

Latest Results, Status of Data Analysis

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Outline:

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- 2 July Testbeam Results
- 3 September Testbeam Results
- 4 Summary

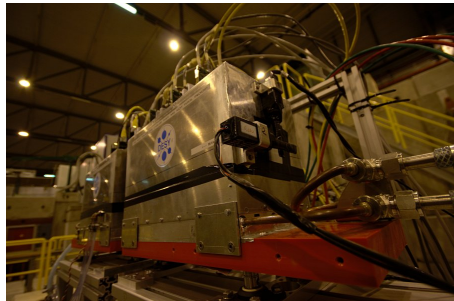
Overview: Mimosa 26 Testbeam Campaigns (1/2)

July 2009:

- three Mimosa 26 sensors as DUT
- six MIMO TEL sensors as reference telescope
- SPS H6 beam: **120 GeV** hadrons

Analysis:

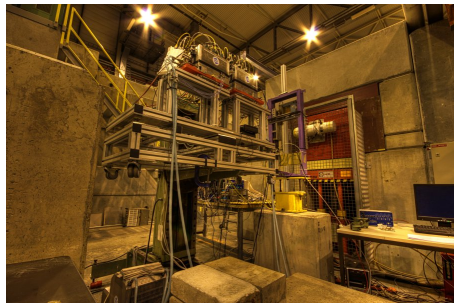
- data were treated as one telescope with 9 planes ⇒ **all clusters were stored in one collection**
- ↪ this approach could be interesting for users if they want to analyse more than one DUT plane (*no gear modification needed*)
- **Mimosa 26 thresholds were set to 12**



Overview: Mimosa 26 Testbeam Campaigns (2/2)

September 2009:

- upgrade of the telescope to **six Mimosa 26 sensors**
(unfortunately only five could be used)
 - SPS H6 beam: **120 GeV** hadrons
 - with beam a data taking peak rate of about **200 Hz** was reached (limited by the beam)
 - with an internal fixed TLU trigger rate: \approx **990 Hz**
 - 3 kHz function generator as TLU input: \approx **990 Hz**
 - data with basically three different threshold configurations were taken:
 - ① **12**: 1.1 M events
 - ② **10**: 1.5 M events
 - ③ **8**: 113000 events
- \Rightarrow **\approx 2700000 events!**



Eutelescope: Digital Fixed Frame Clustering

Integration of Mimosa26

- the Mimosa 26 data are integrated as zero suppressed data collections
- the new cluster type *EUTelDFFC* cluster was introduced (CoG shift etc. is available)
- a digital **fixed frame clustering** algorithm was implemented:

| | |
|---|---|
| 1 | 2 |
| | 1 |

| | | |
|---|---|---|
| 1 | 3 | 2 |
| | 2 | 2 |

| | |
|---|---|
| 2 | 1 |
| 1 | |
| | 0 |

| | | |
|---|---|---|
| 2 | 2 | |
| 3 | 4 | 1 |
| 2 | 2 | |

Clustering:

- for each hit pixel the number of neighbour pixels N is counted (*ignoring diagonal neighbours*)
- the obtained list of seed candidates is sorted with decreasing N
- the resulting list is processed starting from the seed candidate with the largest N
- all hit pixels in a fixed $x \otimes y$ frame around the seed are put into the cluster and removed from the pixel collection
- cluster filter processor: cut on the number of hit pixels inside the cluster (**default 0**)

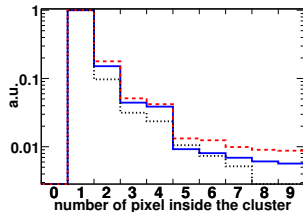
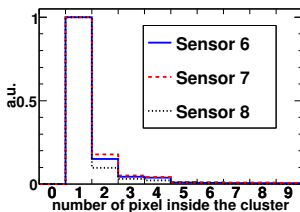
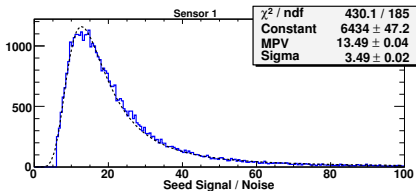
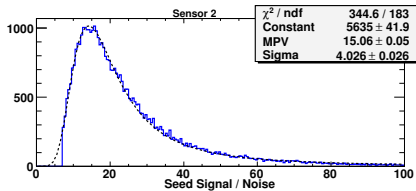
July TB: Clustering

MimoTEL Sensors (*right*):

- **reasonable** seed and cluster $\frac{S}{N}$ spectra!

