VERTEX DETECTOR

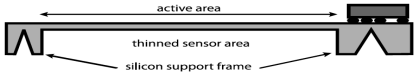
Pythia Minbias EIC ($Q^2 > 10^{-6}$) $\sigma \sim 200\ \mu b$ (HERA $\sim 165\ \mu b$)
N events = $\sigma \cdot L \sim 2 \cdot 10^6$ ev. per sec (2MHz) ~ 2 events / μs or ~ 20 events per readout

ZEUS/HERA(ep)= $165 \cdot 10^{-30} \cdot 2 \cdot 10^{31} \sim 3.3 \cdot 10^3$ per sec (~3kHz)

MAPS:
ALICE:
1 layers (with support)
$\approx 1\ \%\ X/X_0$
10 millions pixels
Integration time 30μs

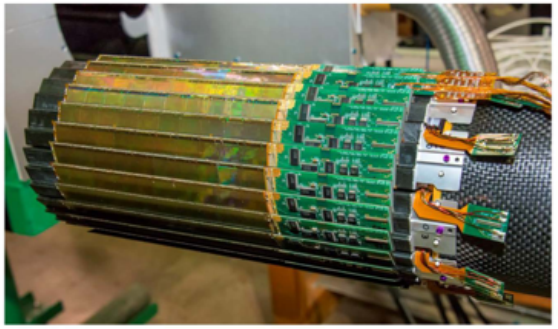
STAR:
1 ladder 0.39% X/X_0
50μm thickness
Pixel size 20.7x20.7 μm^2
356 millions pixels
R1=2.8 cm, R2=8cm
Integration time 185.6 μs

DEPFET
PXD BELLE-II:
-8 millions pixels
-1 ladder : **0.19 % X_0**
-thickness 50μm
(self-supporting)



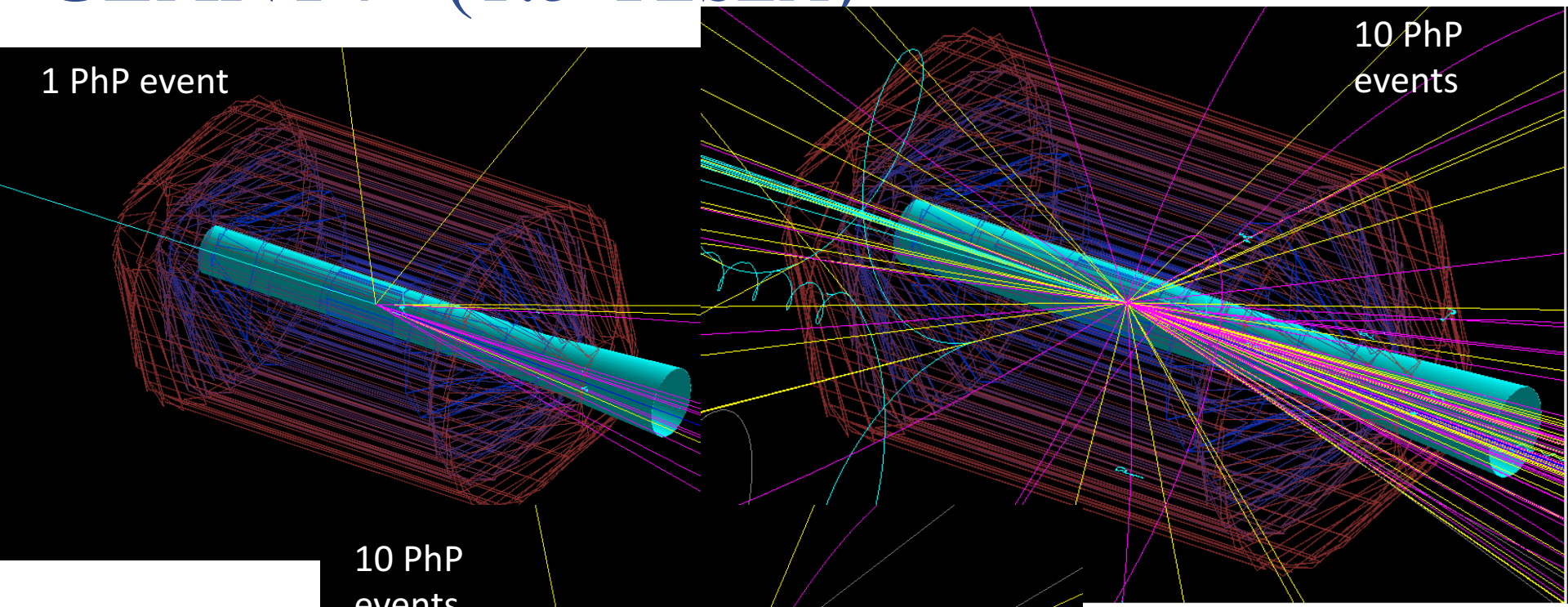
-Integration time **~10μs**
-price for vertex ~R
(2.5 M$ for L ~12 cm R ~1 cm)

