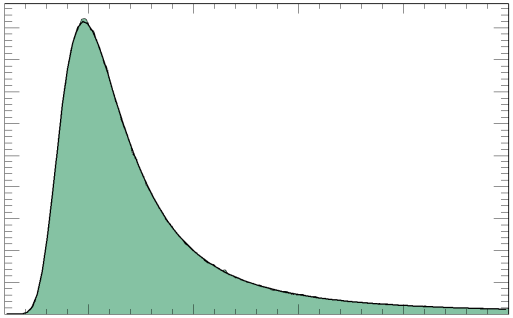
Update of Tracking Studies in Hadronic Showers

Lars Weuste
Diploma student

Calibration of the HCal

- MIPs passing through matter generate a Landau energy distribution



  ➔ Use the peak to calibrate the tile

Problem: The Landau represents the mean energy deposition of one passing particle.

Idea: Try to find isolated tracks in the HCal.

➔ Only single particle hits

Calibration via Tracking

Plan:

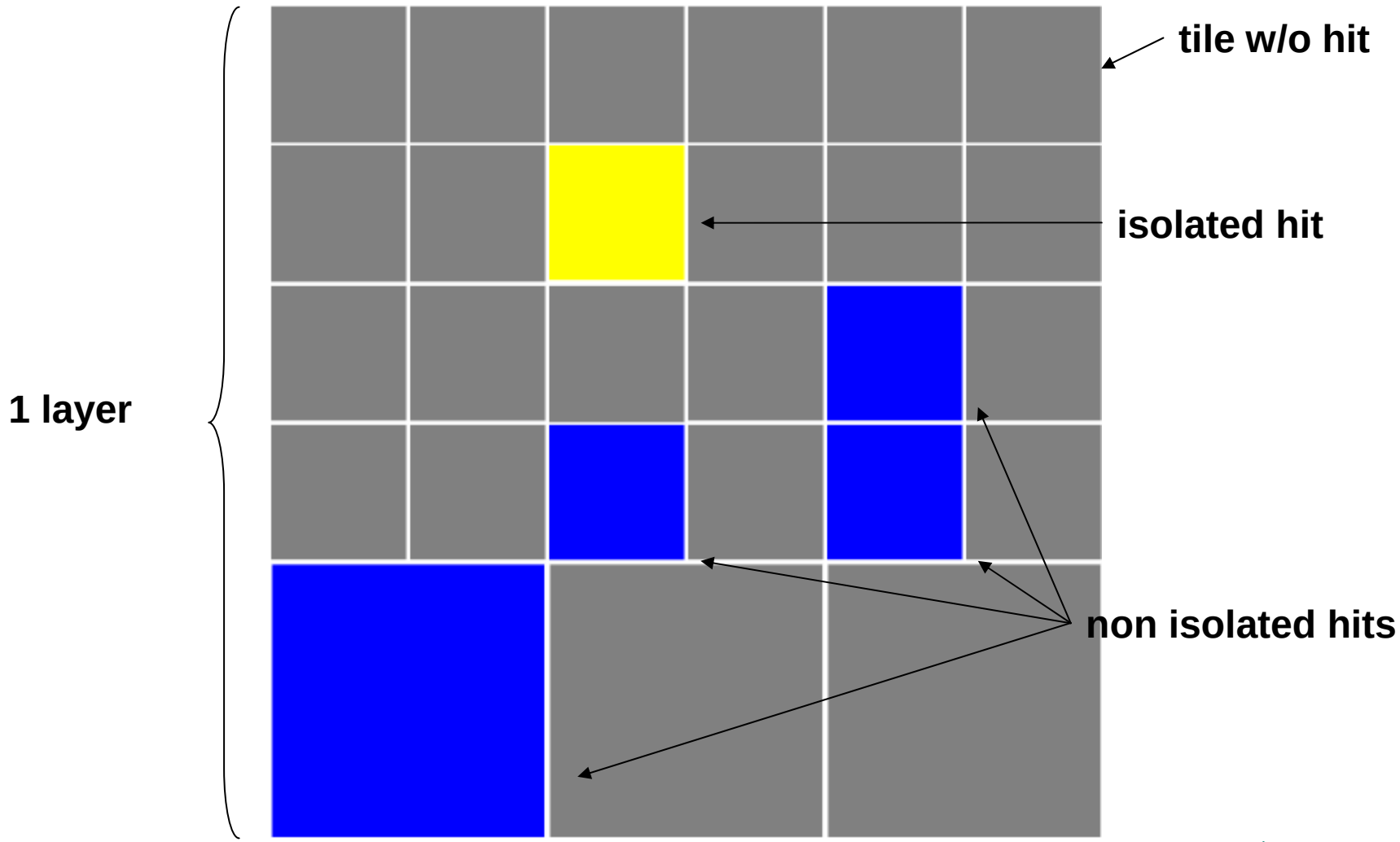
1) Find all isolated hits in an event

2) Try to find tracks consisting only of these isolated hits

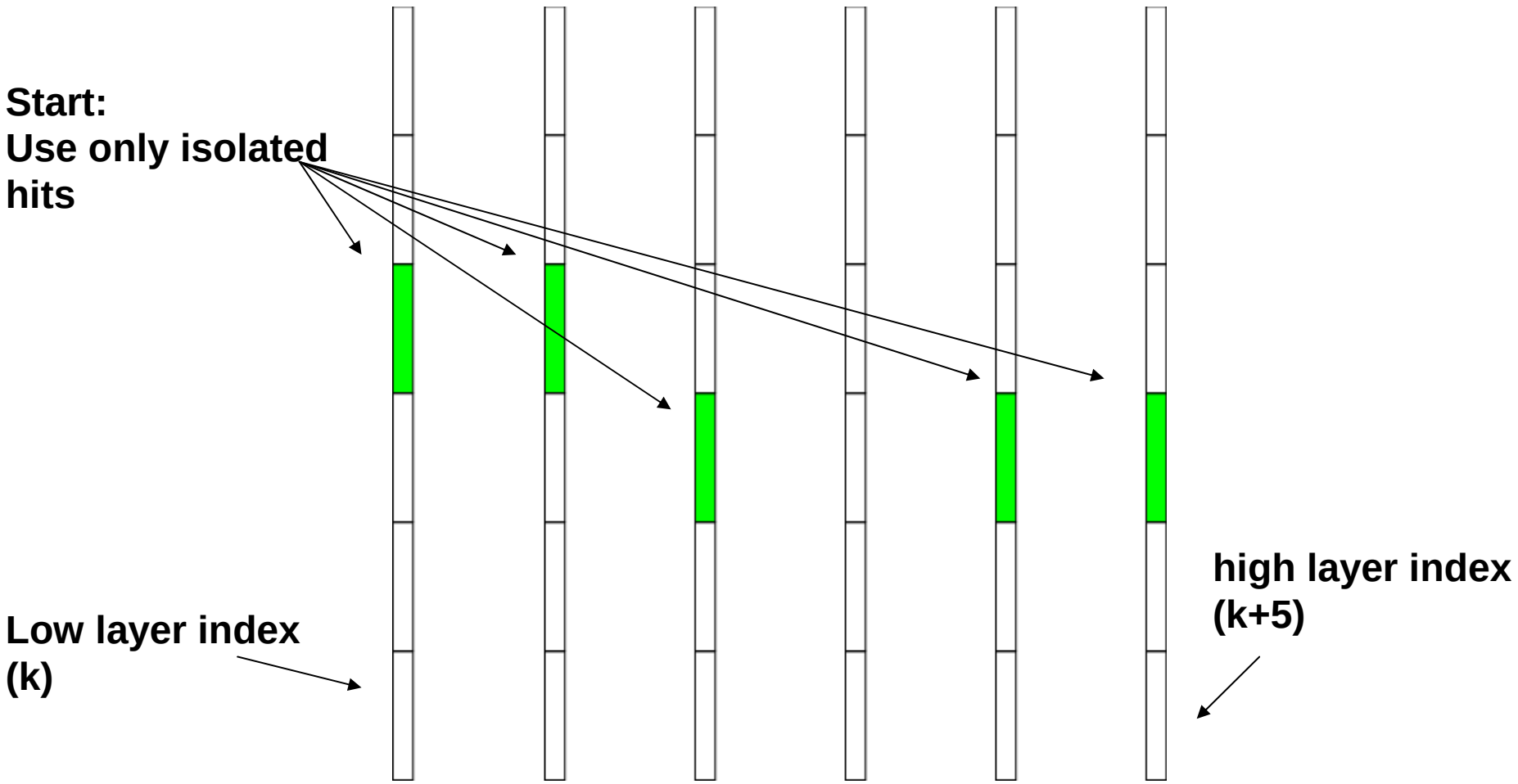
3) Fill the energy deposition for each tile into its own histogram

