p13 Z(ee)+X cross section with (stat) error calculation

- Preselection:
- WZ EM skim
- p13
- $120pb^{-1}$
- |ID|=10,11
- pT>15GeV
- 4 single EM triggers OR'd
- Badrun list
- Badlumi list

- Electron selection:
- EMF>.9
- Iso<.15
- HMx<20.
- pT>20GeV
- Including phi cracks
- CC-CC: |eta|<1.1
- Requiring at least one trackmatched electron
- 80 GeV < M_{ee} < 100 GeV

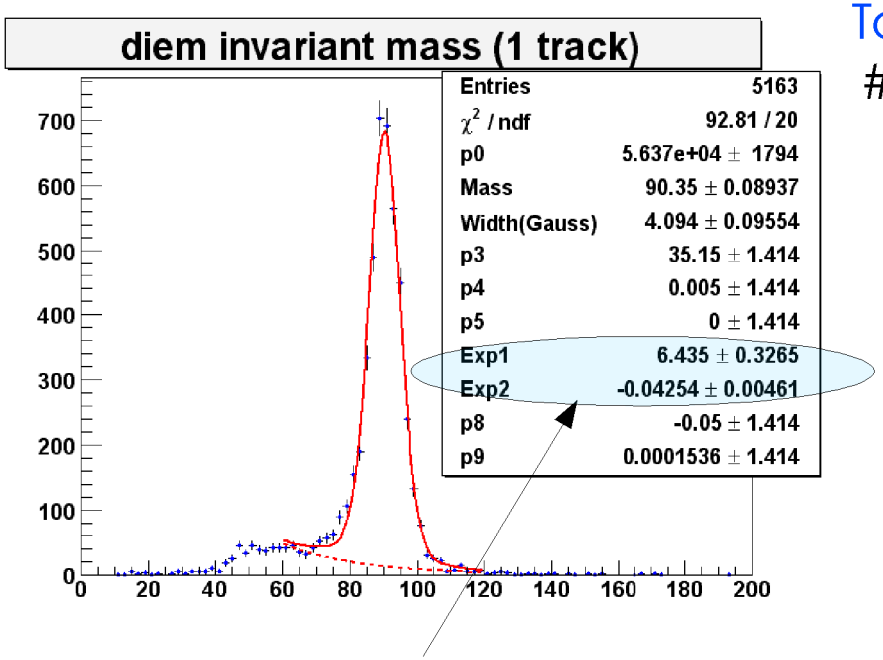
- Jet selection:
- .05<EMF<.95
- Chfrac<.4
- HotFrac<10.
- N90>1
- F90 cut
- dR(Jet-EM)>.45
- pT>20GeV

- Statistics:
- # of Z candidate events after applying M_{ee} masswindow cut = 3949
- Inclusive jet counting:

n	0	1	2	3	4	5
#	3949	546	111	25	8	2

QCD background

- Using Z/Gamma* MC to extract percentage of DY contribution: **2.1%** (+.7%-.52%)
- Fitting exponential and convolution of Gaussian & BW to the diem invariant mass plot to separate pure Z->ee from DY+QCD



Need to look at off-diagonal elements of correlation matrix. If large, then Exp1 and Exp2 are correlated and I'm overestimating my error!

Total # of events (80-100GeV) = **3949**

from QCD and DY (80-100GeV)= 140

=> Signal = Z + DY = 3891
Background = QCD = 58

Stat error on QCD+DY from shifting the exponential fit up/down by 1sigma.
Then recalculating number of background events (QCD).
=> stat error on background

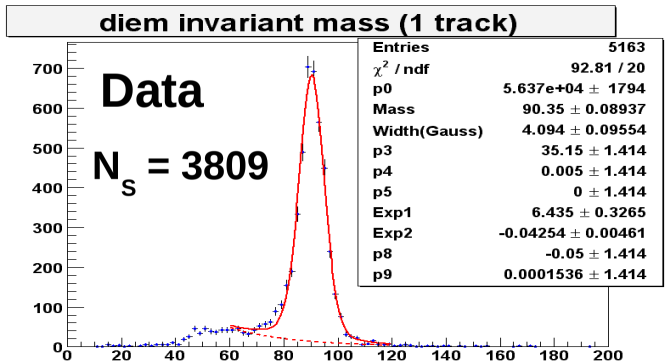
S = N - B
error on N is SQRT(N)
then adding in quadrature:

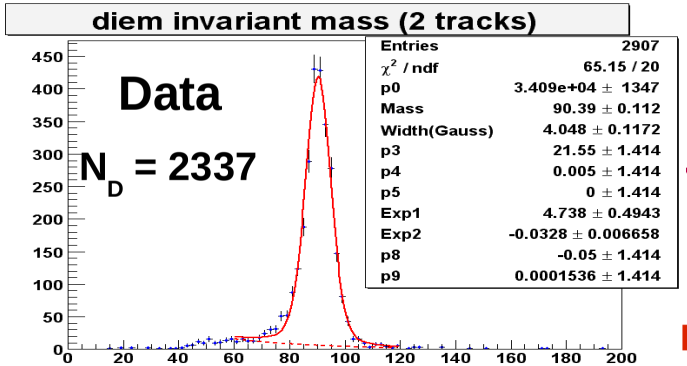
$$\delta S = \sqrt{\delta N^2 + \delta B^2}$$

=> del S = +169 - 99

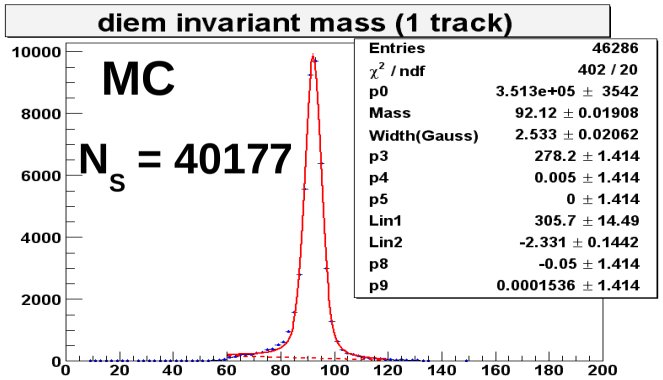
Trackmatching/finding efficiencies in data and MC

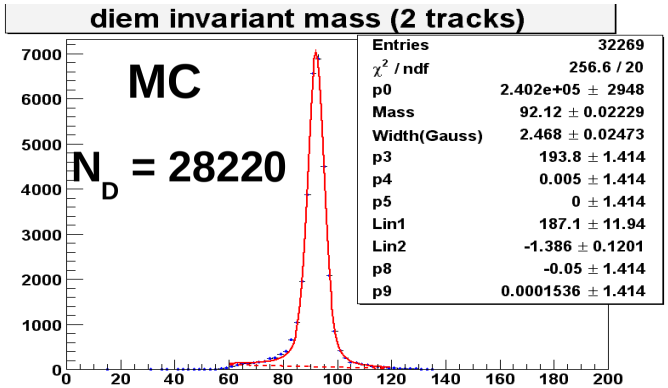
- N_S = # of events with 2 trk matches
- N_D = # of events with at least 1 trk match
- Efficiency = $2N_D/N_D + N_S$
- Fit: Gaussian+BW for signal and exponential(data)/linear function (MC) for background





