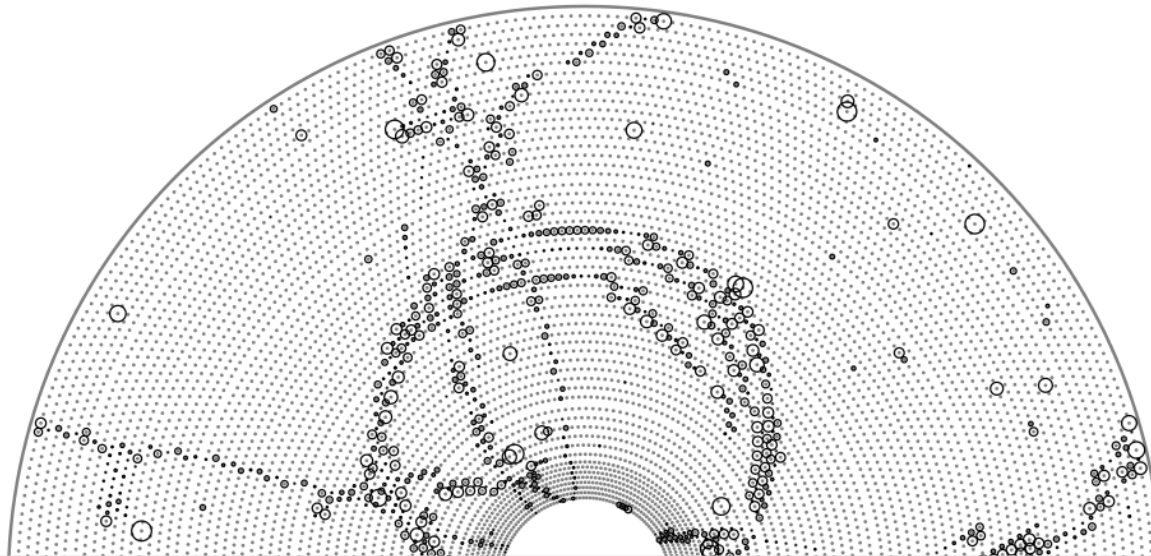


# Tracking inefficiency

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12.01.2016 | F2F tracking meeting @ Munich

Karlsruhe Institute of Technology (KIT)