4) Move the Landau for each tile to one point

1.) Isolation criteria



2.) principle of the algorithm



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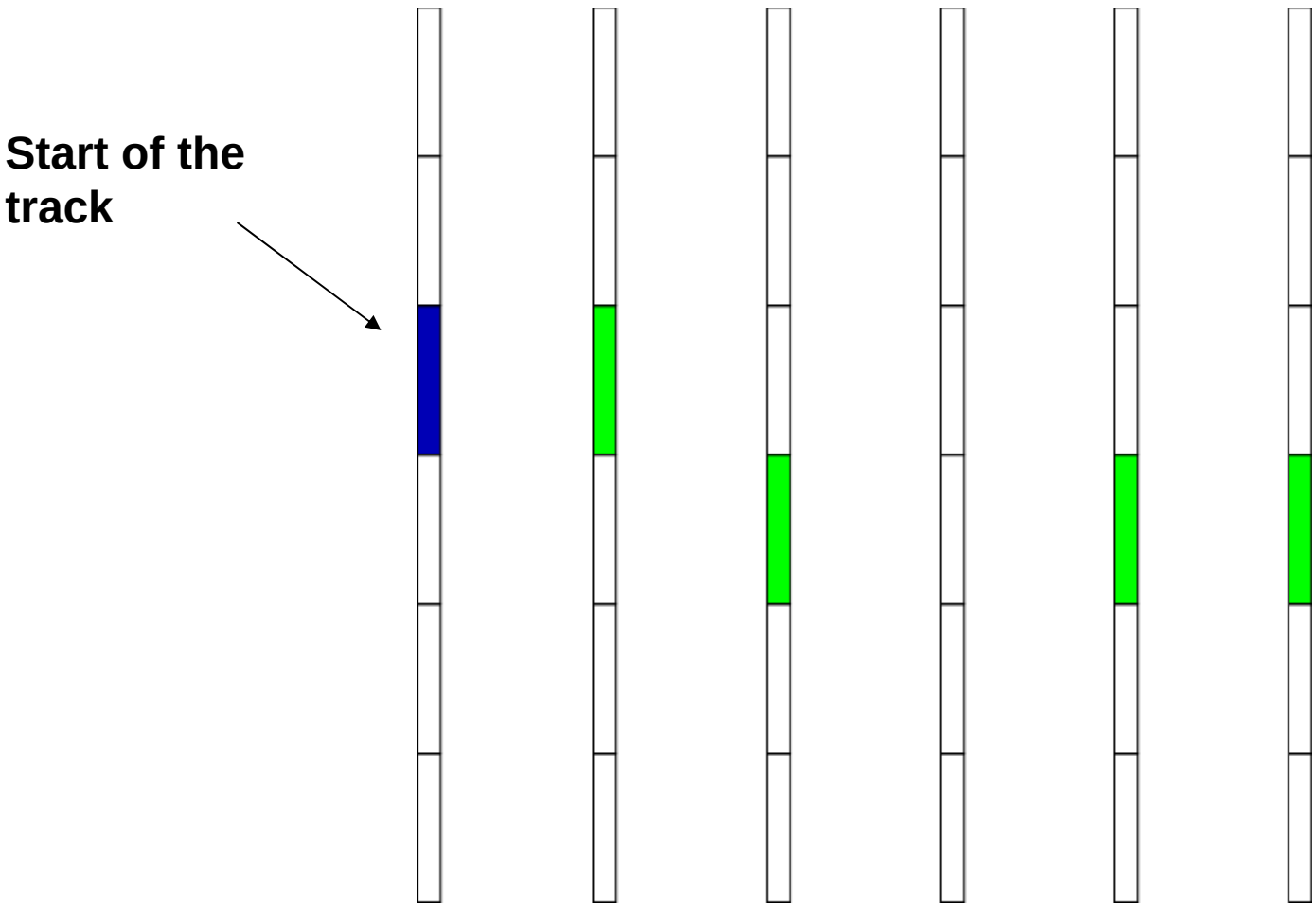
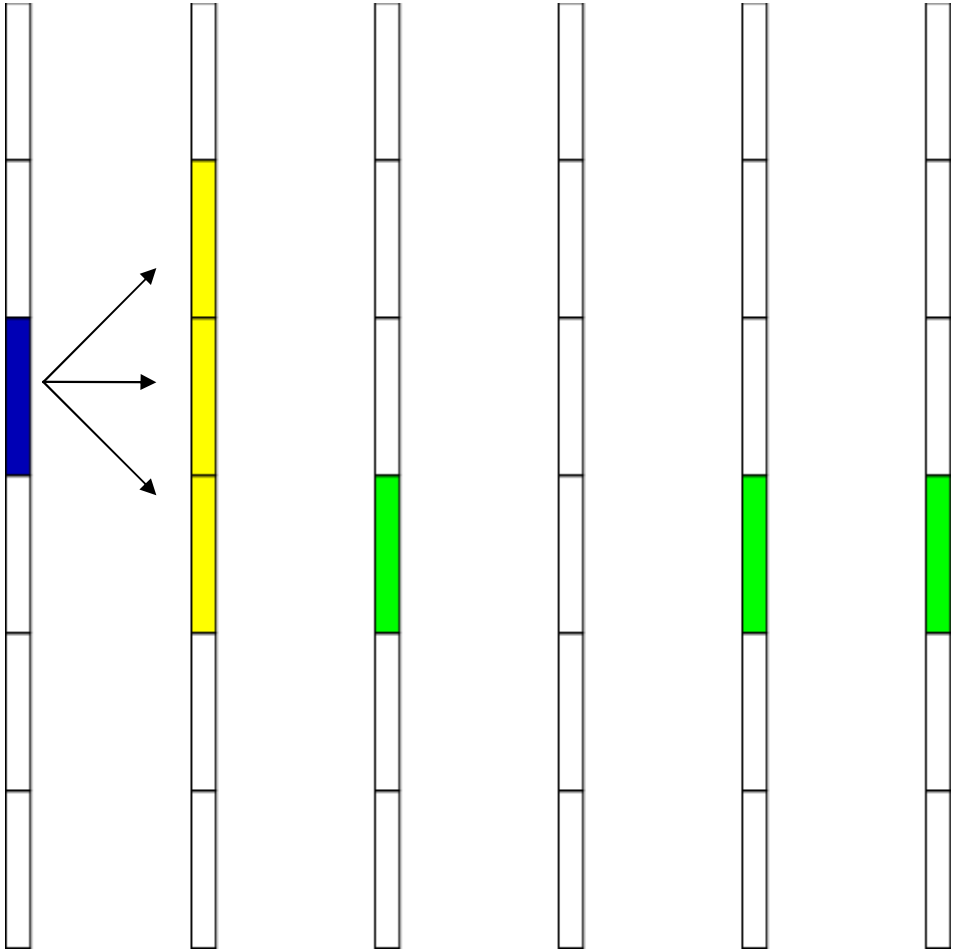


