DC Track Seed Finder Development

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All stereo drift chamber tracking

2 pairs seed construction

MEGII

Seeding from 2 pairs of hits (each pair on own layer) with beam axis constrain

× 2 consecutive hits in same layer
→ 4=2x2(Left-Right) pairs with direction
× 2 Pairs from nearest layers comptable by:
|Δcos(φ(direction)-φ(position))|<0.2, crossing Z inside DCH
× 1 Pair with beam axis → Pt estimation (taken averaged over 2 pairs)
× Cross Point of stereo 2 pairs give Z-coordinate (with Δφ correction from Pt)
× Pz = 0 at initial
Z measurement give additional compatability check between 2 hits and between 2 pairs

Red hits projection on middle plain
Yellow – also rotated with φ

Numbers from MC dist smeared, isochrone usage <~10% CPU

1 event per 0.7 sec with Z measurement
1 per 1.2 sec without Z information
(numbers for fixed T0=0 and 250nsec time window)

Kalman Filter Tracking (track following method)

1) all T0 from SPX clusters, T0 from 3wires
2) Seeds constructed from outer layers (iteratively layer by layer from not used hits)
3) track prolongated by Kalman Filter (over single turn)
4) Additional next turn seeding from founded track segments
5) shared and double track removal by quality factor(based on χ2,N of hits,hits density)

as output from PR Track turns
(or sometimes separated track segment)

Numbers from MC dist smeared, isochrone usage <~10% CPU

40.8k <compatible pairs> → 442.8 <good track segment>
+1082<track turns from next turn seeding>
→ 39.8 <track turn candidate>
CPU perfomance 6.6 sec/event

- MEGII drift chamber with small radius
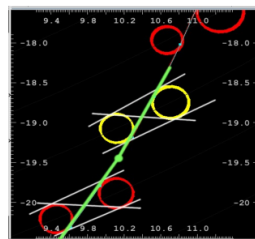 - 2m long, 10 layers at R=17.7-23.8 cm, 6-8° stereo angle
- COMET CDC stereo angle is 3.78-4.23°

IDEA drift chamber tracking

- IDEA drift chamber: Rout=200cm@2Tesla
- IDEA DC use same tracking method with MEGII

