ATLAS Pixel Standalone Testbeam

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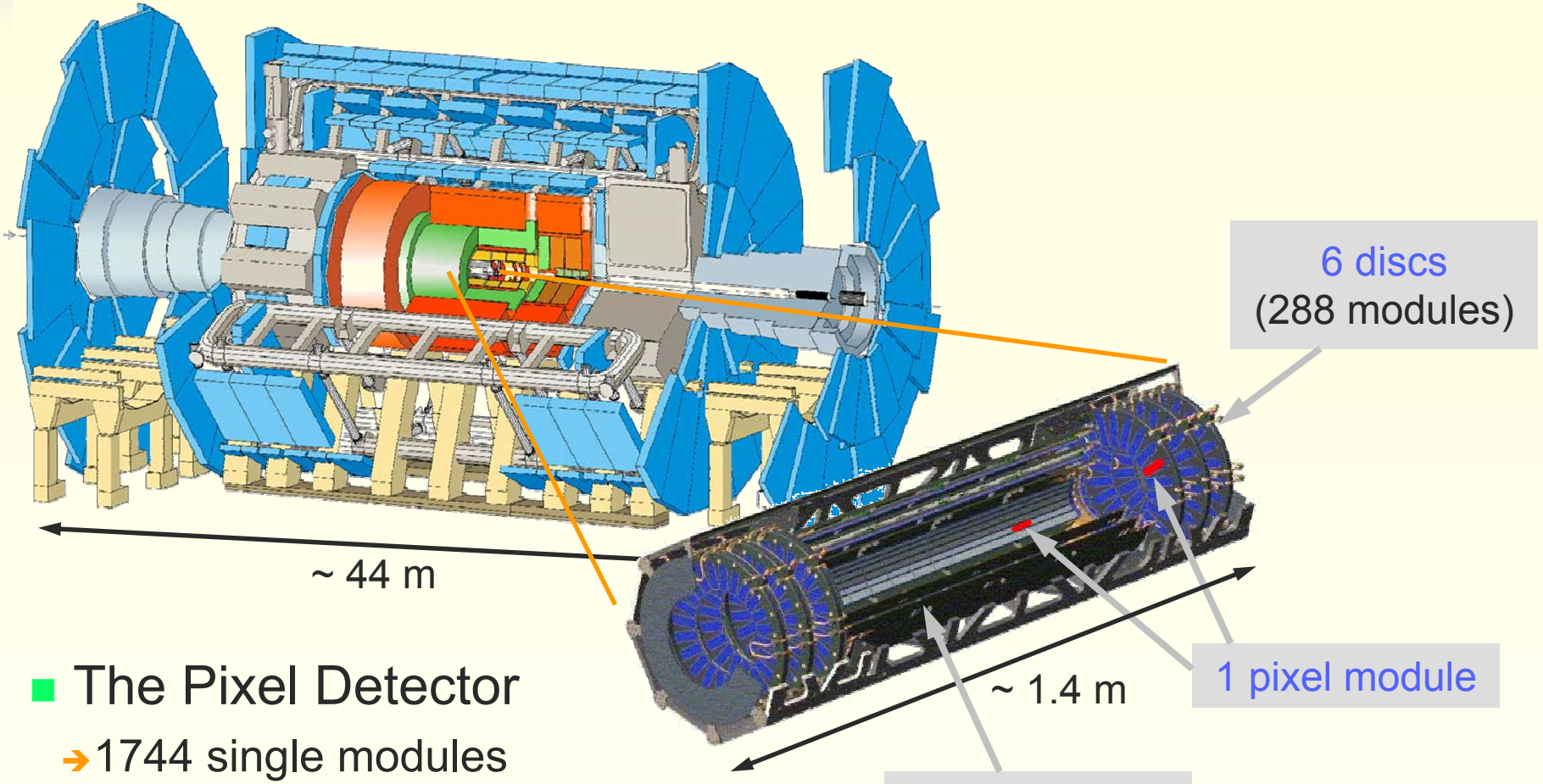
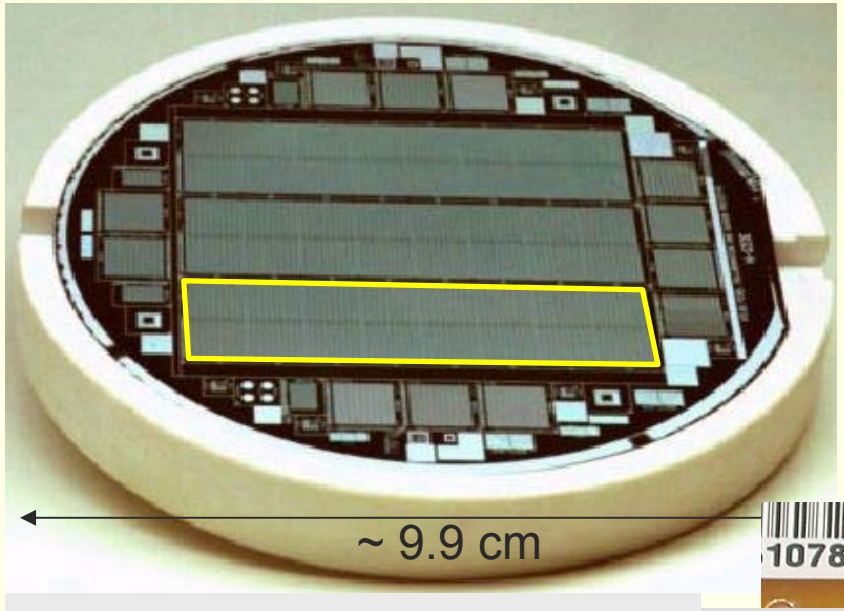
CERN Summer Student Programme 2004

