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AIDA-2020

Advanced European Infrastructures for Detectors at Accelerators

Poster

Beam Telescopes at DESY II Test Beam Facility

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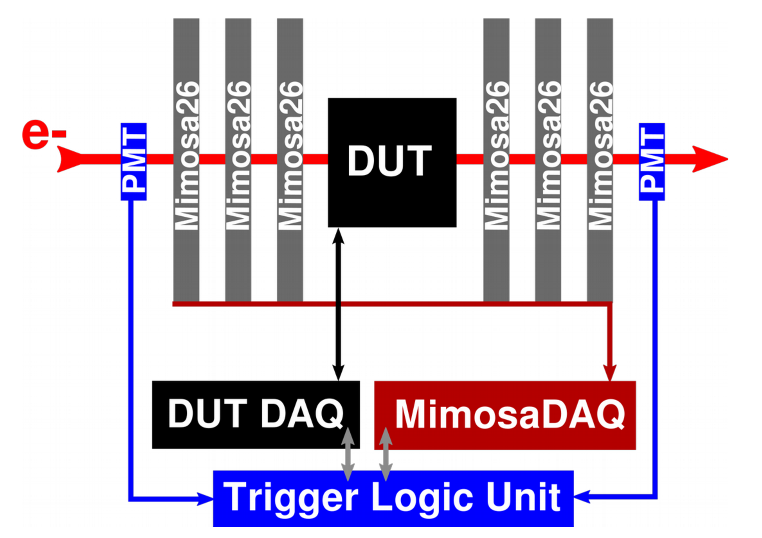
Beam Telescopes

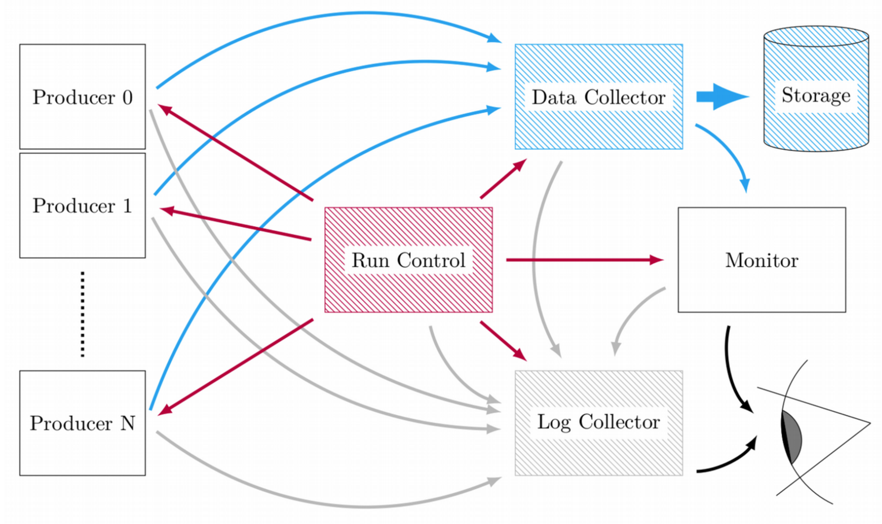
A common tool: the EUDET-type beam telescope package

A high resolution ($\sigma \approx 2$ µm) beam telescope based on monolithic active pixel sensors (Mimosa26) was developed within the EUDET collaboration [1,2]. In the last decade it has become a in-beam tool for many different high-energy physics groups, largely due to its precise spatial resolution, reliable operation and user device-under-test (DUT) integration capabilities. Besides the hardware components [1,2], two software frameweorks play a central role: EUDAQ [3], a multi-platform data acquisition system that allows easy integration of the device-under-test, and EUTelescope [4], a group of processors running in ILCSoft's Marlin framework that allows the spatial reconstruction of particle tracks and the final data analysis.

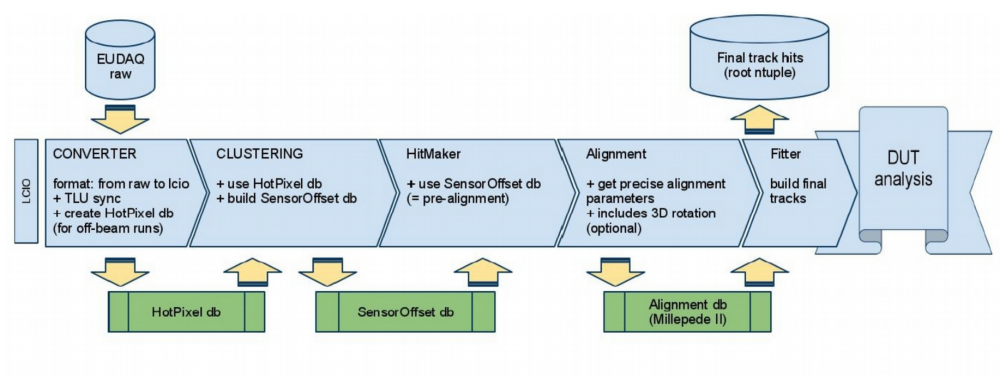
EUDET-type hardware ⟷ **EUDAQ** ➜ **EUTelescope**



