

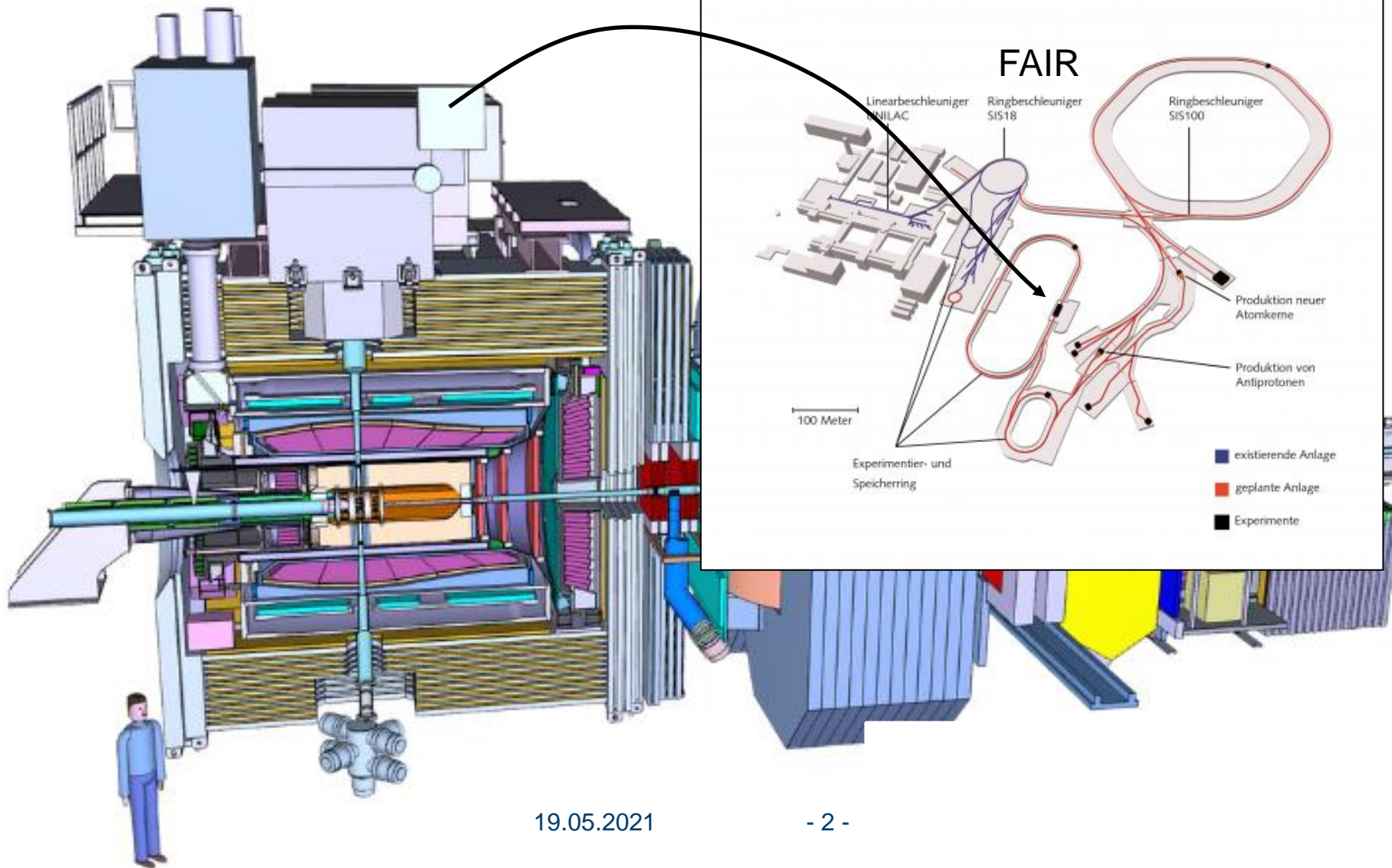
Track finding for the PANDA detector based on Hough transformations

