Event generation with whizard update

Last time : Process $e^+e^- \to W^+b\,W^-\bar{b}$

Top quark distributions

W not observable within detector : Purpose: get closer to detector effect, keep b at truth-level

Study process : $e^+e^- \to l^+ v\, b\, l^- \bar{v}\, \bar{b}$

Reconstruction method :

Pmiss = ($p_v + p_{\bar{v}}$) + *Resolution to smear components*

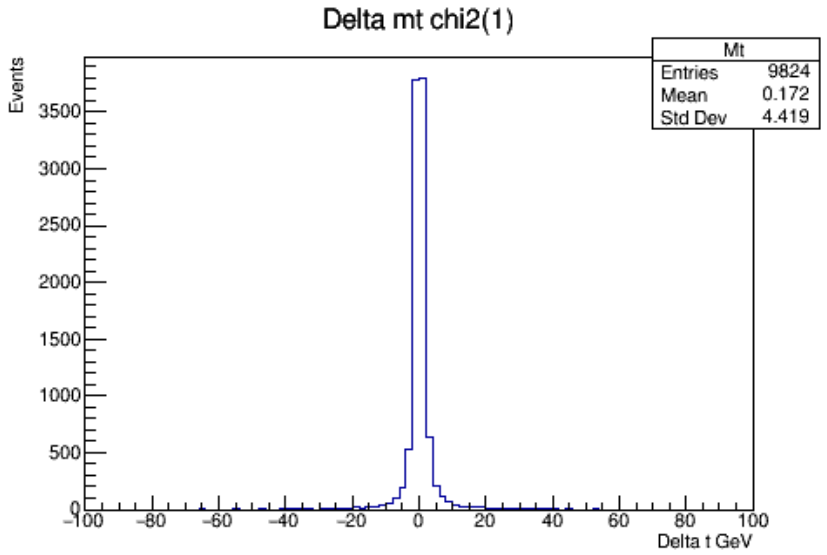
Chi2 method

$$\chi^2 = \left(\frac{m_t - M_{(W^+b)}}{\Gamma_t}\right)^2 + \left(\frac{m_{\bar{t}} - M_{(W^-\bar{b})}}{\Gamma_{\bar{t}}}\right)^2 + \left(\frac{m_{W^+} - M_{(l^+v)}}{\Gamma_{W^+}}\right)^2 + \left(\frac{m_{W^-} - M_{(l\bar{v})}}{\Gamma_{W^-}}\right)^2 + \left(\frac{\overrightarrow{|P_{miss}|} - \overrightarrow{|P_v|}}{resolution}\right)^2$$

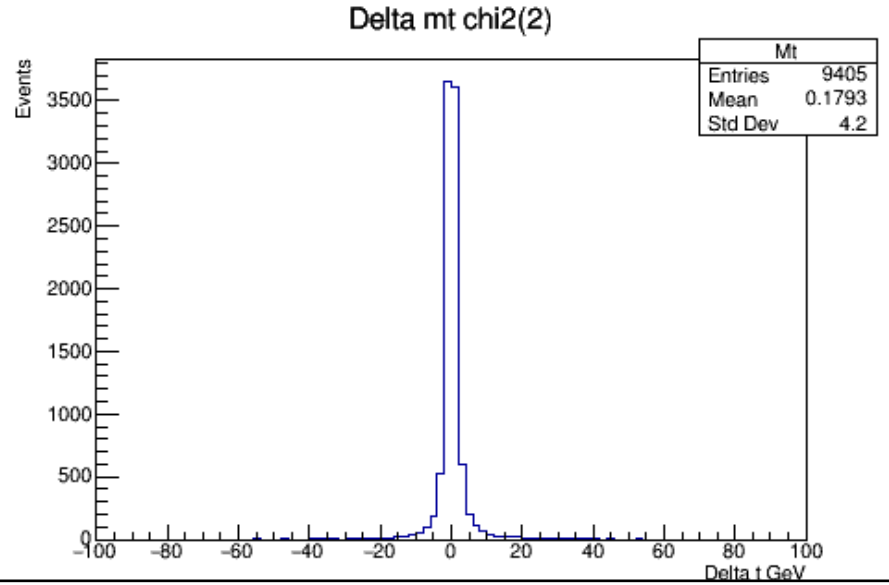
Parameters : m_t, $m_{\bar{t}}$, m_{W^+}, m_{W^-} , $\overrightarrow{|P_{miss}|}$

6 unknowns to minimize : p_{vx}, p_{vy}, p_{vz}, $p_{\bar{v}x}$, $p_{\bar{v}y}$, $p_{\bar{v}z}$,

