LAMPS-TPC Simulation

HIM @ Andong National University 2013. 12. 07
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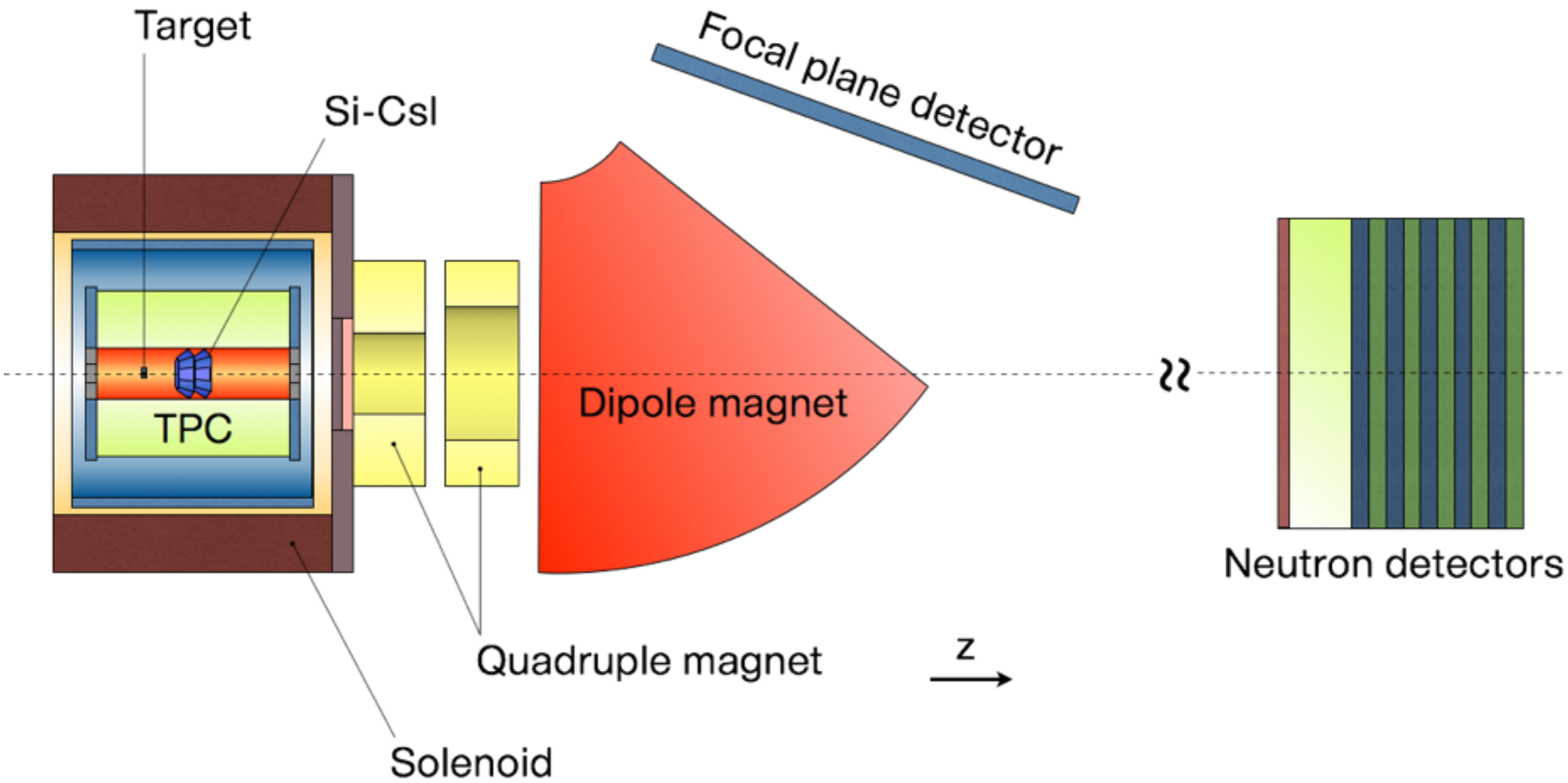
LAMPS@RAON

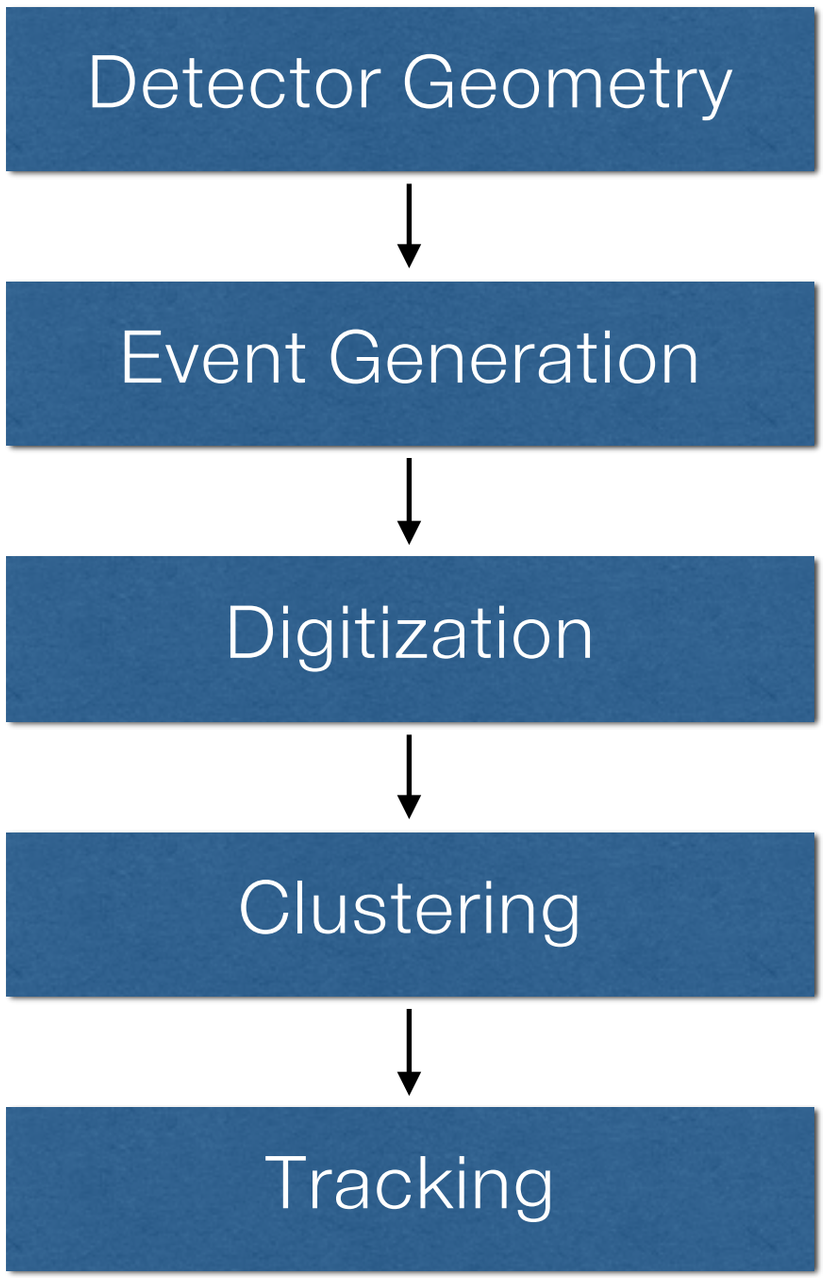
Large Acceptance Multi-Purpose Spectrometer



Time Projection Chamber

- 3D Tracker
- Detect charged particles produced in large angles.
- Using constant drift velocity of electron clouds in the gas.
- GEM detector is used to read charge and position information.

