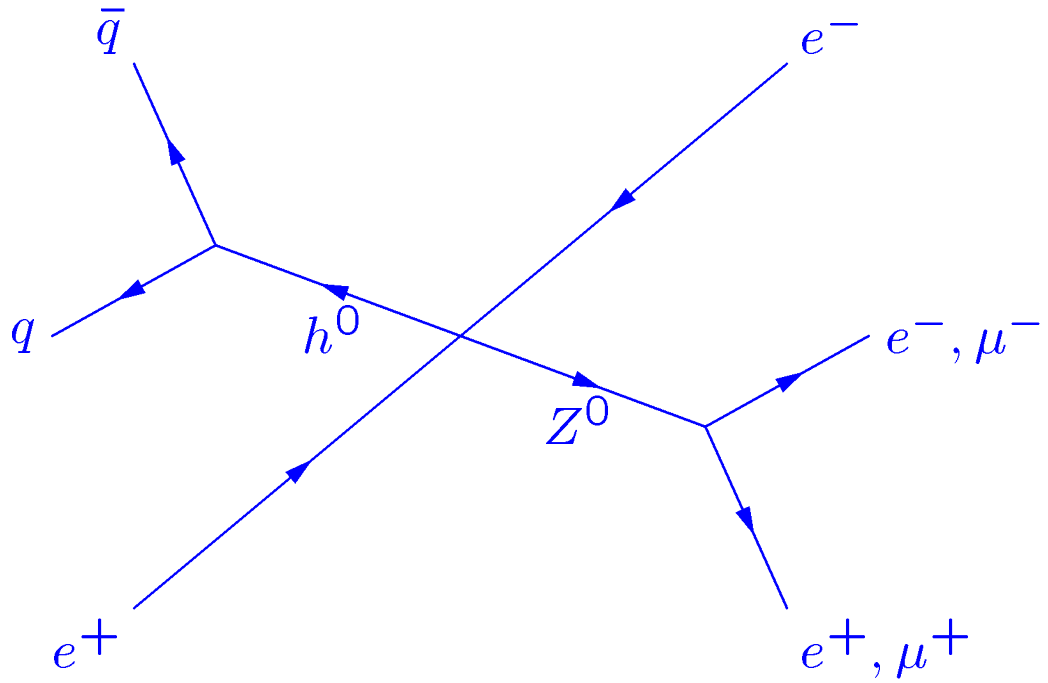
Point 3

Higgs Z0 Production



Cross sections (in fb) for Higgs Z^0 events and for Standard Model background production modes at E_{cm} = 350 GeV, 60% left polarization

Mode	Cross Section (fb)
h^0 Z^0	182
W^+W^-	17759
$\gamma + \gamma$	13030
$\gamma^* or Z^0$	10490
$\gamma + \gamma^* or Z^0$	10310
$Z^0 + Z^0$	689
$\gamma^*\gamma^*$	3.99 x 10^7

