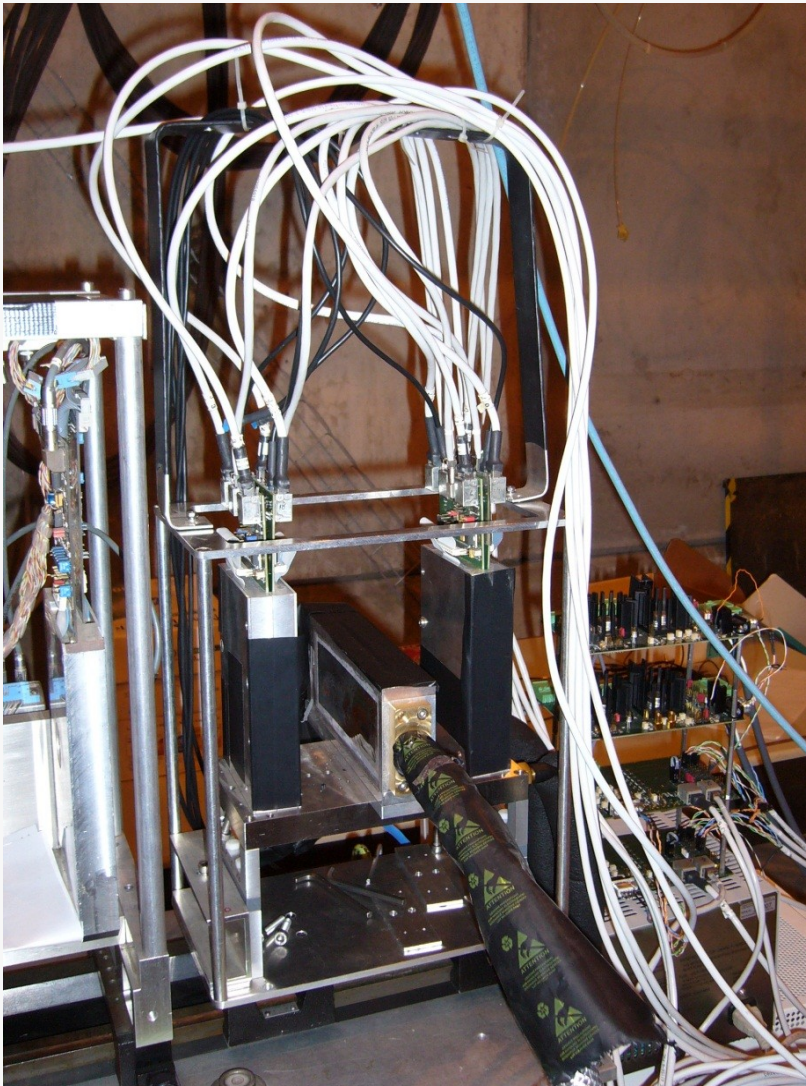


PLUME Beam Test, Nov 2011.

PLUME phone call 11 January 2012

Preliminary test beam results

Speaker : Loic COUSIN (IPHC)



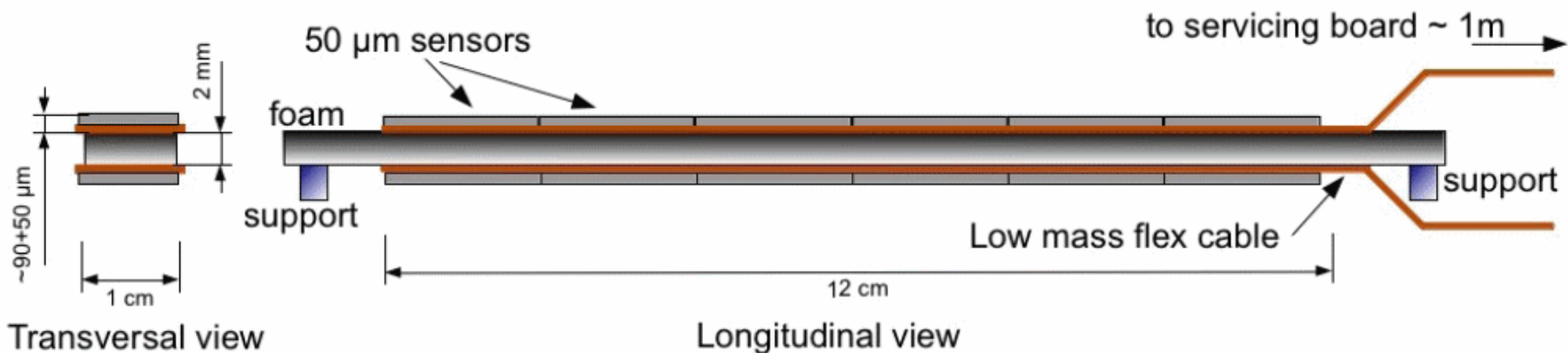
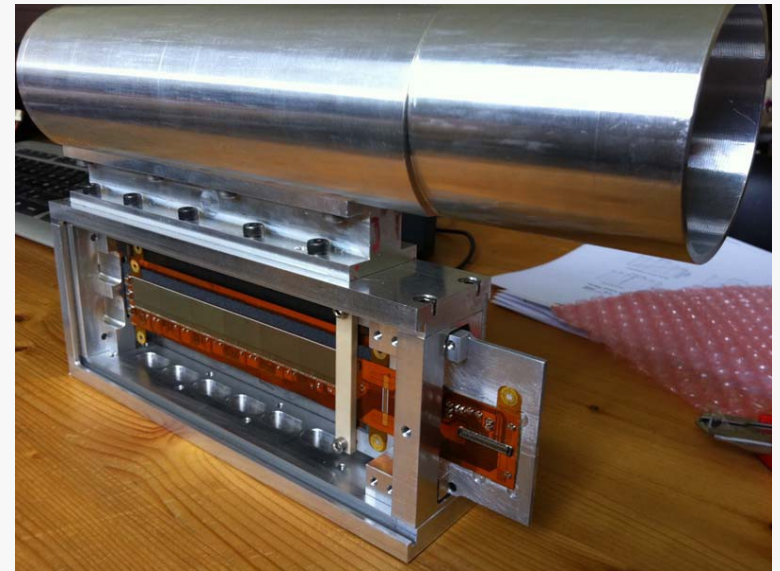
PLUME beam test

31 Oct → 6 Nov

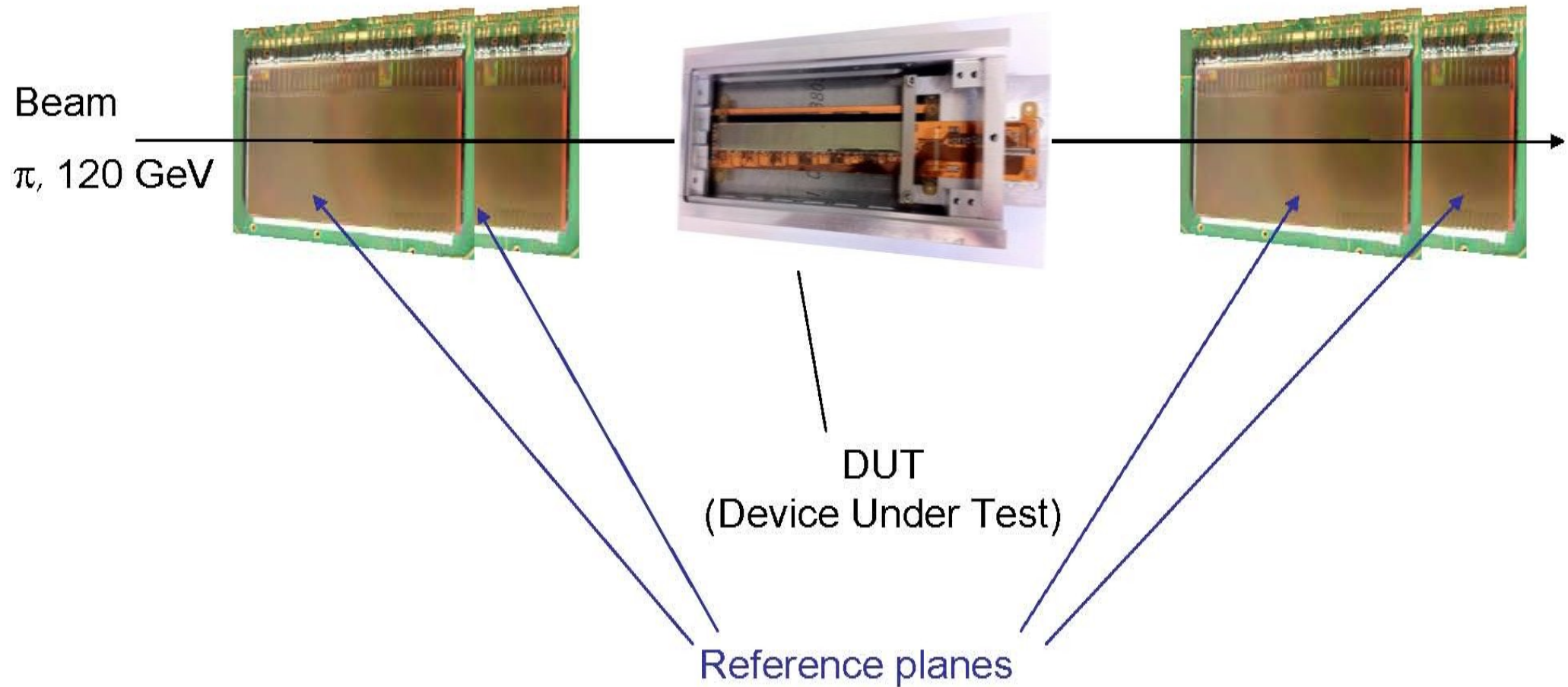
- **Beam condition :**
 - SPS (H6)
 - π^- ; 120 GeV
 - Spill : 9,6 s
 - Period : 45,6 s
 - Scintillator : $7*7 \text{ mm}^2$
 - Trigger rate :
 - 2-8 kHz
 - 1-1,3 kHz (Week-end)
- **Goal :**
 - Validation and characterisation of the first PLUME ladder.
 - Mini-vector study
(Spatial resolution improved ?)
- **IPHC :**
 - Jérôme BAUDOT , Mathieu GOFFE , Gilles CLAUS, Nathalie CHON-SEN, Loïc COUSIN.
- **Oxford :** Rhorry Gauld

Material in beam

- PLUME Ladder 01 : OKF3 + OKF6
- 12 Mimosa 26 epi standart sensors. (6 per side) thinned down to 50 μm .
- All sensors at same threshold.
- Data : only from 2 sensors per side.
- 2 mm SiC foam between sides.
- Double-sided 50 μm kapton PCB. (Cu, 20 μm /side)
- 0,6% X0 material budget.