Track finding – local method for DCH only

IDEA

Drift chamber for FCC
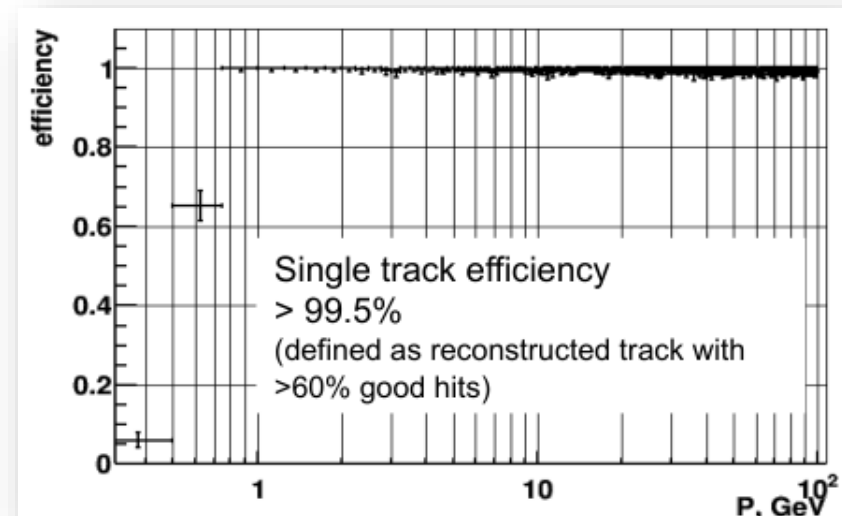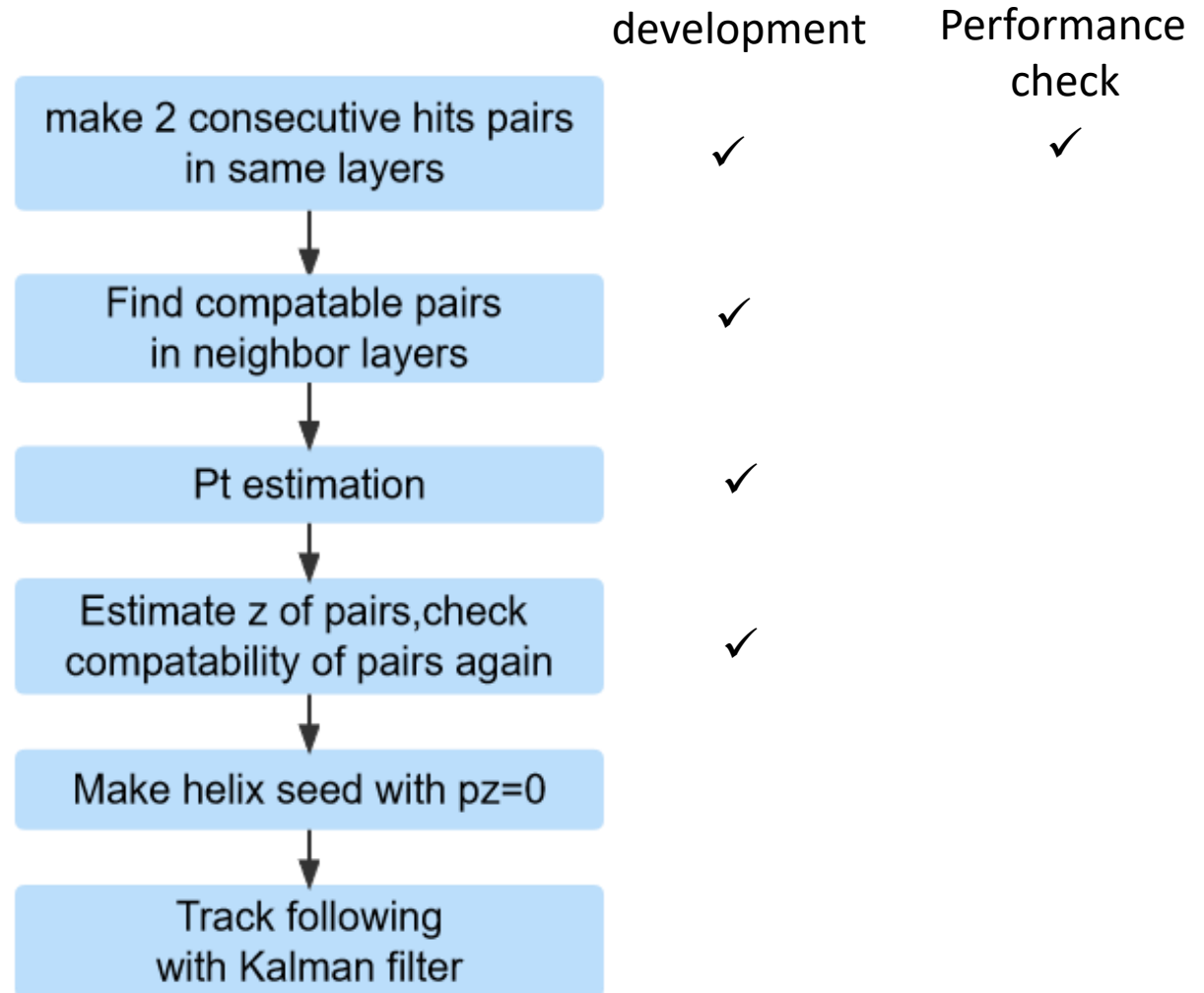
Seeding from 2 pairs of hits (each pair on same layer) pointing at the origin

- 2 consecutive hits in same layer
  → 4=2x2(Left-Right) pairs with direction
- 2 pairs from nearest layers compatible:
  |Δcos(φ(direction)-φ(position))|<0.2,
  crossing Z inside DCH
- 1 pair with origin → Pt estimate
  (averaged over 2 pairs)
- Cross Point of 2 opposite stereo pairs give
  Z-coordinate (with Δφ correction from Pt)
- Pz = 0 at beginning

Z measurement give additional compatibility check
between 2 hits and between 2 pairs

Combinatory low: 2 local compatibilities + 1 from opposite
stereo view, but with direction angle check

Red hits projection at z=0 plane
Yellow rotated according to φ

Single track efficiency
> 99.5%
(defined as reconstructed track with
>60% good hits)