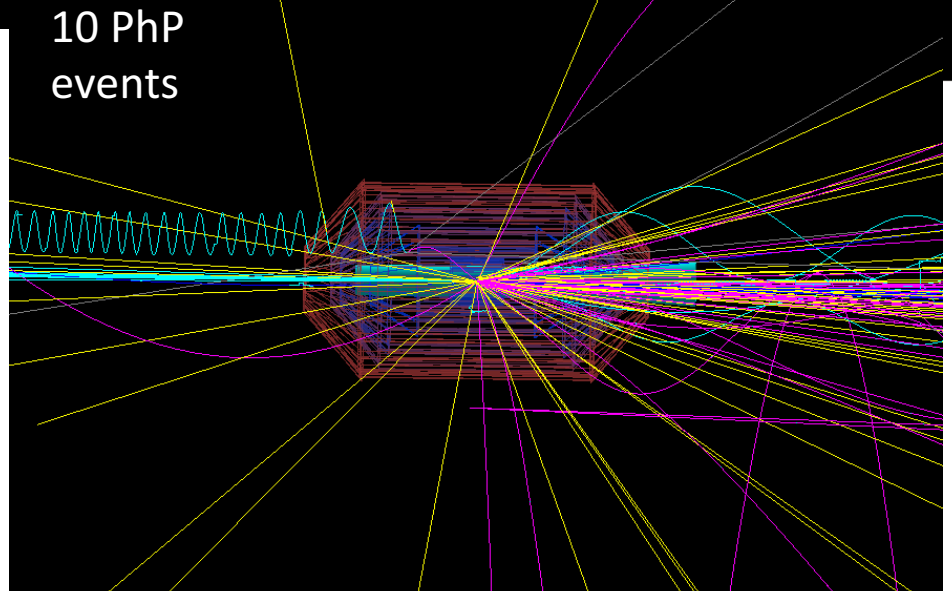
MAPS



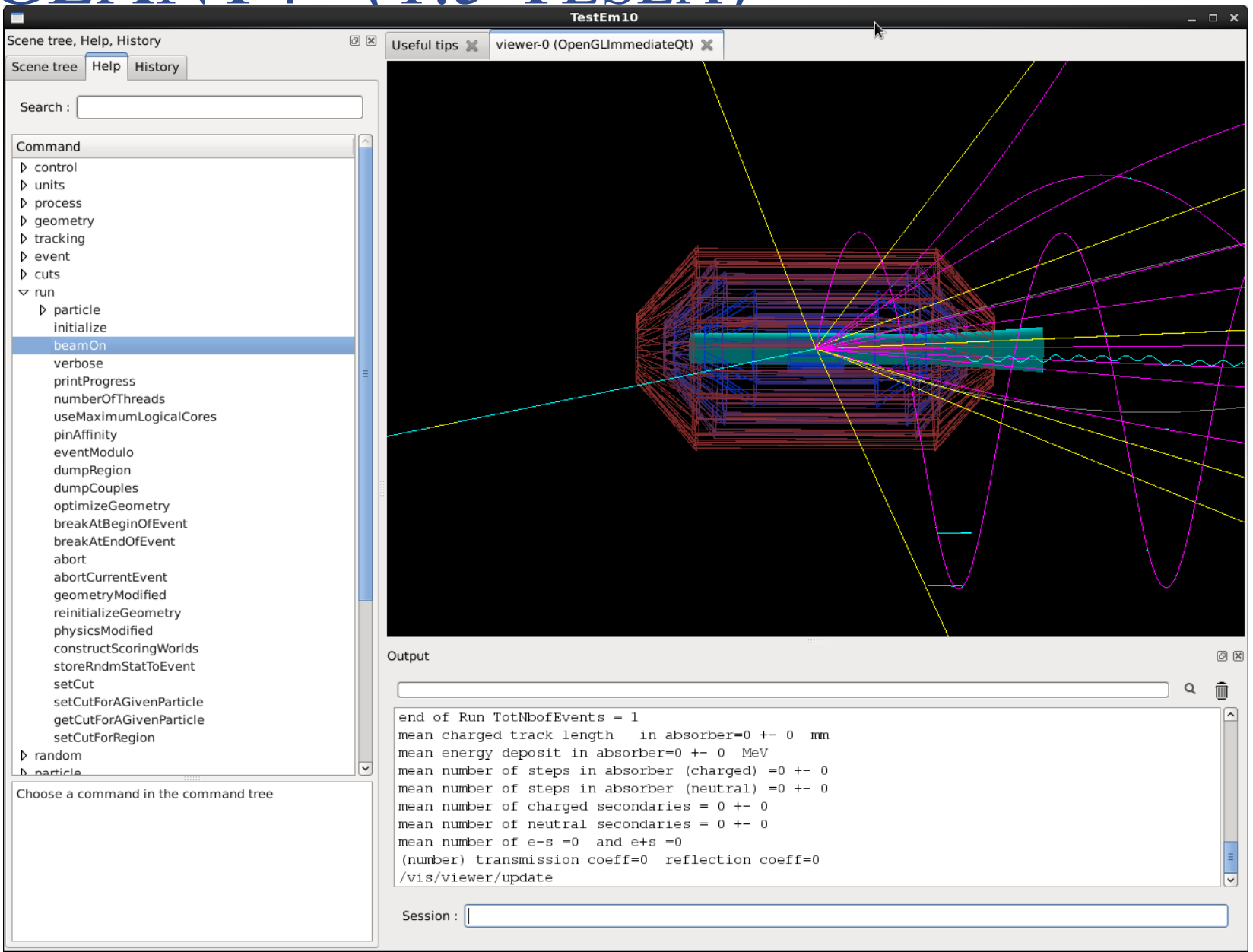
DEPFET

GEANT4 (1.5 TESLA)





GEANT4 (1.5 TESLA)