Experimental Setup

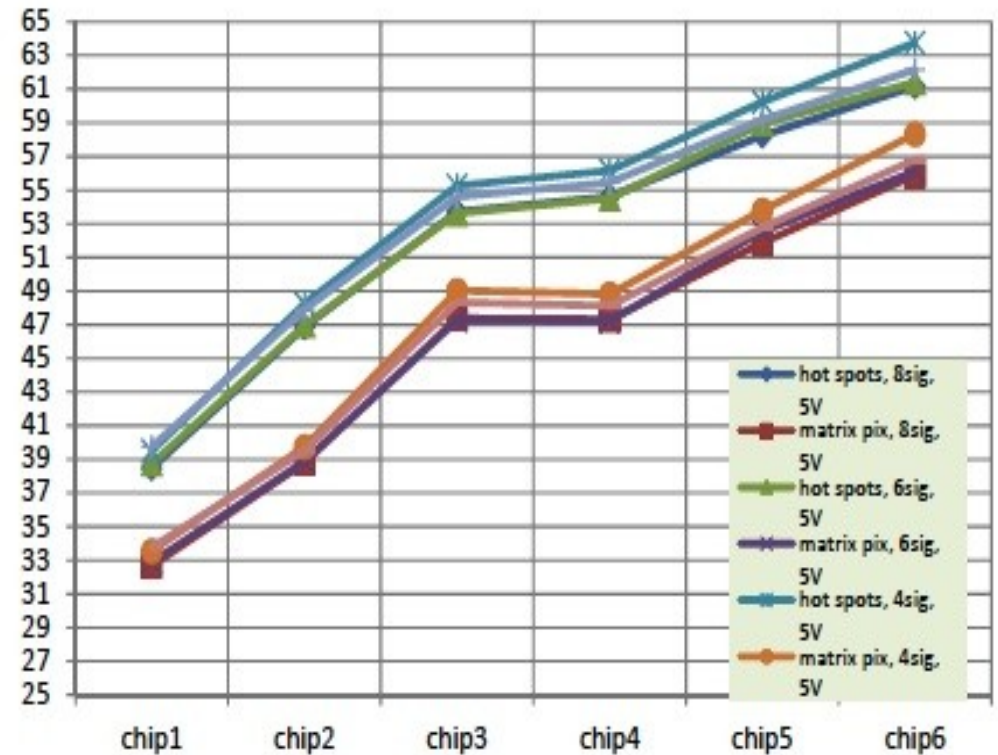
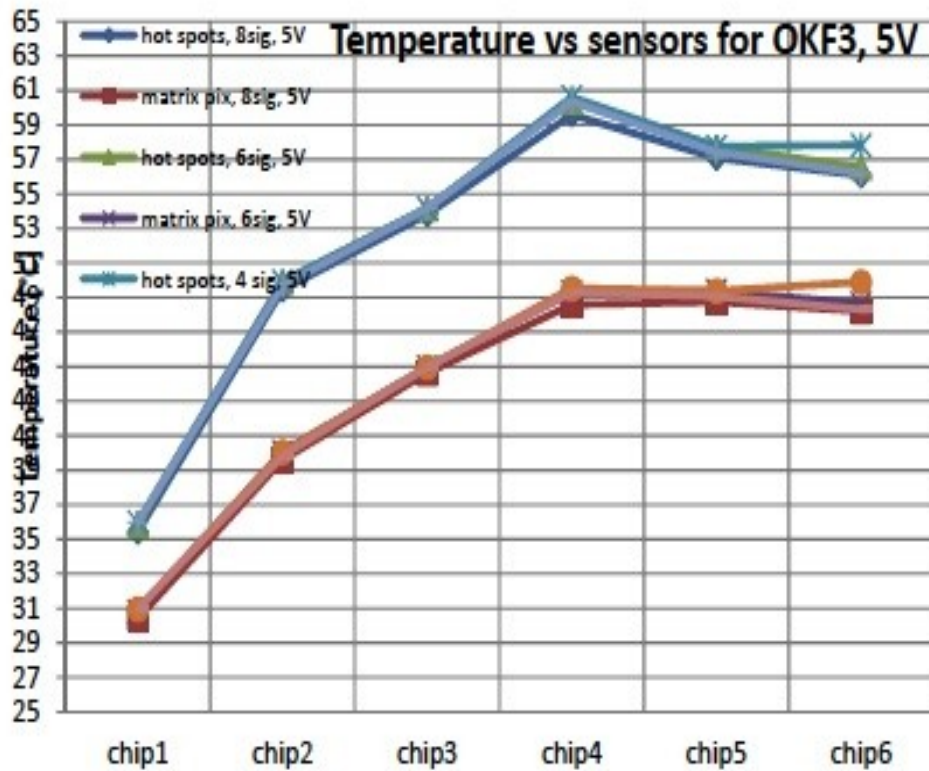


Runs

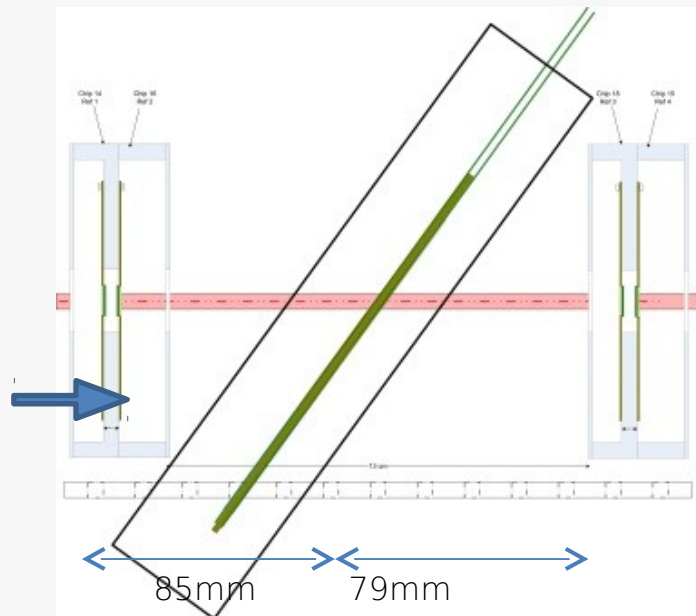
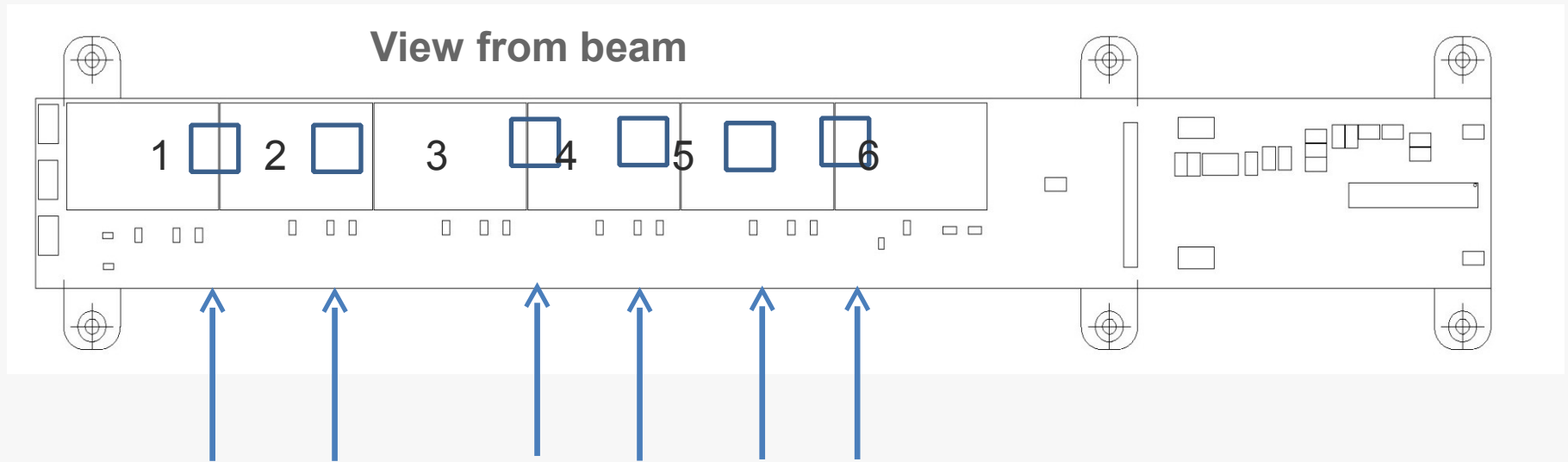
- **Scan in threshold**
 - 4, 5, 6 σ (σ = average value of temporal noise)
- **Scan in position** to study all the sensors
- **Tilted configurations**
 - 30, 36, 40, 60 degrees
- **Cooling : Different air flow speed**
 - Fan with 5V or 10V \rightarrow air flow speed \sim 3 and 6 m/s.
- 83 run with beam
- 30 noise runs

Temperature

Preliminary results

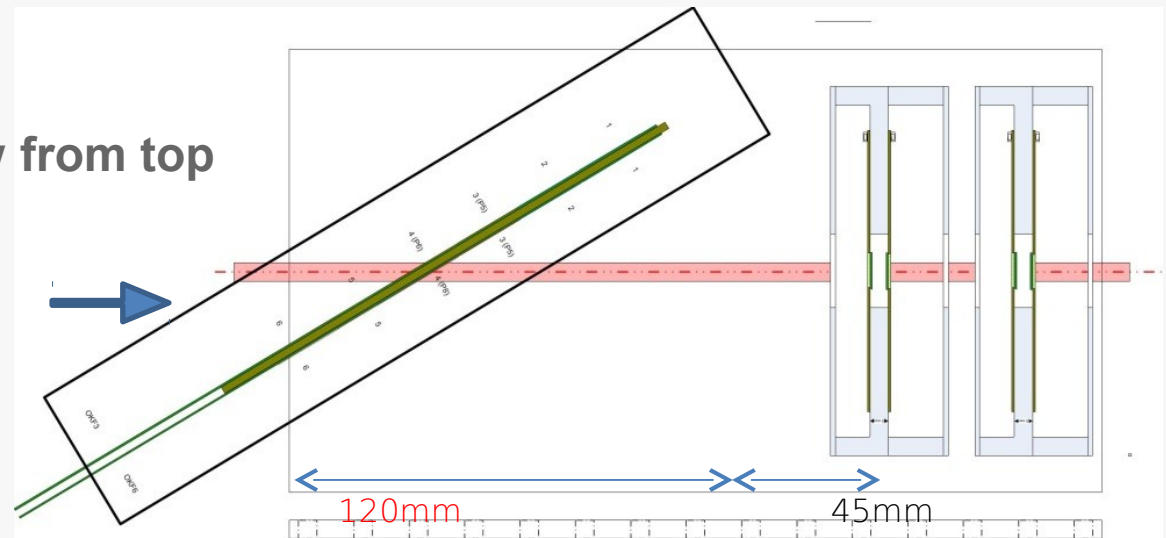


Run configuration :



tilt : 30, 36, 40 deg

View from top

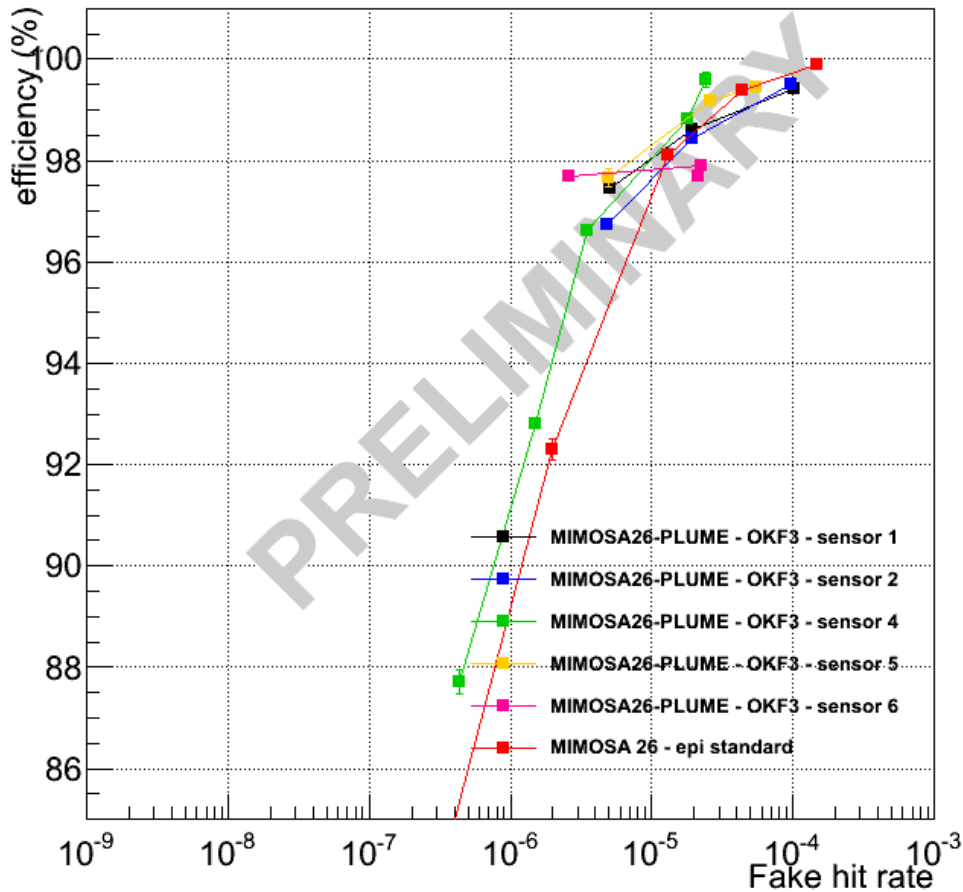


Large tilt : ~ 60 deg.