ε_{TRK}^{data} = 76.0%+-.54%





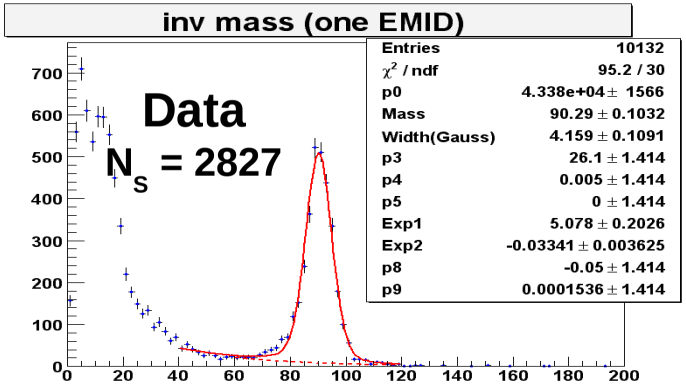
Errors are binomial:

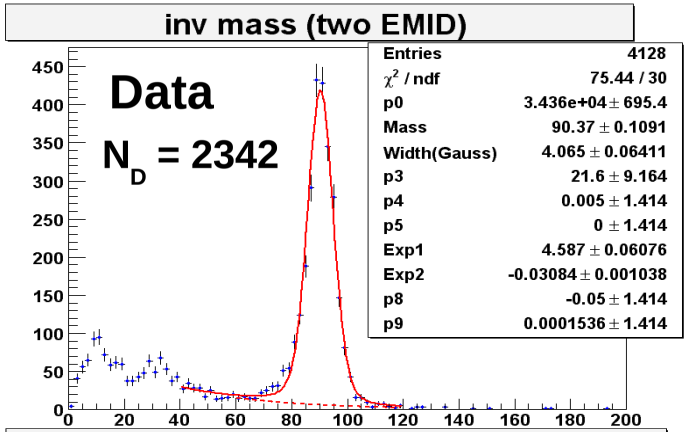
$$\delta\epsilon = \sqrt{\frac{(1-\epsilon)*\epsilon}{N}}$$

ε_{TRK}^{MC} = 82.5%+-.15%

EMID efficiencies for data and MC

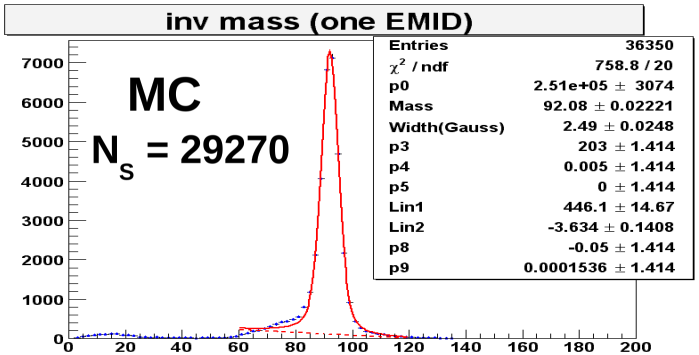
- N_S = # of events where 2 EM objects pass EMID cuts
- N_D = # of events where at least one EM object passes EMID cut
- Efficiency = $2N_D/N_D + N_S$
- Fit: Gaussian+BW for signal and exponential(data)/linear function (MC) for background

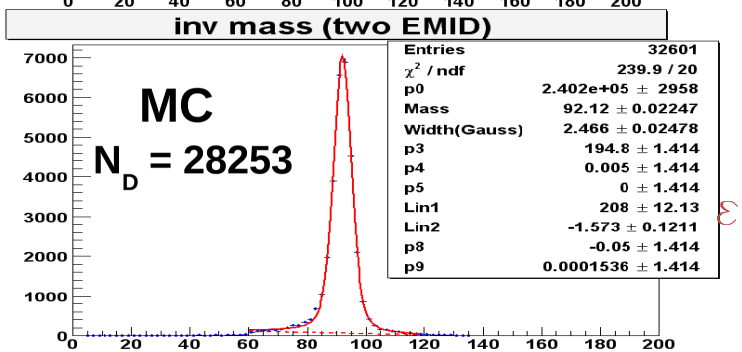




$\varepsilon_{EMID}^{data}$ = 89.7%+-.42%

Binomial errors ...





ε_{EMID}^{MC} = 98.2%+-.06%

Z(ee) + X Cross Section

$$XSection \cdot BR = \frac{N - B}{Lumi \cdot Trigger \cdot Accept \cdot Trk \cdot EMID}$$

$$Trk = \frac{2 * \epsilon_{data} - \epsilon_{data}^2}{2 * \epsilon_{MC} - \epsilon_{MC}^2}$$

$$2\epsilon * (1 - \epsilon) + \epsilon^2 = 2\epsilon - \epsilon^2$$

$$EMID = \frac{\epsilon_d^2}{\epsilon_{MC}^2}$$

	Value	Uncertainties
N_Z	3888	+169-99
Lumi	119pb-1	+- 11.9pb-1
A	17.1%	+- 0.08%
ε^d_{EMID}	89.7%	+-0.42%
ε^M_{EMID}	98.2%	+-0.06%
ε^d_{track}	76.0%	+-0.54%
ε^M_{track}	82.5%	+-0.15%
$\varepsilon_{trigger}$	98.0%	+-2.0%
$\sigma \times$ BR	**250pb**	**+12.3-8.6pb (stat)**

Error propagation:

$$z = f(x, y)$$

$$\delta z = \sqrt{\left(\frac{df}{dx} * \delta x\right)^2 + \left(\frac{df}{dy} * \delta y\right)^2}$$

p14 Z(ee) + Jets

- Based on 210 pb^{-1} of recorded lumi (19 April 2002 - 7 Sept 2003 / run range: 151817 - 180956)
- CSG's 1EMloose skim:
  - (ID=10 OR |ID|=11) AND (pT>15GeV)
  - p14.06 tmbfixed w/o T42
- ✔ ATHENA'lized and further skimmed down by Alan !
- ✔ Good event selection:
  - ✔ Jet/MET v5.0 list of bad LBNs
  - ✔ CAL, SMT, CFT based on runquality database
- ✔ Checking for event duplication
- ✗ Triggers: follow the WZ group's recipe ...
- ✗ Lumi calc: runrange_luminosity function ...

