

Tracks in hadron showers

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CALICE HCal meeting

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Overview

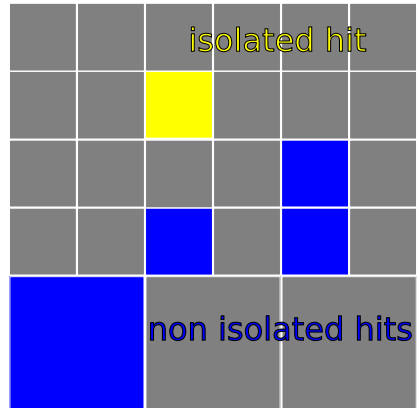
- 1 Update on tracking
 - algorithm reminder
 - angle correction
- 2 parameter search inspired by Hough Transformation
 - idea
 - line parameters
 - first results
- 3 GEV

Tracking in hadronic showers

We are using the analog HCal only
For more information see CAN-013

Algorithm

- 1 Find all isolated hits / layer

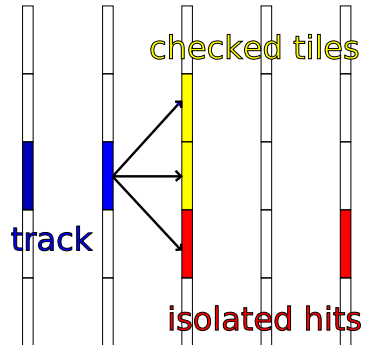


Tracking in hadronic showers

We are using the analog HCal only
For more information see CAN-013

Algorithm

- 1 Find all isolated hits / layer
- 2 Start at innermost layer, connect hits at roughly same position in adjacent layers

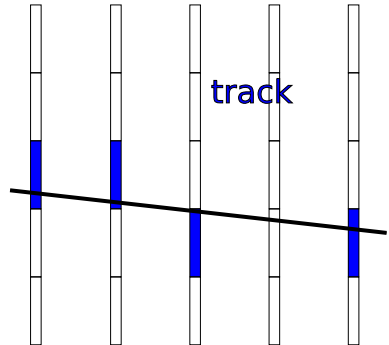


Tracking in hadronic showers

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Algorithm

- 1 Find all isolated hits / layer
- 2 Start at innermost layer, connect hits at roughly same position in adjacent layers
- 3 Use the finished track



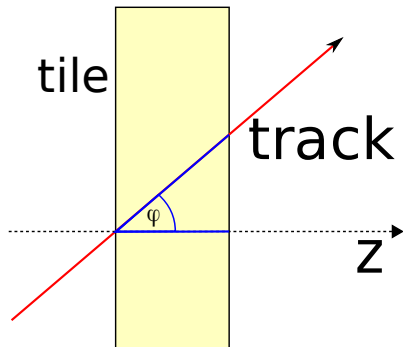
angle correction

Incident π hits @ central region

- ⇒ cells in outer region are hit by tracks with high angle
- ⇒ longer passage through the tile
- ⇒ more energy deposited
- ⇒ angle correction necessary

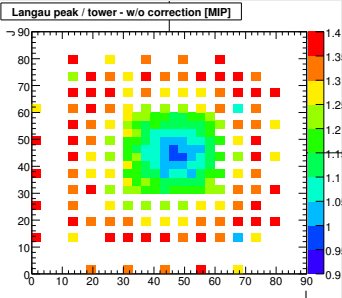
angle correction

$$E_{\text{corrected}} = E_{\text{deposited}} \cdot \cos \varphi$$

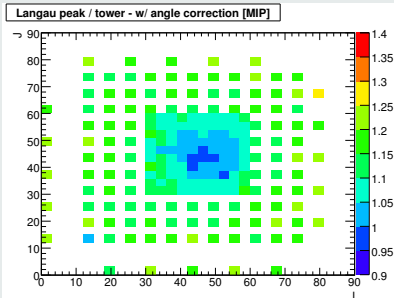


Effect of angle correction

no angle correction

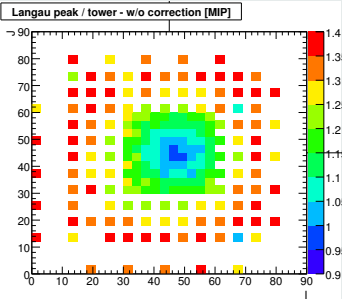


w/ angle correction

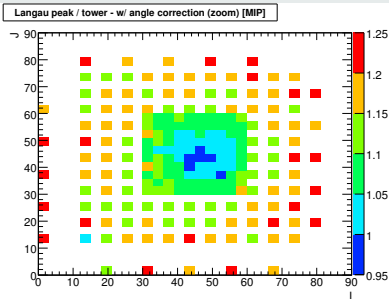


Effect of angle correction

no angle correction



w/ angle correction



Interpretation

Angle correction works, but is not strong enough!