Tracking procedure

development   Performance check

make 2 consecutive hits pairs in same layers   ✓   ✓

Find compatable pairs in neighbor layers   ✓

Pt estimation   ✓

Estimate z of pairs,check compatability of pairs again   ✓

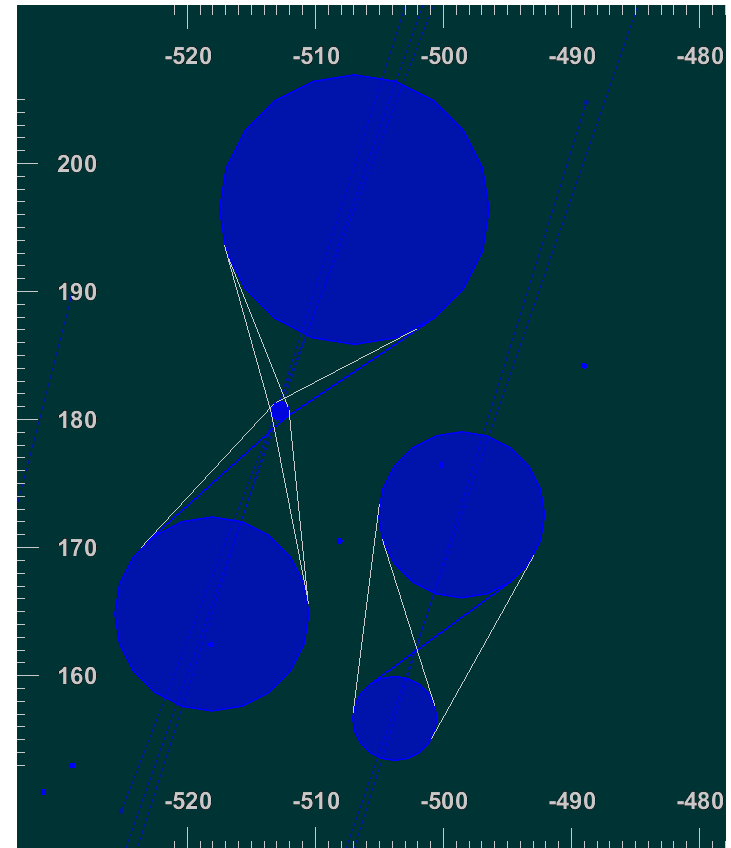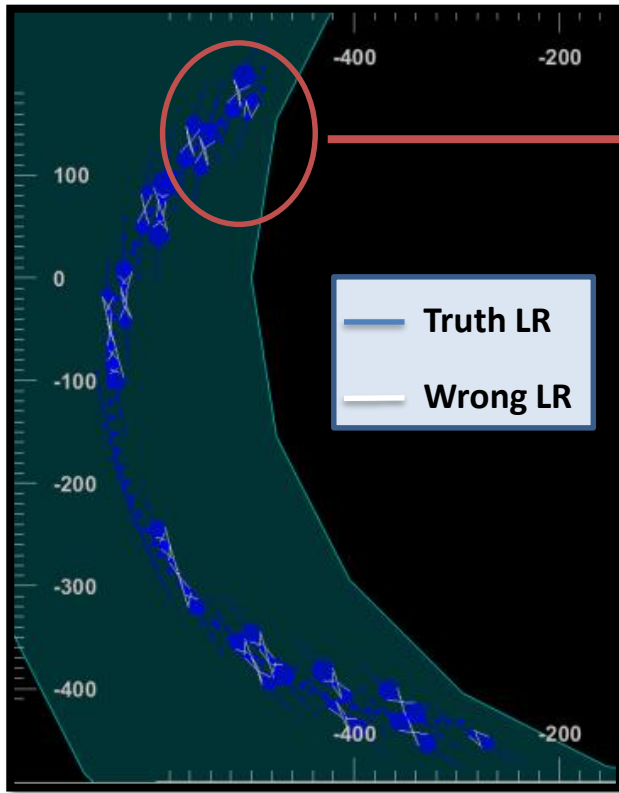Make helix seed with pz=0