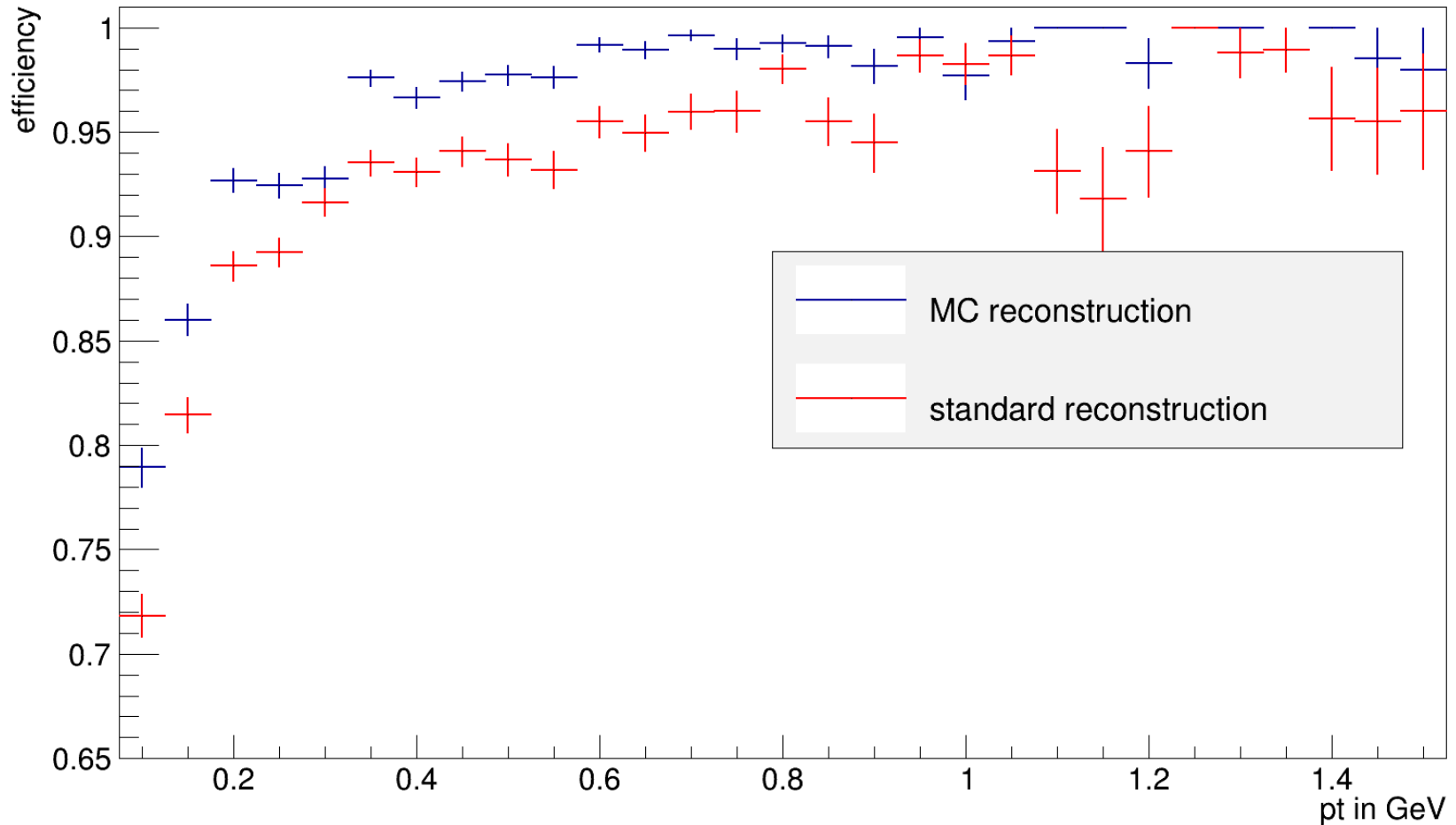


# Tracking efficiency

- To produce efficiency plots standard tracking validation script were used
  - Includes full tracking reconstruction
  - ParticleGun (muons) was replaced with EvtGen module
- Standard tracking reconstruction path compared to MC reconstruction
  - Allows to eliminate Genfit failures
    - e.g. caused by “bad” trajectories
  - ...and to show inefficiency of pattern recognition itself
    - Includes missing tracks, wrong hits assignment, missing hits, etc

# Efficiency: generic events ( $\Upsilon 4S$ )

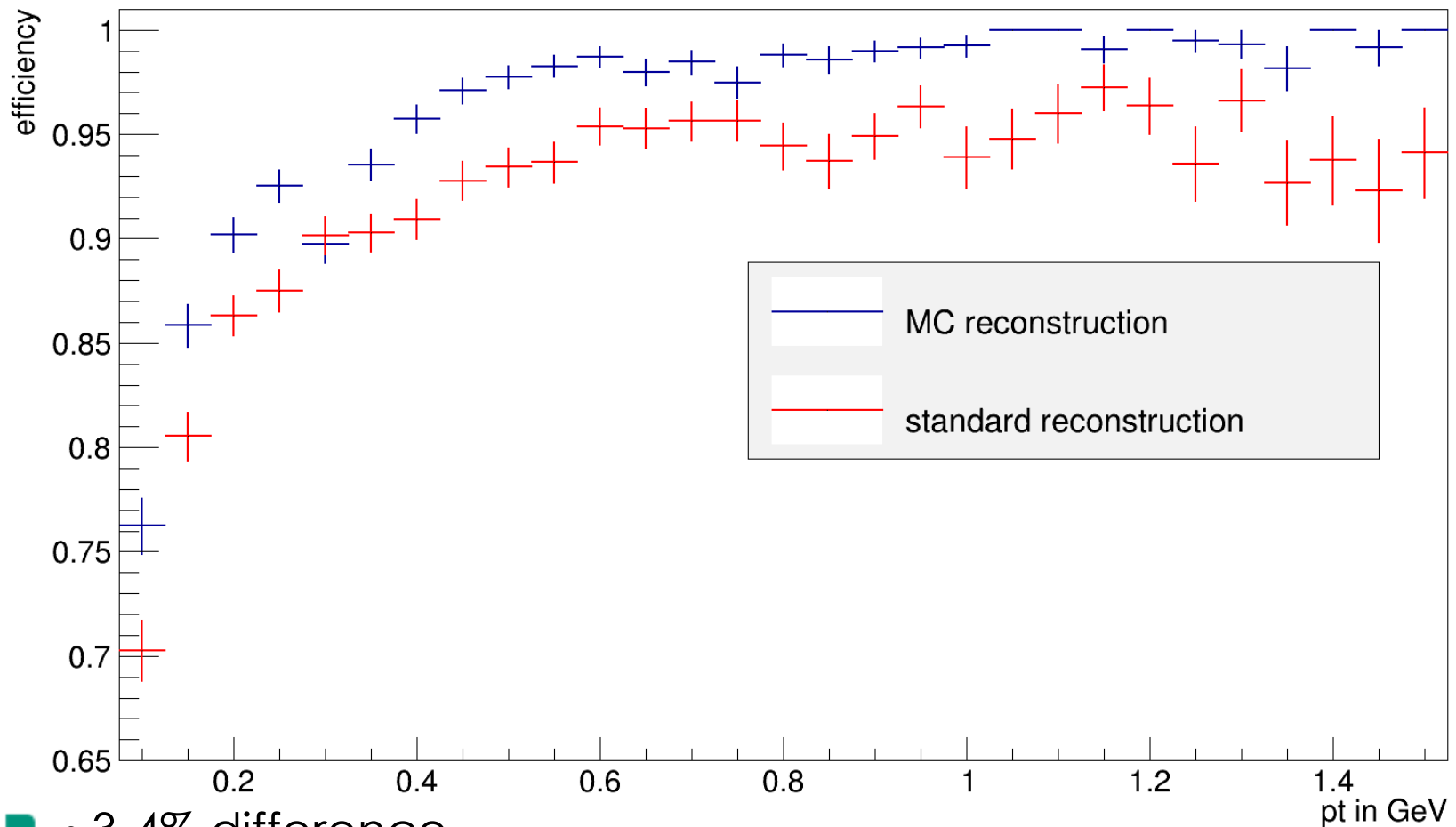
Tracking efficiency in bins of transverse momentum pt.



