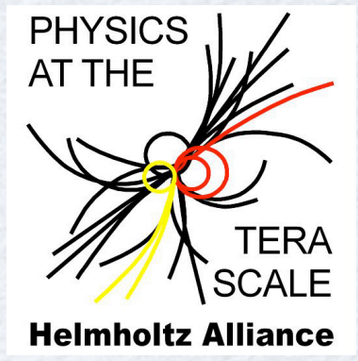
W PHYSICS

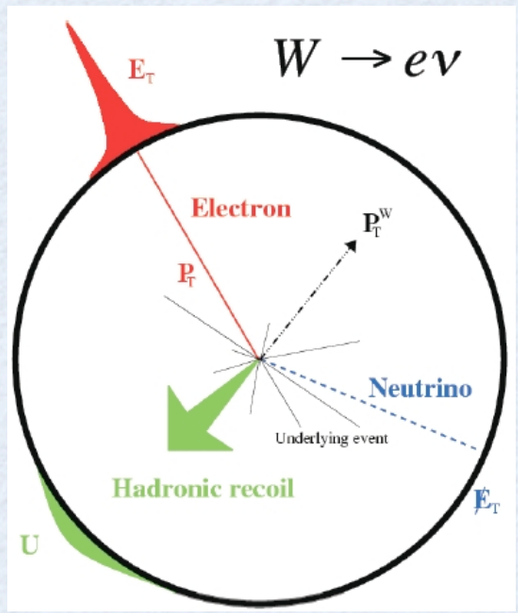
Sarah Ghasemi, David Sosa, Tai-Hua Lin

25th Feb. 2011 @DESY Hamburg



OUTLINE

- Introduction & Pre- Task Work
- Jets Study : Event (Cuts) Selection
- Half Maximum to Mass Calibration Curve
- the Mass of W and Error on Result
- Question & Feedback



INTRODUCTION & PRE-TASK WORK

$$W \rightarrow e^{-} + \nu_e$$

1. apply the electron energy calibration

2. selection of W boson events

3. measure the W mass
   (using the Jacobian peak of lepton momentum)

JETS STUDY (EVENT[CUTS] SELECTION)

electron energy calibration

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ElecCalibBad.C – Kate

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```
// useable variables
//  e_raw = raw energy
//     pt = transverse momentum
//    eta = pseudorapidity
//    phi = azimuthal angle
//  etiso = transverse energy
// eoverp = E/p
//  drjet = minimal delta R of jets


double energy = e_raw;
double mZ = 91.2;

// ============ energy calibration ==============

if      ( fabs(eta) < 0.5 ) energy = e_raw * mZ/89.26 * mZ/96.64 *mZ/101.34 * mZ/103.56 *mZ/104.13;
if      ( fabs(eta) > 0.5 && fabs(eta) < 1.0 ) energy = e_raw * mZ/88.12 * mZ/95.70 * mZ/100.31 *mZ/100.58 * mZ/105.98;
if      ( fabs(eta) > 1.0 && fabs(eta) < 1.5 ) energy = e_raw * mZ/86.45 * mZ/93.97 *mZ/98.78 *mZ/100.34 * mZ/104.33;
if      ( fabs(eta) < 1.5 && fabs(eta) < 2.0 ) energy = e_raw * mZ/83.76 * mZ/87.06 * mZ/89.70 * mZ/90.39 * mZ/101.88;
else if ( fabs(eta) > 2.0 ) energy = e_raw * mZ/86.73 * mZ/93.04 * mZ/96.46 * mZ/100.00 * mZ/103.71;

// ================================================================================================


return energy;
```

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Terminal

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double energy = e_raw;
double mZ = 91.2;

// ============ energy calibration ==============

if      ( fabs(eta) < 0.5 ) energy = e_raw * mZ/89.26 * mZ/89.37 *mZ/92.97 * mZ/91.77 * mZ/91.61;
else if ( fabs(eta) < 1.0 ) energy = e_raw * mZ/88.73 * mZ/91.65 * mZ/91.98 *mZ/90.99 * mZ/91.04;
else if ( fabs(eta) < 1.5 ) energy = e_raw * mZ/88.04 * mZ/90.61 *mZ/91.37 *mZ/90.52 * mZ/90.69;
else if ( fabs(eta) < 2.0 ) energy = e_raw * mZ/87.26 * mZ/90.04 * mZ/90.74 * mZ/90.02 * mZ/90.21;
else if ( fabs(eta) < 2.5 ) energy = e_raw * mZ/87.12 * mZ/89.37 * mZ/90.22 * mZ/89.61 * mZ/89.98;

// ================================================================================================


return energy;
}
```