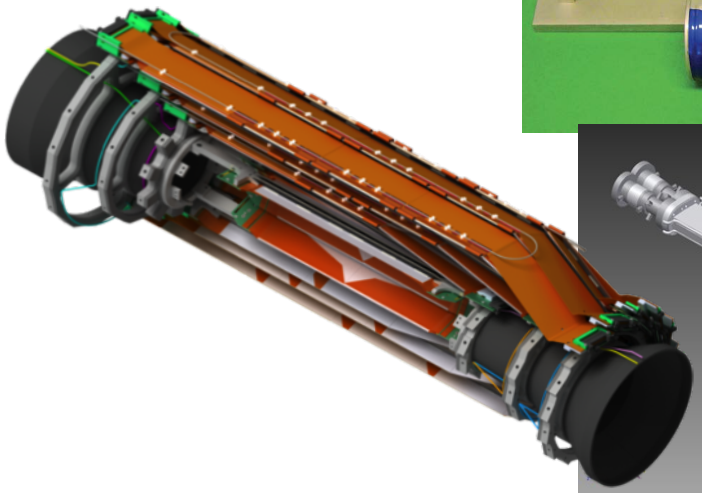


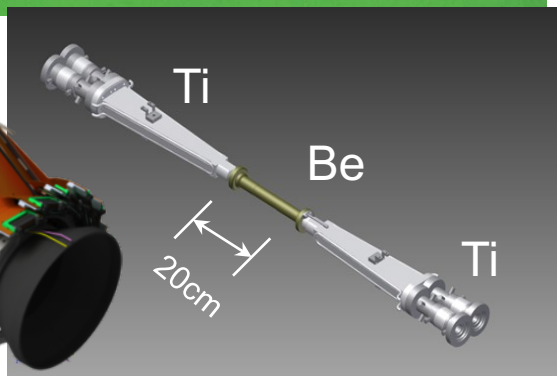
BELLE-II VERTEX DETECTOR

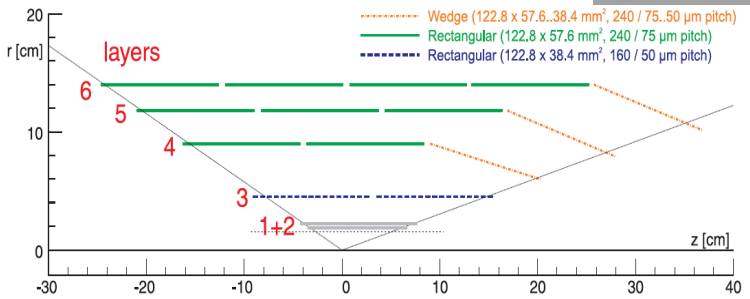
- price for pixel detector ~R (2.5 M$ for L ~12 cm R ~1 cm)

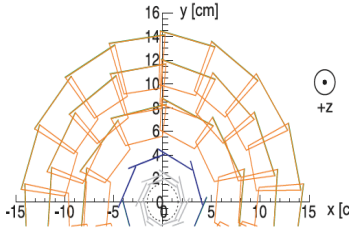
  1-2 PXD: DEPFET pixel sensors
  3-6 SVD: double-sided strip sensors

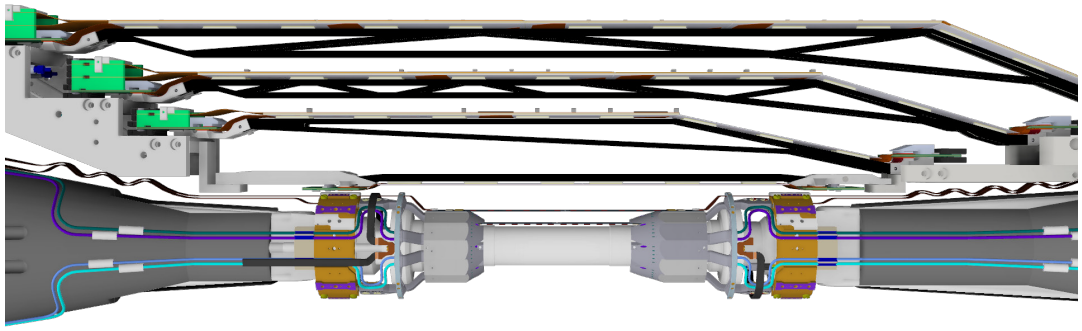
- Low material budget
- Very good resolution
- Good integration with beam-pipe
- Radiation hard (including electronics)
- Cooling











GEANT4 VTX

- **BEAM-pipe**

R=3.1 cm

Ca. 50 cm straight section

½ (50mrad) crossing angle

Space for VERTEX det. R~ 20cm

- **Pixel detector** 2 layers

2x10 (11) cm ladders (Box)

