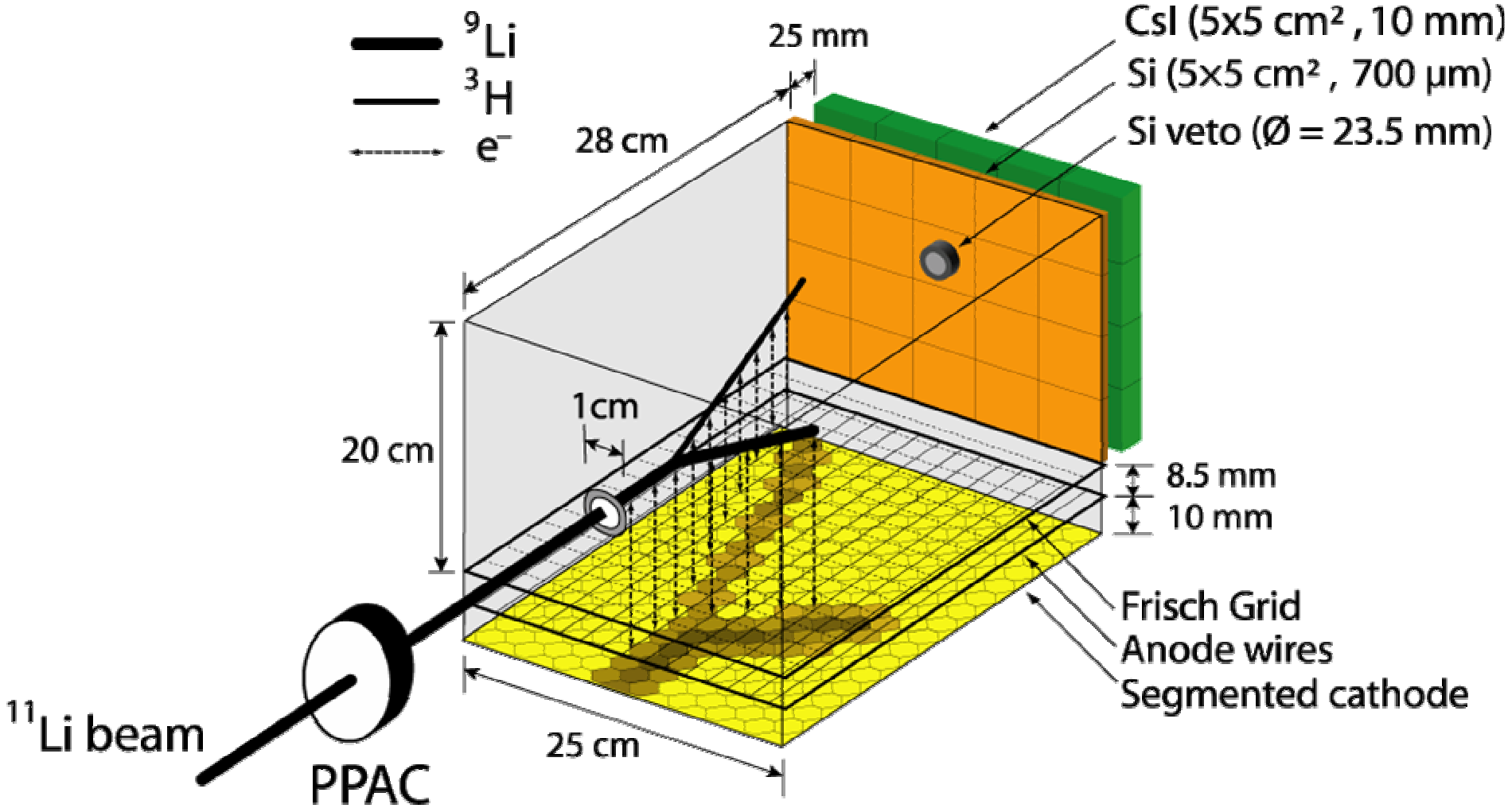
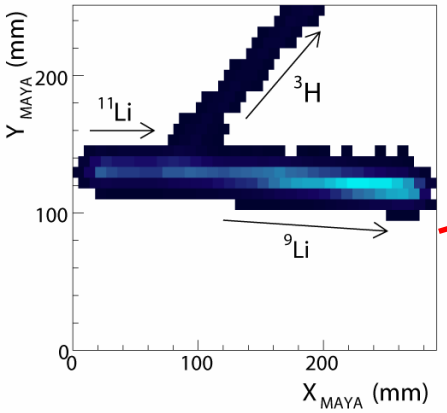
Active target data analysis