■ ~3% difference

# Efficiency: $c\bar{c}$

Tracking efficiency in bins of transverse momentum  $p_t$ .

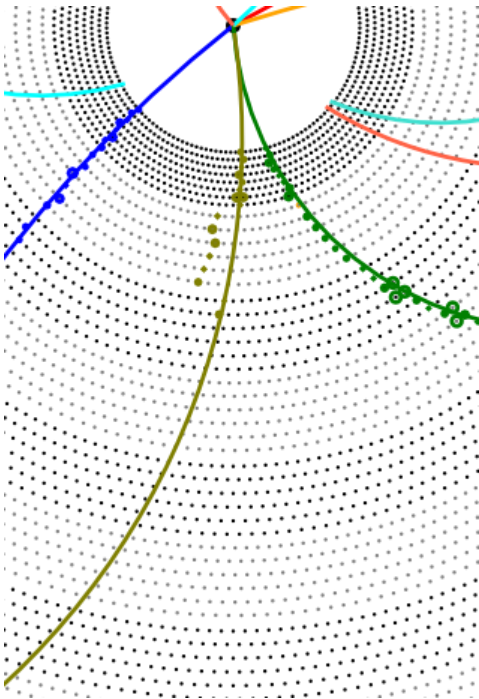


■ ~3-4% difference

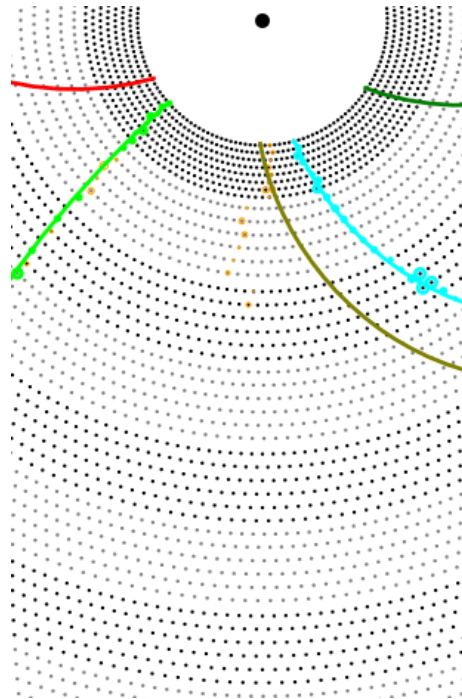
# Reco path (CDC only)

- Standart reco path was used:
  - WireHitTopologyPreparer
  - SegmentFinderCDCFacetAutomatonDev
  - TrackFinderCDCLegendreTracking
  - TrackQualityAsserter
  - StereohitFinderCDCLegendreHistogramming
  - SegmentTrackCombinerDev
  - TrackQualityAsserter
  - GenFit

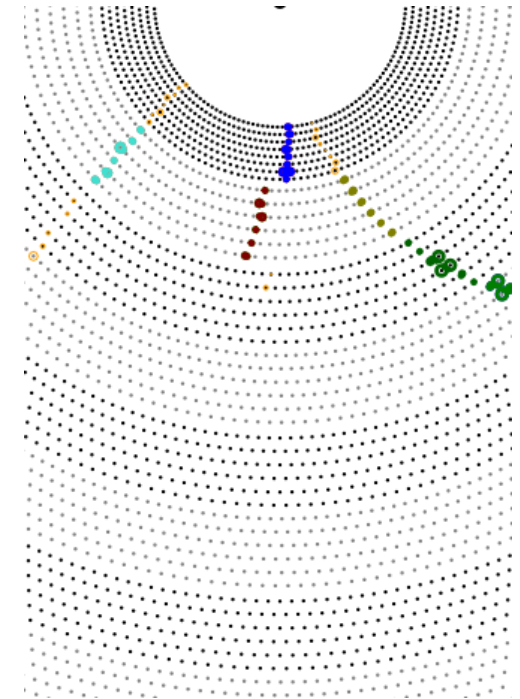
# Tracks with large polar angle (short in $\rho - \phi$ projection)