Combined Mass Equations

To find the mass of the particle that produced the hadron jet,

add the x momentum of each particle in the hadron jet, $\sum p_x$

add the y momentum of each particle in the hadron jet, $\sum p_y$

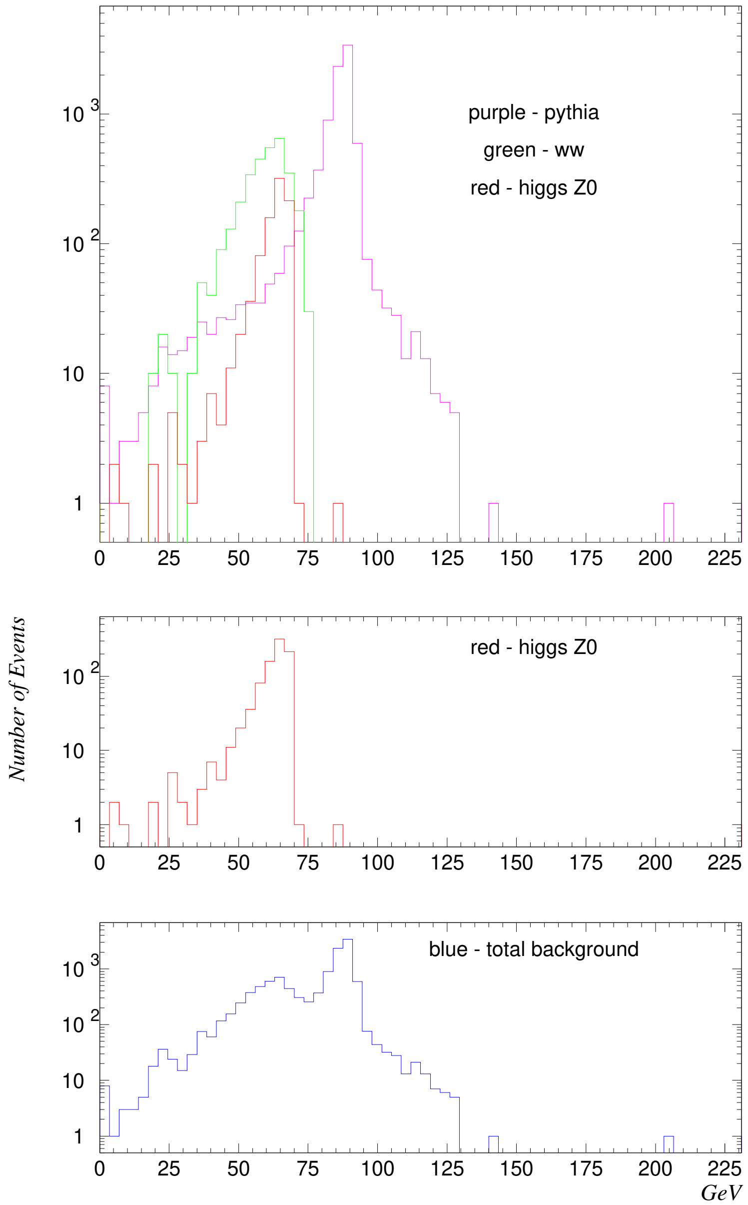
add the z momentum of each particle in the hadron jet, $\sum p_z$

add the energies of each particle in the hadron jet, $\sum E$

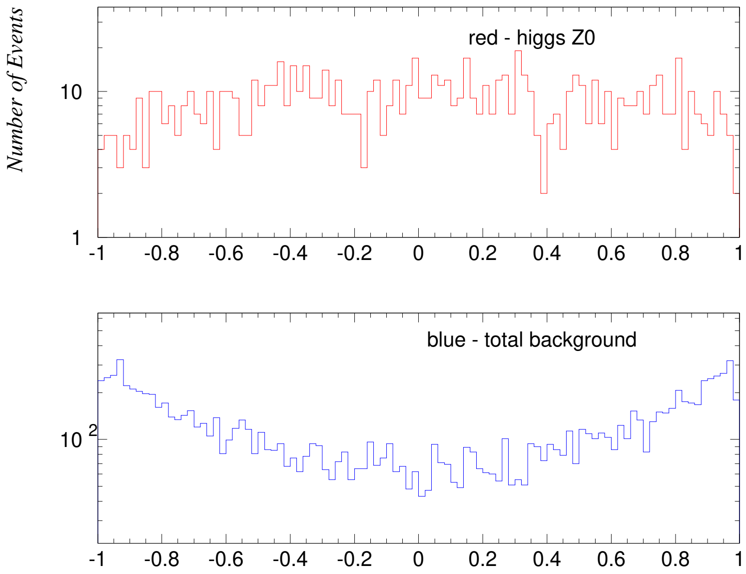
$$\begin{aligned} P^2 &= (\sum p_x)^2 + (\sum p_y)^2 + (\sum p_z)^2 \\ E^2 &= (\sum E)^2 \end{aligned}$$

$$M_{h^0} = \sqrt{E^2 - P^2}$$

Combined mass of hadrons for events that have visible hadrons and one e^- (or μ^-) and one e^+ (or μ^+); the combined mass of the e^- and e^+ must be within $\pm$ 5 GeV of the mass of the Z^0 (91 GeV).