The active target MAYA

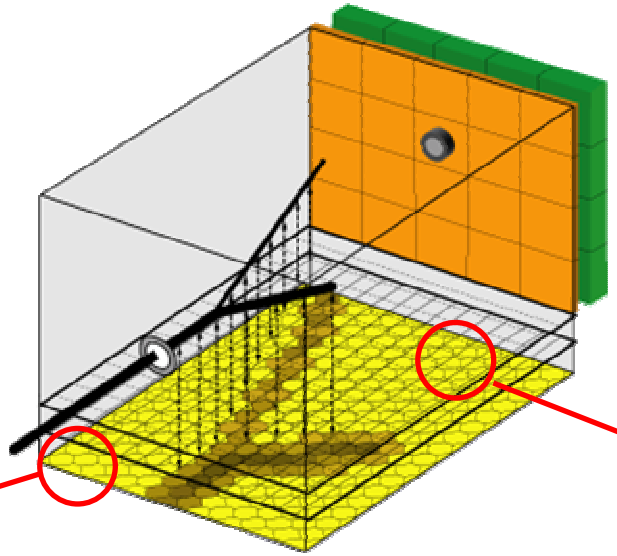


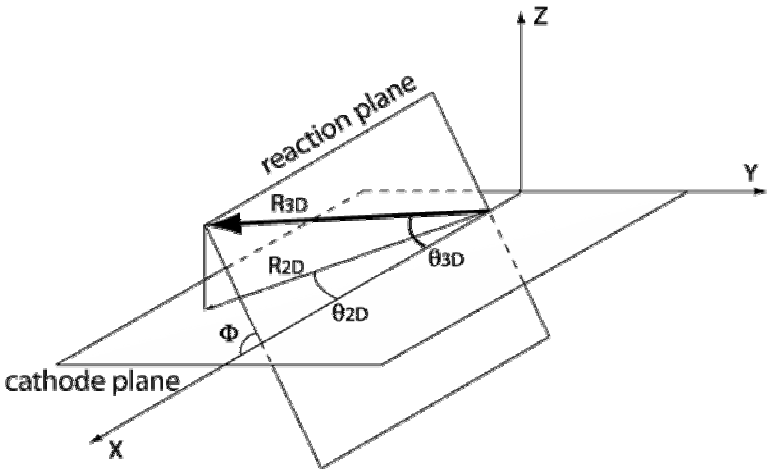
The active target MAYA

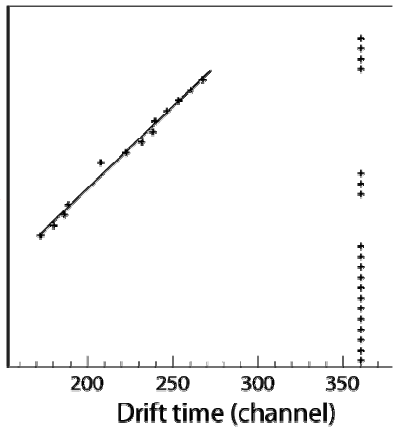
A two dimensional charge – one dimensional time projection chamber