Track following with Kalman filter

Find hits pair in same layer

- Find consecutive 2 hits(pair)
  - Skip outermost layer
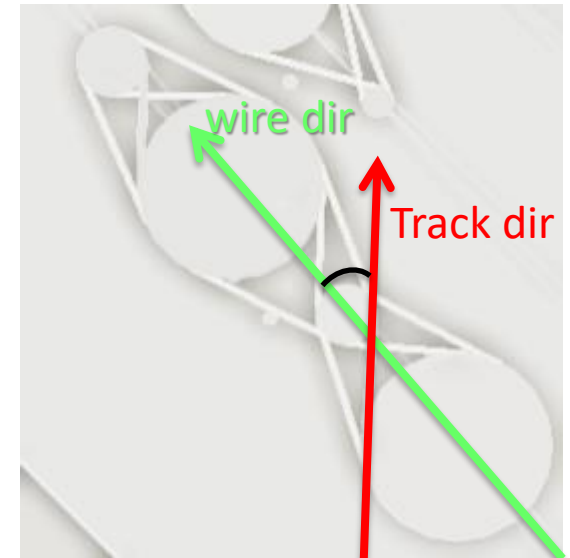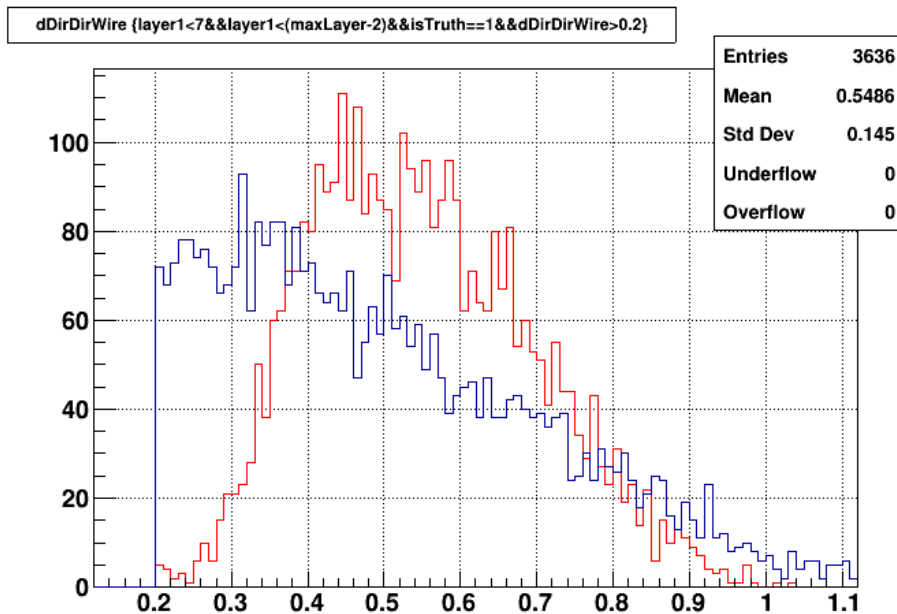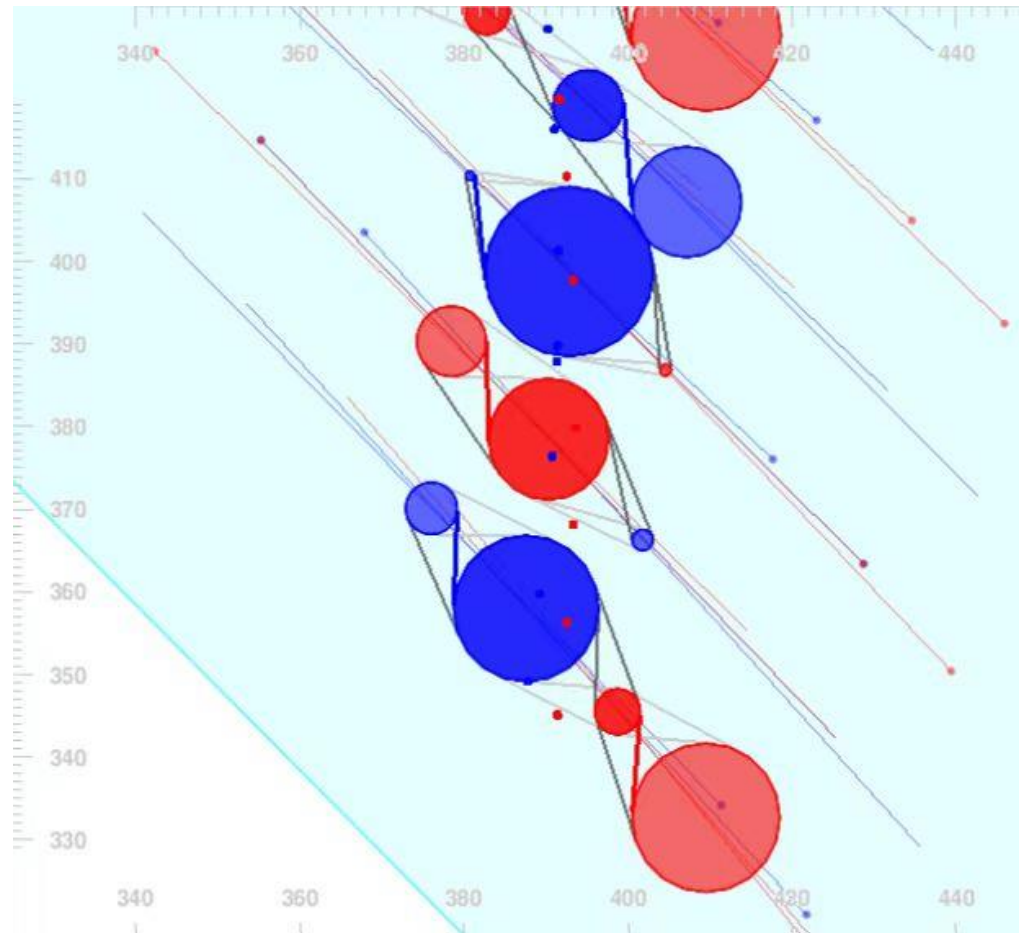 - Calc. 4 tangent lines of hit pairs @ z=0 reference code
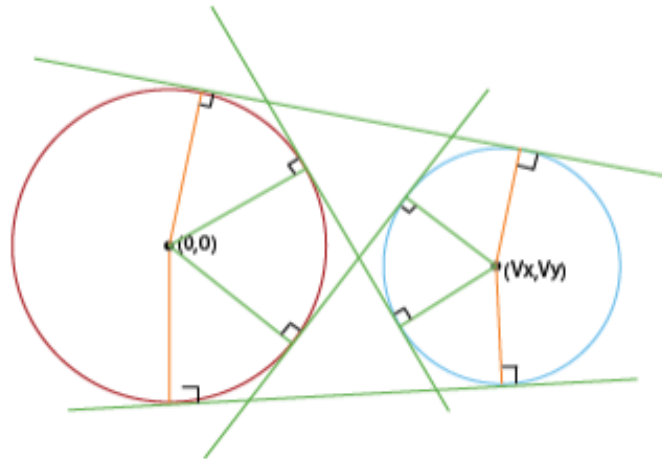
Event display