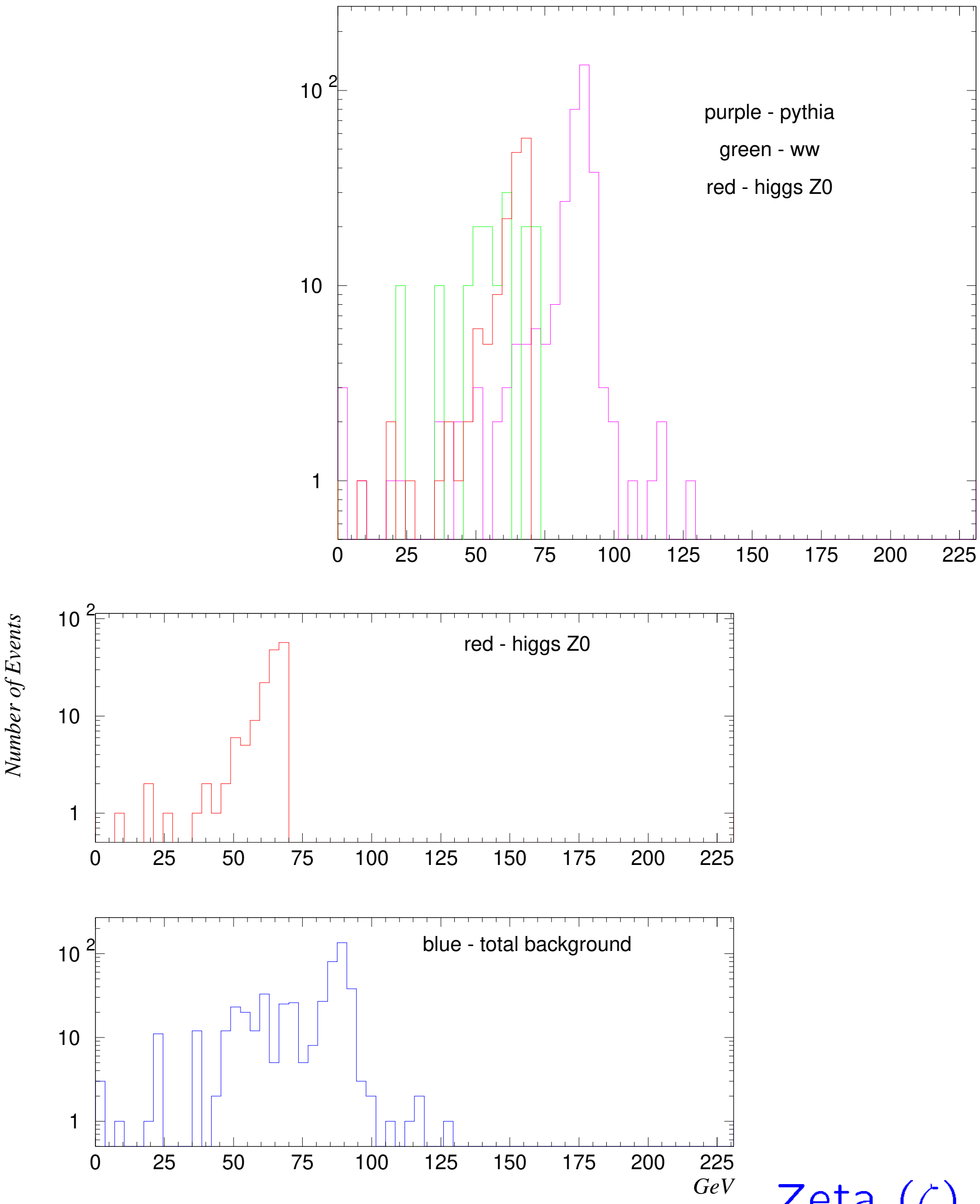


Cosine of the Angle of Particles (ζ) with Respect to the Beam Axis



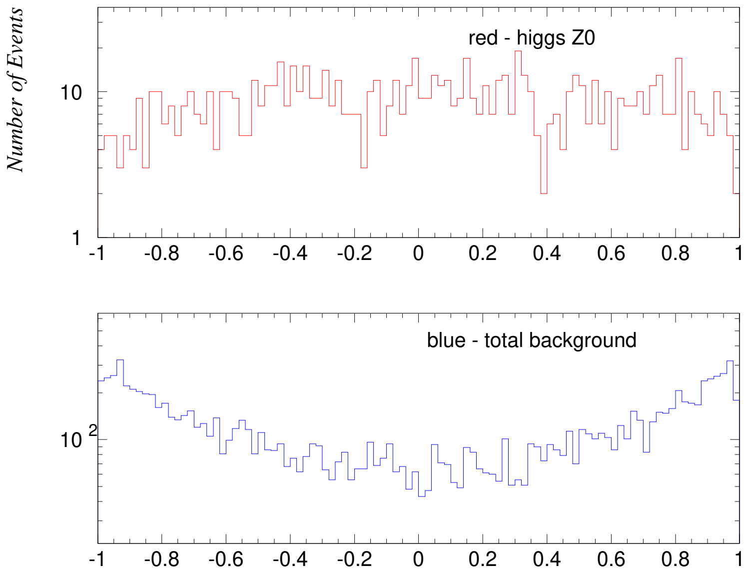
(Zeta (ζ) is the angle of the particle with respect to the beam axis.)