MC finder



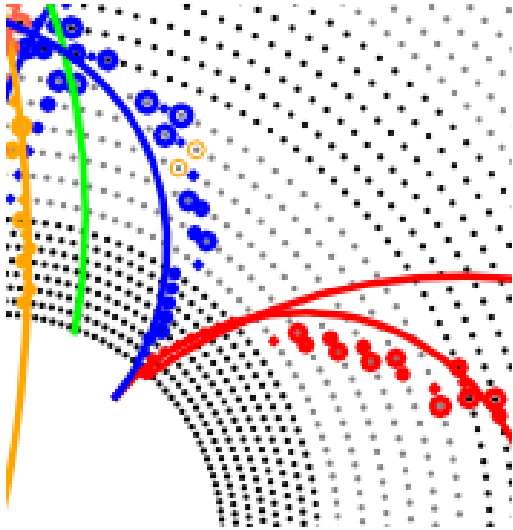
Pattern recognition



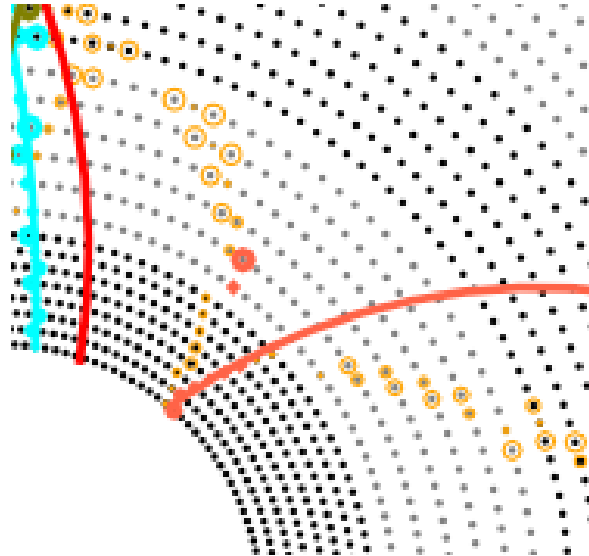
Segments

- Lack of hits
- Conformal transformation blows up drift circles in 1<sup>st</sup> SL
  - As result intersection in Legendre phase space is smeared

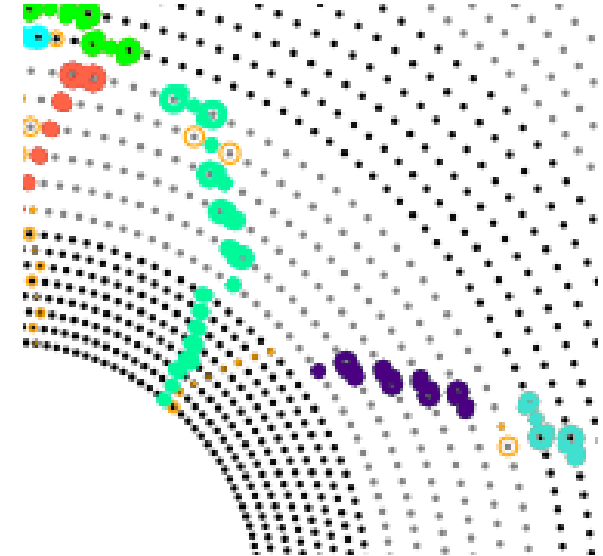
# Tracks with large polar angle (short in $\rho - \phi$ projection) II