Cathode recorded pattern
➔ 2 dimensions



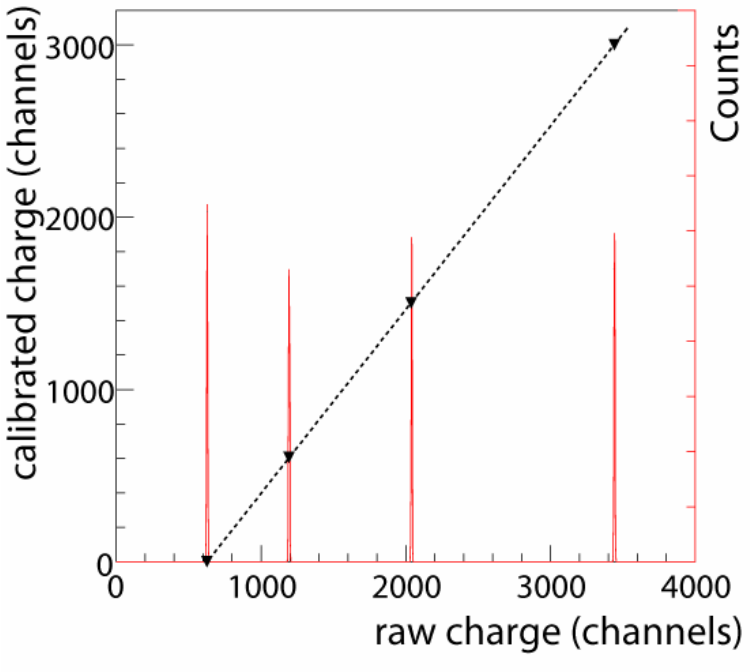




Wire recorded time
➔ 3rd dimension

Calibrations

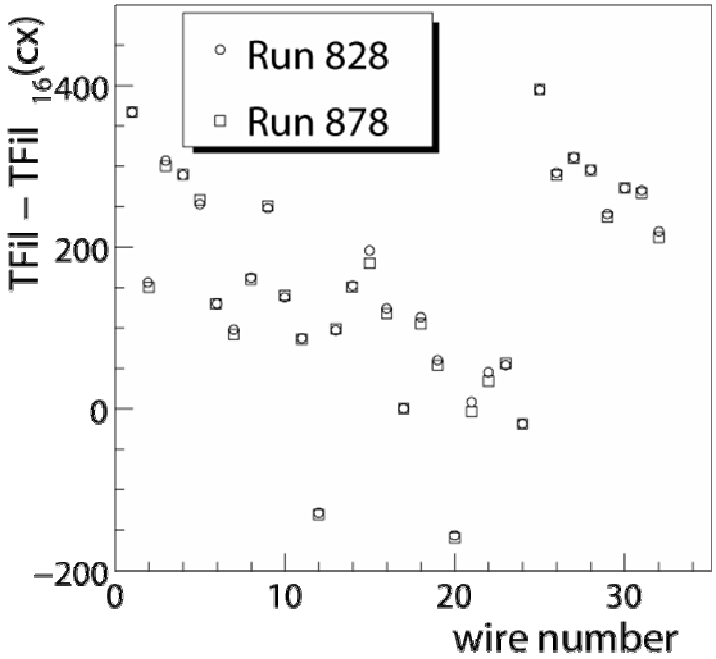
PADS calibration with pulser



Dynamic : 90%

Resolution : < 0.5%

Time calibration with pulser

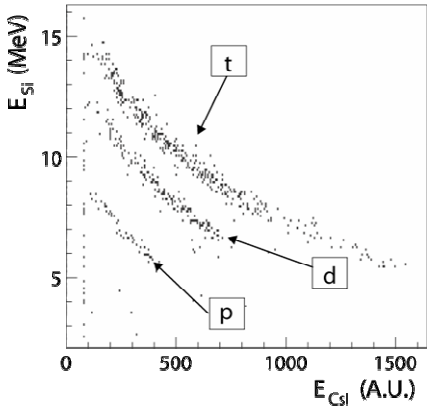


Good stability

Resolution : < 5%

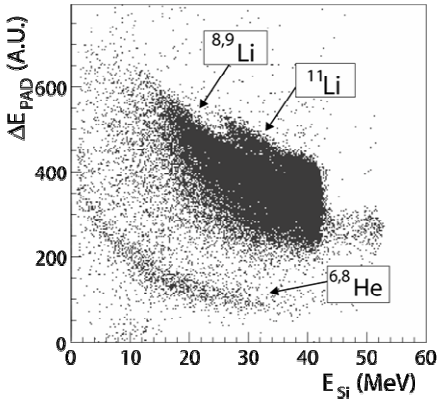
Particle identification

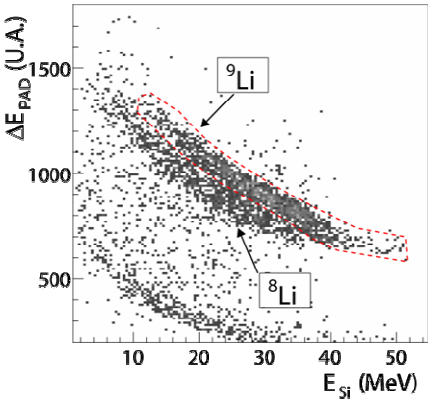
Light + high E → Si / CsI



Good resolution
Calibration of CsI?

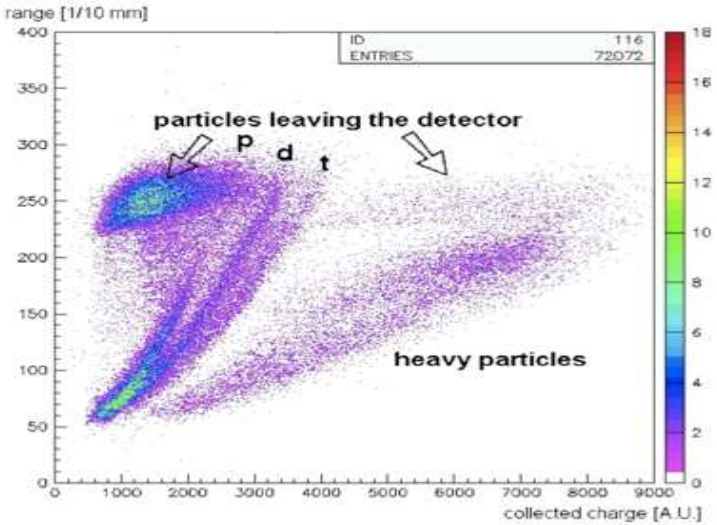
Medium E → PADS / Si





ΔE resolution - Dynamics ?
Absolute calibration of charge ?

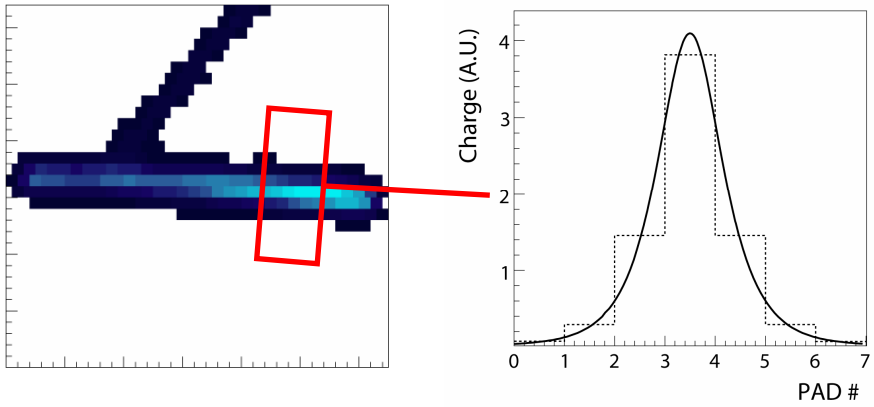
Low E → Range / ΔE



Range resolution?
ΔE resolution - Dynamics ?