Combined mass of hadrons after cut removing events with more than 1 GeV of visible energy between $0.65 \leq |cos(\zeta)| \leq .995$.

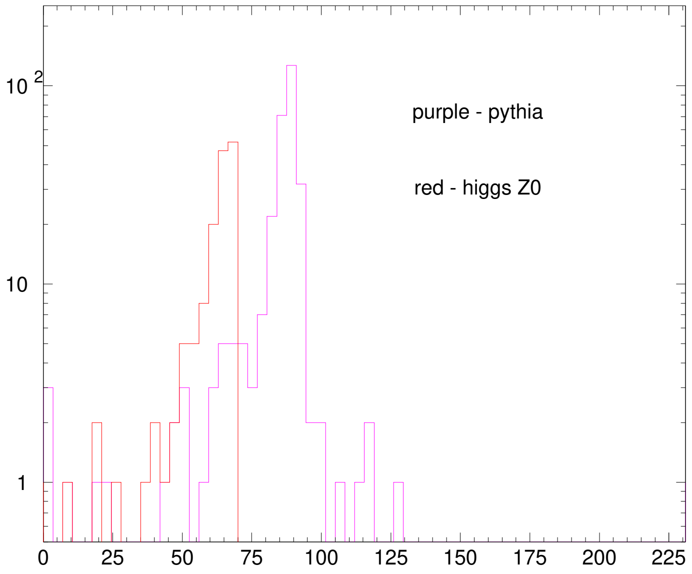


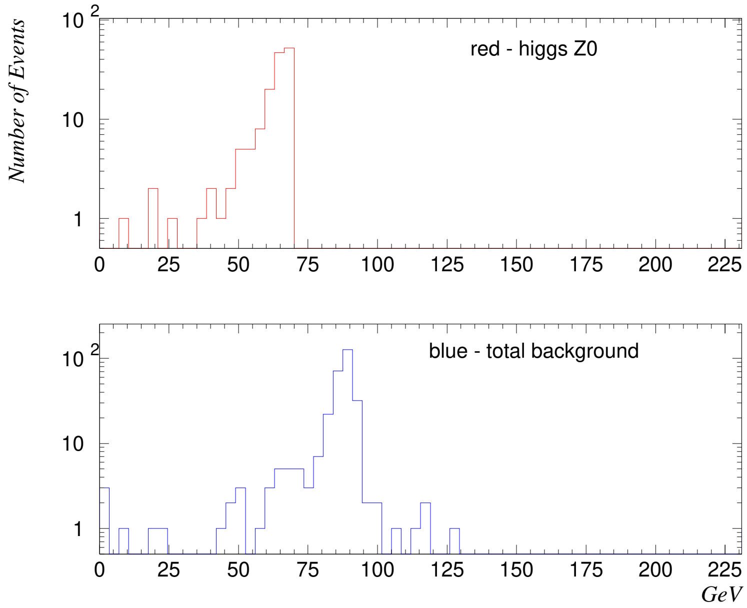
Zeta (ζ) is the angle of the particle with respect to the beam axis.