19.05.2021 | vCHEP2021 | Anna Aliche

INTRODUCTION



The PANDA detector

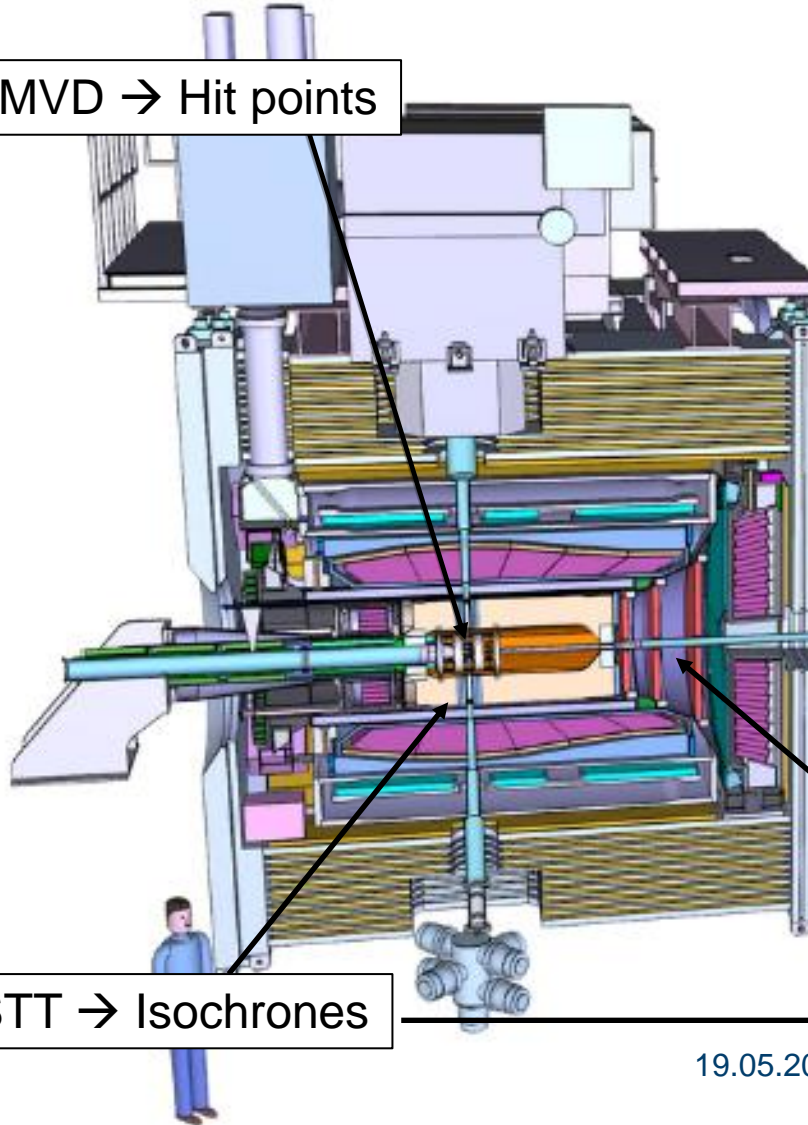


INTRODUCTION



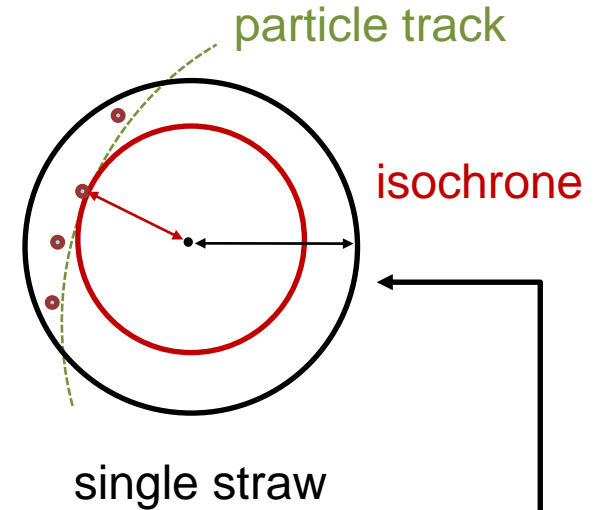
The PANDA detector

MVD → Hit points



STT → Isochrones

Focusing on barrel part of detector

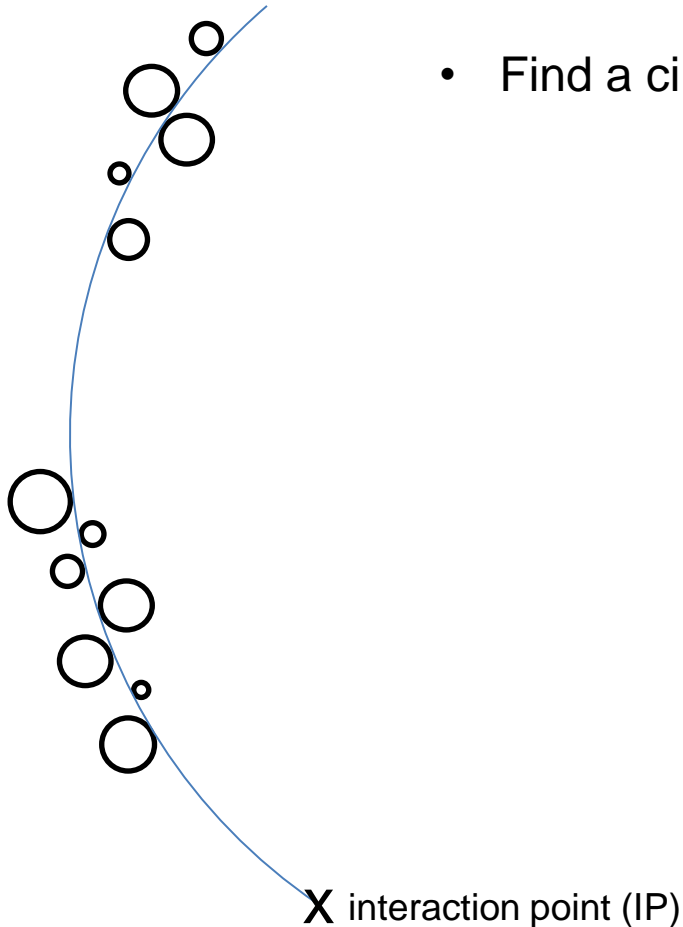