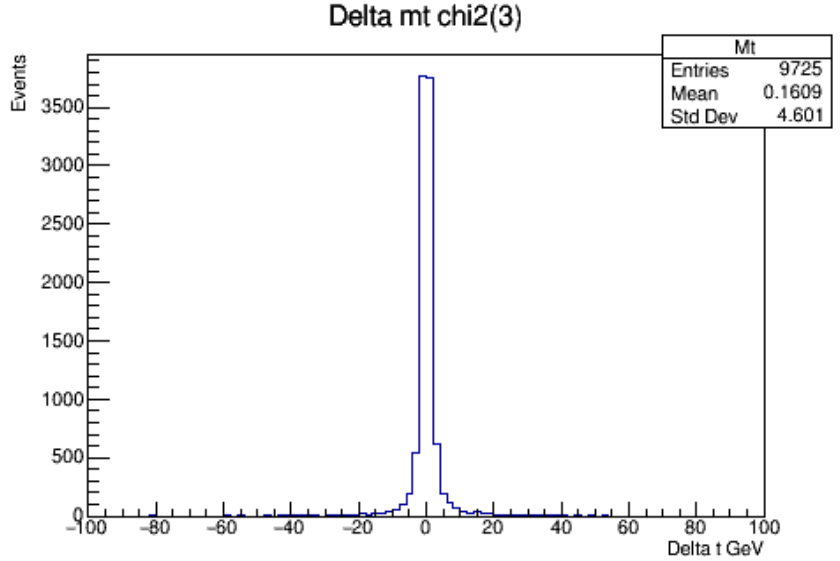
Chi2 test:



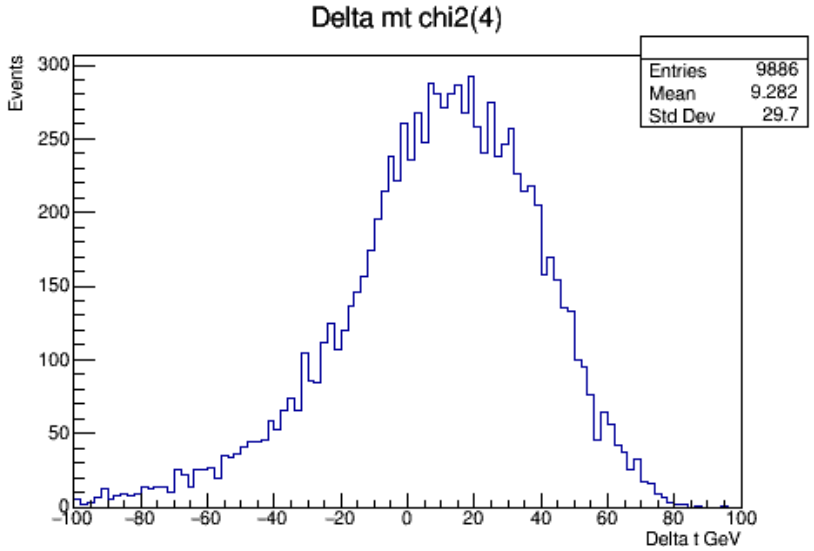
$$\chi^2 = \left(\frac{m_t - M_{(W^+b)}}{\Gamma_t}\right)^2 + \left(\frac{m_{\bar{t}} - M_{(W^-\bar{b})}}{\Gamma_{\bar{t}}}\right)^2 + \left(\frac{m_{W^+} - M_{(l^+v)}}{\Gamma_{W^+}}\right)^2 + \left(\frac{m_{W^-} - M_{(l\bar{v})}}{\Gamma_{W^-}}\right)^2$$



$$\chi^2 = \left(\frac{m_t - M_{(W^+b)}}{\Gamma_t}\right)^2 + \left(\frac{m_{\bar{t}} - M_{(W^-\bar{b})}}{\Gamma_{\bar{t}}}\right)^2 + \left(\frac{m_{W^+} - M_{(l^+v)}}{\Gamma_{W^+}}\right)^2 + \left(\frac{m_{W^-} - M_{(l\bar{v})}}{\Gamma_{W^-}}\right)^2 + \left(\frac{|\overrightarrow{P_{miss}}| - |\overrightarrow{P_v}|}{resolution}\right)^2$$