Normal incidence study / Software = TAF

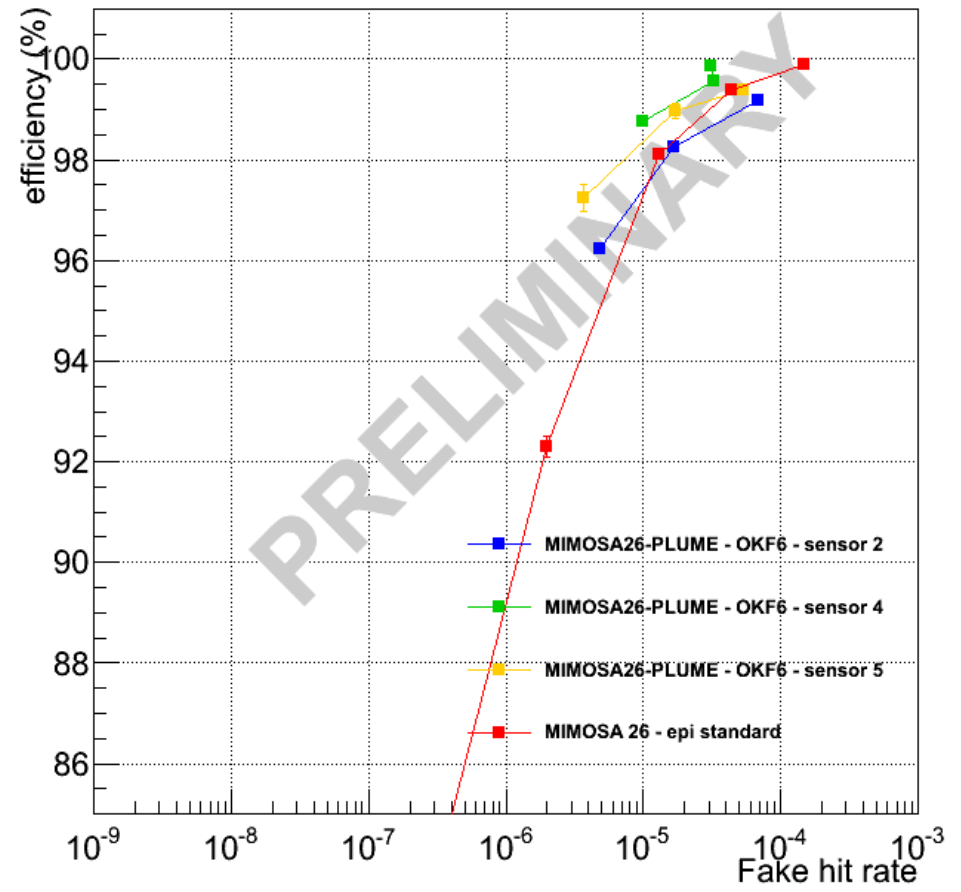
Efficiency vs fake hit rate

Efficiency vs Fake hit rate



OKF3

Efficiency vs Fake hit rate

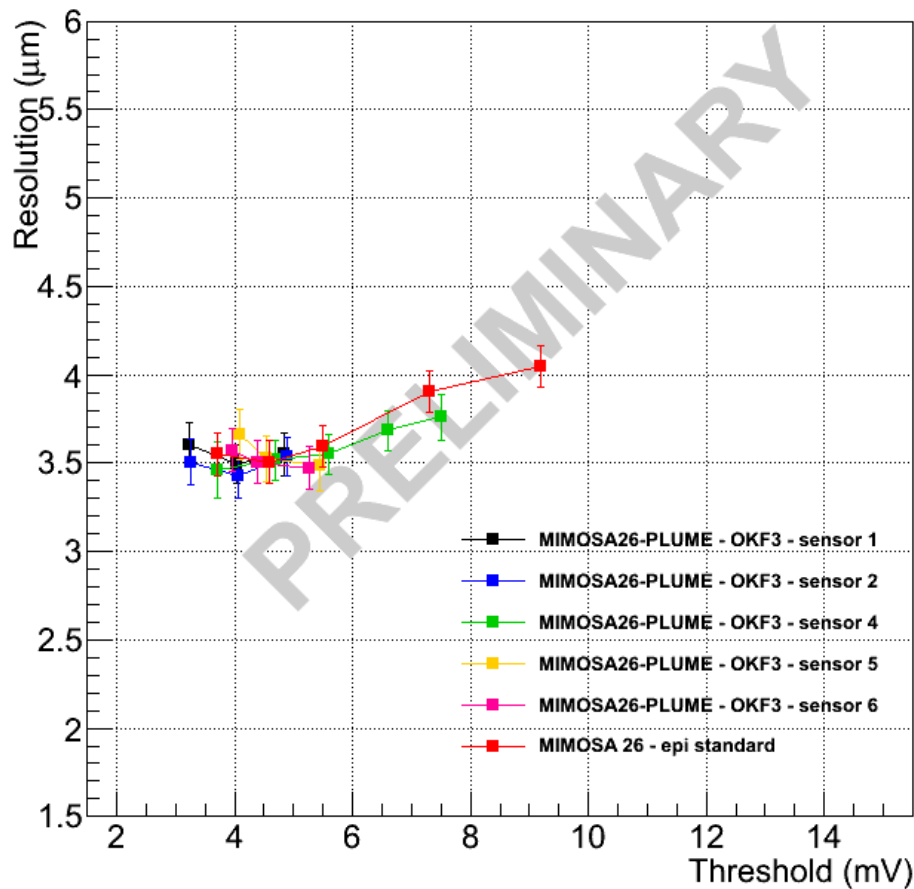


OKF6

Normal incidence study / Software = TAF

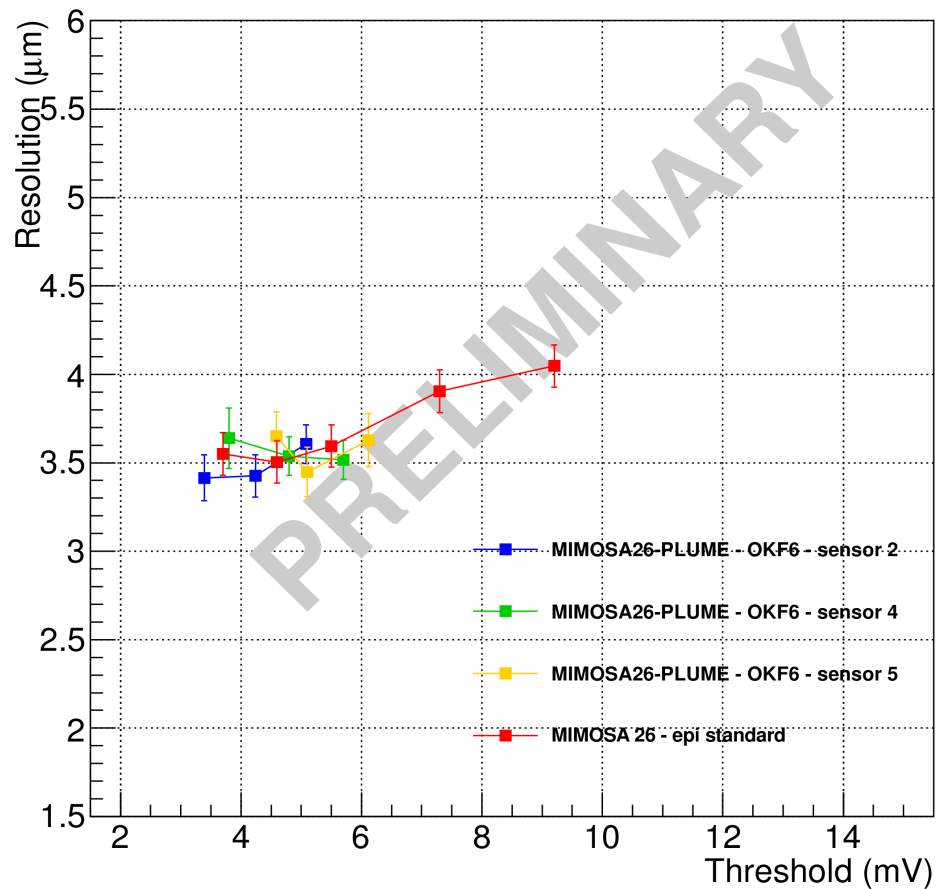
Resolution vs threshold (mV)

Resolution vs Threshold



OKF3

Resolution vs Threshold

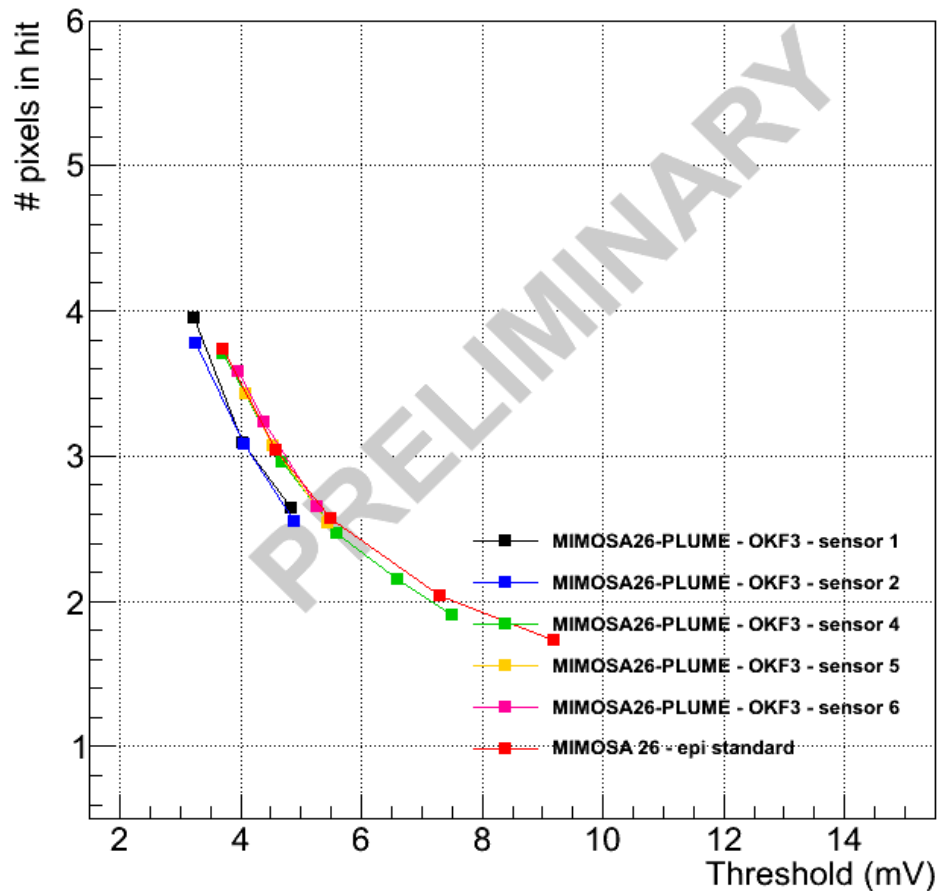


OKF6

Normal incidence study / Software = TAF

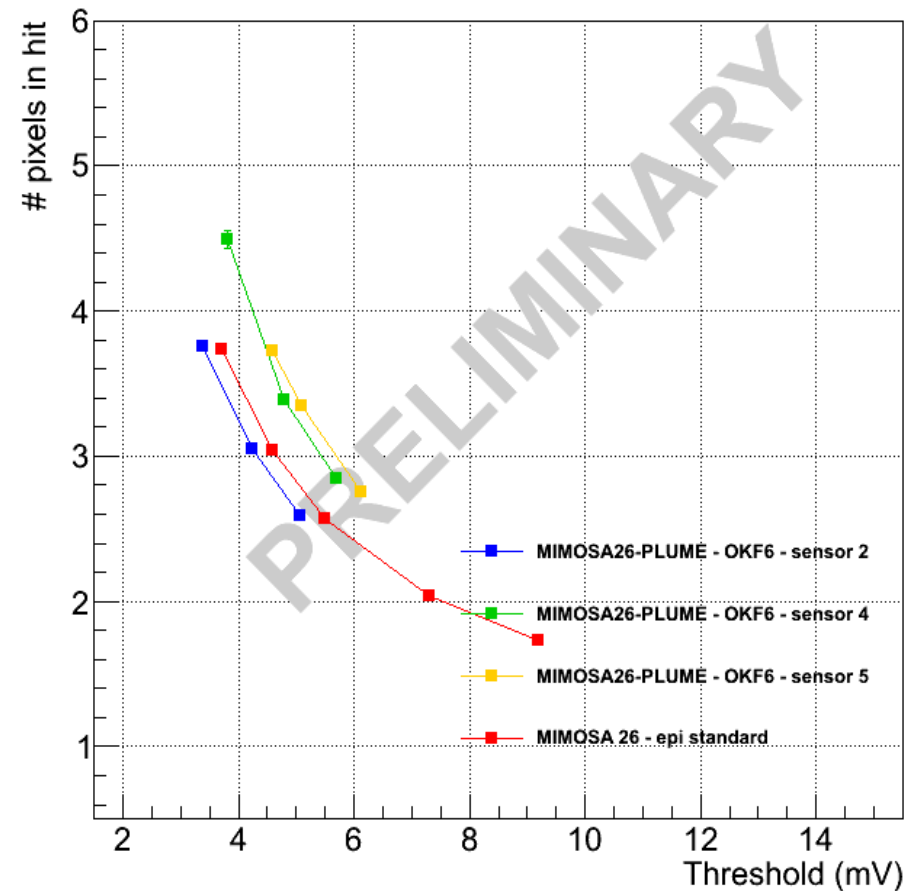
Average pixel multiplicity vs threshold (mV)

