Eidgenössische Technische Hochschule Zürich
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Documentation

ETH Beam Telescope Version 2

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Abstract

Short description of the ETH beam telescope used at PSI. The documents describes the setup of the telescope's planes, its features and the simulation of the ideal distances of the telescope planes.

Contents

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1 Plane Setup

- telescope has two different setups for the Device Under Tests (DUTs)
- telescope functionality is the same for both setups
- Mother Board (MB) is the same for both setups
- planes need stable mounting on the MB (either mechanically or with a connector)

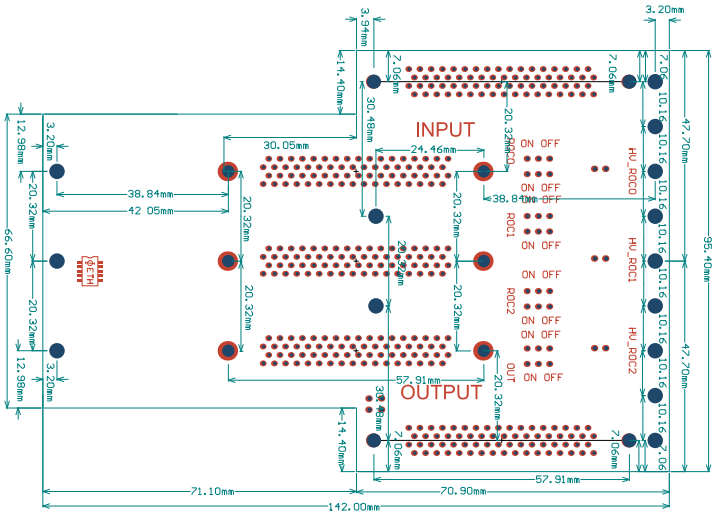

Figure 1: MB Dimensions.

1.1 Pad

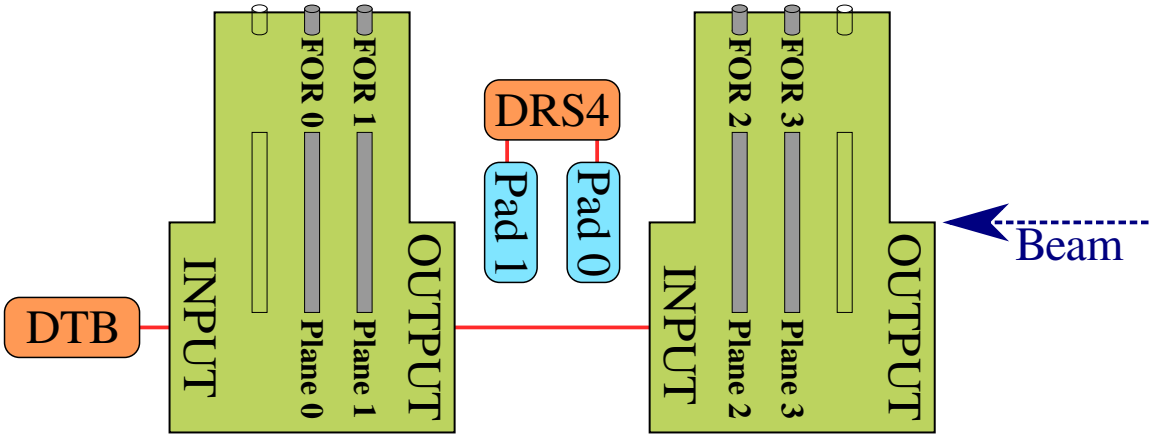

Figure 2: Pad Setup.

- two telescope planes upstream (before the DUT)
- two telescope planes downstream
- space of exactly one MB in between the two MBs
- MBs connected to same read-out

1.2 Pixel

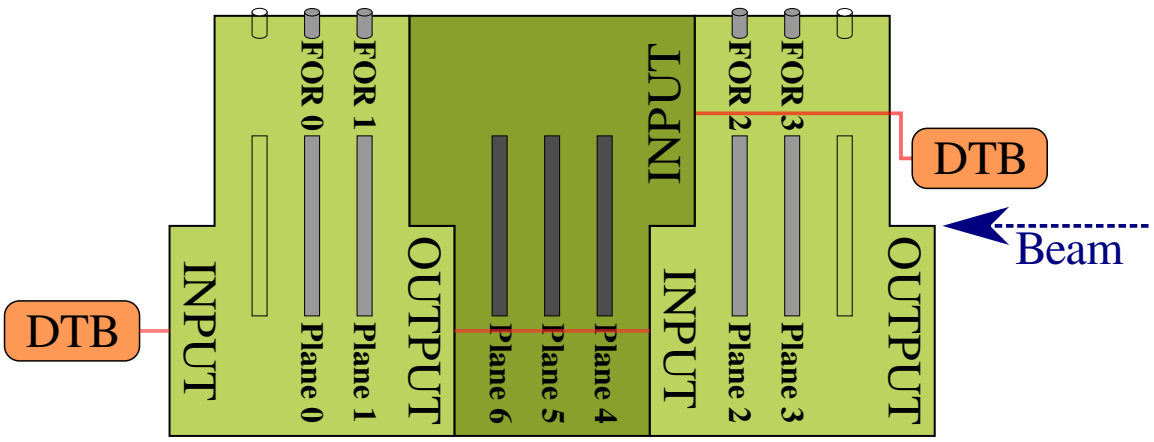

Figure 3: Pixel Setup.

