



Graduate Student's experience in learning, exploring and using FAIRROOT

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EIC Detector R&D Simulation Workshop
Oct 8th 2012
Brookhaven National Laboratory

Acknowledgements

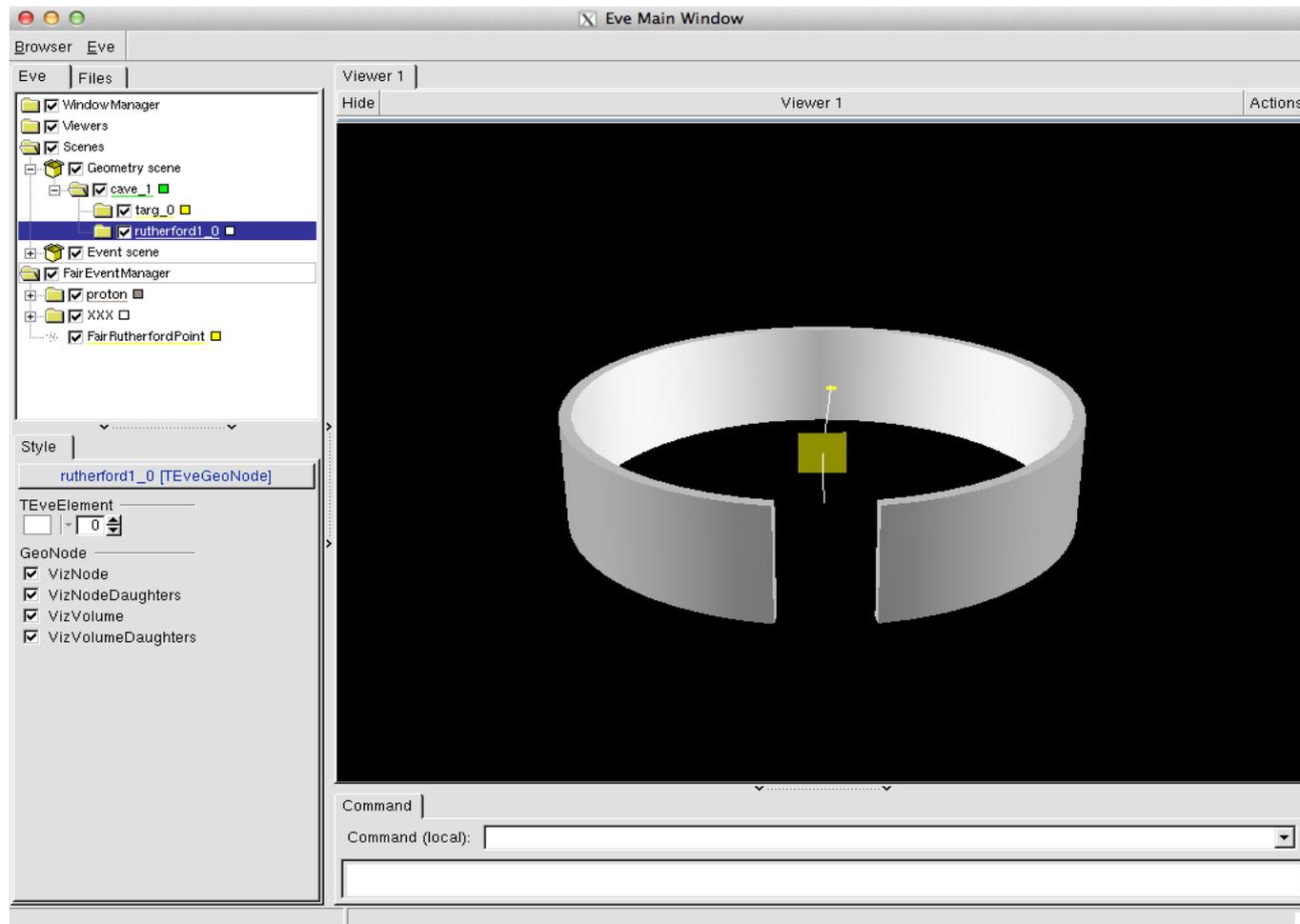
- EIC R&D organizers, BNL EIC task force
- Dr. Abhay Deshpande, Dr. Klaus Dehmelt
Stony Brook University
- Dr. Mohammad Al-Turany, Dr. Florian Uhlig, Dr. Radoslaw Karabowicz
GSI, Darmstadt
- Dr. Stefano Spataro
University of Turin
- Will Forman, Yakov Kulinich and Raphael Cervantes

