H->ZZ->4l
2011+2012 Results Analysis

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7/31/2012

Data Selection

- 2011 7 TeV Data (4.8/fb)
- 2012 8 TeV Data (5.8/fb)
- Summer 2012 Cuts (with muon cut loosen to 4GeV) for the Higgs to ZZ to 4 lepton channel
- Total number of candidate events in the entire mass region: 88(2011)+147(2012)

  (88+142 before loosening the muon cut)

Methodology

We define a signal region for MZZ around 125 GeV and two sidebands as the control region for background estimation.

We then plot different kinematic distributions for ZZ, Z1, Z2 and the 4 leptons.

Definition

Signal Region (13 candidate events)

120<MZZ<130 GeV

Control Region (24 candidate events)

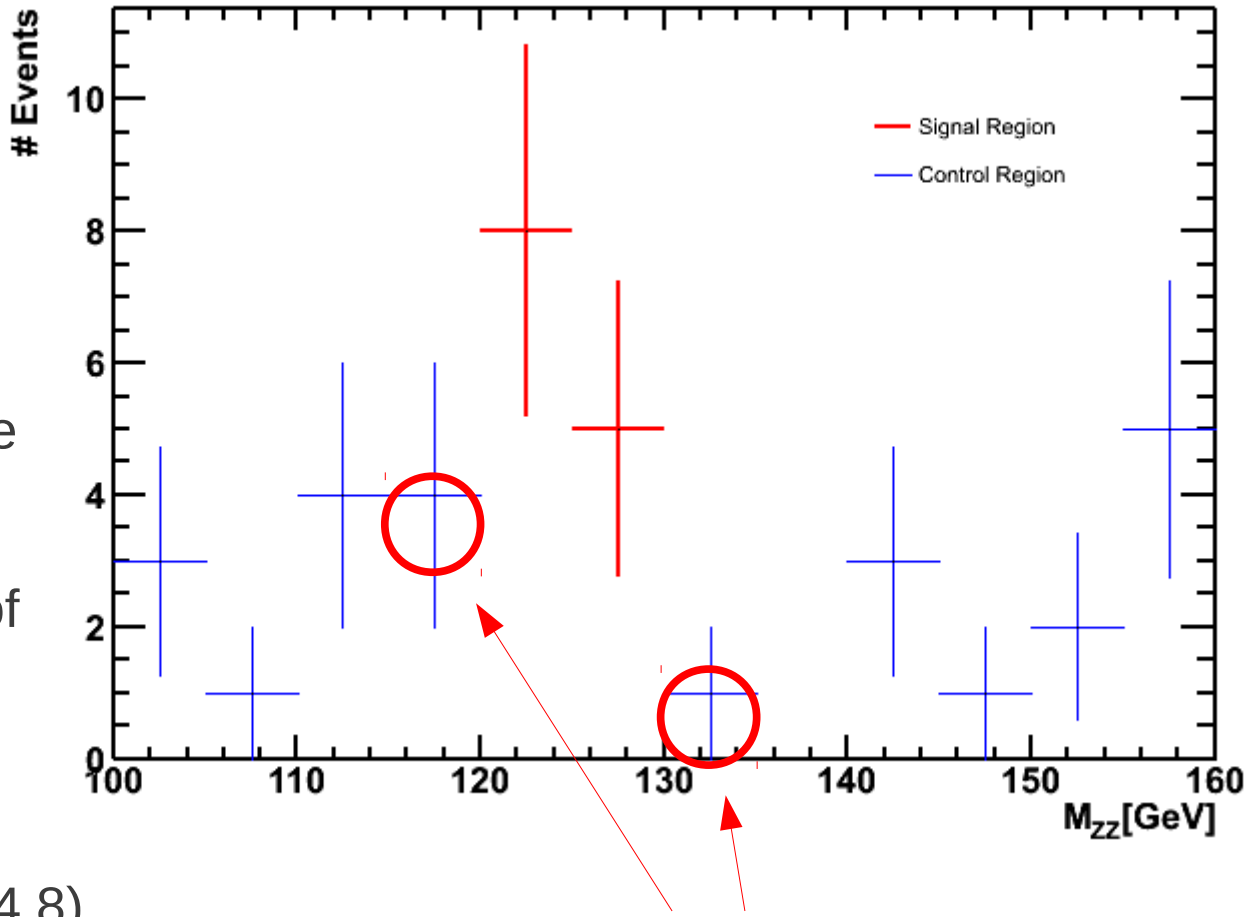
100<MZZ<120 or 130<MZZ<160 GeV

(2 more events after loosening muon cut)

ZZ Mass Distribution

We estimate from the sidebands the average number of bkg events to be 24/50 = 0.48/GeV

Average number of bkg events in the signal region = 4.8 events

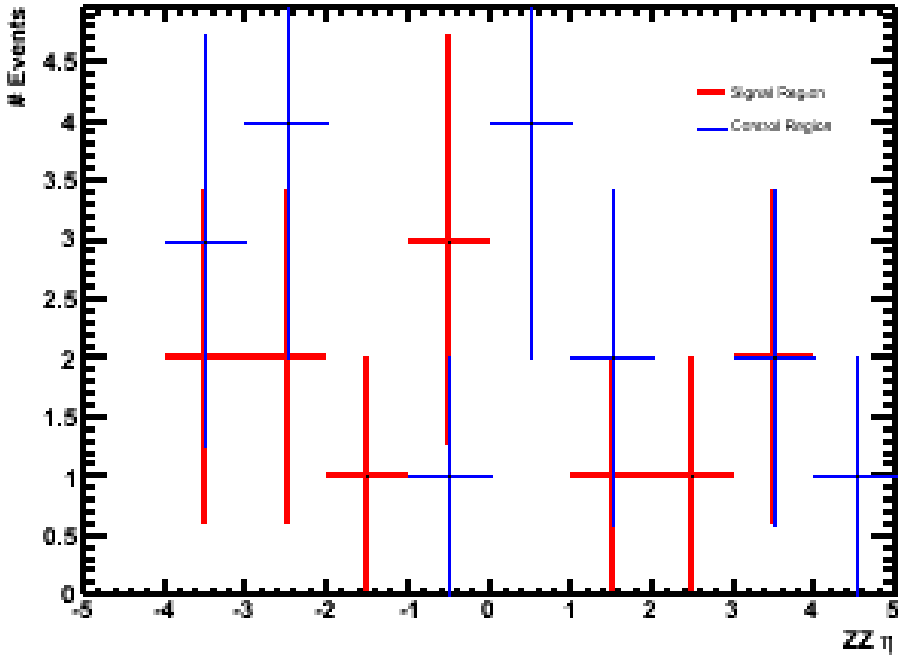


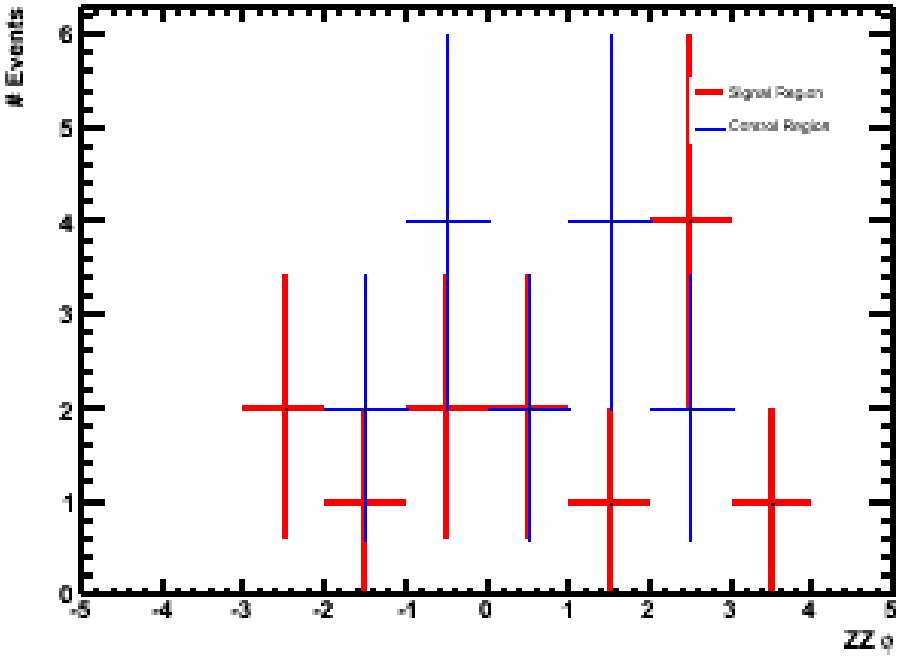
Two extra events after loosening muon cut

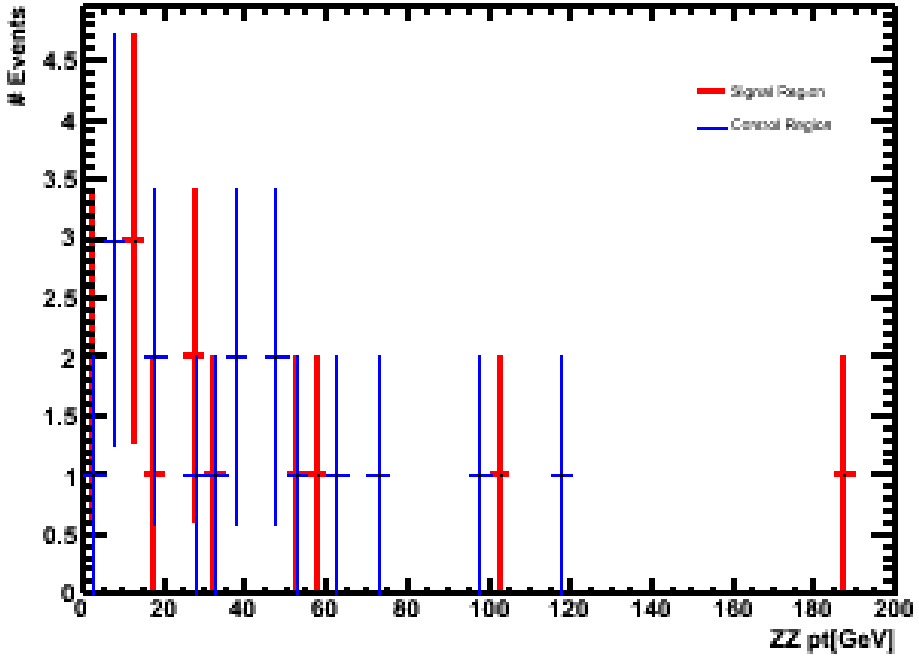
p-value = P(>=13|4.8)
= 0.00142 (~ 3.0 sigma)