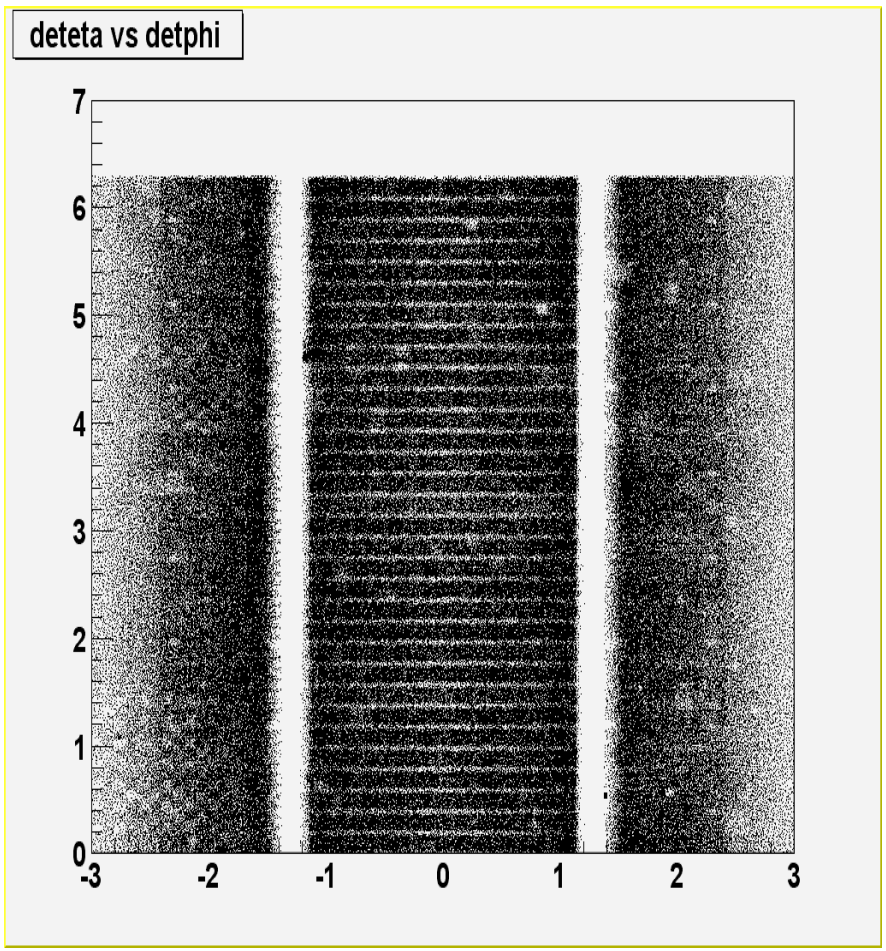
- Electron selection:
- EMF>.9
- Iso<.15
- HMx<20.
- pT>20GeV
- Including phi cracks
- CC-CC: |eta|<1.1
- Requiring at least one trackmatched electron
- 80 GeV < M_{ee} < 100 GeV

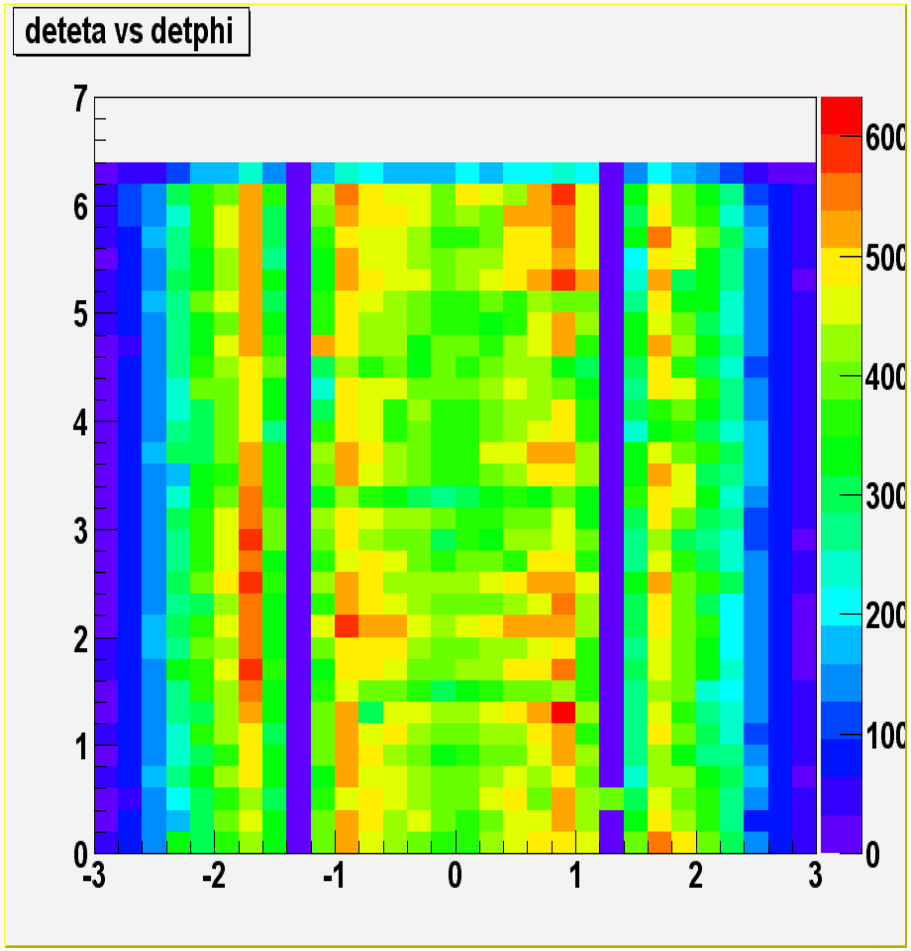
- Jet selection:
- .05<EMF<.95
- Chfrac<.4
- HotFrac<10.
- N90>1
- L1confirmation
- dR(Jet-EM)>.45
- pT>20GeV

Some bookkeeping

- 520 million events to tape
- 74 million in 1EMloose skim
- 8.793.039 events in ATHENA root tuple format
- Duplicate events = 340.144
- Events rejected due to Jet/MET bad LBNs list = 321.803
- Events rejected due to bad CAL run = 674.717
- Events rejected due to bad SMT run = 345.903
- Events rejected due to bad CFT run = 13.385
- Events selected for analysis = 7.184.068
- Events with Z candidates = 7.315
- Z candidate events with dijets (inclusive) = 205