Installing Fairroot

- Integration of different concepts
- No real documentation available
- Continuous conversation with people at GSI
- Heavily dependent on Libraries (which are really hard to understand)
- 1 month – from downloading package to running the example (at start)
- Now less than a couple of hours (depending on the speed of computer)

Running Examples

- Rutherford Experiment



Building a New Detector

- Create a copy of Rutherford that works
- Start modifying that copy
- Hopefully end up with another detector that works.

- Lots of copying and pasting, renaming the classes etc...
- Structure available at PANDAROOT

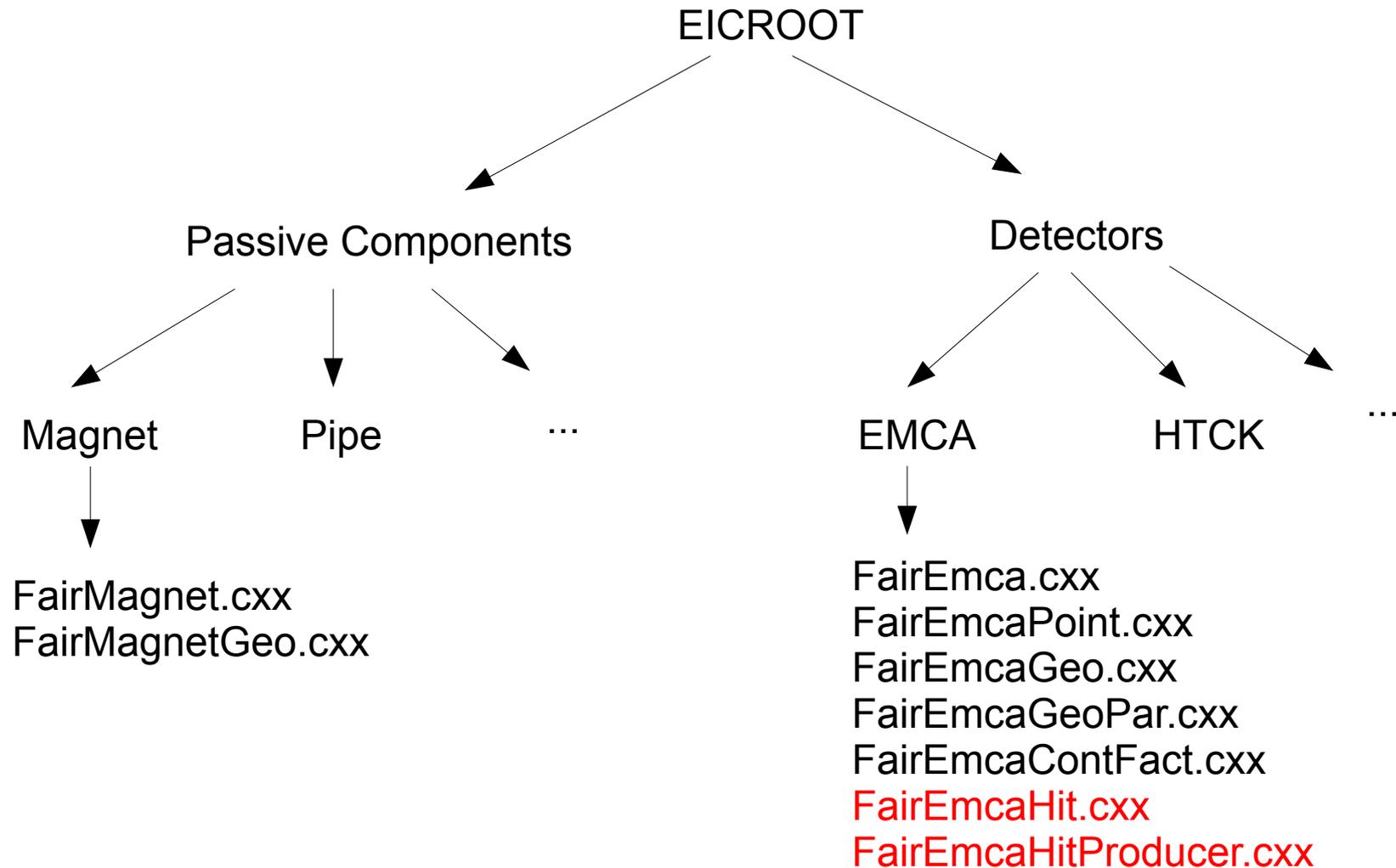
Creating EIC Detector – Geometry Files

Detector	Material
Barrel EM Calorimeter	Lead Glass (O, Si, Ti, As, Pb)
DIRC	Fused Silica (SiO_2)
Silicon Detectors	Si
Trackers	Mylar, Ar/ CH_4/CO_2 90 : 5 : 5
High Threshold Cherenkov (HTCK)	CO_2
RICH	C_4F_{10} , Aerogel (O_2SiH_2)
Barrel Tracker inner surface	Be
Barrel Tracker end plate	Al
Barrel Tracker Gas Volume	He, C_4H_{10} 80:20
Solenoid	Fe
Dipole Magnets	Fe
Beam Pipe	Be
Hadronic Calorimeters	Fe
Electromagnetic Calorimeters	Lead Glass

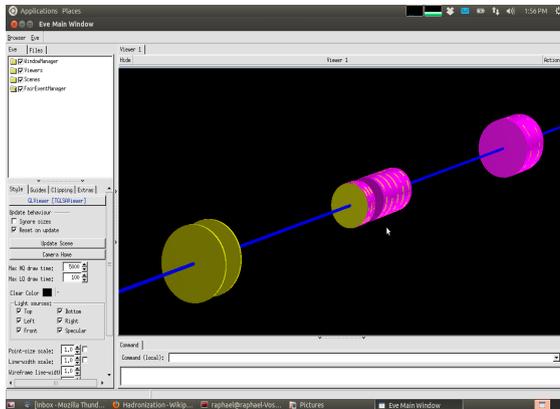
```
//test geometry to find digi
//*****
emca01sensor#1
cave
BOX
FGT_kapton
10. 10. 5.
-10. 10. 5.
-10. -10. 5.
10. -10. 5.
10. 10. 6.
-10. 10. 6.
-10. -10. 6.
10. -10. 6.
0. 0. 0.
1. 0. 0. 0. 1. 0. 0. 0. 1.
//
emca01sensor#2
cave
BOX
FGT_kapton
10. 10. 34.
-10. 10. 34.
-10. -10. 34.
10. -10. 34.
```

