MIPP Offline Software Status

Director's Review
10 Nov 2004

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Indiana University

Major Software Components

- MIPP uses C++ for offline w/ some Fortran in MC
- Leverage ROOT utilities heavily to make best use of limited manpower
- Keep things simple and easy to learn for same reason
- Roughly 1/4 collaborators contribute to offline!

Data Format and I/O

raw format optimized for fast transfers and writes in DAQ
root format optimized for flexibility offline

Database

Based on postgresql. C++, python, and perl interfaces

Job control and configuration

Relatively straight forward. Based on XML test files.

Monte Carlo and Geometry

Geometry stable. MC needs tuning.

Event Display

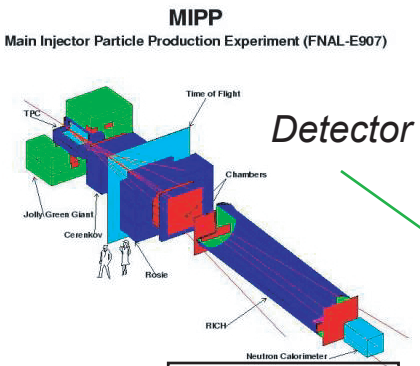
Leverage ROOT gui and graphics classes
Relatively flexible and extendable
Linked to interactively to reconstruction

Reconstruction

Sets of base classes. Most development occuring here now.

- Stable
- Still tweaking
- Actively working

Data Flow



Detector

Shift workers

Environment
(voltages, temperatures, currents, pressures…)

ACNET

IFIX

DAQ

Raw Data

DAQ Monitoring

SlowControl

express line

raw2root

e907daq

e907ana3

offsite_machine

enstore

DB Server

Database

e907ana1

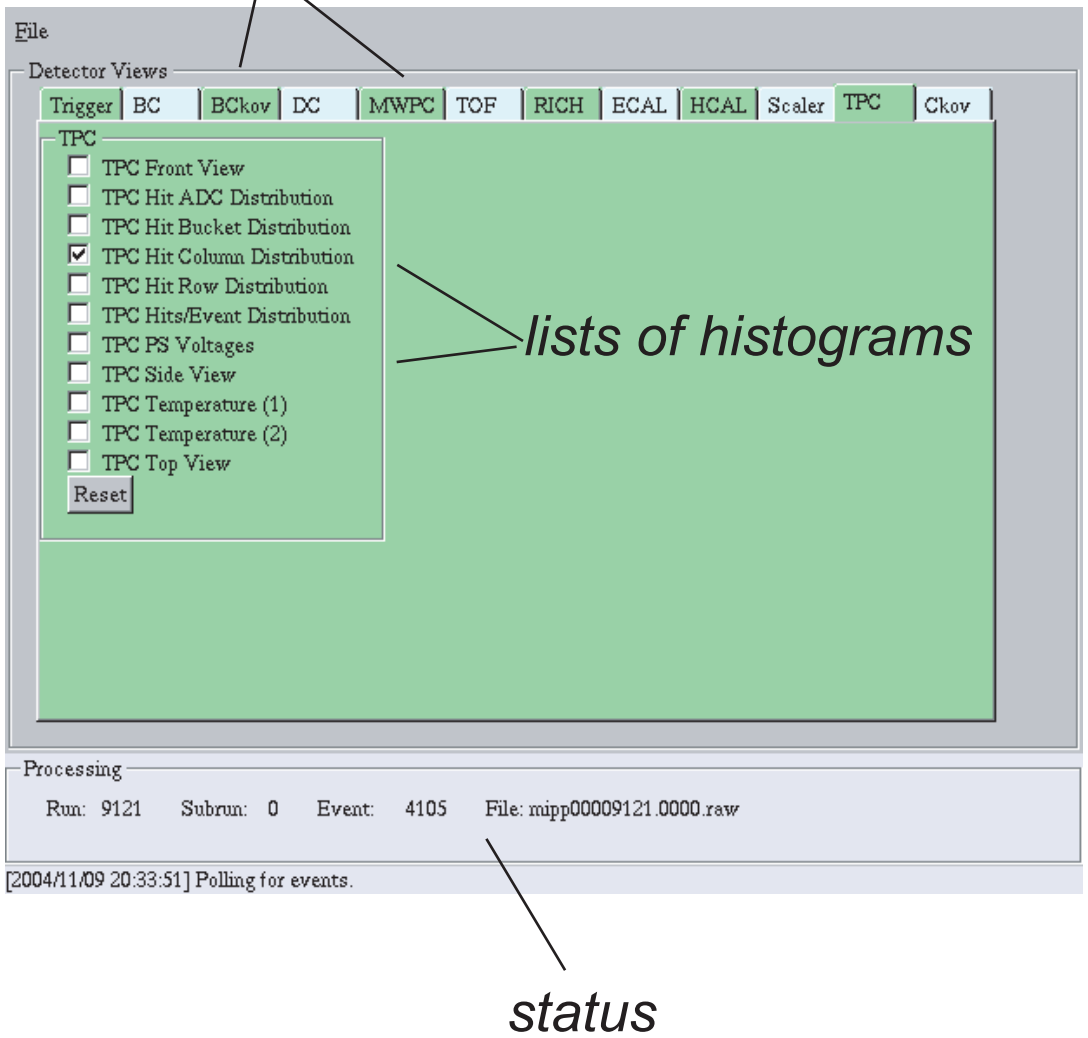
Key:

Connections established during summer run

Connections still to be made

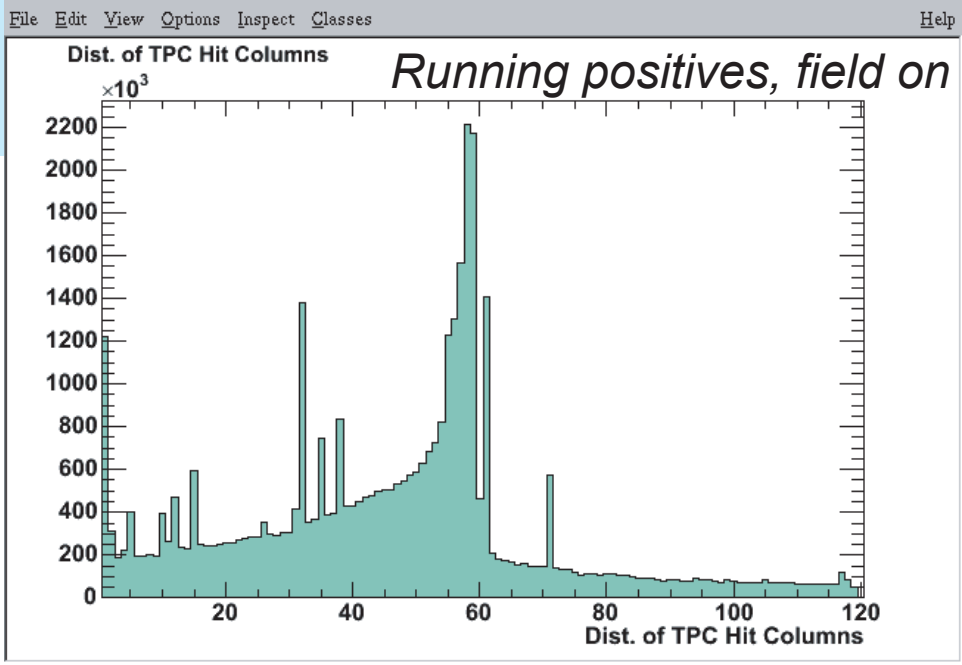
Online Monitoring

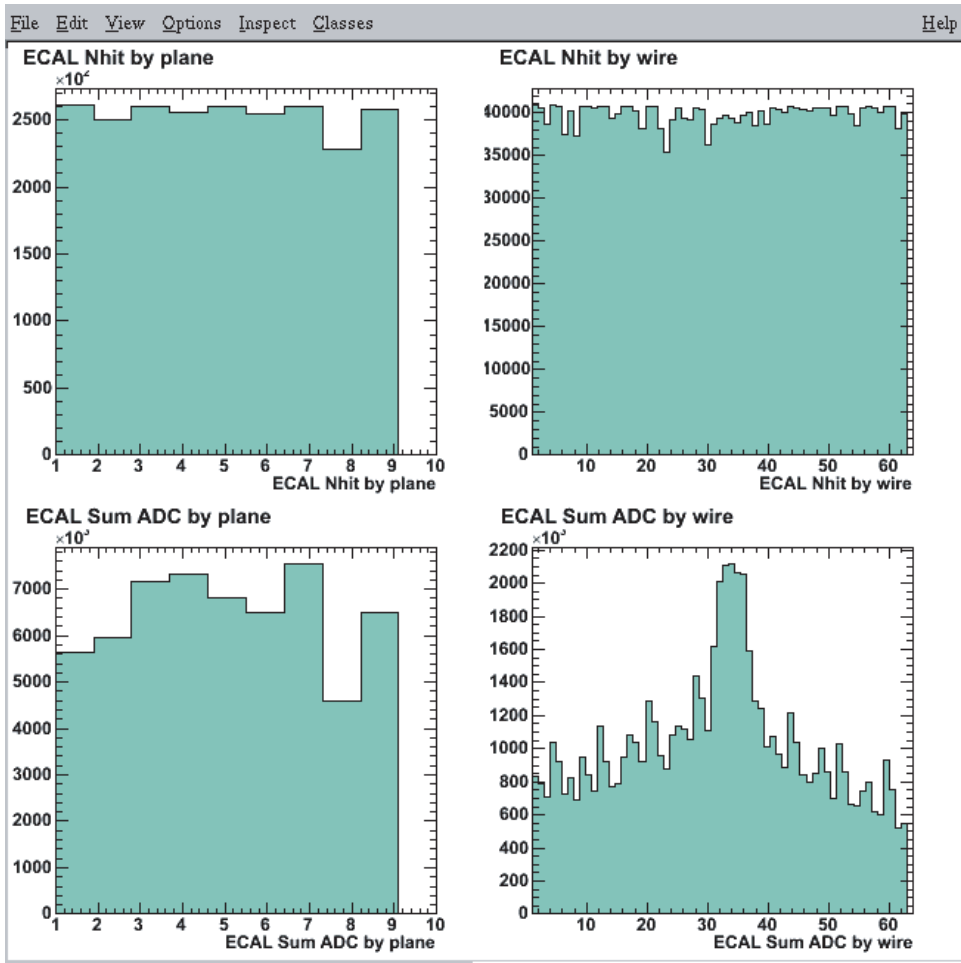
tab for each detector



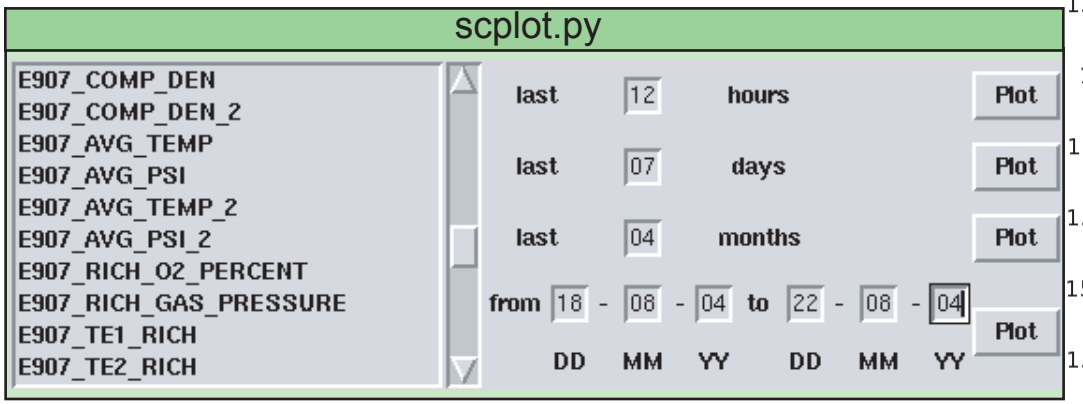
lists of histograms

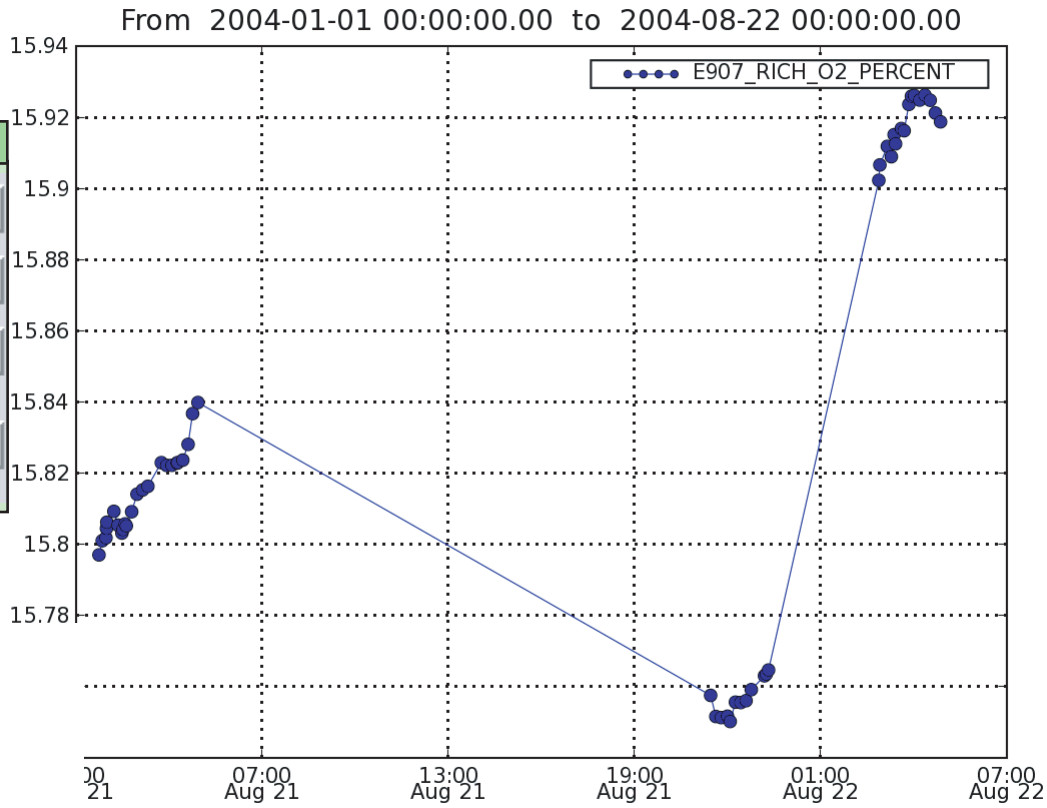
status

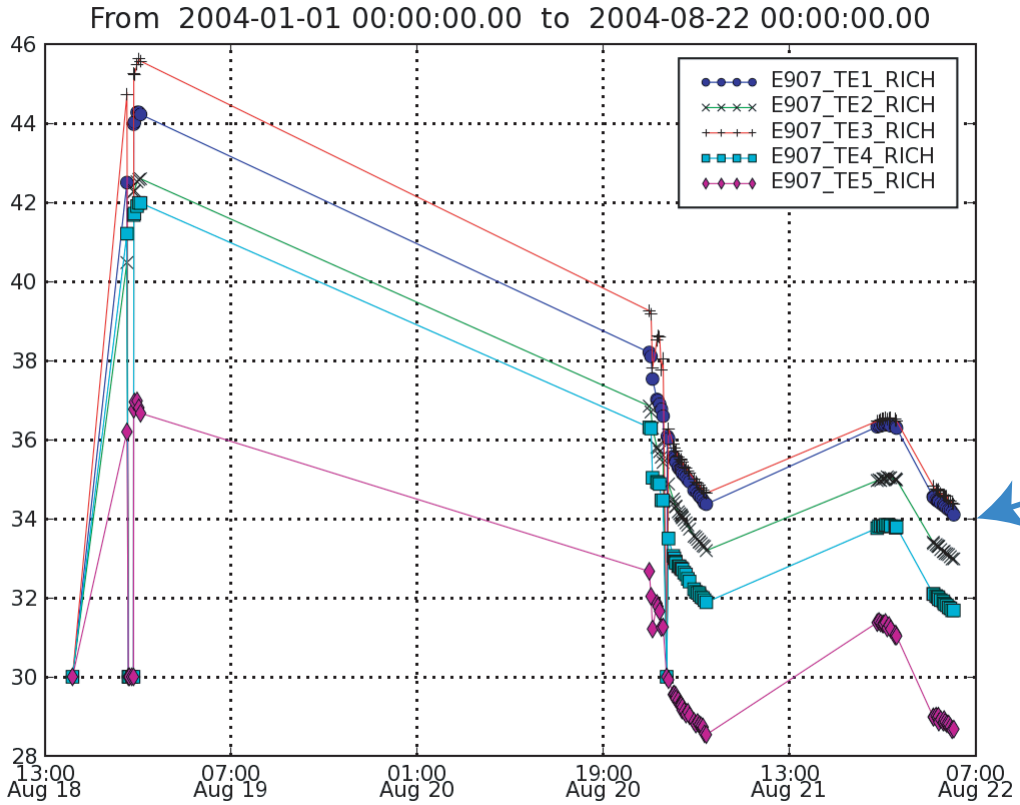




Sample Data From Database







O_2 level in RICH PMT box vs. date

Temperatures in RICH vs. date

Reconstruction Flow Chart

Tracking

Beam Reconstruction

- ⇨ Beam chamber track fits
- ⇨ Trigger PID assignment

TPC

- ⇨TPC Track Finding
- ⇨TPC Helix Fit
- ⇨TPC Vertex Seeds

TPC + Chambers

- ⇨Improved track fit using TPC + chambers
- ⇨Improved vertex fit
- ⇨Search for downstream decays

Particle ID

TPC: dE/dx

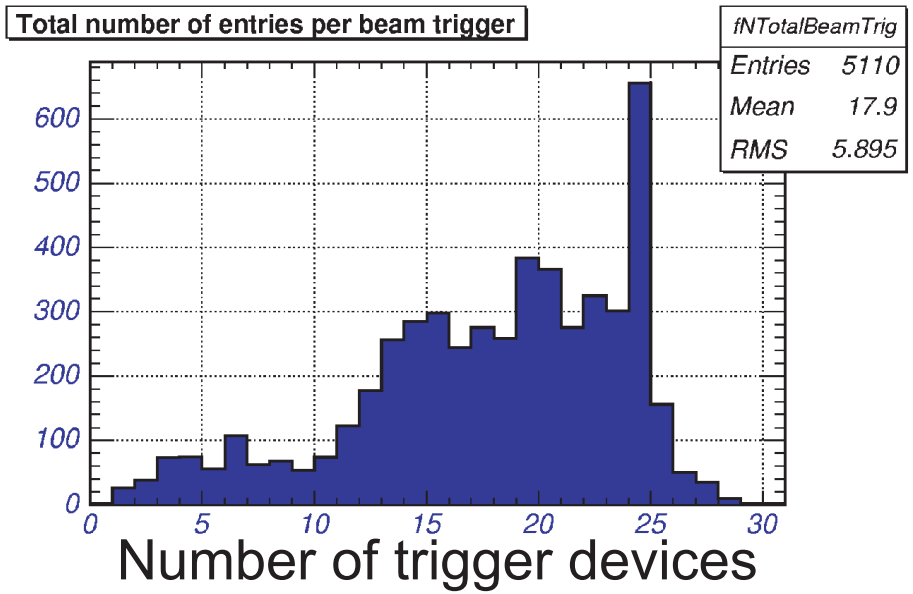
Cherenkov Threshold

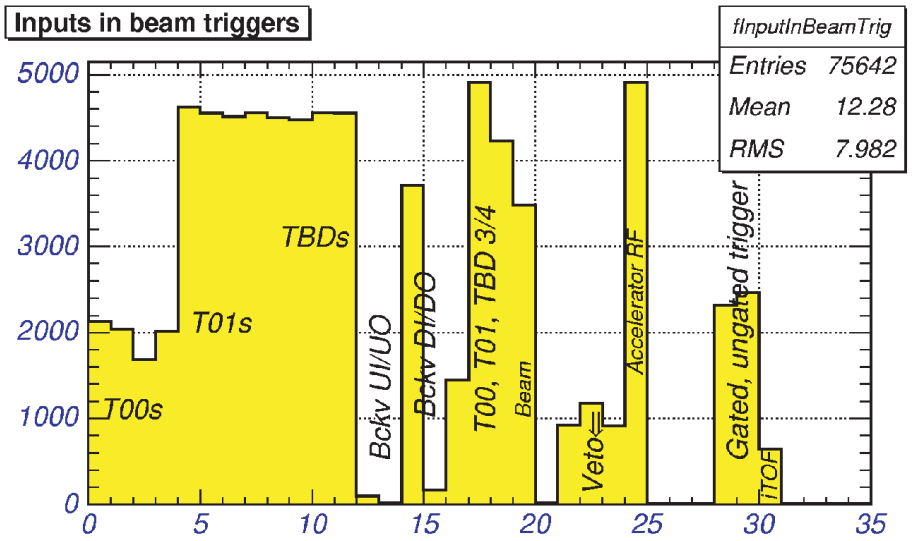
⇨*Time of Flight*

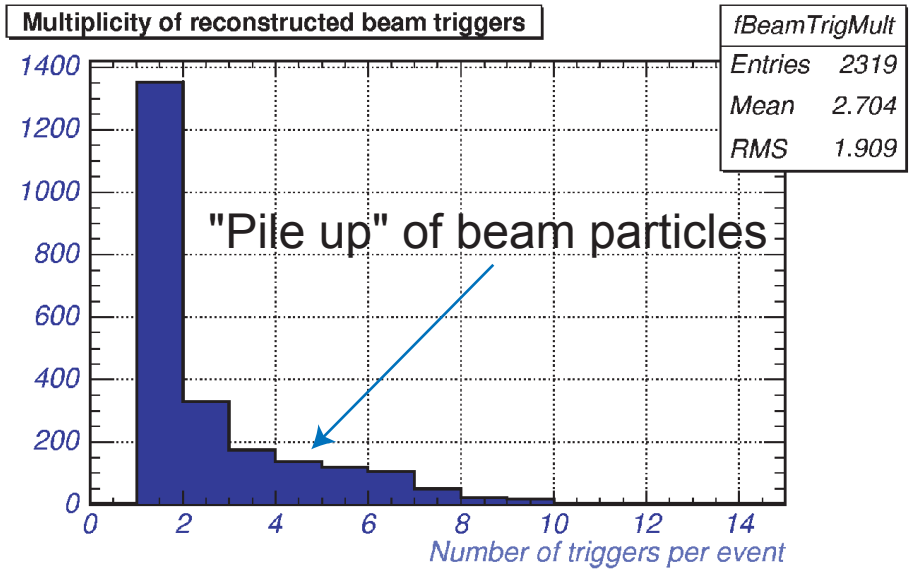
⇨*RICH Cherenkov Radius*

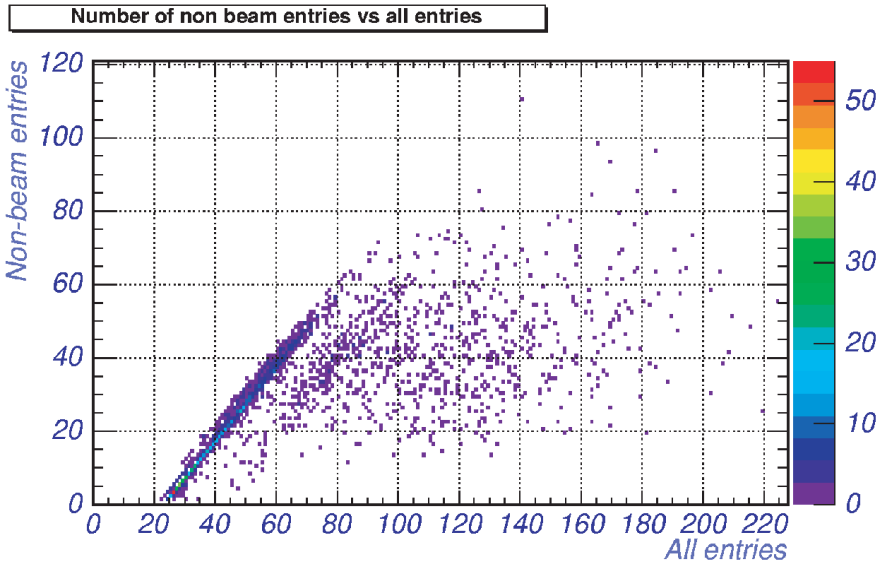
⇨*Things you'll hear about in this talk*

