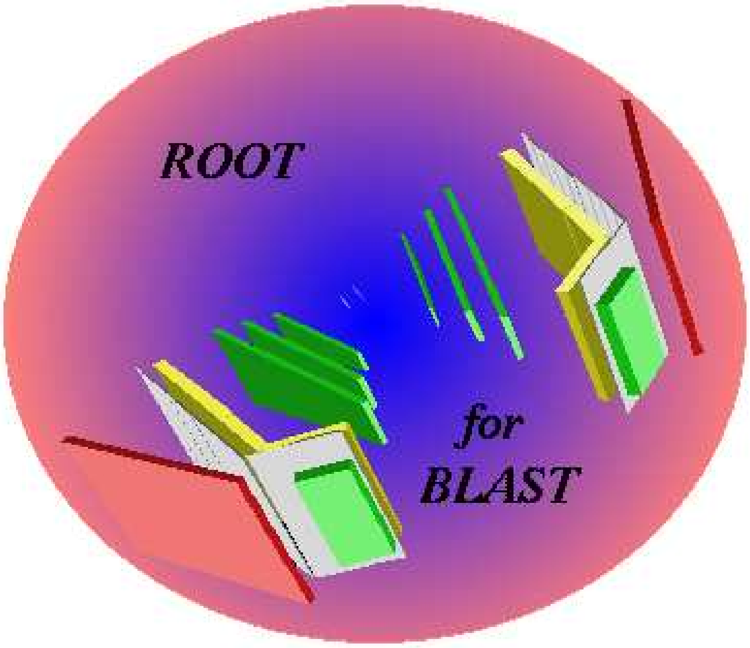
Root and the BLAST project at MIT/Bates Lab.: An Application in Nuclear Physics

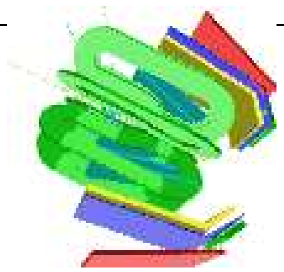


Timothy Paul Smith

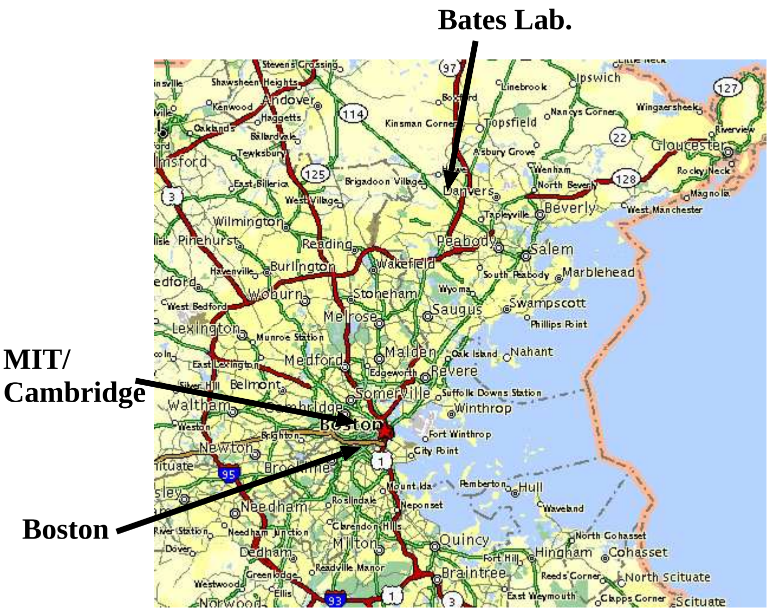
March 23rd, 1999

`http://mitbates.mit.edu/~blast/software`

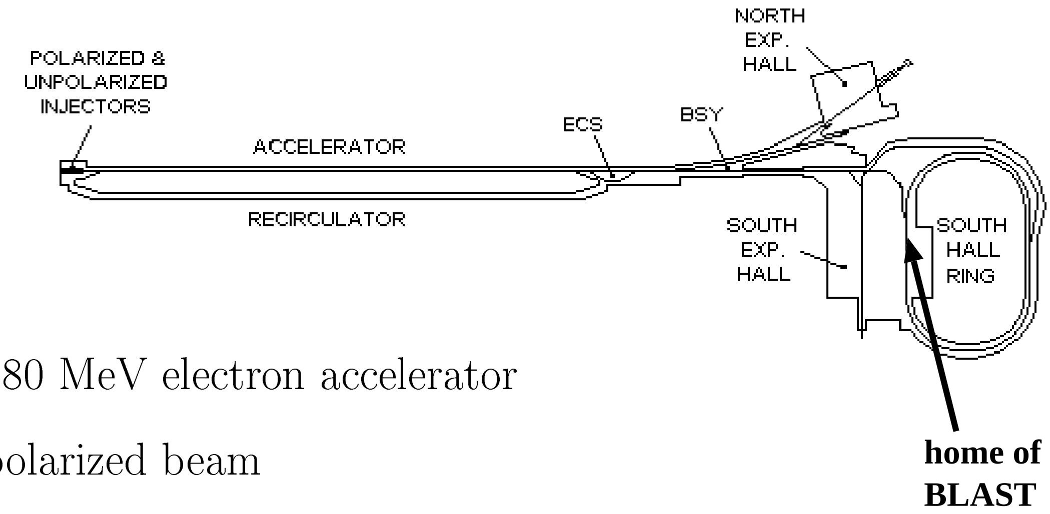
- Where is Bates Lab / What is BLAST
- Online Monitor / Ring Ring '98 test
- Single Event Display
- Reconstruction and Analysis
- Summary



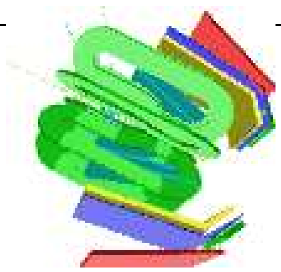
1 Where and What is Bates?