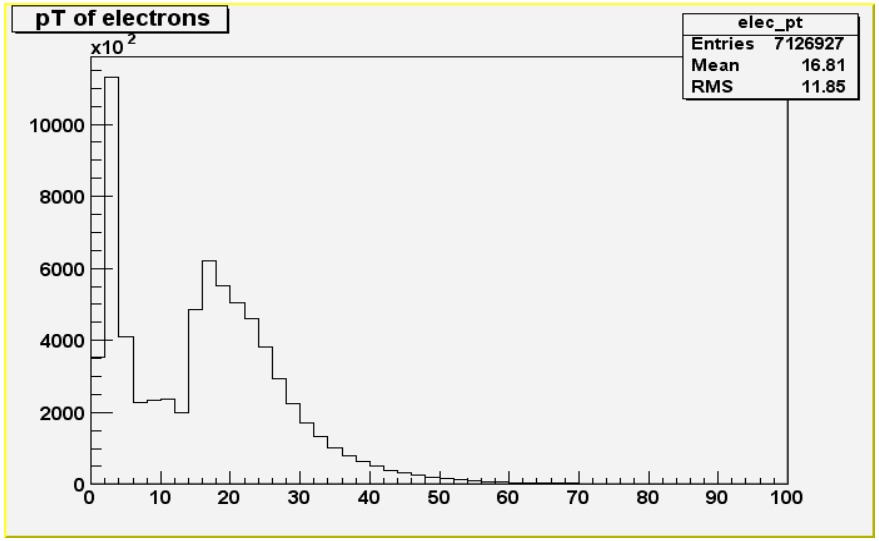
CAL

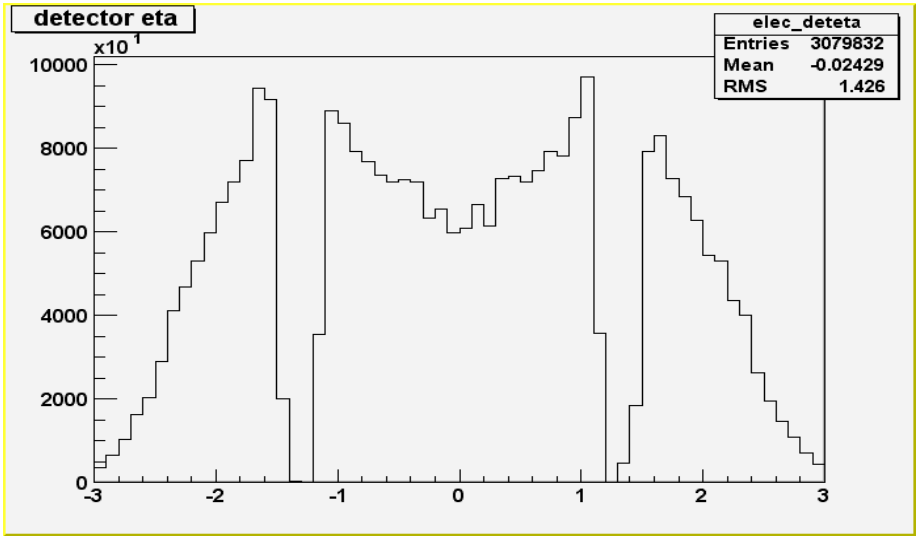


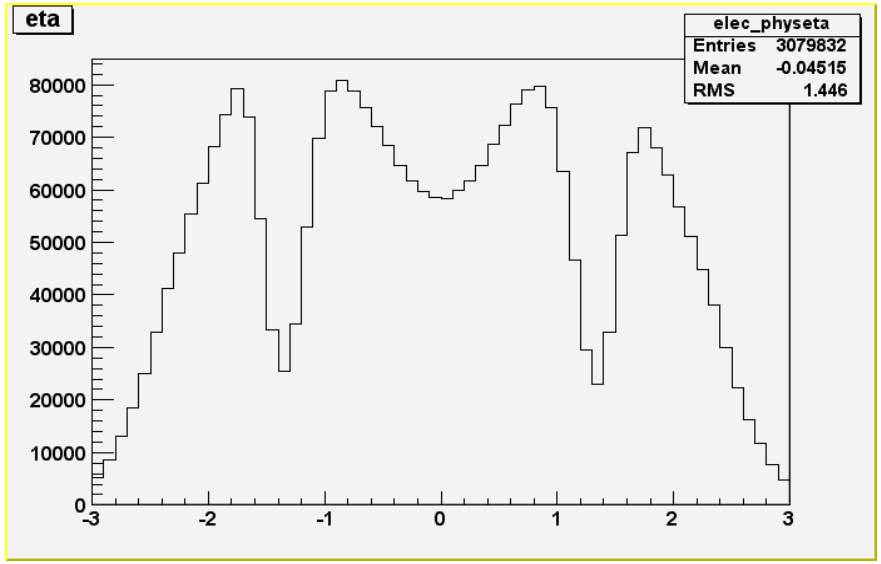


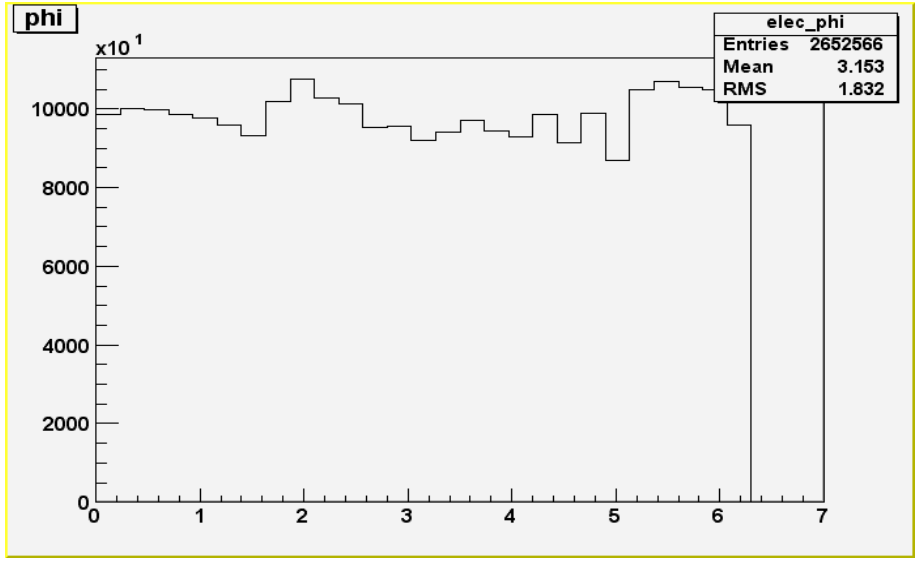
All electrons passing EMF, Iso, HMx, pT cuts - no fiducial cuts - rejecting bad events (Jet/MET, CAL, SMT, CFT)