GEM → Hit points

TRACKING

HOW TO INCLUDE THE ISOCHRONE INFORMATION IN TRACKING?

- Particle is tangent to the isochrone
- Find a circle that connects other circles:

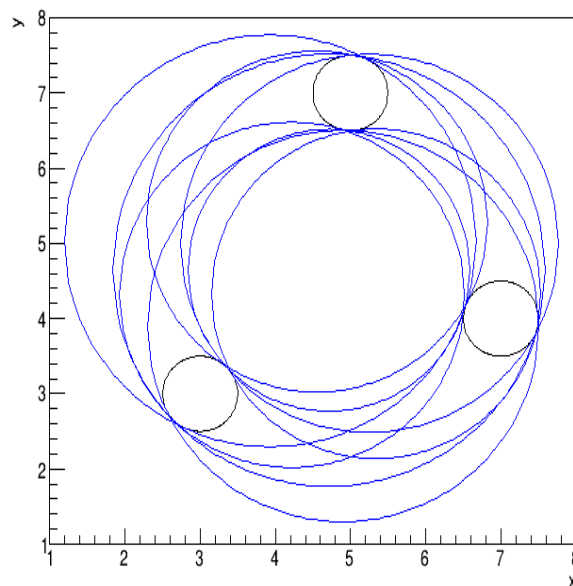


TRACKING

HOW TO INCLUDE THE ISOCHRONE INFORMATION IN TRACKING?