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Terminal

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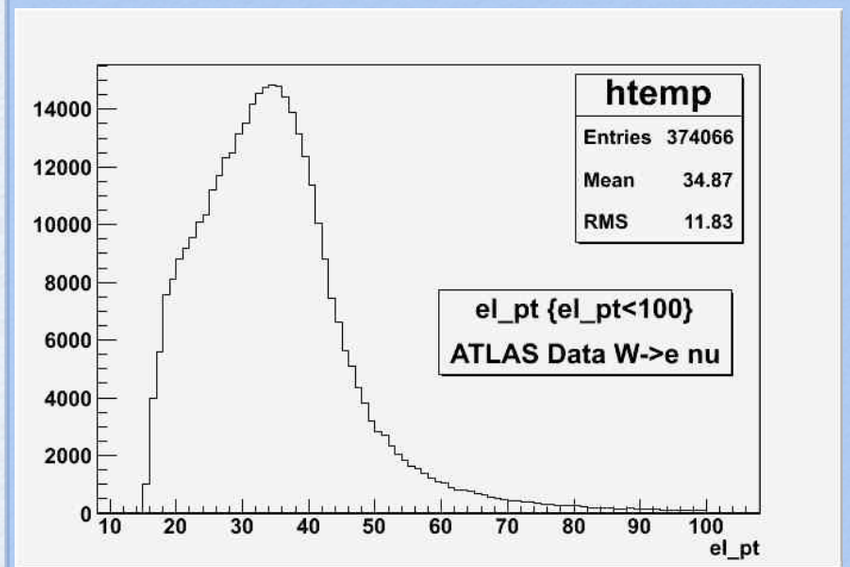
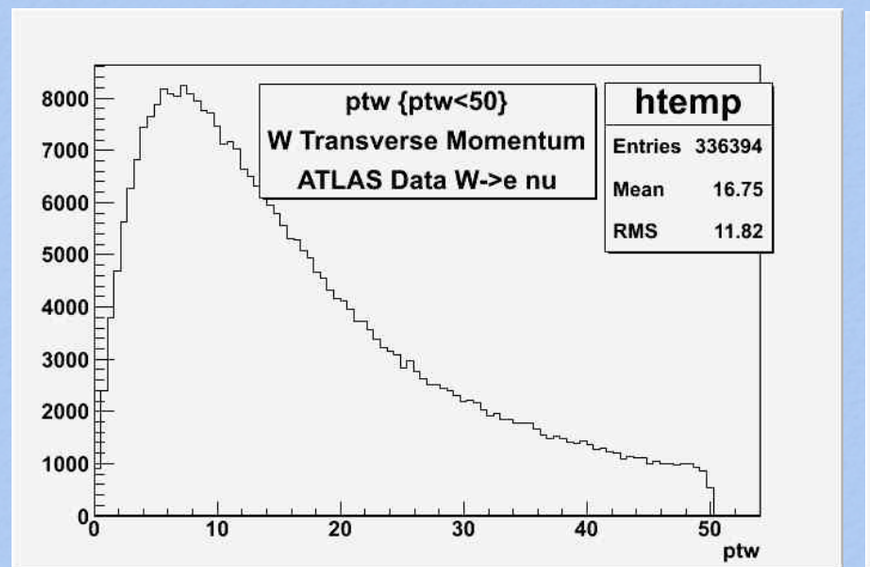
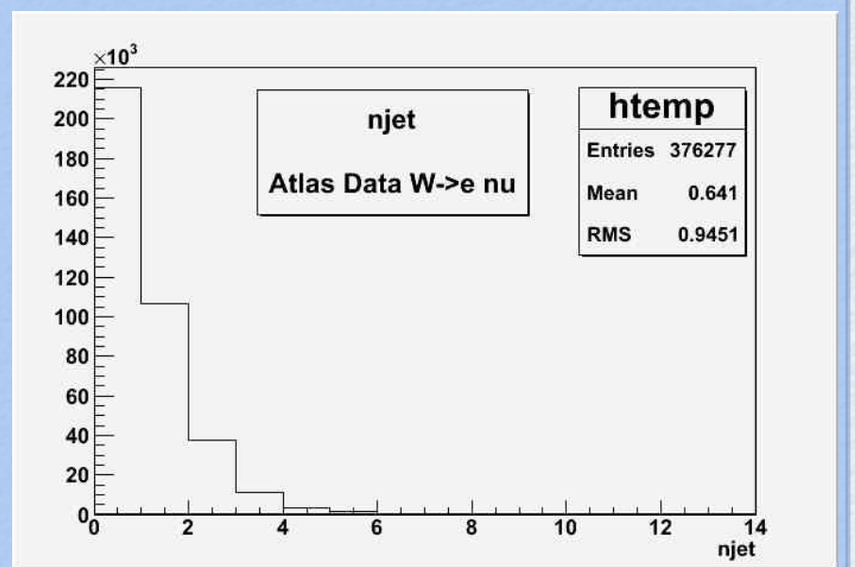
JETS STUDY (EVENT[CUTS] SELECTION)