Angles Reconstruction – SECHS method

➔ Distribution induced by a point source

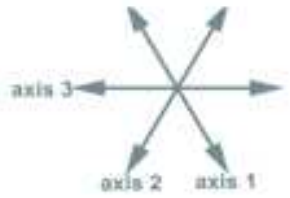


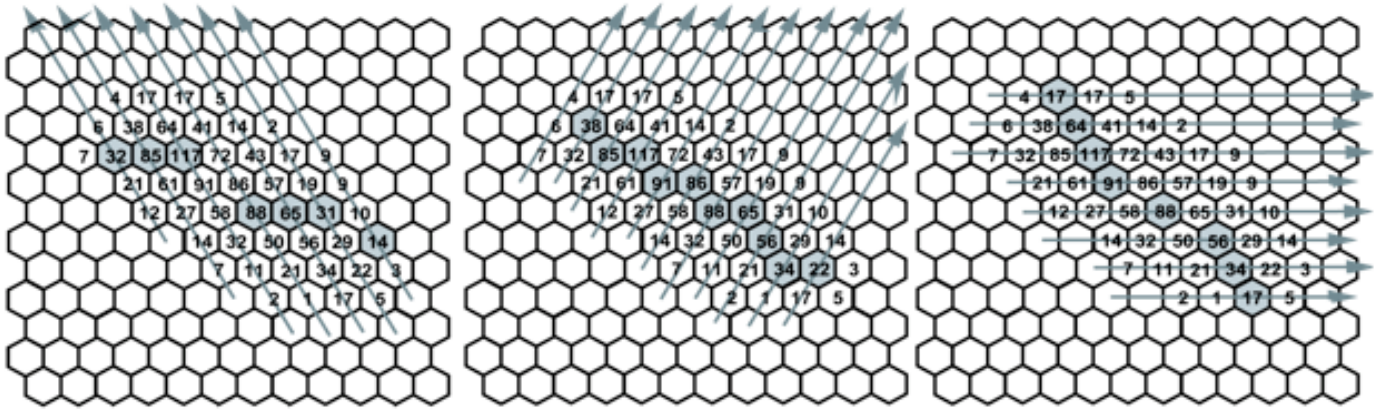
$$\sigma(x,y) = \frac{-Q}{2\pi} \sum_{n=0}^{\infty} \frac{(-1)^n (2n+1) L}{[(2n+1)^2 L^2 + x^2 + y^2]^{3/2}}$$

$$\Delta_R = \frac{w}{2} \frac{ln(\frac{1+a_1}{1-a_1})}{ln(a_2 + \sqrt{a_2^2 - 1})}$$

$$a_1 = \frac{\sqrt{\frac{Q_0}{Q_+}} - \sqrt{\frac{Q_0}{Q_-}}}{2\, sinh\, a_2} \quad \text{and} \quad a_2 = \frac{1}{2}(\sqrt{\frac{Q_0}{Q_+}} + \sqrt{\frac{Q_0}{Q_-}})$$