Trigger Studies





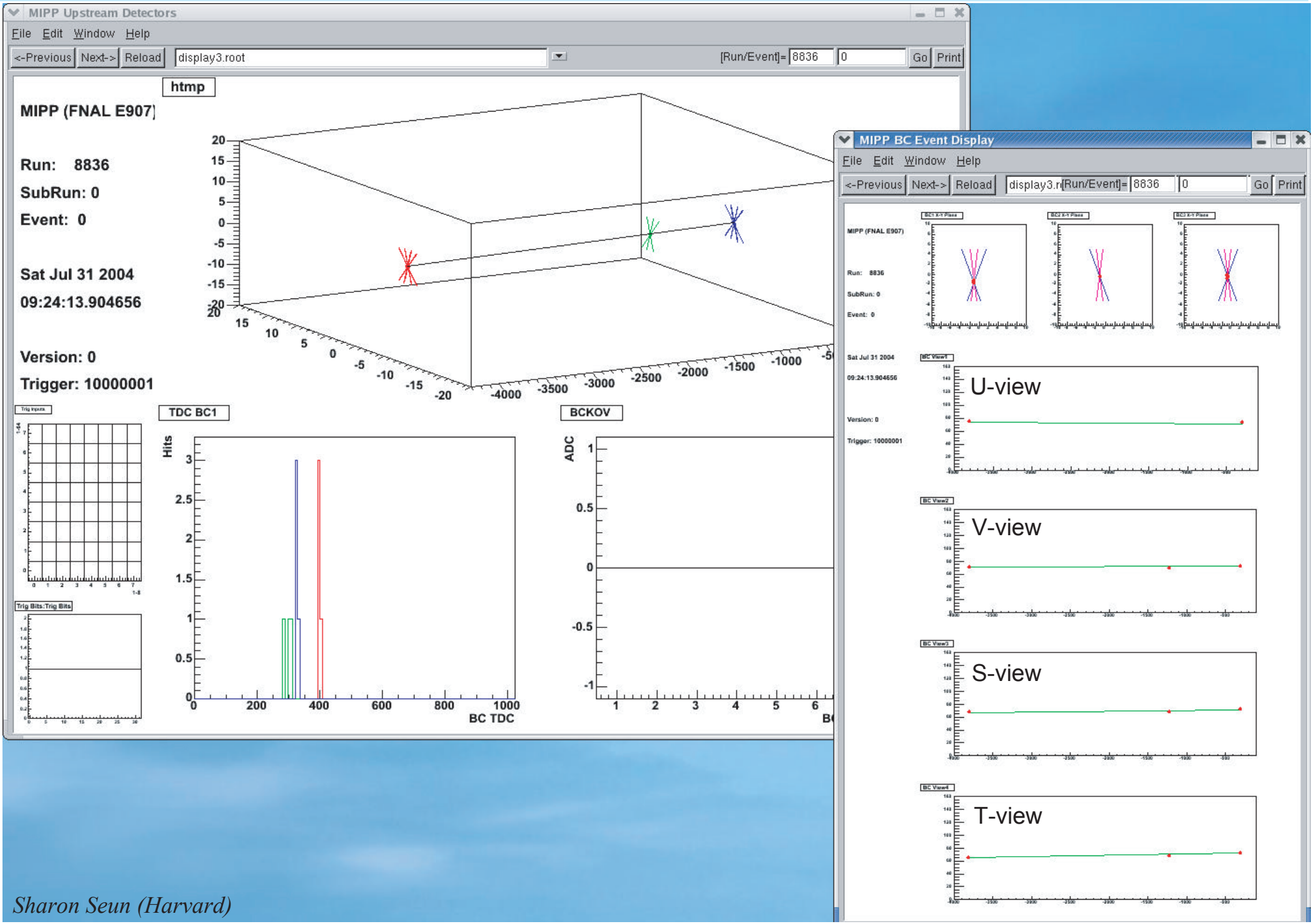




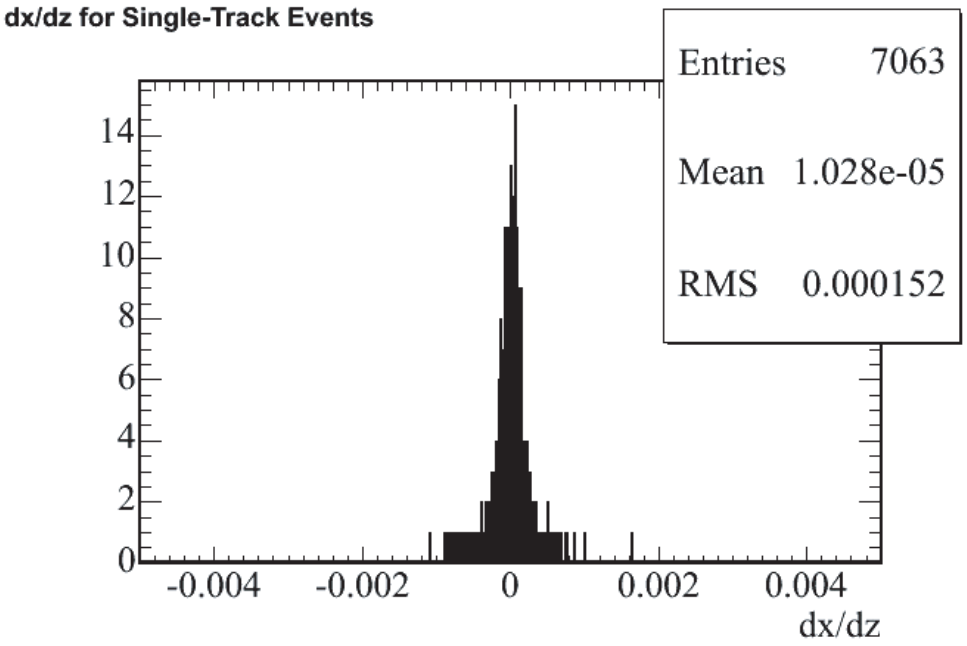
Trigger devices read out same as other devices. Allows offline studies of trigger.

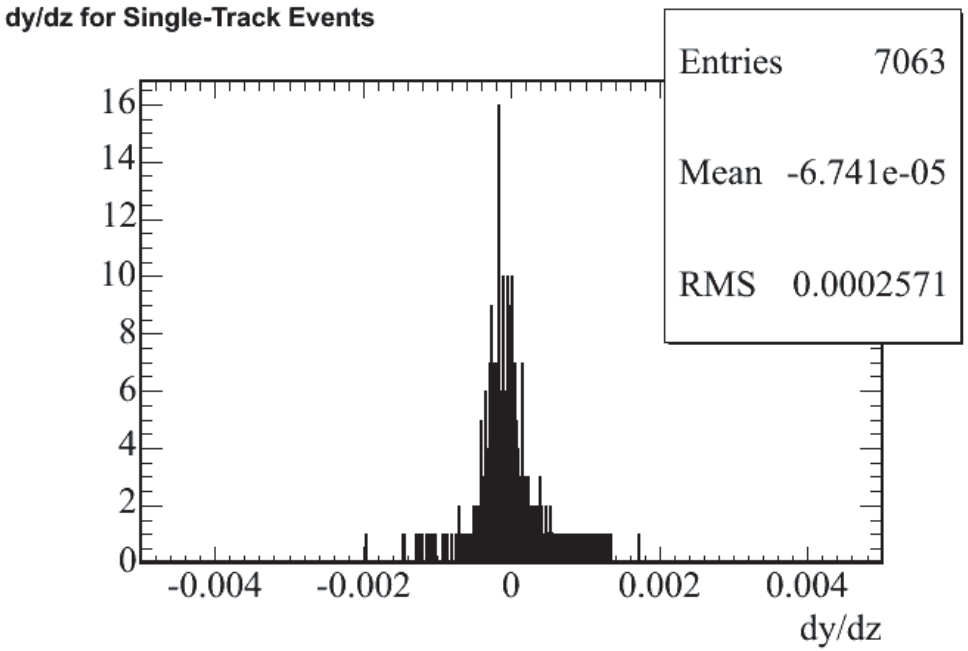
Andre Lebedev (Harvard)

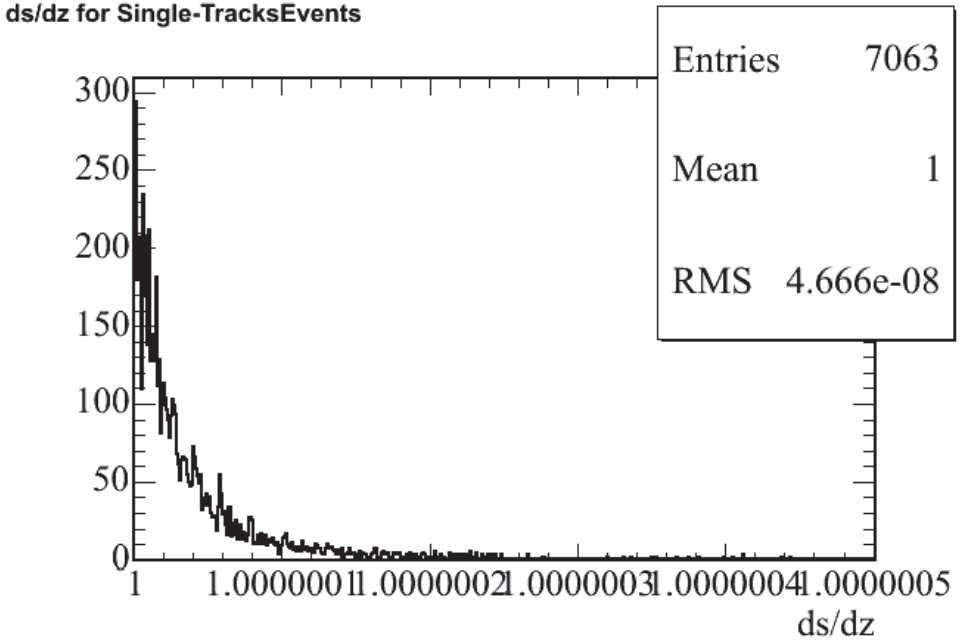
Beam Chamber Reconstruction



BC Reco: Beam Direction







$n_{TrkFind}=5,\ n_{ViewMatch}=3$

$$\frac{ds}{dz}=\sqrt{1+\left(\frac{dx}{dz}\right)^2+\left(\frac{dy}{dz}\right)^2}$$

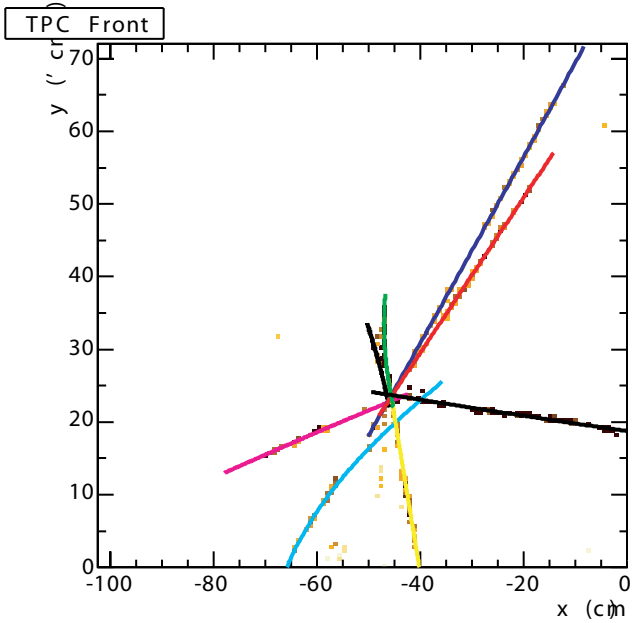
Reconstructed TPC Event: B Field Off

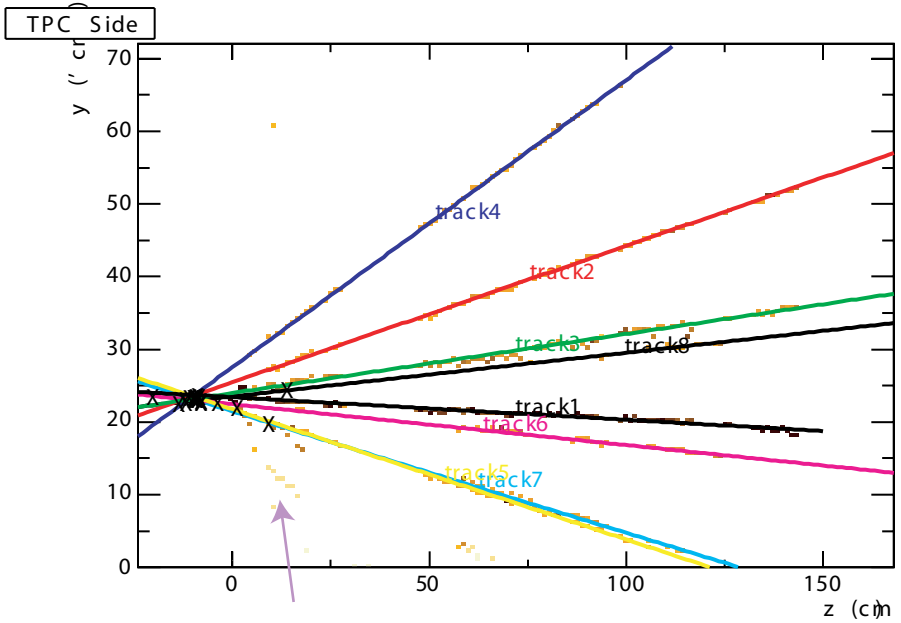
MIPP (FNAL E907)