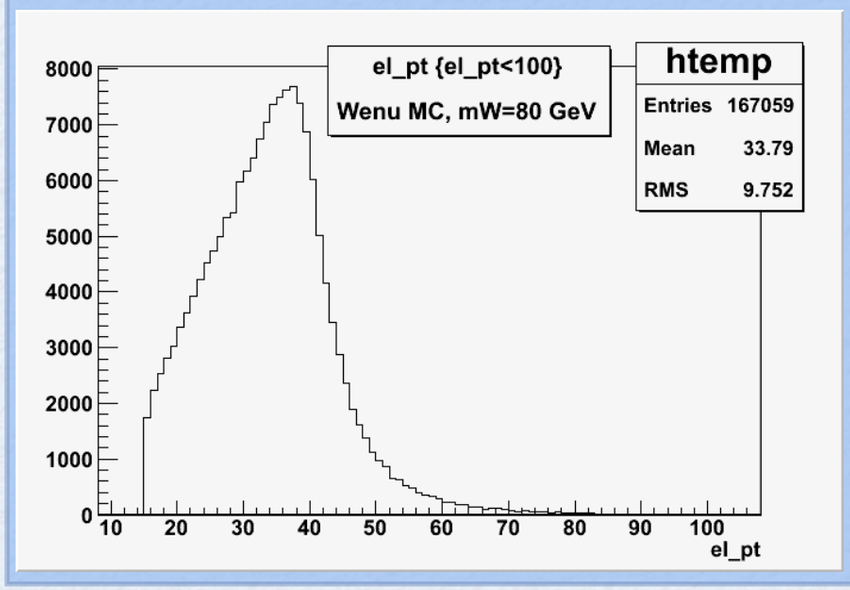
ATLAS

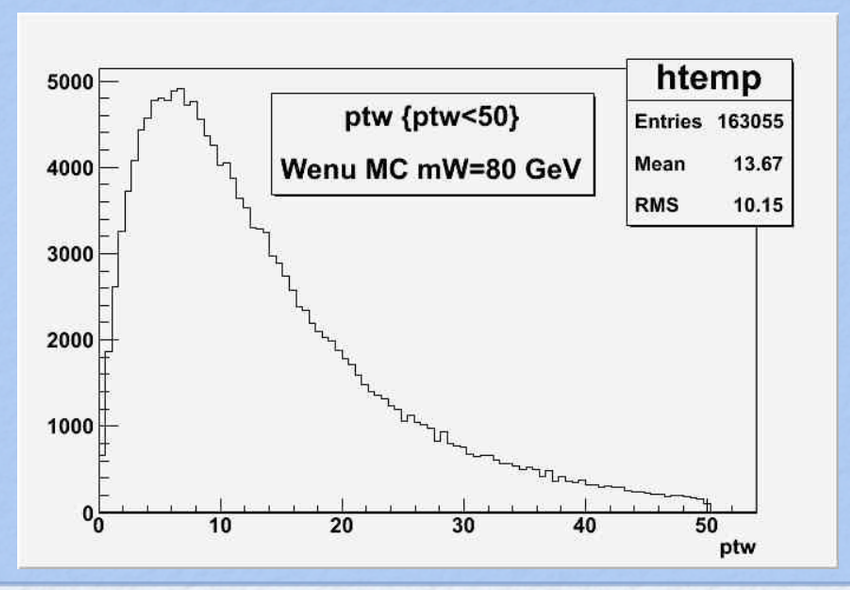


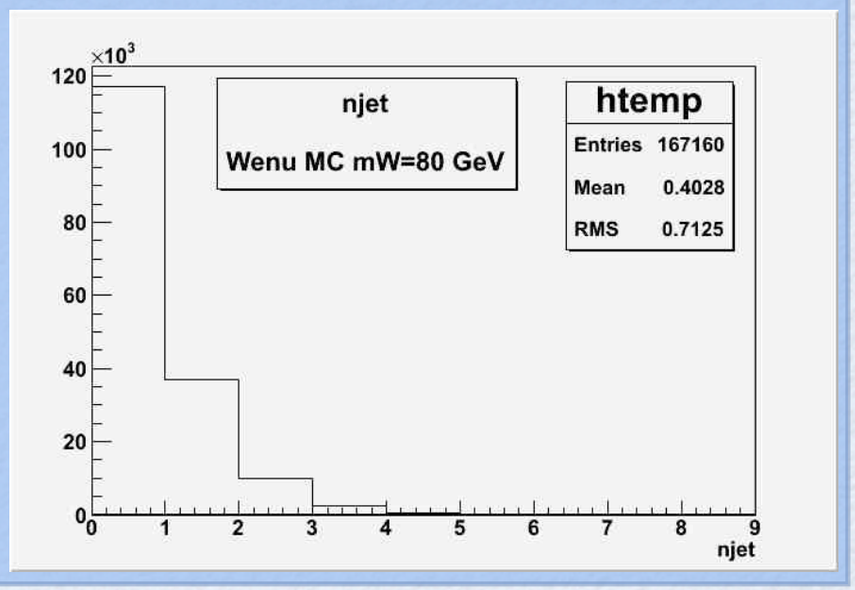