about 20 miles north of Boston

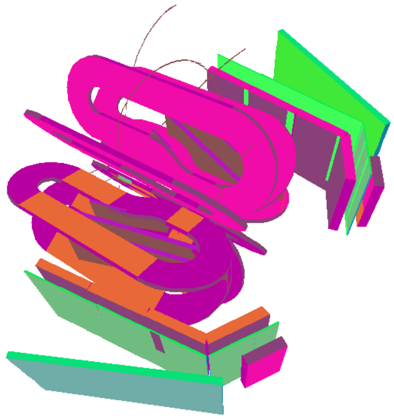


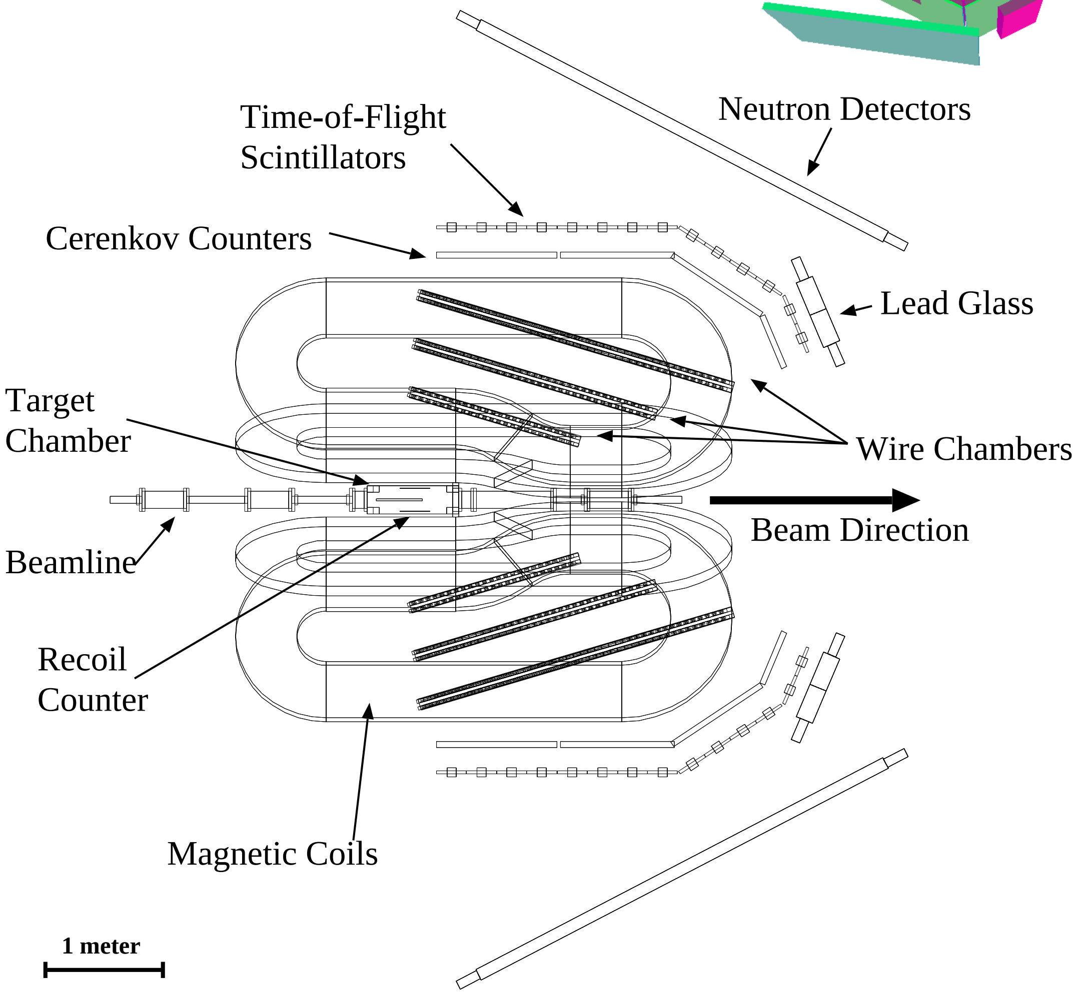
- 880 MeV electron accelerator
- polarized beam
- three experimental area
- storage ring
- internal polarized target facility - BLAST
- part of the MIT Labortory for Nuclear Science (LNS)



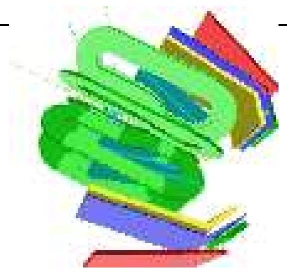
What is BLAST?

Bates Large Acceptance Spectrometer Toroid

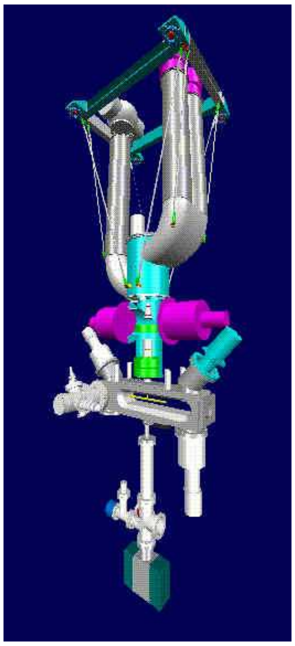




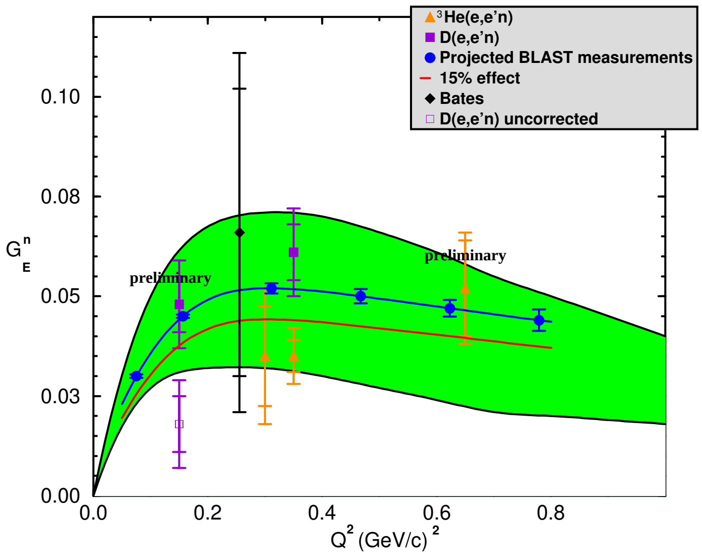
- 1,500 event or more to tape per second
- non-homogenious toridial field with null on the beam axis
- wraped around polarized targets