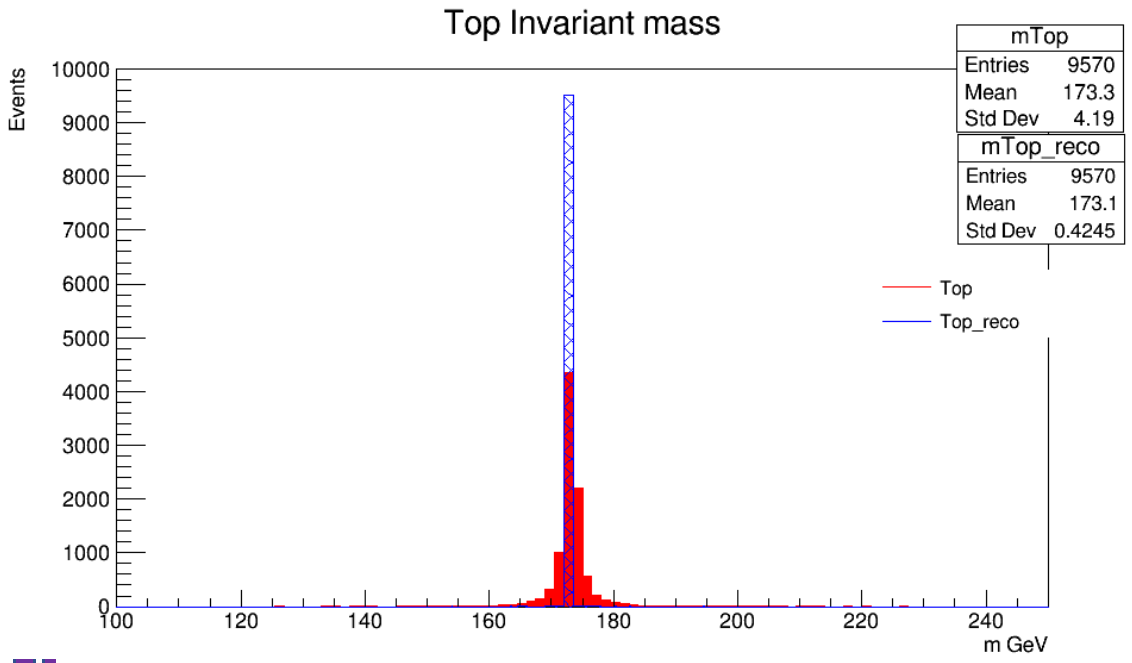
$$\chi^2 = \left(\frac{m_t - M_{(W^+b)}}{\Gamma_t}\right)^2 + \left(\frac{m_{\bar{t}} - M_{(W^-\bar{b})}}{\Gamma_{\bar{t}}}\right)^2 + \left(\frac{|\overrightarrow{P_{miss}}| - |\overrightarrow{P_v}|}{resolution}\right)^2$$

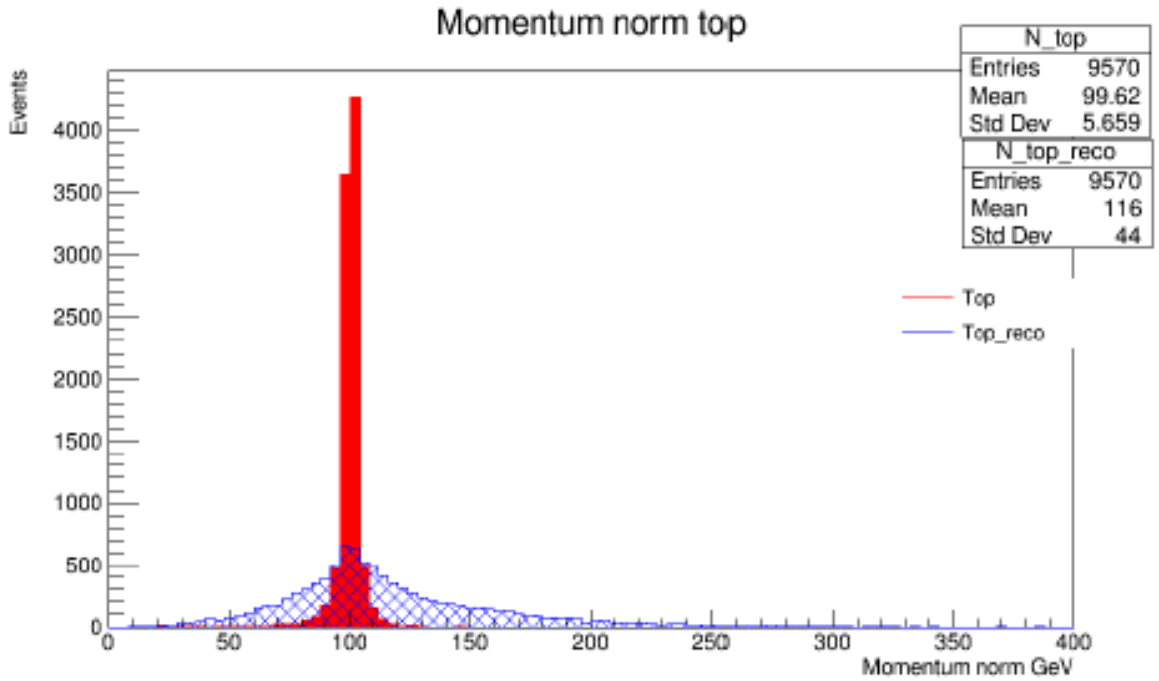


$$\chi^2 = \left(\frac{m_{W^+} - M_{(l^+v)}}{\Gamma_{W^+}}\right)^2 + \left(\frac{m_{W^-} - M_{(l\bar{v})}}{\Gamma_{W^-}}\right)^2 + \left(\frac{|\overrightarrow{P_{miss}}| - |\overrightarrow{P_v}|}{resolution}\right)^2$$

Kinematic of truth and reconstructed distribution :