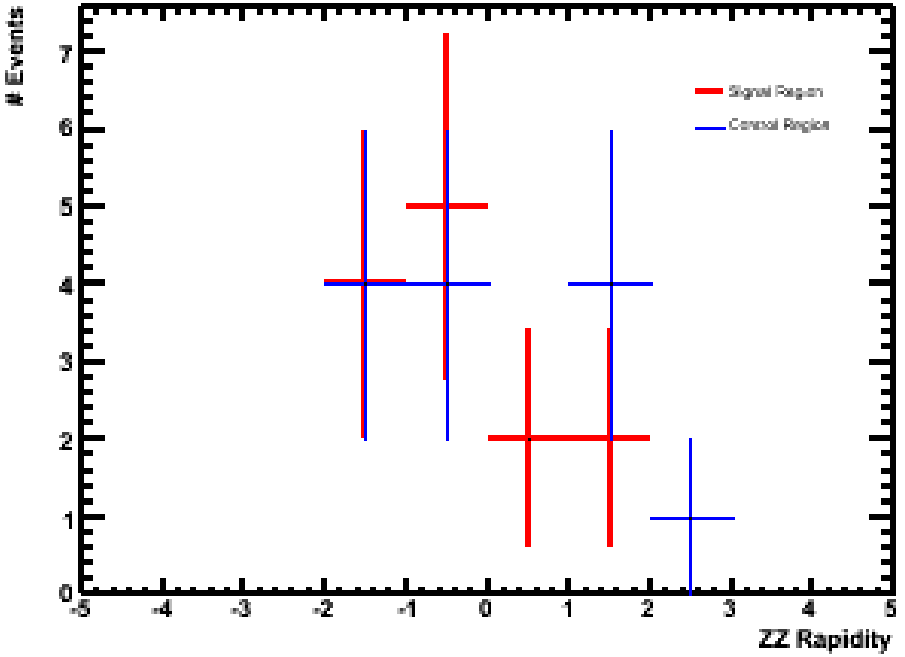
Old p-value = P(>=13|4.4)
= 0.000658 (~3.2 sigma) (before loosening muon cut)