- One correct pair for 2 hits for single turn track

Select pair by direction

- The correction pair will going outside of the layer
 - Select pair by crossing angle between pair and wire

dDirDirWire {layer1<7&&layer1<(maxLayer-2)&&isTruth==1&&dDirDirWire>0.2}

Entries	3636
Mean	0.5486
Std Dev	0.145
Underflow	0
Overflow	0

wire dir

Track dir

Event display

Find compatible pairs in neighbor layers

- Find intersection of one pair to the middle plane of two layers
- Rotate pair alone wires to the intersection point
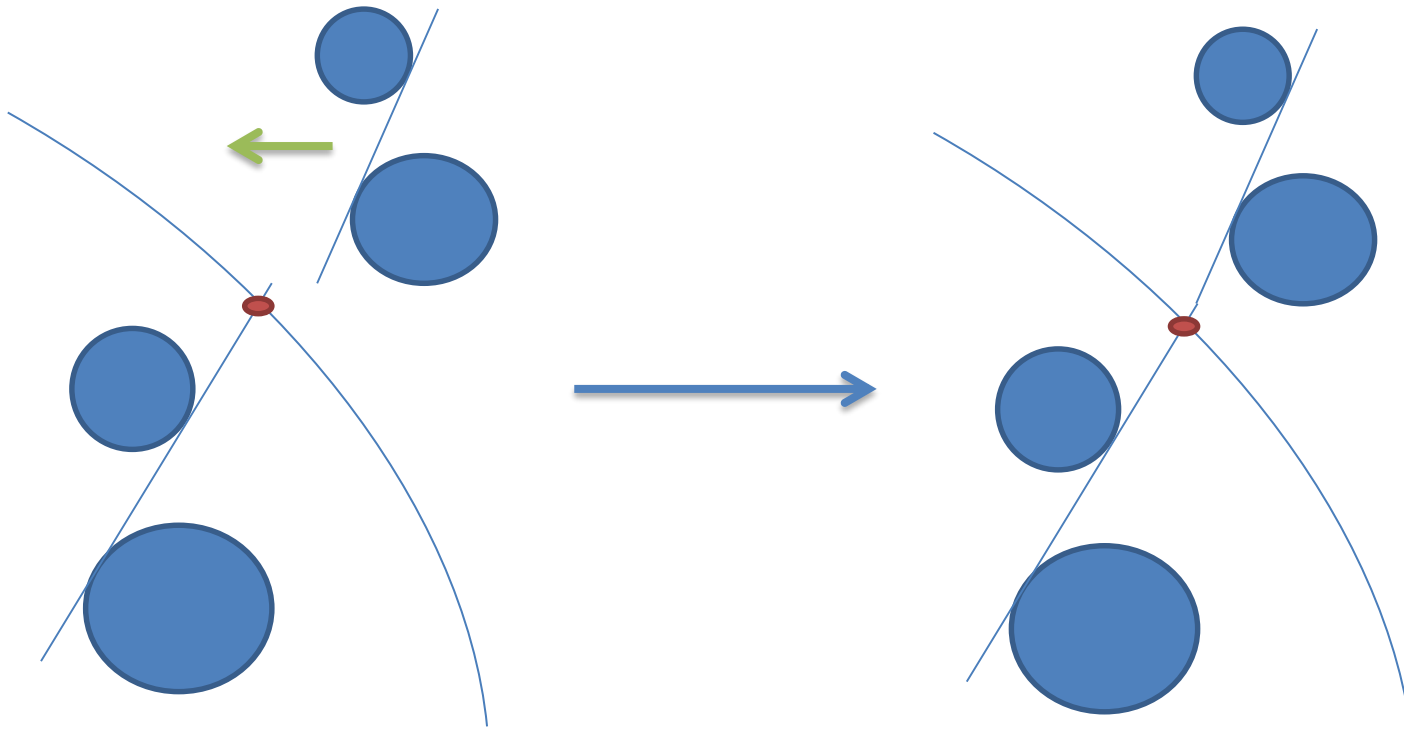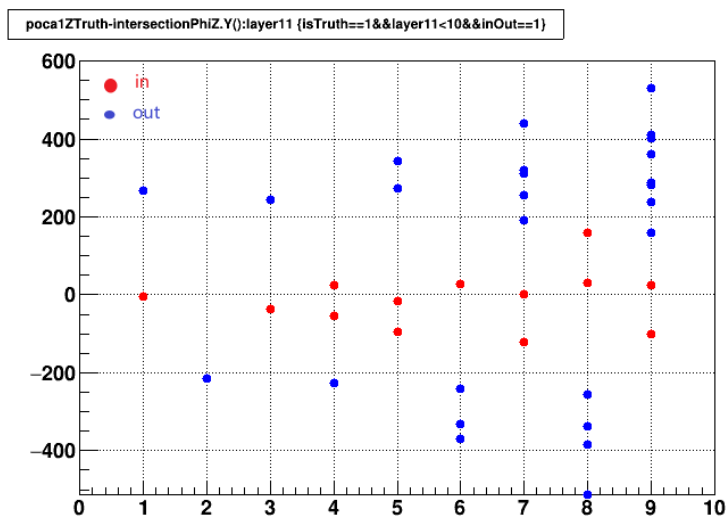
Select compatible pair by direction