2.) principle of the algorithm

advance 1 layer and check direct neighbours



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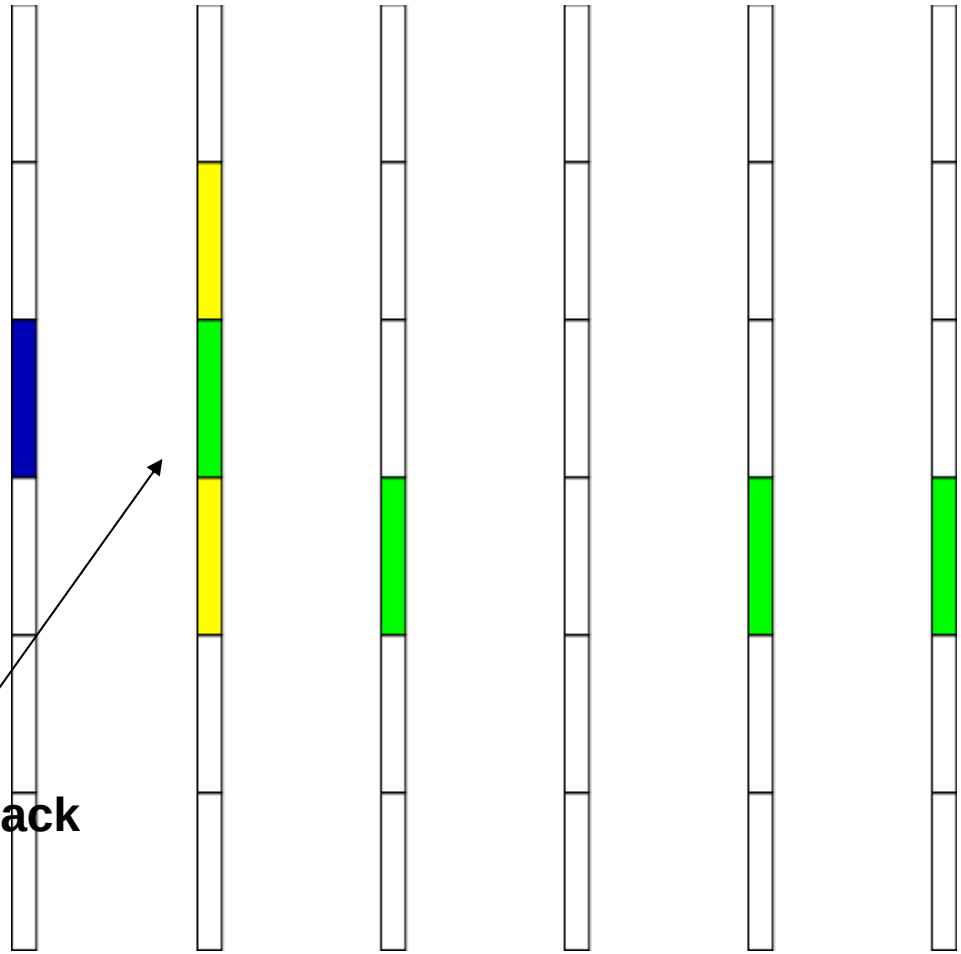
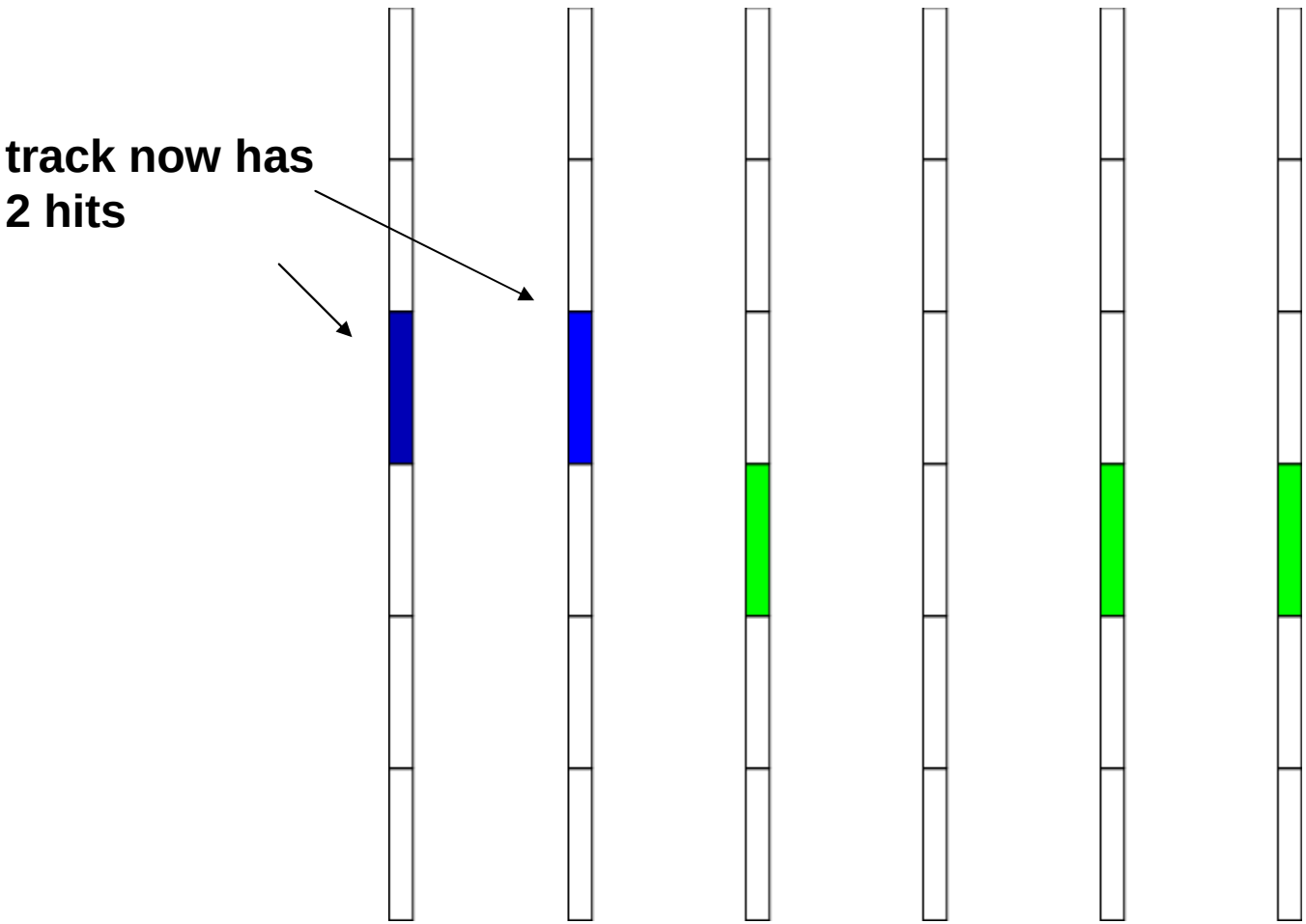
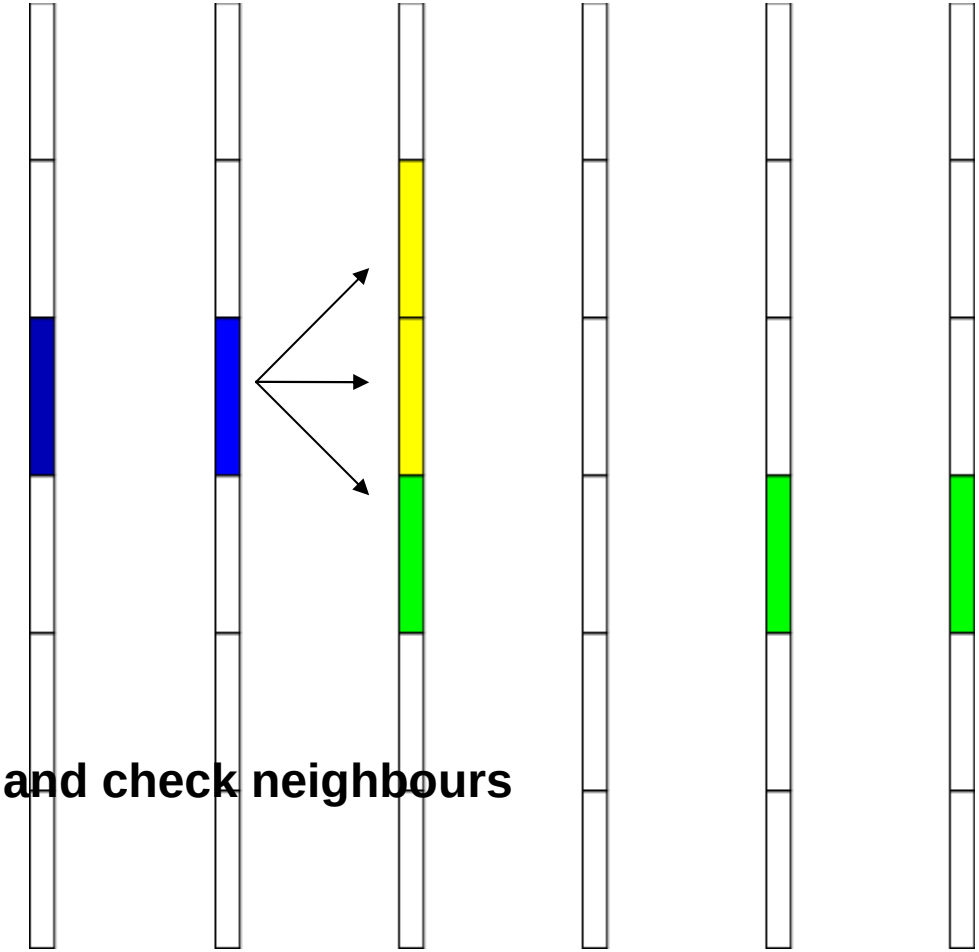