Monte Carlo

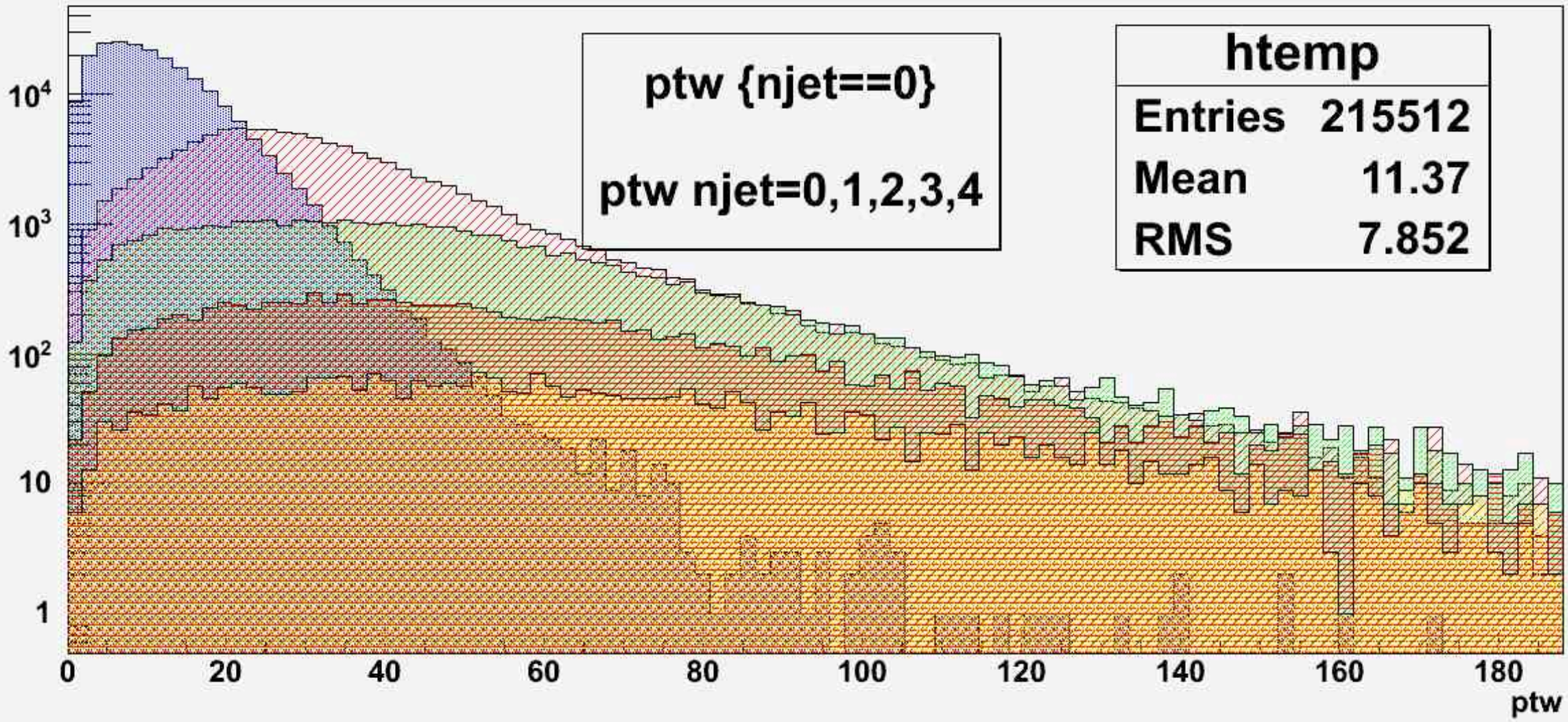






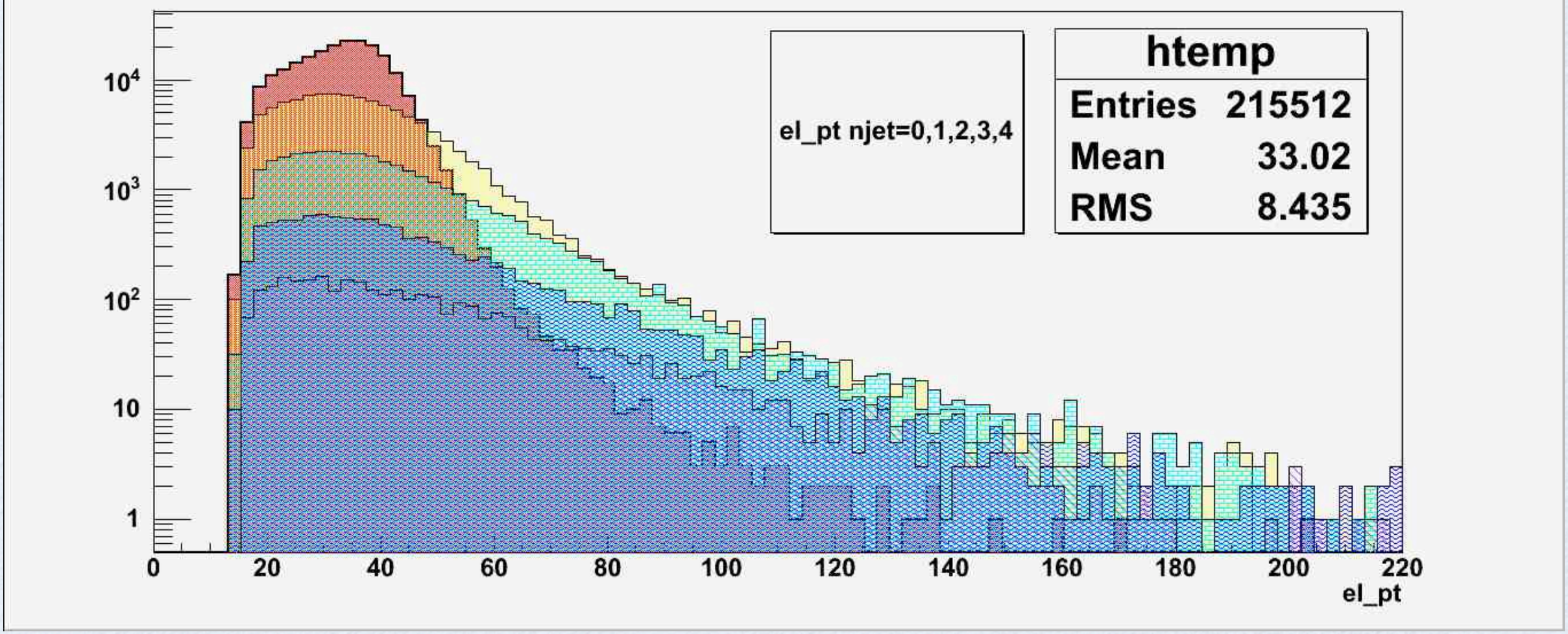
JETS STUDY (EVENT[CUTS] SELECTION)