20um pitch, 50um thickness

2 layers

1st layer- 12 ladders

2nd layer- 14 ladders

- **Strip detector**

➢ **Barrel** 5 layers

ladders 12/12/18/20/24 (Box)

length 24/24/36/40/48

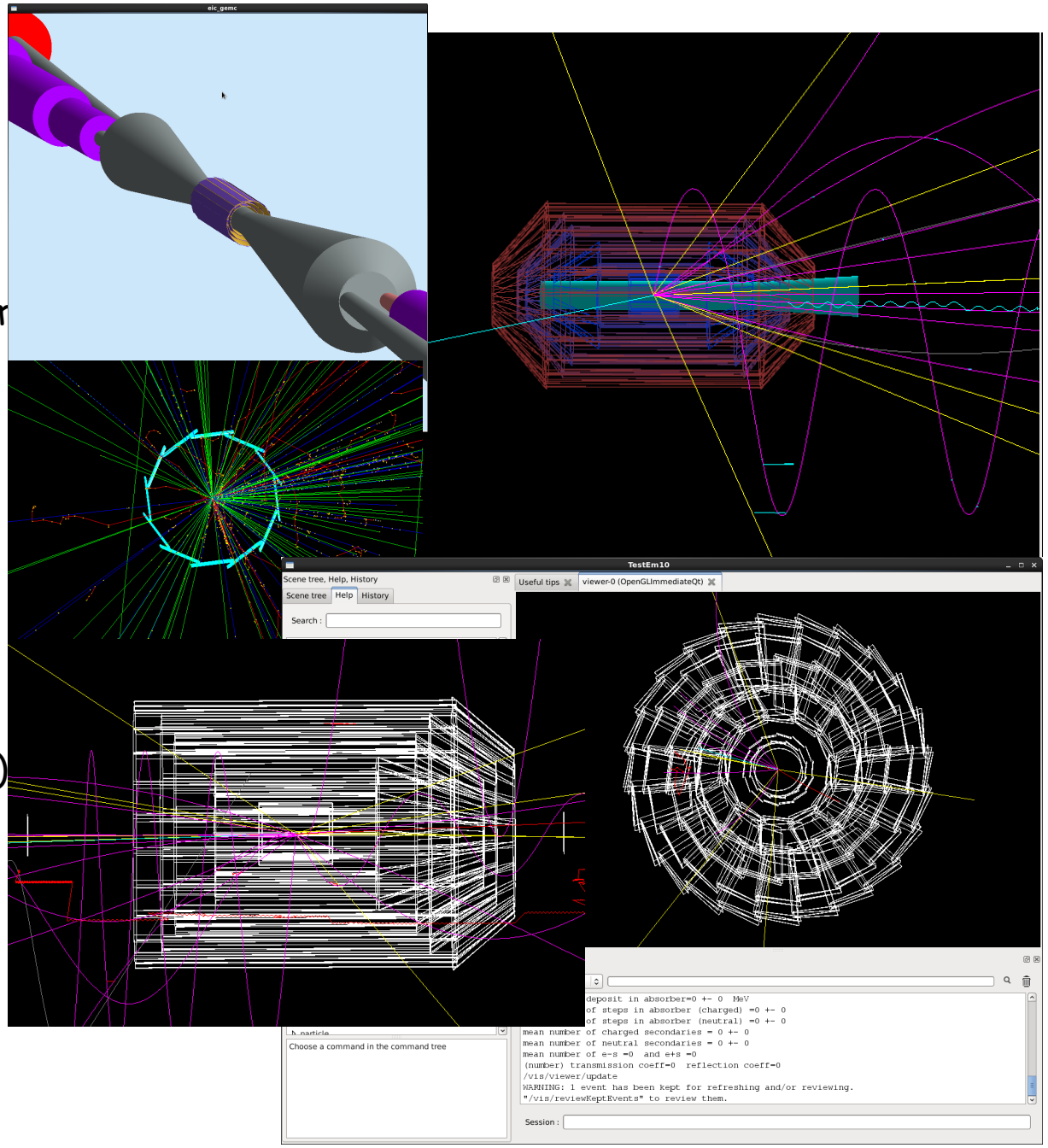
width 4/6/6/6/6

➢ **Endcap** 4 layers

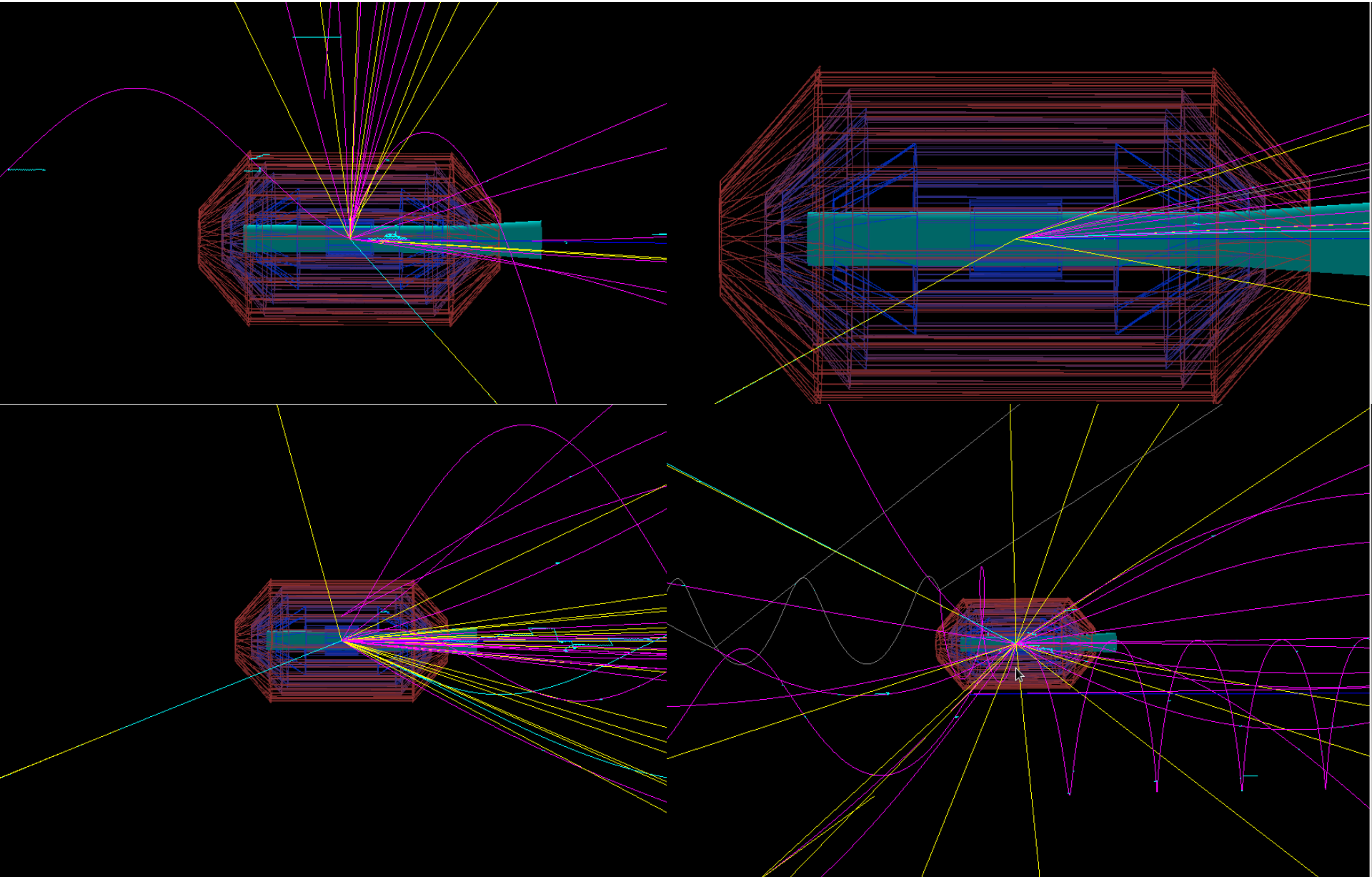
ladders 12/18/20/24(Trap)