Simulation Steps



: Geant4

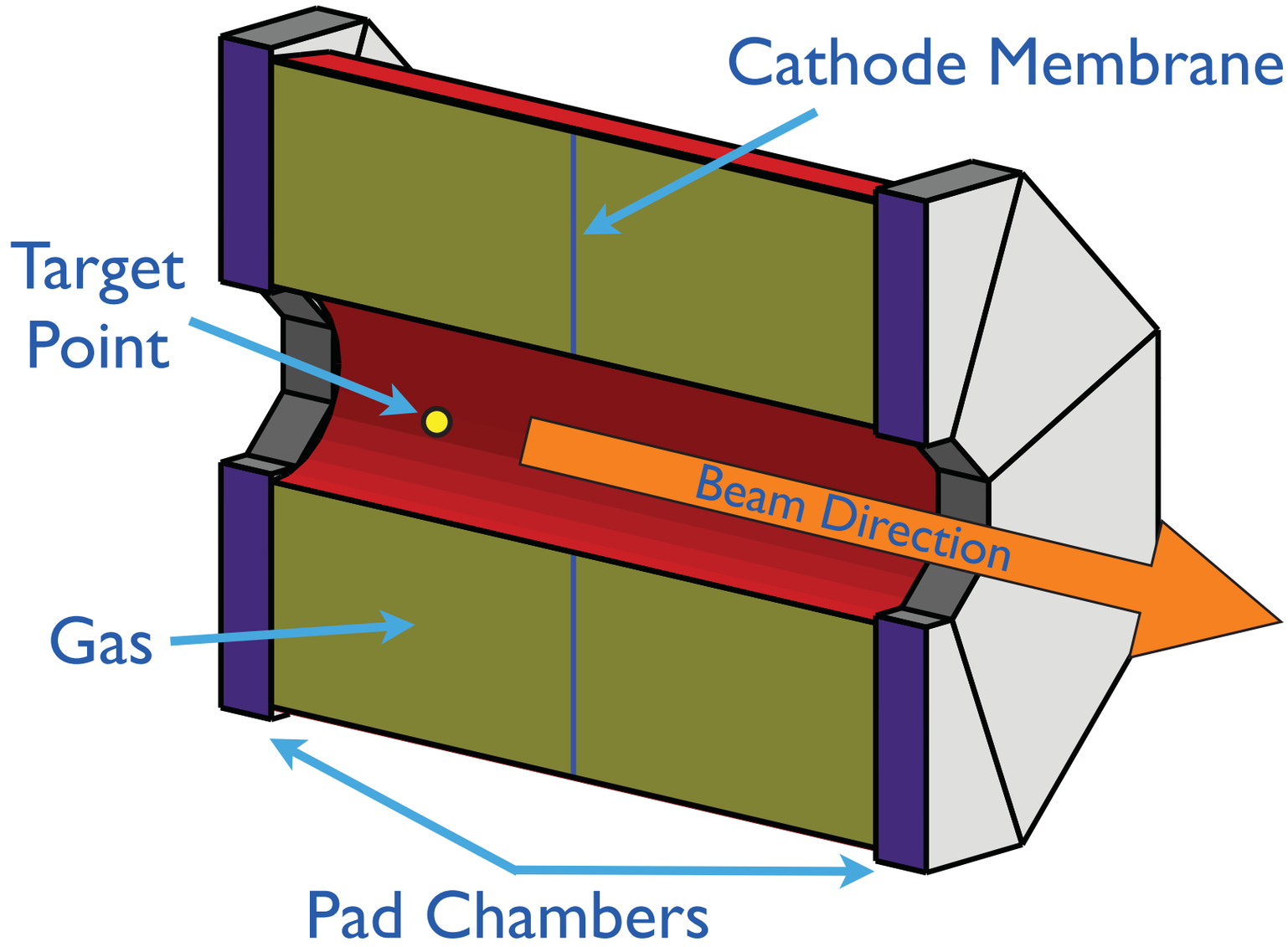
: IQMD Au + Au 250 AMeV

: Diffusion in the gas, GEM response, pad plane distribution of charge.

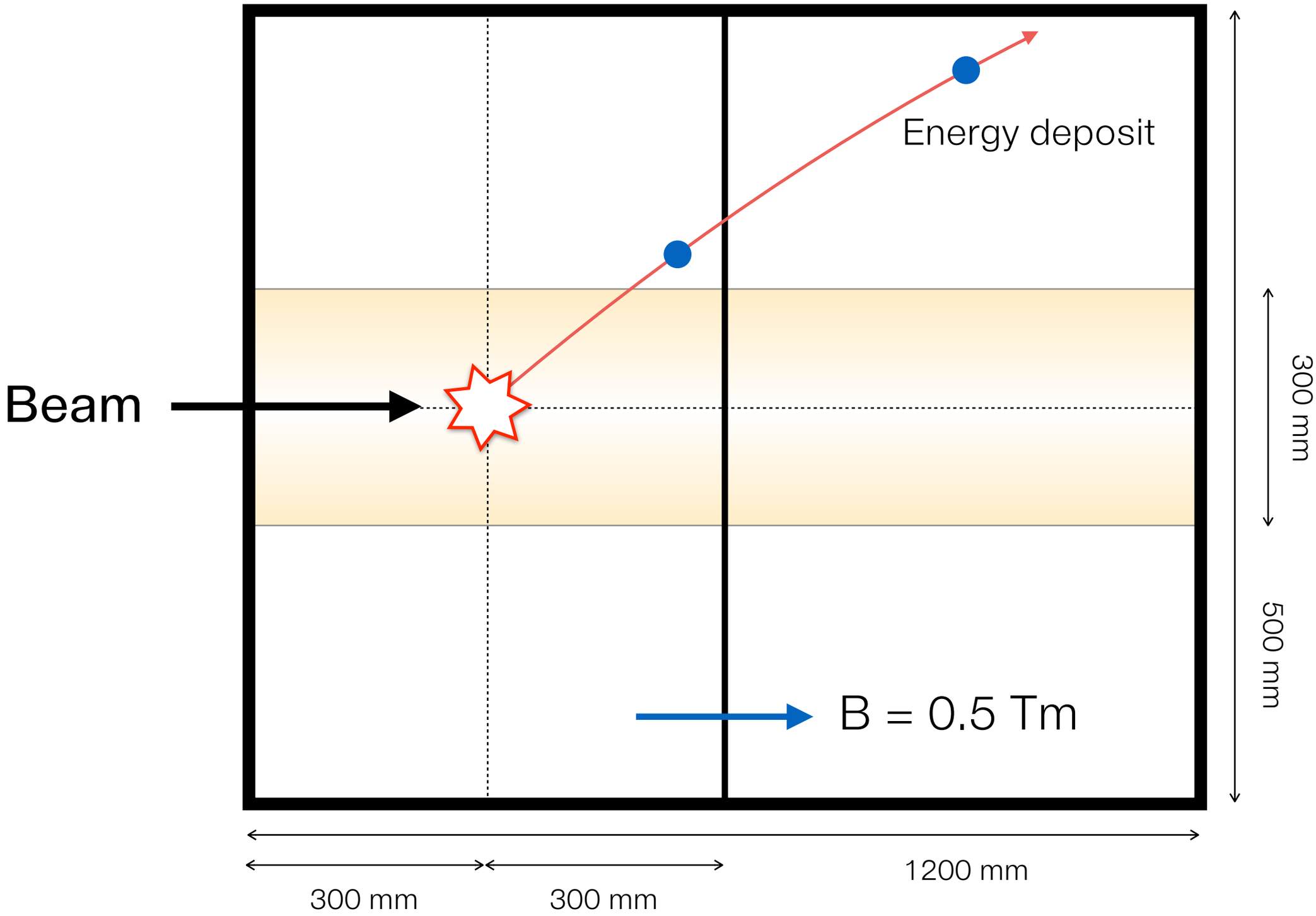
: Find cluster

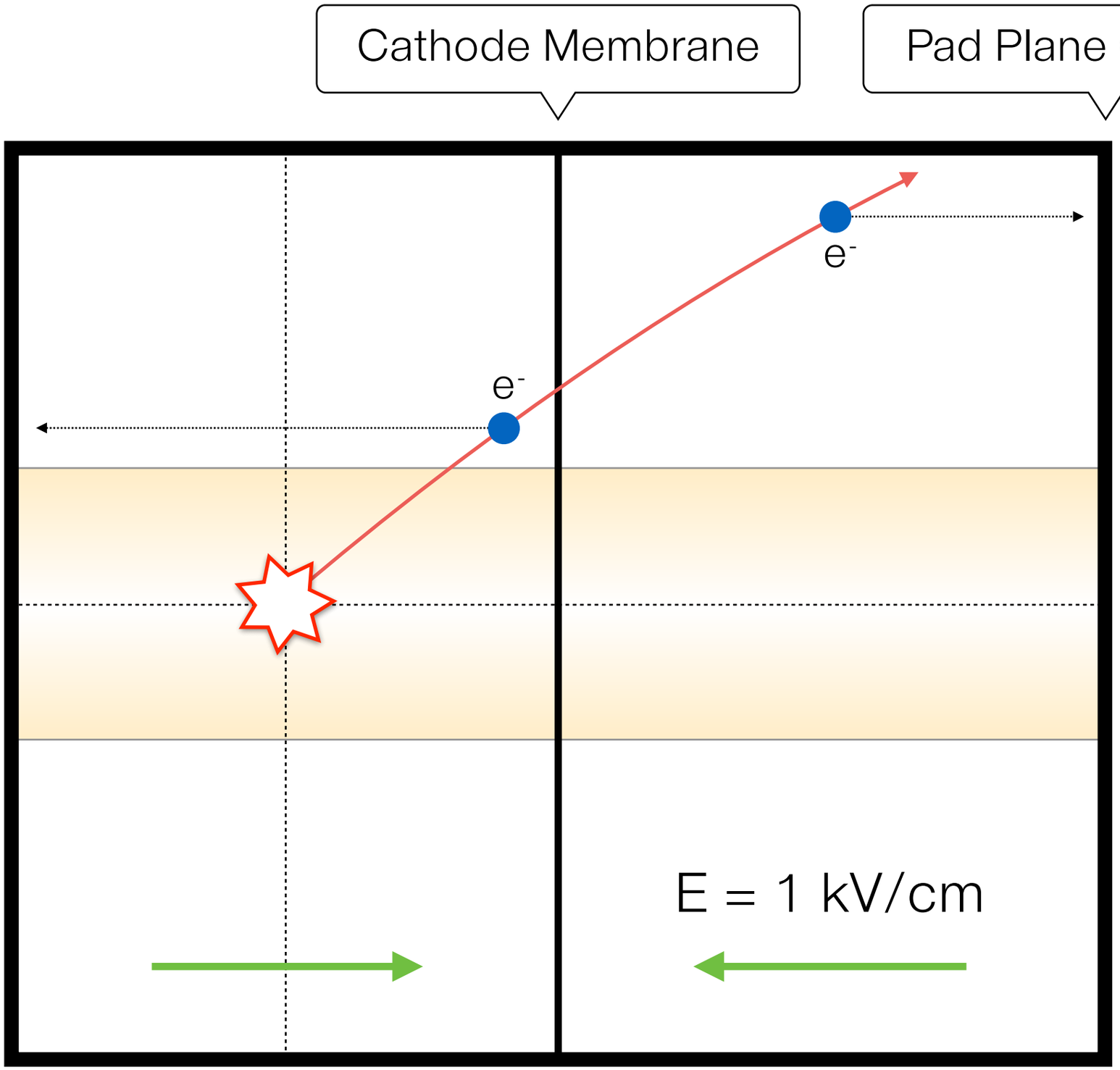
: Reconstruct track based on Kalman filter