Electrons

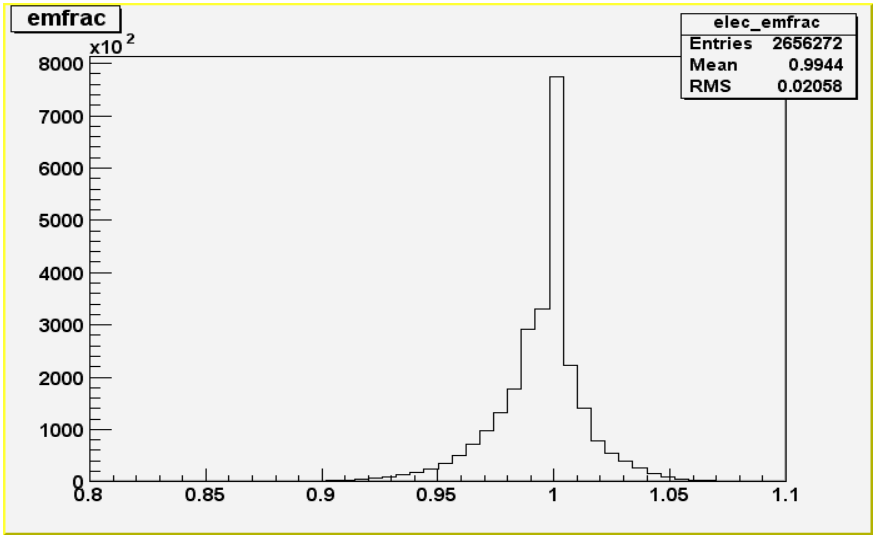

pT of electrons
elec_pt
Entries 7126927
Mean 16.81
RMS 11.85
x10 2

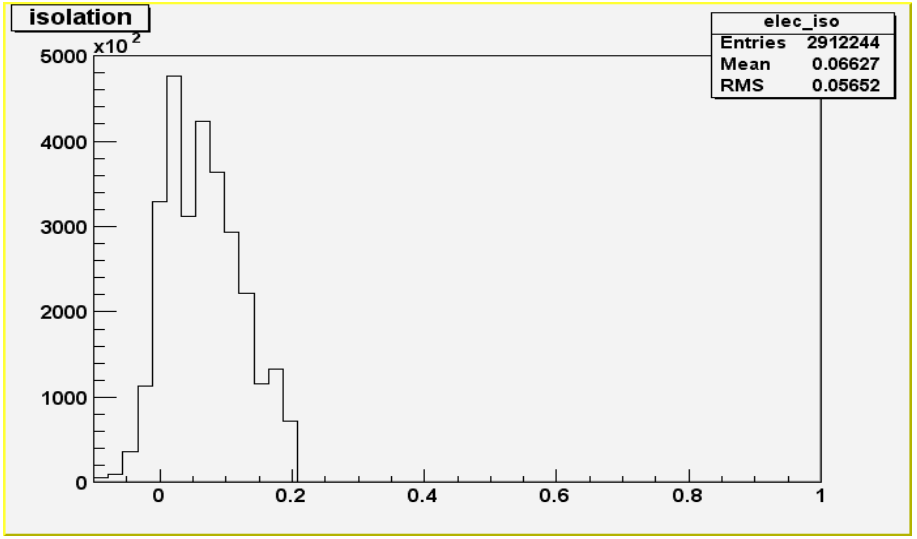

detector eta
elec_deteta
Entries 3079832
Mean -0.02429
RMS 1.426
x10 1

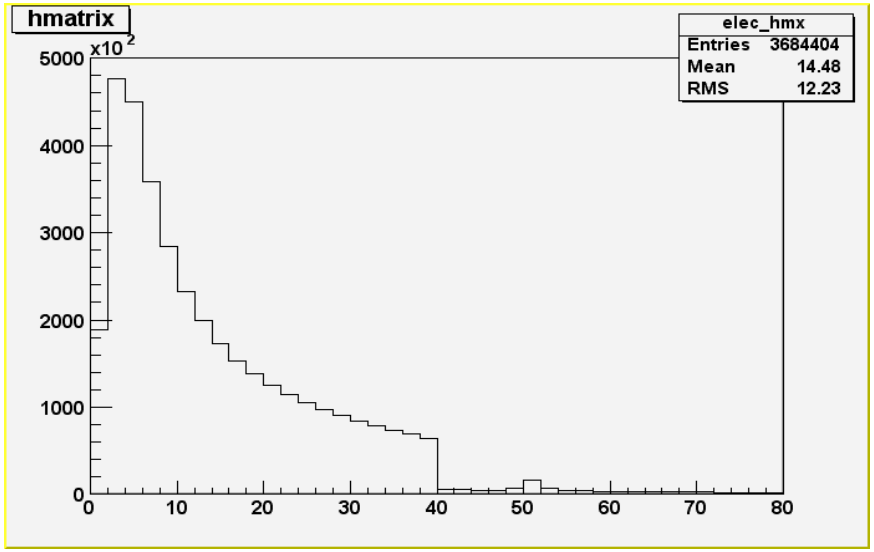

eta
elec_physeta
Entries 3079832
Mean -0.04515
RMS 1.446


phi
elec_phi
Entries 2652566
Mean 3.153
RMS 1.832
x10 1

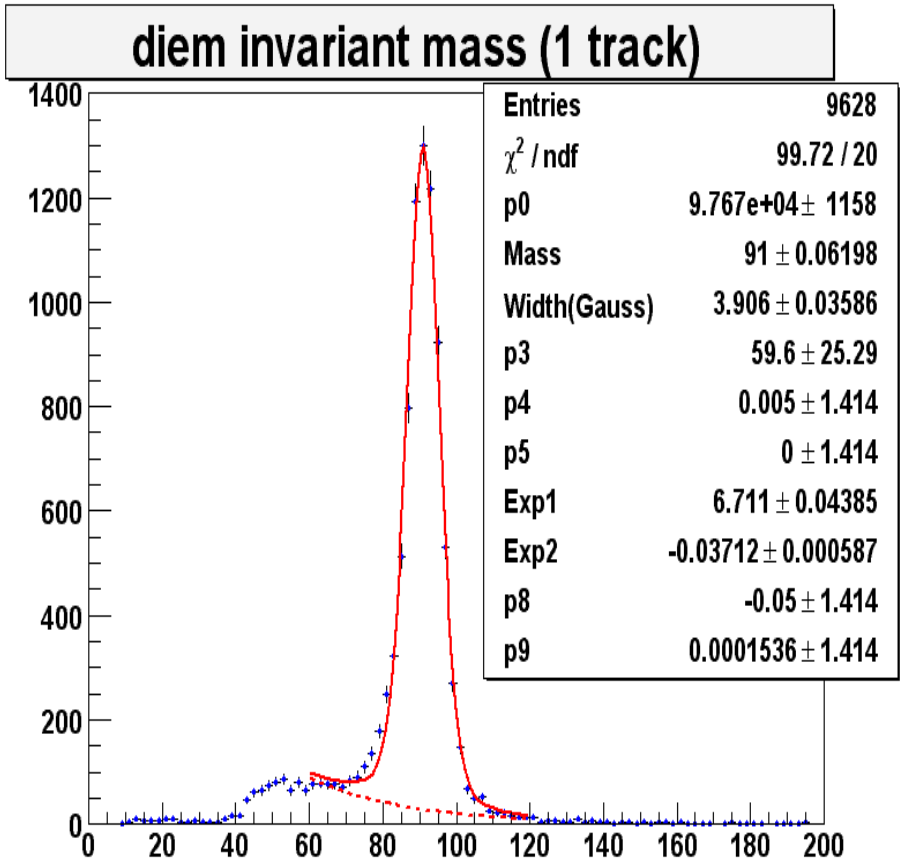
Electrons

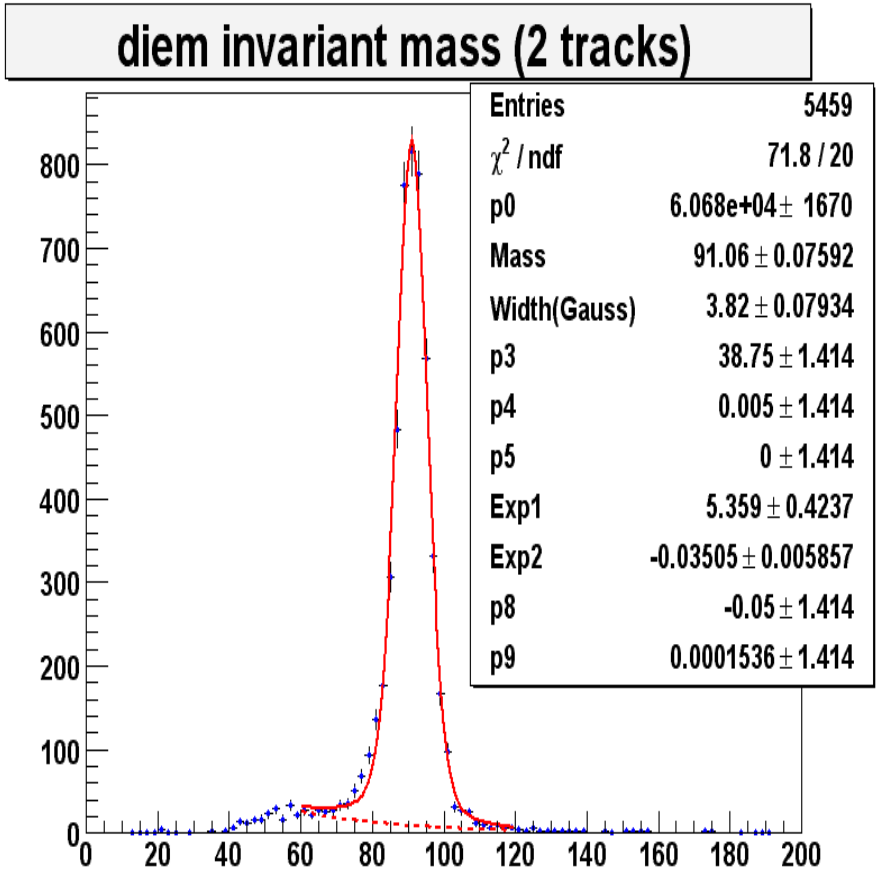

emfrac
elec_emfrac
Entries 2656272
Mean 0.9944
RMS 0.02058
x10 2
8000
7000
6000
5000
4000
3000
2000
1000
0
0.8
0.85
0.9
0.95
1
1.05
1.1


isolation
elec_iso
Entries 2912244
Mean 0.06627
RMS 0.05652
x10 2
5000
4000
3000
2000
1000
0
0
0.2
0.4
0.6
0.8
1