https://wiki.bnl.gov/eic/index.php/Detector_Design

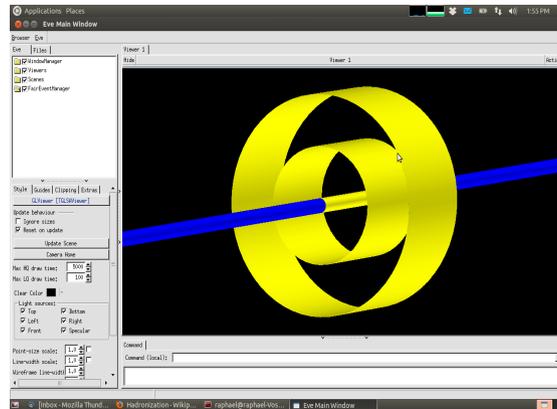
Creating EIC – Detector Classes



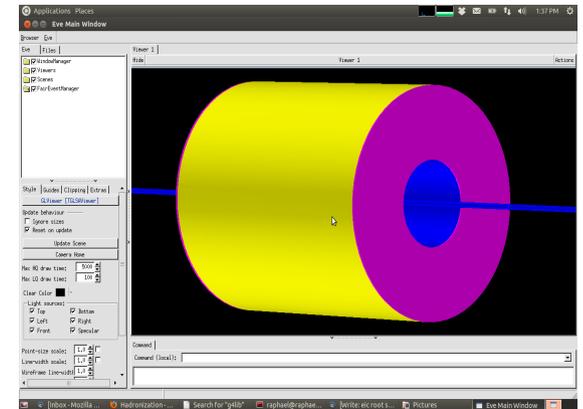
Running "EICROOT"