$\sqrt{S} = 400\ GeV$





Top :

$E = \sqrt{P^2 + m^2} = \sqrt{(99{,}62)^2 + (173{,}3)^2} = 199{,}89\ GeV$

$2E = \sqrt{S} = 400\ GeV$

Top reco :

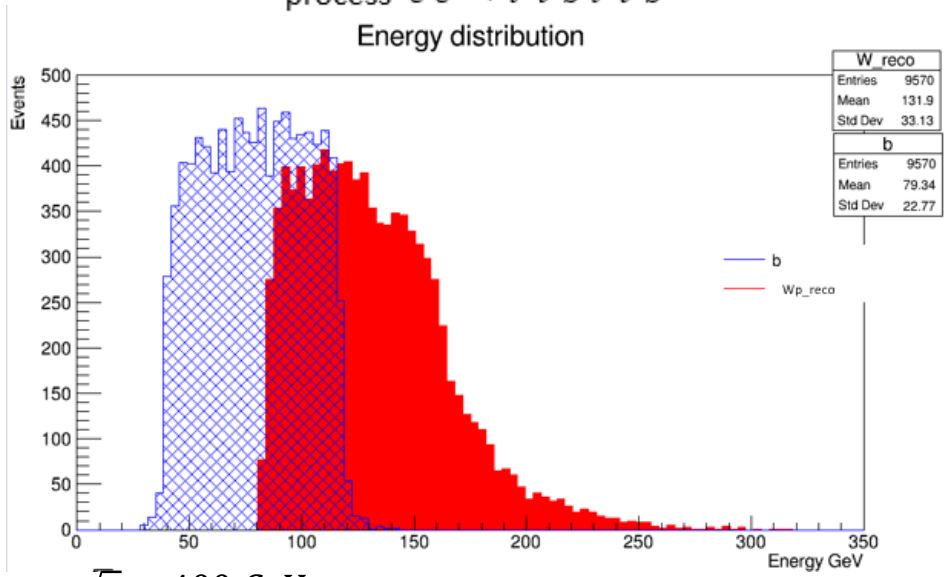
$E = \sqrt{P^2 + m^2} = \sqrt{(116)^2 + (173{,}1)^2} = 208\ GeV$

$2E \approx \sqrt{S}$

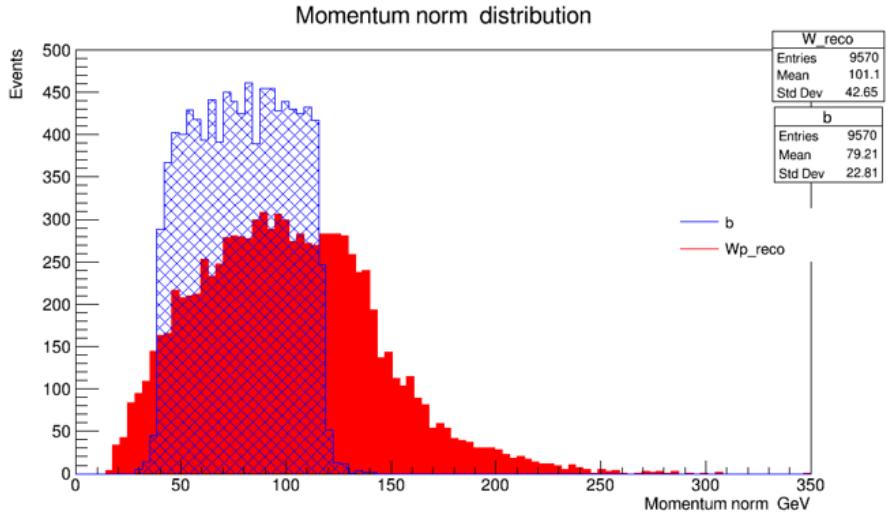
uncertainty due to reconstruction

Kinematic comparison with previous study

process $e^+e^- \to l^+ \nu\, b\, l^- \bar{\nu}\, \bar{b}$



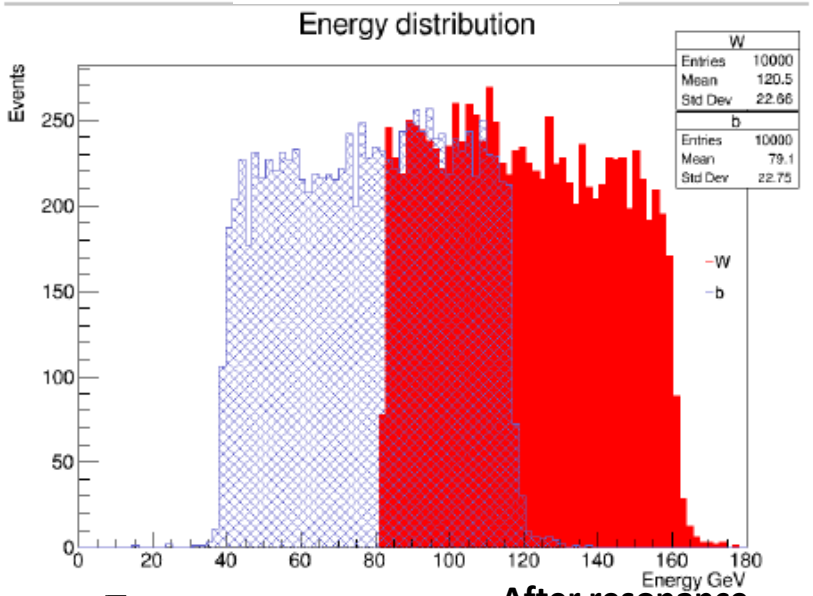
$\sqrt{s} = 400\ GeV$ **After resonance**