TPC Structure

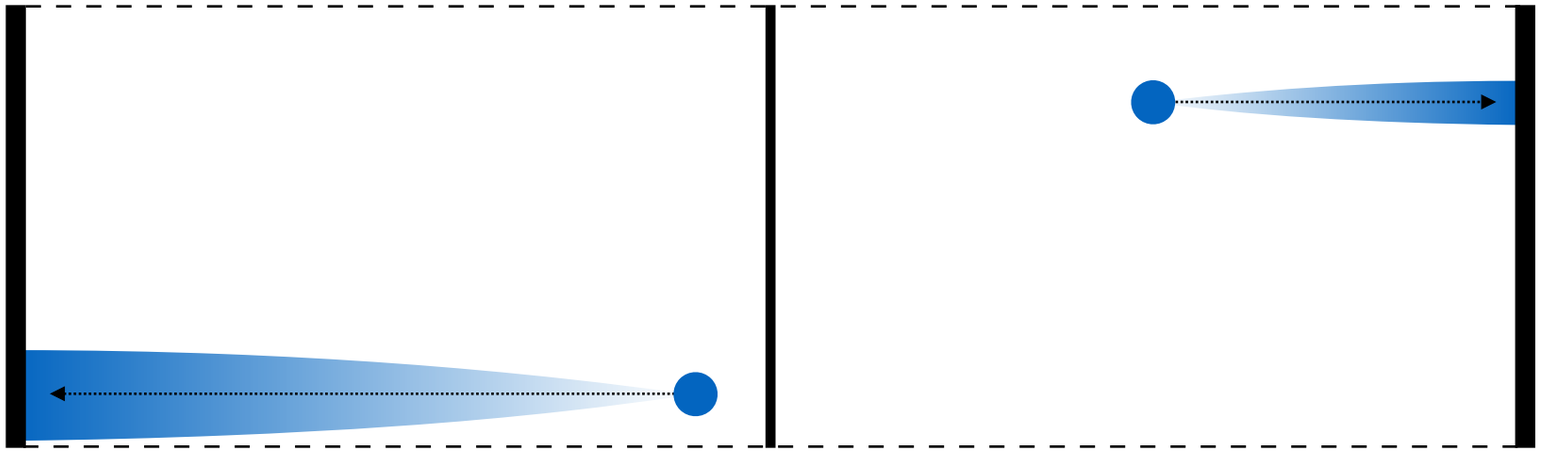


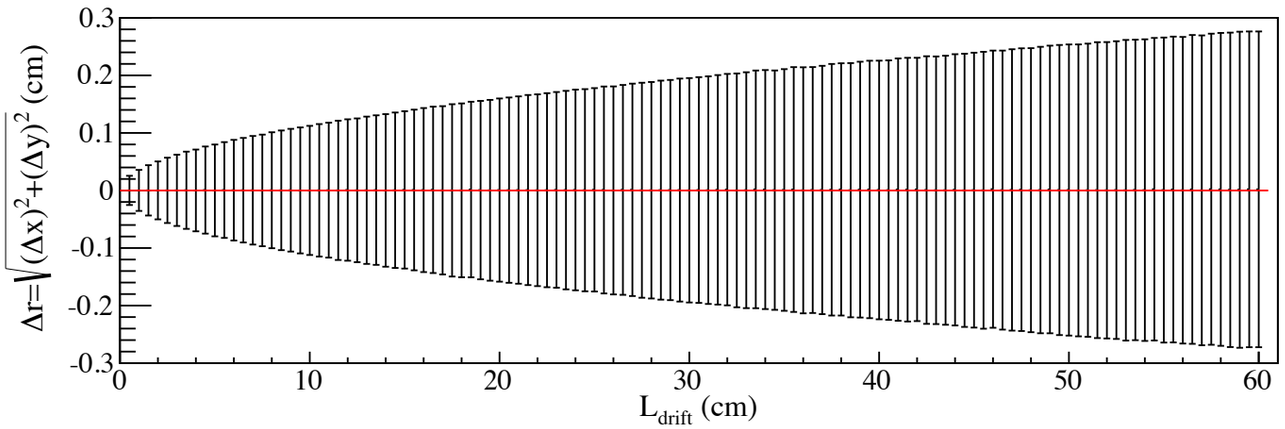
C10(Ar 90% + CO_2 10%) gas is used

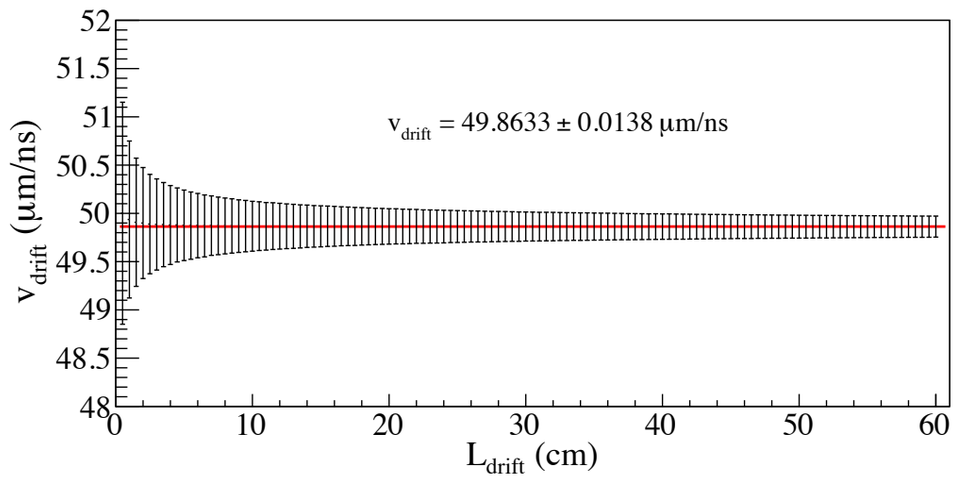



Cathode Membrane
Pad Plane Chamber
e-
e-
E = 1 kV/cm

Electron Drift Simulation



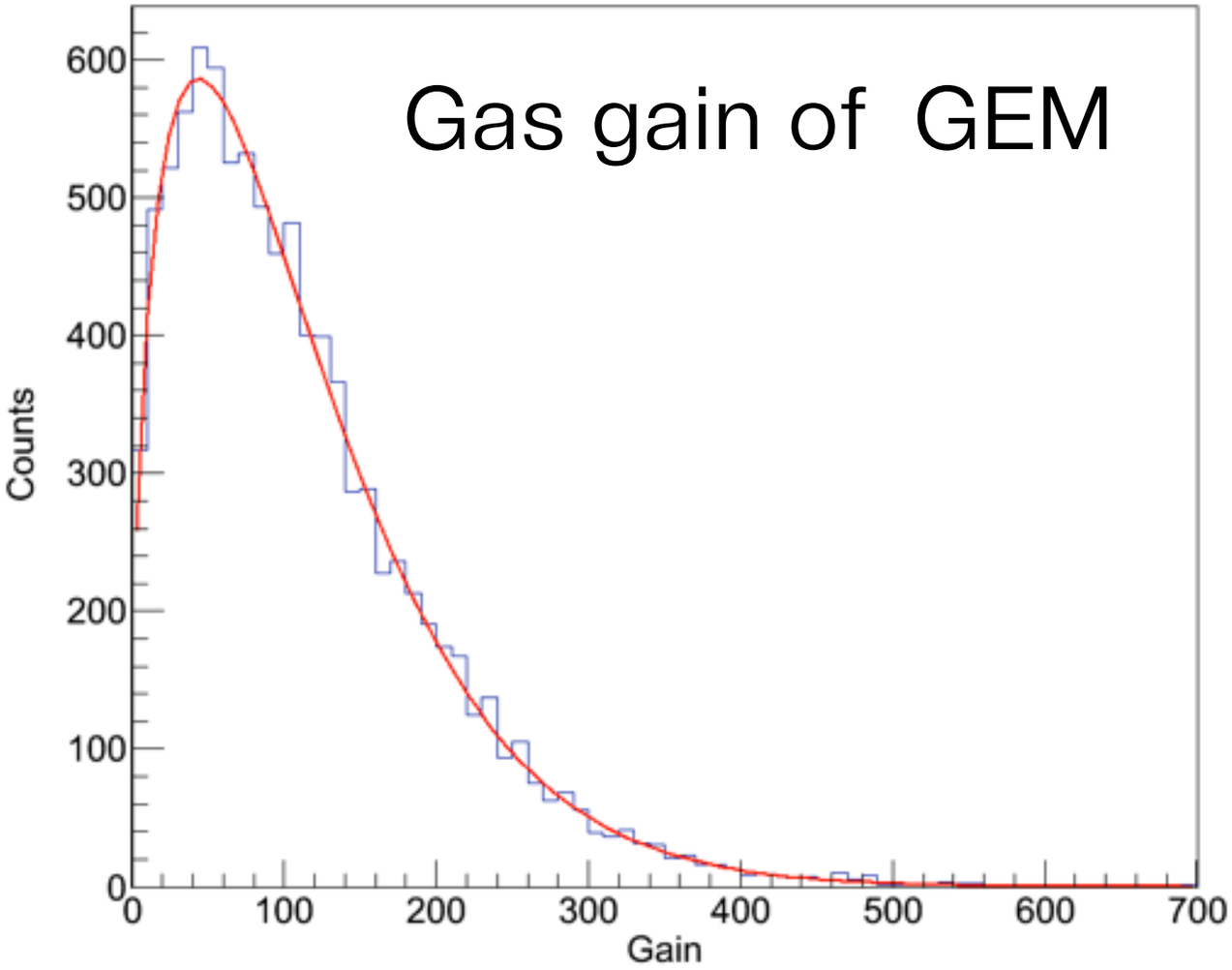




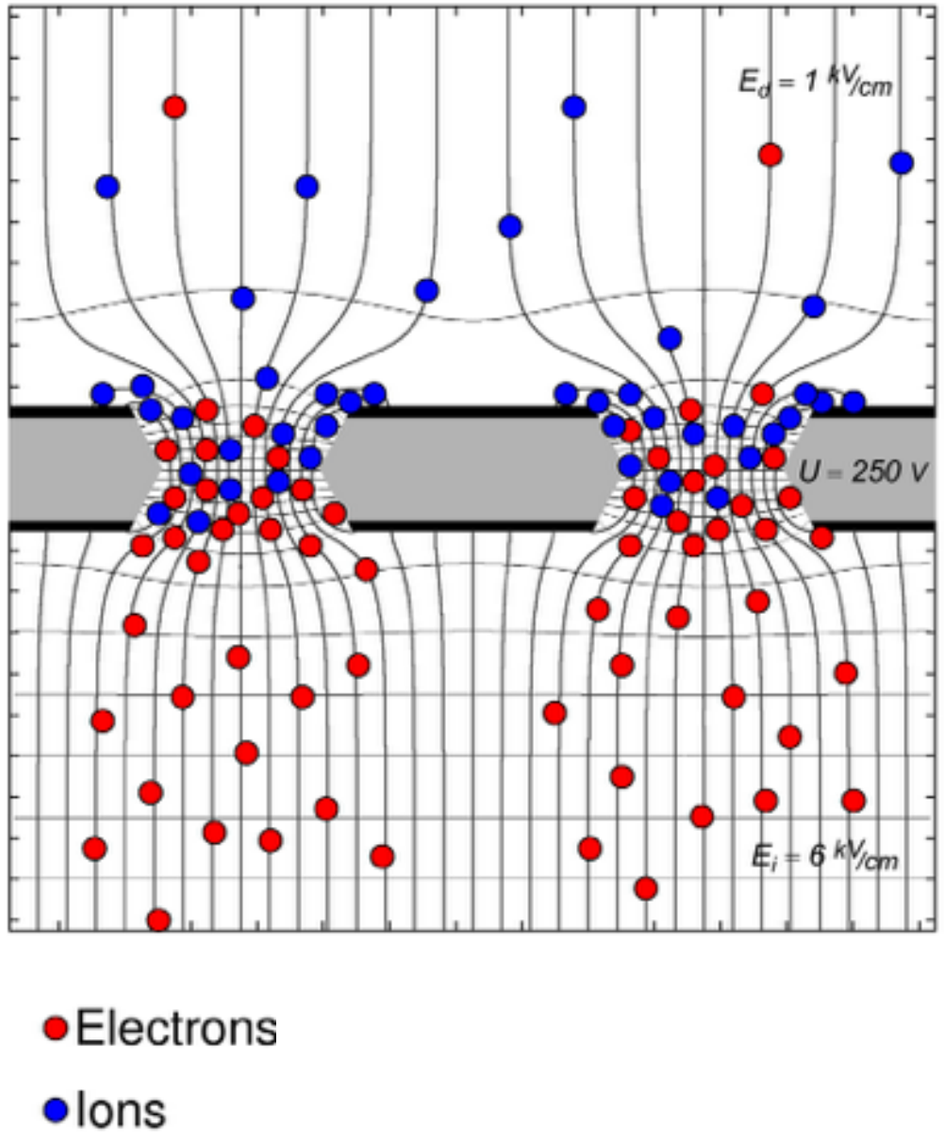
- Full diffusion
  : σ ≃ 3 mm

- Drift velocity
  : v ≃ 50 μm/ns

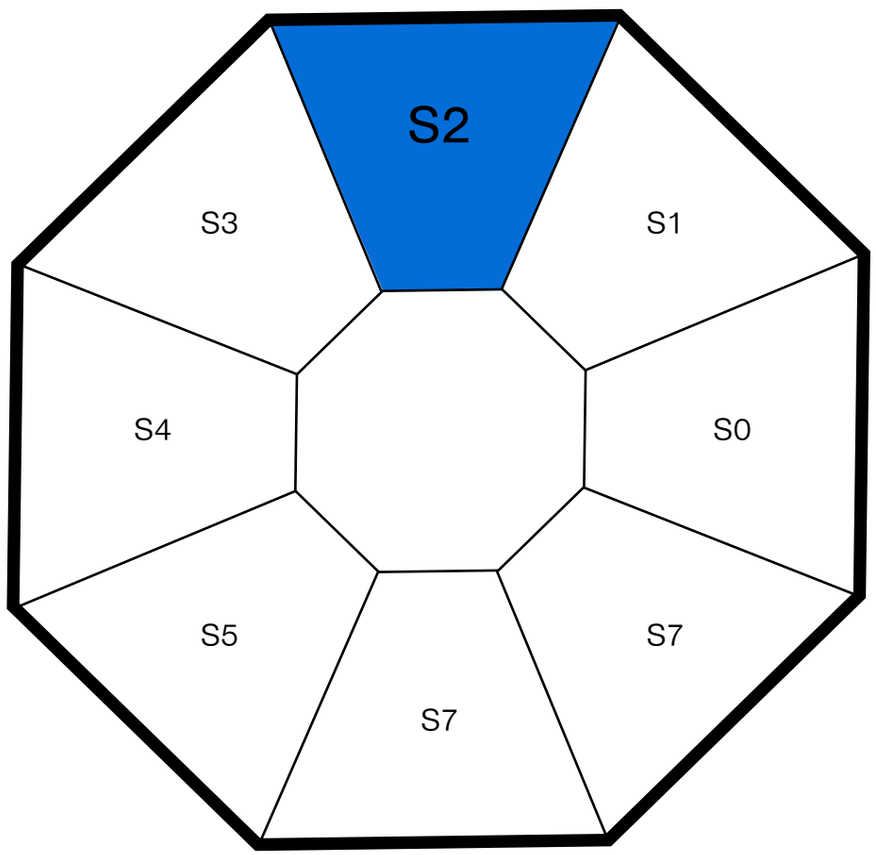
Gas Electron Multiplier(GEM)