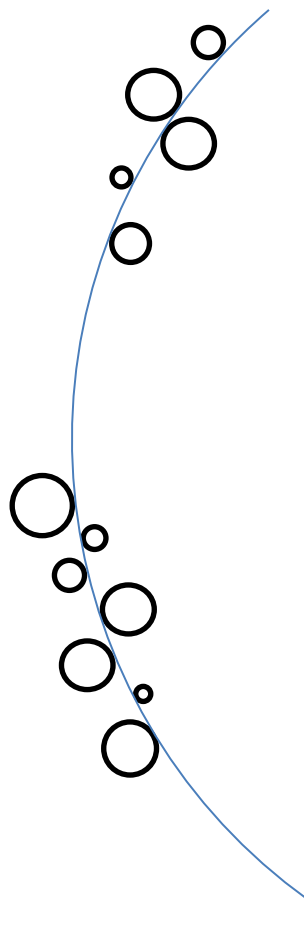
- Particle is tangent to the isochrone
- Find a circle that connects other circles
- Well known mathematical problem:

→ Problem of Apollonius



→ 8 Apollonius circles in total

→ Calculate all hit combinations for a Hough transformation to determine the track parameters



X interaction point (IP)

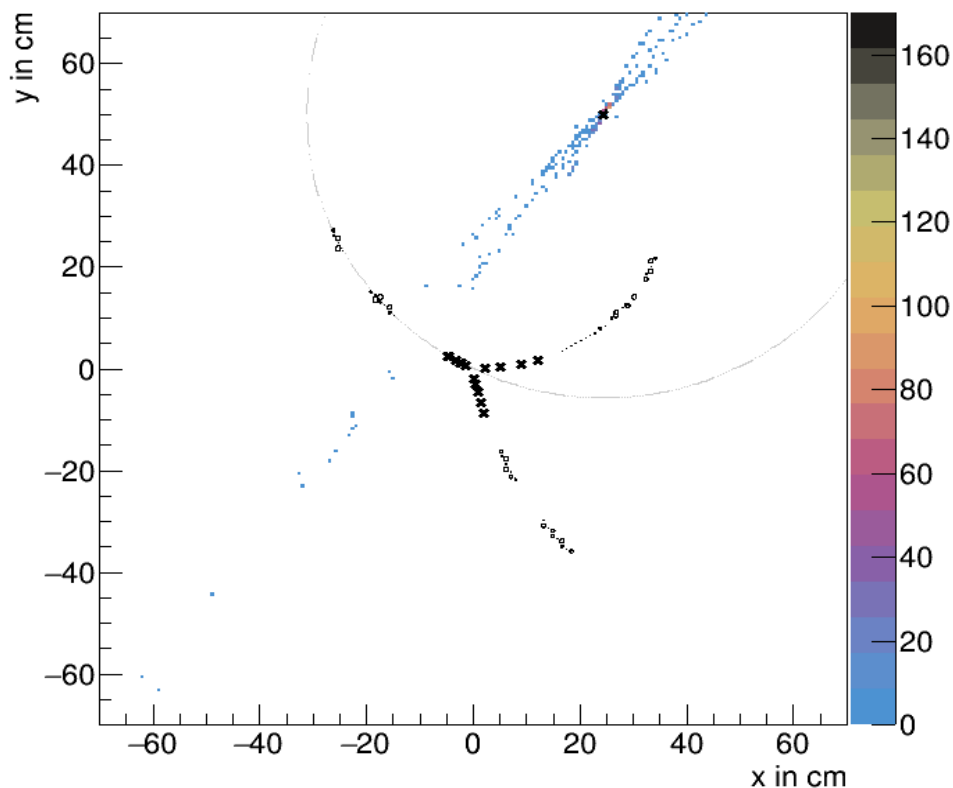
TRACKING

HOW TO USE THE APOLLONIUS PROBLEM FOR TRACKING?