The ATLAS Pixel Detector



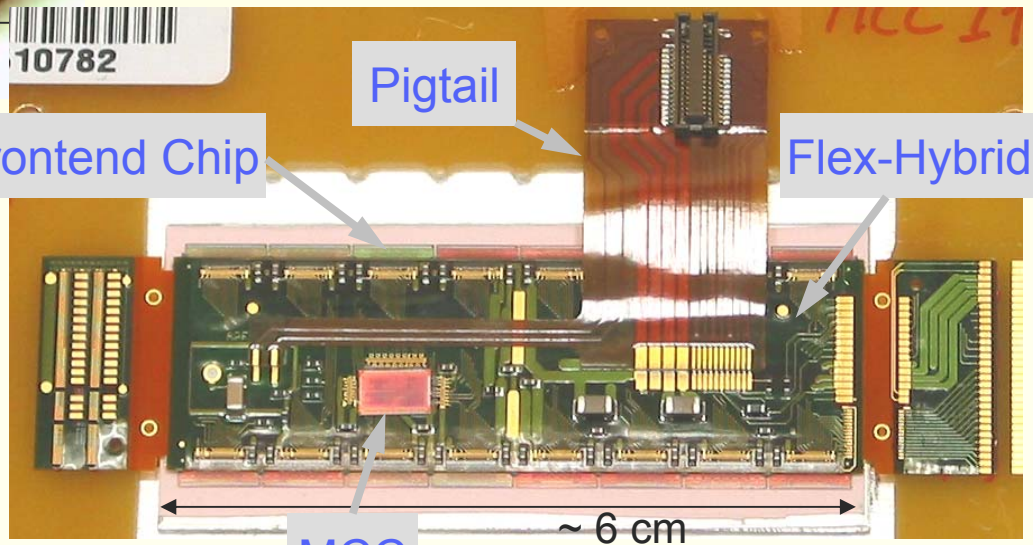
- The Pixel Detector
  - ➔1744 single modules
  - ➔~ 80 million readout channels

The Pixel Modules



- A Pixel Module
  - ➔46080 pixels per module
    - 400x50 μm² pixel dimensions
  - ➔16 Frontend chips
  - ➔1 Module Control Chip (MCC)
  - ➔1 Pigtail + Type0 connector