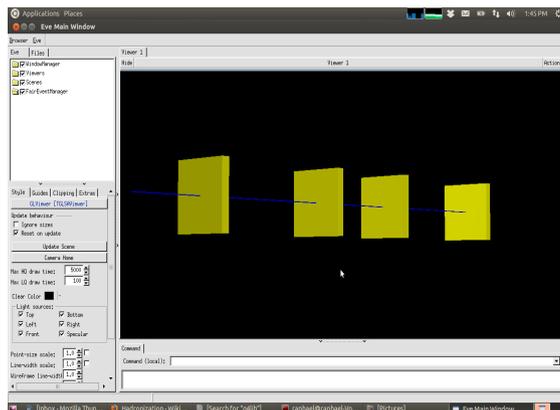
Tracker



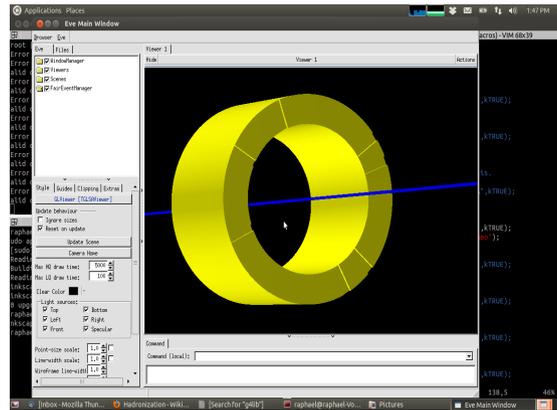
Silicon Tracker



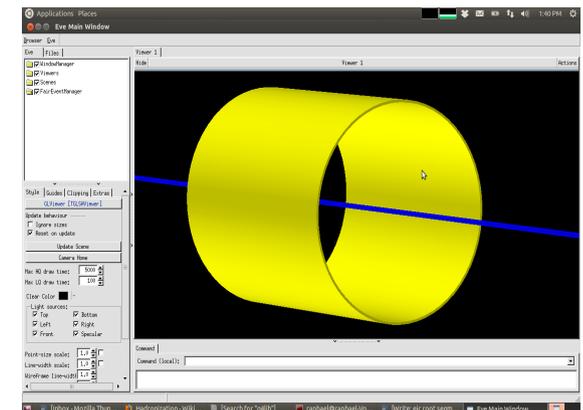
Barrel Tracker



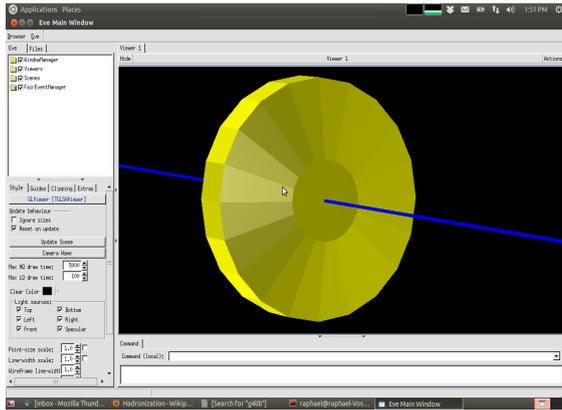