Telescope and DUT data flow and trigger scheme



DAQ software components and work flow



Analysis software scheme and processor flow

[1] Reference paper: see below
[2] Portal of Wiki: telescopes.desy.de

[3] EUDAQ on github

[4] EUTelescope on github

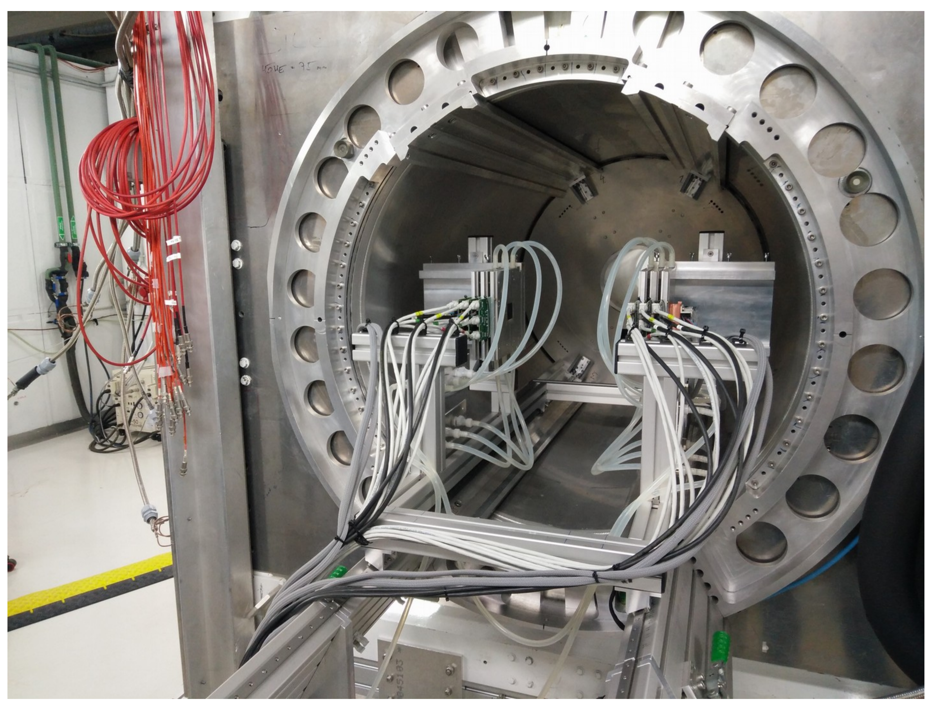
DATURA in TB21

One of 7th EUDET-type telescopes worldwide is permanently installed in area TB21. The Big Red Magnet can be used to deflect particles, for example for energy measurements.

DURANTA in TB22

A second EUDET-type telescope is permanently installed in TB22. This area is the largest area at the DESY II Test Beam facility, which is useful for large user setups.

Options for TB24



EUDET-type telescope planes based on Mimosa26 sensors can optionally be installed in the PCMAG in TB24/1. In 2019 a permanently installed strip telescope (LYCORIS) is available.