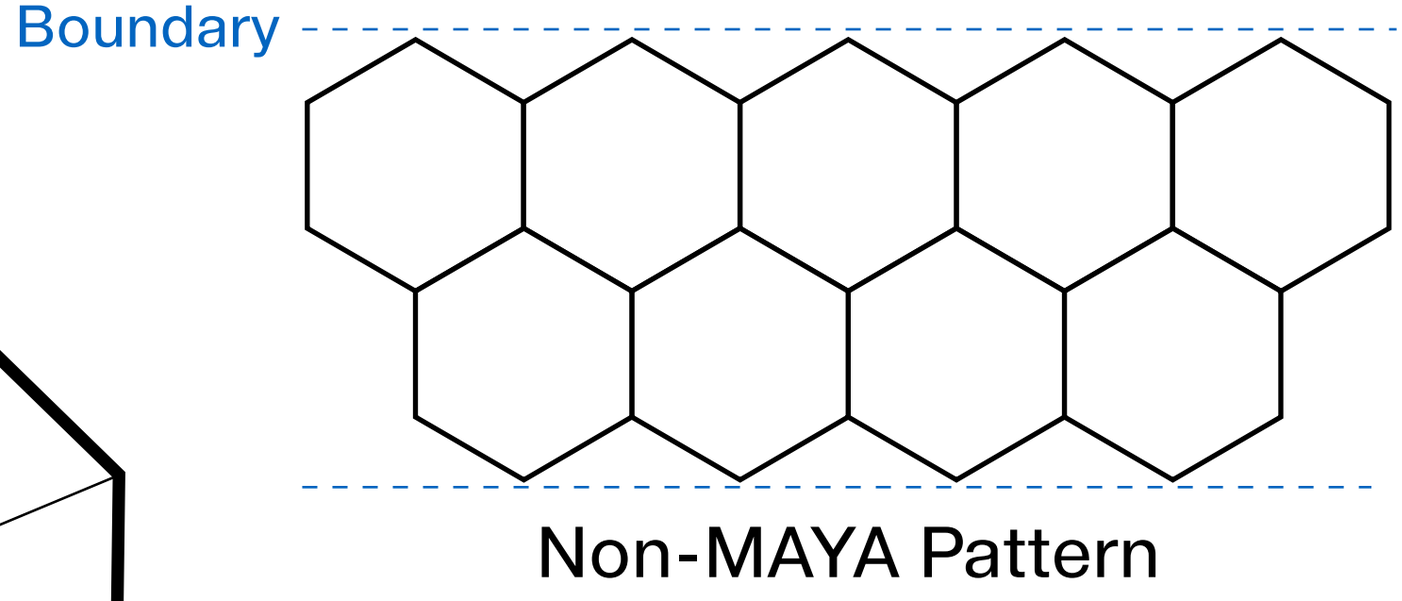
Count of collected electrons when one electron went through the gem foil.
(10000 entries)