➔ Search of the most perpendicular axis





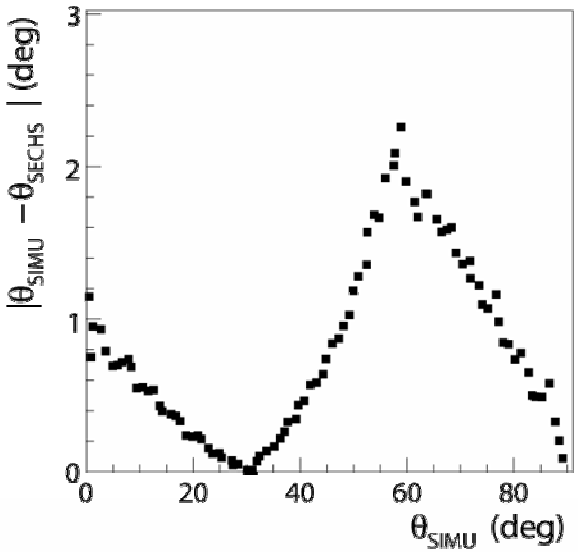
axis 1
7 maxima found

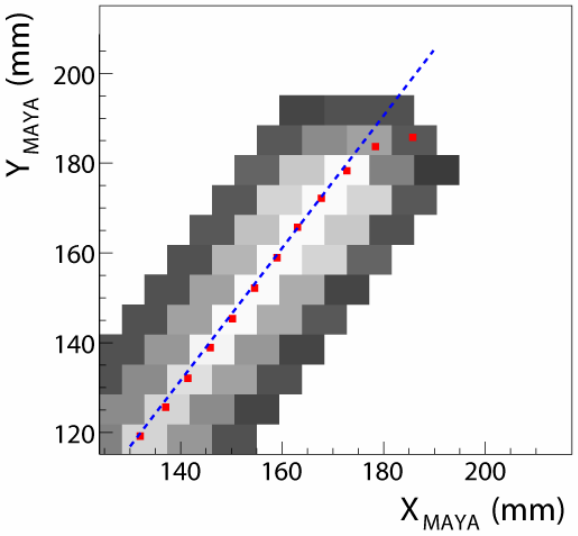
axis 2
10 maxima found

axis 3
8 maxima found

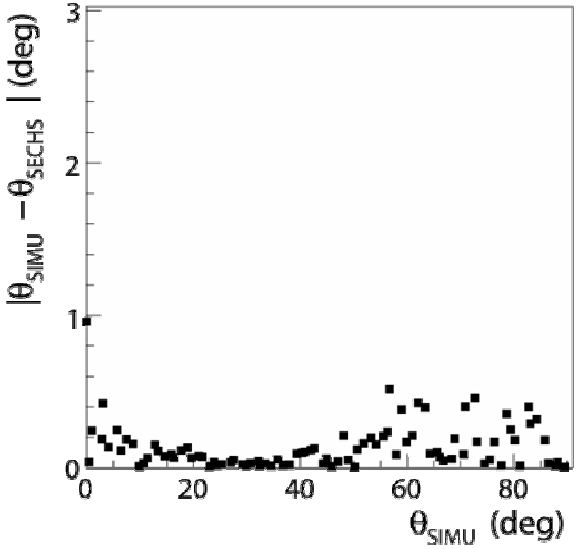
Angles Reconstruction – SECHS method

Calculated angle
shifted around 0° and 60°





Effect disappear
when removing last points



Resolution < 0.5°

BUT:

Range has to be > 4 PADS!

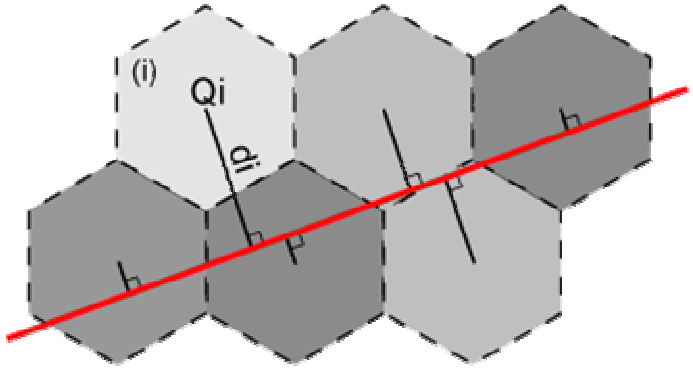
Thickness of the track !

➔ PAD size could help

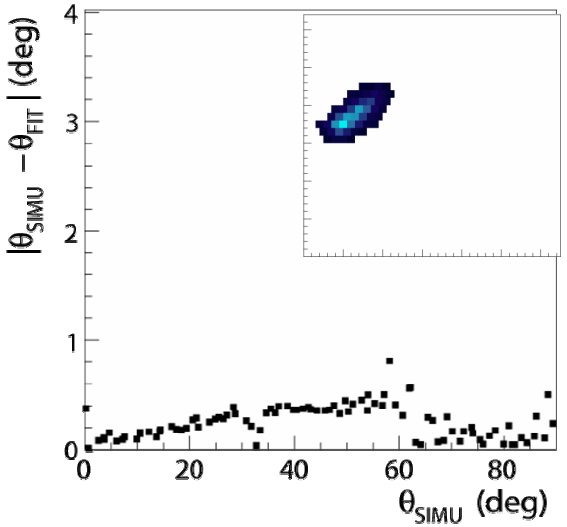
Angles Reconstruction – FIT method

➔ Orthogonal distance regression

$$\chi^2 = \sum_{n=0}^{Npts} Q_n \frac{(ax_n + b - y_n)^2}{a^2 + 1}$$



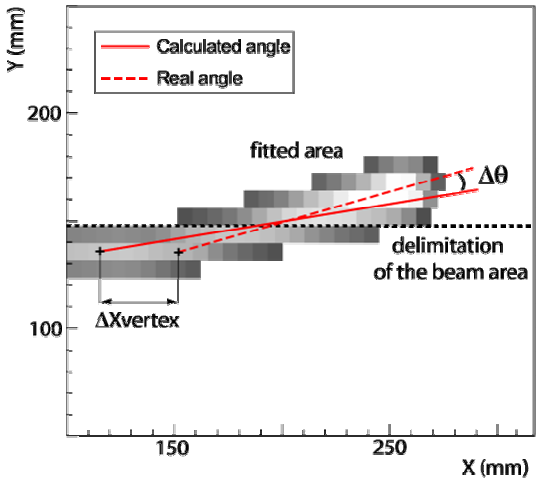
One track

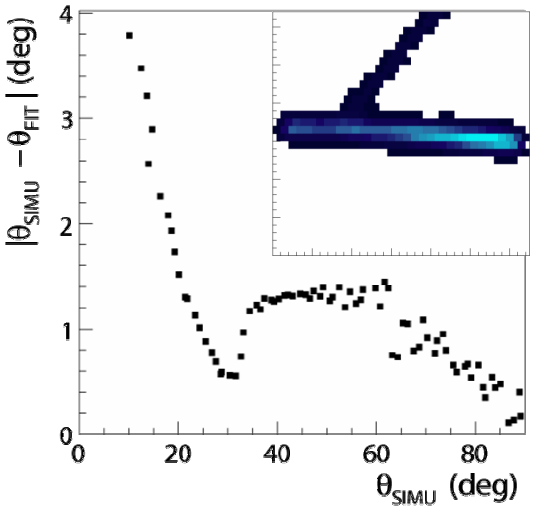


Resolution reaches 0.5°

Range > thickness (3 PADS)