Run: 9196
SubRun:0
Event: 11

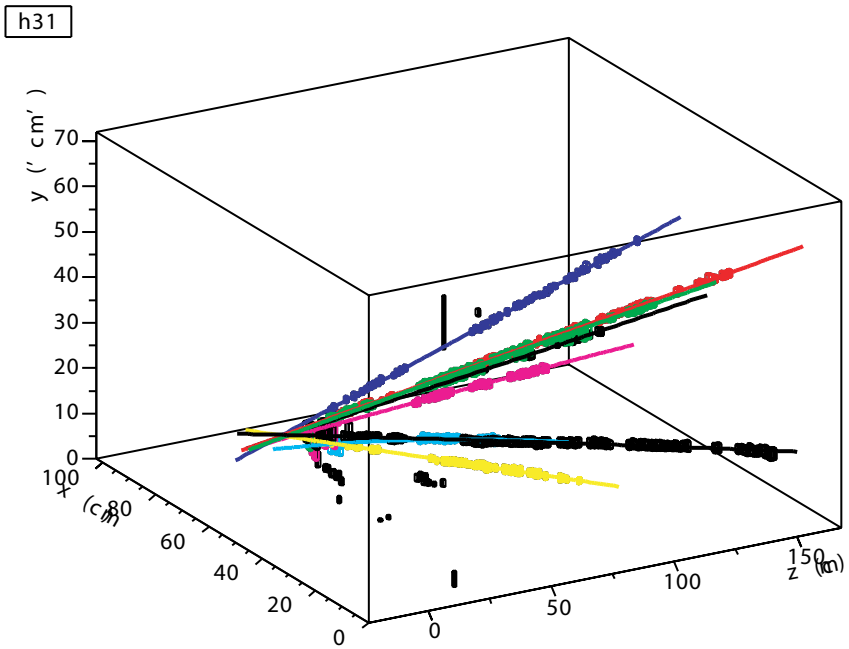
Fri Aug 13 2004
20:34:30.288356

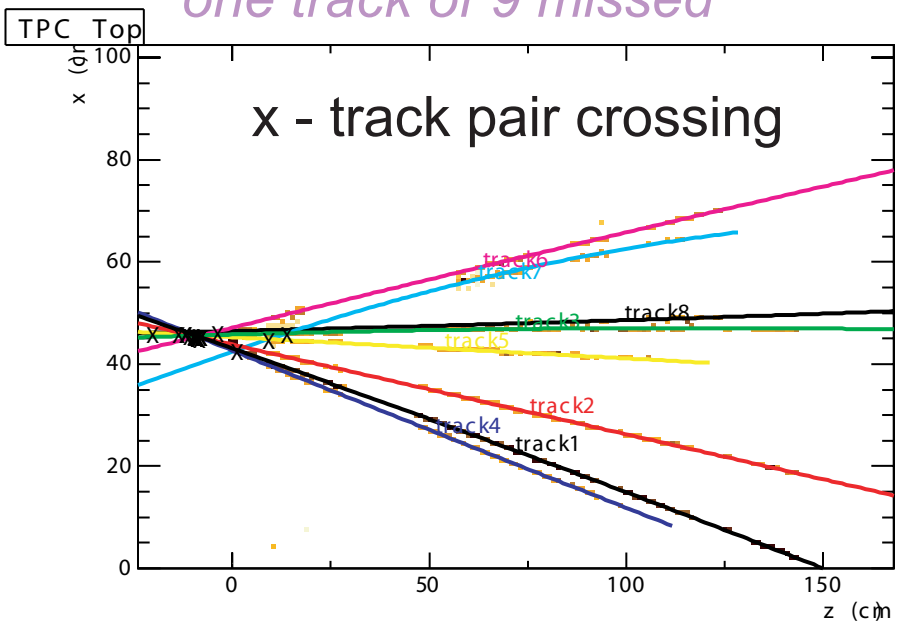
Version:0
Trigger: 10d88009





one track of 9 missed





Readout gap (now fixed)

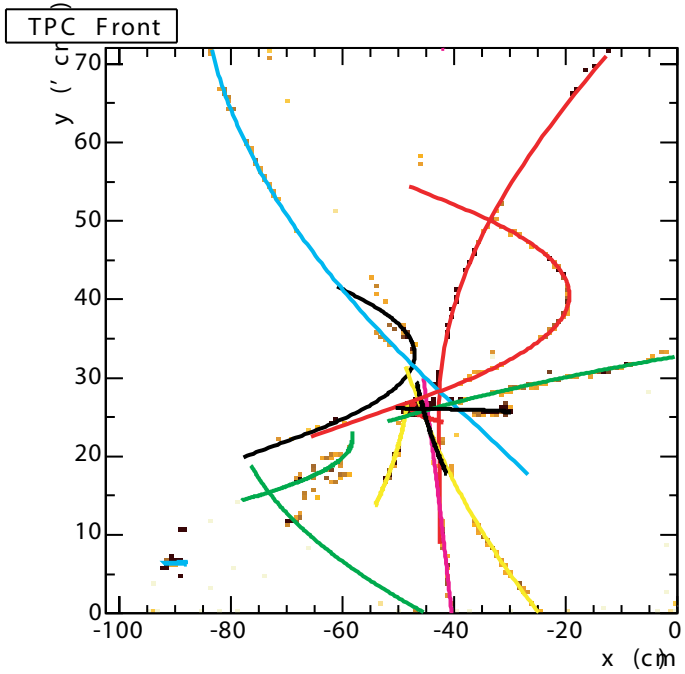
Reconstructed TPC Event: B field on

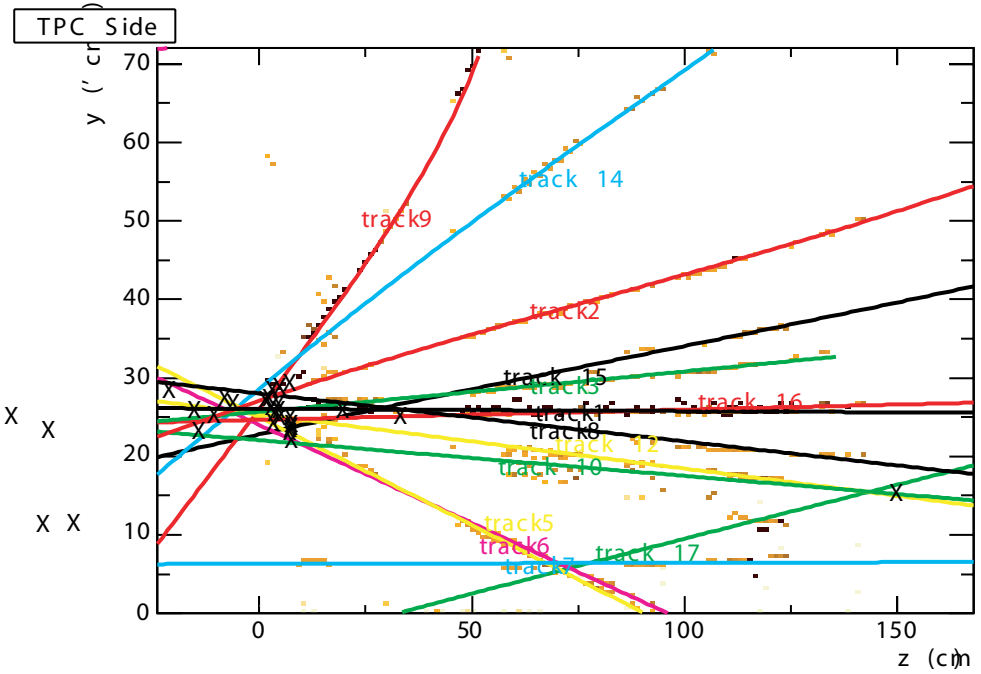
MIPP (FNAL E907)