Pixel multiplicity vs Threshold



OKF3

Pixel multiplicity vs Threshold



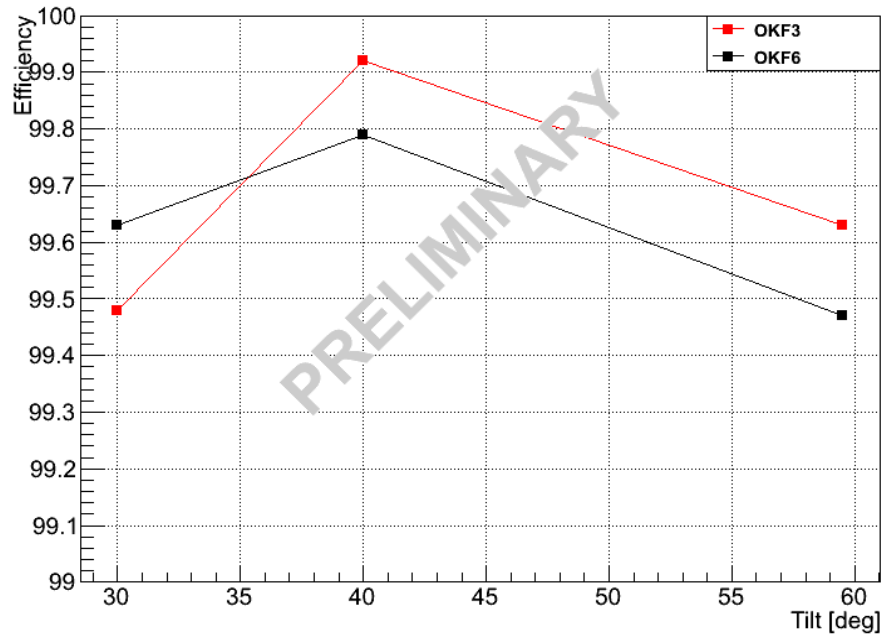
OKF6

Comments

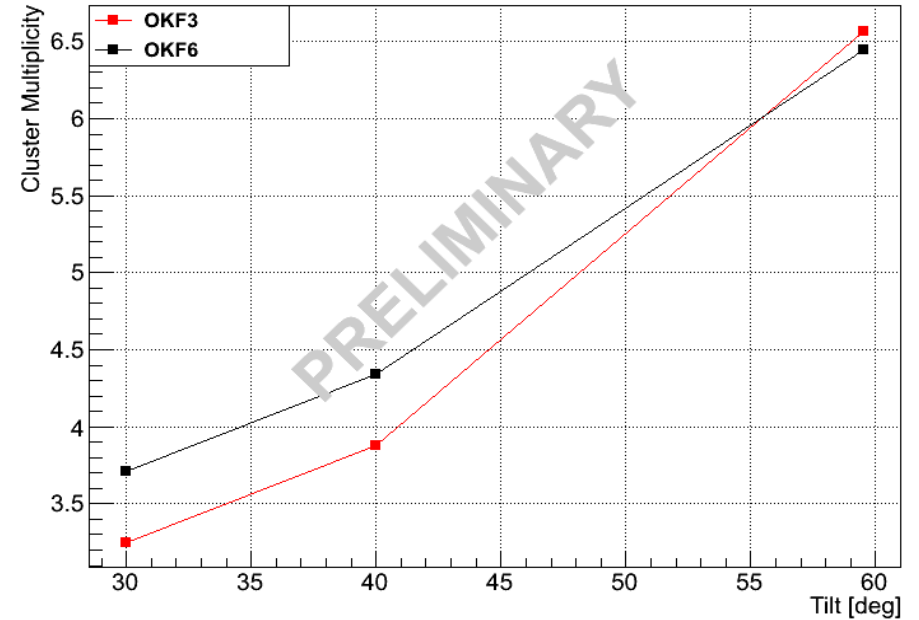
- **Efficiency & fake hit rate issues :**
 - Sensor hit overflow reached at unexpected efficiency level (99-99.5 %)
 - Impossible to further decrease the threshold
 - Fake hit rate also saturates at 10^{-4} /pixel
 - Difficulty with threshold calibration ?
 - maybe due to temperature effect or 6 chips running in parallel
 - Under investigation.
- **Standard behavior** for :
 - Resolution
 - Cluster multiplicity
 - Fake vs efficiency (at high threshold)

Tilted configuration study

Efficiency vs angle (deg)



Cluster multiplicity vs angle (deg)



Software = TAF.

Threshold = 5 Sigma

Spatial resolution : under study (→ alignment difficulties)

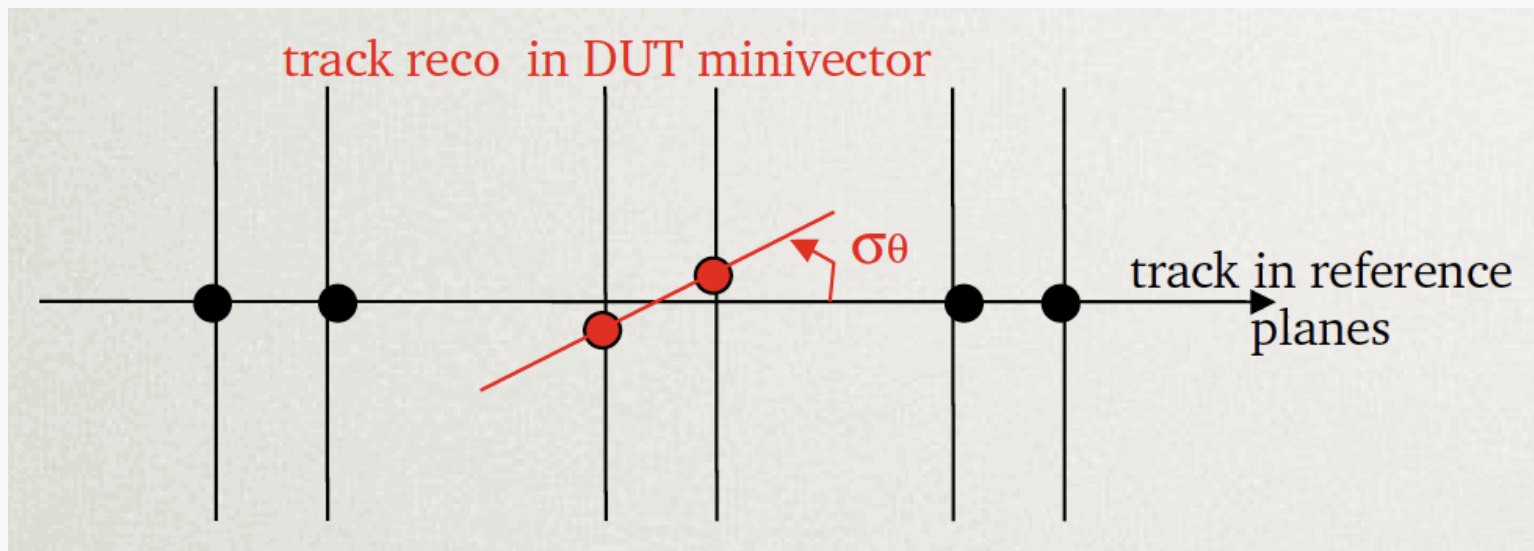
Alignment tools to be improved.

Mini-vectors

Mini-vectors between the two side of the ladder :

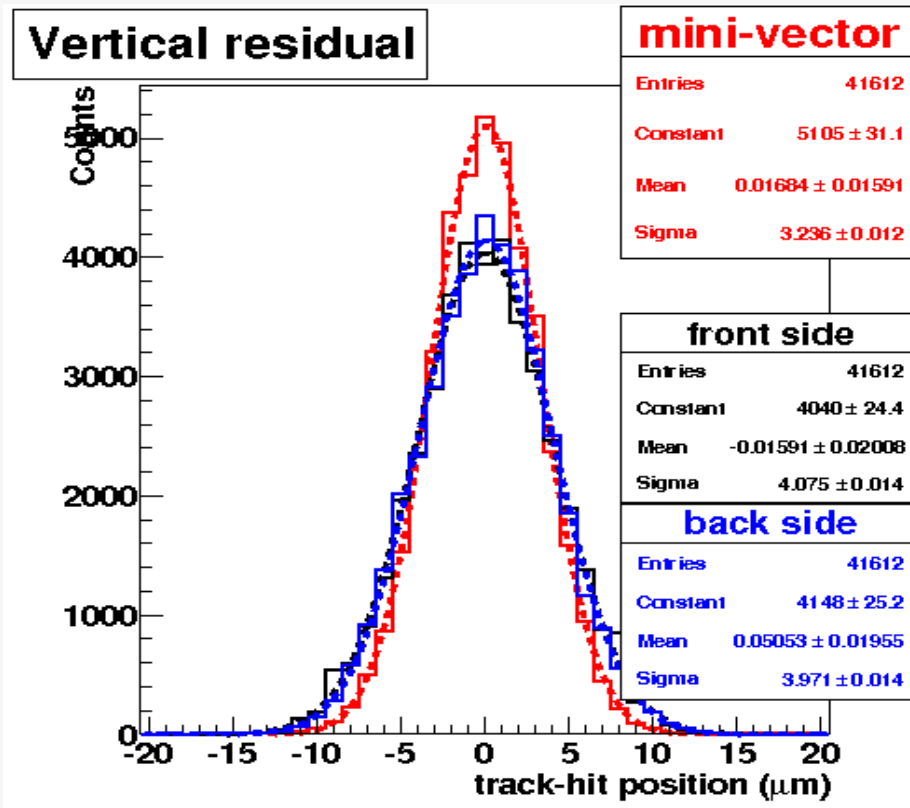
- To **improve spatial resolution.**
- To **estimate angular resolution.**

Hit selection to make the mini vector = hits with the minimum track-hit distance.