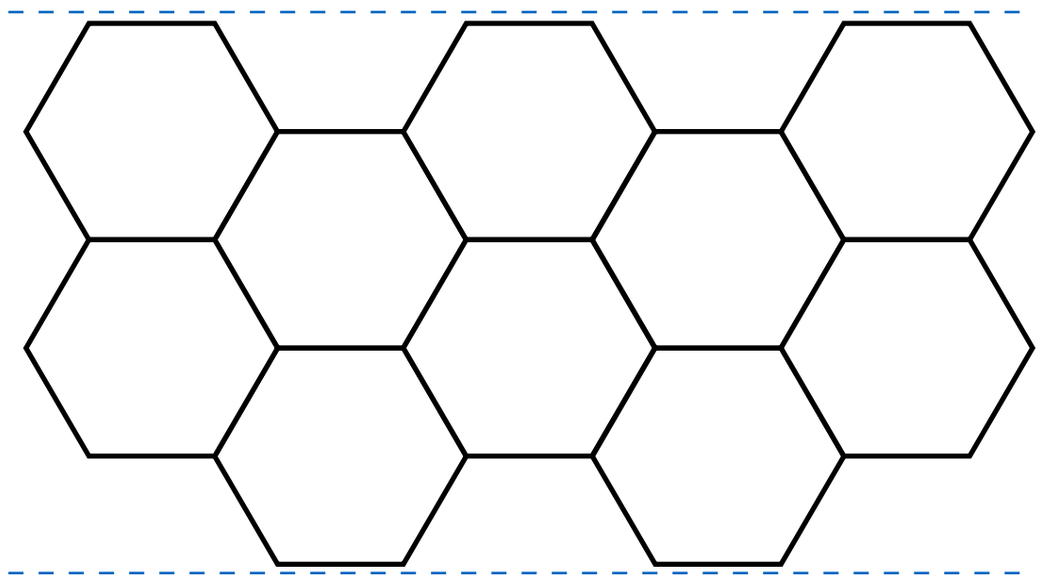
Pad Plane



Pad Plane

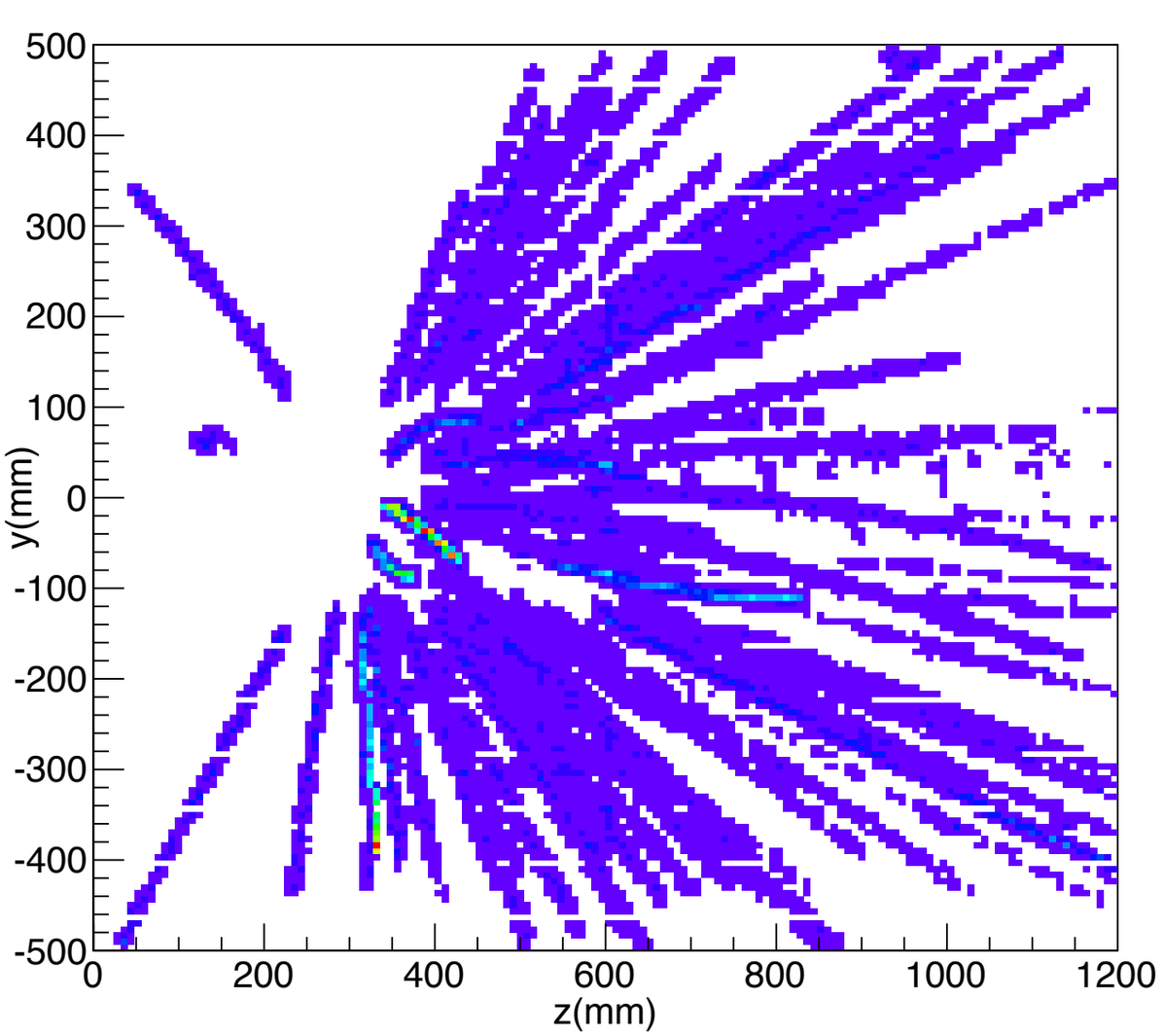


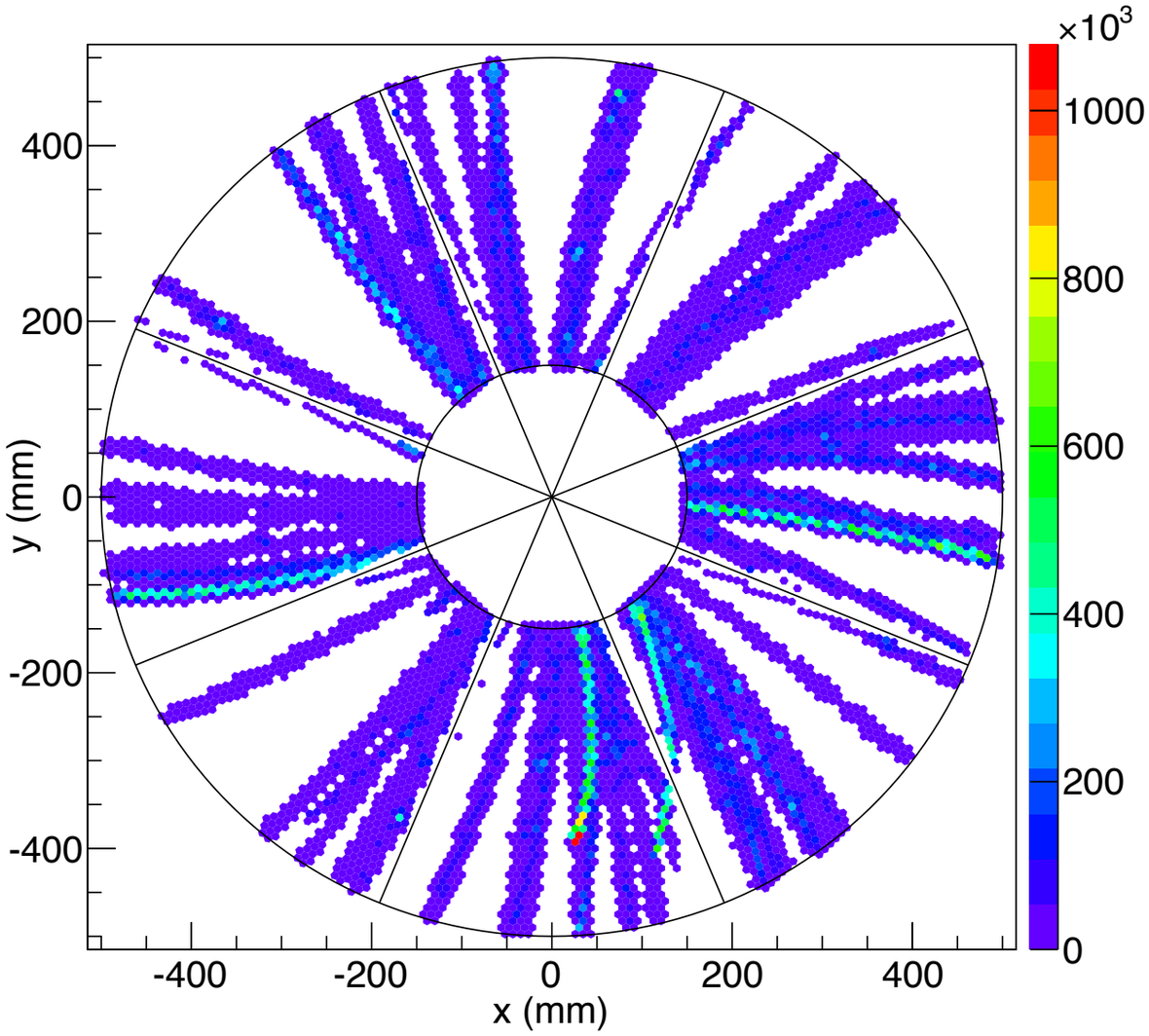
Non-MAYA Pattern



MAYA Pattern