Cosine of the Angle Between Electrons (θ)



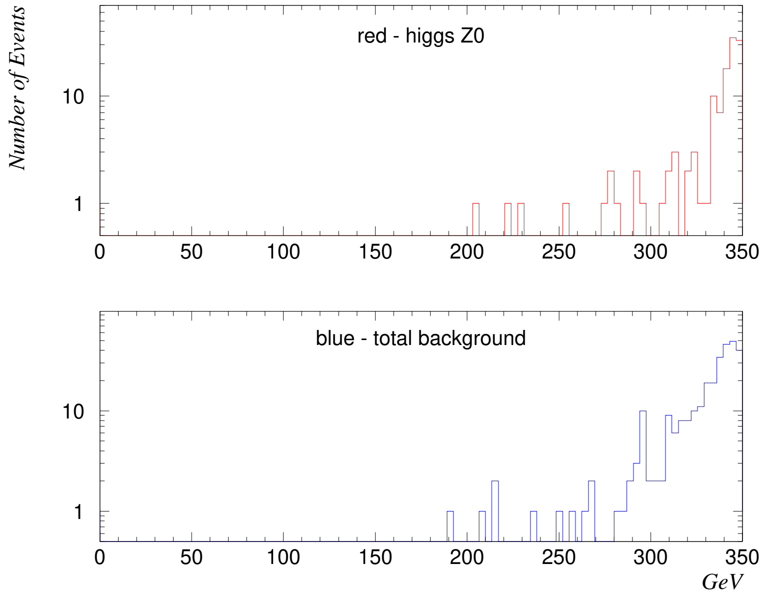
Combined mass of hadrons after cut removing events with $|\cos\theta|$ greater than 0.5.