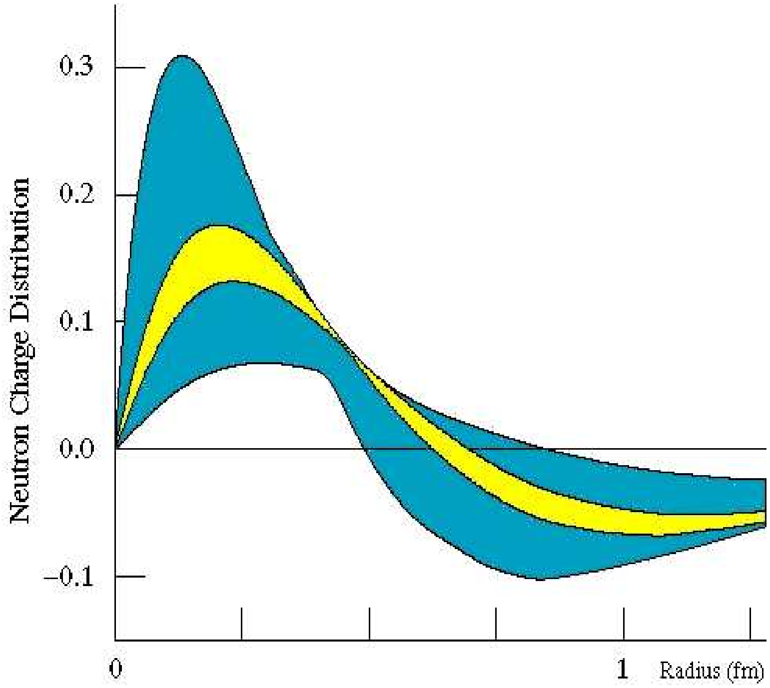


BLAST polarized target - Atomic Beam Source from **NIKHEF**

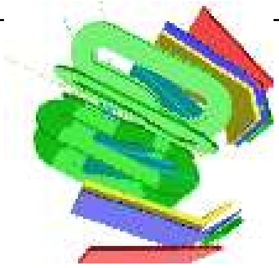


BLAST Physics - G_N^E - and the Charge distribution in a Neutron





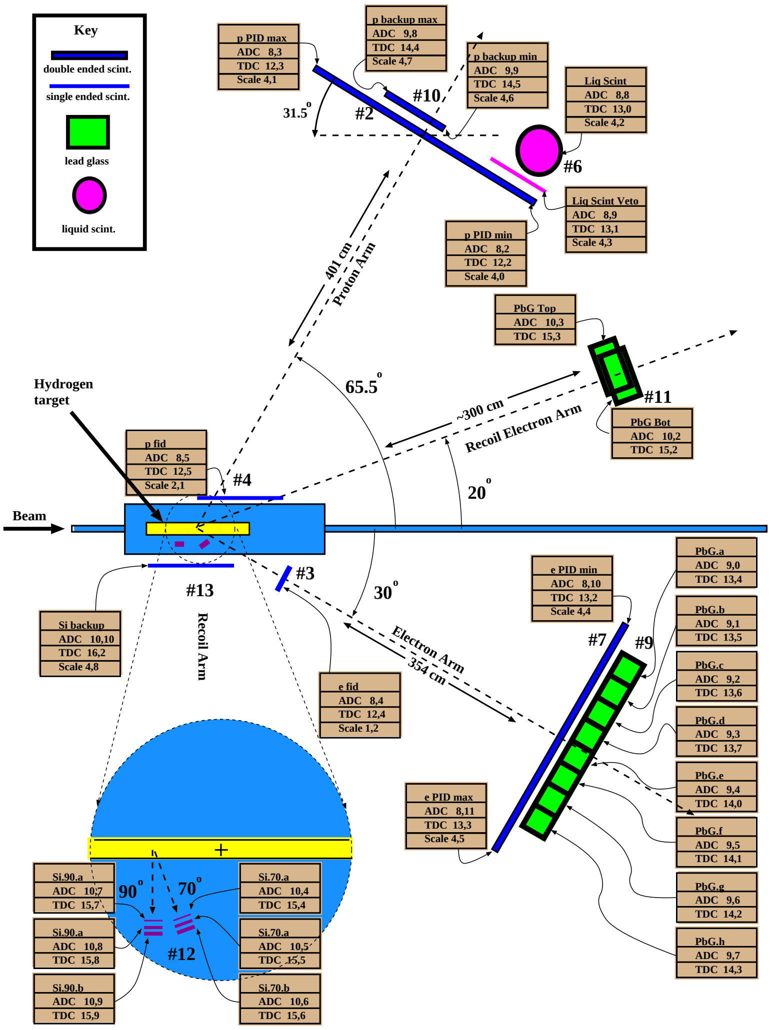
there is a large uncertainity in what a neutron even looks like



Challenges for Software

- Online monitoring - with CODA
- reconstruction 1,500 event/second
- calibration
- hyper sensitive to the conditions of the target
- hyper sensitive to the conditions of the beam