EMCA



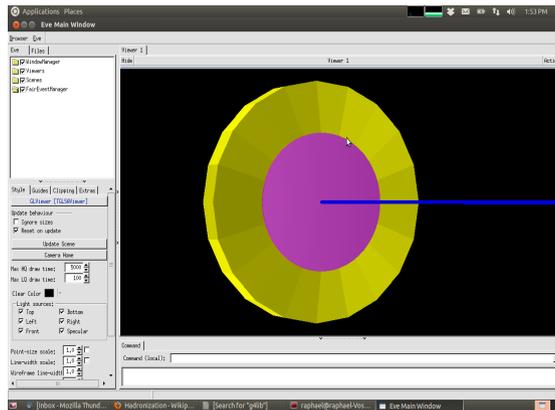
EMLF
EIC R&D @ BNL



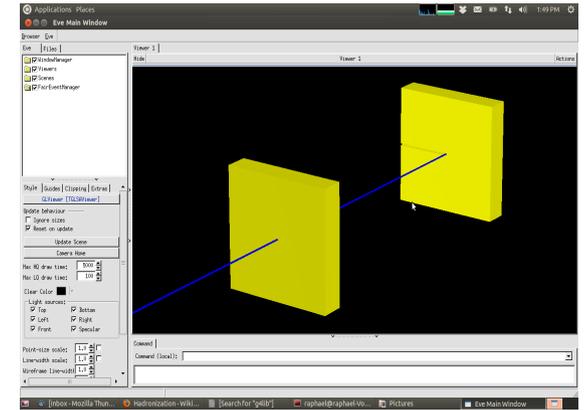
DIRC



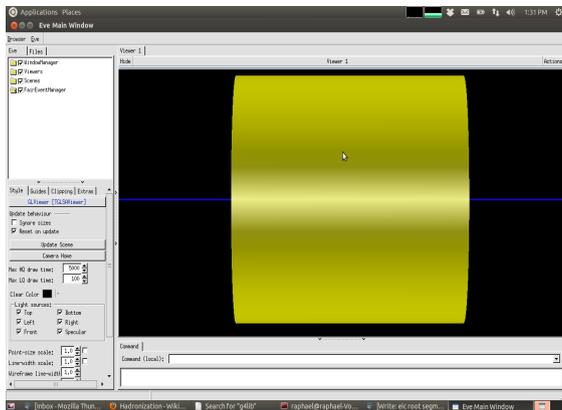
HTCK