HOUGH TRANSFORMATION

- For each hit generate all tracks (circles) compatible with it
- Collect generated circle parameters (2D Hough Space)
- most frequent values = parameters of actual tracks

→ 2 hits + IP
for Apollonius



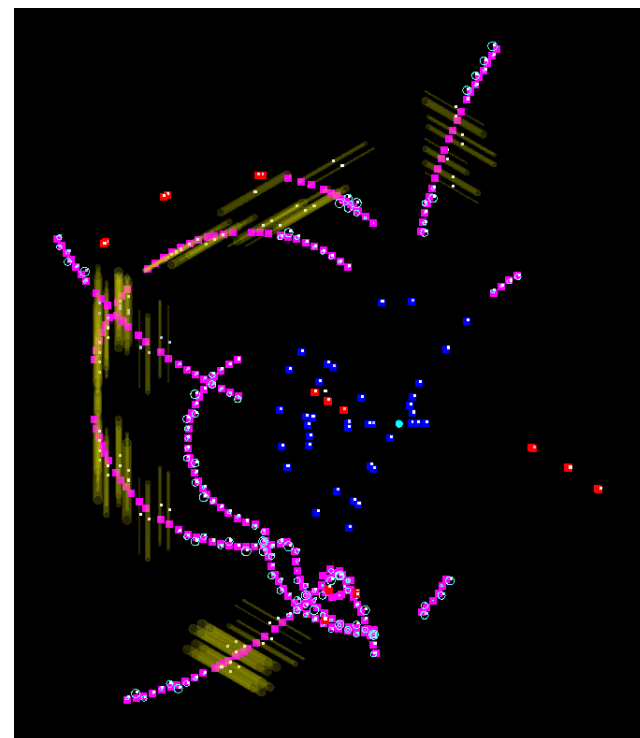
Further information
→ Conference paper

EVALUATION



- data sample:
 - ~ 4 tracks/event
 - $p_T \sim 200$ MeV/c
- ghosts: wrong combination of hits creating a track
- clones: one track found several times

Efficiency (primaries)	ghosts	clones	Runtime [ms/event]
83.2 %	6.8 %	15.4 %	36



- algorithm for clone merging in preparation
- speed up: GPU (apollonius calculation)
~ 23 (1.5 ms/event)

SUMMARY



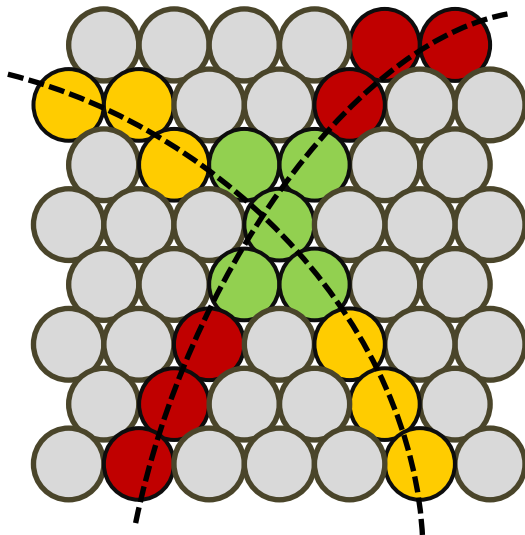
- Introduction into tracking with Hough transformations (HoughTrackFinder)
 - Basic idea of how to include the isochrone information
 - Evaluation: efficiency and ghost ratio already as good as currently best track finder in PANDA
- Further development:
 - GPU calculation

Thank you for
your attention!

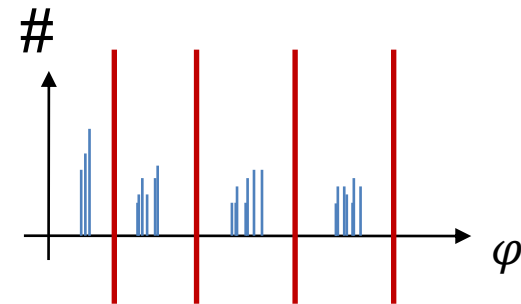
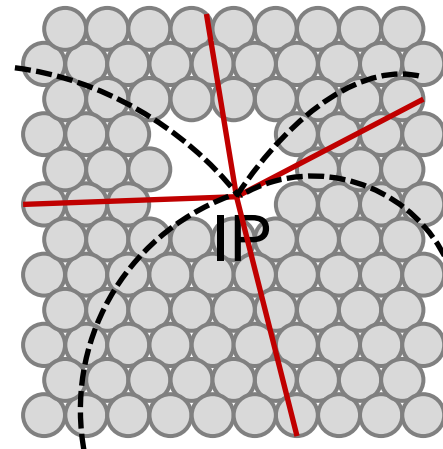
WORKING PRINCIPLE OF THE TRACK FINDER