MC finder



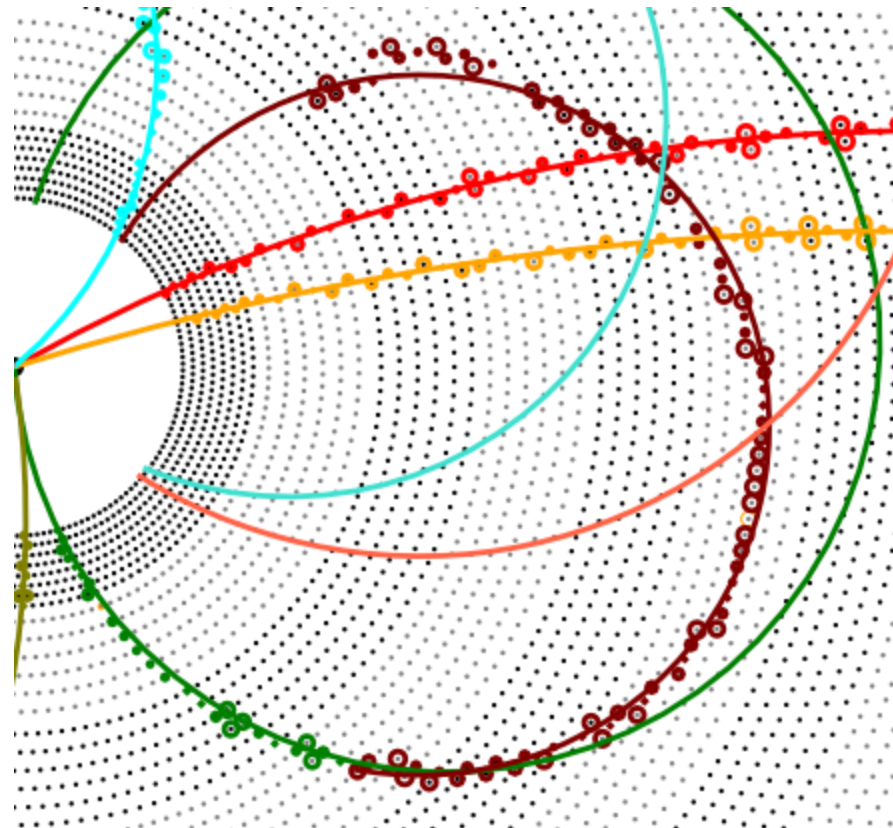
Pattern recognition



Segments

■ Tracks are coming not from IP

# Kink and wrong hits

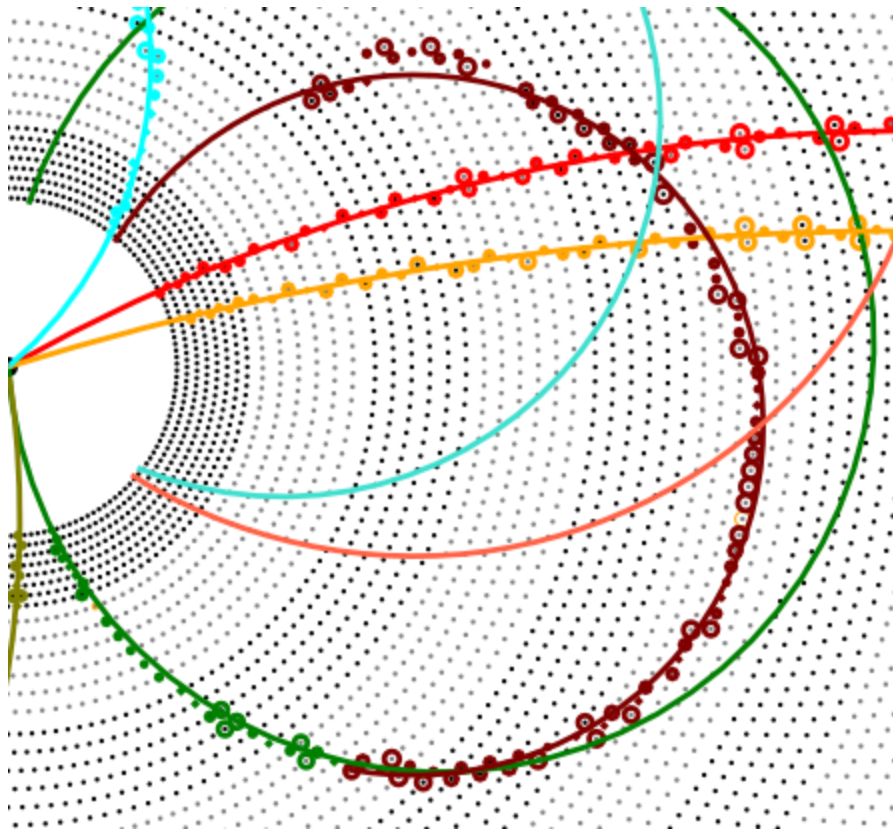


MC finder

- Decay is a rare case which bring inefficiency
- But this event is interesting from point of view of pattern recognition