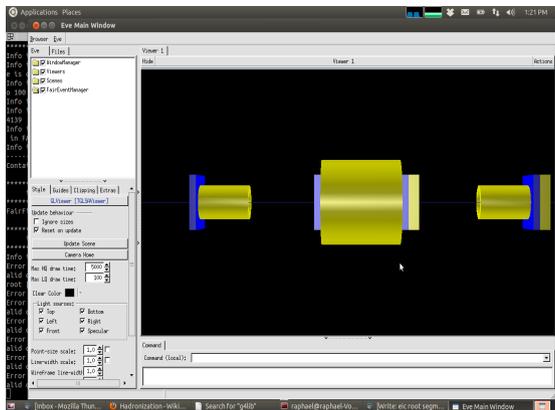
RICH



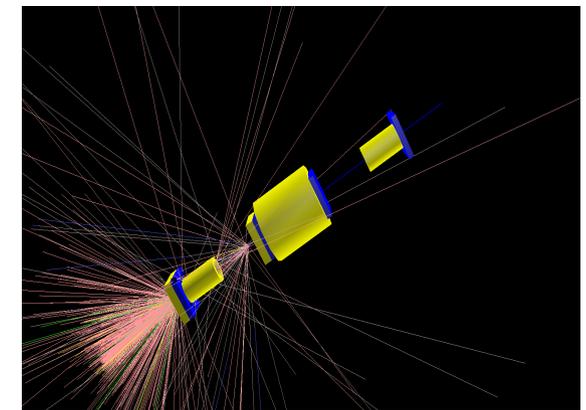
HACA



Solenoid Magnet

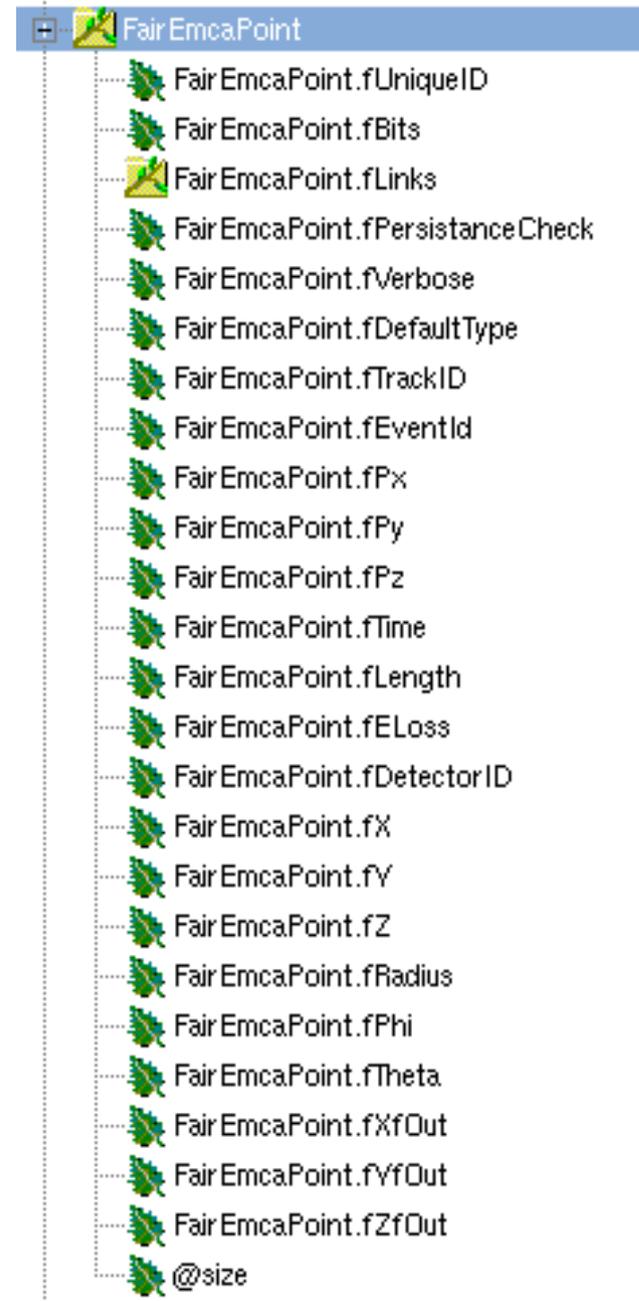
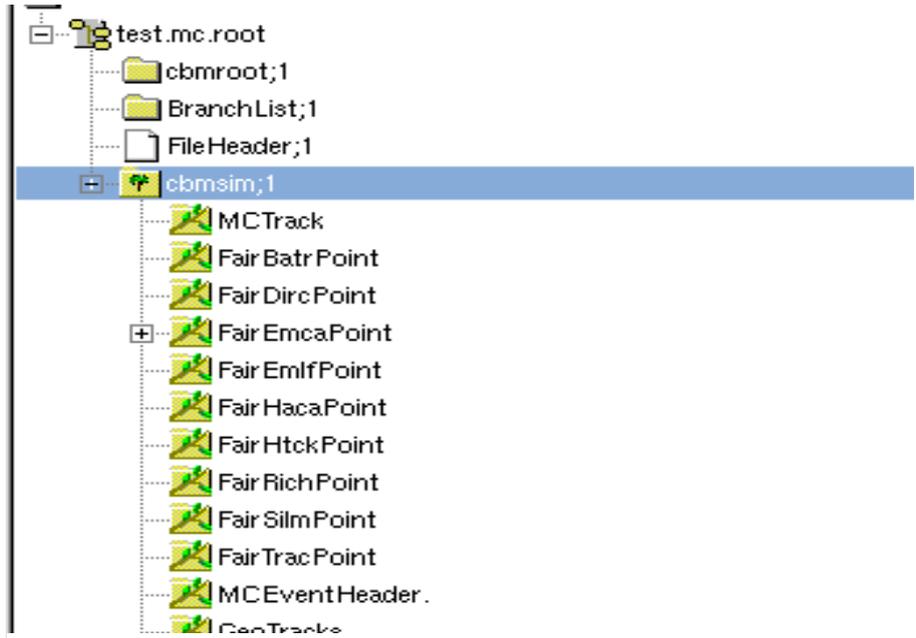