- two telescope planes upstream (before the DUT)
- two telescope planes downstream
- three DUT planes in the centre
- DUT planes have separate read-out than the two connected telescope MBs

2 Features

2.1 FAST-OR Trigger

- each plane generates a FAST-OR trigger if any of the pixels of this plane is hit during a clock cycle (40 MHz)
- used to trigger the the whole setup
- amplified on the adaptor planes (Figure 4)
- after amplification: ∼100 mV differential signal
- needs to be converted to NIM-signal for the Trigger Unit (TU)
- every plane needs LEMO out for the FAST-OR

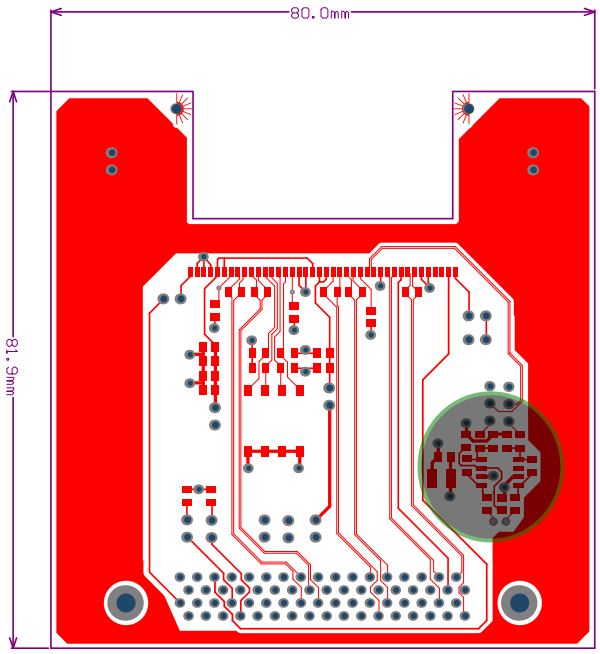

Figure 4: Plane adaptor dimensions with indicated FAST-OR amplification circuit.

2.2 General Read-Out

- telescope read out by a Digital Test Board (DTB) that runs on a 40 MHz clock
- DTB provides clock to the planes
- DTB receives trigger from the TU
- DTB sends a token-signal that sequentially passes by the individual planes
- Read-Out Chip (ROC) sends data after receiving the token and issues a new token signal
- jumpers on the MB next to each plane in order to bypass the plane and send the token directly to the next plane

  → allows for different configurations and not connected planes

3 Track Simulation

- simulation shows that setup with 4 tracking planes is slightly better than with 6 tracking planes

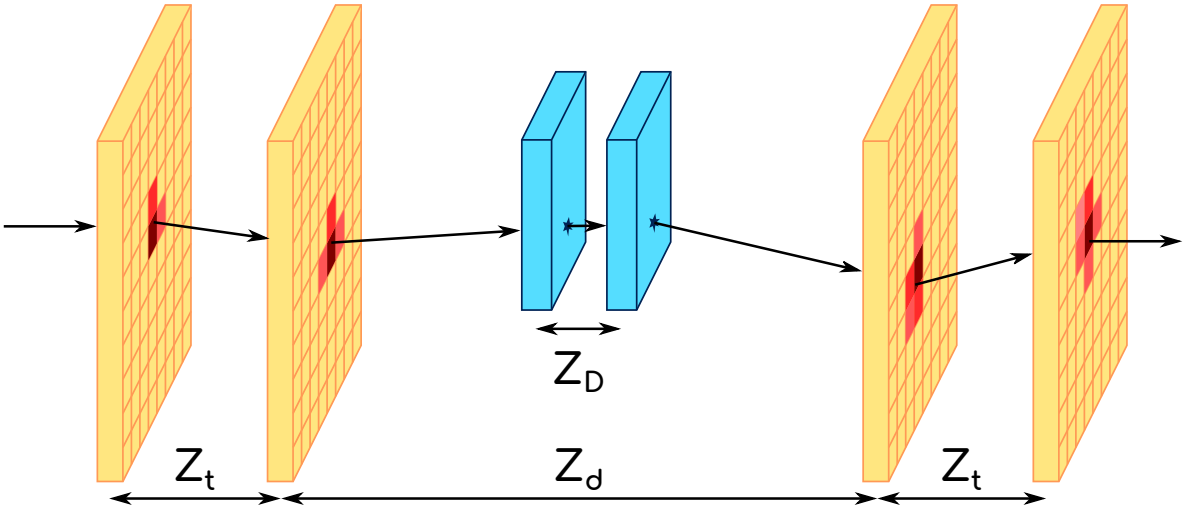

Figure 5: Schematic tracking.