W Transverse Momentum

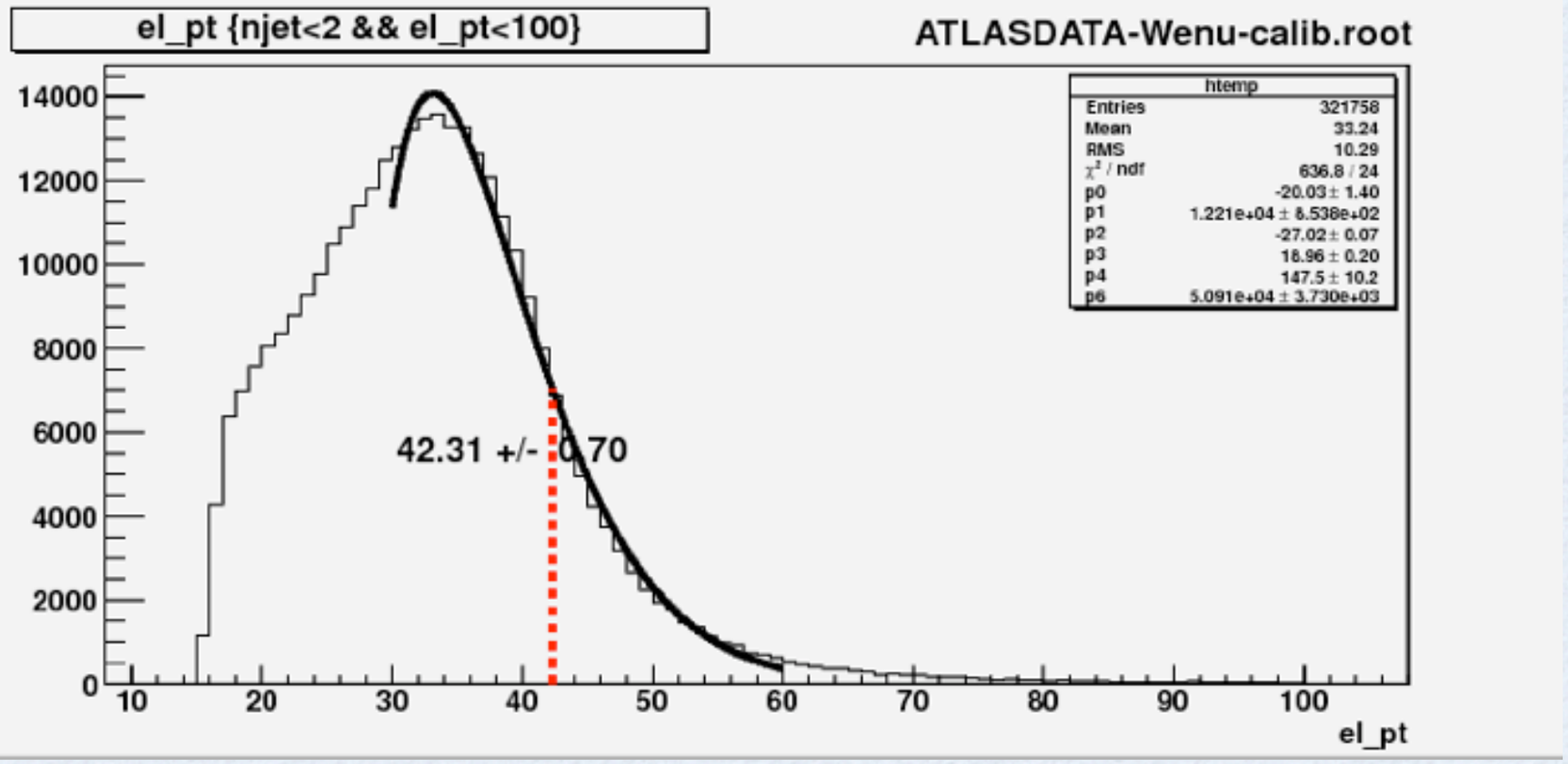


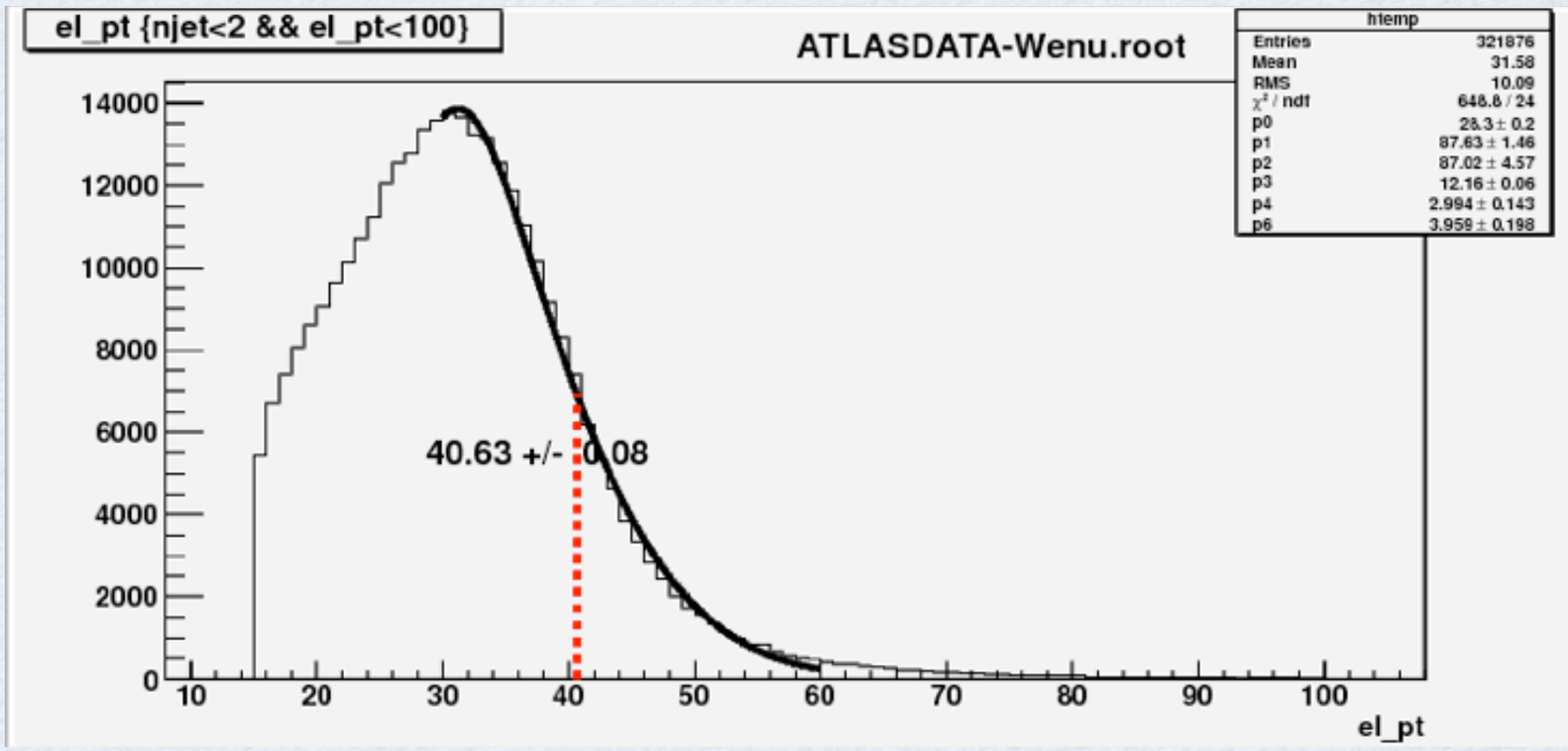
JETS STUDY (EVENT[CUTS] SELECTION)