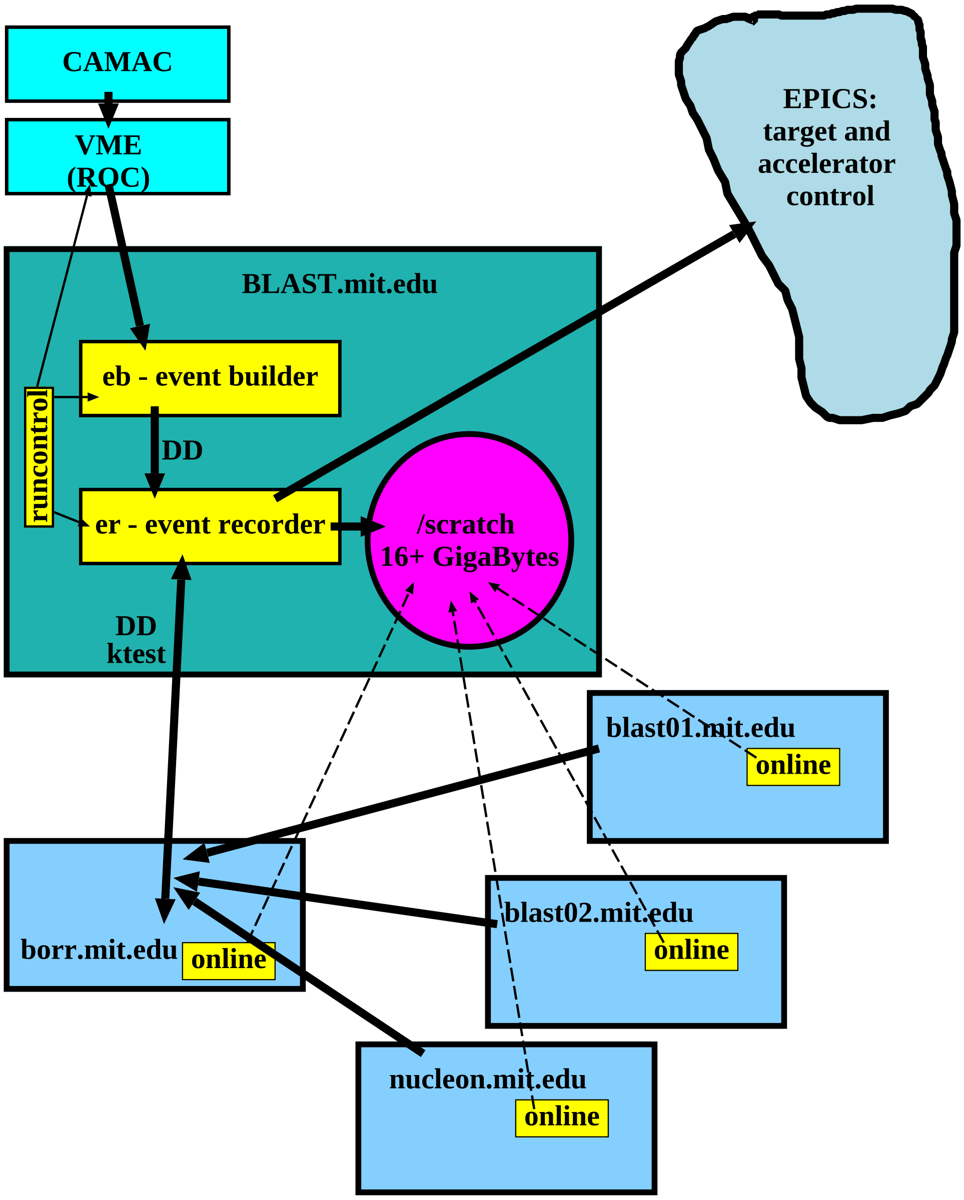
2 *online* and the Fall 1998 Ring Run



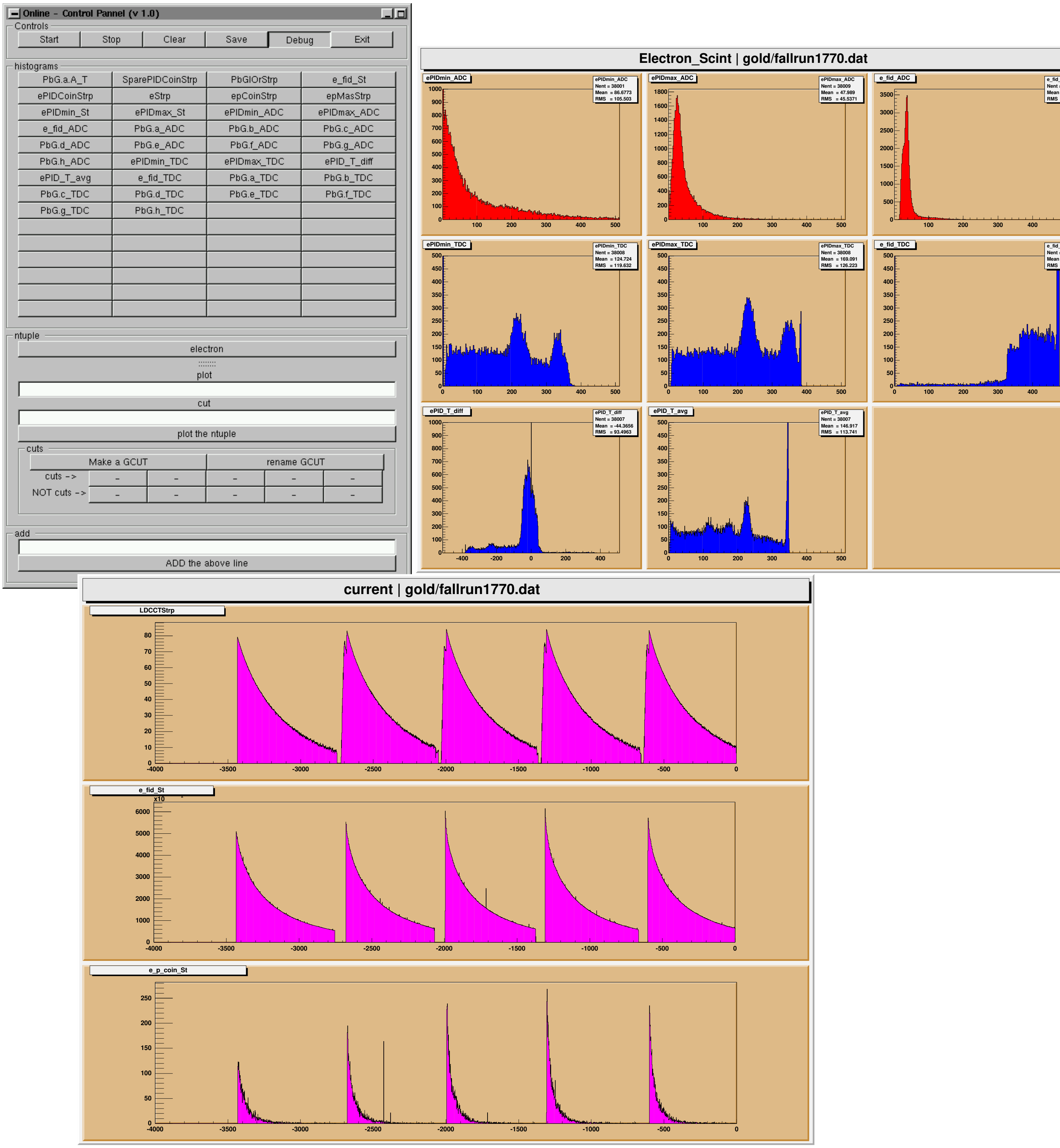
The goals for the Fall 1998 Ring Run were

- Ring Develope studies - putting beam through the target
- Background Studies
- Storage Ring Lifetime studies
- *secondly:* Data Acquision Studies - CODA
- *secondly:* New Analysis - Root based