Mini-vectors : spatial resolution

	σ_{Res} observed [μm]	$\sigma_{expected}$ [μm]	σ_{Tel} [μm]	σ_{DUT} [μm]
Black/Blue curve : 1 plane	3.97 / 4.08	3.94	1.8	3.5
Mini-vectors Red curve	3.24	3.06	1.8	2.47

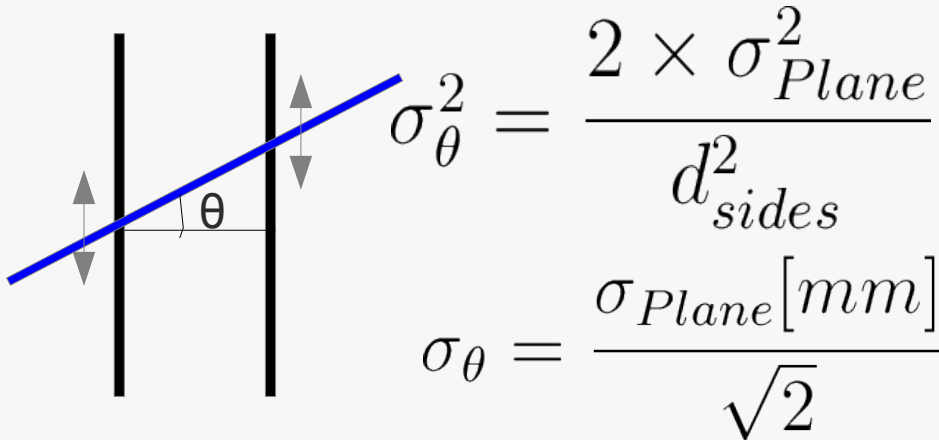


$$\sigma_{Res}^2 = \sigma_{Tel}^2 + \sigma_{DUT}^2 (+\sigma_{m.s.}^2)$$

$$\sigma_{mini} = \frac{\sigma_{DUT}}{\sqrt{2}}$$

- **Spatial resolution improved.**
- Correlation between observation and theoretical result => **mechanical stability of the ladder.**

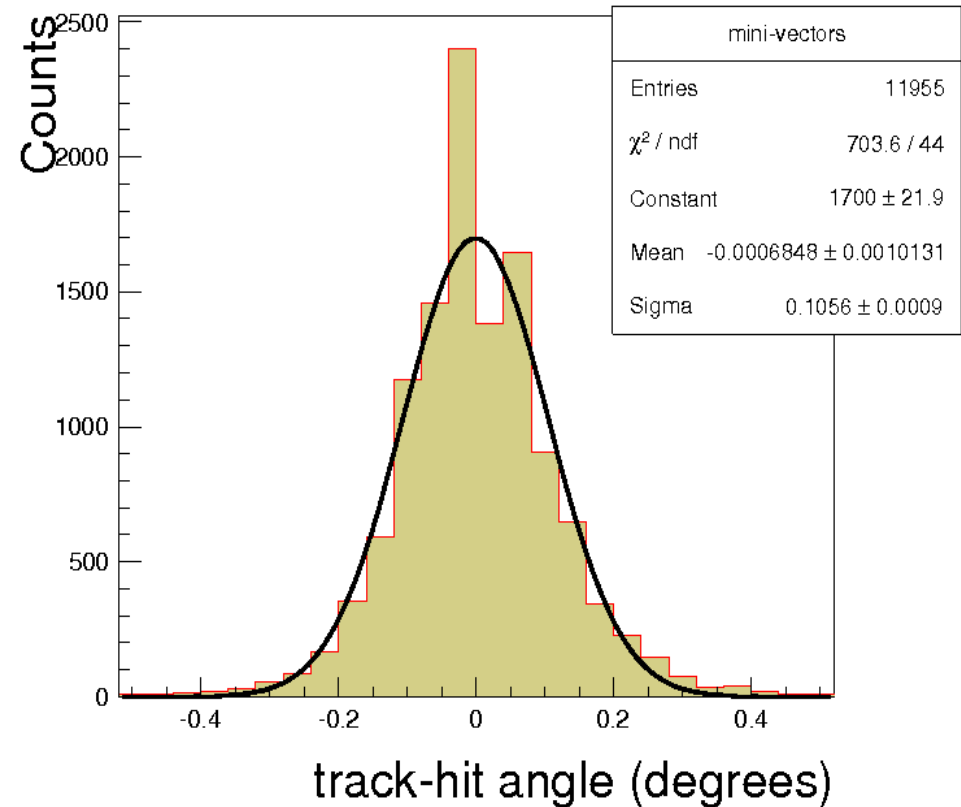
Mini-vectors : angular resolution



- Observed : 0,11 degree with multi-pixel clusters
- Expected : 0,14 degree
- Study with different cluster multicity.

Angular residual :

Angular residual for multi-pixels cluster



Conclusion

- Already a lot of results
 - Indicate **correct mechanical behavior**
 - Maybe some difficulties with the temperature and/or threshold settings
- Further possible studies
 - Evaluate insensitive gap between sensors
 - Evaluate fine alignment to evaluate ladder deformation
 - Investigate several strategies to generate mini-vectors (efficiency/purity)
 - Pointing precision of mini-vectors toward other planes

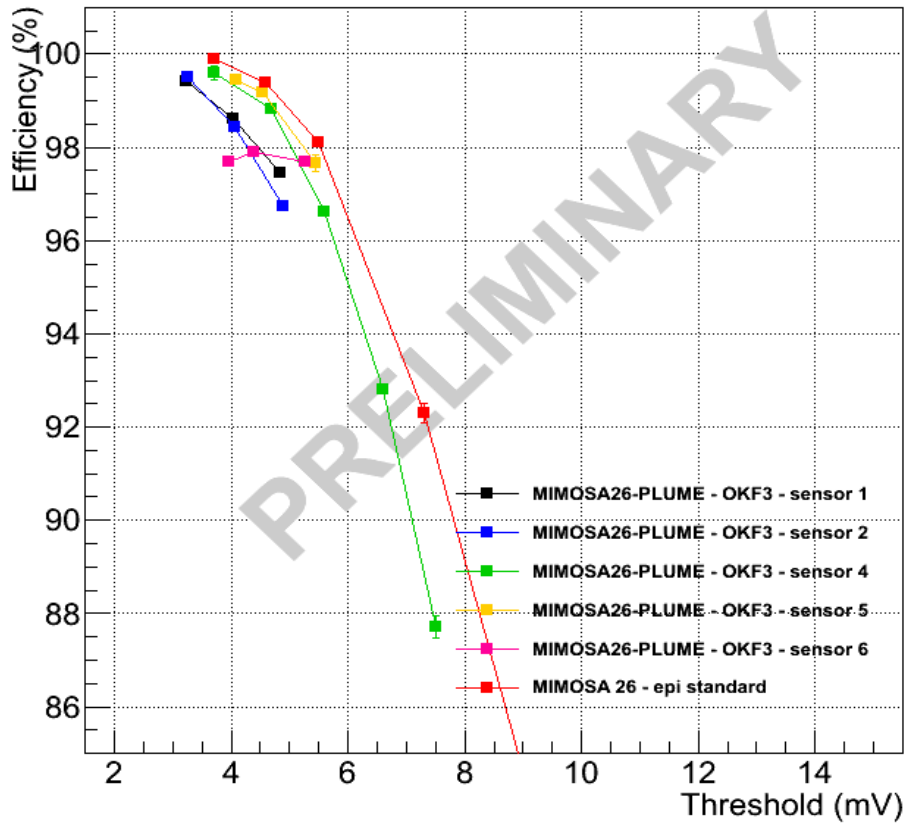
Thank you !

Backup

Normal incidence study / Software = TAF

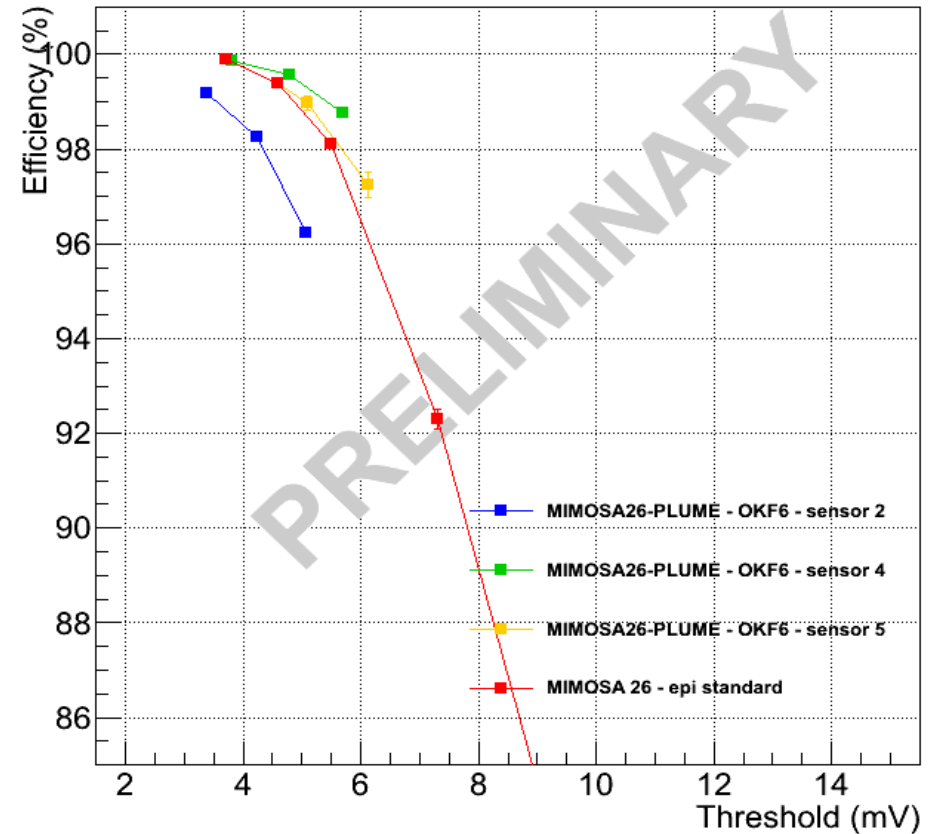
Efficacy vs threshold (mV)

Efficiency vs Threshold



OKF3

Efficiency vs Threshold



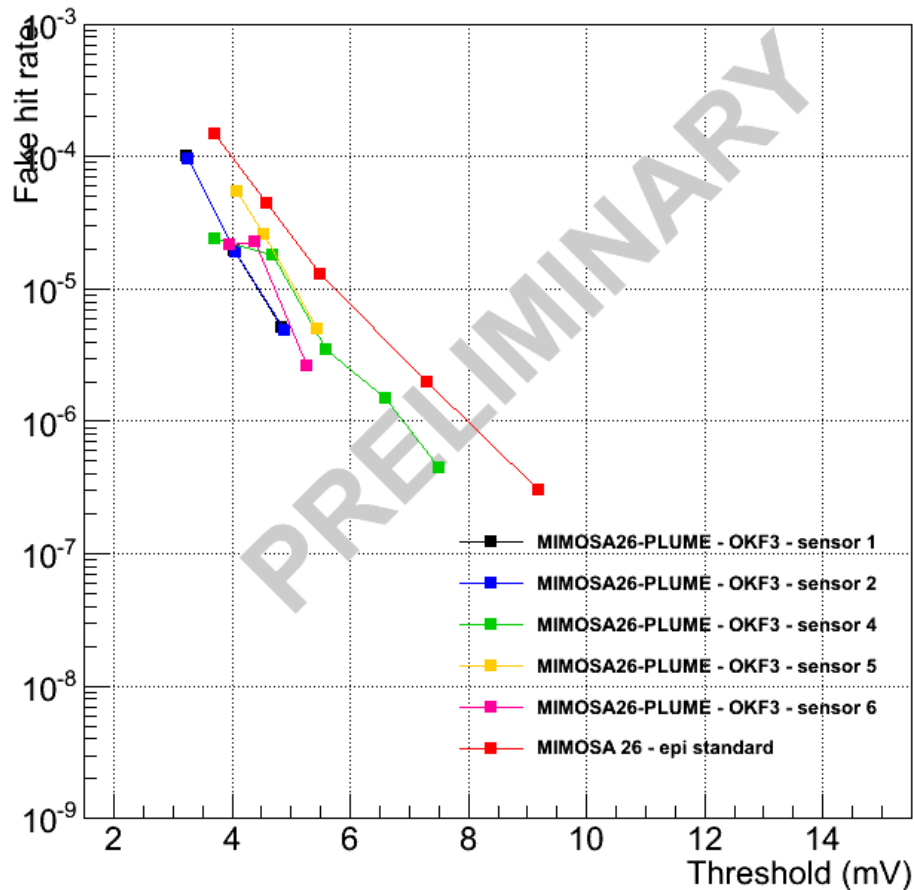
OKF6

- Not a 100% efficiency : saturation at low threshold.
- Threshold calibration problem ?