Electron Transverse Momentum



HALF MAXIMUM MASS CALIBRATION CURVE





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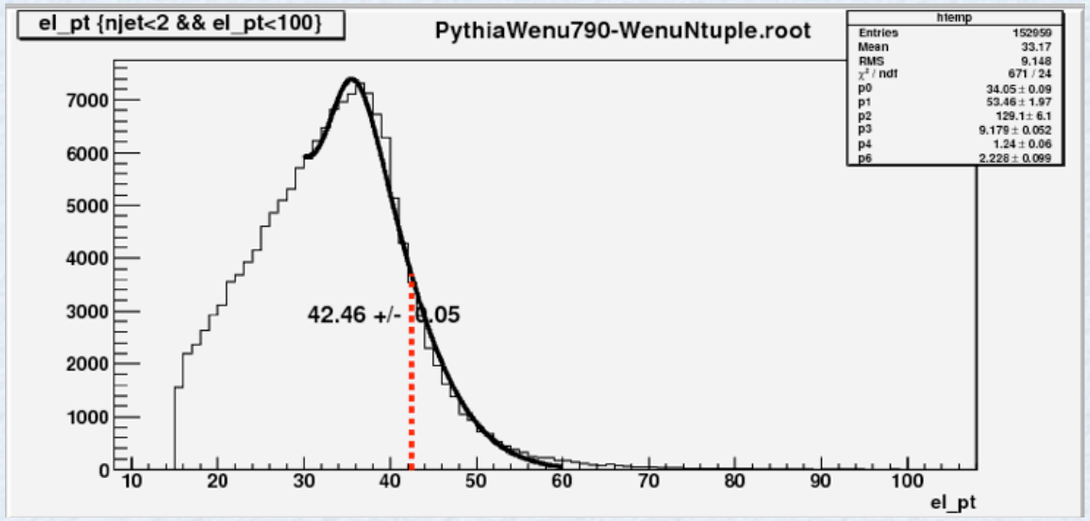