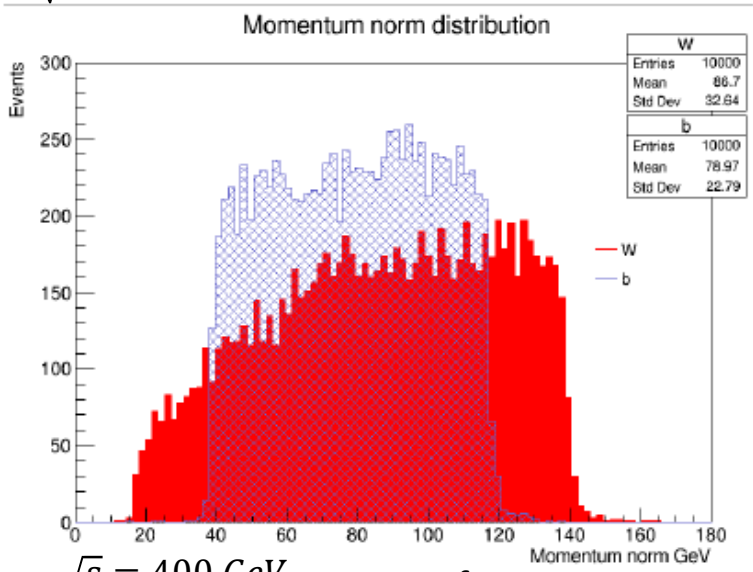
$\sqrt{s} = 400\ GeV$ **After resonance**

Plots came from FCC meeting : May the 4th

Process $e^+e^- \to W^+b\, W^-\bar{b}$



$\sqrt{s} = 400\ GeV$ **After resonance**



$\sqrt{s} = 400\ GeV$ **After resonance**

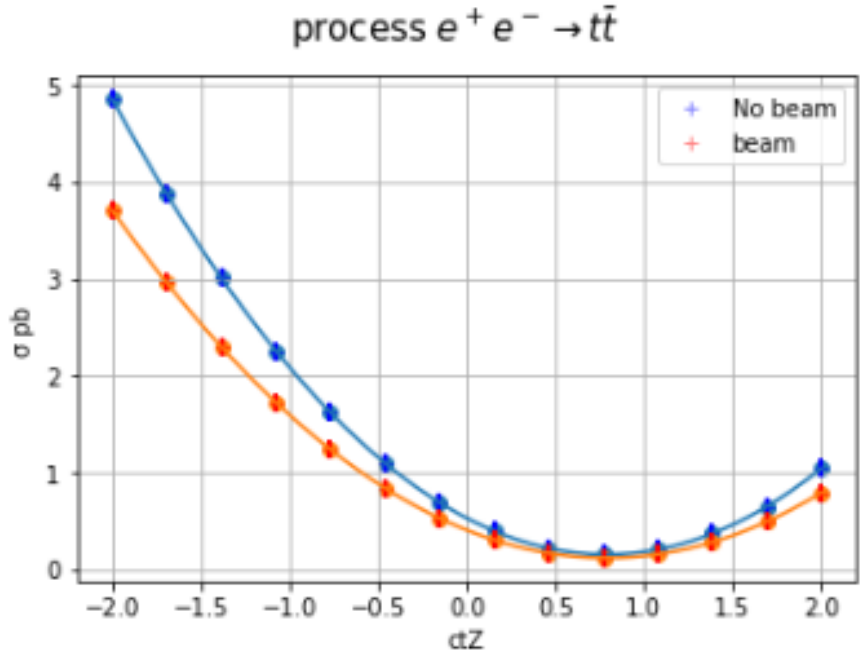
Similar distribution shape, W_reco r.m.s much larger