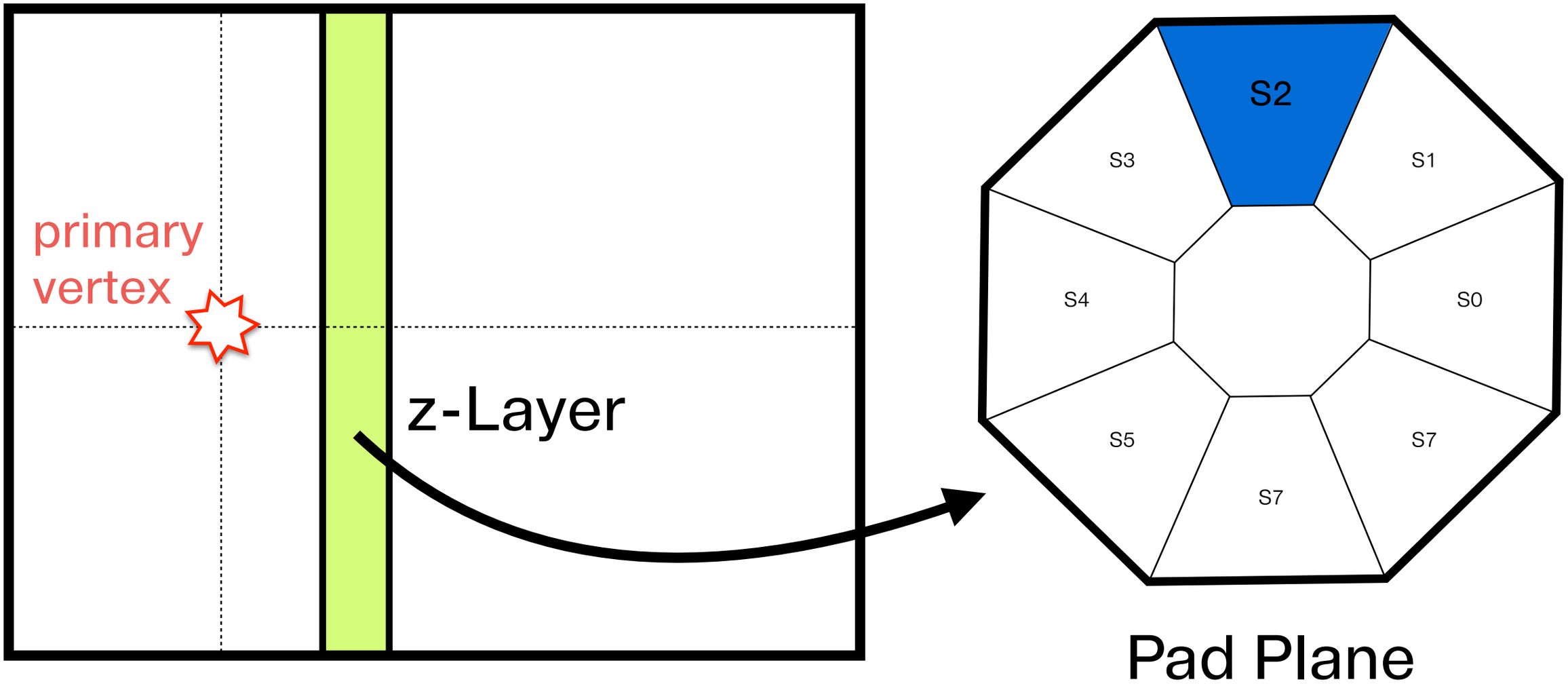
Digitized Data





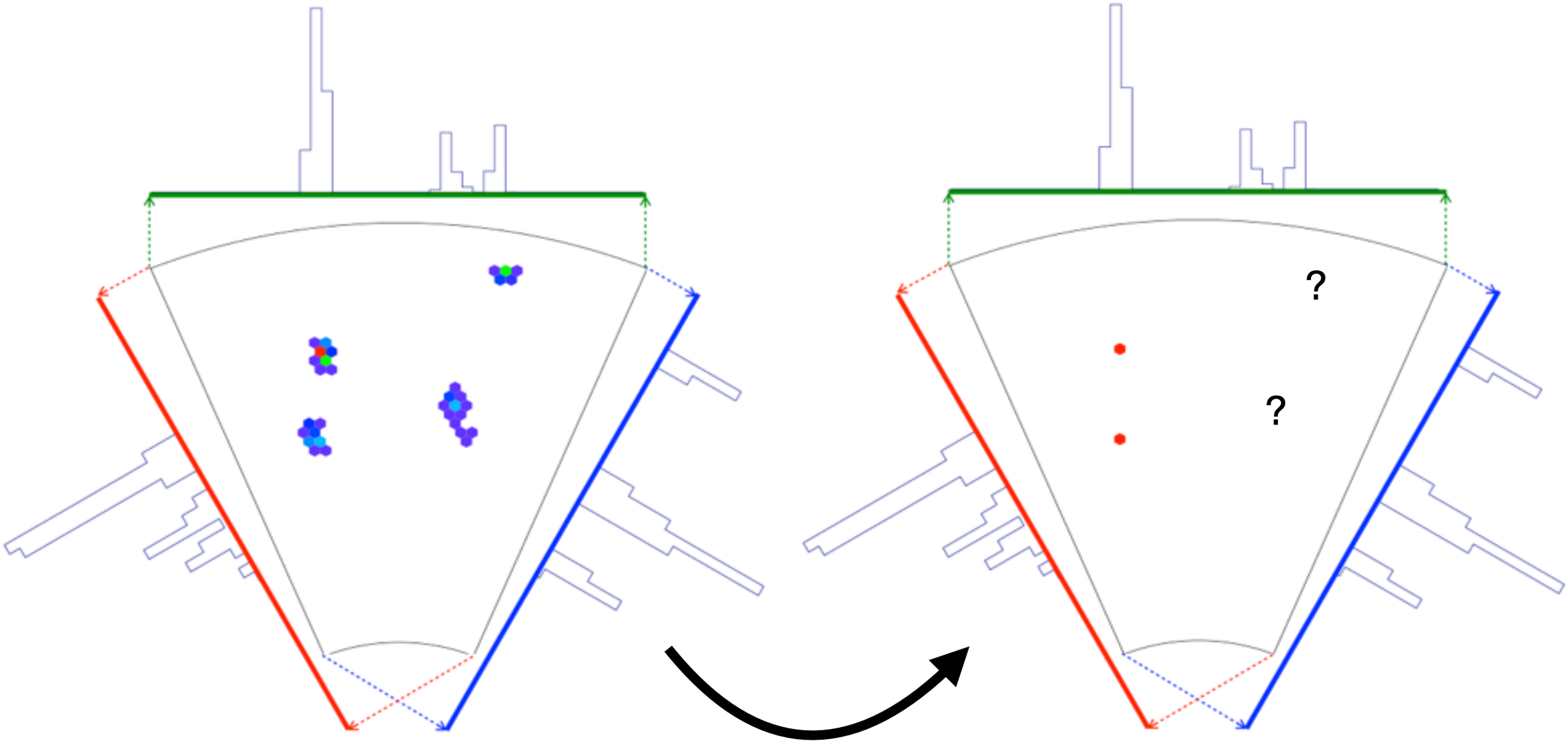
Projection of reconstructed hits collected in pad plane.
Tracks are thick due to diffusion of electrons.