- Complex system
  - ➔single pixel calibration
  - ➔25 ns bunch crossing
    - data storage
  - ➔radiation hardness
    - > 50 Mrad total dose

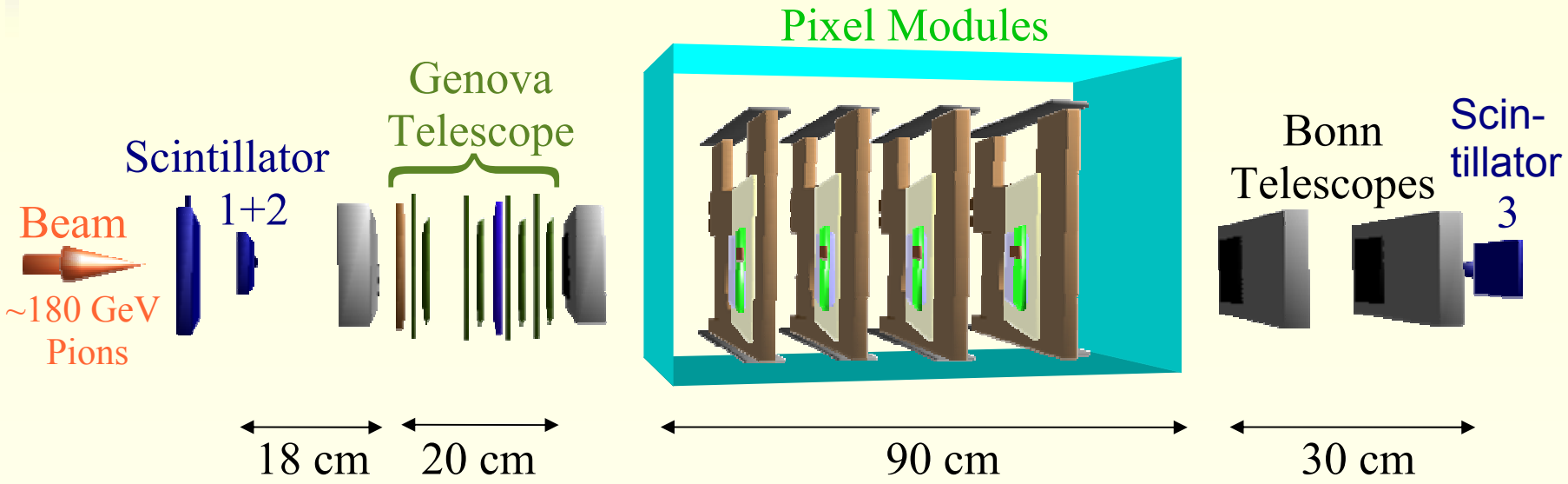


Why a Testbeam Experiment?

- Various fields of interest
  - ➔ Testing the modules with real high energy particles and at high particle intensities
  - ➔ Spatial resolution of the pixel sensor
  - ➔ Efficiency and in-time efficiency of the detector modules
    - Every signal has to be assigned to the correct event, that means it has to be in the correct 25 ns interval.
  - ➔ Irradiated modules
    - Depletion depth
    - Charge collection