ZZ Distributions

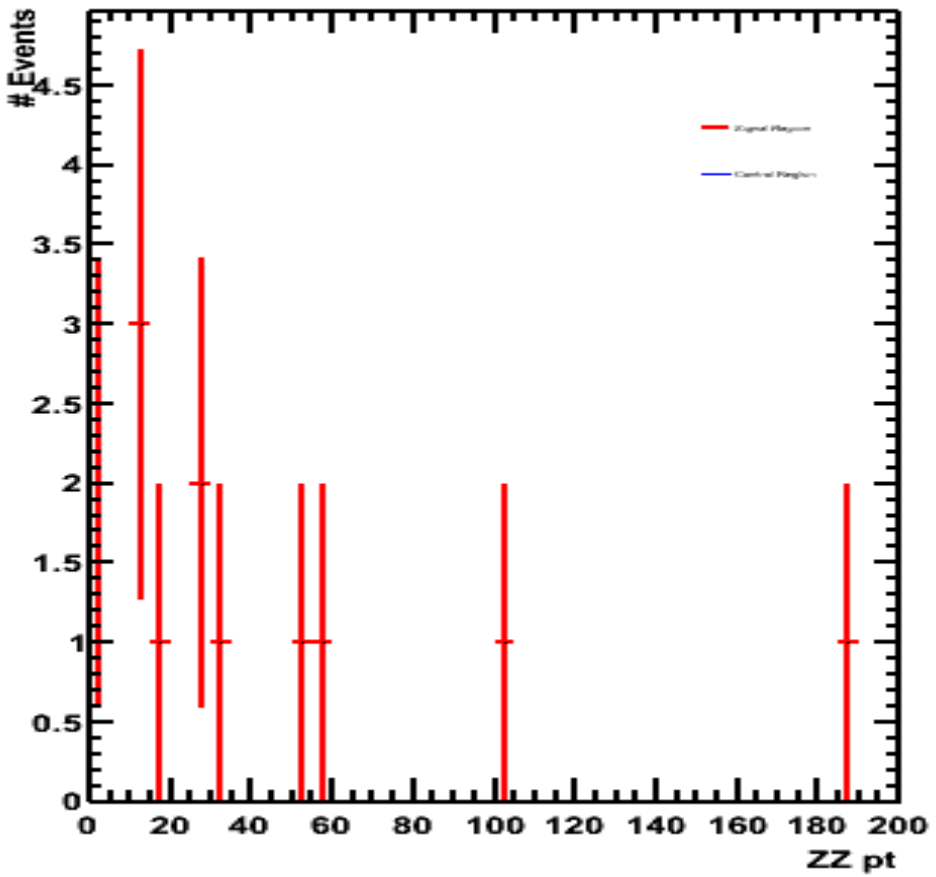




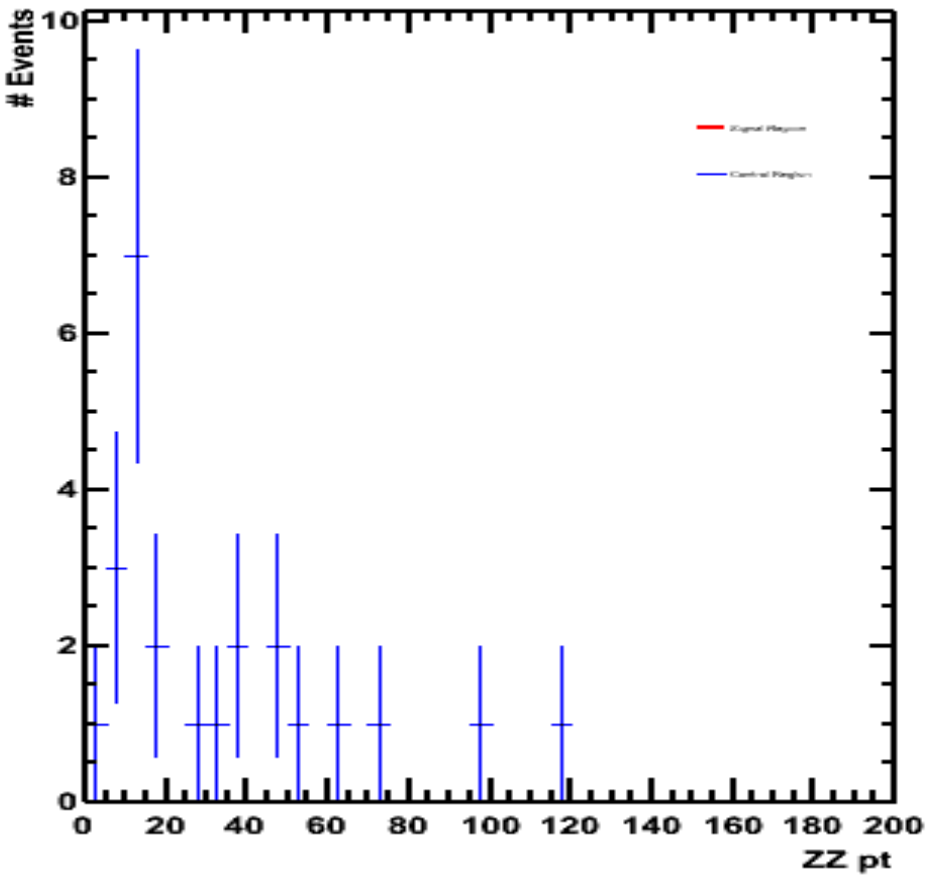




ZZ Pt Distribution

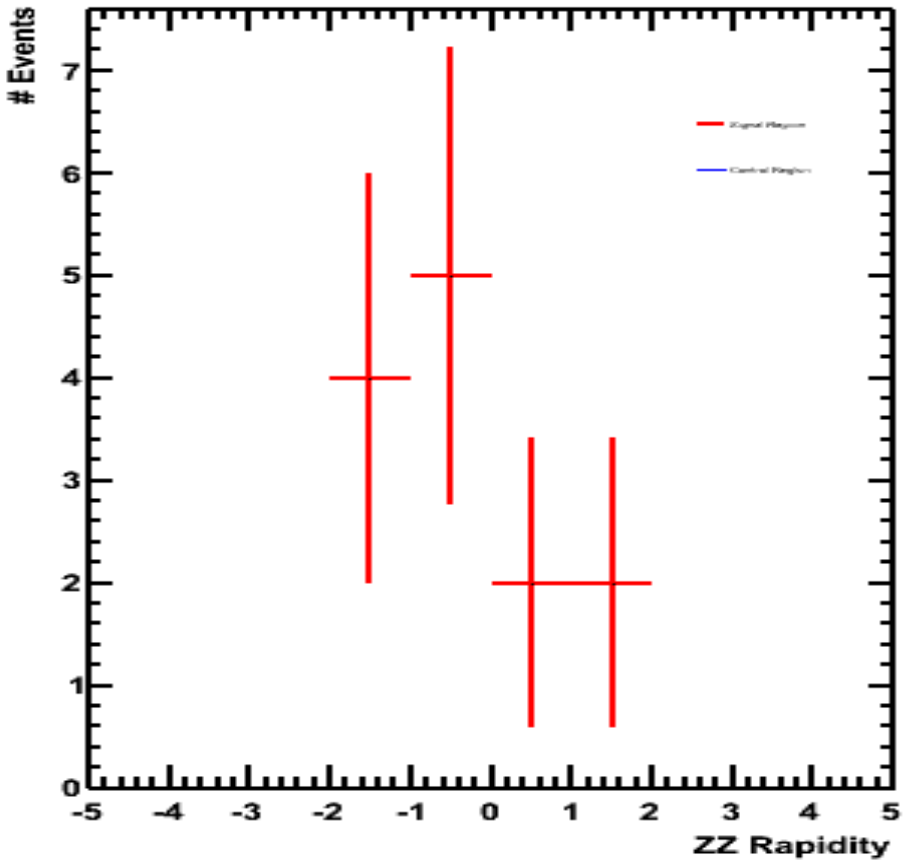


Signal

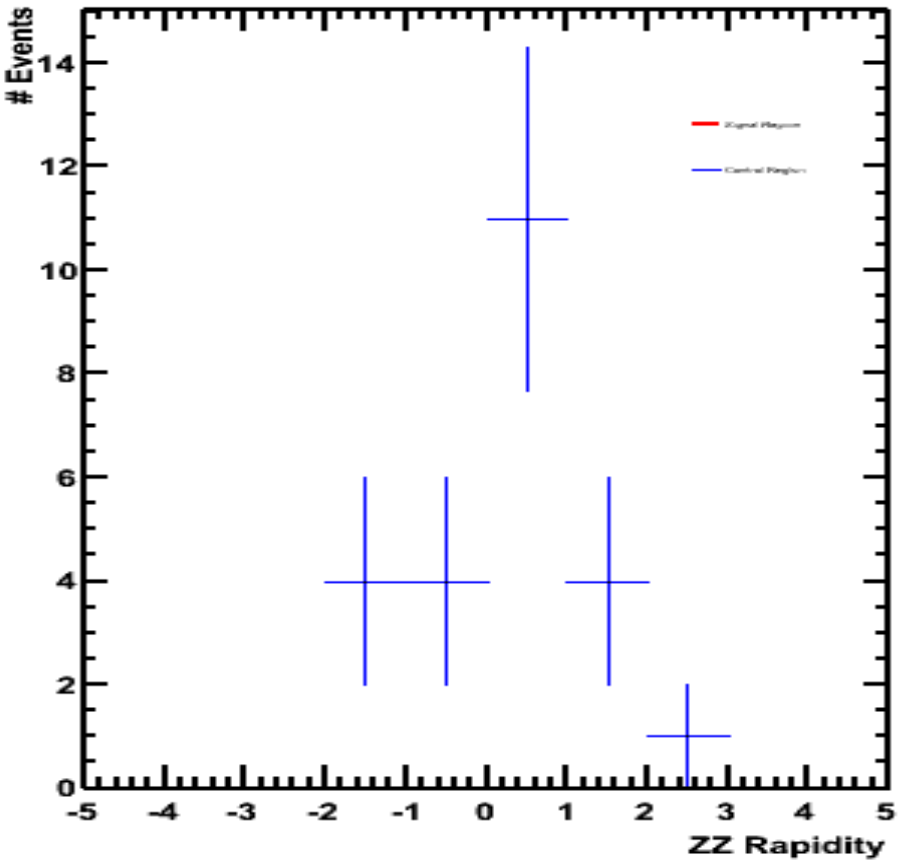


Background

ZZ Rapidity Distribution

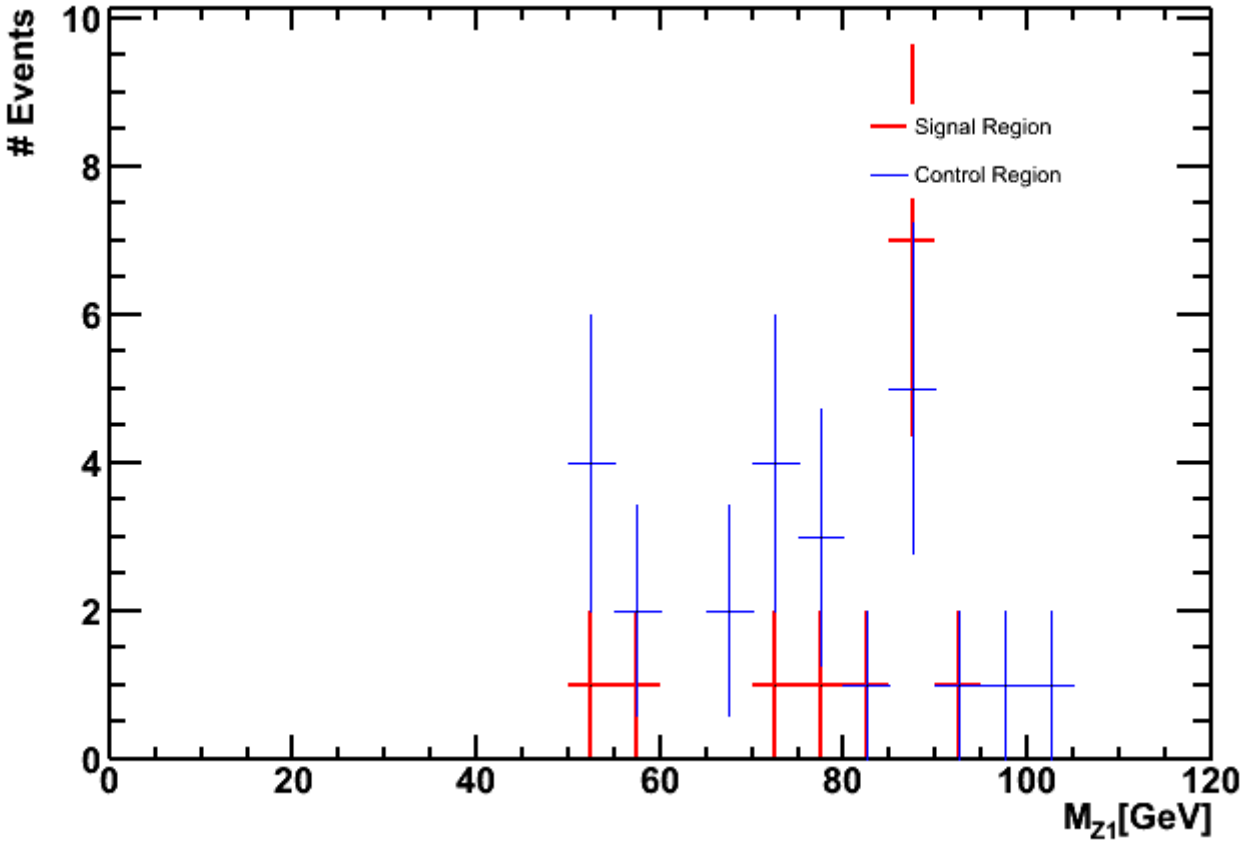


Signal