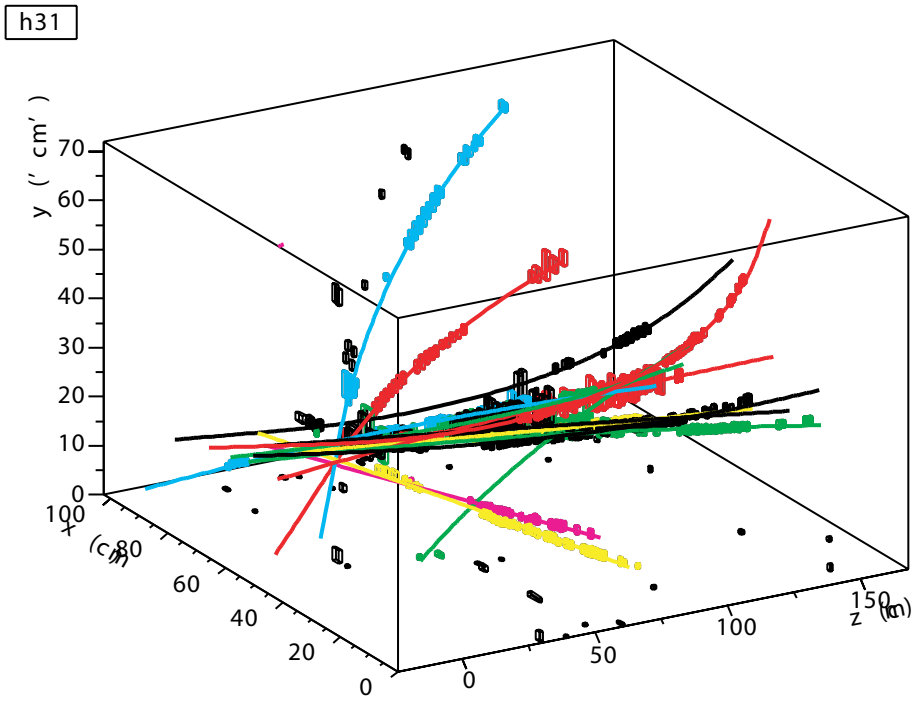
Run: 9303
SubRun:0
Event: 5

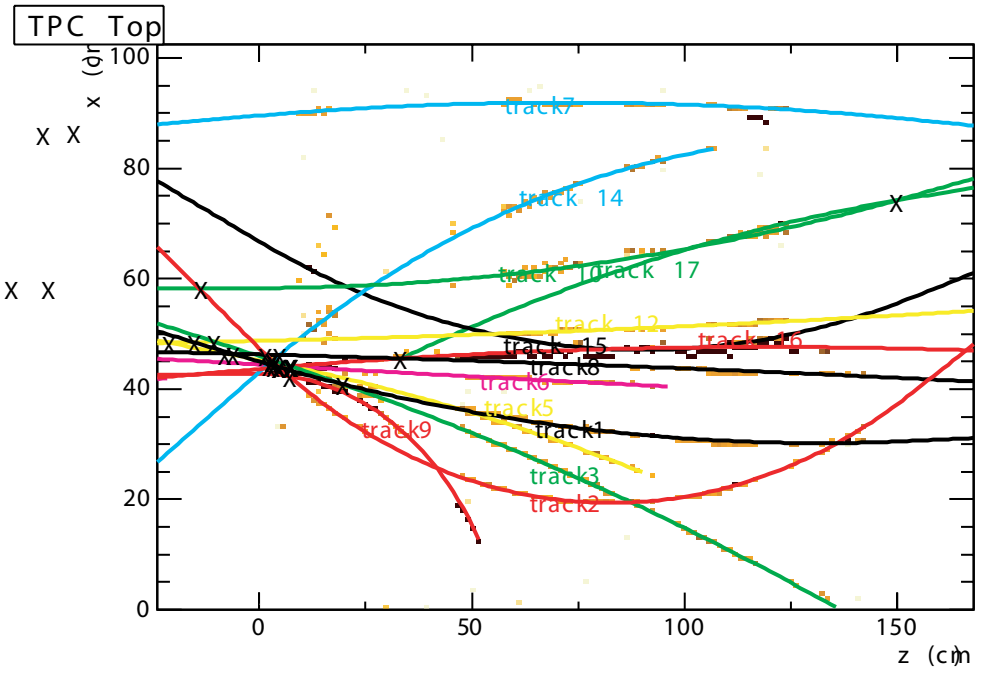
Thu Aug 19 2004
02:52:43.180806

Version:0
Trigger: 10008709

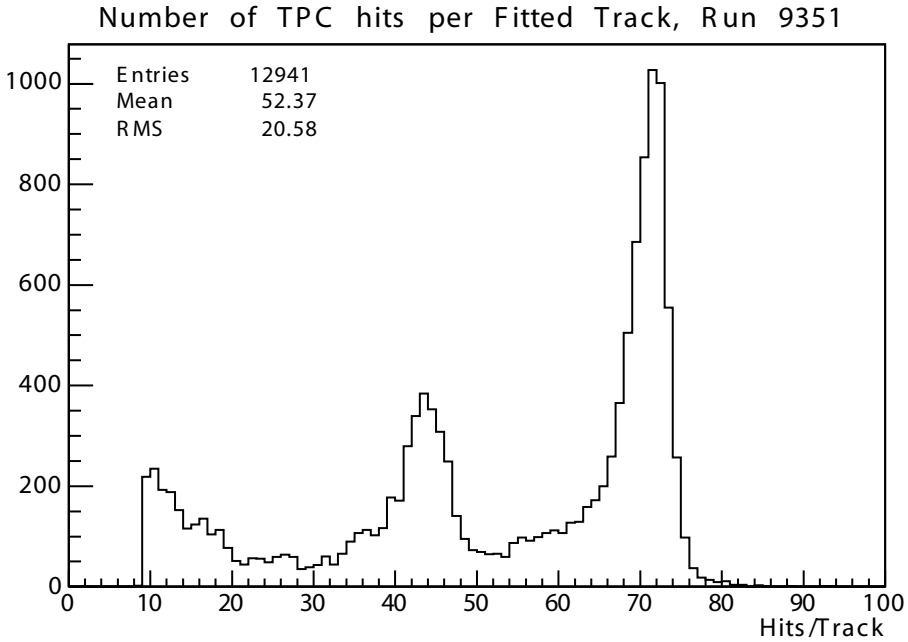






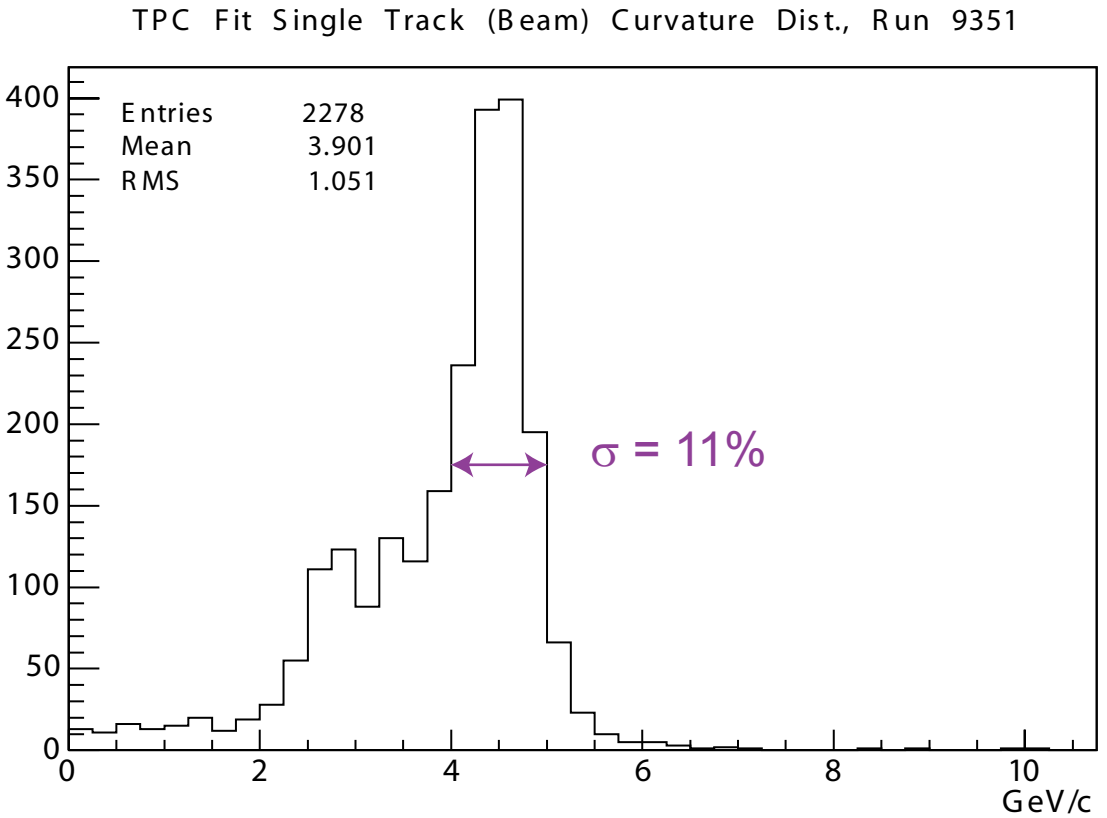


TPC Track Distributions

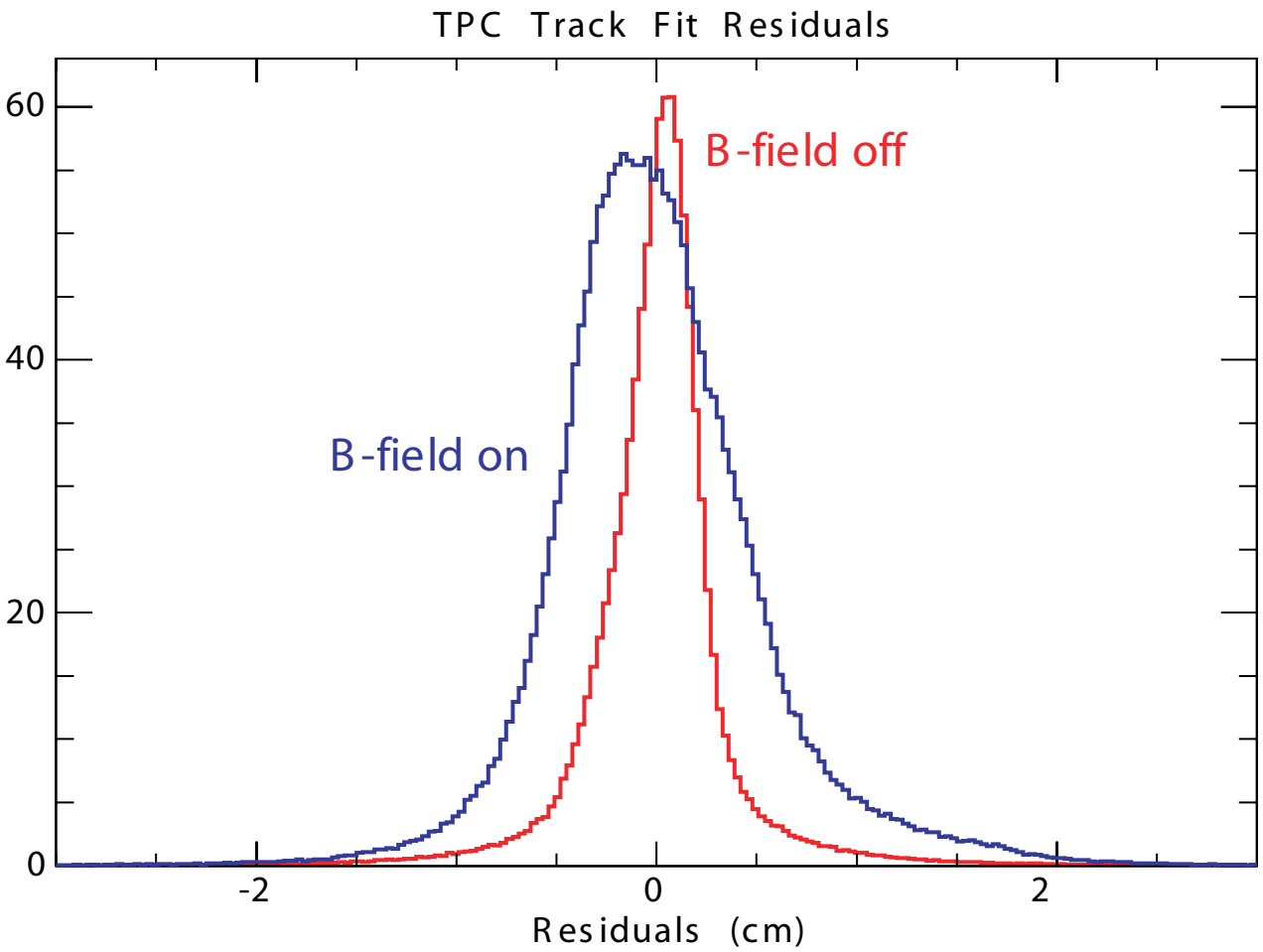


120 pad columns total in TPC
bi-modal distribution result of readout gap

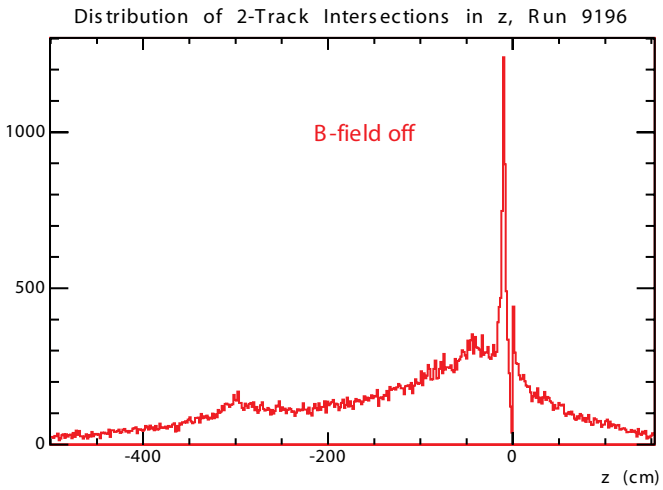
5 GeV beam tracks
Result of helix fit (const B field assumed)

