



```
void SmearingTool::getPtVSmearing (TLorentzVector trueboson, TLorentzVector& smearedboson, int mode) {

    double a = 0.645;
    double b = 8.2;
    double c = 5.1;

    double R = a*log(c*(trueboson.Pt()/1000.) + b)/log(c*15 + b);

    double recoil_res = 0.82; // sampling
    double sigmaU = recoil_res*sqrt((trueboson.Pt()/1000.));
    double smeared_gaus = r.Gaus(0,sigmaU);
    double E_T_UReco1 = ((trueboson.Pt()/1000.)*R + smeared_gaus;

    if (E_T_UReco1 < 0) {E_T_UReco1 = 0.001;}

    double E_T_U=(-(trueboson.Pt()/1000.);
    double E_T_U_X = (-(trueboson.Px())/1000.);
    double E_T_U_Y = (-(trueboson.Py())/1000.);
    // forget about lepton hole

    double angular_turn = 15.;
    double angular_start = 0.44;
    double angular_decrease = 0.30;
```

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double thetaU;
  if (E_T_U <= angular_turn)
  {
    thetaU = atan2(E_T_U_Y,E_T_U_X) + (r.Uniform()-0.5)*(sqrt(12)*(angular_start-((E_T_U/
angular_turn)*angular_decrease)));
  }
  else if (E_T_U > angular_turn)
  {
    thetaU = atan2(E_T_U_Y,E_T_U_X) + (r.Uniform()-0.5)*(sqrt(12)*(angular_start-angular_decrease));
  }
double E_T_U_XReco1 = E_T_UReco1*cos(thetaU);
double E_T_U_YReco1 = E_T_UReco1*sin(thetaU);
// Underlying energy
double underlying_energy = 5.2;
double E_T_U_ue = (r.Gaus(0, underlying_energy));
double alpha = r.Uniform()*2*M_PI;
double E_T_U_X_ue = E_T_U_ue*cos(alpha);
double E_T_U_Y_ue = E_T_U_ue*sin(alpha);

double smeared_boson_Px = (E_T_U_X_ue + E_T_U_XReco1)*1000.;
double smeared_boson_Py = (E_T_U_Y_ue + E_T_U_YReco1)*1000.;
double smeared_boson_E = sqrt ( smeared_boson_Px*smeared_boson_Px + smeared_boson_Py*smeared_boson_Py
) ;
smearedboson.SetPxPyPzE(smeared_boson_Px, smeared_boson_Py, 0., smeared_boson_E);
}

```