- Check compatibility
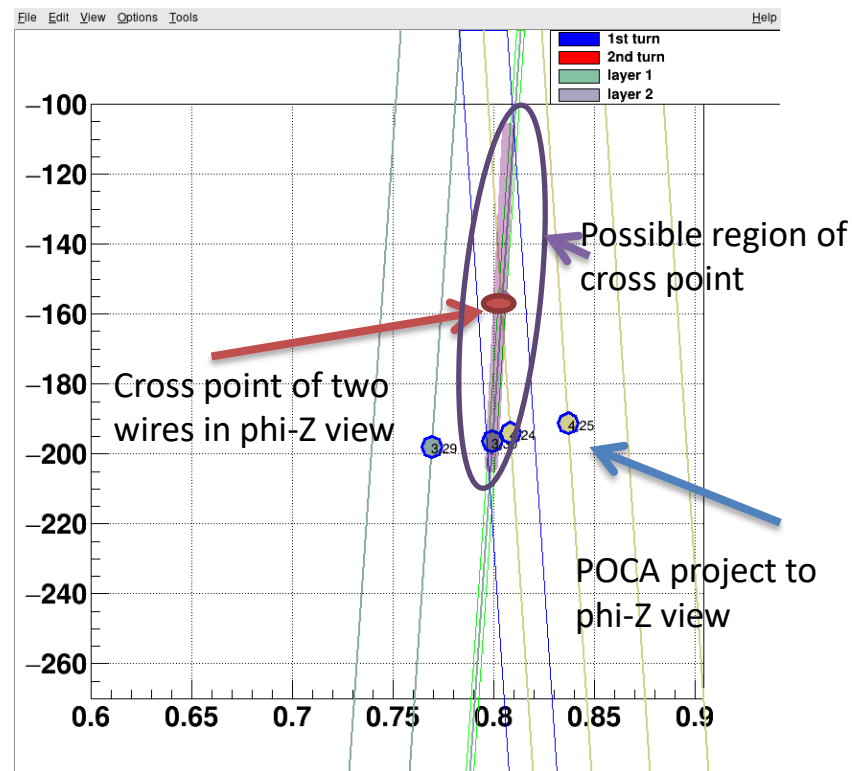 - Direction of two pairs
  - Cross z position inside CDC
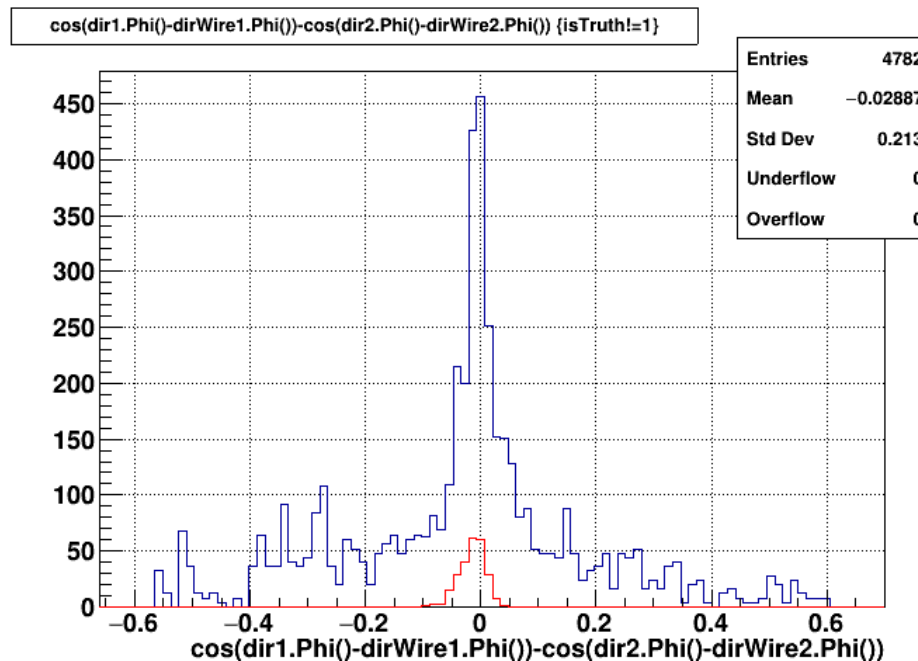
Difference of direction between two pairs