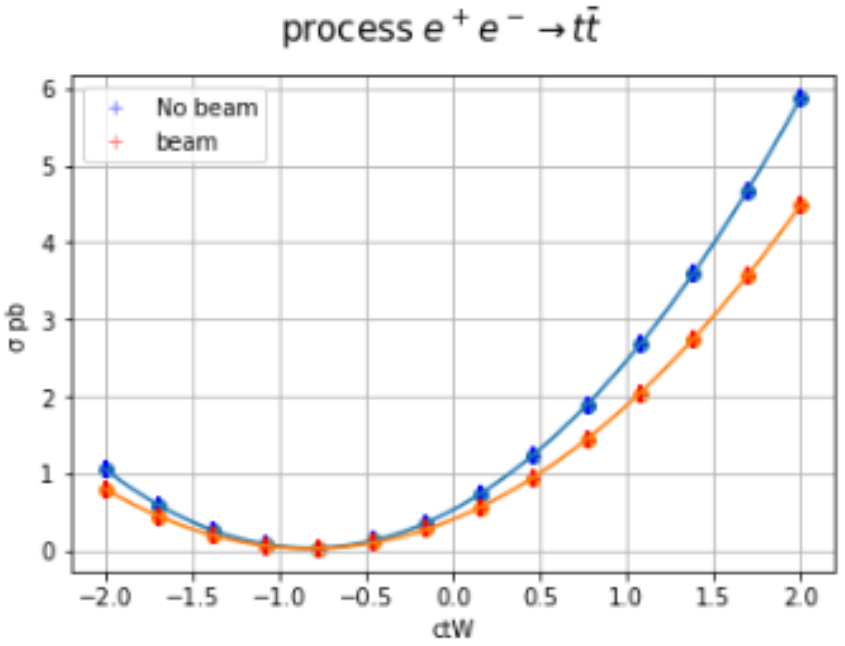
Step 1 :Reconstruction method

Step 2 :Results part about UFO study

UFO model :

$\sqrt{S} = 365\ GeV$





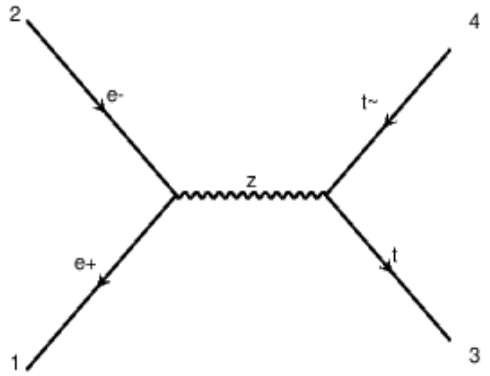
Perform a quadratic fit :

ctZ coefficient:

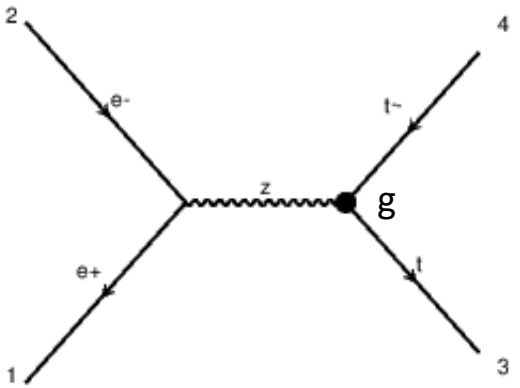
$$\sigma \propto \int_{\phi} |M|^2 \, d\phi$$