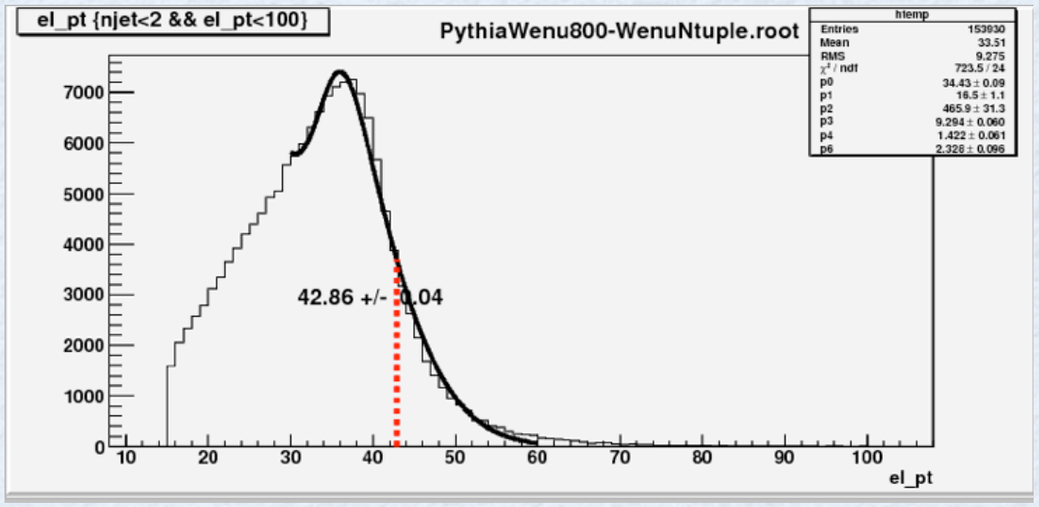
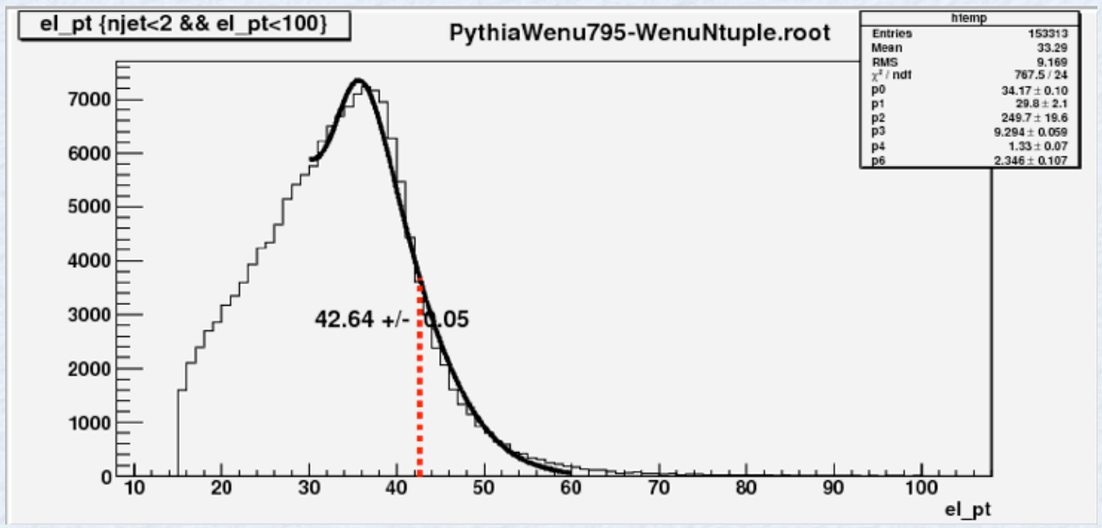
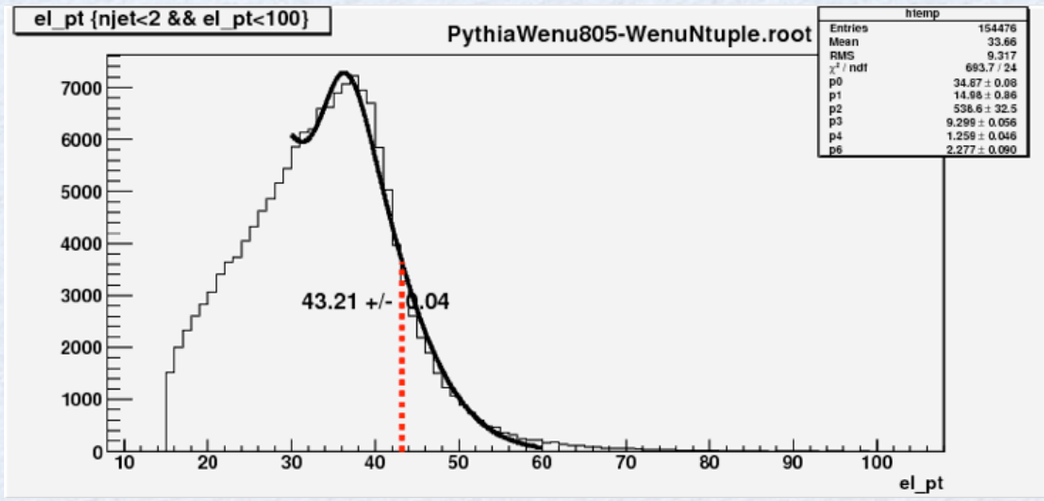
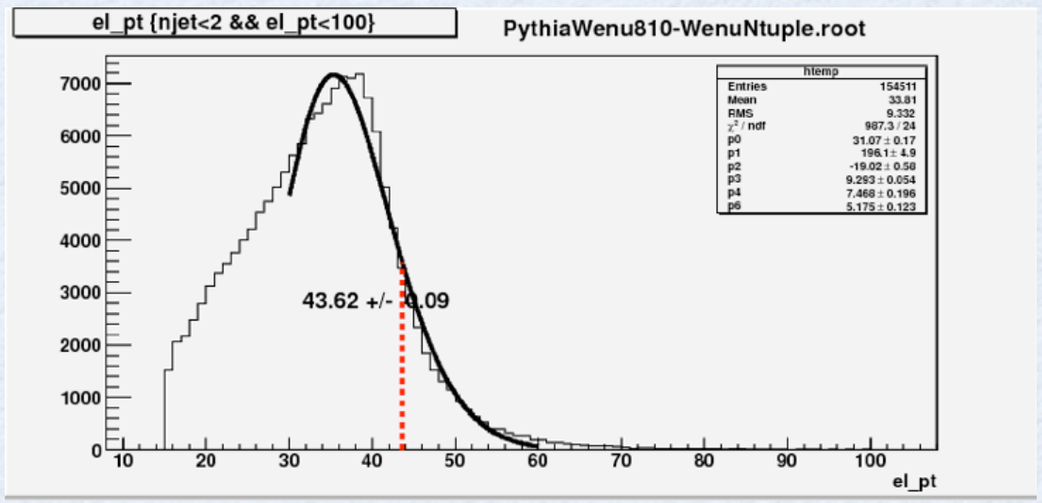