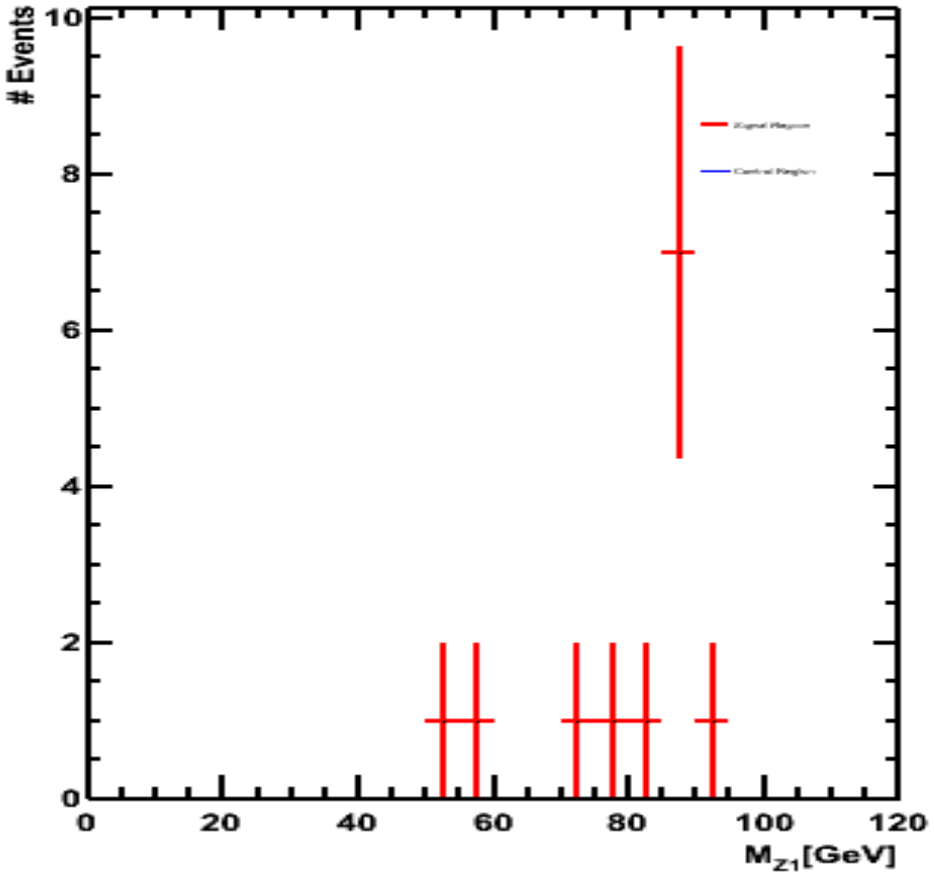


Background

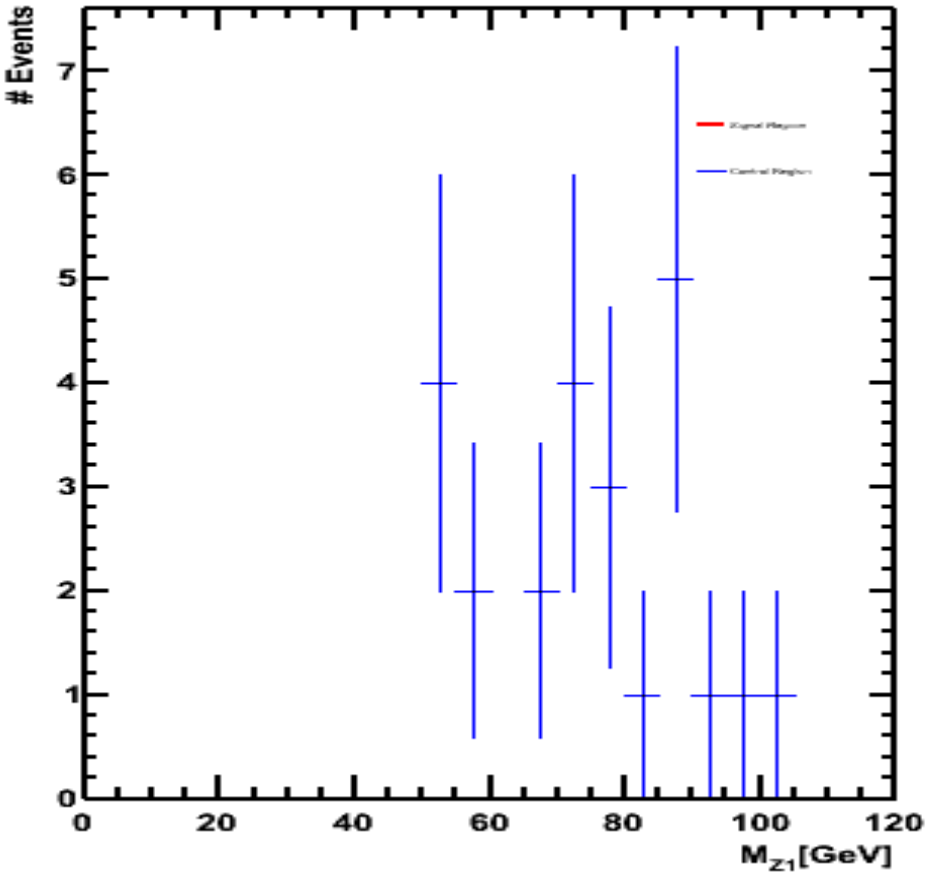
Z1 Mass Distribution



Z1 Mass Distribution

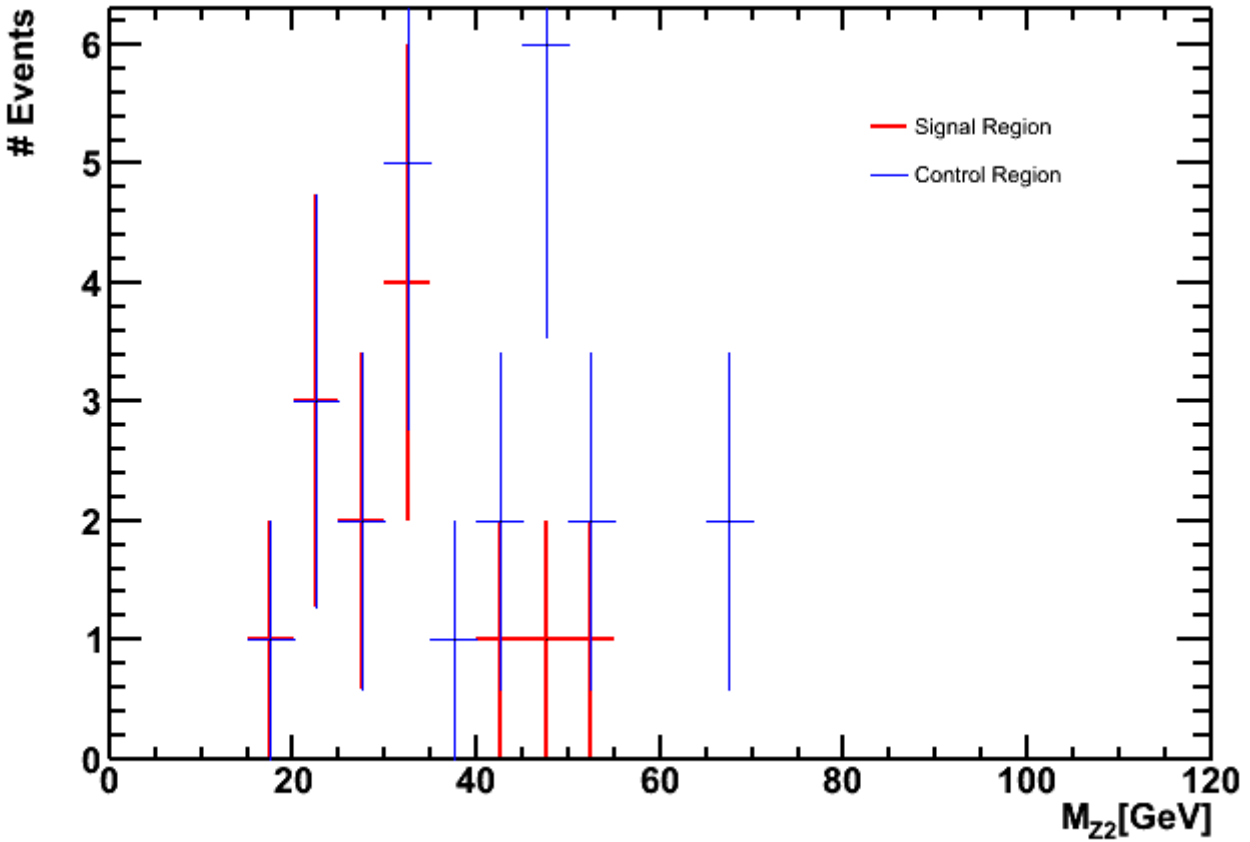


Signal

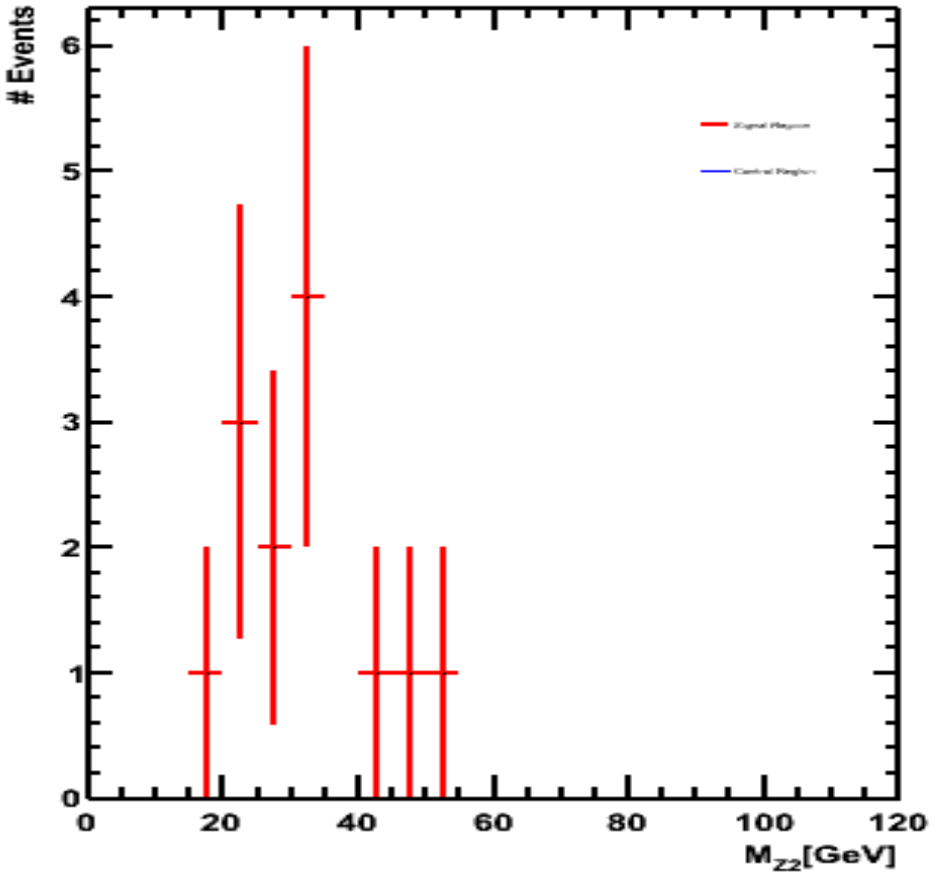


Background

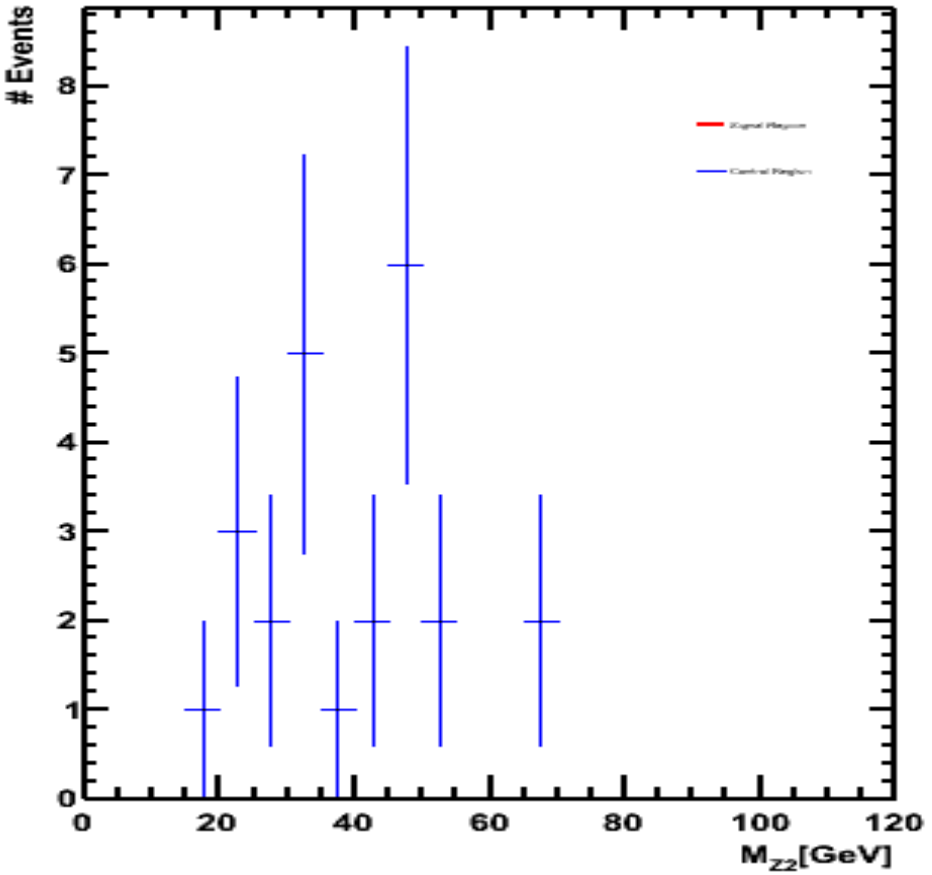
Z2 Mass Distribution



Z2 Mass Distribution