this is an isolated hit
➜ use it to continue track

2.) principle of the algorithm



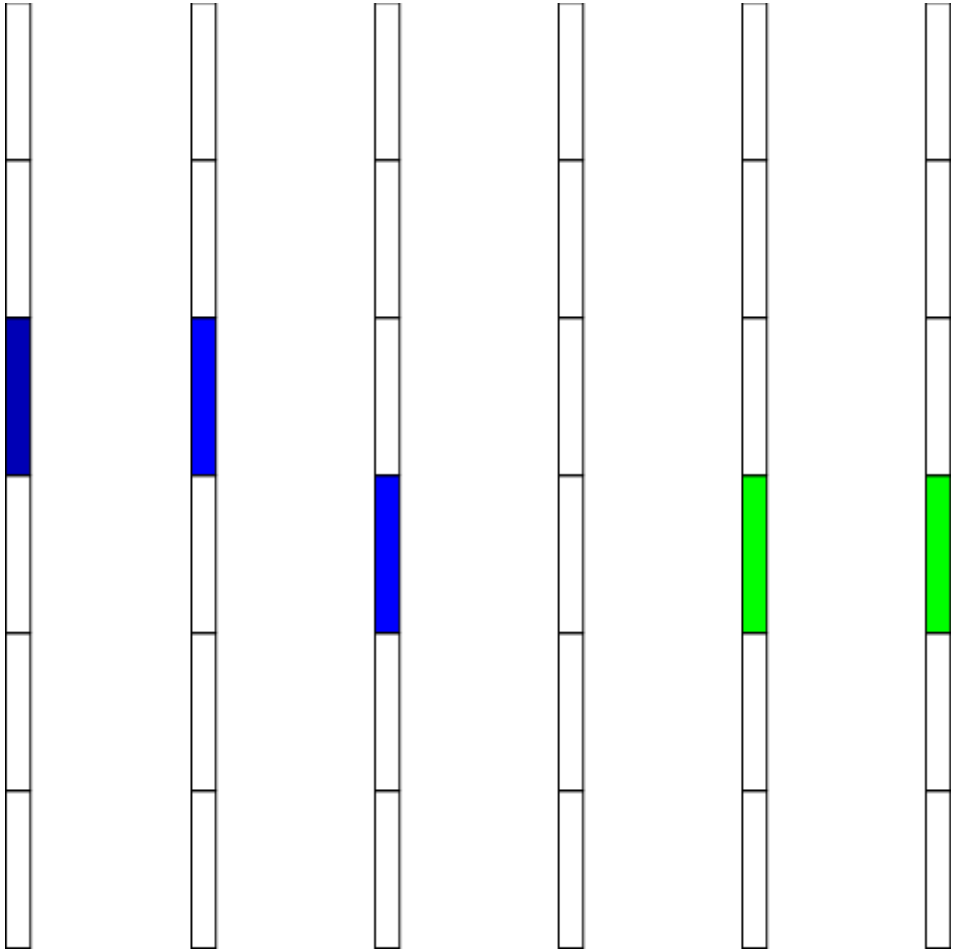
2.) principle of the algorithm



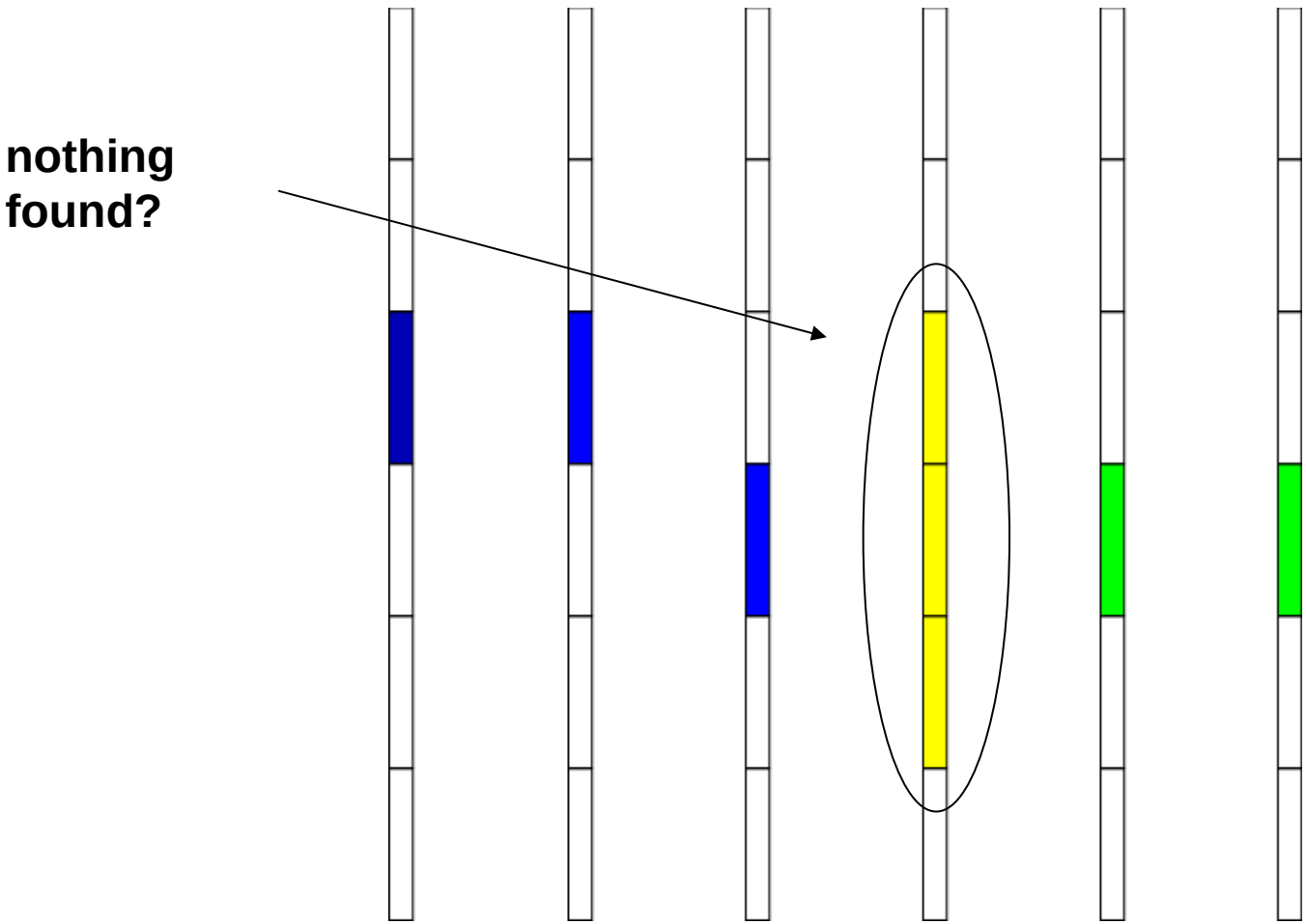
same here:
advance 1 layer and check neighbours

2.) principle of the algorithm

track continues ...