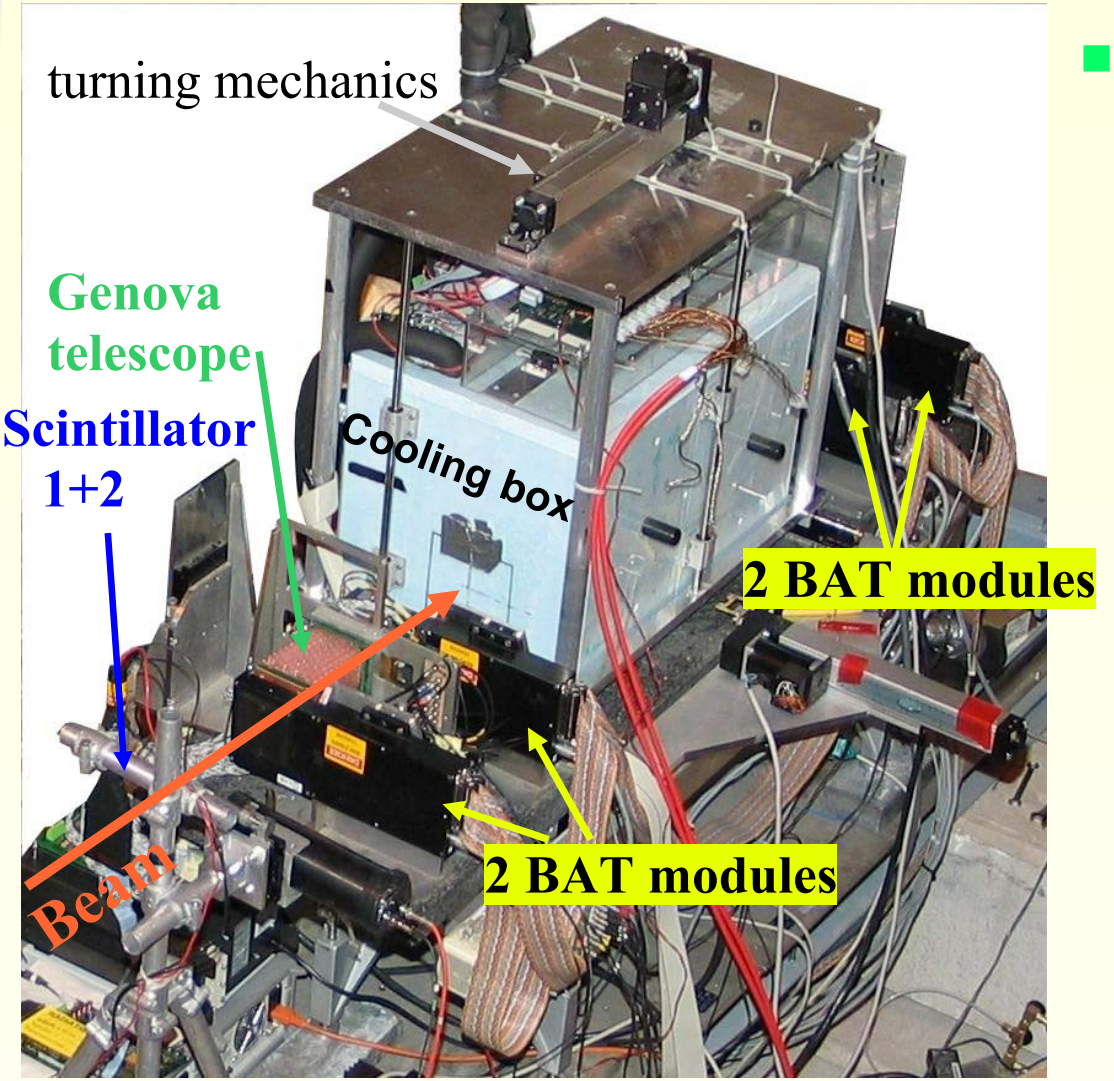
…

The ATLAS Pixel Testbeam Setup



- Plastic scintillators as triggers
- Bonn microstrip telescopes (BAT) for track definition
  - used for low intensity beam
- Genova pixel telescope for track definition
  - used for high intensity beam