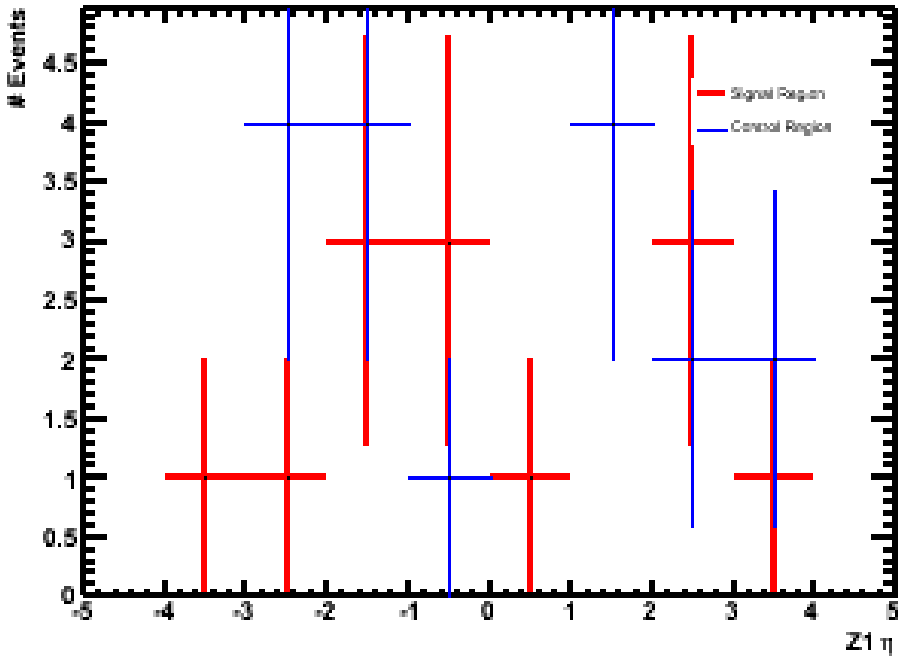


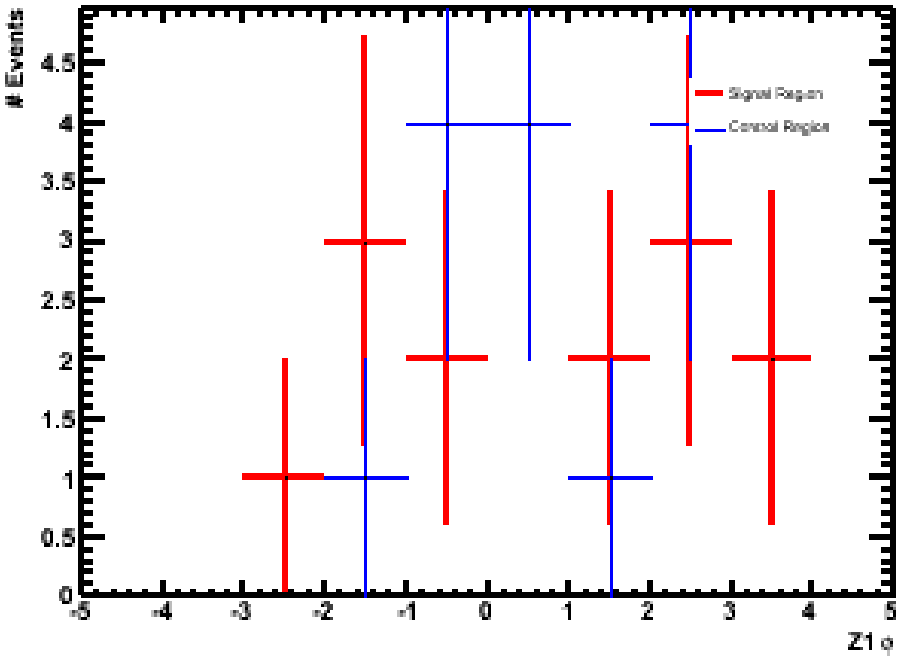
Signal

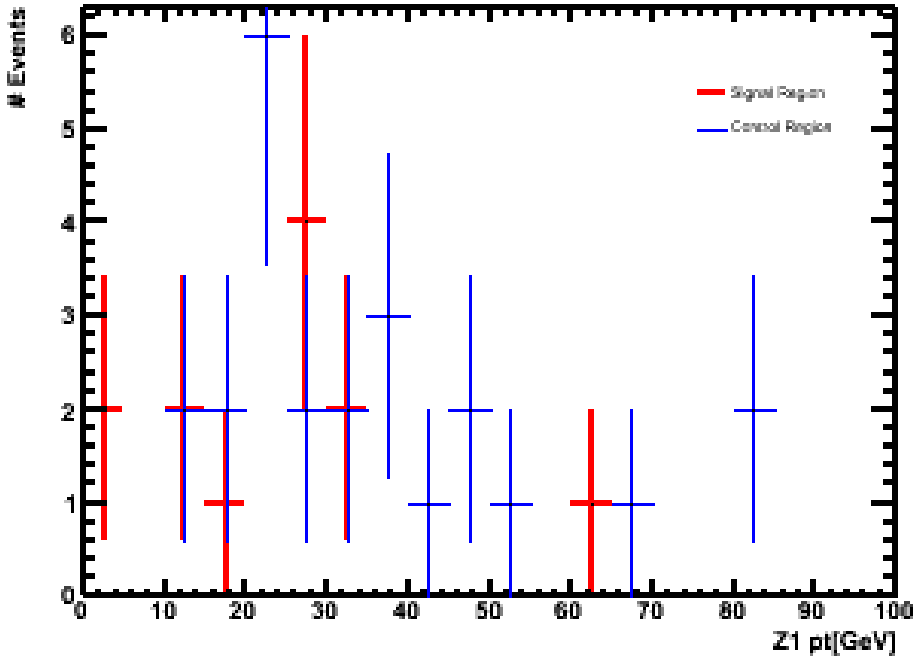


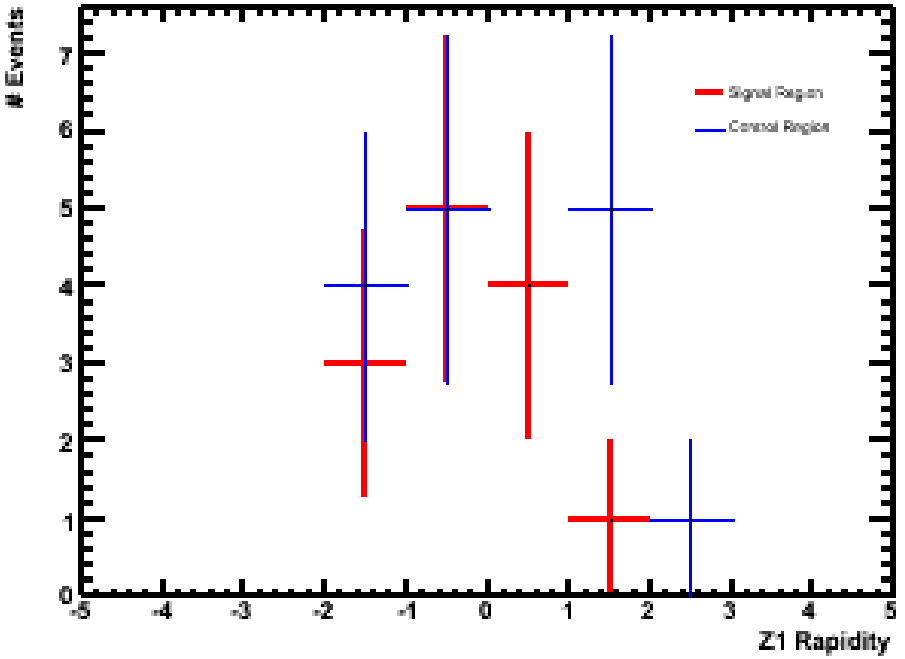
Background

Z1 Distributions

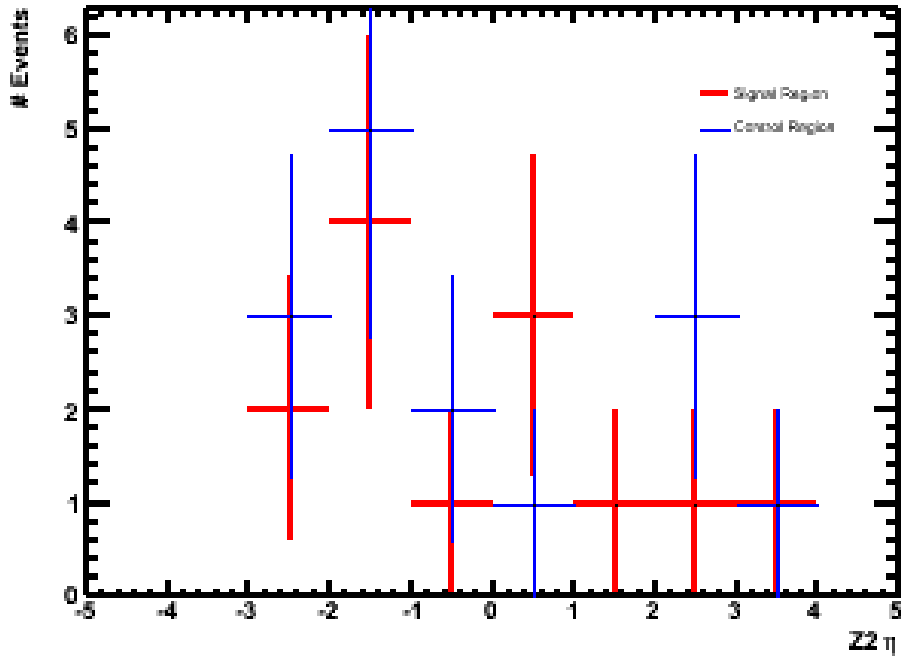


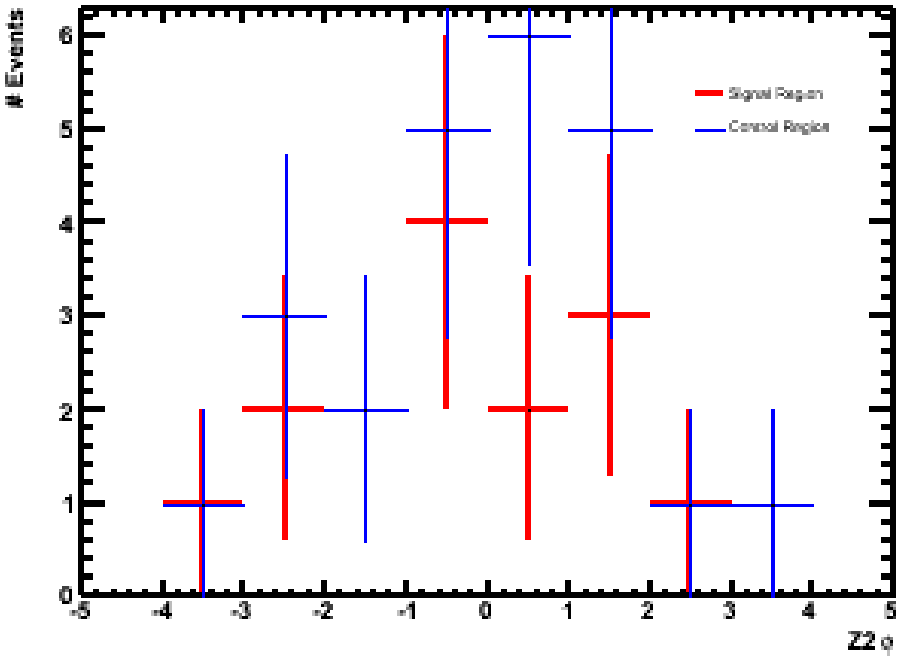


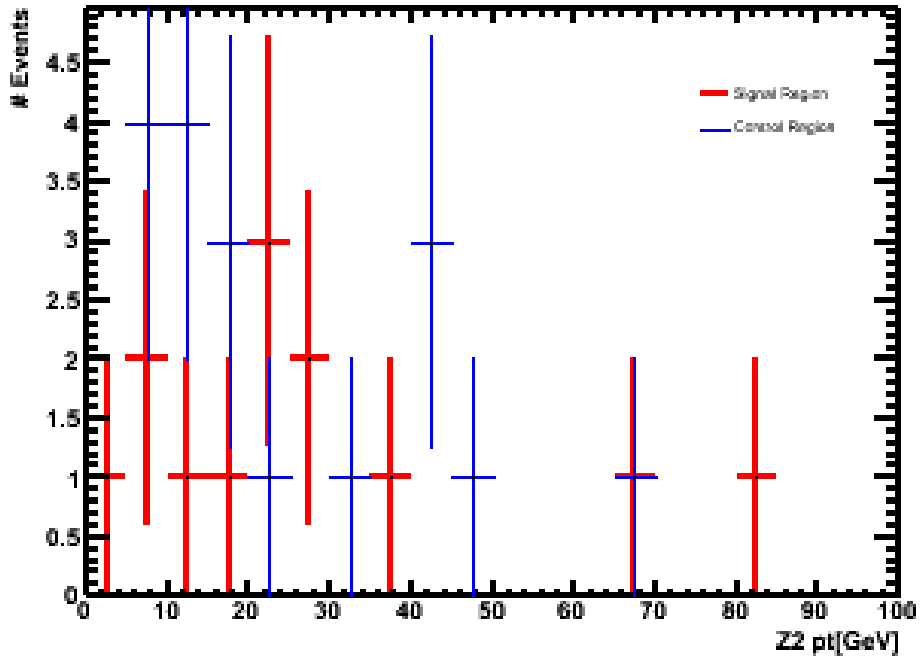