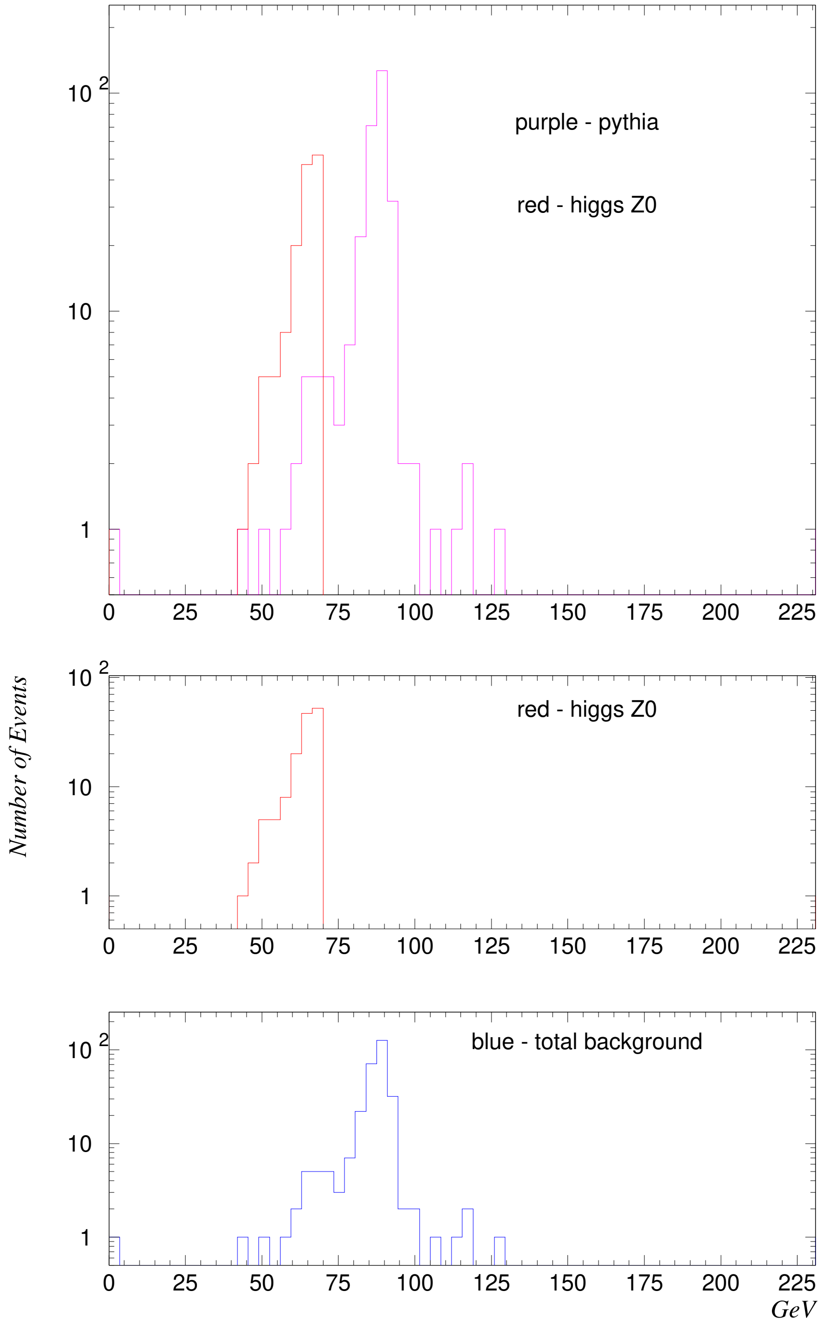


θ is the angle between the visible electron and positron

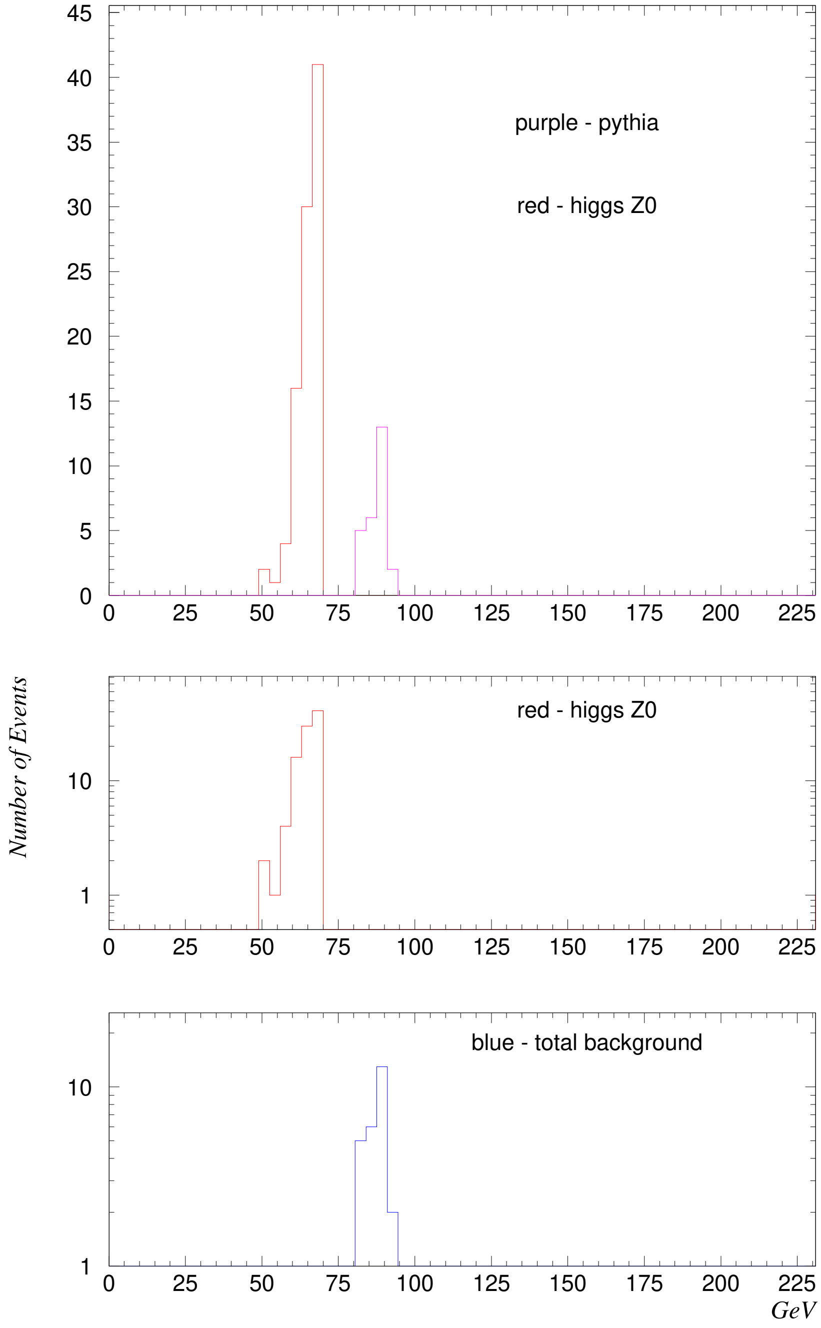
Visible Energy



Combined mass of hadrons after cutting events with evis less than 280 GeV.



Combined mass of hadrons after requiring that all events have a b quark and a $\bar{b}$ quark.

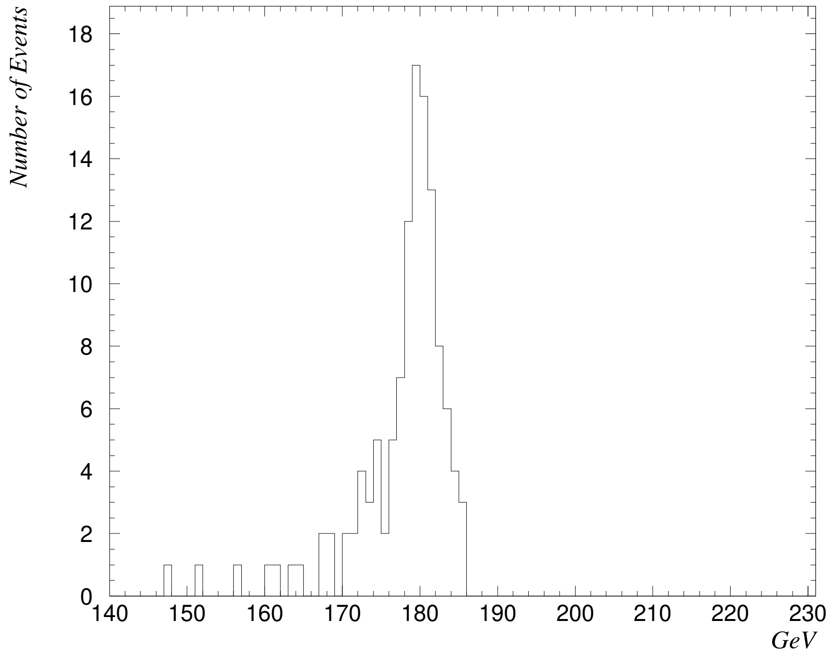


Mass of the Higgs (GeV)
Determined Using
Combined Mass Method

Known Mass	Calculated Mass	Discrepancy
69.2	68.5$\pm$ 1.9	1.0%

Mass of the Higgs (GeV)
Determined Using
Recoil Energy of Z^0

$$m_{h^0}^2 = E_{cm}^2 - 2E_{cm}E_{Z^0} + m_{Z^0}^2$$



The mean of this plot is 180.2, which we use as E_{Z^0}, $E_{cm} = 350$ GeV and $m_{Z^0} = 91.2$ GeV. Using these values, we obtain a mass of 68.3, which differs from the theoretical mass of 69.2 with a discrepancy of 1.3%.