Normal incidence study / Software = TAF

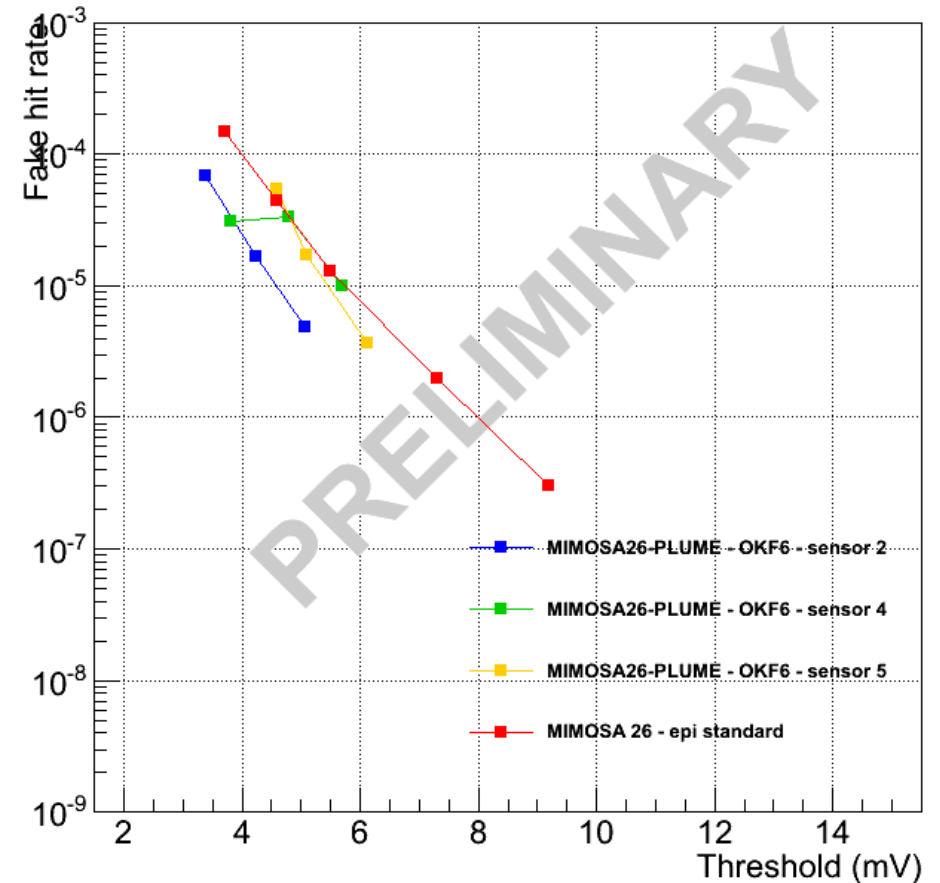
Fake vs threshold (mV)

Fake hit rate (whole sensor) vs Threshold



OKF3

Fake hit rate (whole sensor) vs Threshold



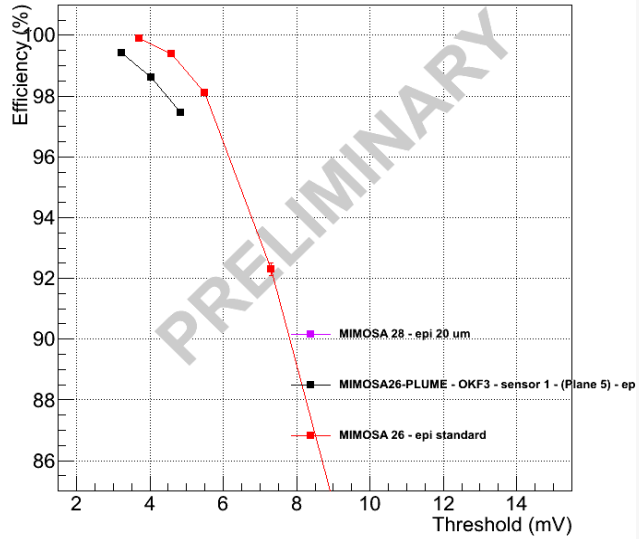
OKF6

→ Saturation at low threshold.

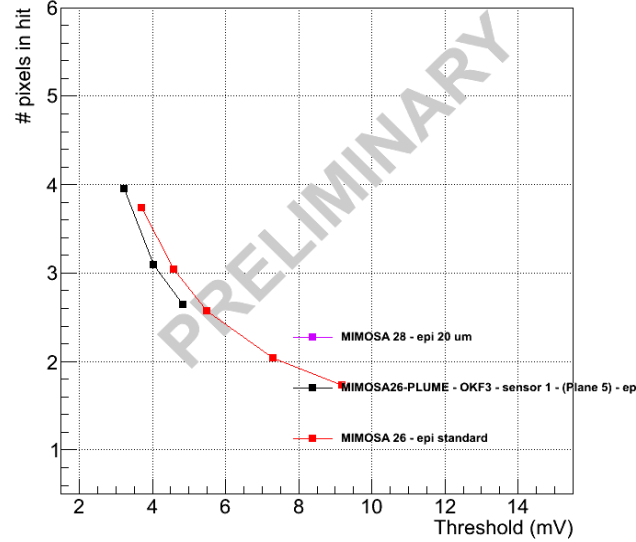
→ Low fake hit rate vs mimosa26 epi standard.