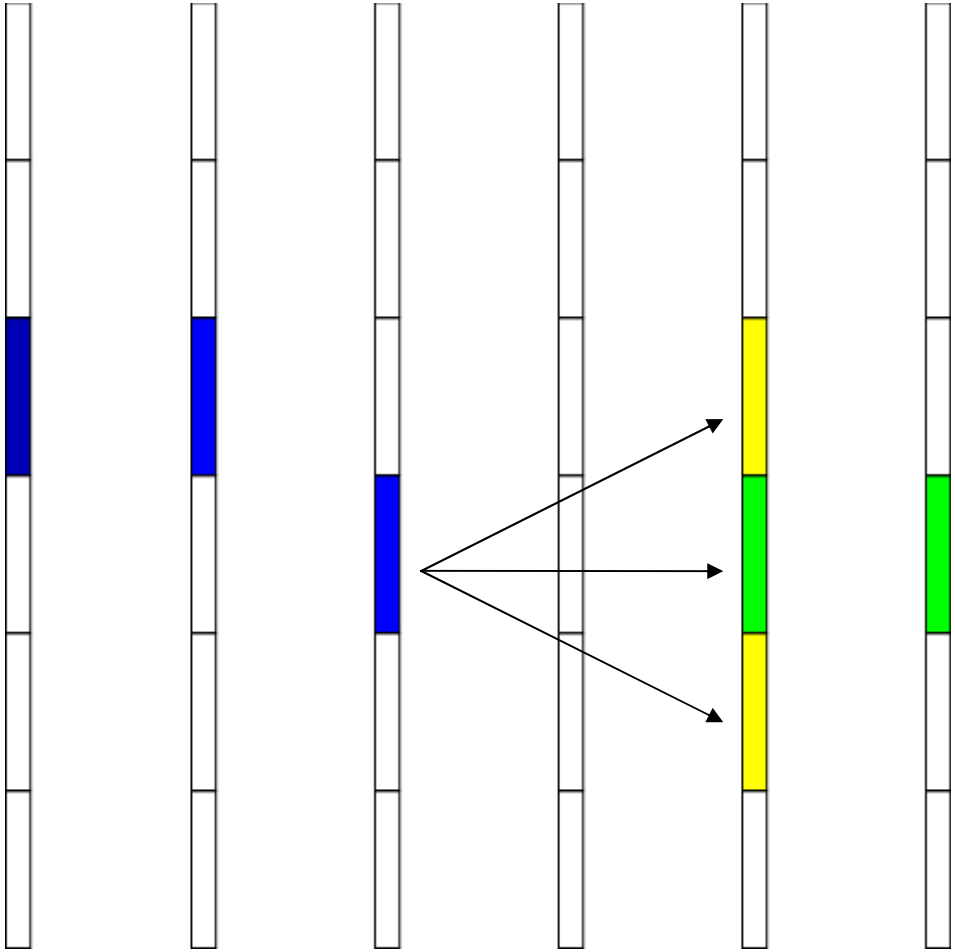


2.) principle of the algorithm



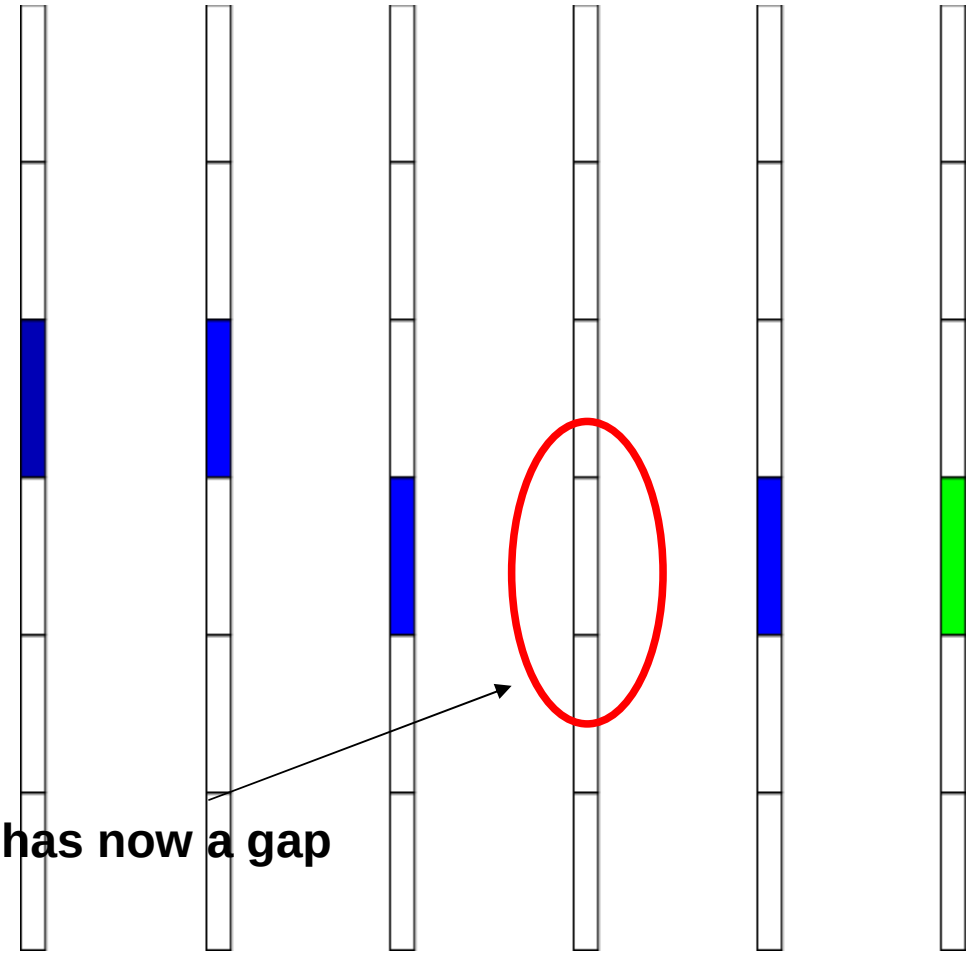
2.) principle of the algorithm

continue searching in next layer!



2.) principle of the algorithm

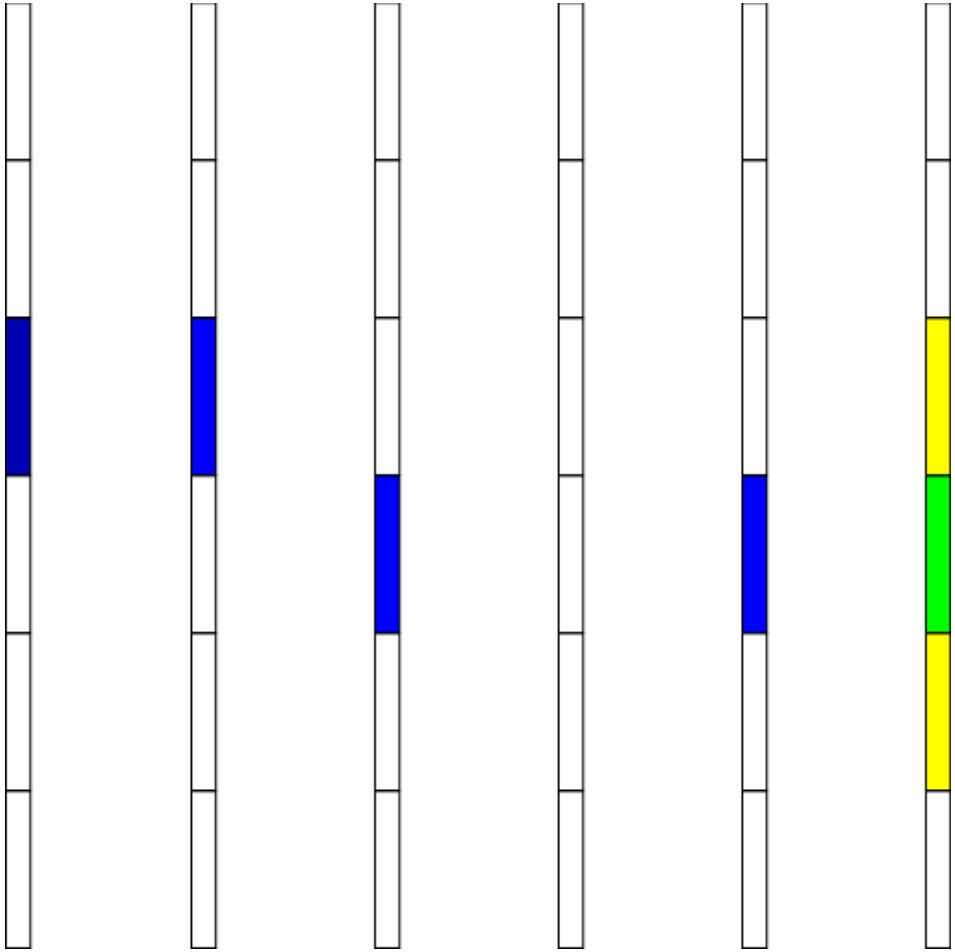
Worked!