Resolution predictions for DUT integrations

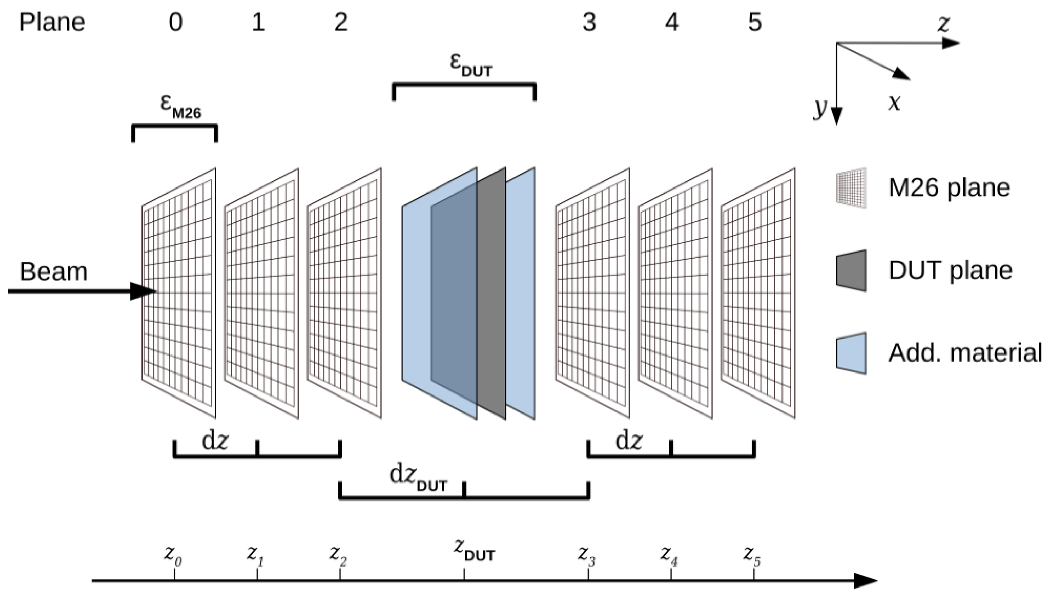
Using the measured intrinsic resolution, the material budget in the beam (telescope planes, air, DUT) and GBL fitting, predictions of the track resolution at the actual DUT position z_{DUT} are possible. The mean intrinsic resolution of a Mimosa26 sensor is measured to be $\sigma_{M26} = (3.24 \pm 0.09)$ µm @ thr. 6 and the normalised material budget of one telescope plane is $\varepsilon_{M26} = 7.5 \cdot 10^{-4}$ including 54 µm Silicon and 2x25 µm Kapton foil.

Using an EUDET-type telescope at the DESY II test beam facility (1-6 GeV), the optimum telescope geometry can be predicted by using:

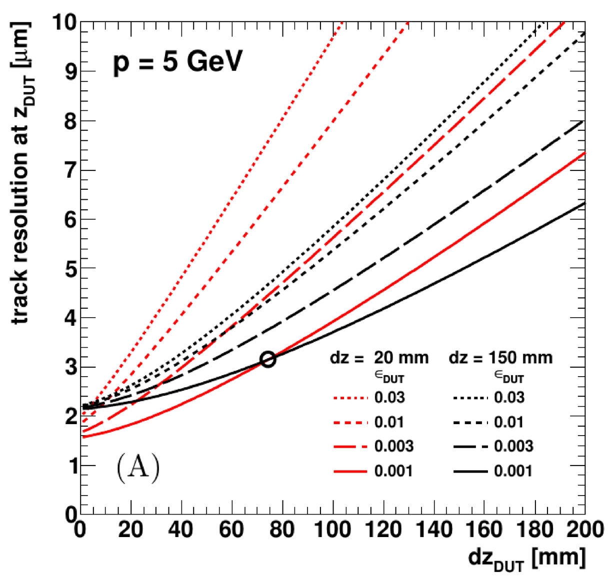
1. a small dz_{DUT} (distance between inner telescope plane and DUT)

2. the narrow (dz = 20 mm) or the wide (dz = 150 mm) setup depending on the total DUT's budget ε_{DUT}

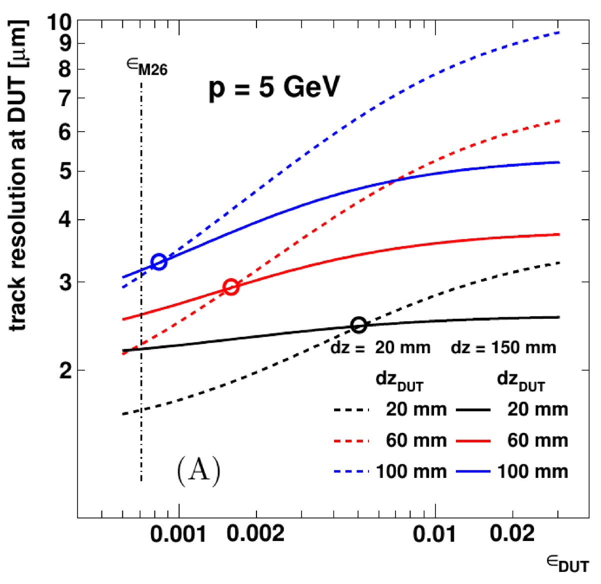
[1] Jansen, H. et al. EPJ Techn Instrum (2016) 3: 7.



Telescope geometry



Resolution vs. dz_{DUT}



Resolution vs. ε_{DUT}

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