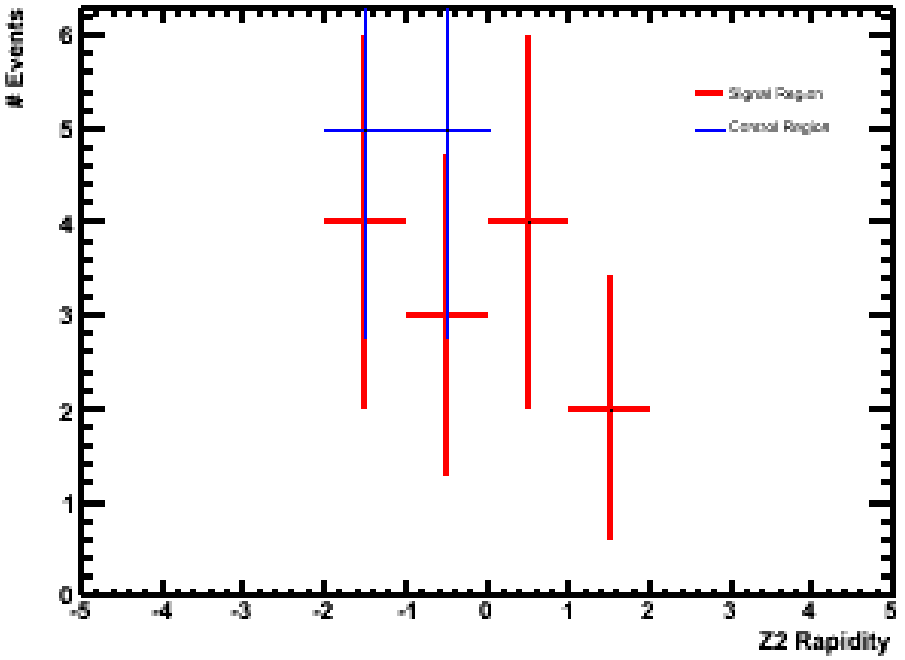


Z2 Distributions

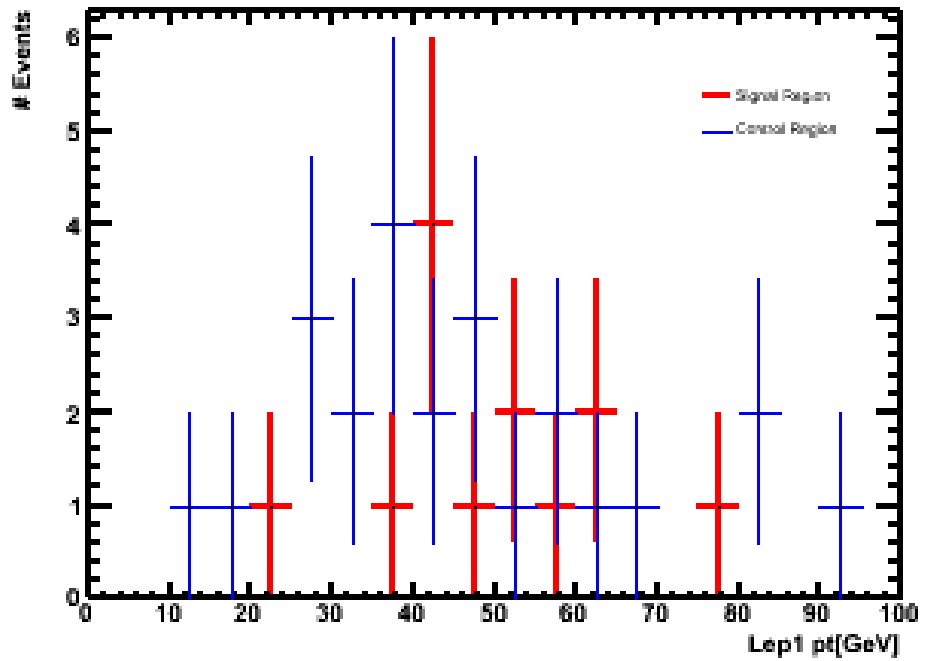


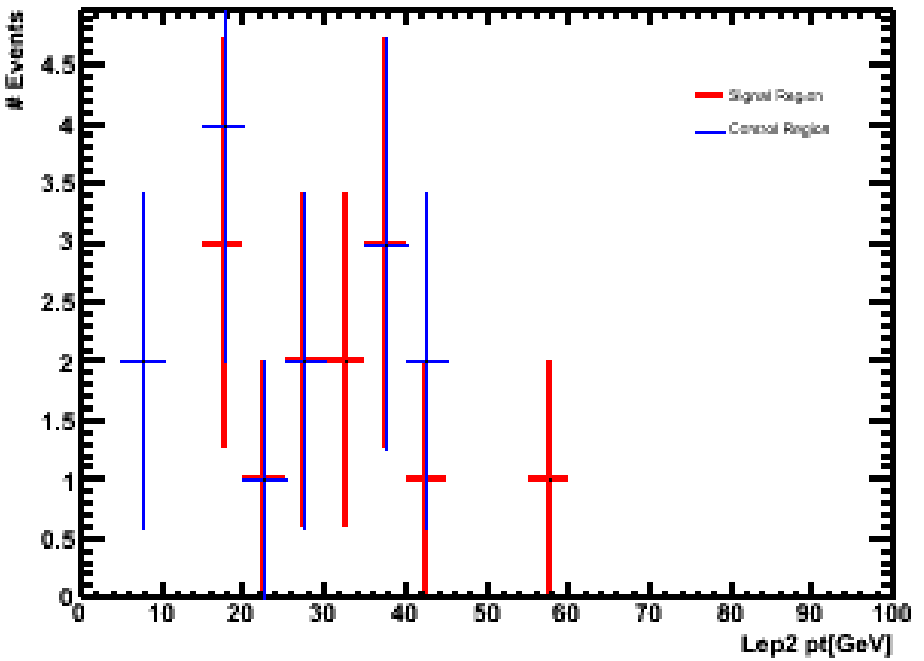


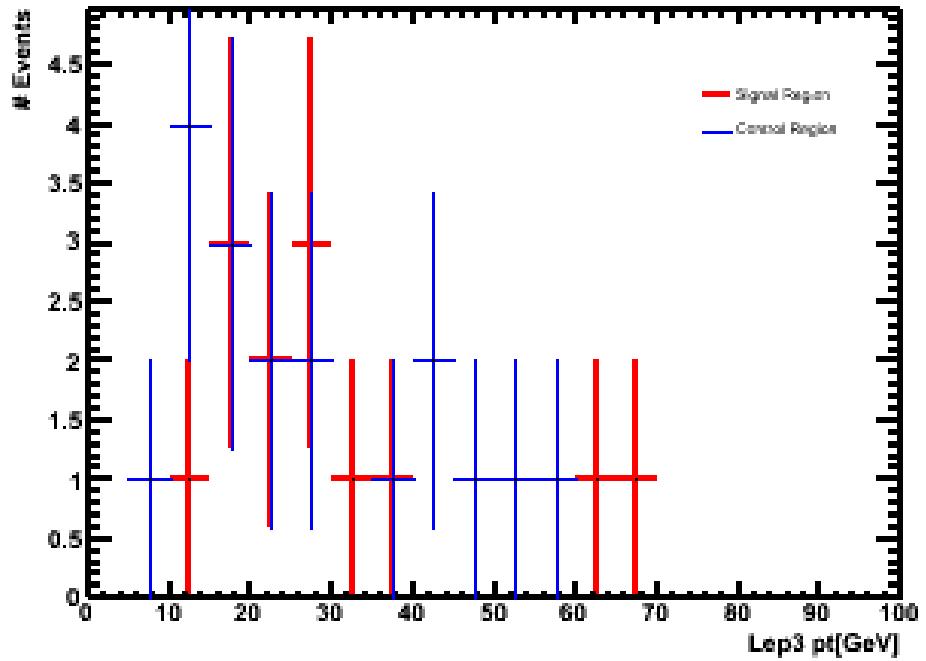


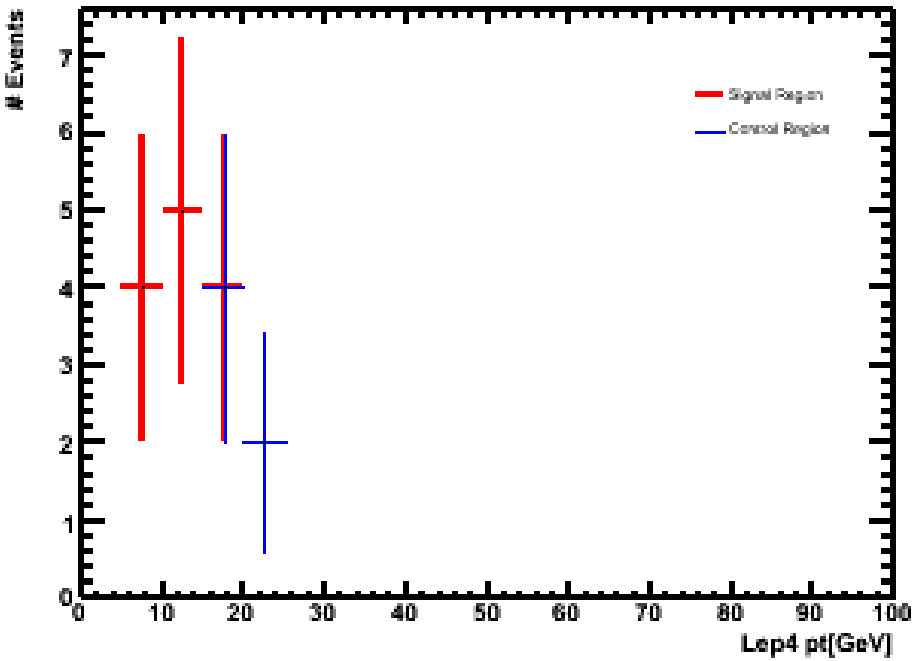


Lepton Pt Distribution

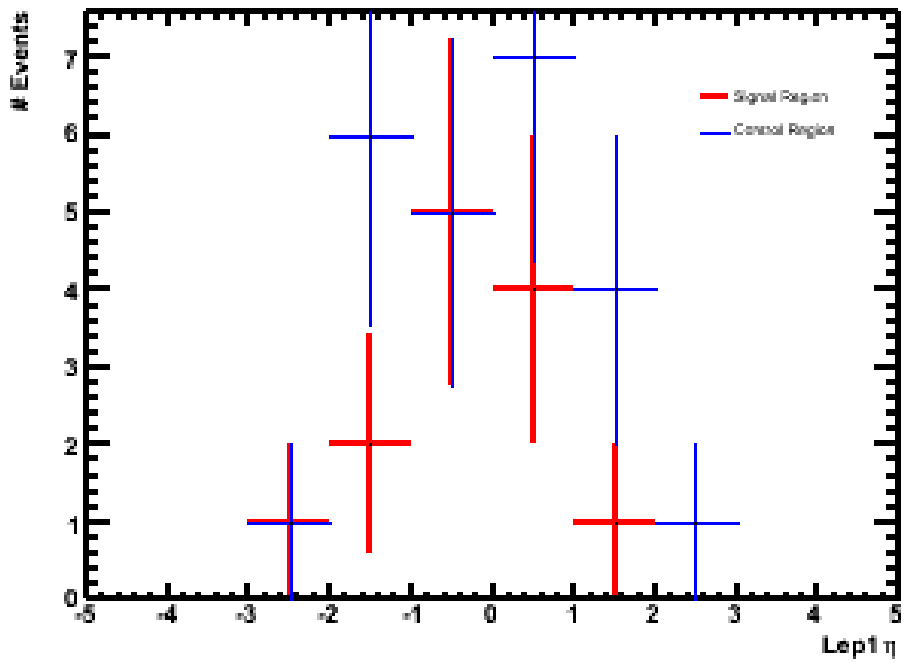