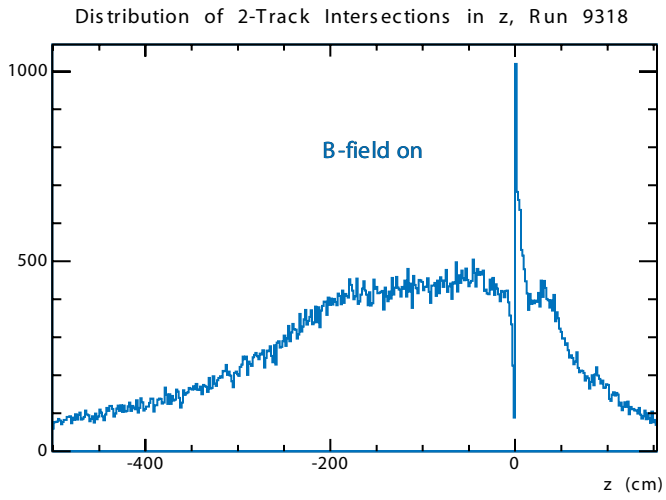


TPC Track Fits



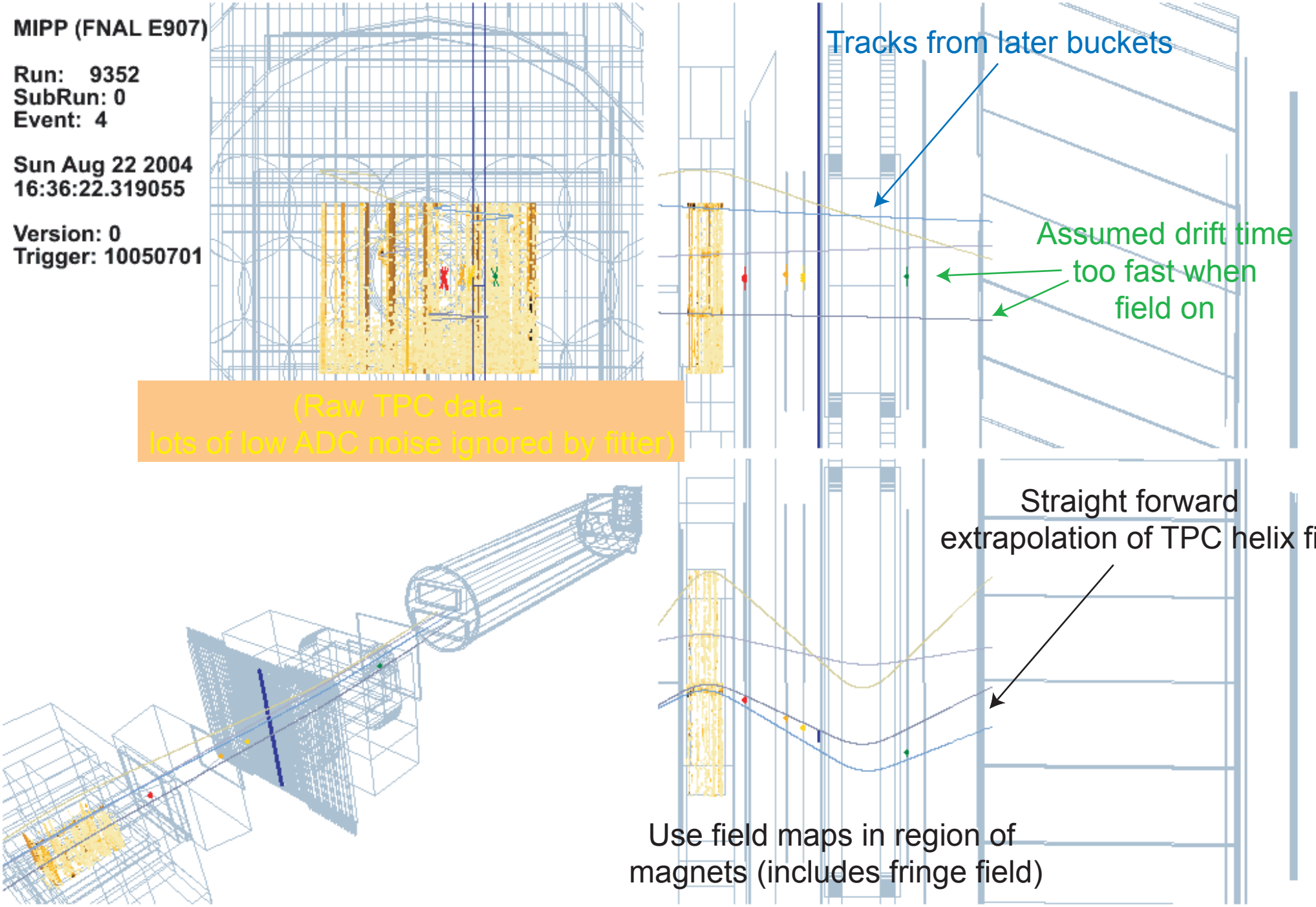
Z positions of vertex candidates



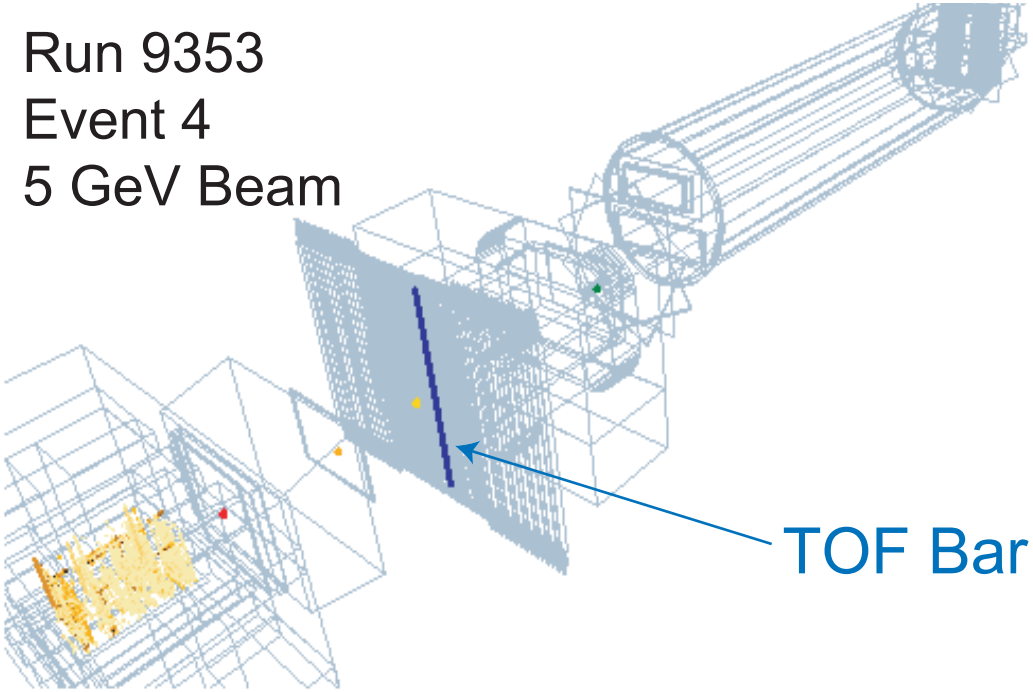


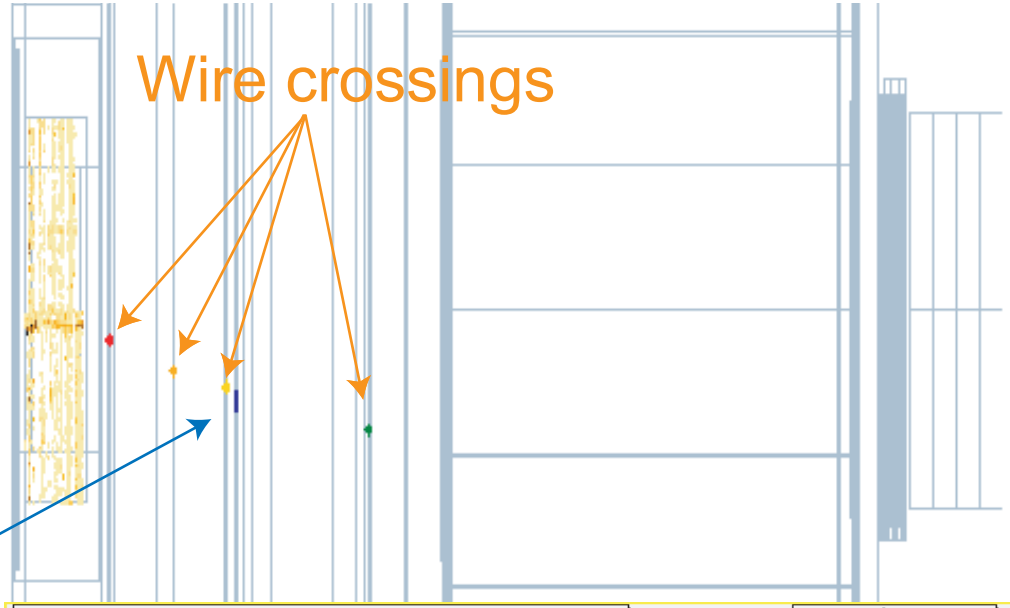
Track residuals show effect of ExB effect
on electron drift. More study needed to map effect.