$$|M|^2 = a\,g^2 + b\,g + cte$$

dim6top — Interference term — SM



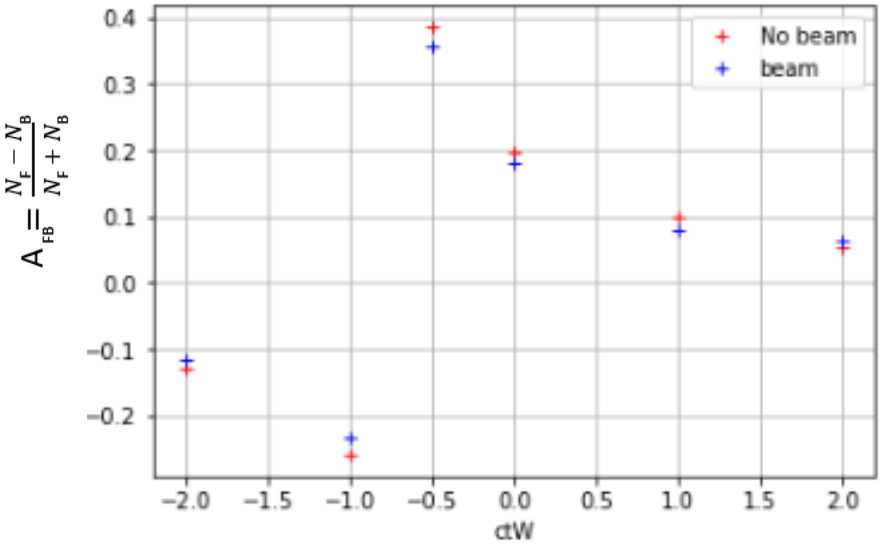
SM

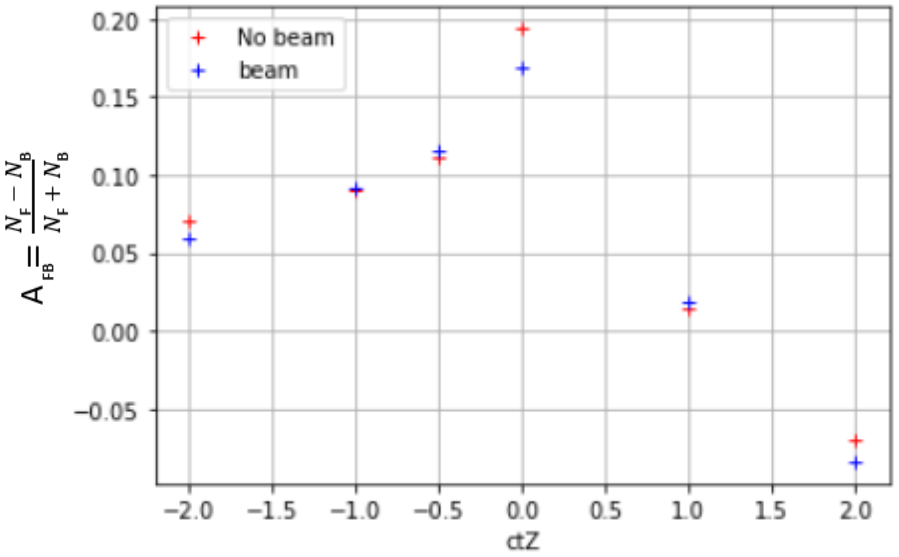


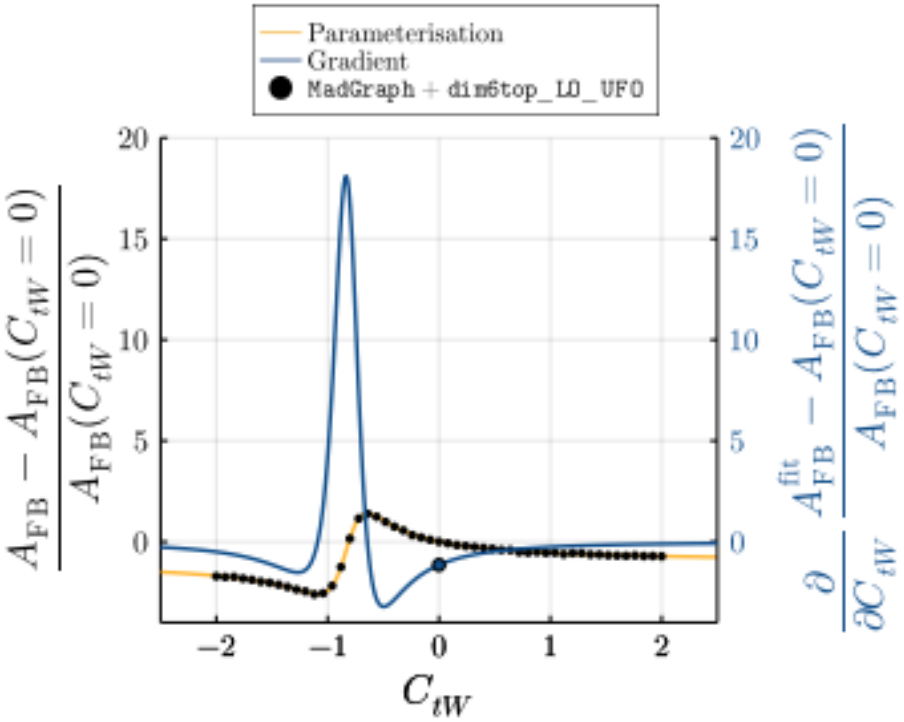
dim6top

UFO model :

$\sqrt{S} = 365\ GeV$







Plot came from Lars studies

-> Small asymmetry influenced due to beam effects

-> Results in good agreement with Lars studies

Conclusion :

Reconstruction method :

Use chi2 method

Good agreement between results coming from 2 processes

UFO model :

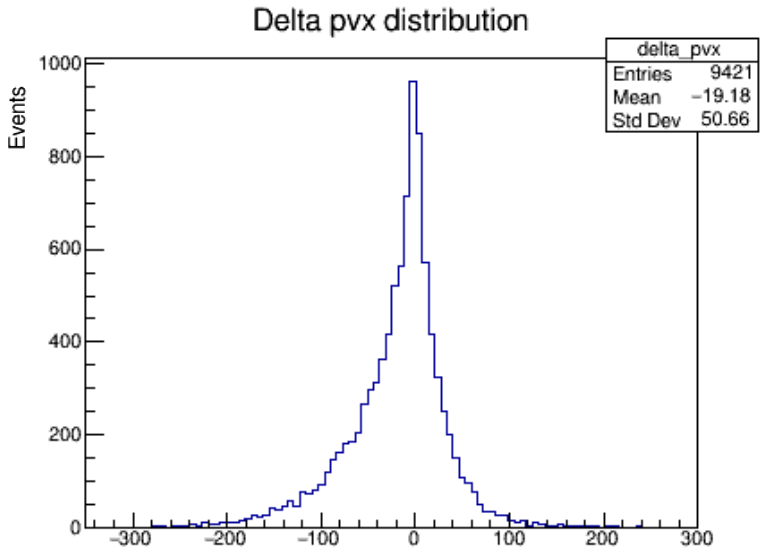
Looking at ctW and ctZ coefficent, include beam effect, perform a quadratic fit