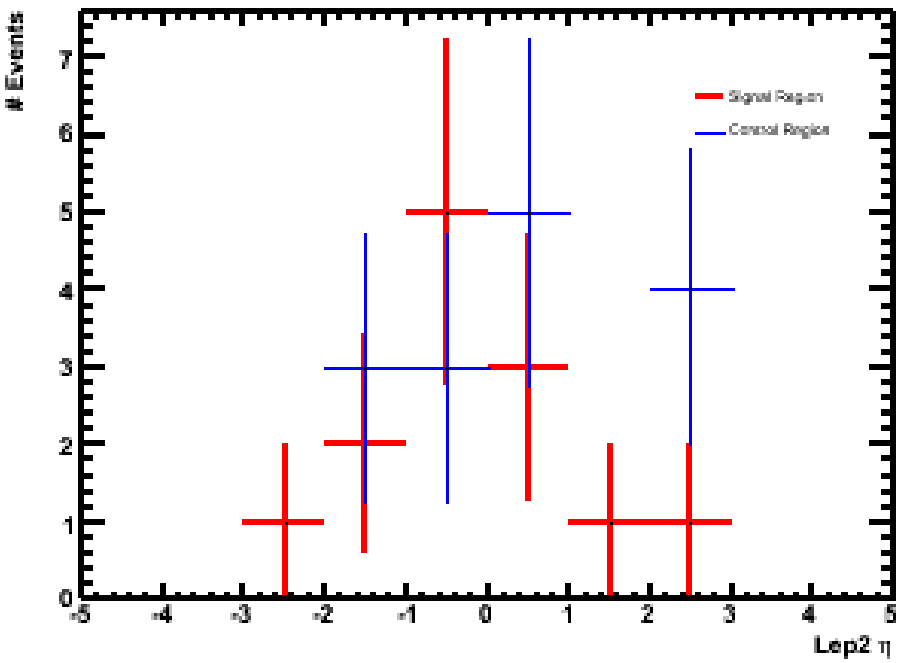


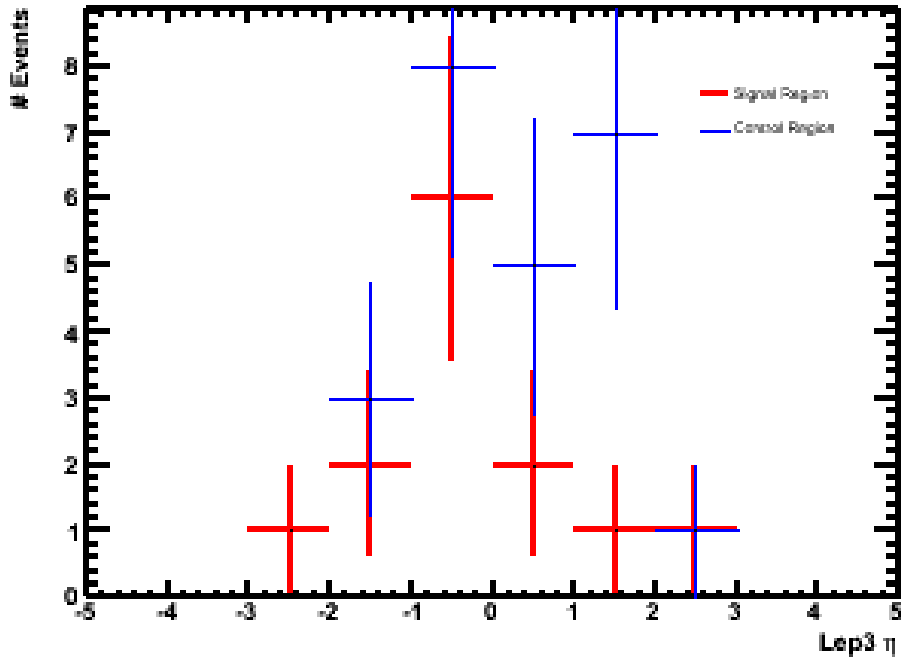


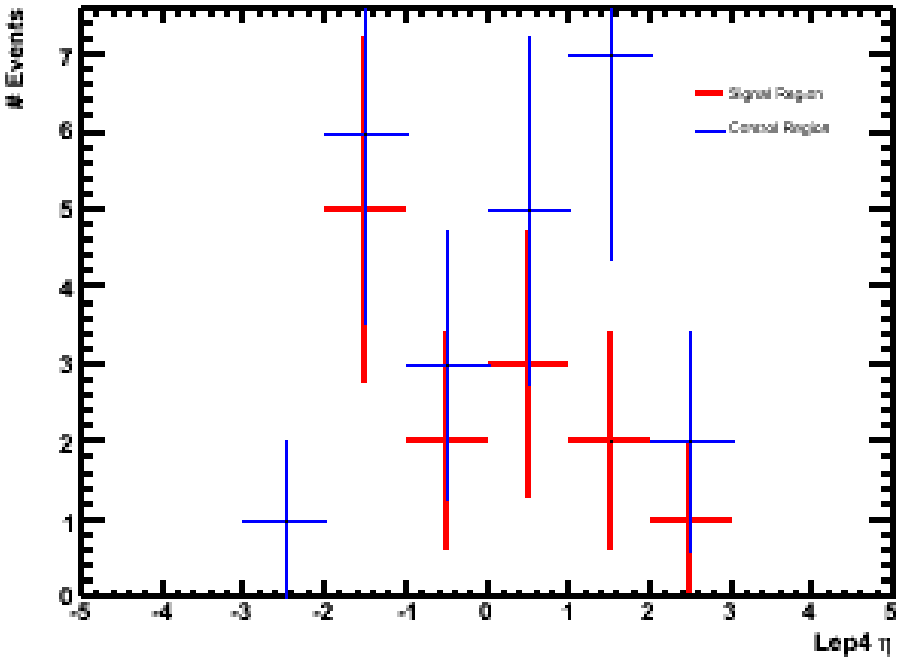


Lepton Eta Distribution

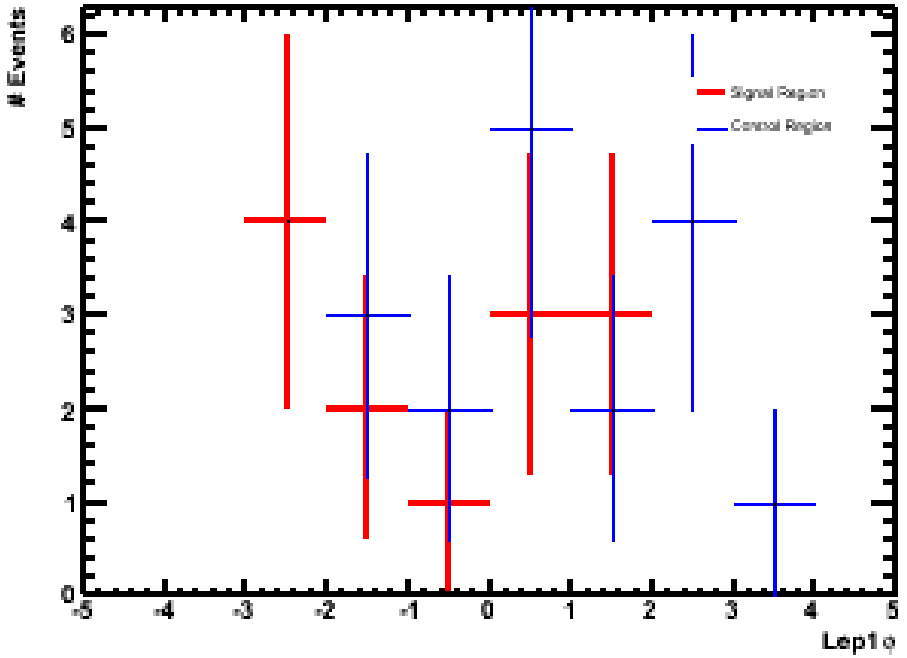


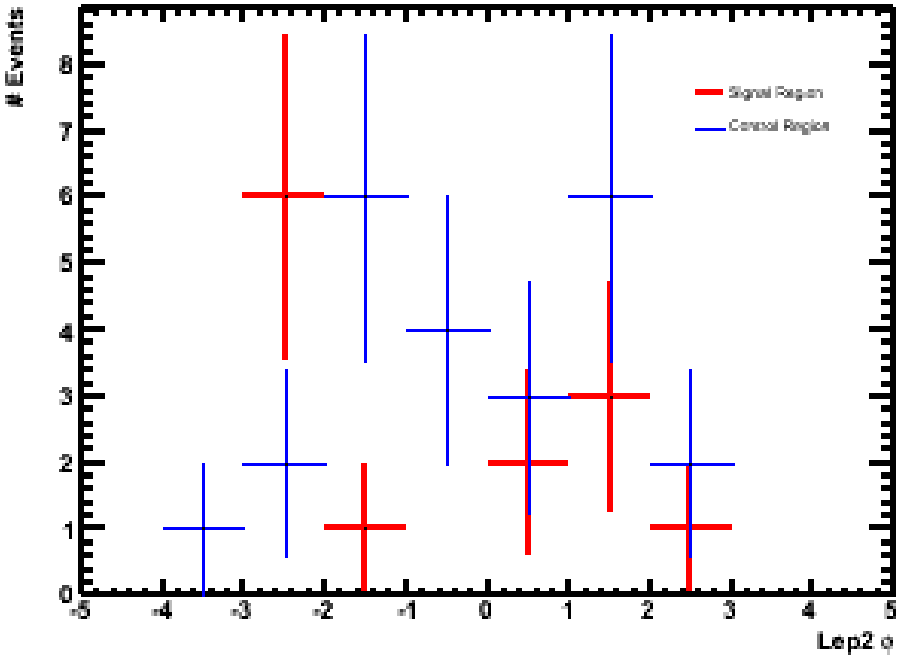


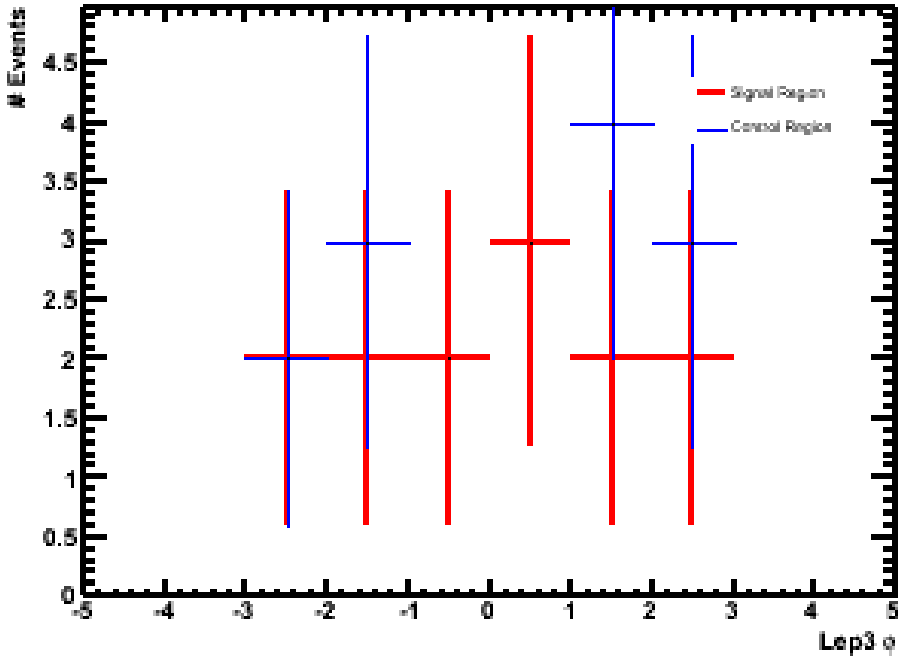


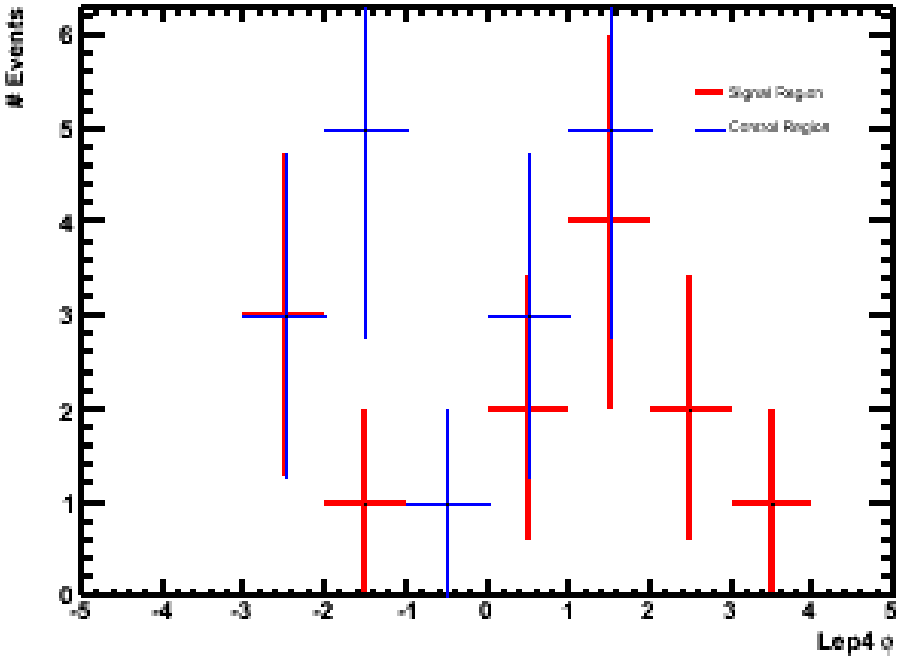


Lepton Phi Distribution









What to do next?

Since our results are limited by statistics, we plan to increase acceptance by further loosening the cuts to the single-resonance cuts.

MZ1 > 30, MZ2 > 5

Mu(Pt) > 4, E(Pt) > 5 (Energy scale correction Needed)

Quadruplet

Pt_Lep1 > 20, Pt_Lep2 > 10(15), Pt_Lep3 > 5(10)