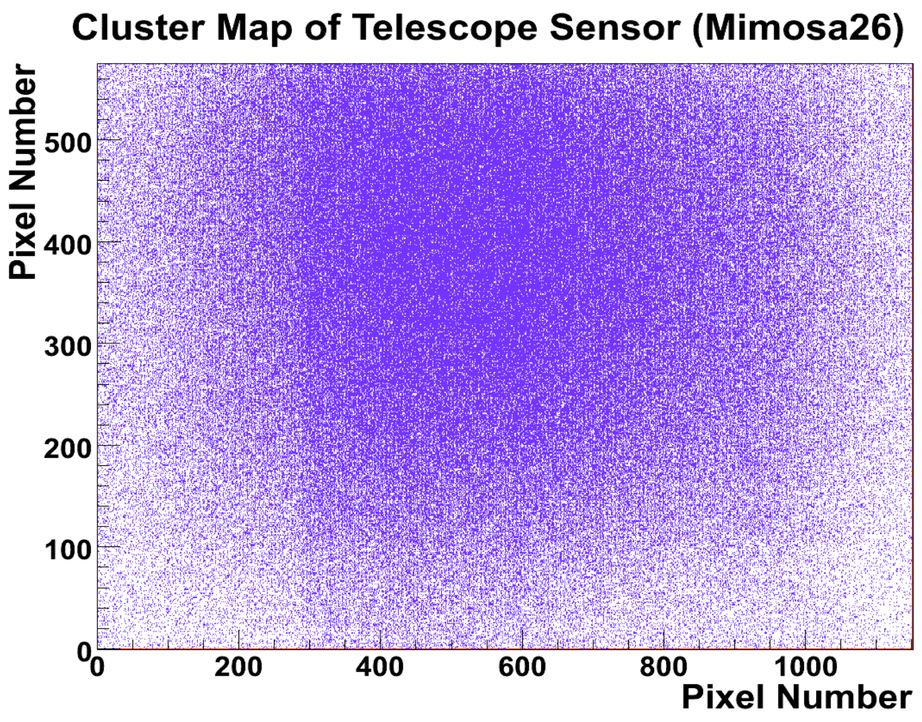
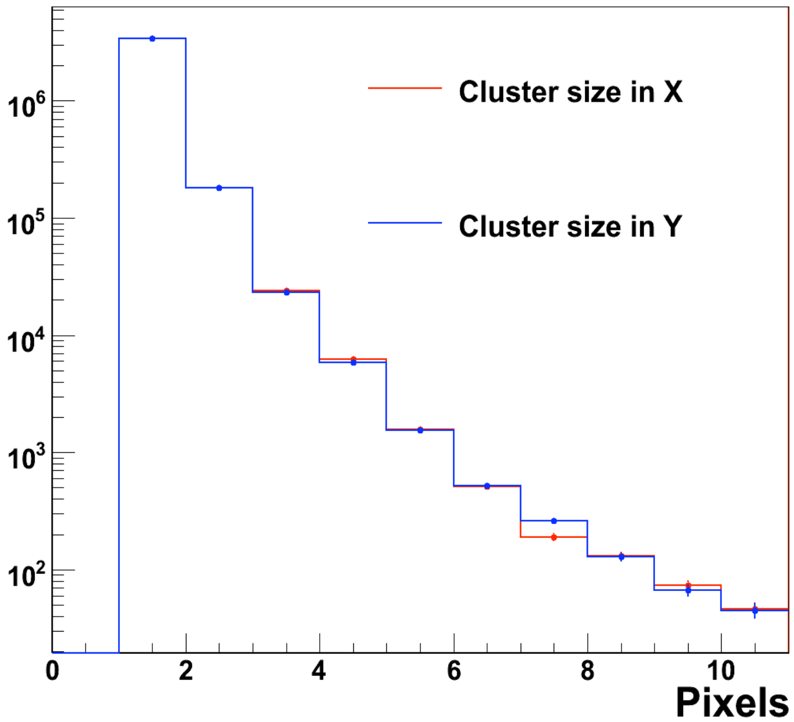


Figure 3: Cluster Map of Telescope Sensor

Figure 2: Cluster size of clusters in the EUDET telescope



4 Analysis

For the data analysis the EUTelescope software package was used. The main goal of the EUTelescope software is to go from raw data acquired by a set of data aquisition boards to high level objects like tracks crossing the telescope. Those tracks are used to characterize both, the telescope itself and any other position sensitive detector (DUT) that can be inserted into the telescope setup.