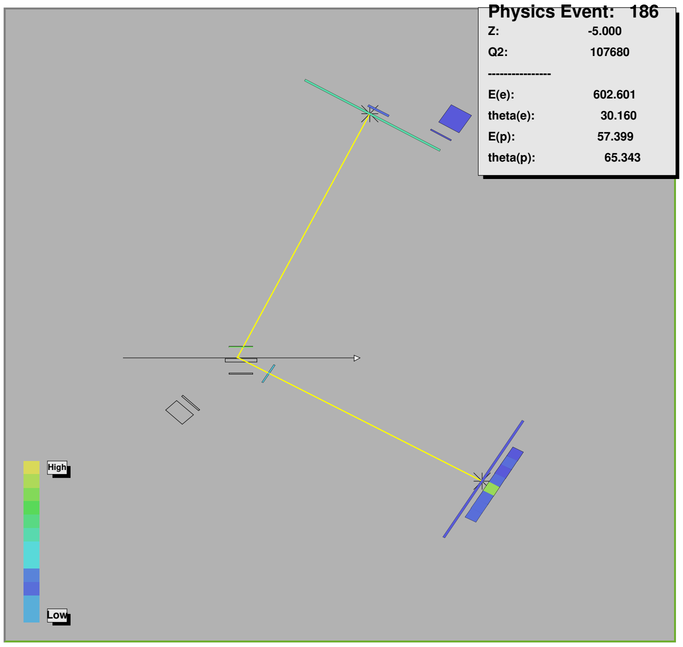
CODA → Root


CAMAC
VME
(ROC)
EPICS:
target and
accelerator
control
BLAST.mit.edu
eb - event builder
runcontrol
DD
er - event recorder
/scratch
16+ GigaBytes
DD
ktest
blast01.mit.edu
online
borr.mit.edu
online
blast02.mit.edu
online
nucleon.mit.edu
online

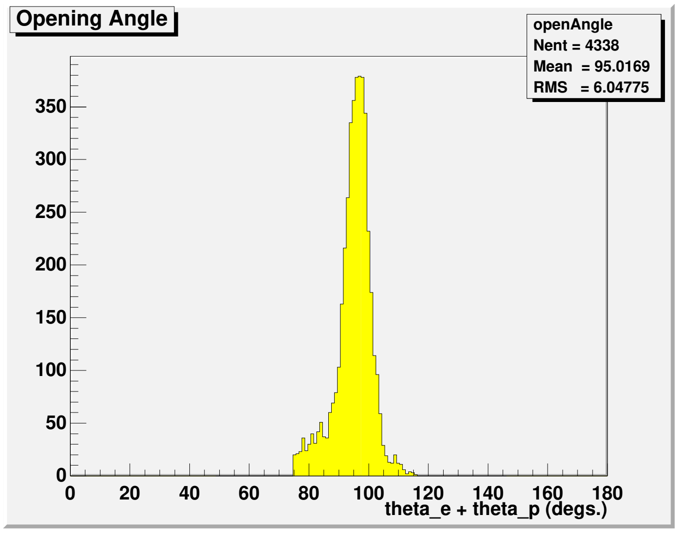
online


Online - Control Pannel (v 1.0)
Controls
Start
Stop
Clear
Save
Debug
Exit
histograms
PbG.a.A_T
SparePIDCoinStrp
PbGlOrStrp
e_fid_St
ePIDCoinStrp
eStrp
epCoinStrp
epMasStrp
ePIDmin_St
ePIDmax_St
ePIDmin_ADC
ePIDmax_ADC
e_fid_ADC
PbG.a_ADC
PbG.b_ADC
PbG.c_ADC
PbG.d_ADC
PbG.e_ADC
PbG.f_ADC
PbG.g_ADC
PbG.h_ADC
ePIDmin_TDC
ePIDmax_TDC
ePID_T_diff
ePID_T_avg
e_fid_TDC
PbG.a_TDC
PbG.b_TDC
PbG.c_TDC
PbG.d_TDC
PbG.e_TDC
PbG.f_TDC
PbG.g_TDC
PbG.h_TDC
ntuple
electron
plot
cut
plot the ntuple
cuts
Make a GCUT
rename GCUT
cuts ->
NOT cuts ->
add
ADD the above line
Electron_Scint | gold/fallrun1770.dat
ePIDmin_ADC
ePIDmax_ADC
e_fid_ADC
ePIDmin_TDC
ePIDmax_TDC
e_fid_TDC
ePID_T_diff
ePID_T_avg
current | gold/fallrun1770.dat
LDCCTStrp
e_fid_St
e_p_coin_St

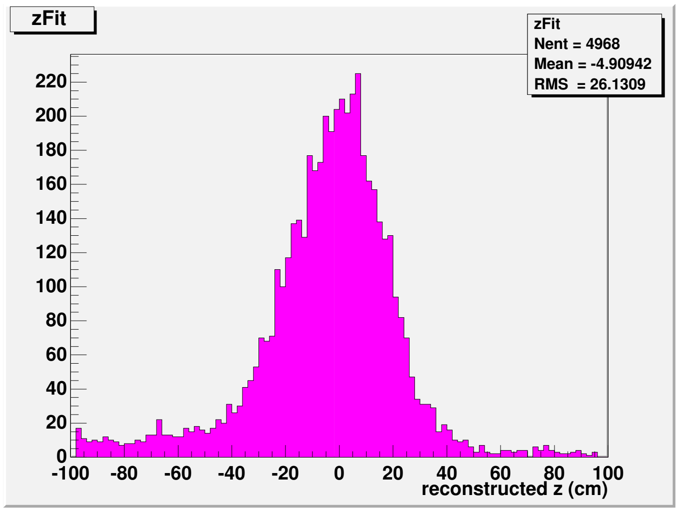
Ring Run'98 - Single Event Display & offline analysis