Whole EIC Detector

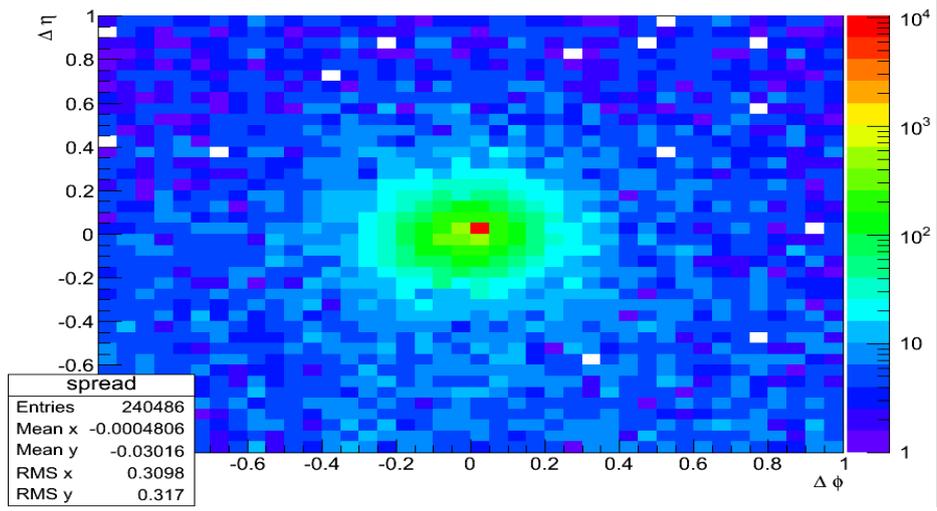


Whole EIC Detector showing one event

Physics Analysis



Spread of all the jet particles in LQ in vacuum in the 3pion decay events



Fairroot on RCF

- `/direct/eic+u/raghavke/EICROOT/`
- Integrated with FastJet 3.0.3
- Env variables set in `/direct/eic+u/raghavke/config.csh`
- Macros (for running EIC and Jet analysis) available at `$EICWORKDIR`
- Lepto-quark detector simulation study → comparing jet-widths from tau decays and DIS jets

Creating EIC in Fairroot

- Current
 - Build is in Fairroot (learning period)
 - Digitization and Reconstruction only for EMCA
 - No PID/tracking without event display.
- Near future
 - Excited at the prospect of collaborating with BNL EIC task force
 - Standalone EICROOT
 - Individualized detector classes (hit production / reconstruction)
 - Add Fast simulations as an option