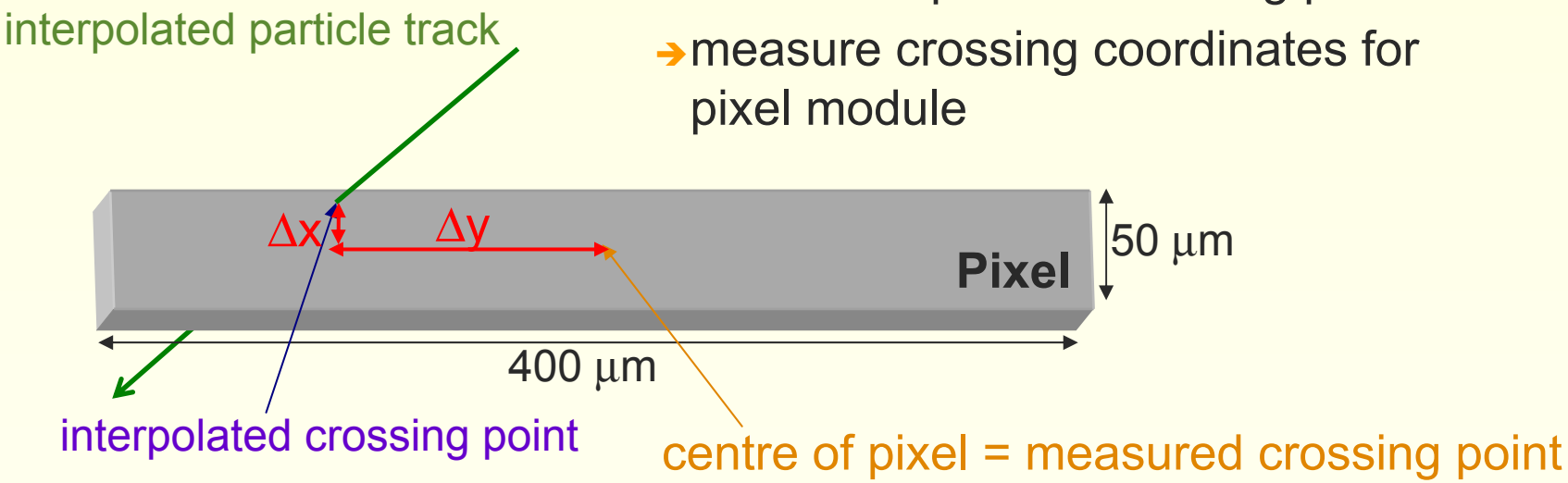
Measurements



- Quantities measured
  - ➔Pixel modules
    - local coordinates of passing particle
    - timestamp of passing particle
    - charge deposited by passing particle
  - ➔Telescopes
    - coordinates of passing particle at telescope planes

Spatial Resolution

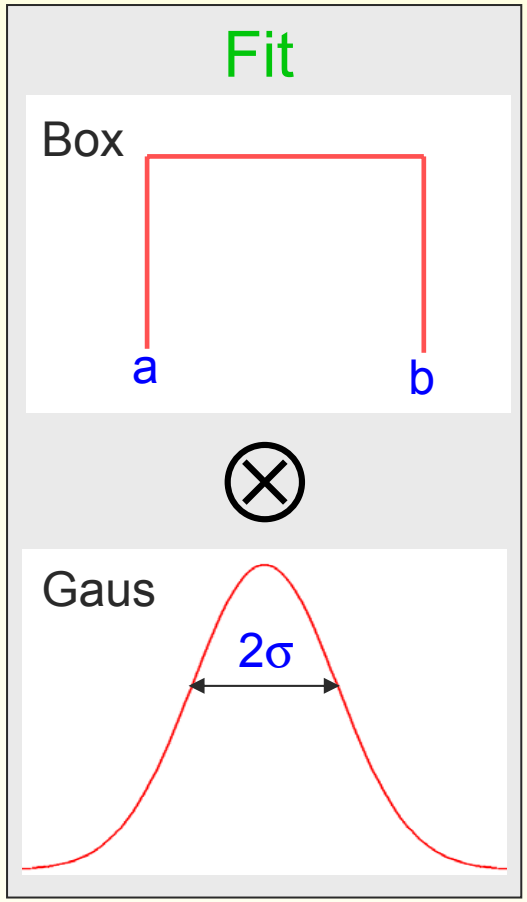
- Calculating the residuals
  - ➔measure coordinates with telescopes
    - calculate particle track
      - ➔interpolated crossing point
  - ➔measure crossing coordinates for pixel module