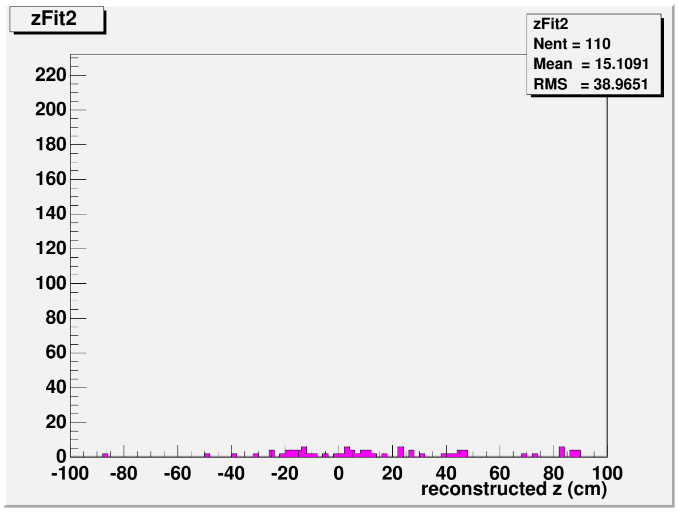


SED (v 0.0) - Single Event Display



reconstructed Opening Angle



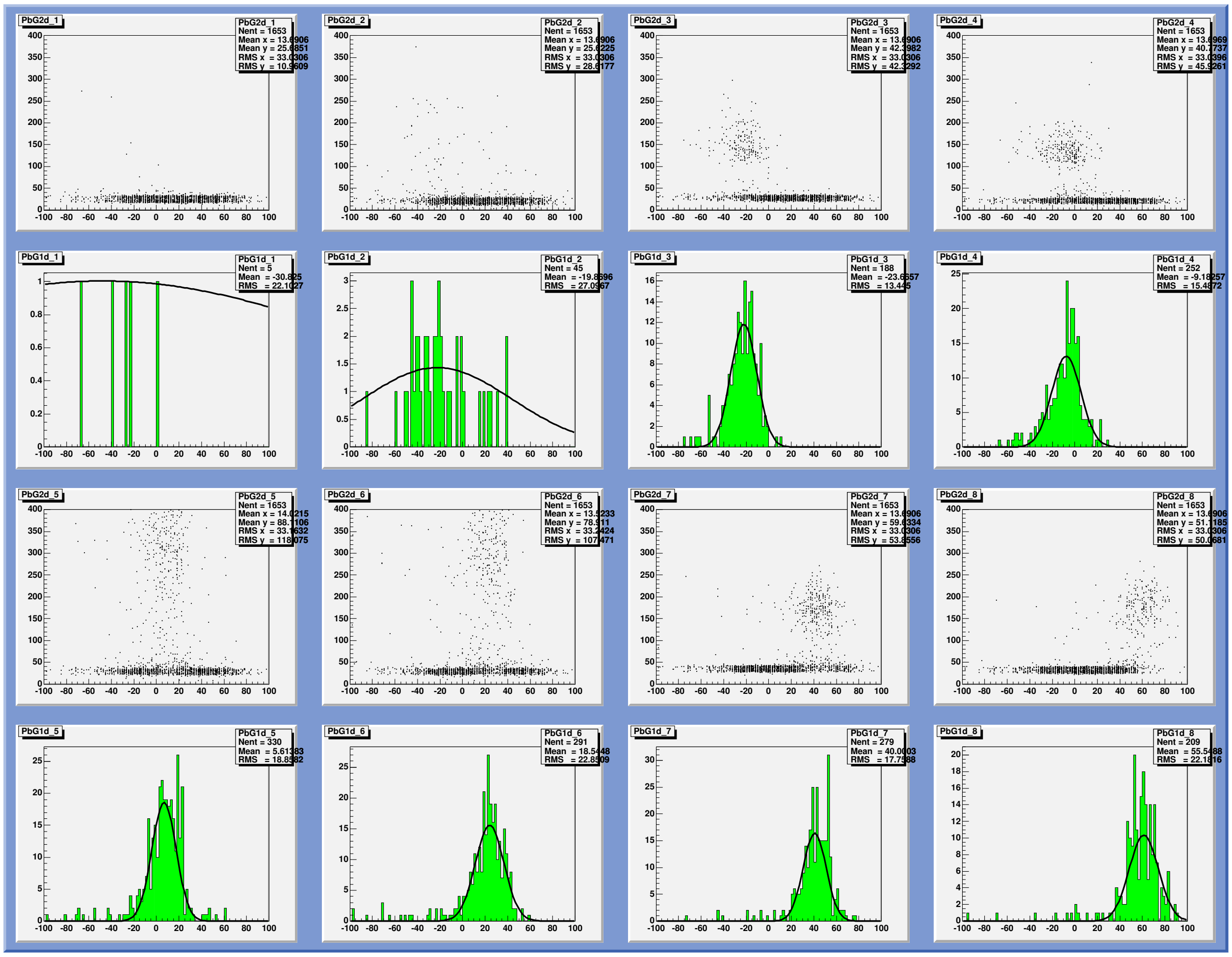


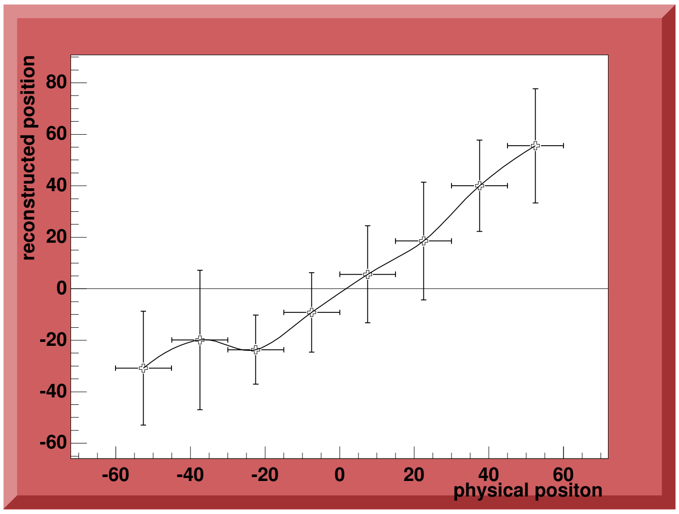
reconstructed vertex

target full

target empty

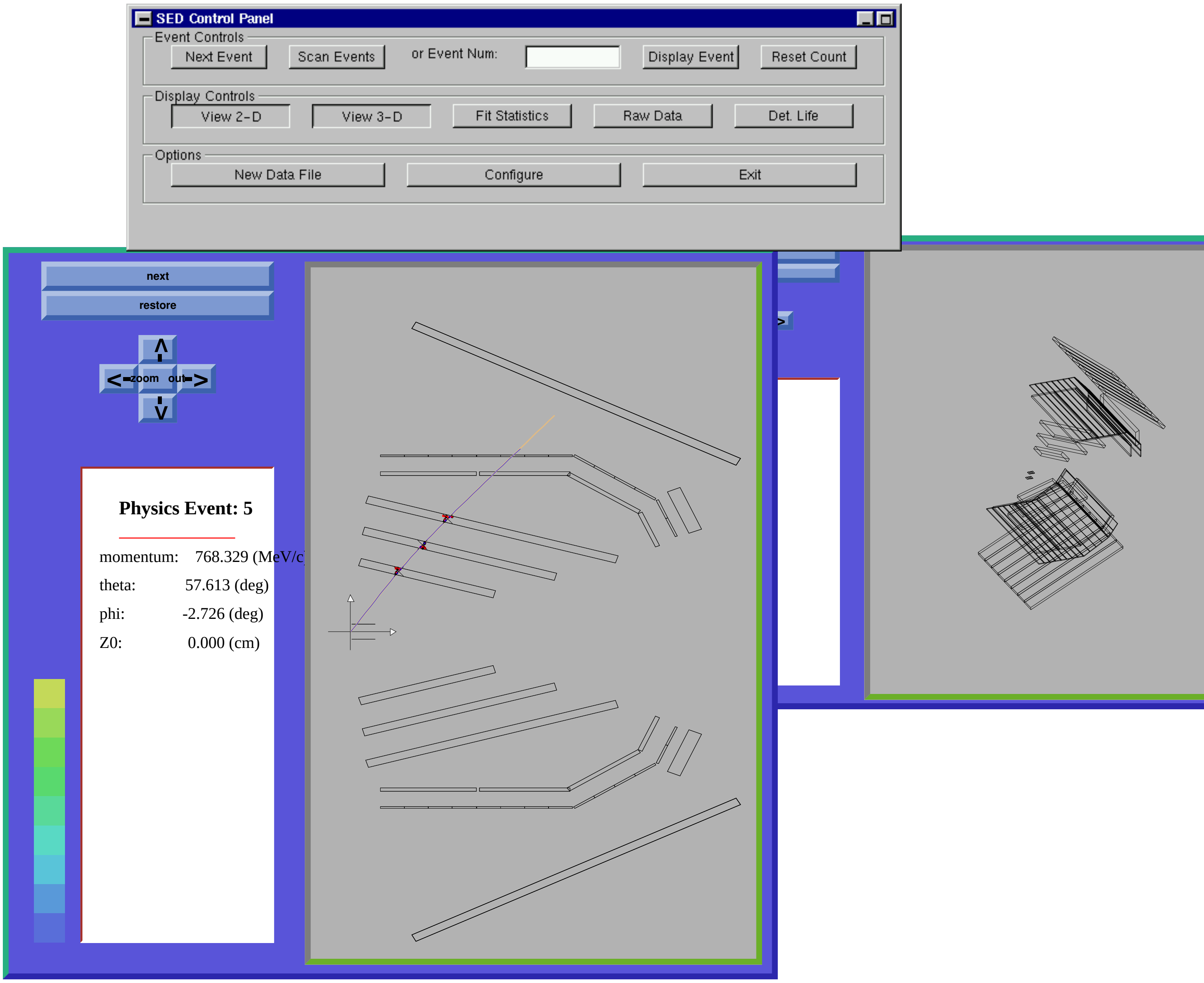
Ring Run'98 - analysis

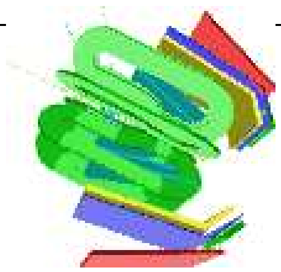




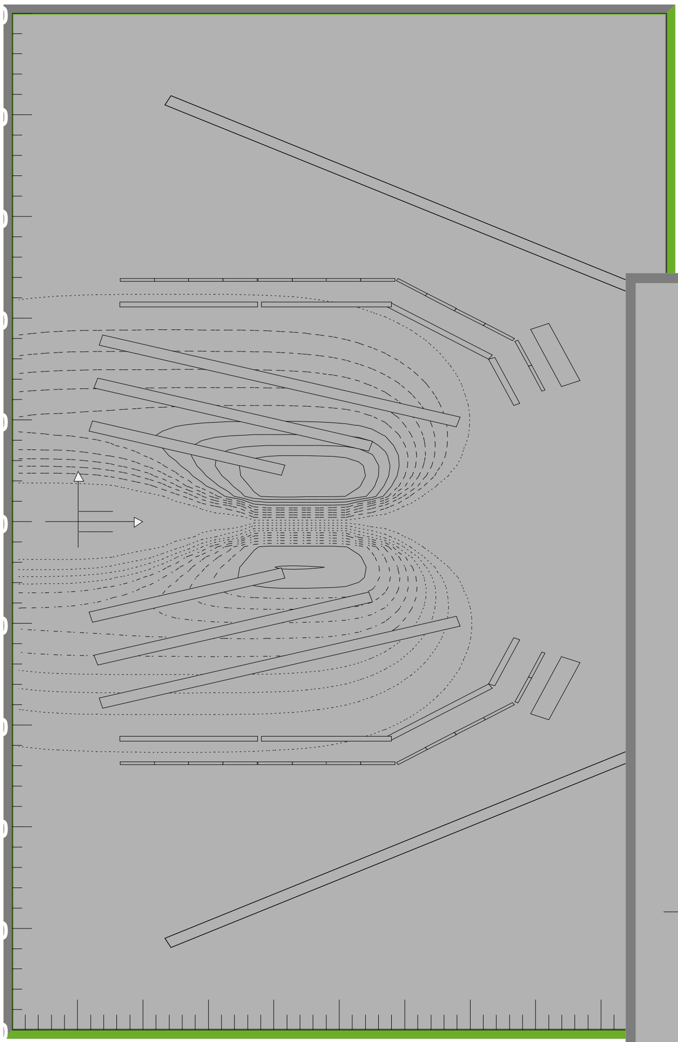
3 SED Single Event Display

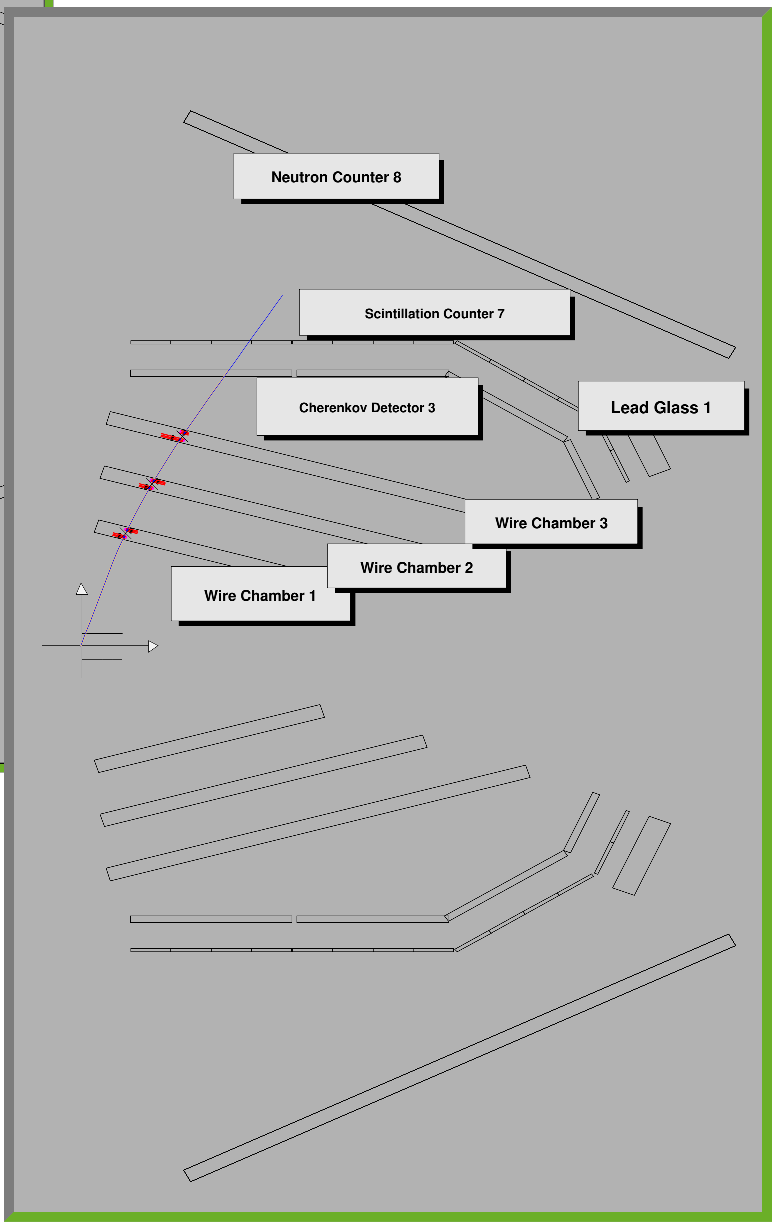