Our track has now a gap

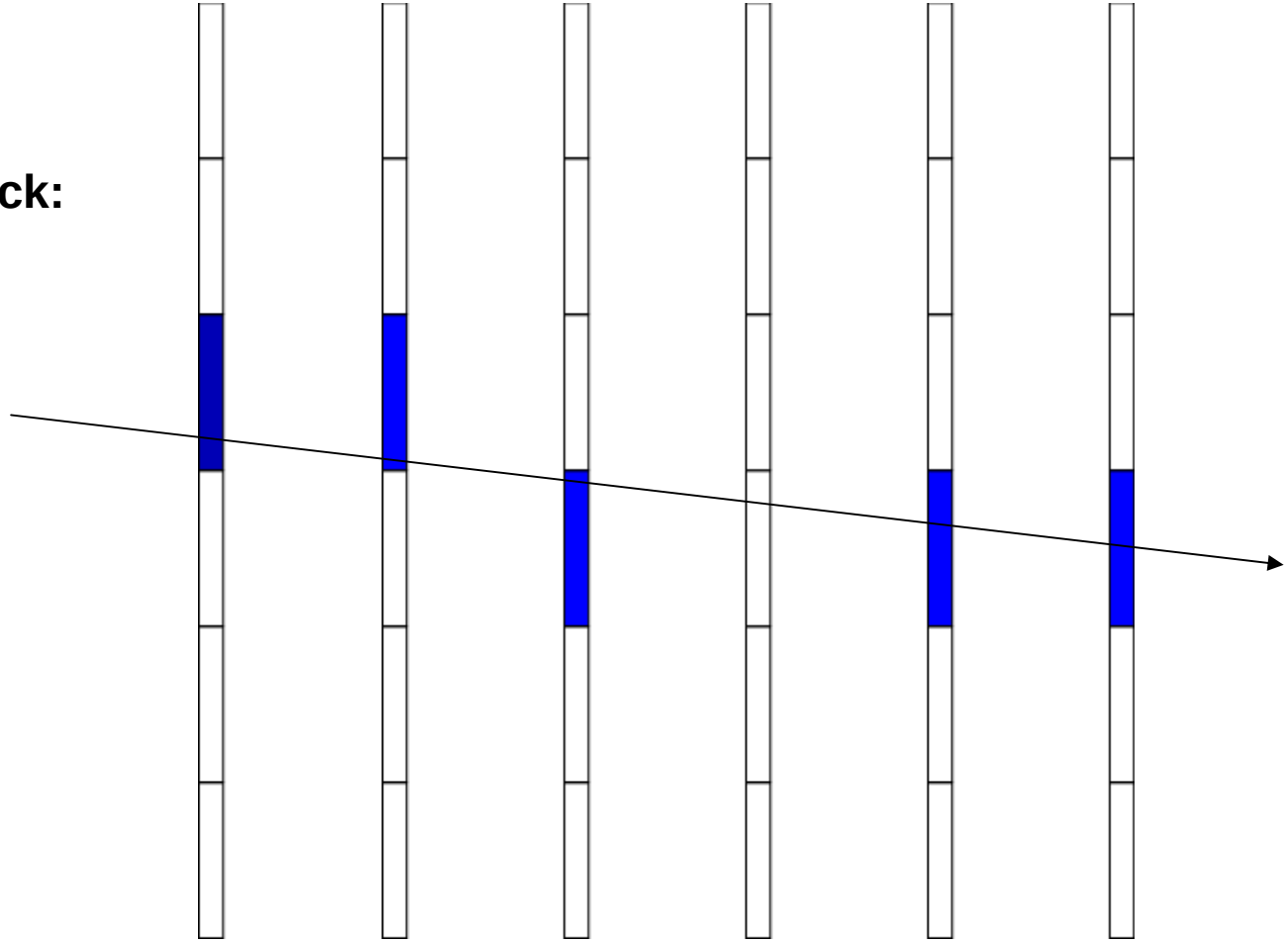
2.) principle of the algorithm

and we continue searching ...

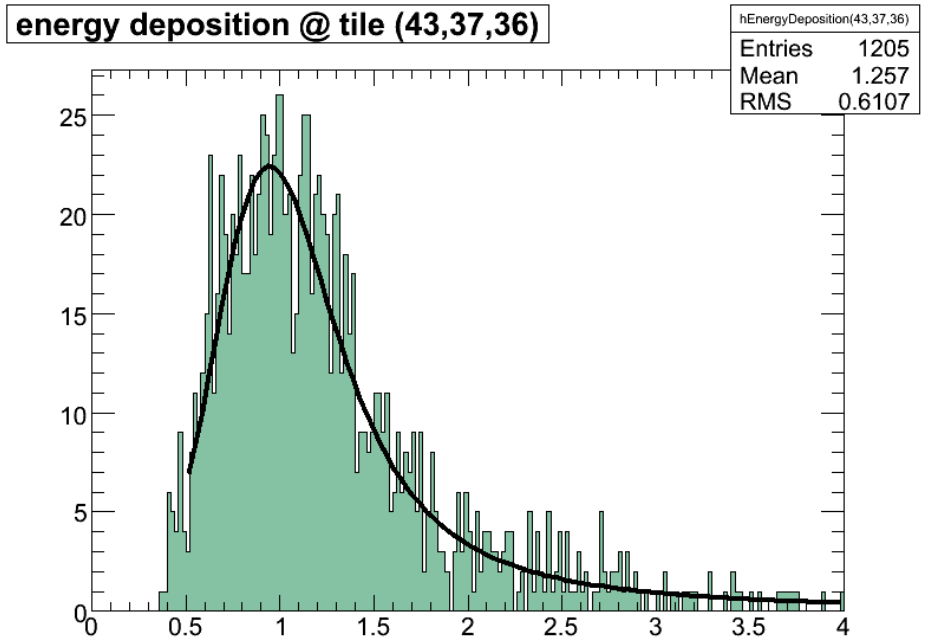


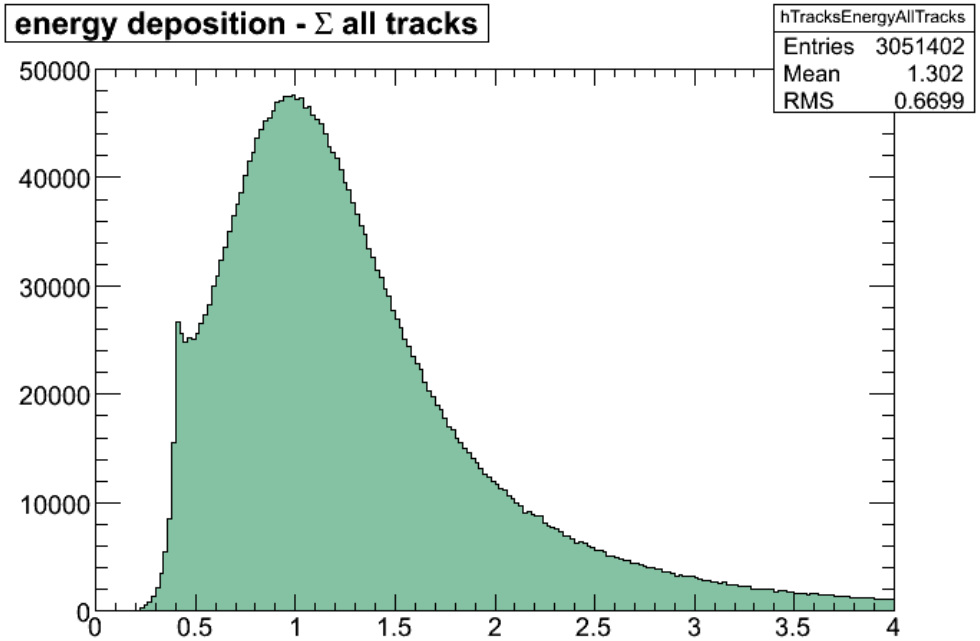
2.) principle of the algorithm

Our found track:



3.) Fill the histograms



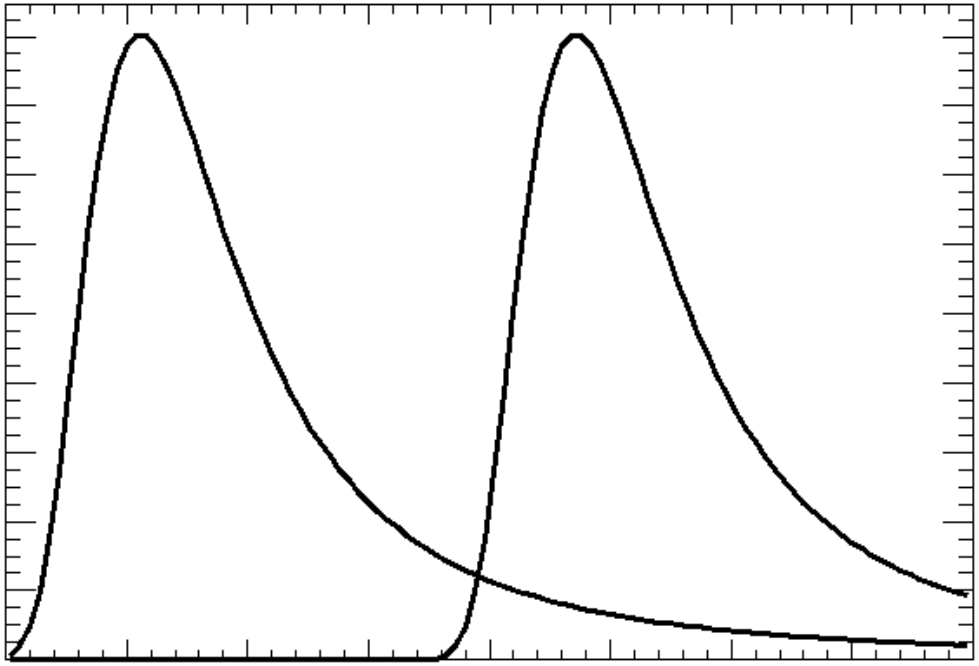


examples from run 330650 – taken @ CERN

the landau function can clearly be seen

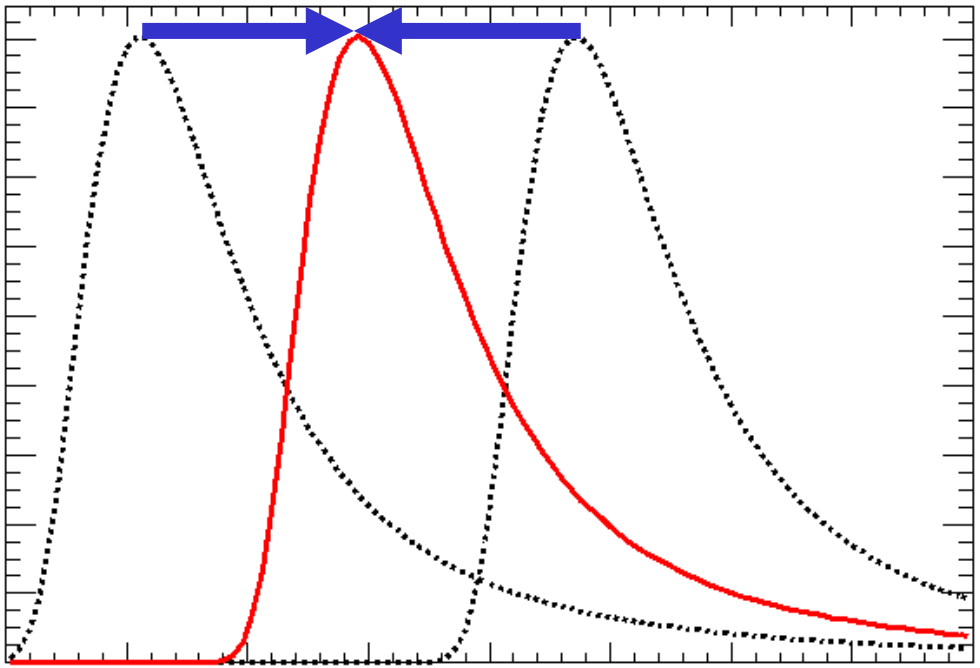
4.) Calibration: principle

Different tiles have initially different landau distributions
(due to local temperature, gain of SiPM, coupling …)