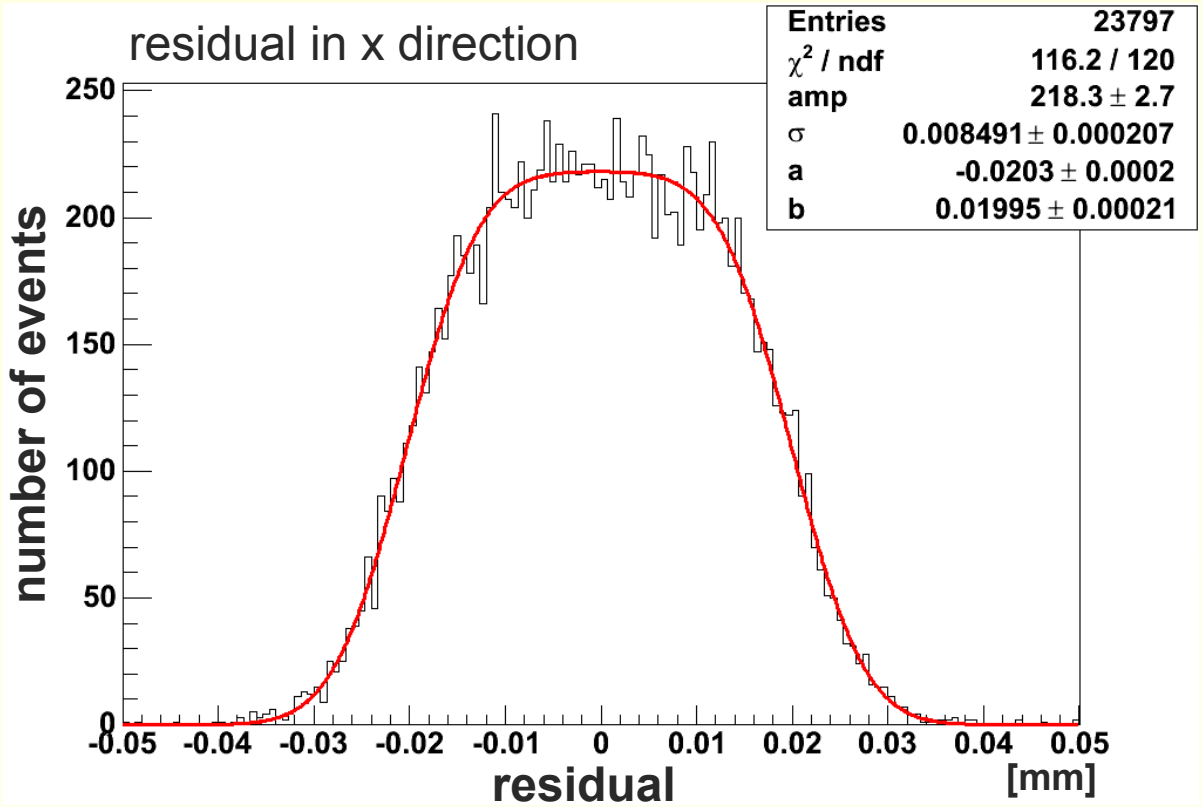


Residual: $\begin{pmatrix} \Delta x \\ \Delta y \end{pmatrix}$ = (measured crossing point) – (interpolated crossing point)

Testbeam Analysis

- Spatial resolution of a pixel
  - ➔ Residual = (measured crossing point) – (interpolated crossing point)





Summary

- The pixel detector is the innermost detector of ATLAS
  - Crucial for tracking and vertex reconstruction
- It‘s important to test the modules before building the detector
  - Best testing condition is reached in a testbeam experiment, because kind and luminosity of available particles are similar to the ones expected at ATLAS
  - Testing irradiated modules to ensure lifetime of > 10 years
    - August Testbeam
- With the taken data analysis of the modules can be done (my job)
  - Spatial resolution, reconstruction efficiencies, …

Questions???

Pictures taken from http://atlasexperiment.org