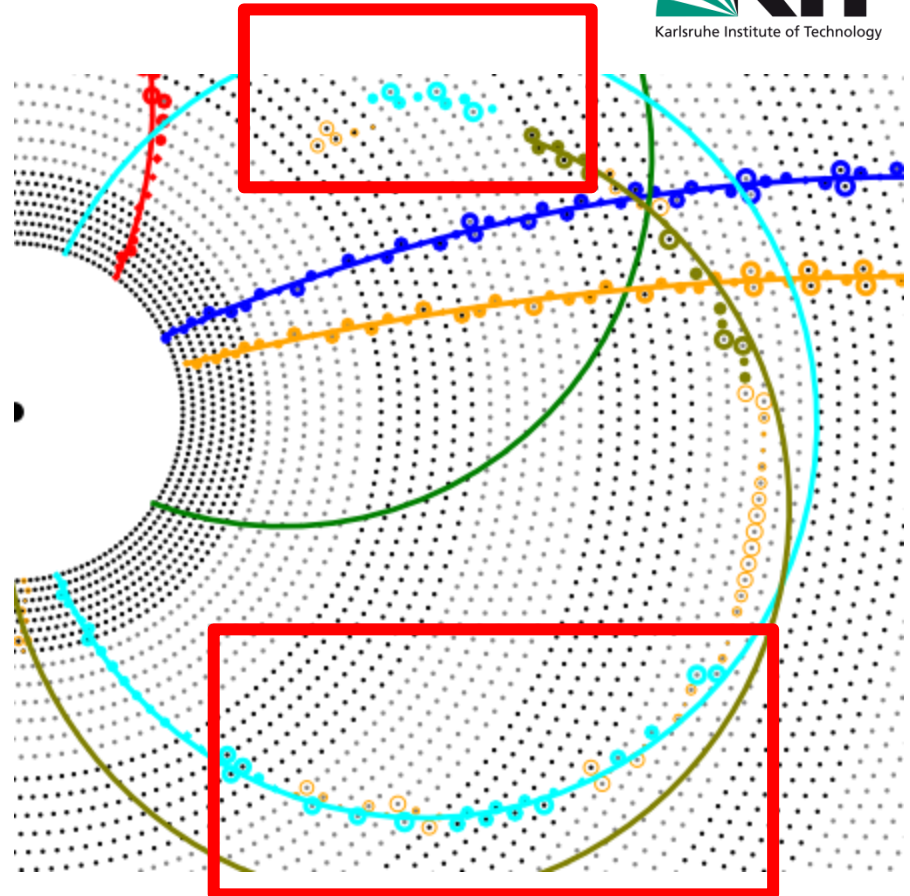


# Kink and wrong hits II



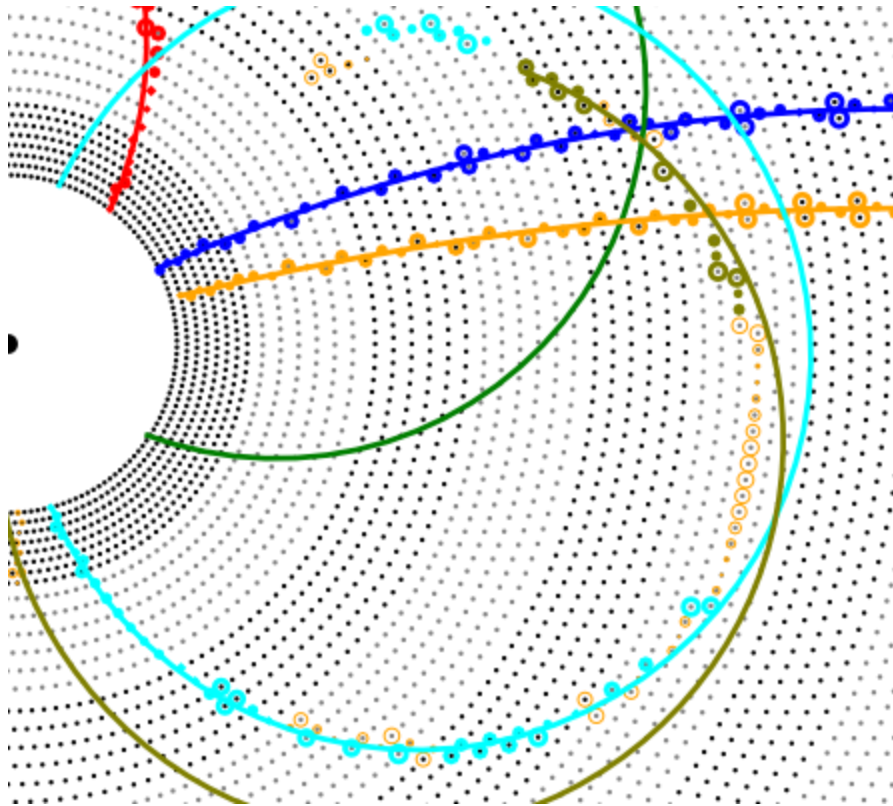
MC finder

- It includes 2 cases:
  - Kink
  - Wrong hits

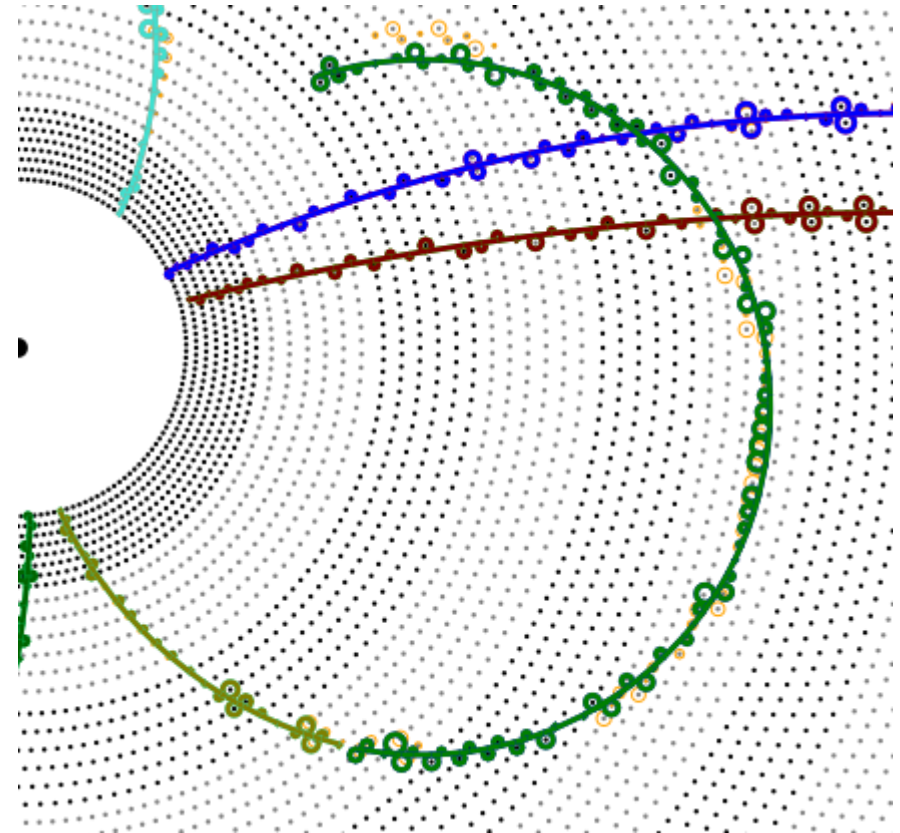


Pattern recognition

# Kink and wrong hits – Genfit fitting



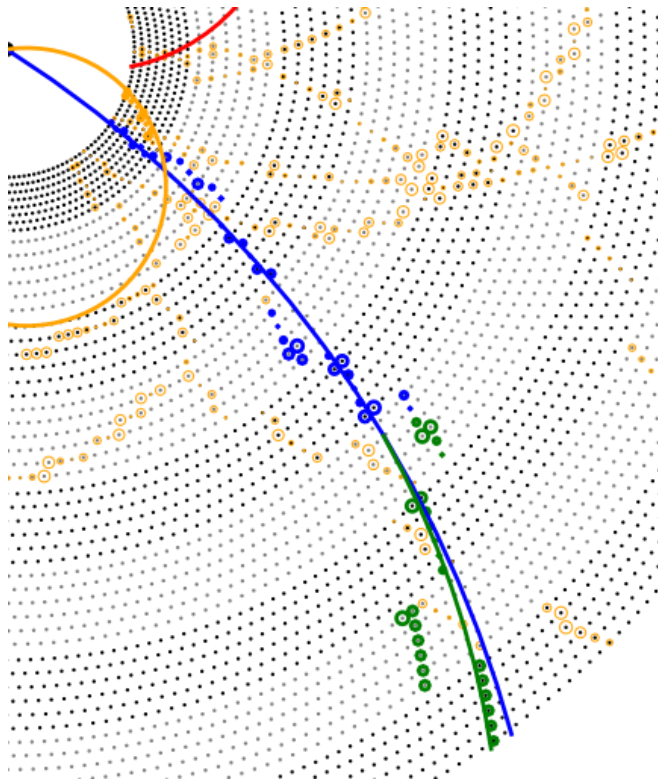