Multiple tracks



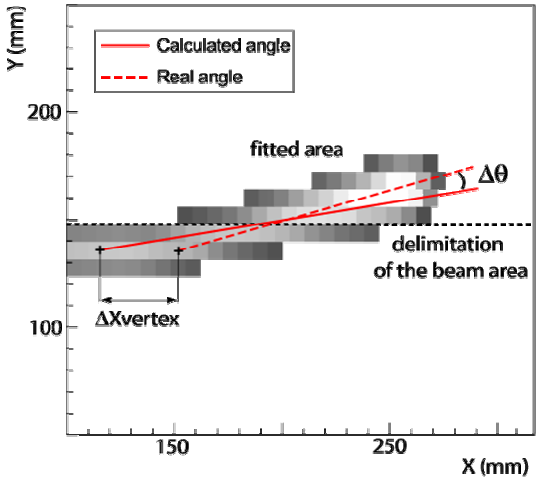


Resolution > 1°

PAD size could help… (image processing)

Range measurements : Vertex point

Intersection point method



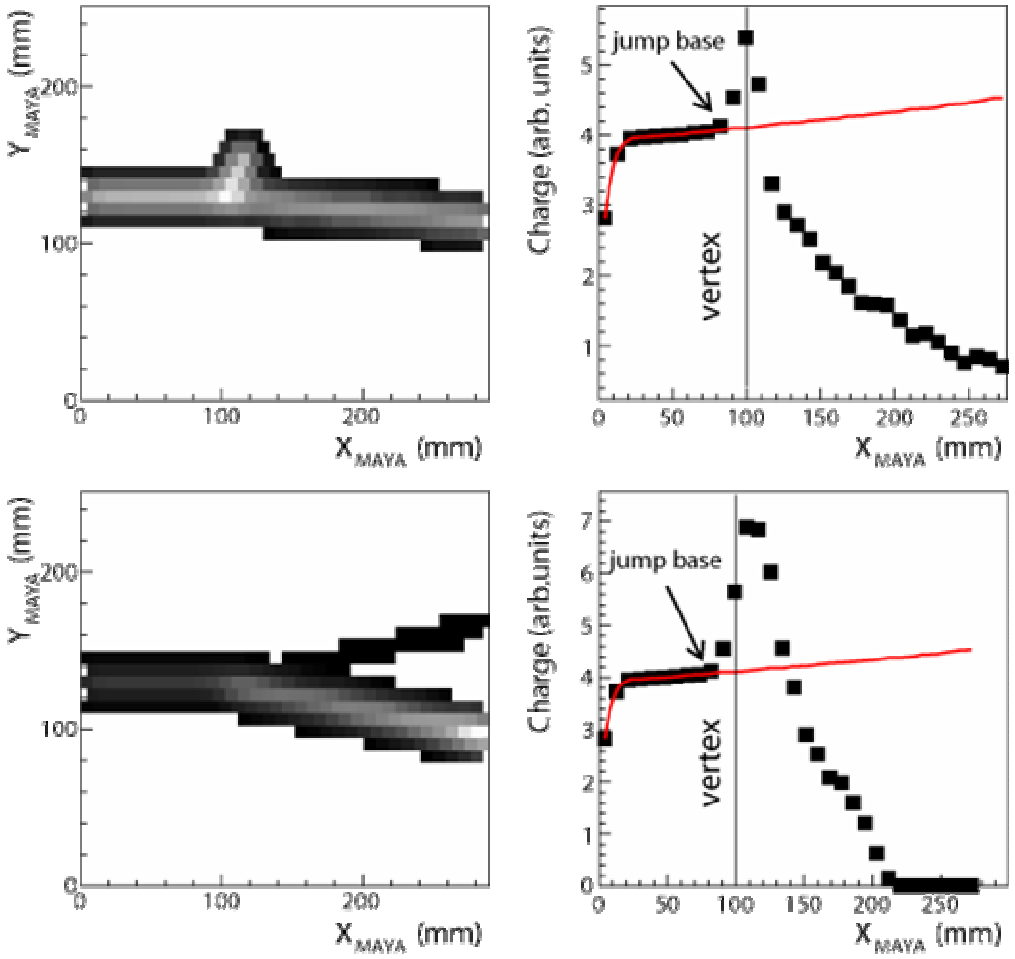
angles > 30°

→ Resolution < 2 mm

Small angles

→ Resolution > 8 mm

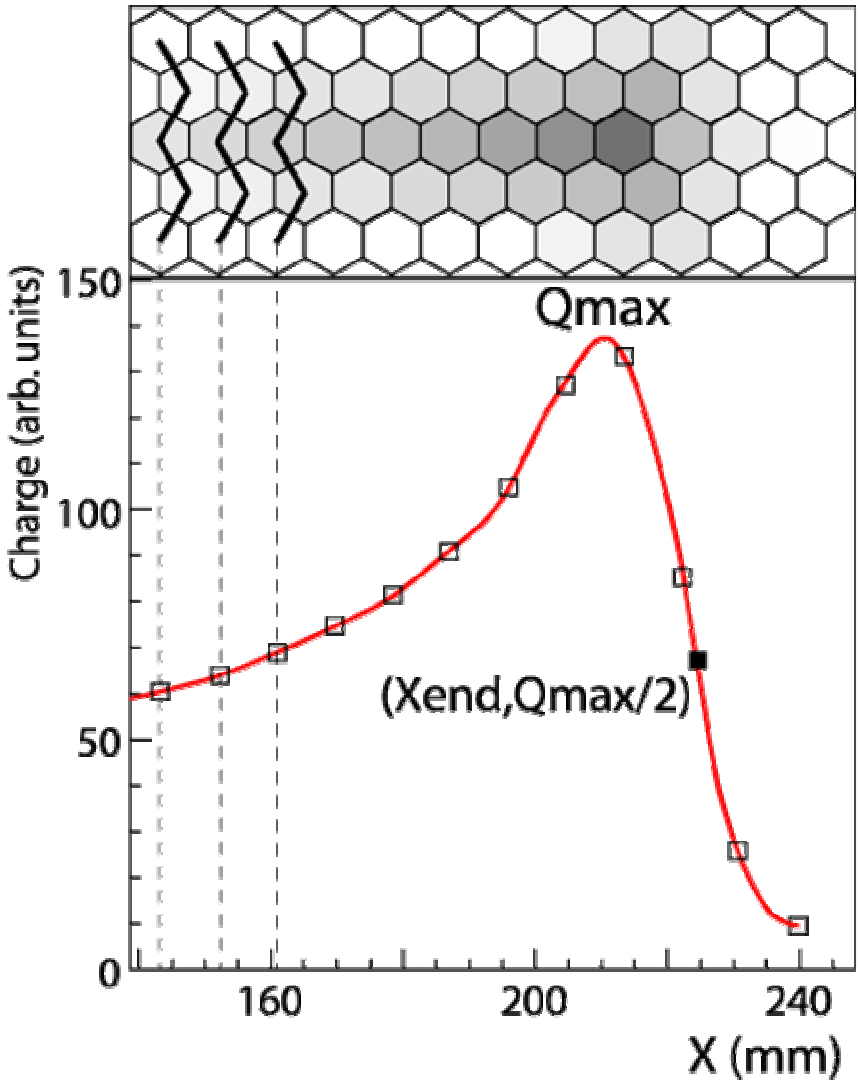
Charge profile method

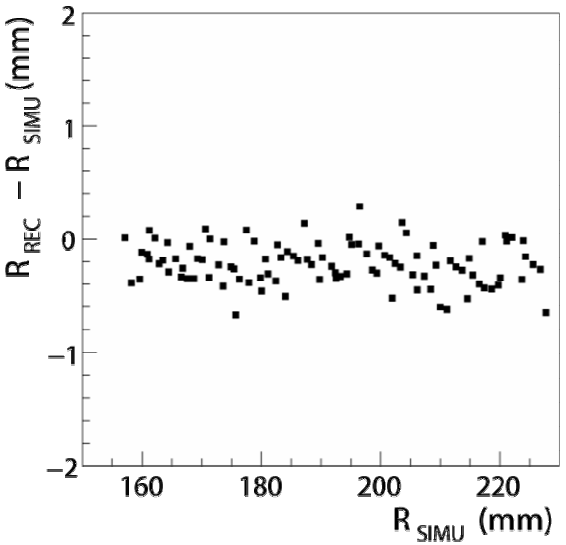


Resolution : 1 PAD

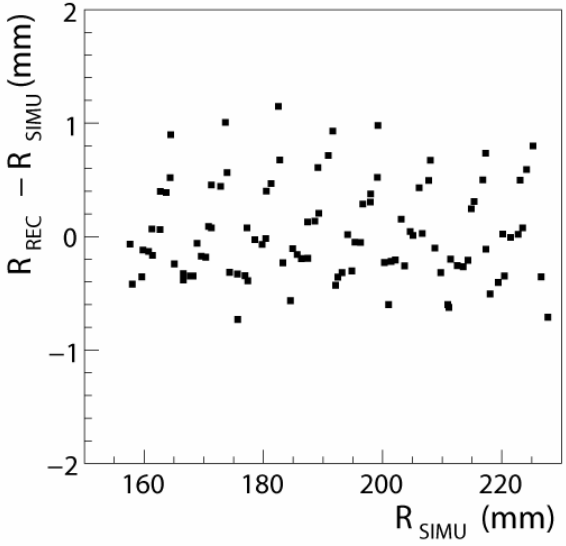