Top asymmetry : similar results to those obtained by Lars

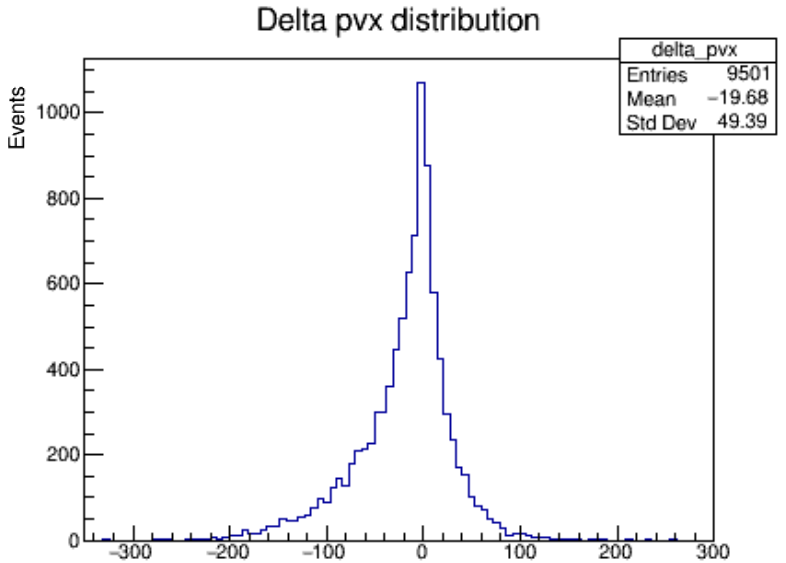
Next step : writing my report

Backup

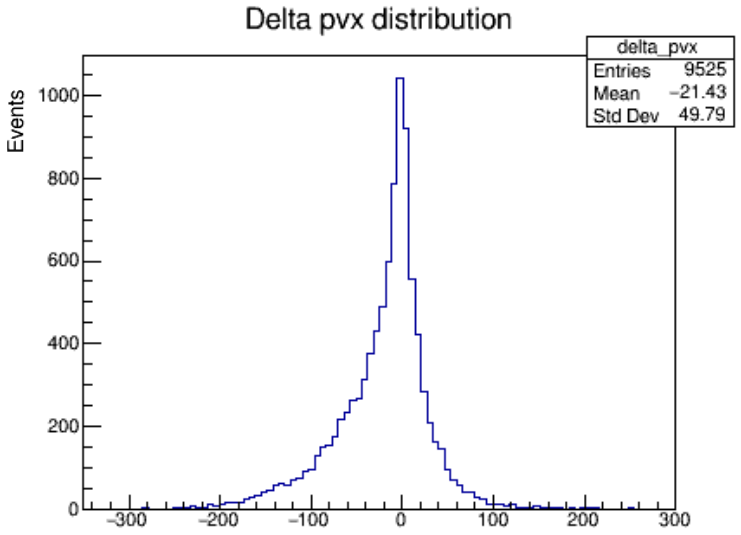
Choice of best resolution :



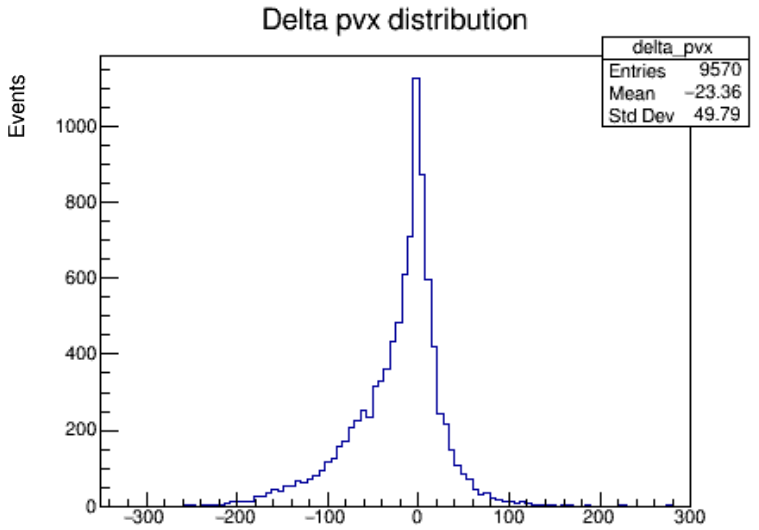
Resolution = 20 GeV



Resolution = 10 GeV



Resolution = 5 GeV



Resolution = 3 GeV

Resolution not influence r.m.s of distributions