- Z_t - spacing between the tracking planes
- Z_d - gap for the DUT between upstream and downstream planes
- Z_D - distance between the DUTs $\approx$15 mm

- varying the two parameters Z_t & Z_d
- best resolution for minimal gap and maximum distance between the planes
- $\rightarrow$ general spacing of all planes 10 mm ($\rightarrow$ discuss if possible)
  - 6 planes upstream
  - 6 planes downstream
  - 3 planes for DUT

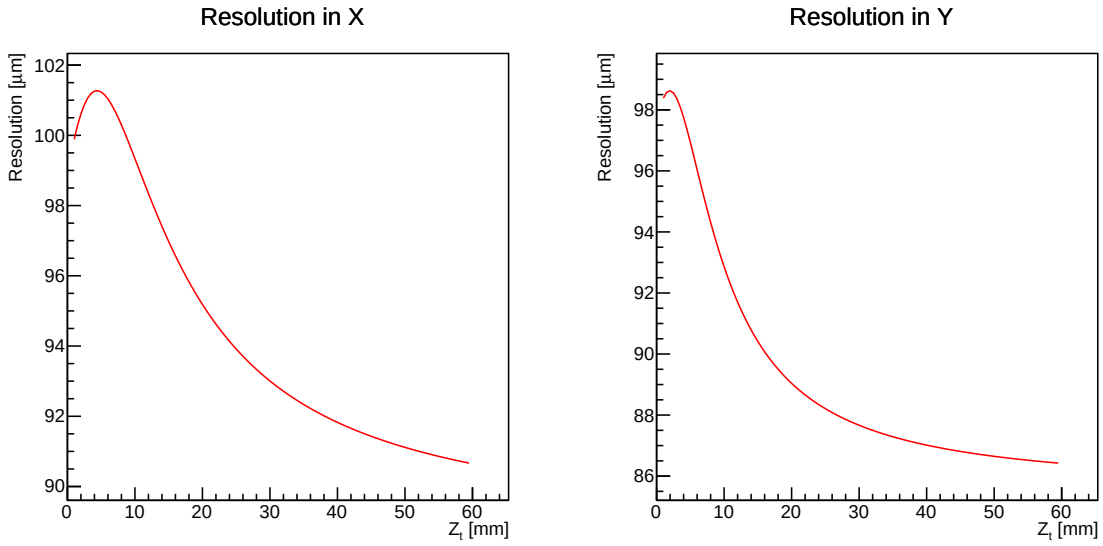

Figure 6: Resolution at the DUT for $Z_d = 100\,\mathrm{mm}$

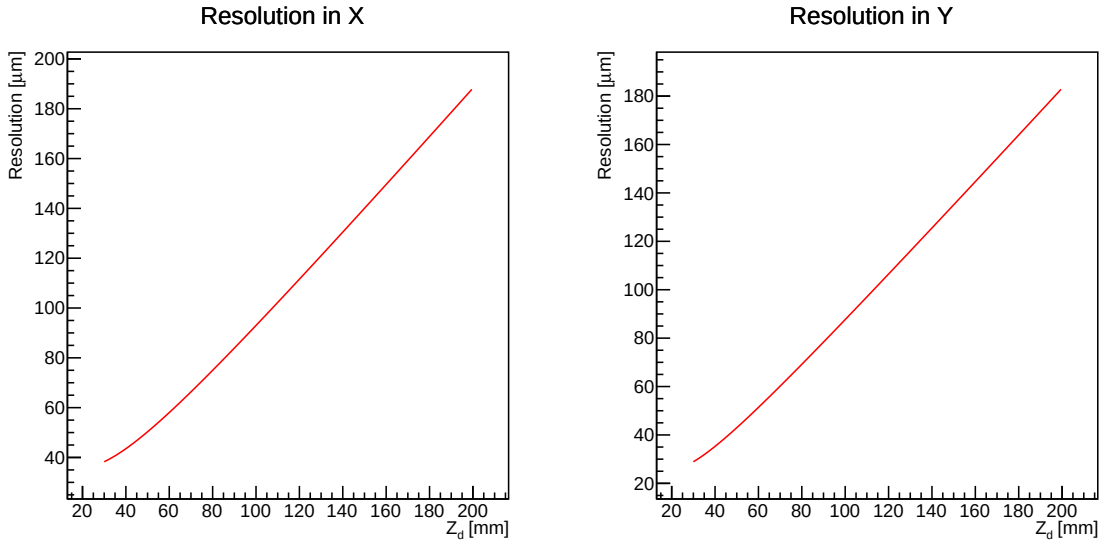

Figure 7: Resolution at the DUT for $Z_t = 20\,\mathrm{mm}$

List of Acronyms

DUT Device Under Test

DTB Digital Test Board

TU Trigger Unit

MB Mother Board

ROC Read-Out Chip