Improve using crossing Z of two pairs

- Order hits by azimuthal angle
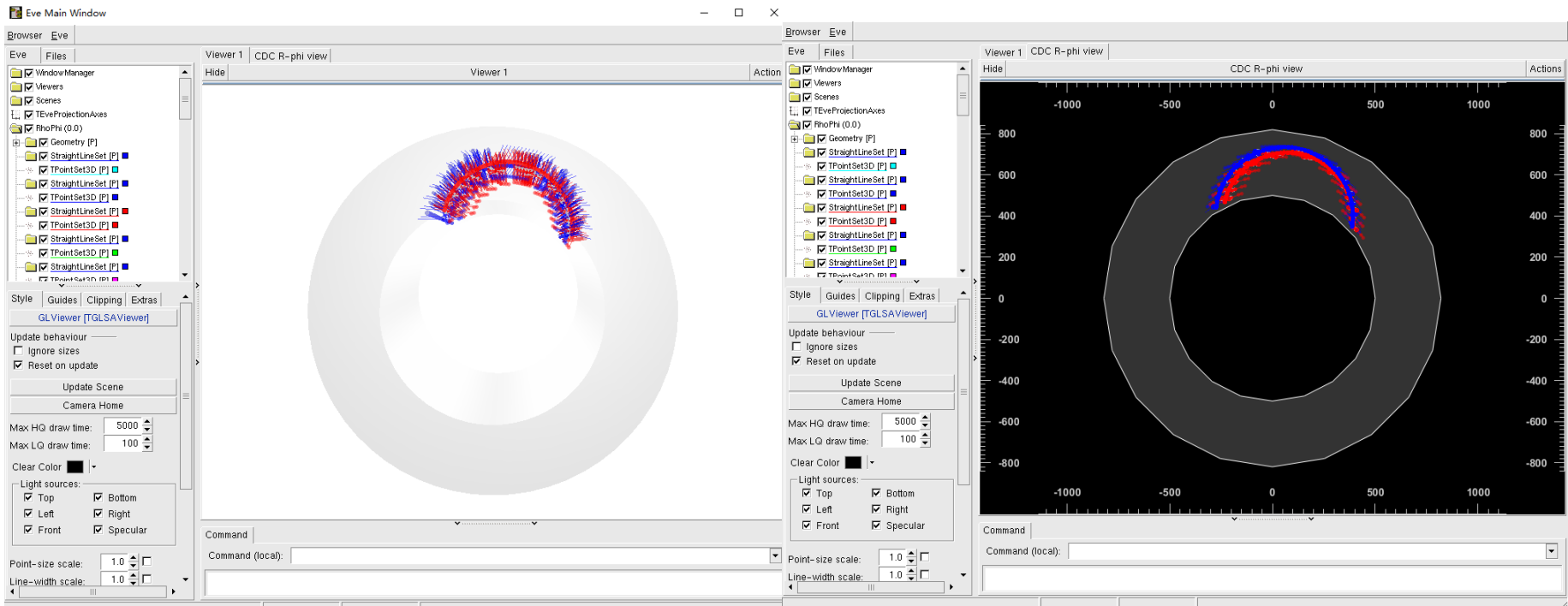- Find cross wires by hit order of two pairs
- Calculate cross point