Sector Selection



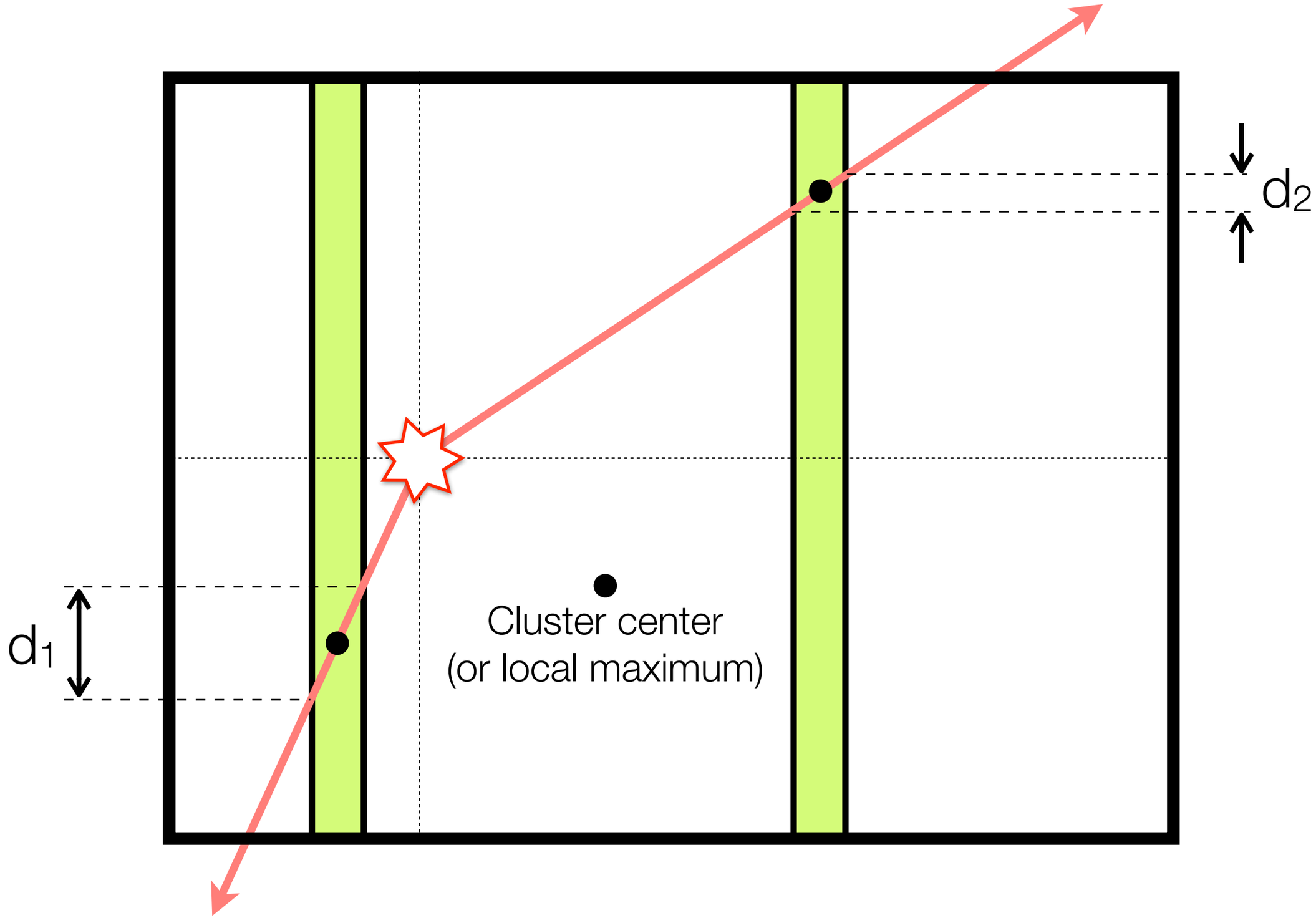
Layers are sliced along z-axis and projected into pad plane.
The layer thickness Δz is thinner near the primary vertex.

Clustering

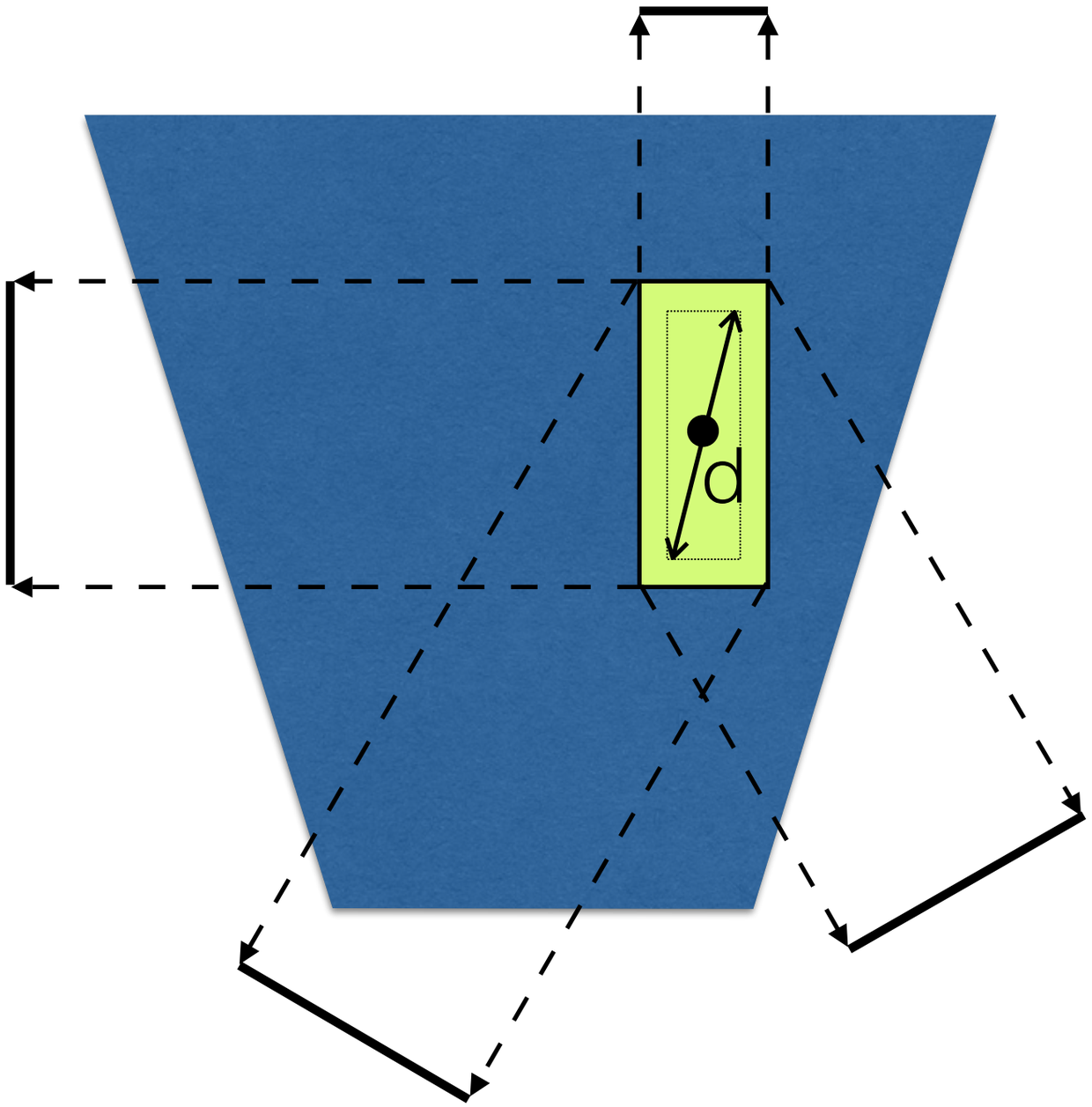


Cluster centers are not found at once but can be found by iteration.