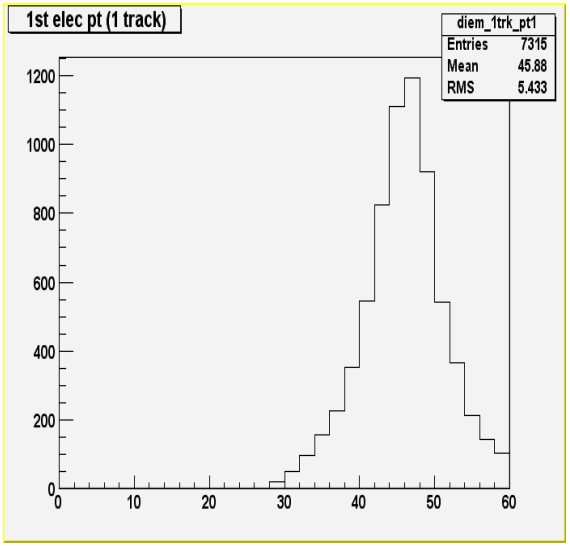

hmatrix
elec_hmx
Entries 3684404
Mean 14.48
RMS 12.23
x10 2
5000
4000
3000
2000
1000
0
0
10
20
30
40
50
60
70
80

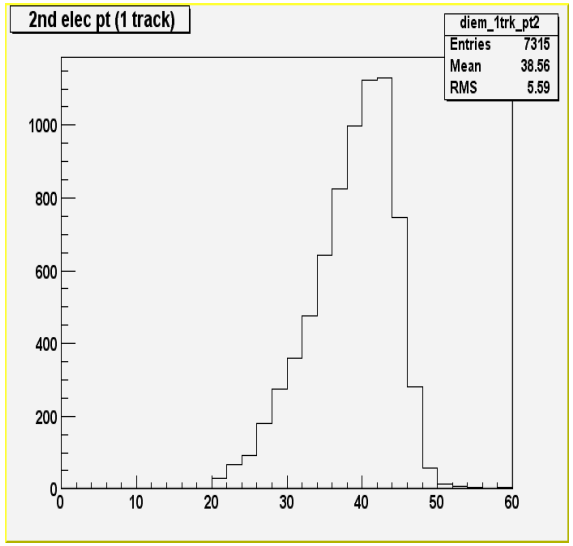
Z peaks

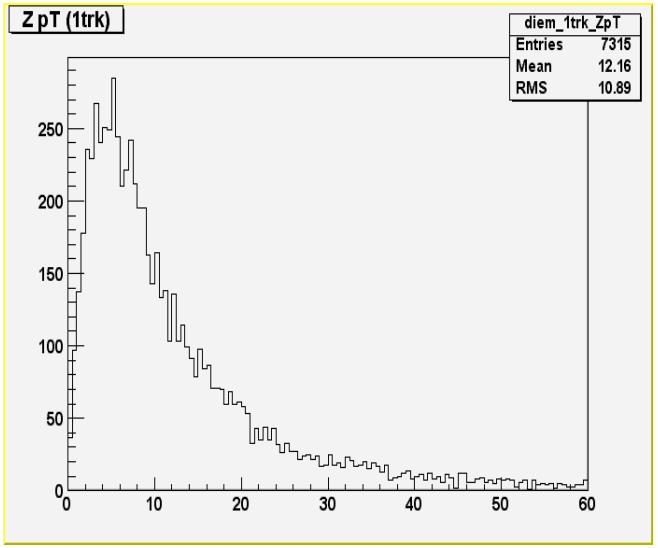

diem invariant mass (1 track)
Entries 9628
χ^2 / ndf 99.72 / 20
p0 9.767e+04 ± 1158
Mass 91 ± 0.06198
Width(Gauss) 3.906 ± 0.03586
p3 59.6 ± 25.29
p4 0.005 ± 1.414
p5 0 ± 1.414
Exp1 6.711 ± 0.04385
Exp2 -0.03712 ± 0.000587
p8 -0.05 ± 1.414
p9 0.0001536 ± 1.414

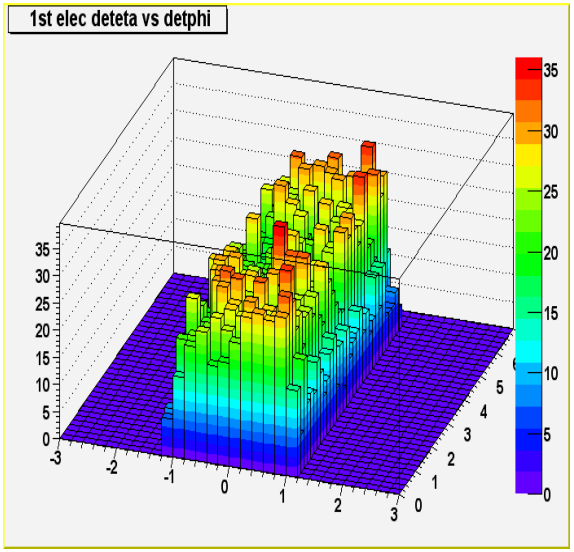

diem invariant mass (2 tracks)
Entries 5459
χ^2 / ndf 71.8 / 20
p0 6.068e+04 ± 1670
Mass 91.06 ± 0.07592
Width(Gauss) 3.82 ± 0.07934
p3 38.75 ± 1.414
p4 0.005 ± 1.414
p5 0 ± 1.414
Exp1 5.359 ± 0.4237
Exp2 -0.03505 ± 0.005857
p8 -0.05 ± 1.414
p9 0.0001536 ± 1.414