... also useful as a test bed for analysis methods ...





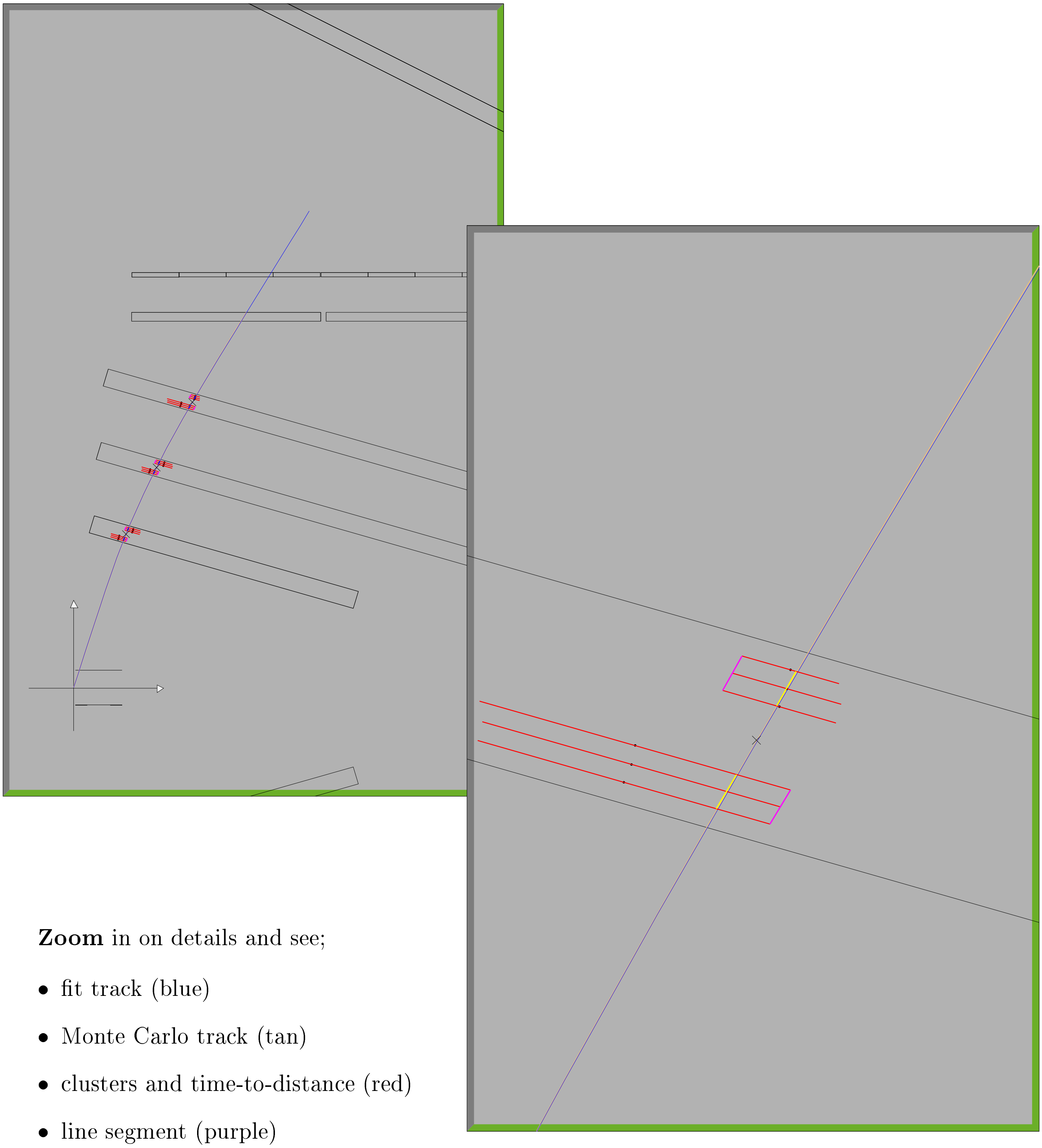
SED - Single Event Display cont.





Overlay the Magnetic Fields
and/or Detector information

SED - Single Event Display cont.



Zoom in on details and see;

- fit track (blue)
- Monte Carlo track (tan)
- clusters and time-to-distance (red)
- line segment (purple)
- corrected line segment (yellow)

4 Summary

in the last year ...

- Looking for software - January 1998
- adopted Root - April 15
- First "real" class - June
- CODA-to-Root - August 1998
- Live with Beam - November
- Ring Run Analysis - December
- SED - January
- started full BLAST analysis - February

Classes developed

- TBLCodaRead, TBLCodaEvio, TBLCodaSwapUtil
- TBLGeometry
- TBLMagField
- TBLTrack
- TBLEvent
- TBLDetector
- TBLAnalyze, TBLrr98Analyze

Major projects

- CODA-to-Root
- online
- rr98anal
- SED