length 12/14/16/18

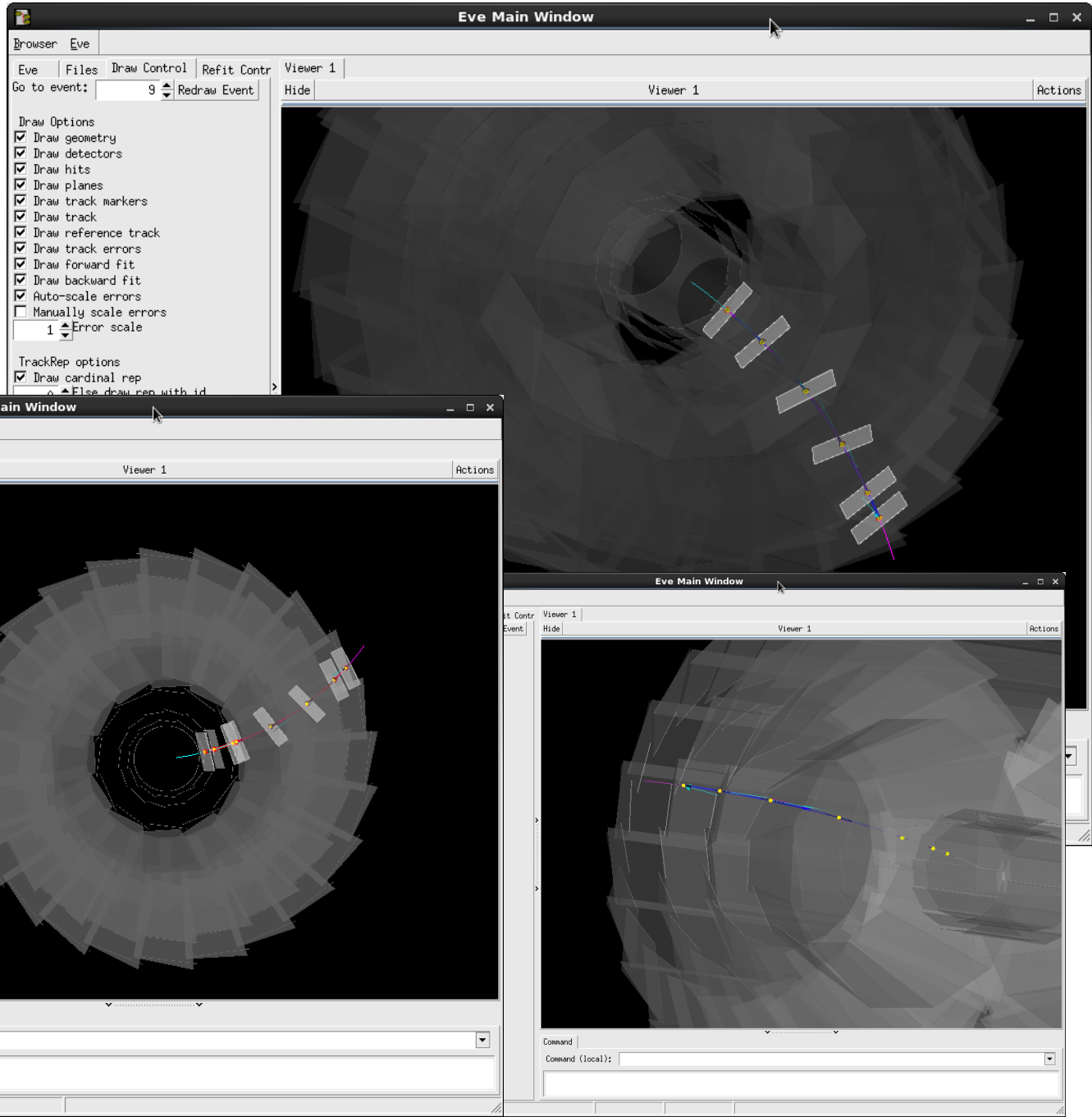
width1 4, width2 6



VERTEX WITH CHARM EVENT Q2>10, 1.5 TESLA



GENFIT


Eve Main Window
Browser Eve
Eve Files Draw Control Refit Contr Viewer 1
Go to event: 9 Redraw Event
Hide Viewer 1 Actions
Draw Options
Draw geometry
Draw detectors
Draw hits
Draw planes
Draw track markers
Draw track
Draw reference track
Draw track errors
Draw forward fit
Draw backward fit
Auto-scale errors
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1 Error scale
TrackRep options
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Eve Files Draw Control Refit Contr Viewer 1
Go to event: 5 Redraw Event
Hide Viewer 1 Actions
Fitting options
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0 debug level
Fitter type:
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Reference Kalman
DAF w/ simple Kalman
DAF w/ reference Kalman
Multiple measurement handling in Kalmar
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unweighted average
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unweighted, closest to reference
weighted, closest to prediction
unweighted, closest to prediction
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Use square root formalism (simple Kal
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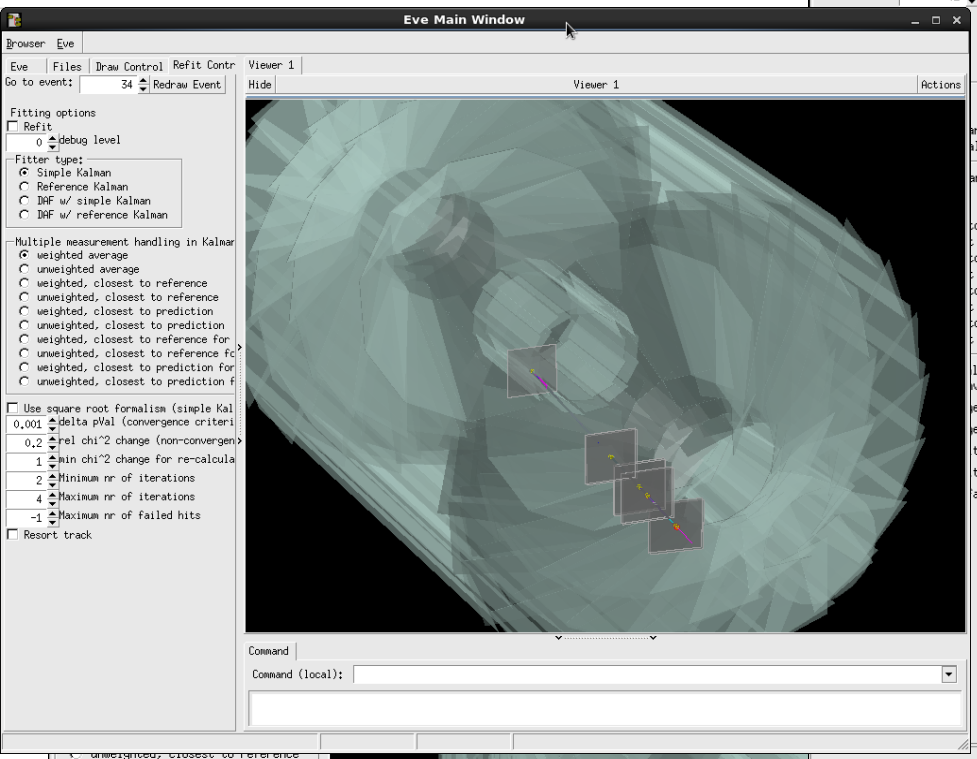
1 min chi^2 change for re-calcula
2 Minimum nr of iterations
4 Maximum nr of iterations
-1 Maximum nr of failed hits
Resort track
Command
Command (local):
Eve Main Window
Hide Viewer 1 Actions
Command
Command (local):