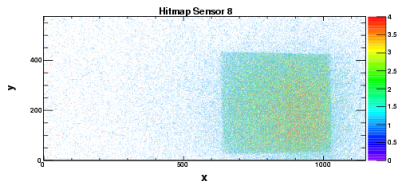
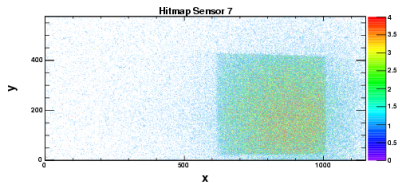
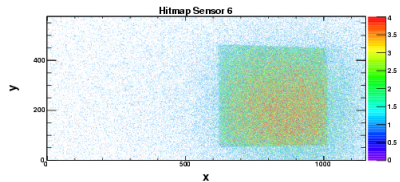
Mimosa 26 Sensors (*bottom*):

- shown: **number of hit pixels inside cluster** (*norm. to the number of single pixel cluster*)
- dominated by **single pixel cluster**
- small differences visible



July TB: Clustering

- Mimosa 26 sensors
- **2D hit maps clearly show the trigger window!**



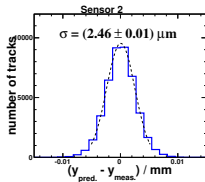
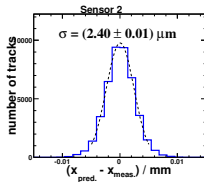
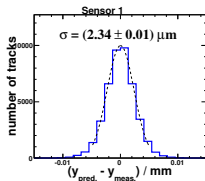
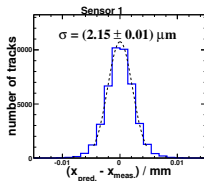
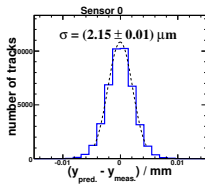
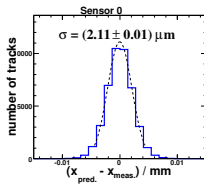
July TB: Alignment and Track Fitting

Alignment:

- hit collections from all 6 MimoTEL and 3 Mimosa 26 sensors were used
- straight lines were fitted to all 9 planes
- alignment constants for shifts in x , y and rotations around z were **simultaneous** determined with *Millepede*

Track Fitting:

- the analytical fitter was used
- the three Mimosa 26 sensors were **NOT** included in the fit!
- observed shifts of the MimoTEL residual distributions (see plots): $< 0.07 \mu\text{m}$ (**Telescope alignment was a success!**)



MimoTELS in first telescope box!

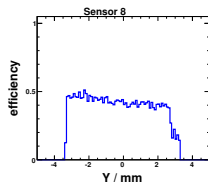
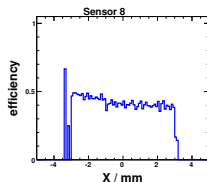
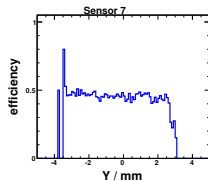
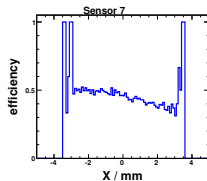
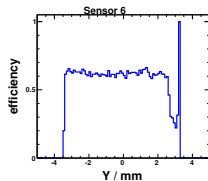
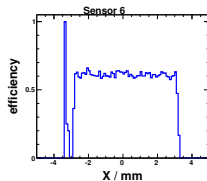
July TB: Mimosa 26 Results (1/2)

DUT Treatment:

- Mimosa 26 data were not included in the track fit!
- *a hit was assigned to a track if the distance was smaller than $100 \mu\text{m}$*

Mimosa 26 Efficiency:

- area limited by the size of the trigger window
- the efficiency is typically between 40% to 60%
- does not fit expectation for **threshold 12**
- still under investigation ...



July TB: Mimosa 26 Results (2/2)

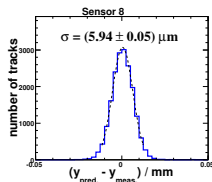
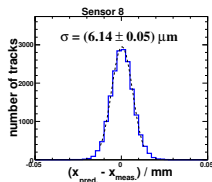
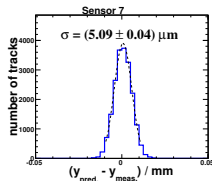
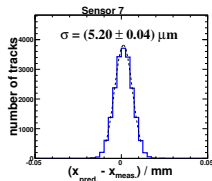
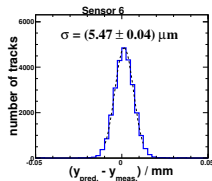
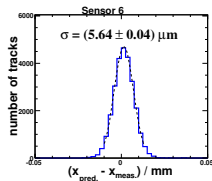
Residual Distributions:

- Mimosa 26 pixel pitch:
→ $p = 18.4 \mu\text{m}$
- Mimosa 26 resolution:
→ $\sigma_{\text{M26}}^2 = \sigma_{\text{obs}}^2 - \sigma_{\text{tel}}^2$
- telescope resolution (k : geometrical scaling factor):
→ $\sigma_{\text{tel}}^2 = k \cdot \sigma_{\text{MimoTEL}}^2$

Mimosa 26 Resolutions:

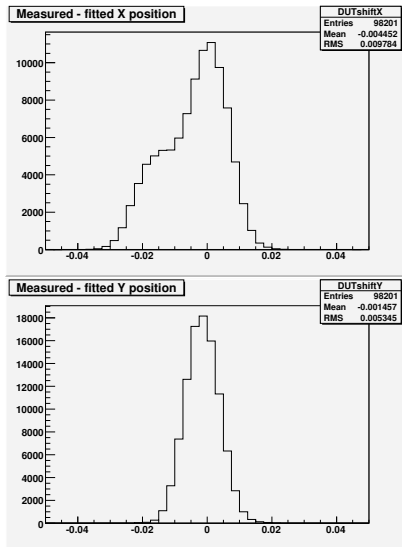
| Sensor ID | σ_x | σ_y |
|-----------|--------------------|--------------------|
| Sensor 6 | $5.45 \mu\text{m}$ | $5.27 \mu\text{m}$ |
| Sensor 7 | $5.00 \mu\text{m}$ | $4.88 \mu\text{m}$ |
| Sensor 8 | $5.97 \mu\text{m}$ | $5.76 \mu\text{m}$ |

⇒ consistent with “number of pixels inside cluster”- plot



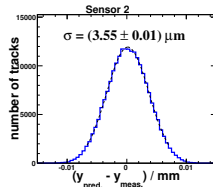
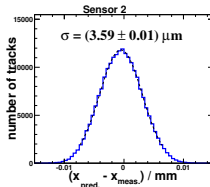
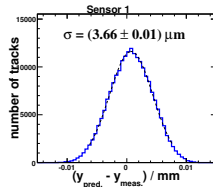
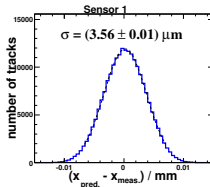
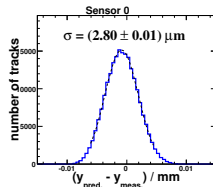
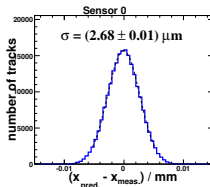
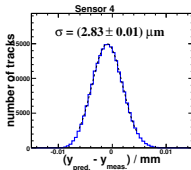
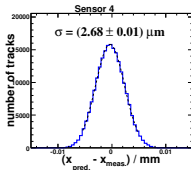
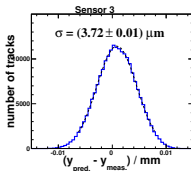
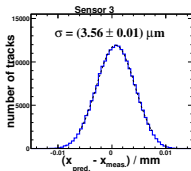
July TB: Problems

- the x residual distributions are showing **shoulders**
- the y residuals are not affected!
- **during** one run it occasionally happened that the x coordinates of all pixels were shifted by **exactly 1**
- the pixel x coordinates of all three Mimosa 26 sensors were affected **simultaneously**
- one *jump* was found in the July data
 ⇒ residuals show sum of two Gaussians with exactly one pixel pitch difference of the mean values
- **presumably more difficult to see with the final telescope! :-)**



September TB: First Results

- **six Mimosa 26 sensors** (5 were used in the analysis)
- **analysis is still ongoing!**
- all sensors were included in the fit
- most of the data are influenced by a **sync. problem** between the VME crates



Ongoing Data Analyses

| | | |
|----------------|--|--------------|
| Atlas Lucid | Marie GELIN(?), Igor Rubinsky(?) | mostly done? |
| DEPFET | Julia Fourletova(?) | ... |
| SILC | <i>they have not asked for support yet</i> | ... |
| FORTIS | Alessandro Caldarone(?) | ongoing |
| Peric, Takacs | Jörg Behr, Christian Takacs | done! |
| Atlas TRT | ... | done (?) |
| Mimosa26 | Jörg Behr | ongoing |
| Atlas 3D Pixel | Igor Rubinsky(?) | ... |

Summary

- **three Mimosa 26 sensors were investigated as DUT during the July testbeam:**

- observed resolution and expectation are compatible
- efficiency needs further investigations

- **the final telescope was tested in September:**

- as a first result reasonable residual distributions were obtained

⇒ **The Eutelescope software is ready for Mimosa 26 data!**