Standard reconstruction



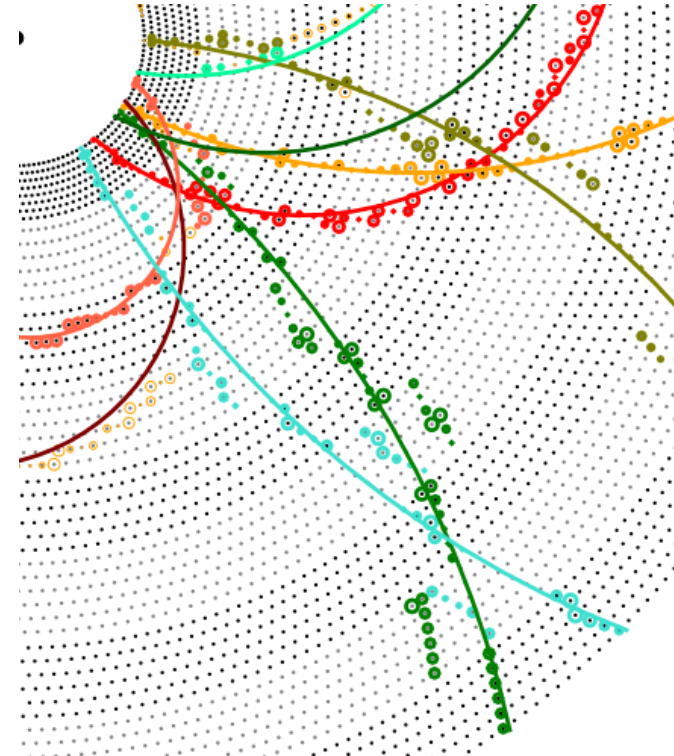
MC reconstruction

- This track could be fitted with Genfit
  - In case of correct hits assignment

# False positive case (of the tracking inefficiency)



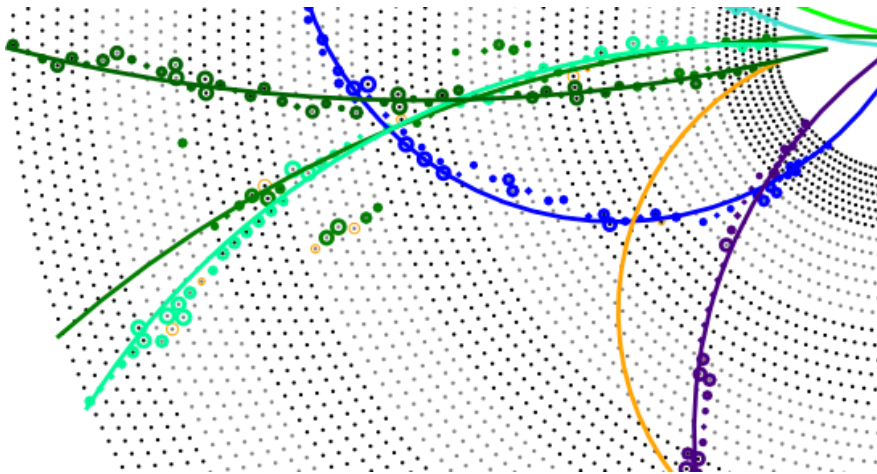
MC finder (missing tracks)