GENFIT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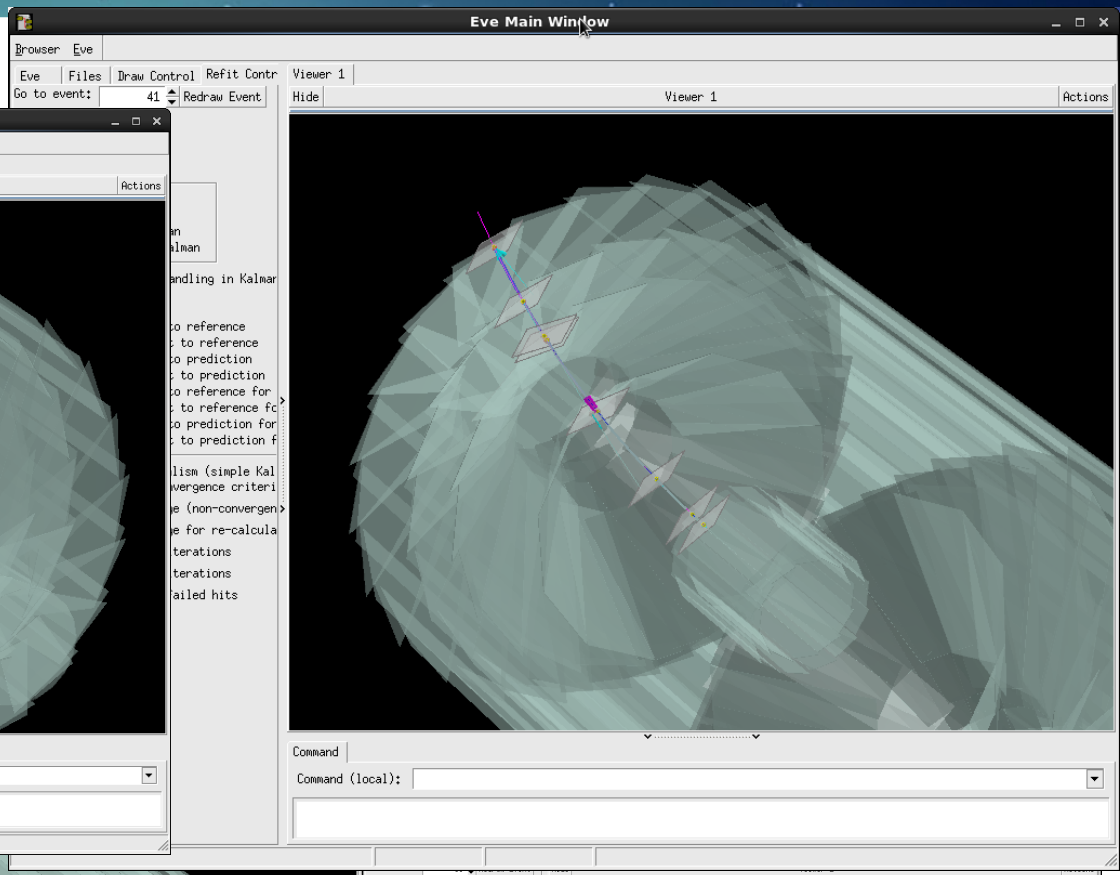
Resort track
Viewer 1
Hide
Viewer 1
Actions
Command
Command (local):


Eve Main Window
Browser Eve
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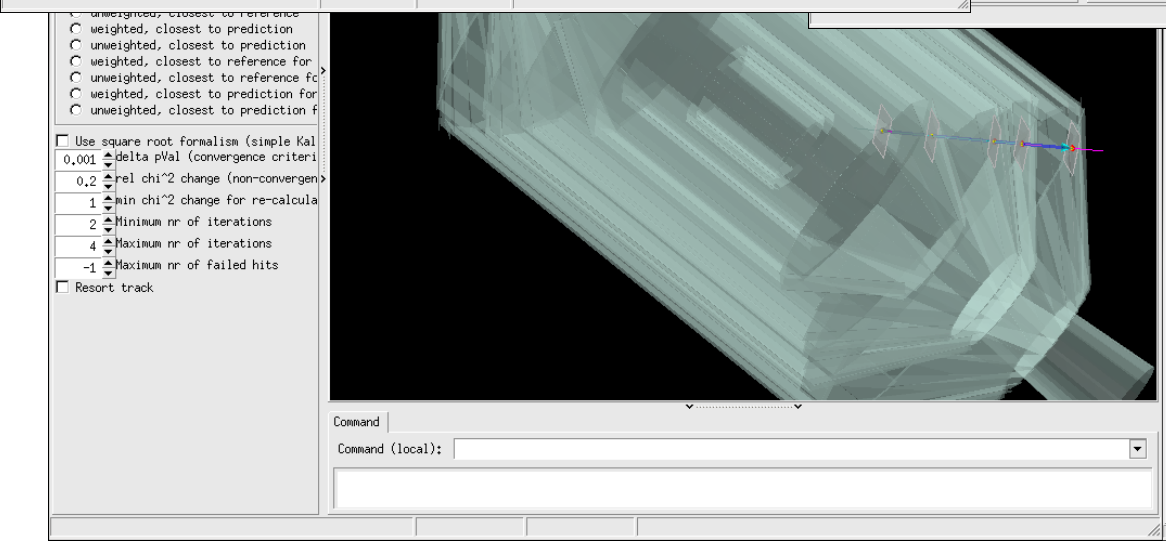
Go to event: 41 Redraw Event
Viewer 1
Hide
Viewer 1
Actions
Command
Command (local):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unweighted, closest to prediction
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unweighted, closest to reference fc
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Resort track
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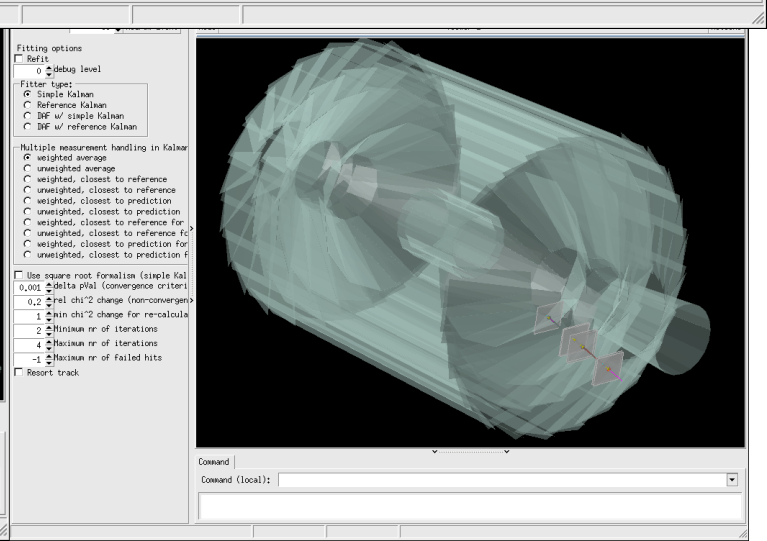
Command (local):