Better if good charge resolution

Range measurements : Ending point





No threshold :
Resolution < 0.5 mm

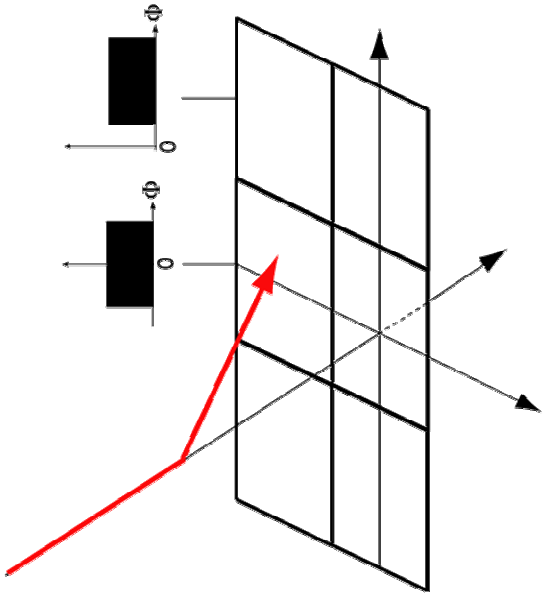


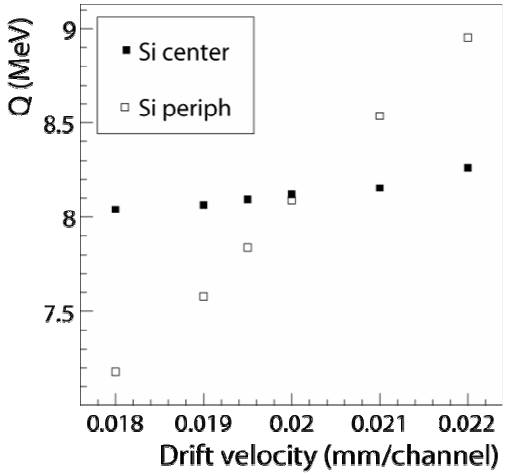
10% threshold :
Resolution > 1.5 mm
+ digitalization!!

Lower threshold
needed!!!

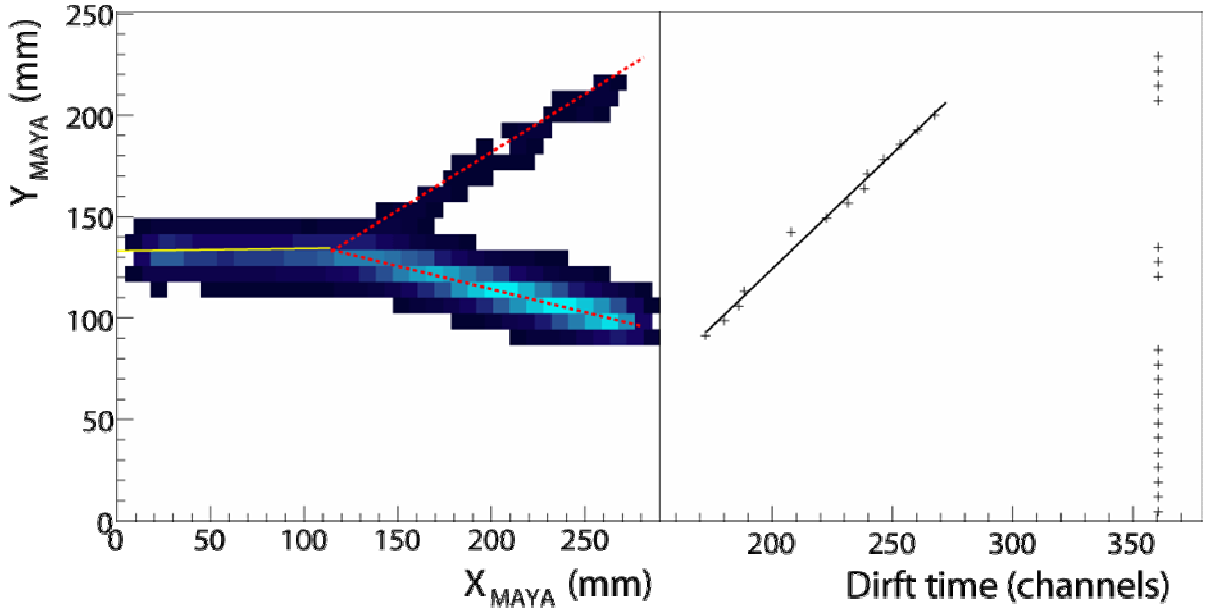
Getting 3rd dimension…

Drift velocity calibration
→ using physics!





Reaction plane angle



Resolution > 3°

Requires at least 2 wires

→ Limitation : lΦl < 60°

Solutions :

- more wires
- time signal from pads

Summary

Observable	Resolution	Difficulties	Solutions…
ΔE_{PAD}	> 1 au	Dynamics No absolute calibration	Better charge resolution Increase dynamics
θ_{2D}	~ 1°	Thickness of the track Range of particles	Smaller pad size Increase dynamics
Φ	> 3°	Number of wires/points	More wires – time signal on pads
Range	~ 1.5 mm	Influence of the threshold	Lower threshold