Clustering

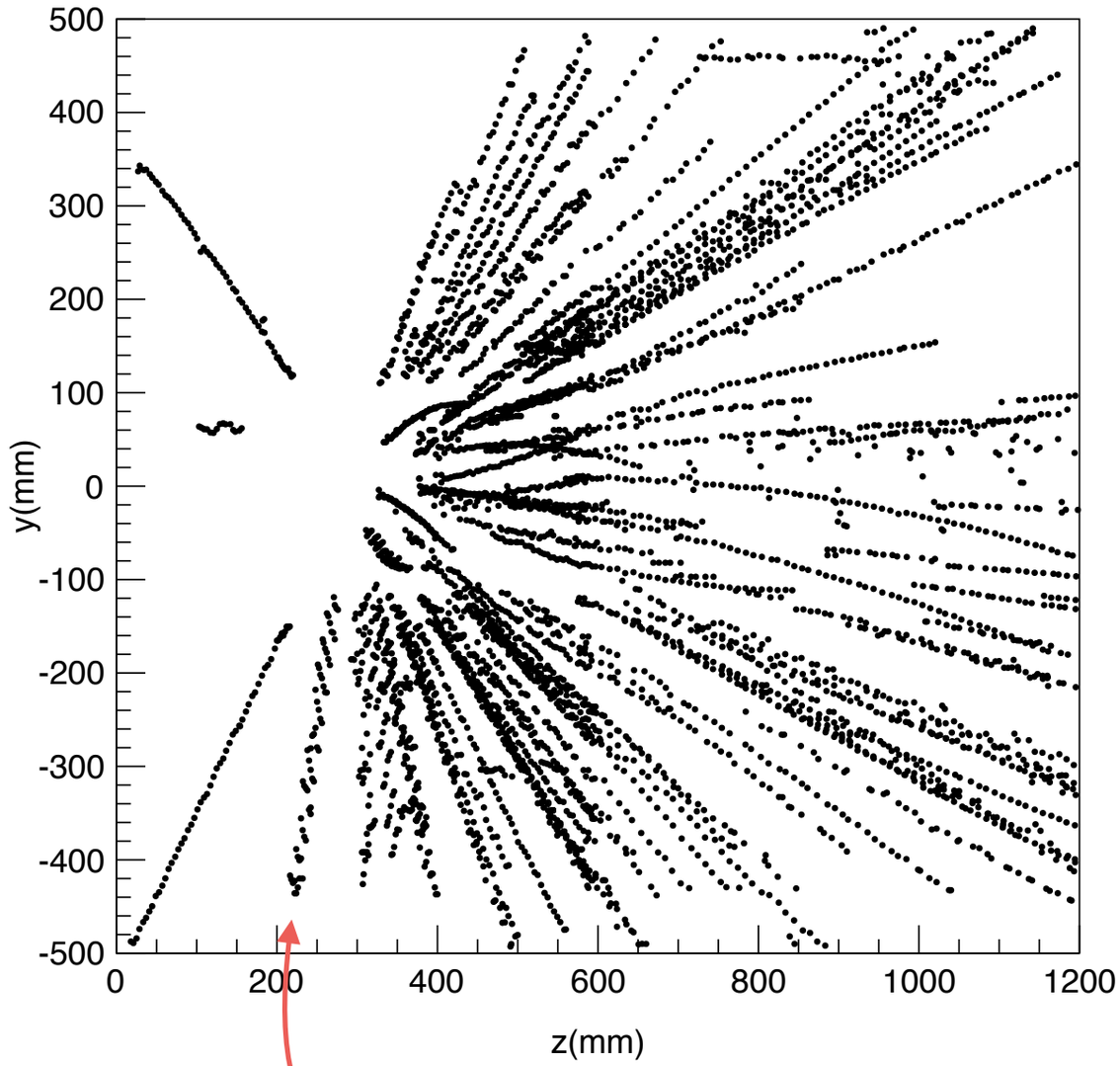


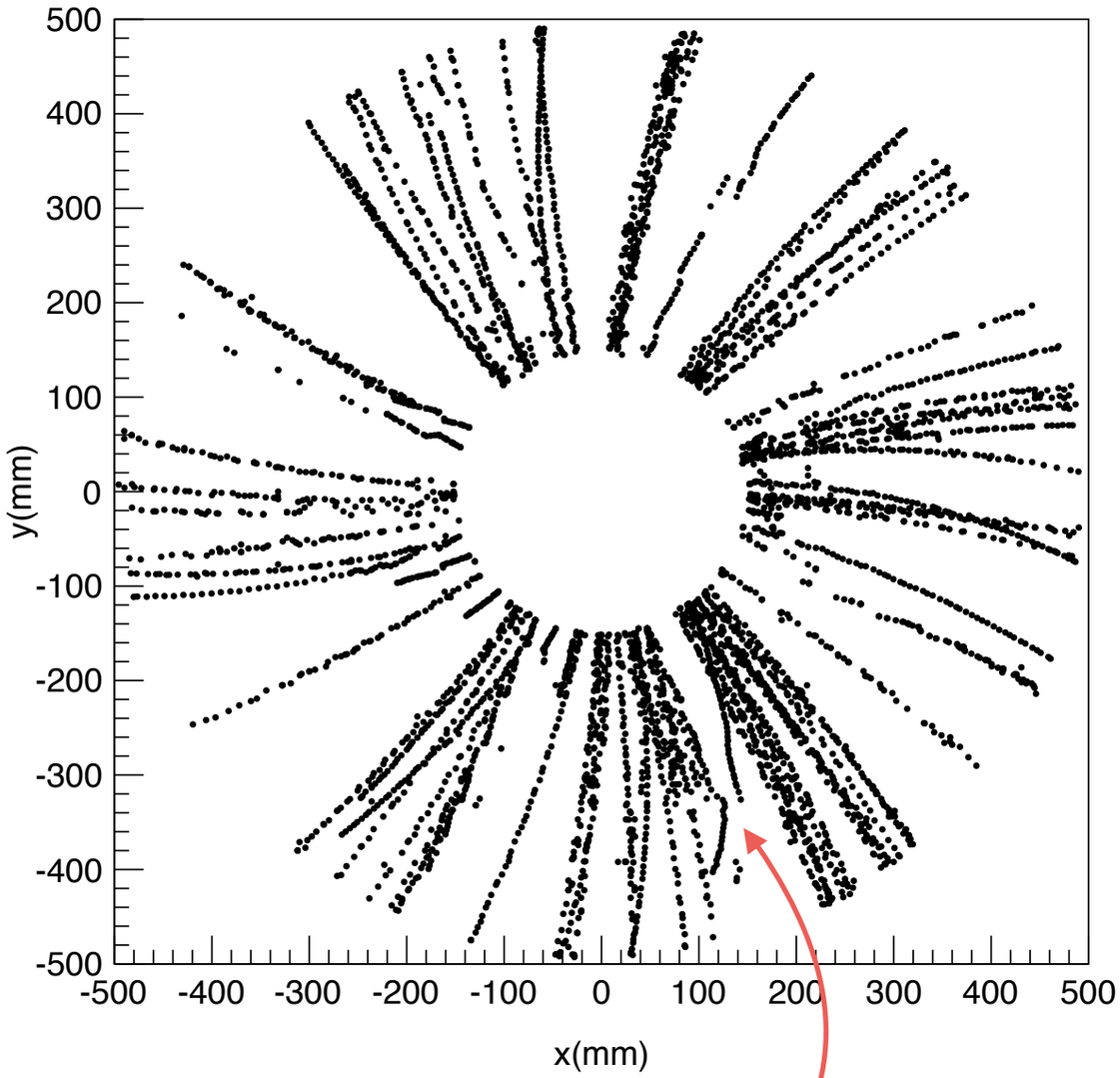
Clustering



- List of pads belong to a cluster
- Cluster position
  : Center of gravity
- Cluster size
  : σ_x, σ_y, σ_z

Clustered Data





Clustering is not easy in some regions.

Tracking

To be developed!

Summary

- LAMPS is being developed to study symmetry energy and nuclear physics phenomenas.
- TPC is key detector of LAMPS.
- Performance prototype-TPC will be helpful for improving TPC simulation.