Fitting options
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Reference Kalman
DAF w/ simple Kalman
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2 Minimum nr of iterations
4 Maximum nr of iterations
-1 Maximum nr of failed hits
Resort track
Command
Command (local):

TODO:

- **GEANT4:**

- First version of VERTEX det. is ready
-Add outer tracker (TPC or MW in barrel, GEM-endcaps)

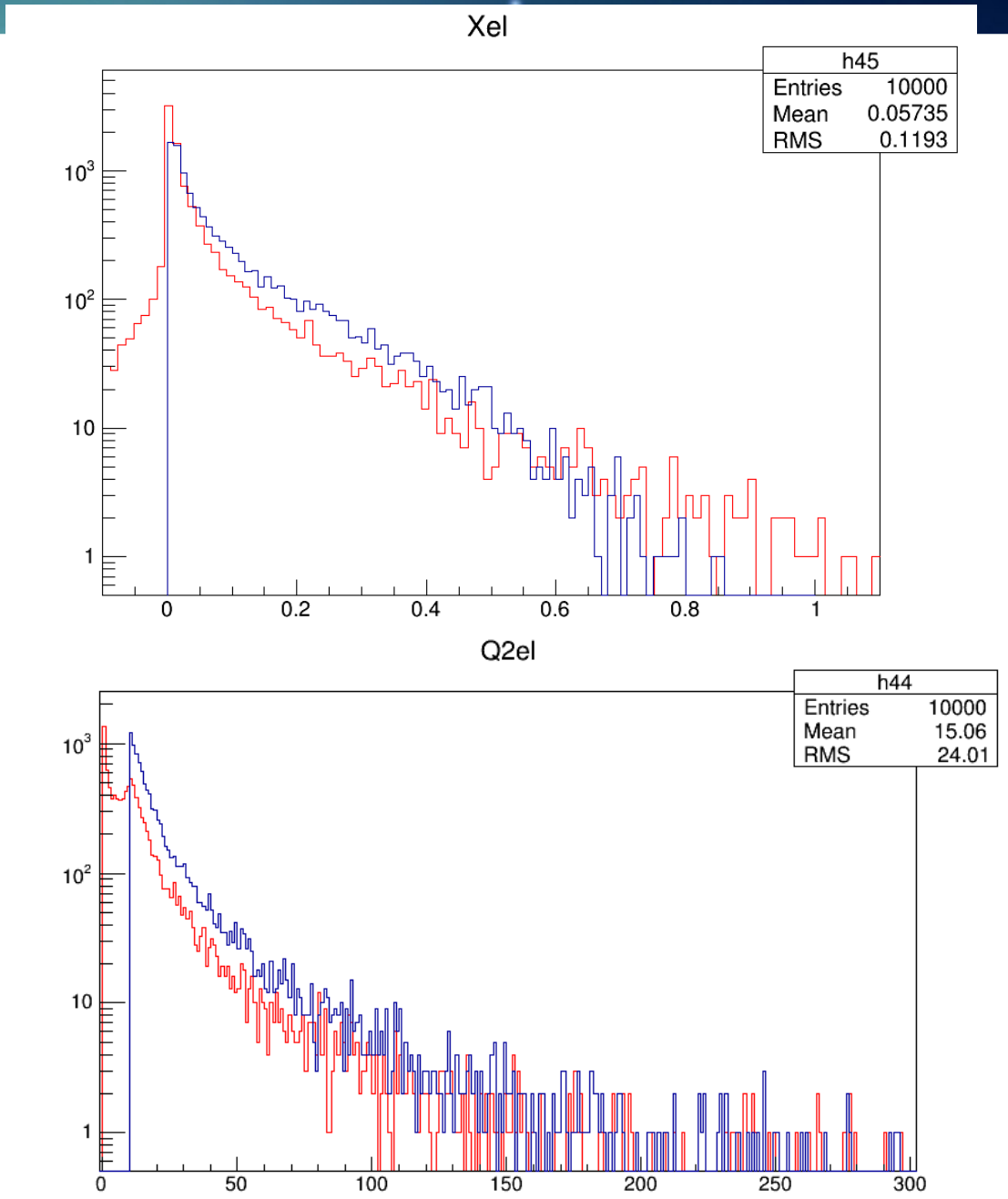
- **GENFIT**

- I/O file:
  -> Now: hits and track ID only.
  -> add MC info (org. momentum, id, etc.)
- 'Eve' Event display
  -> At the moment – track by track
  -> Create Event (multiple tracks)
  -> Use Eve as Event Display

- **RAVE** (vertex fitting)

- Have software, but have to learn how to use it

- **Analysis**

- Create "LUND" or … file with reconstructed mometa, vertex, PID
-

Electron Method