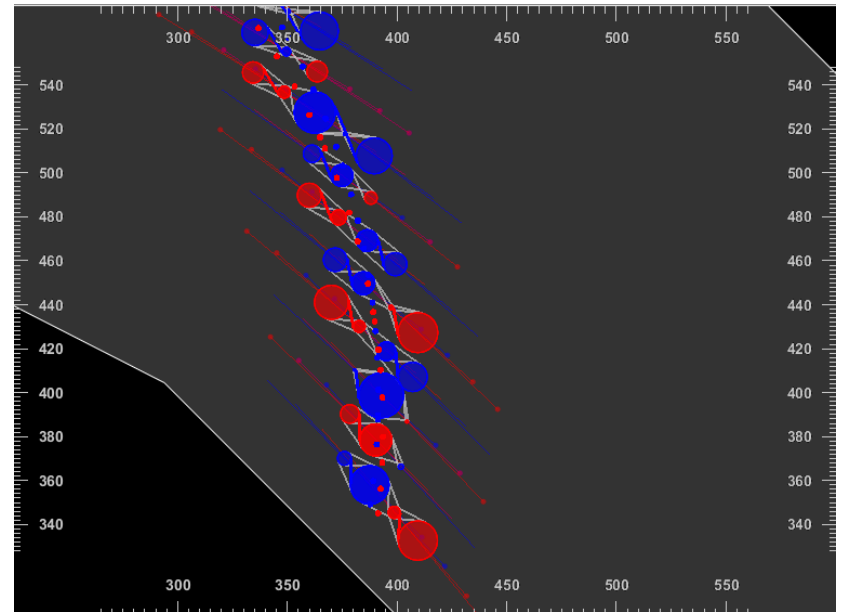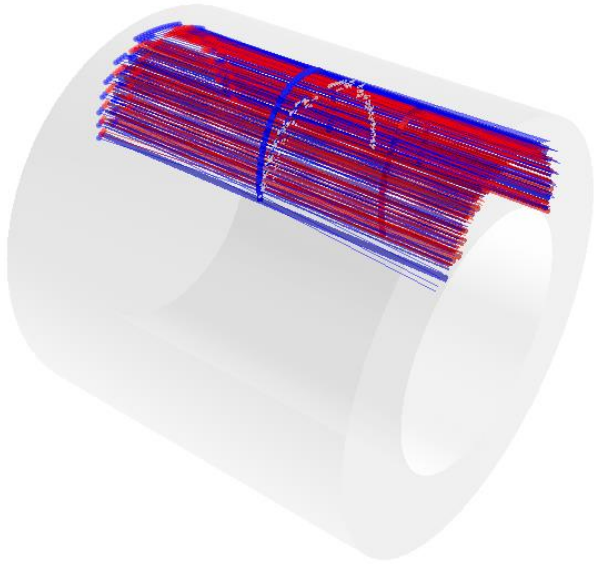Difference of z truth and z of intersection point of one event

Phi-Z view of a pair

CDC event display

- An event display have been developed based on ROOT eve for tracking study
- 3D and R-phi view are available with zoom in/out and rotate
- Use analysis tree/oaEvent from ICEDUST as input
  - Truth, digi, hit pair are supported now

CDC event display

Conclusion