⇒ maybe another physical effect?

Possible solution: landau peak is thickness dependant?

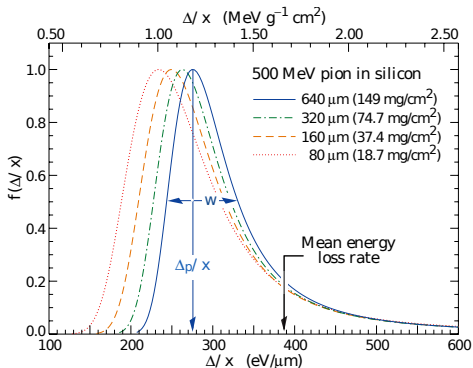
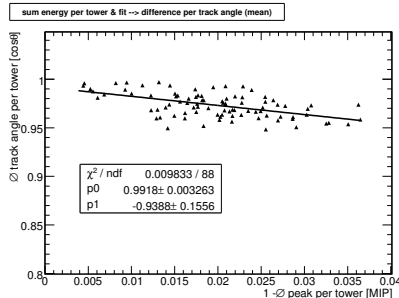


Figure 27.7: Straggling functions in silicon for 500 MeV pions, normalized to unity at the most probable value $\delta_{p,x}$. The width w is the full width at half maximum.

taken from Particle Data Book 2008, July 24

will be checked!

landau peak thickness dependant?



First results

- Plot shows deviation from expected value of 1 MIP vs $\cos \phi$
- If angle correction was sufficient: straight line
- Early result! Needs more investigation.

Tracking: parameter search - idea

A parameter search inspired by Hough Transformation.

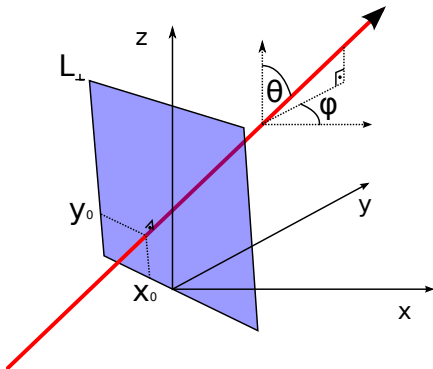
Idea

each (infinite) 3 dimensional line has 4 parameters

- θ, ϕ for the direction
- an arbitrary 3D point of the line for the position.
Infinite possibilities \rightarrow reduces by 1 dimension.

\Rightarrow We need 4 parameters

Tracking: parameter search - line parameters



Ansatz: the parameters

(θ, ϕ) as in spherical coordinate

(x_0, y_0) of the layer L_{\perp} perpendicular to (θ, ϕ)

Tracking: parameter search - algorithm

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 - For each hit calculate (x_0, y_0) , i.e. take (x, y) of rotated detector hit
 - Fill this combination of (θ, ϕ, x_0, y_0) into a histogram (parameter space)

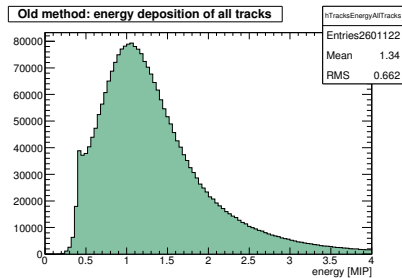
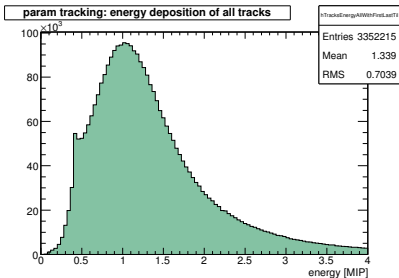
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- Filter these tracks according to minimum required number of hits, gap sizes ..

Tracking: parameter search - first results



Impressions

- results look good
- tracks are splitted very often
- ≈ 100 times slower than old method
- For picture see next slide

The GEV: Generic Event Viewer

Properties

- Based on Qt and OpenGL
- Written by Andreas Moll (MPP) for Belle/Belle2 as official Event Display
- Generic InputModule interface for easy addition of other data input sources like LCIO
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- Please press ALT-TAB for live demo :)