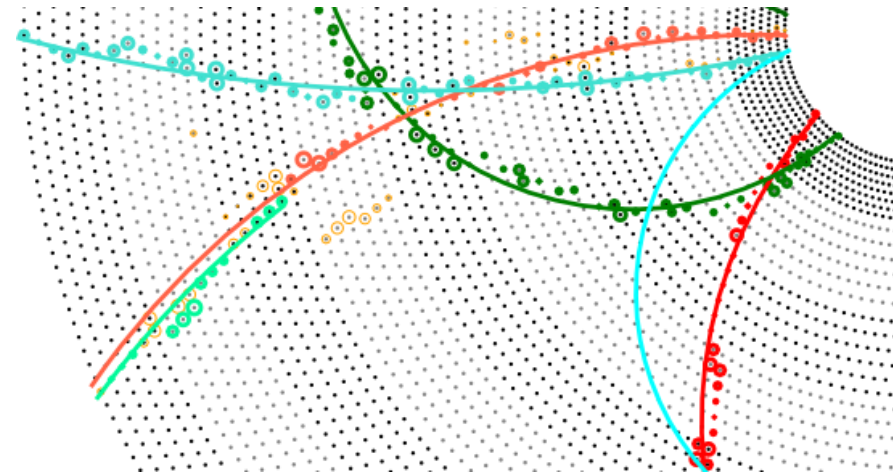
Pattern recognition

- Blue track (MC finder) has corresponding PR track (green), but there is no relation in DataStore between them
  - Decay; both particles are reconstructed as the same track
- Possible reason – too many “wrong” hits are assigned

# Tracks overlapping (wrong hits)



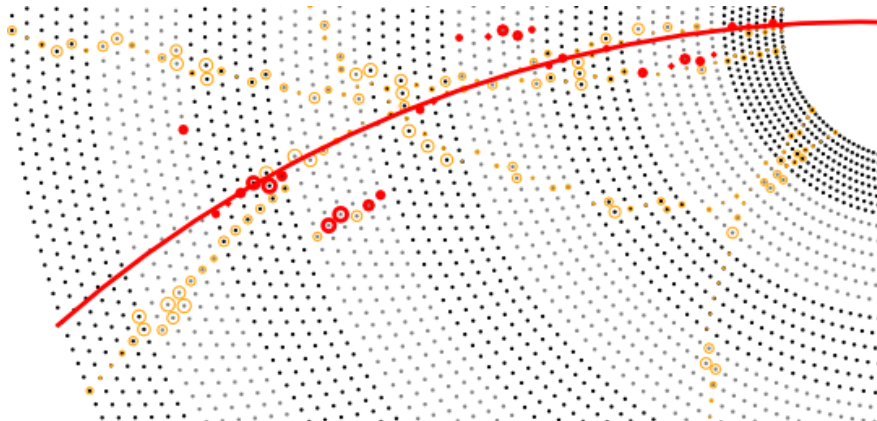
MC finder



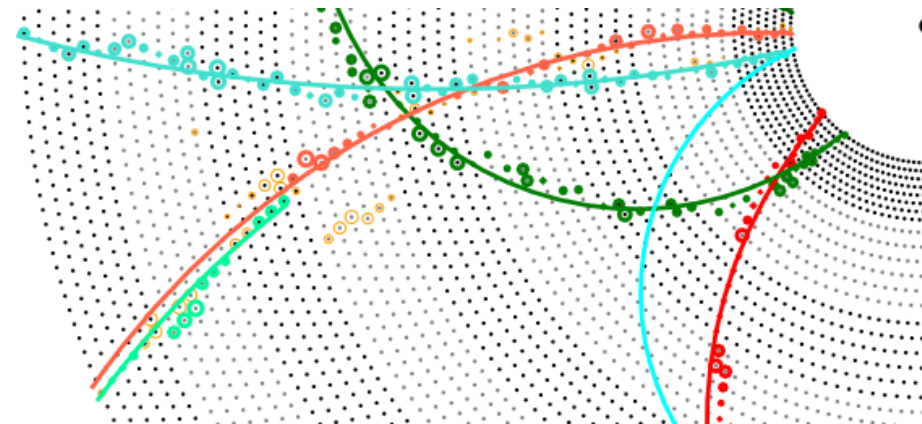
Pattern recognition

- In case of track overlapping it could be tricky to make correct decision on hits assignment
  - Most problematic are stereohits
  - Possible solution – to introduce global optimization for stereohits assignment

# Tracks overlapping (wrong hits)



MC finder  
(missing tracks)



Pattern recognition

- Stereohits of the red track assigned to wrong track and as result track is lost (from point of view of  $MC \rightarrow PR$  relation)

# Conclusion

- We are still able to gain better efficiency of the tracking
  - With improved patten recognition we may gain ~3% (ideally)
- Next quantity we should take care of – purity
- False positive cases need further investigation
  - As alternative we can introduce efficiency measurement based on the kinematics

*Thank you for your attention!*