The structure of EUTelescope is very modular and the each processor is just taking care of doing a particular task on the input collection and eventually to add other output collections that can be used by other following processors.

The main input of the full analysis chain is the LCIO output file produced by the DAQ system containing the pixel raw data. The analysis of the ATLAS pixel sensors was added to this tool to have everything in one package. But as the system is very modular, the users can still choose to use other DUT analysis tools like TBMON (the main tool used by APIX).

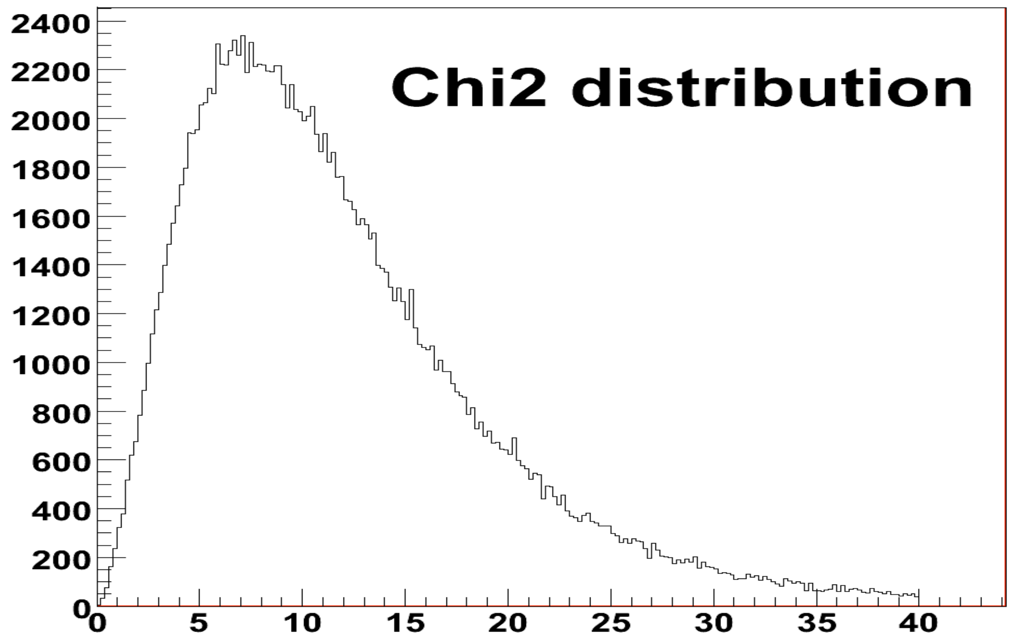
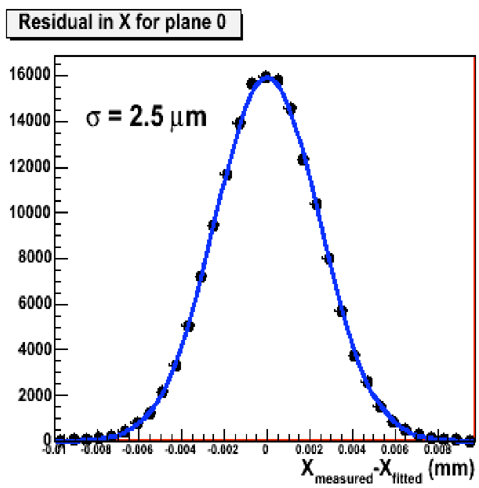
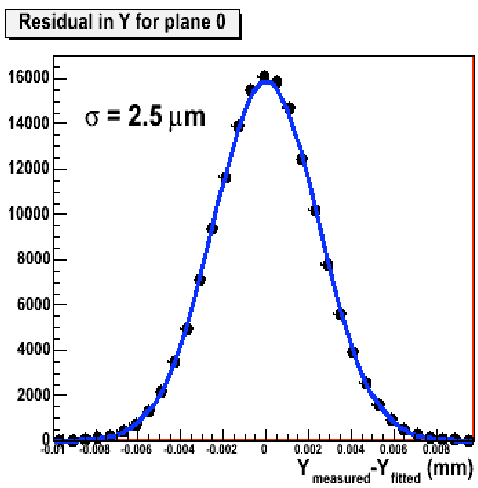
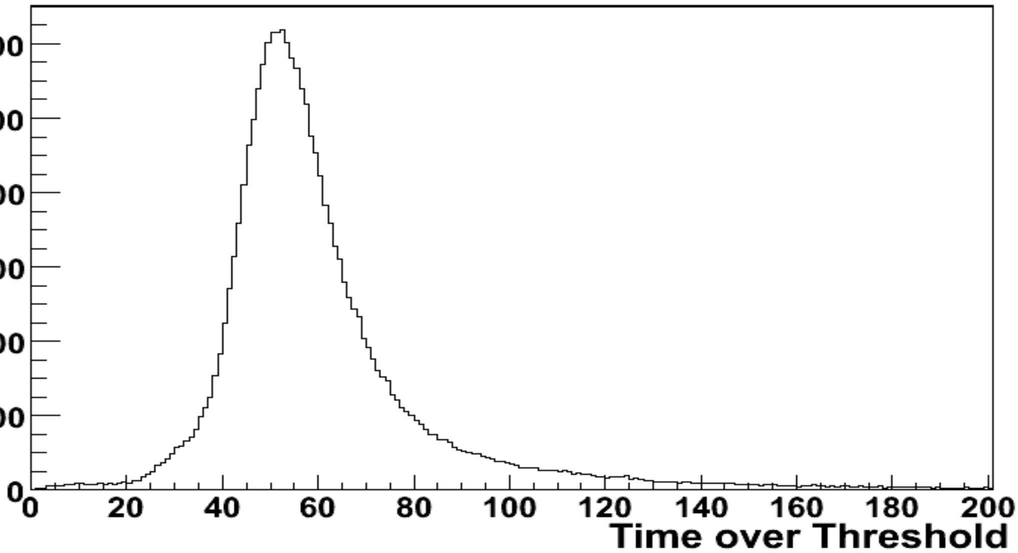
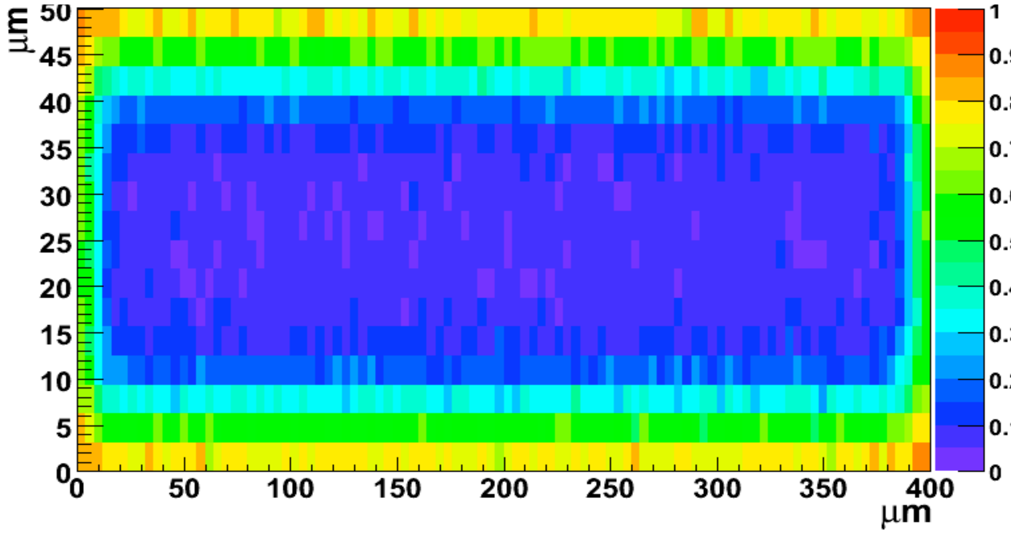


Figure 3: Chi2 distribution









Conclusion

Analysis of July 2010 testbeam data is in progress. In this talk the data analysis was entirely done within EUTelescope. The presented results agree to tbmon.

Acknowledgement

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