Chip 1

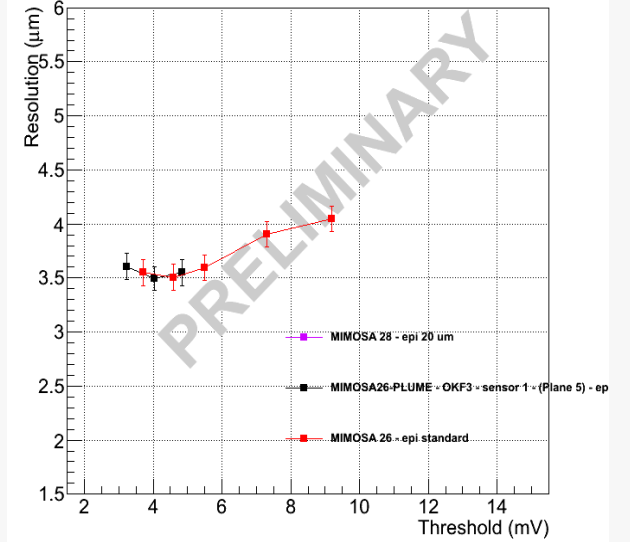
Efficiency vs Threshold



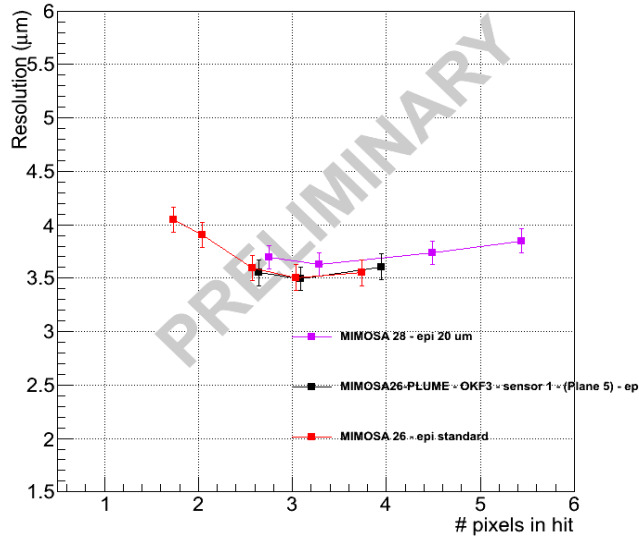
Pixel multiplicity vs Threshold



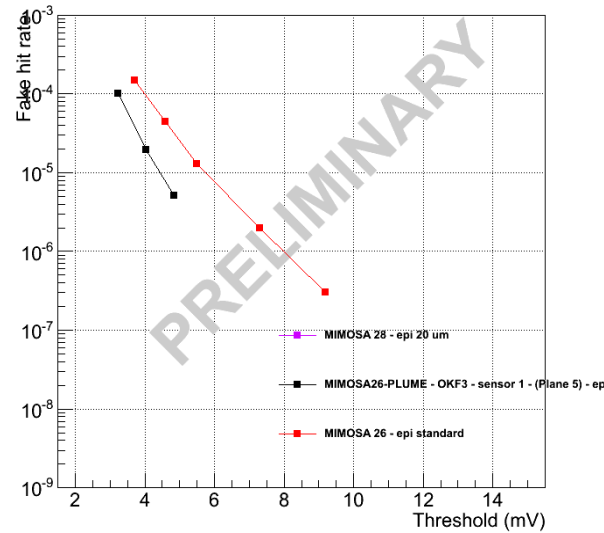
Resolution vs Threshold



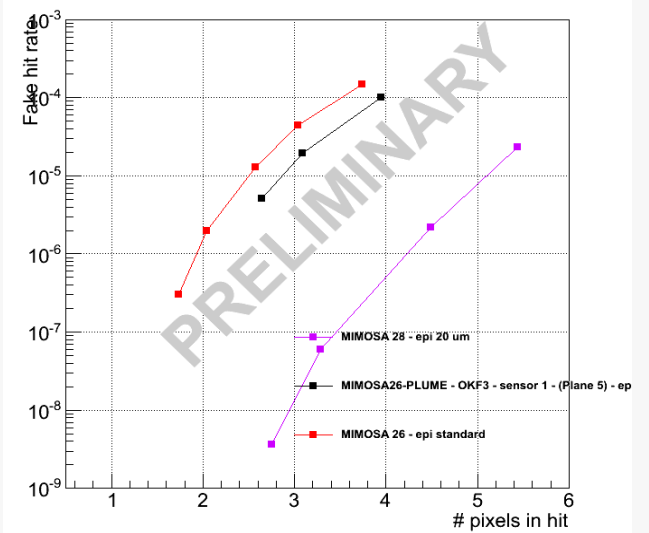
Resolution vs Pixel multiplicity



Fake hit rate (whole sensor) vs Threshold

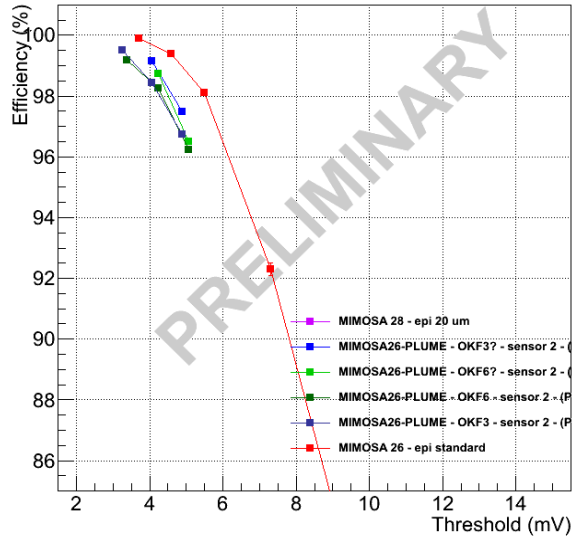


Fake hit rate (whole sensor) vs Pixel multiplicity

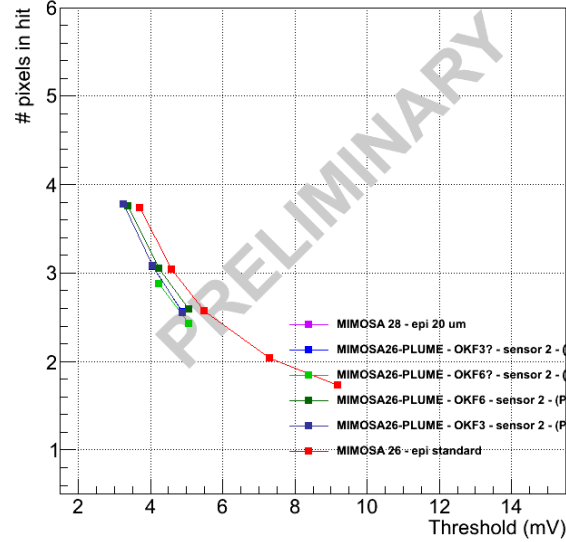


Chip 2

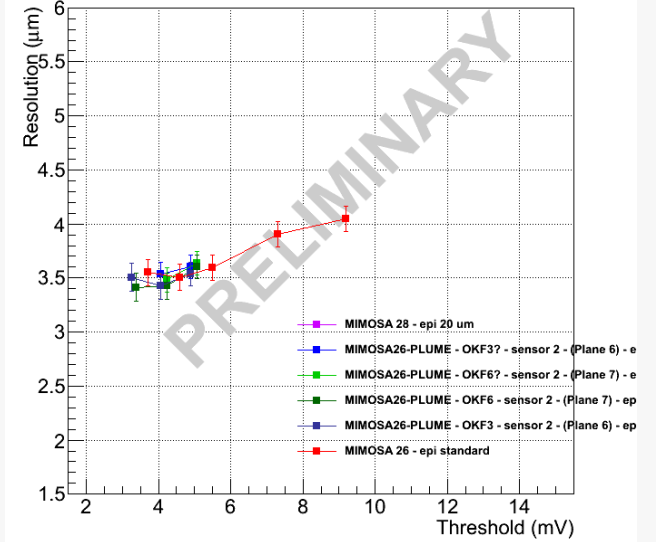
Efficiency vs Threshold



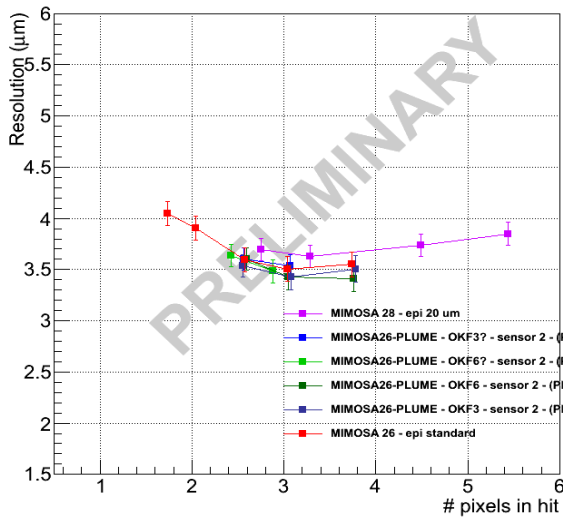
Pixel multiplicity vs Threshold



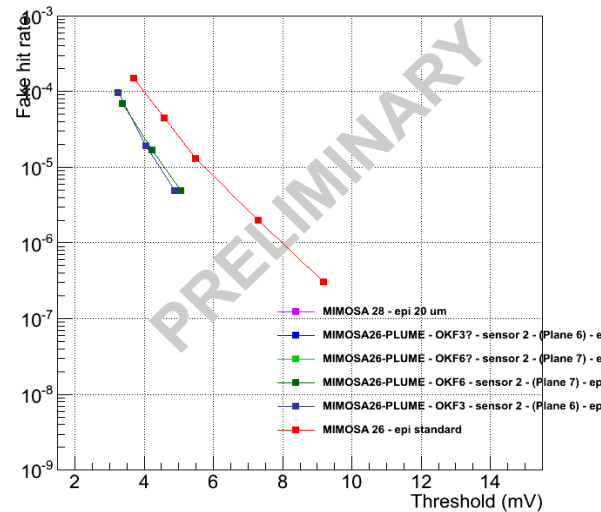
Resolution vs Threshold



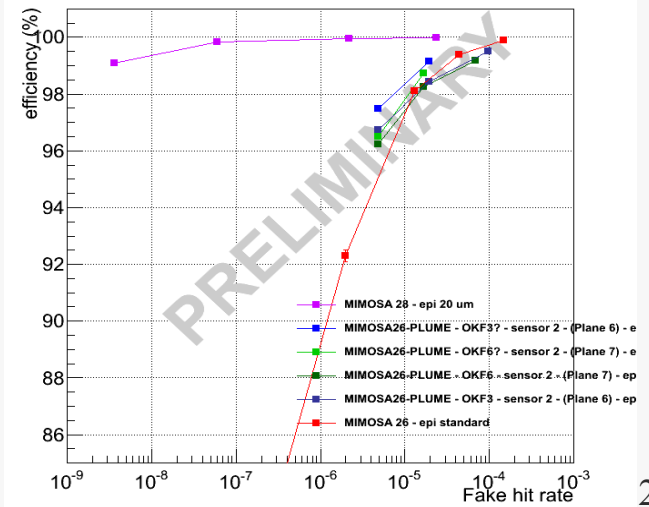
Resolution vs Pixel multiplicity



Fake hit rate (whole sensor) vs Threshold

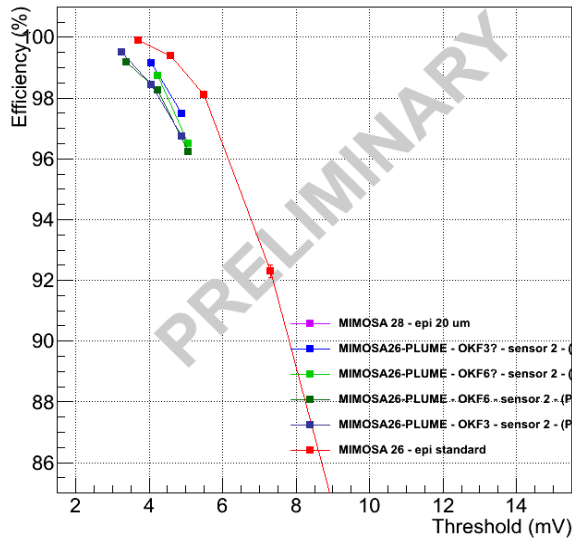


Efficiency vs Fake hit rate

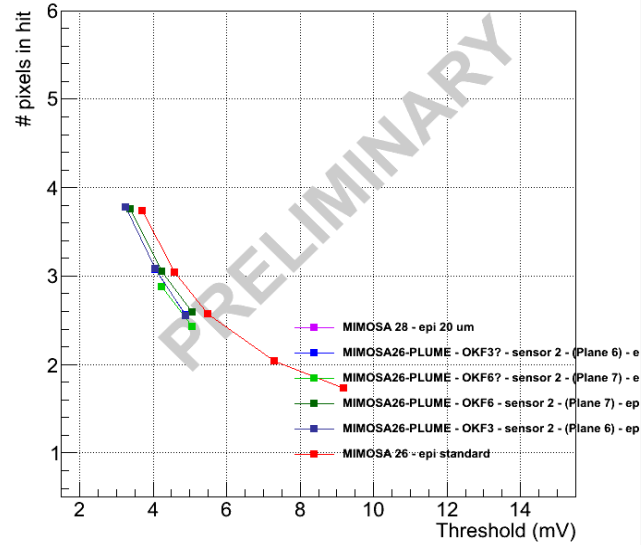


Chip 4

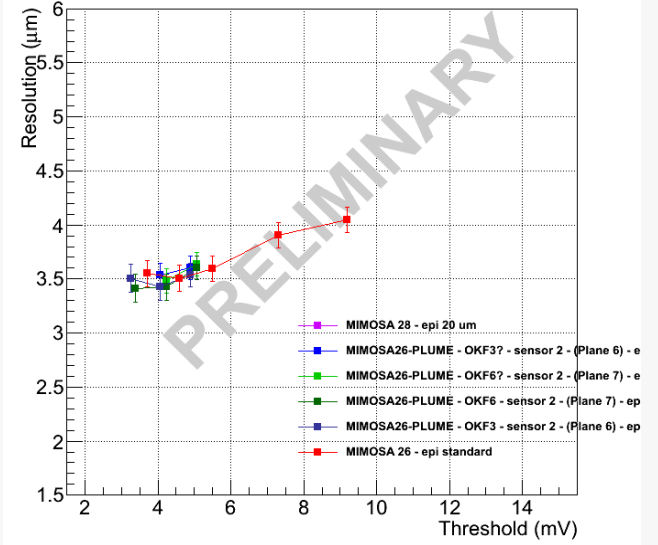
Efficiency vs Threshold



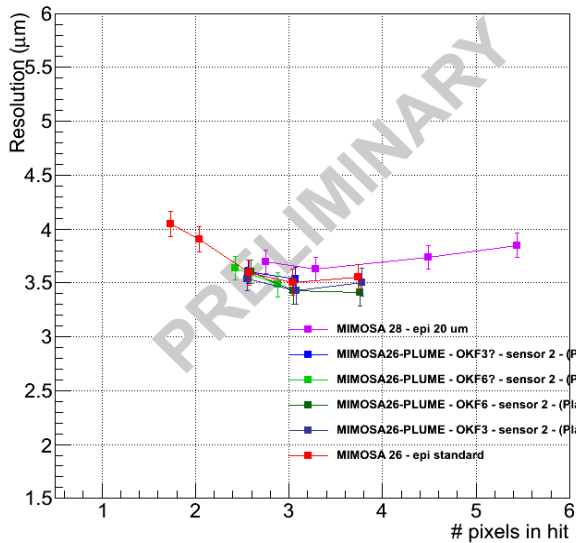
Pixel multiplicity vs Threshold



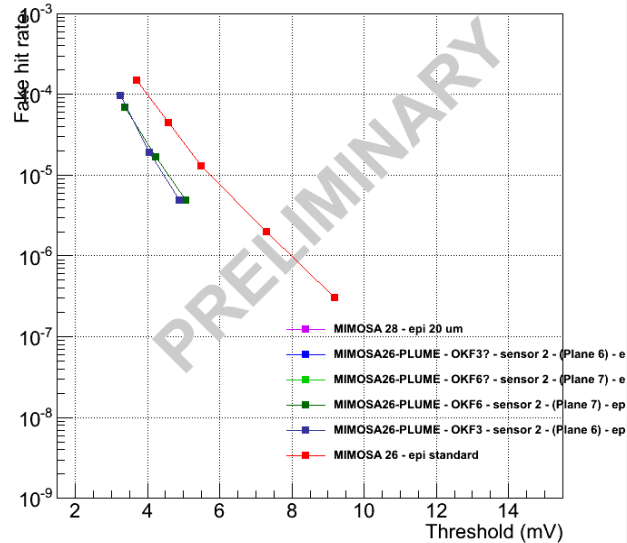