Swimming Tracks Out of TPC



Run 9353
Event 4
5 GeV Beam

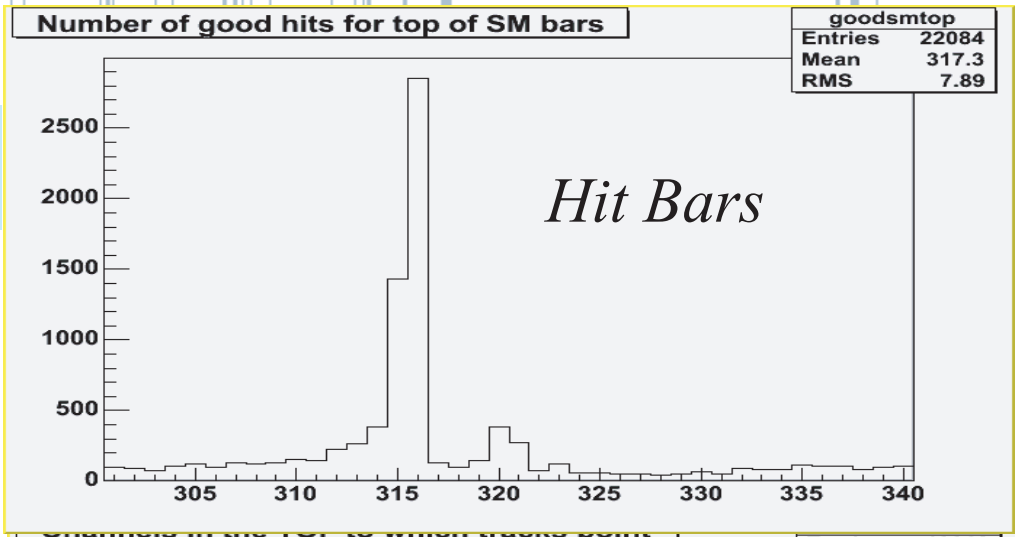


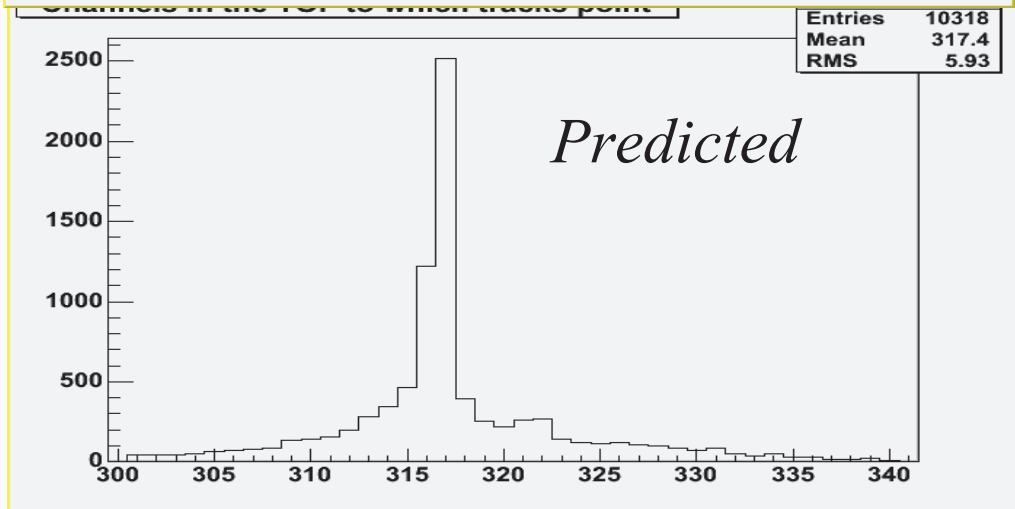


Projecting On To TOF Wall

Extend TPC tracks out and ask which TOF bar they would hit

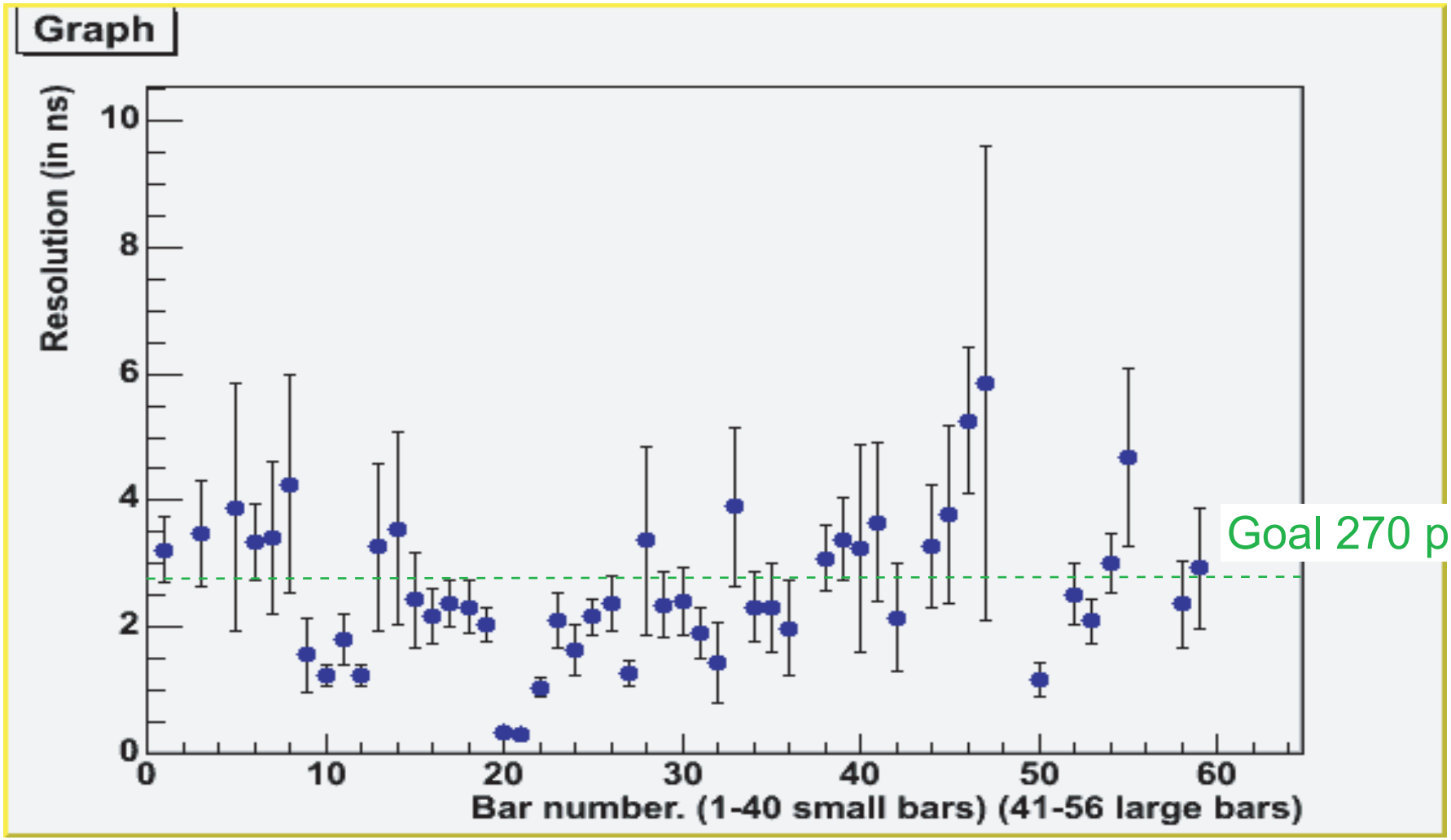
At same time can pick up near by DC wires to improve fit. Just getting started on this.