1. Preselection:

Stt Hits: Cellular Automaton



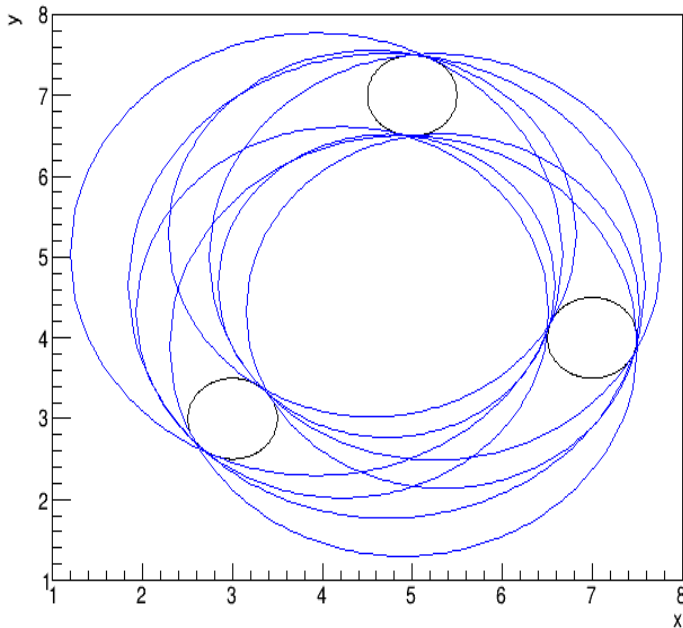
MVD/GEM Hits: Segmentation



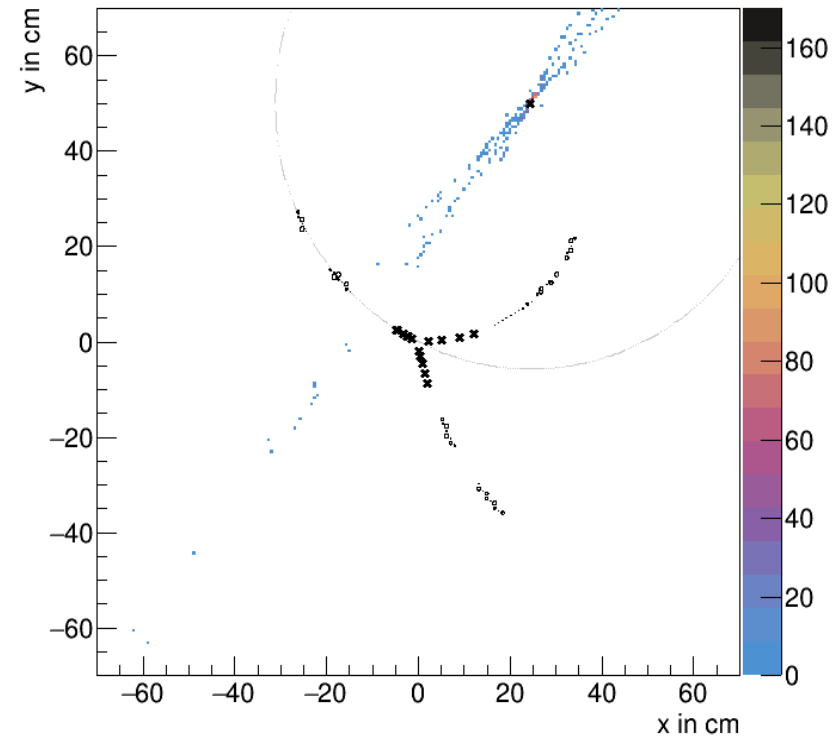
WORKING PRINCIPLE OF THE TRACK FINDER

2. Hough Transformation

Apollonius calculation



Hough Transformation



WORKING PRINCIPLE OF THE TRACK FINDER

3. Merging of tracklets:

Tracklets of one particle track are closer as the one of different tracks
→ distance of maxima in Hough space as merging criterion