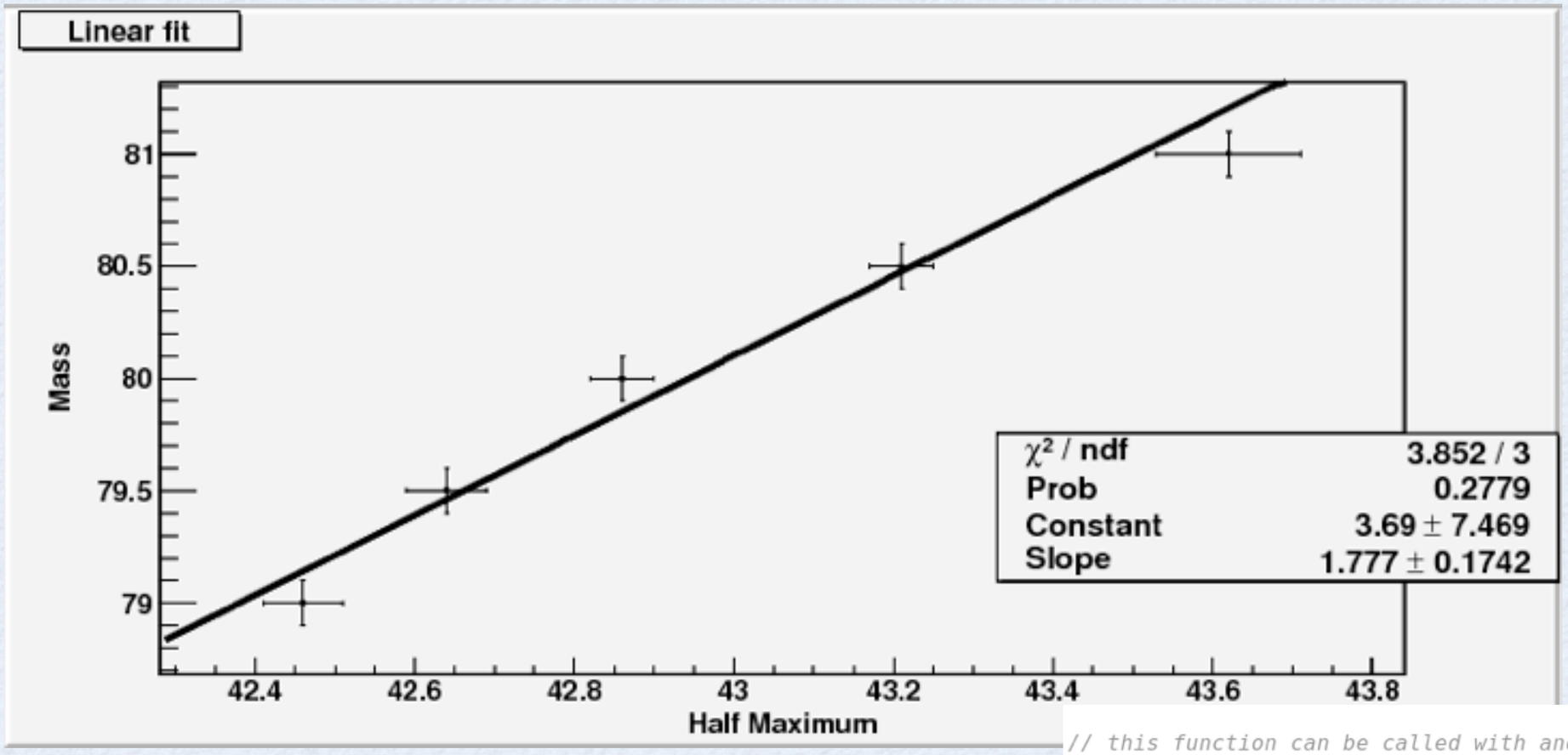








HALF MAXIMUM MASS CALIBRATION CURVE



$$HMvalue = 42.31$$

$$M_W = 78.8752$$

```
// this function can be called with and without a parameter
void linear_fit(Double_t HMdata=-1)
{
  // ============ put in here fit parameter =================

  // number of entries for fitting
  const int n=5;

  // HalfMaximum
  Double_t x[n]={42.46, 42.64, 42.86, 43.21, 43.62};

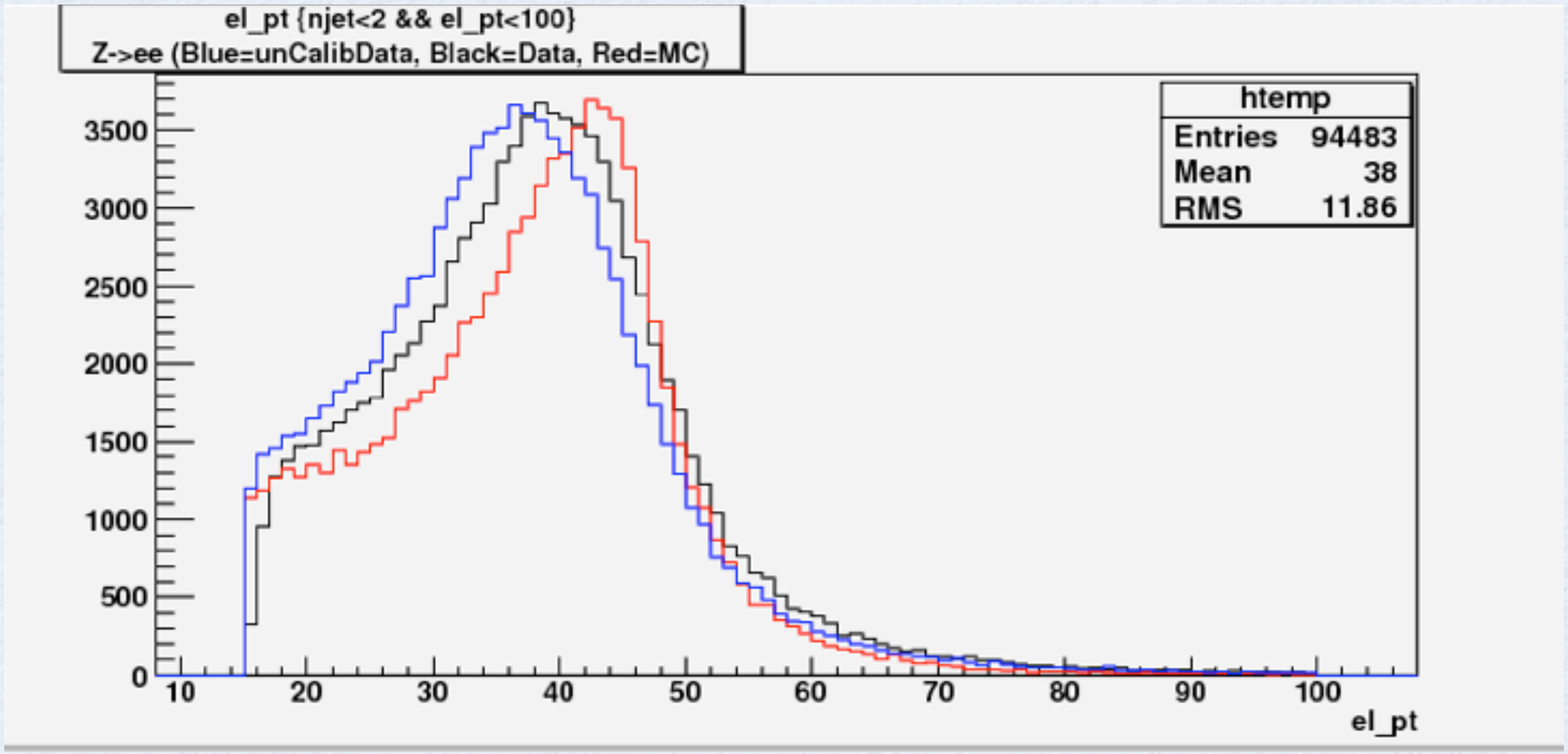
  // Monte-Carlo W mass
  Double_t y[n]={79.0, 79.5, 80.0, 80.5, 81.0};

  // Error on HalfMaximum
  Double_t ex[n]={0.05, 0.05, 0.04, 0.04, 0.09};

  // Error on MC W mass is set to 0.1 GeV
  Double_t ey[n]; for (int i=0;i<n;++i) ey[i]=0.1;

  // =======================================================
```

SYSTEMATIC UNCERTAINTY



QUESTION & FEEDBACK

Thanks for your attention! =)