Resolution vs Threshold



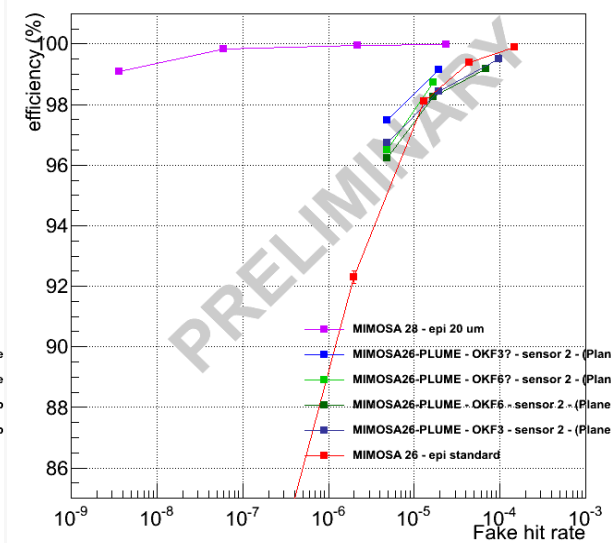
Resolution vs Pixel multiplicity



Fake hit rate (whole sensor) vs Threshold

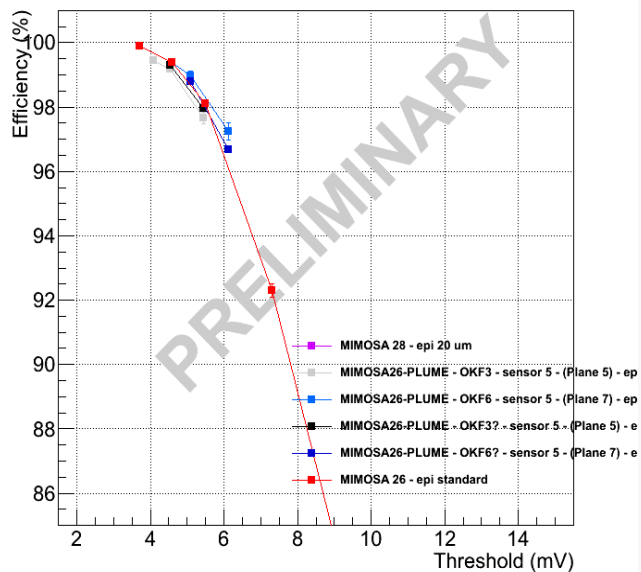


Efficiency vs Fake hit rate

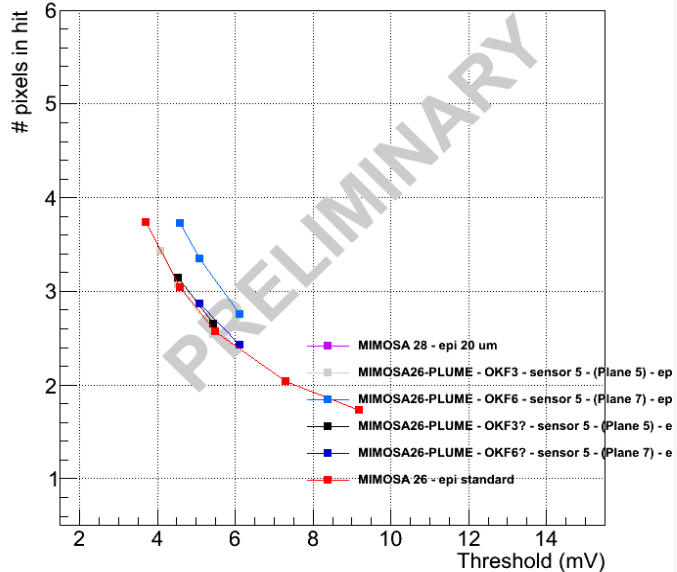


Chip 5

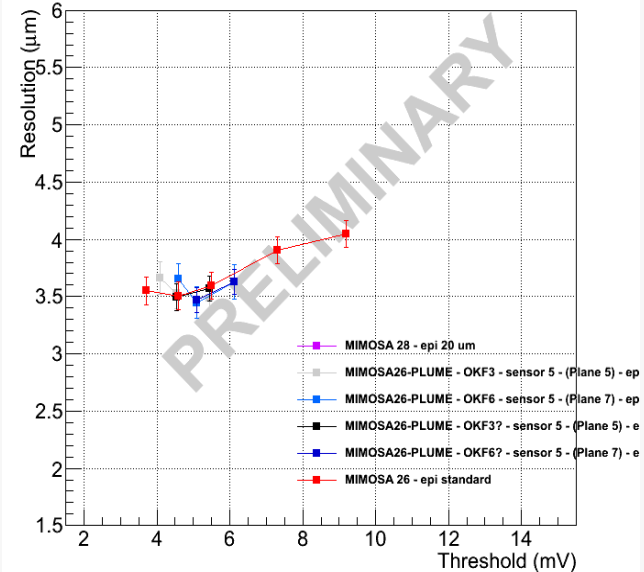
Efficiency vs Threshold



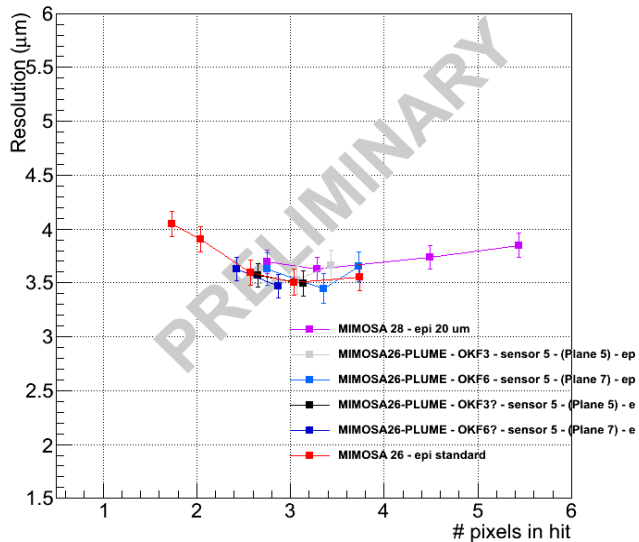
Pixel multiplicity vs Threshold



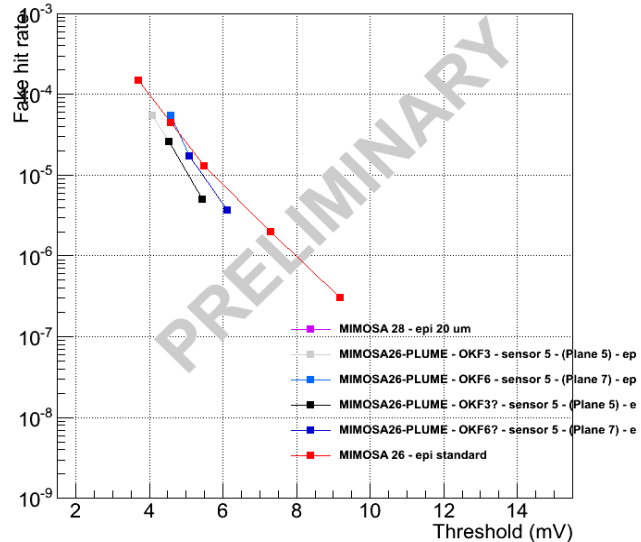
Resolution vs Threshold



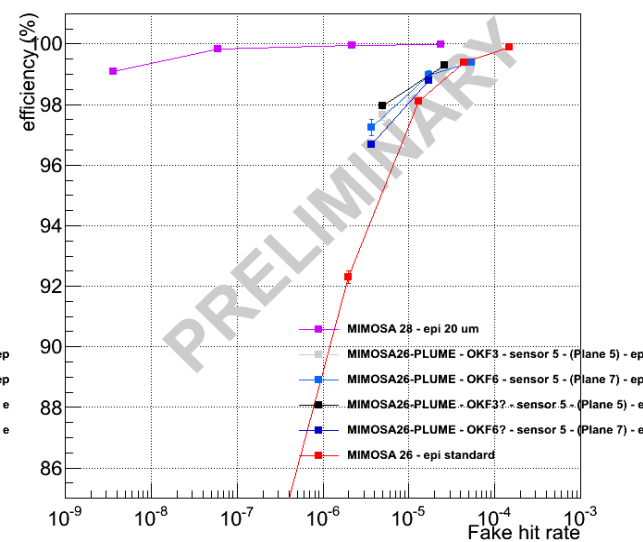
Resolution vs Pixel multiplicity



Fake hit rate (whole sensor) vs Threshold

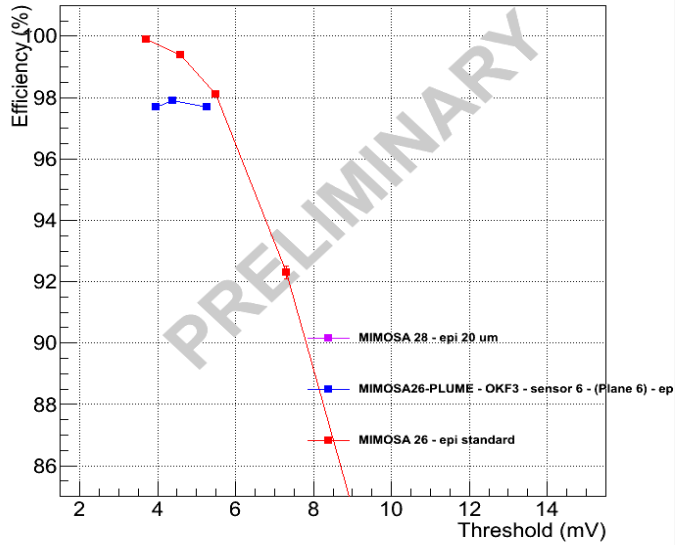


Efficiency vs Fake hit rate

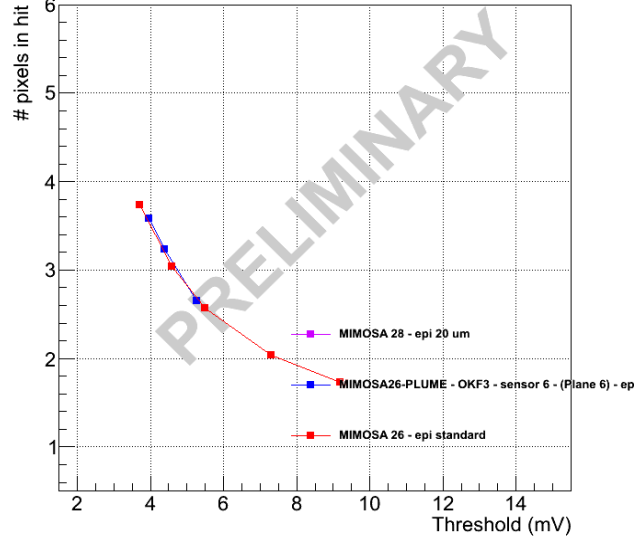


Chip 6

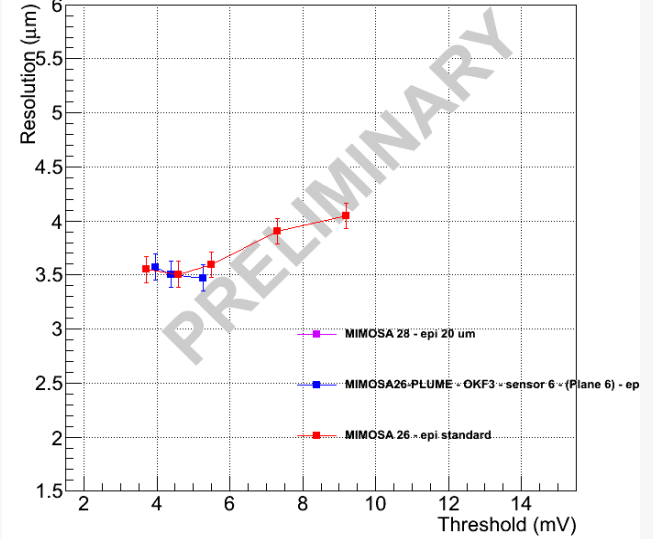
Efficiency vs Threshold



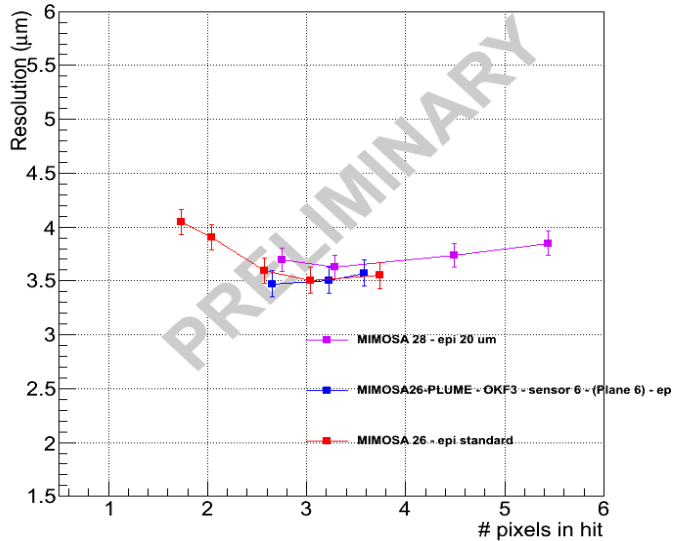
Pixel multiplicity vs Threshold



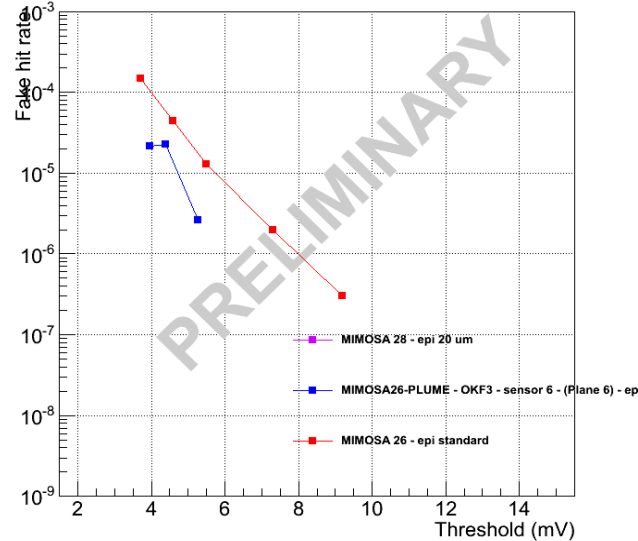
Resolution vs Threshold



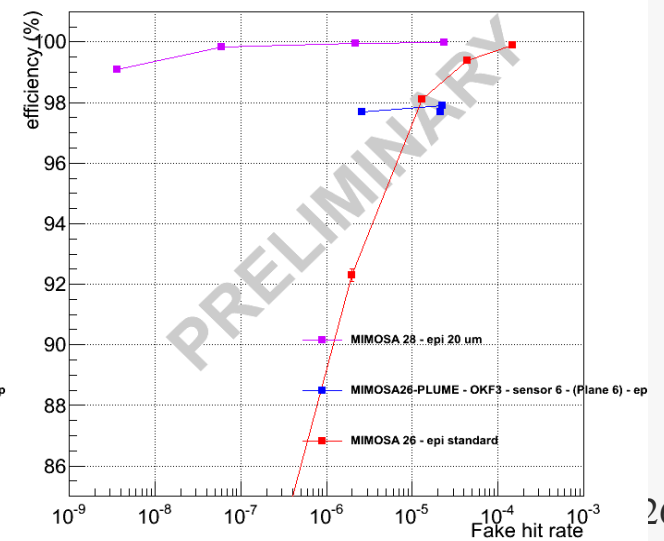
Resolution vs Pixel multiplicity



Fake hit rate (whole sensor) vs Threshold



Efficiency vs Fake hit rate



Angular residual vs cluster multiplicity