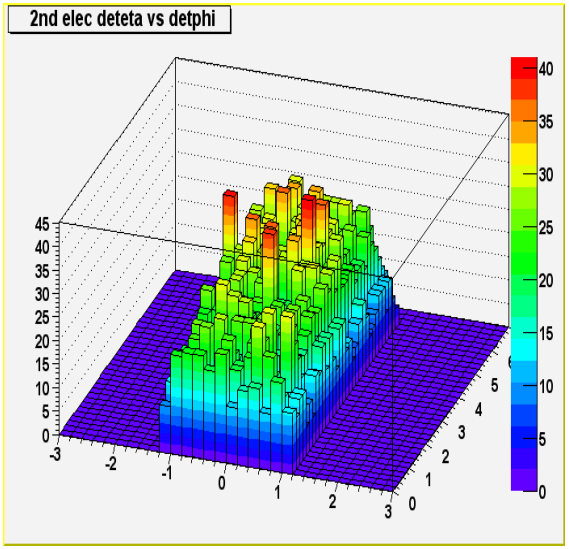
Z (1trk) plots

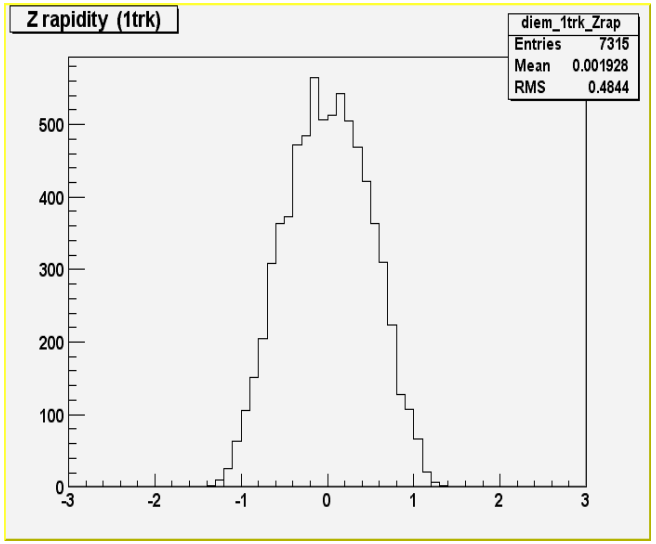

1st elec pt (1 track)
diem_1trk_pt1
Entries 7315
Mean 45.88
RMS 5.433


2nd elec pt (1 track)
diem_1trk_pt2
Entries 7315
Mean 38.56
RMS 5.59

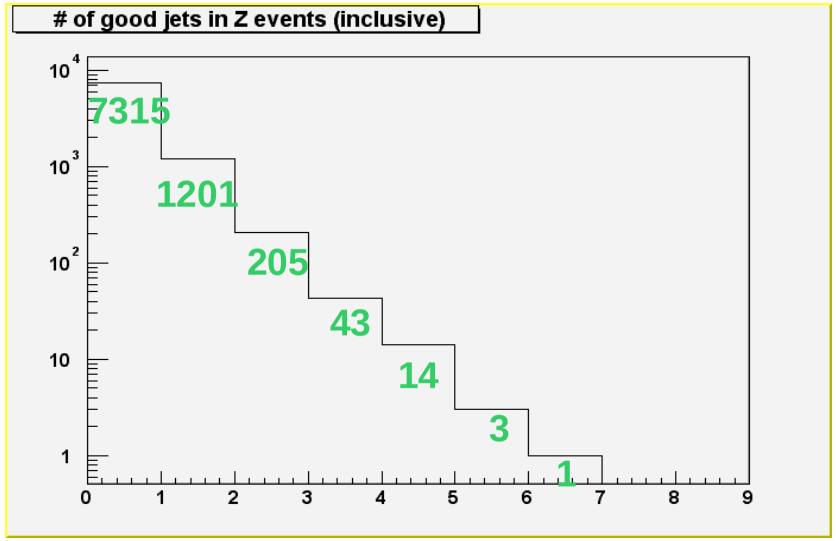

Z pT (1trk)
diem_1trk_ZpT
Entries 7315
Mean 12.16
RMS 10.89

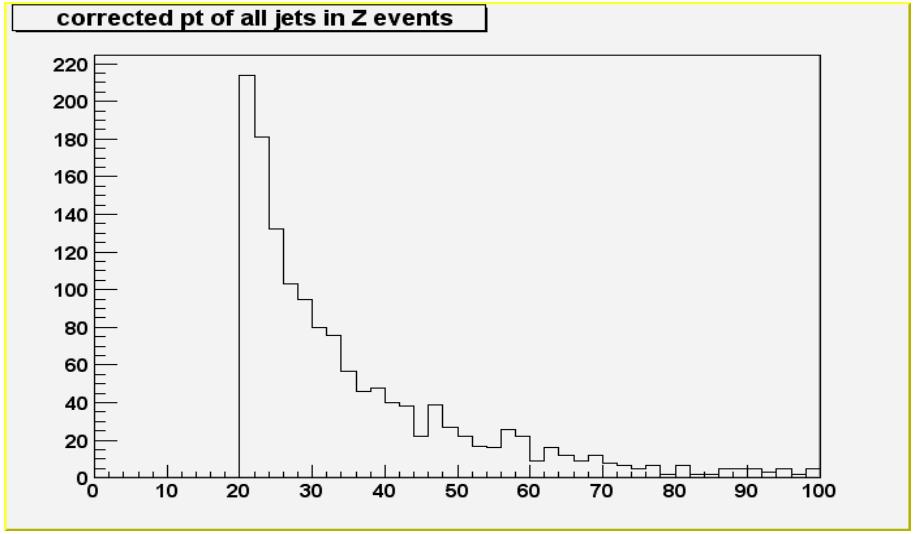

1st elec deteta vs detphi

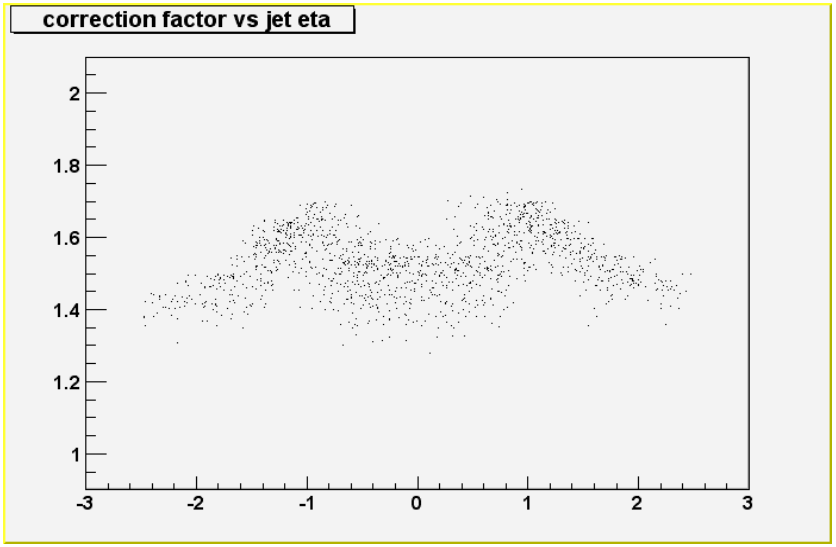

2nd elec deteta vs detphi

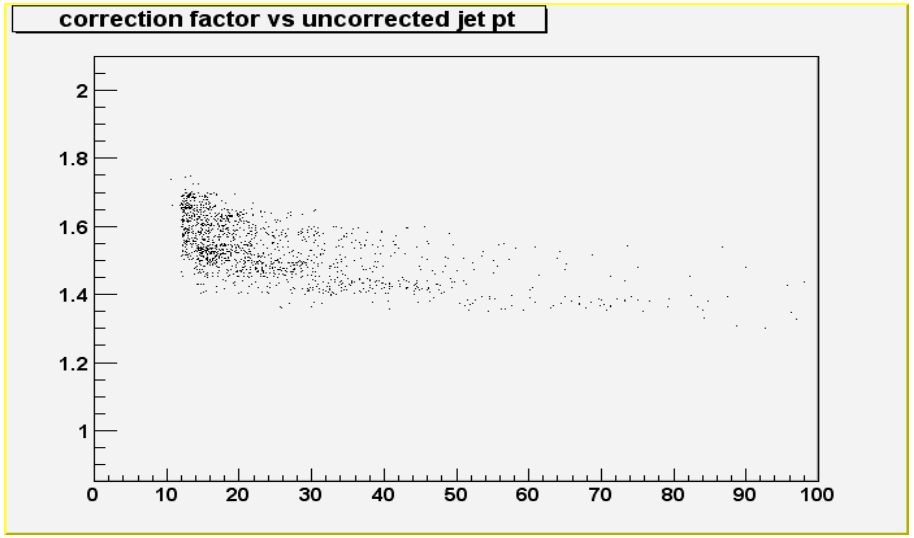

Z rapidity (1trk)
diem_1trk_Zrap
Entries 7315
Mean 0.001928
RMS 0.4844

Jets (after Z[1trk] mass window cut)