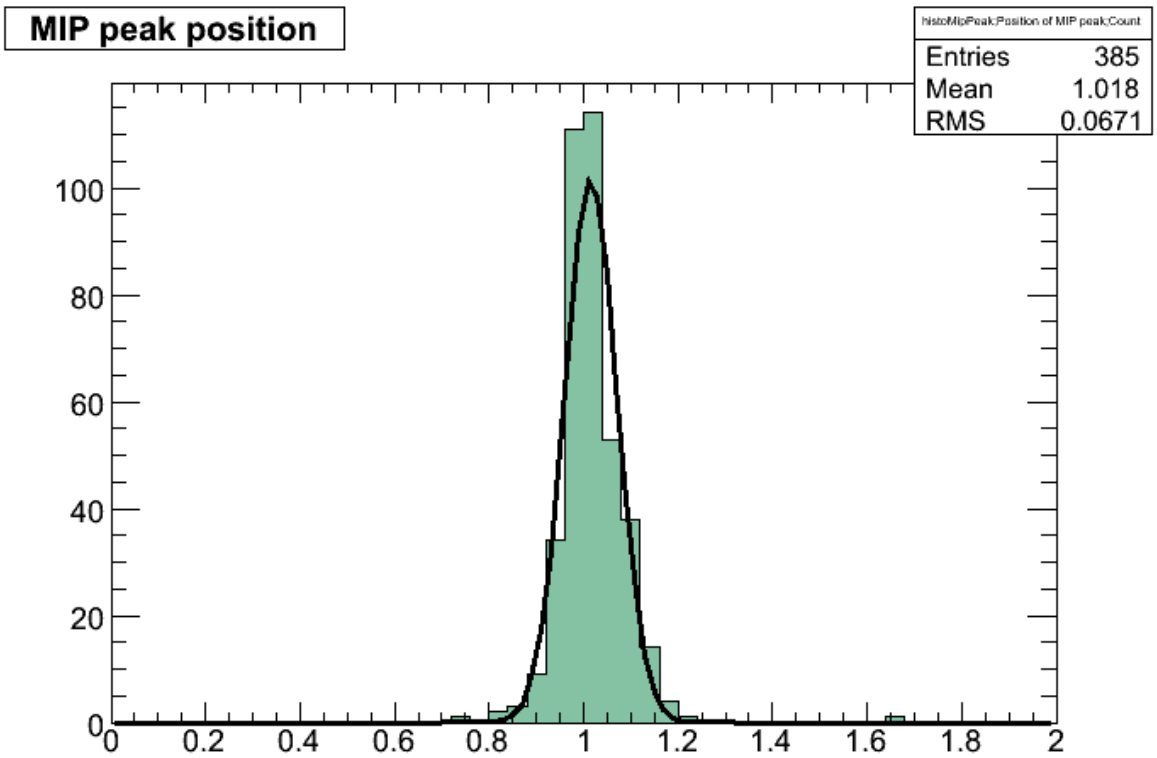


4.) Calibration: principle

Move the landau distributions such that the peak is the same for all

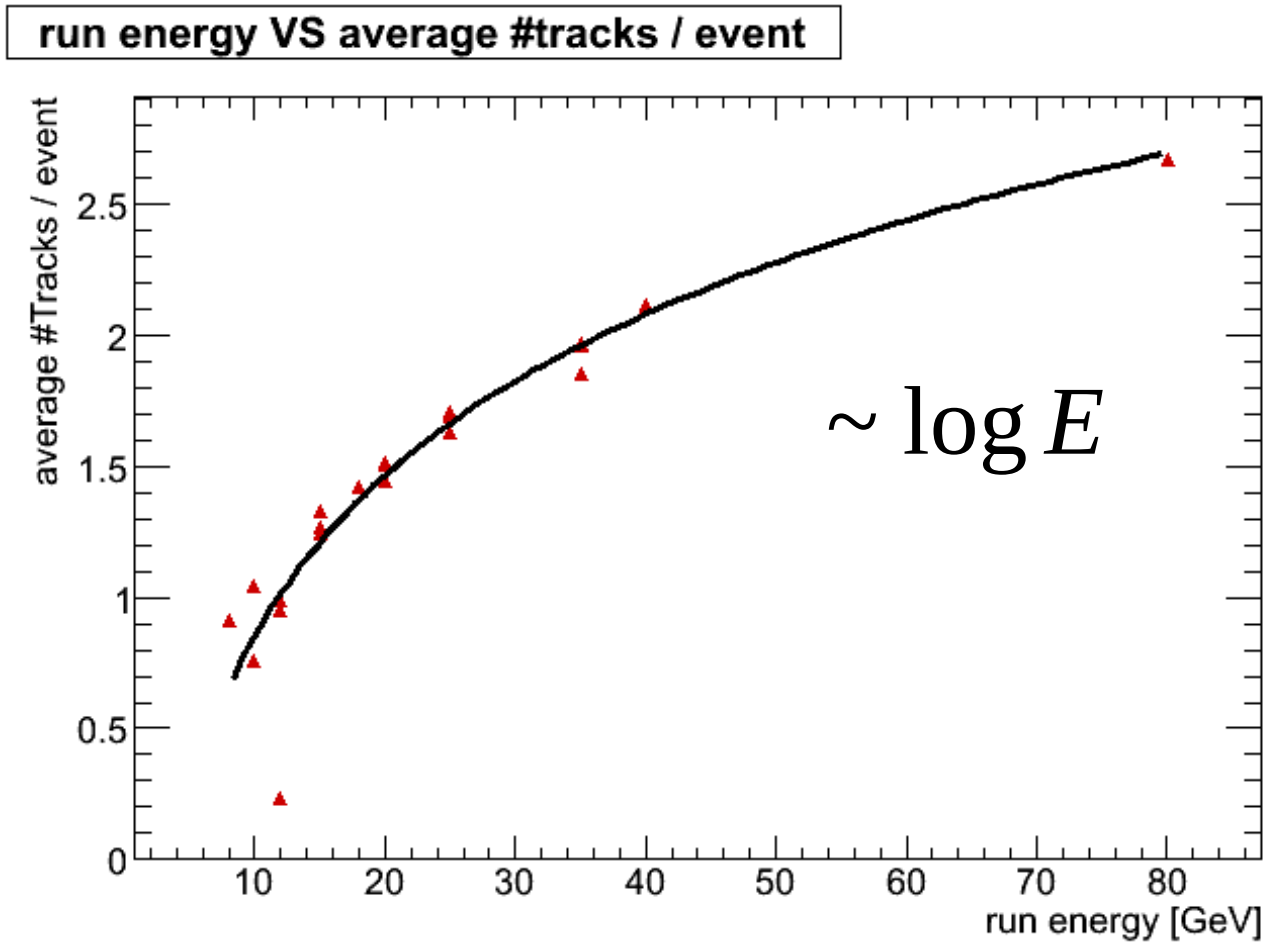


Result: Compare peak position

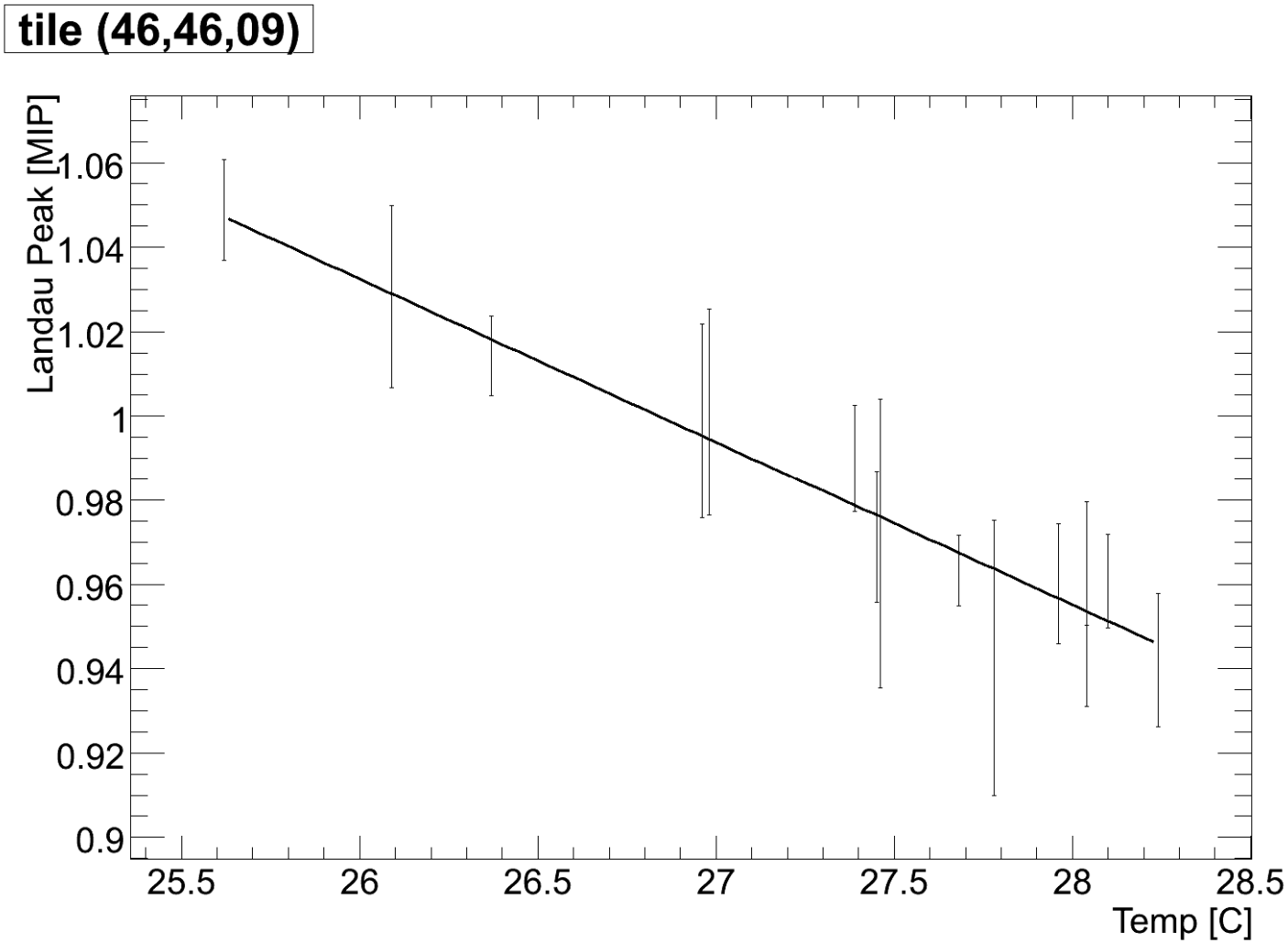


The peak positions of the Landaus are Gauss distributed around 1 MIP

Result: ø tracks / event



Result: temperature dependence



Tracking: the program

- Implementation as MARLIN Processor
- Current parameters:
  - Min track length: 6 layers
  - Max gap size: 1 layer
  - Max gap percentage: 50%

Tracking: Issues

- Max track angle is ~63° (3x3) or ~76° (6x6)
  - ➔ Works best for linear tracks (= no B-field)
- Too much noise reduces isolated track count
- Is this method accurate enough to do calibration?

  → simulation

Summary: Goals of my thesis

- Show that tracking can be a good way to calibrate the calorimeter
- Simulation of CALICE and ILD hadronic calorimeters with several physic models
- Compare simulation results with real CALICE data
- Improve track finding algorithm to work efficiently with magnetic fields