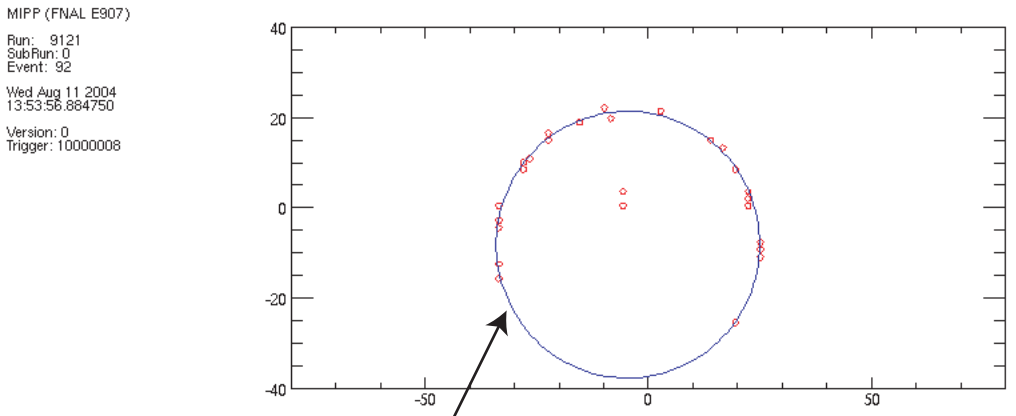


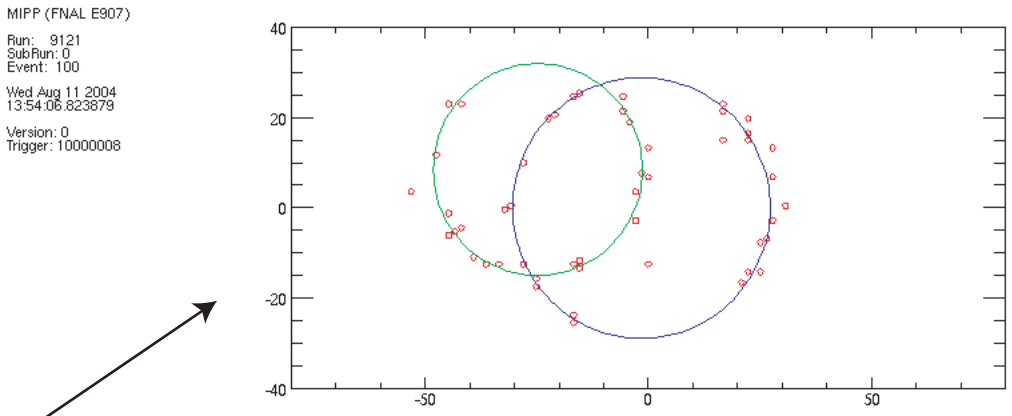


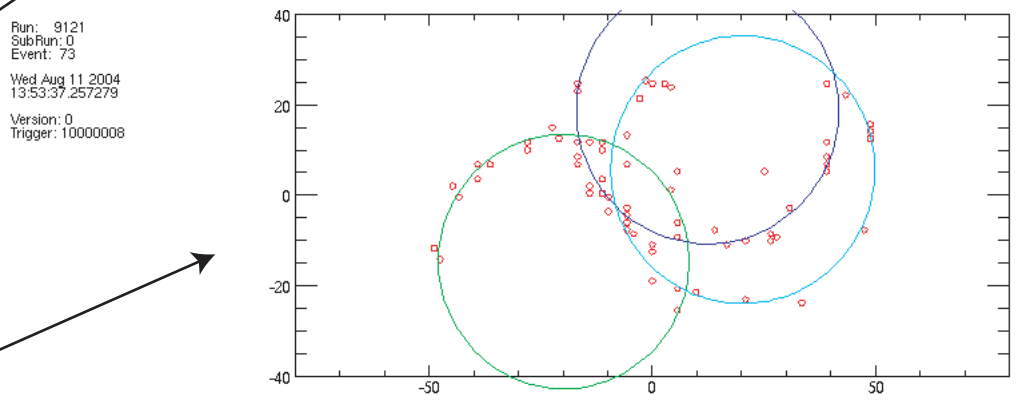
TOF Time Resolution Bar-by-bar

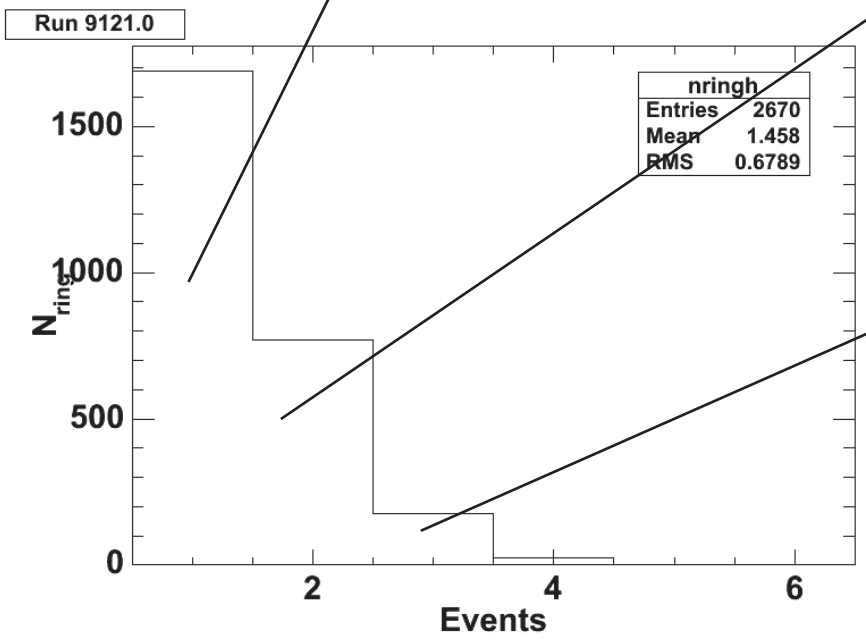
TOF Time resolution vs. bar number

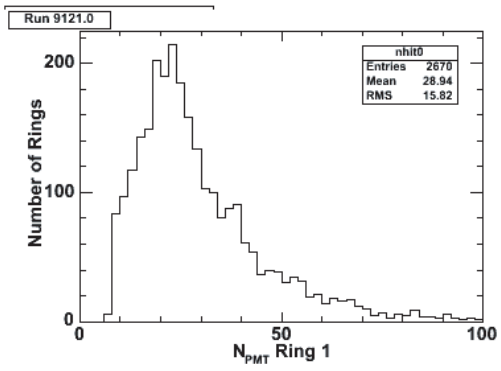


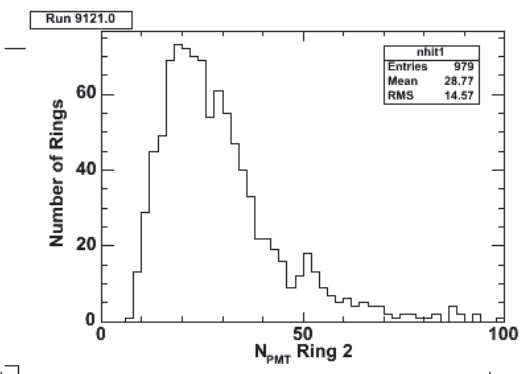


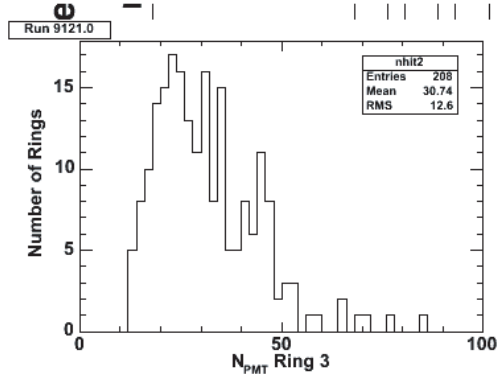


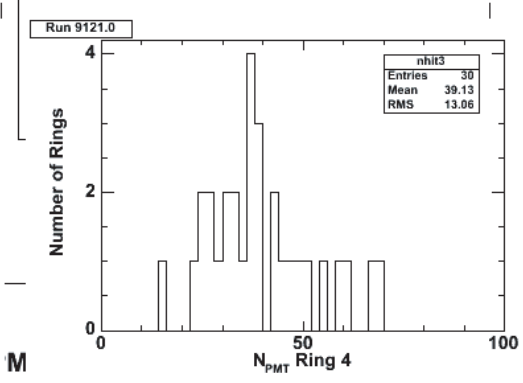












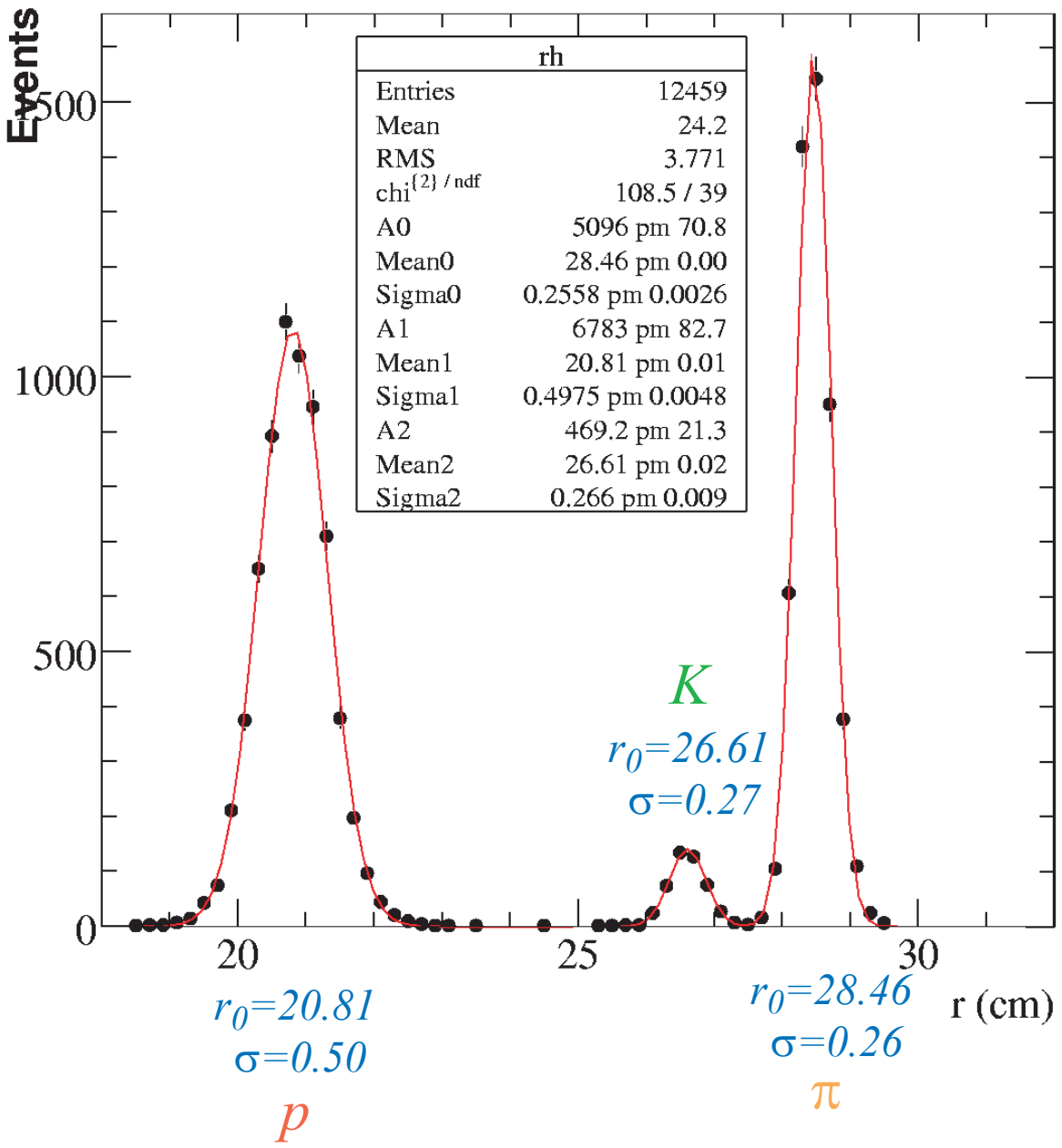
RICH Reconstruction

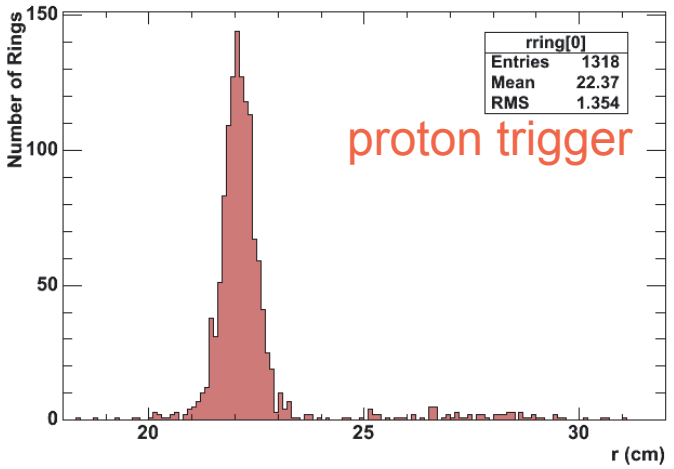
Two algorithms

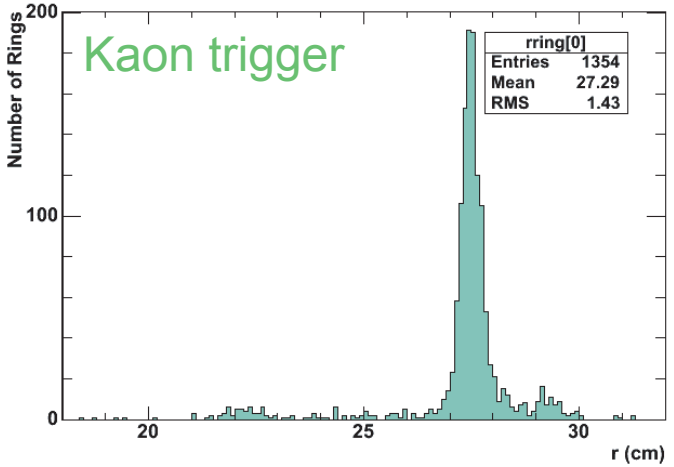
- [1] Stand alone based on Hough transform
- [2] Uses track fit and momentum

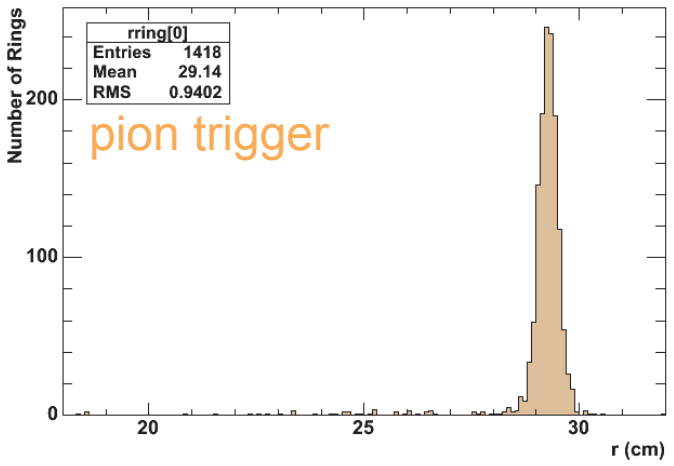
RICH Ring Radii

80 GeV - Target out (Run 8836)





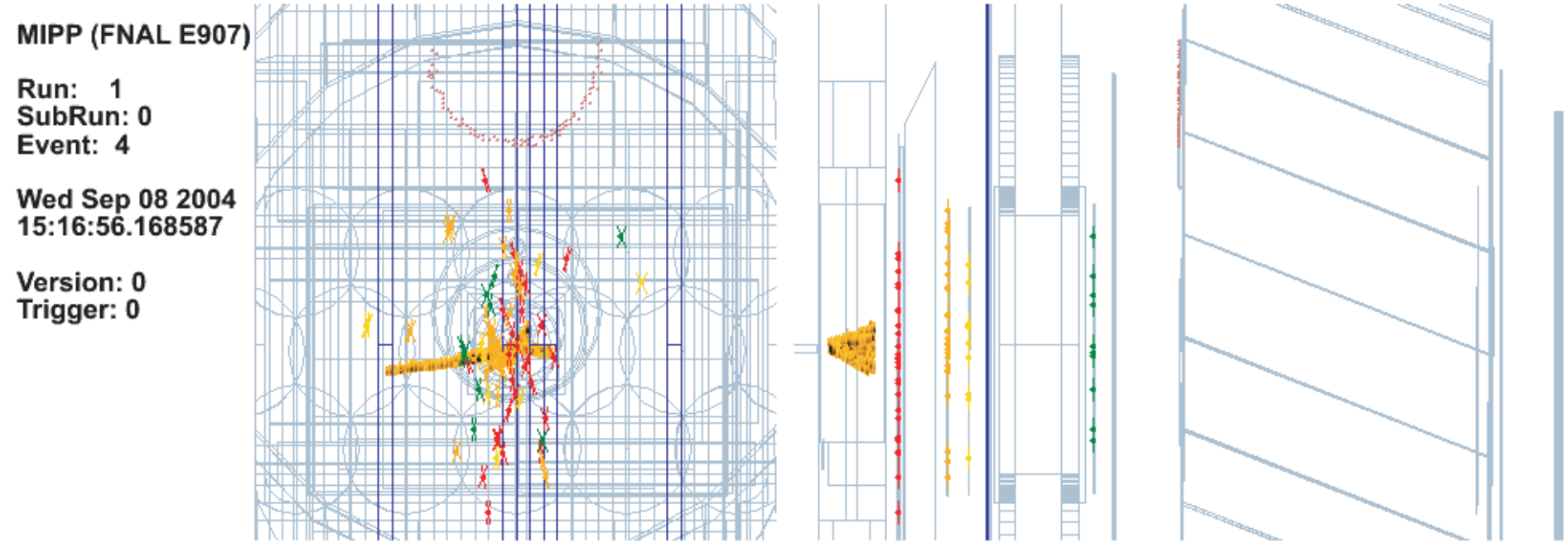




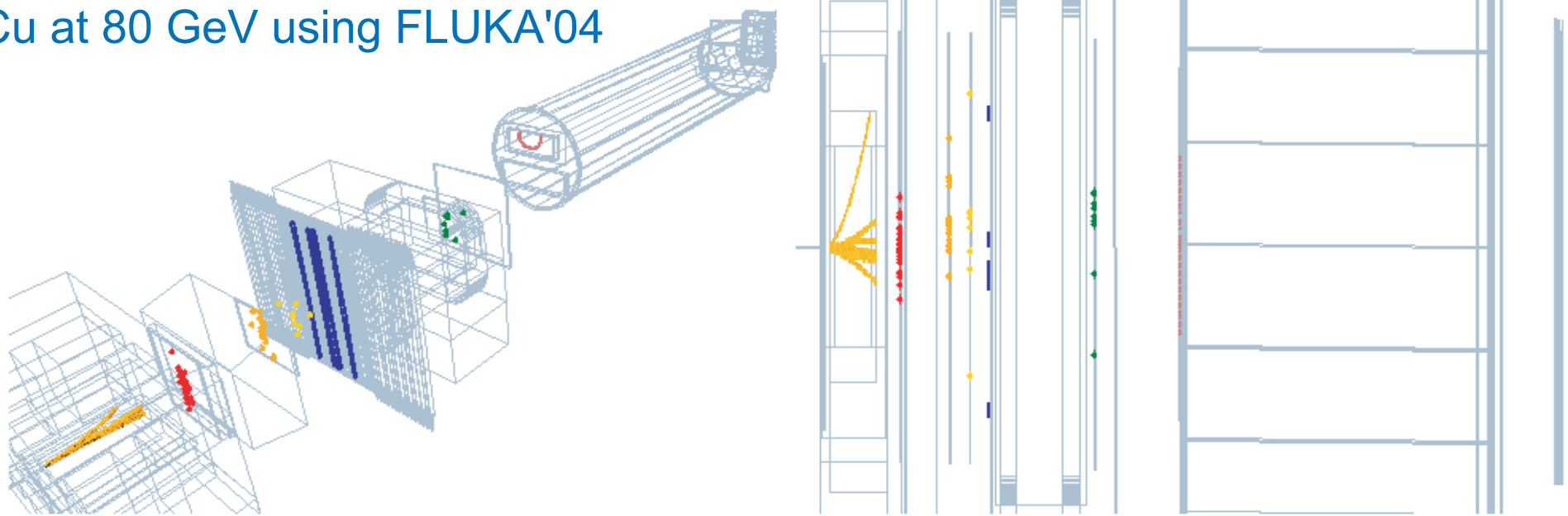
Runs 9099-9103 40 GeV target out

Monte Carlo

GEANT-3 Based
Geometry GEANT-3 to ROOT TGeo to offline using standard tools
All detectors roughly 80% digitized. Code exists for all detectors.
All detectors too clean!



p-Cu at 80 GeV using FLUKA'04



Nick Graf (IU) R. Raja (FNAL)

Summary

- Basics of MIPP software all in place
  - Framework stable
  - Framework has been exercised
- Certainly have essentials to operate and monitor detector
- Top priority now is tracking code
  - TPC in good shape
  - TPC+Chambers getting started
- PID follows from tracking
  - TOF Getting Started
  - RICH Reconstruction in place
- Goal to get full reconstruction working at ~85% before going back to "perfect" algorithms