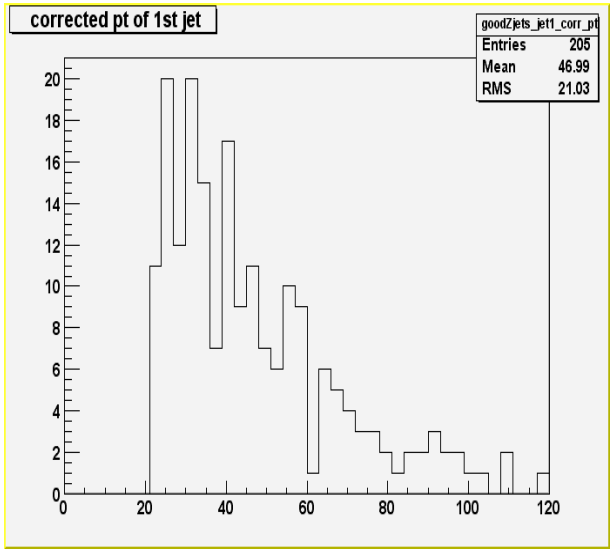


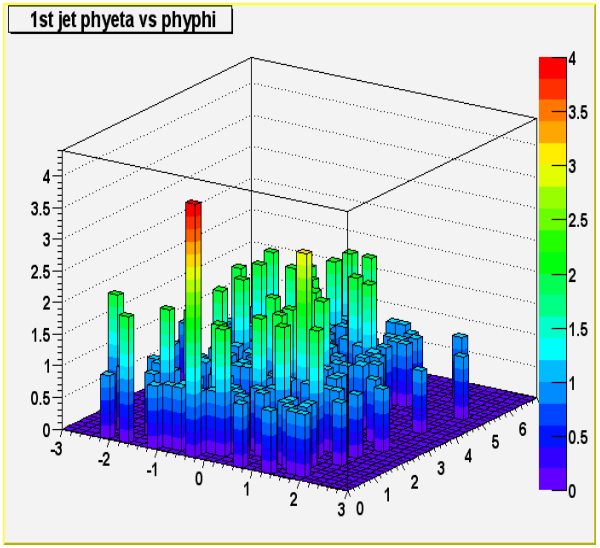


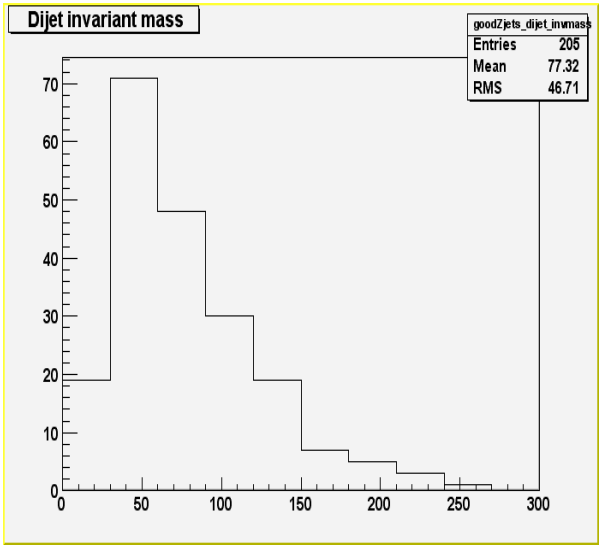


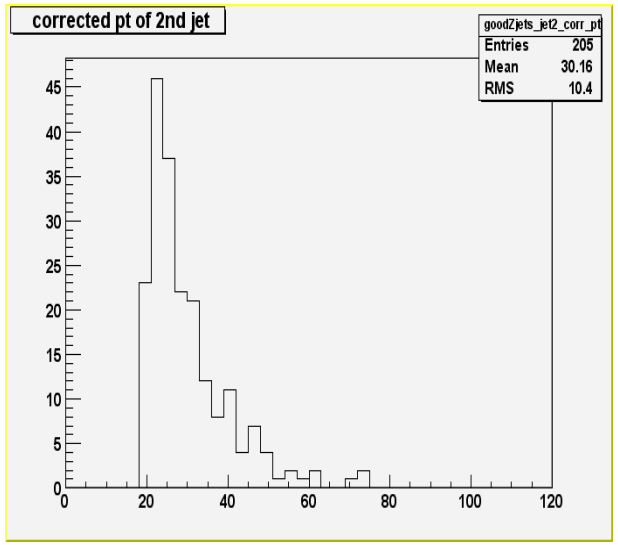


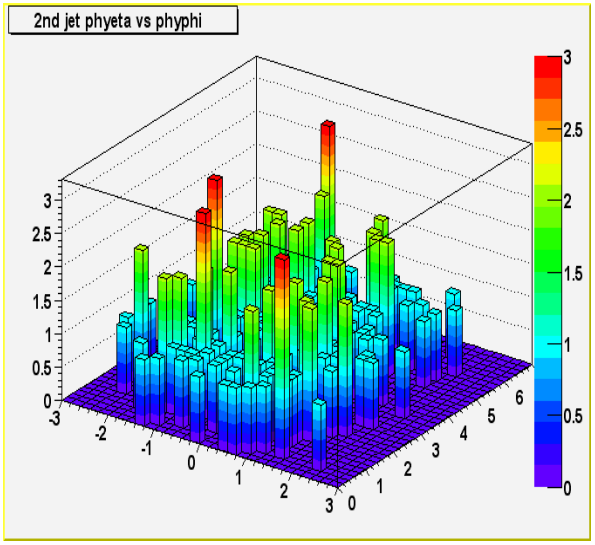
Dijets

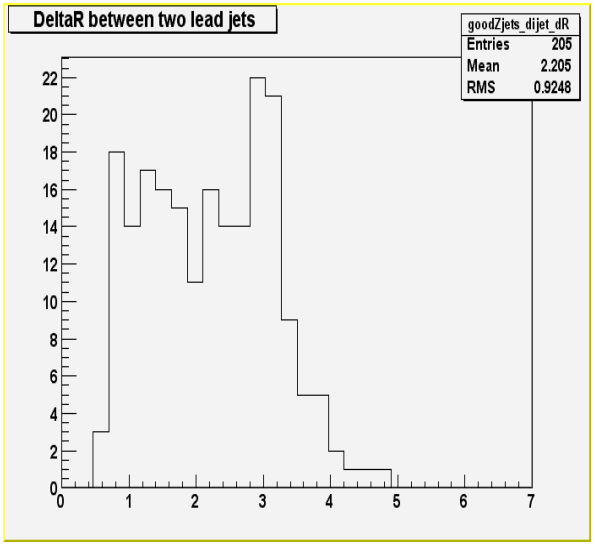

corrected pt of 1st jet
goodZjets_jet1_corr_pt
Entries 205
Mean 46.99
RMS 21.03


1st jet phyeta vs phyphi


Dijet invariant mass
goodZjets_dijet_invmass
Entries 205
Mean 77.32
RMS 46.71


corrected pt of 2nd jet
goodZjets_jet2_corr_pt
Entries 205
Mean 30.16
RMS 10.4


2nd jet phyeta vs phyphi


DeltaR between two lead jets
goodZjets_dijet_dR
Entries 205
Mean 2.205
RMS 0.9248

p14 Plans

- Implement trigger selection
- Calculate luminosity
- Redo Z(ee)+X cross section
- Redo wrt Jets