Sensitivity to New Resonances with Electroweak Fits at 3 TeV

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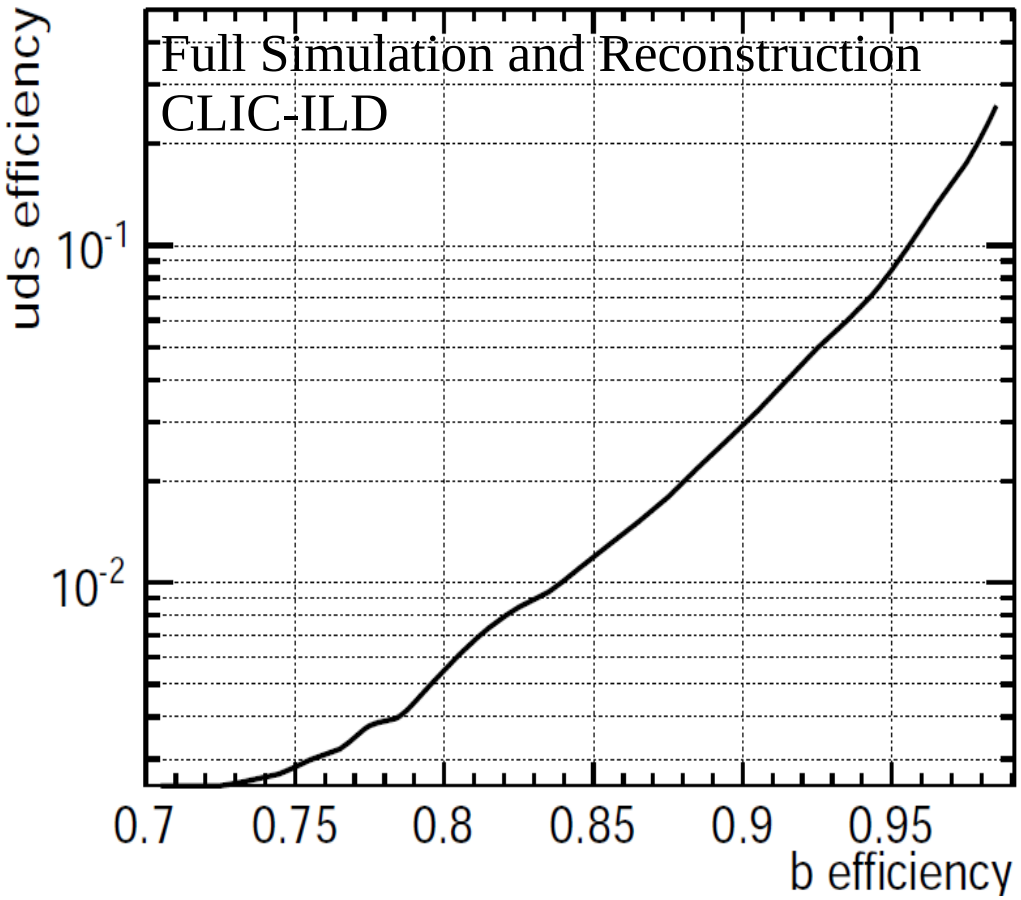
b Tagging of high energy jets

Explicit b-tagging based on topological vertex reconstruction with ZVTOP-ZVRES;

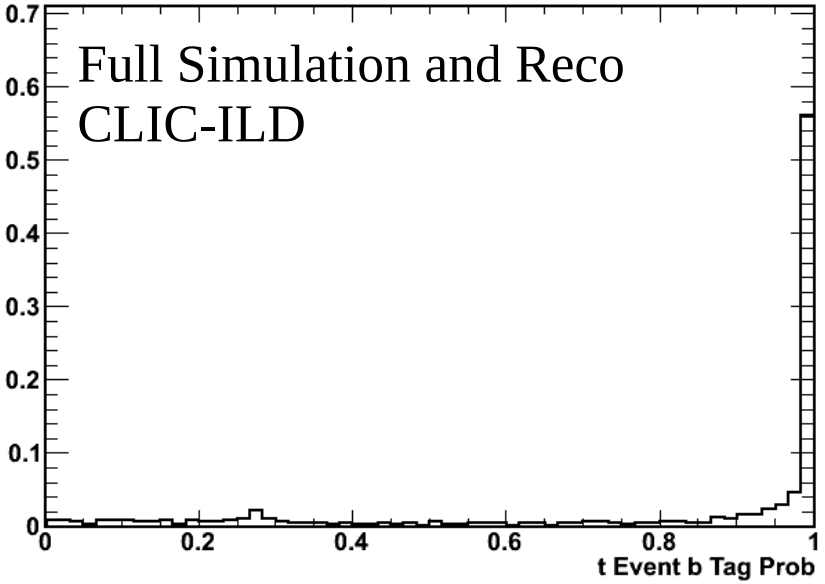
b-tagging optimise for high efficiency by performing secondary particle search in jets with no reco secondary vertices;

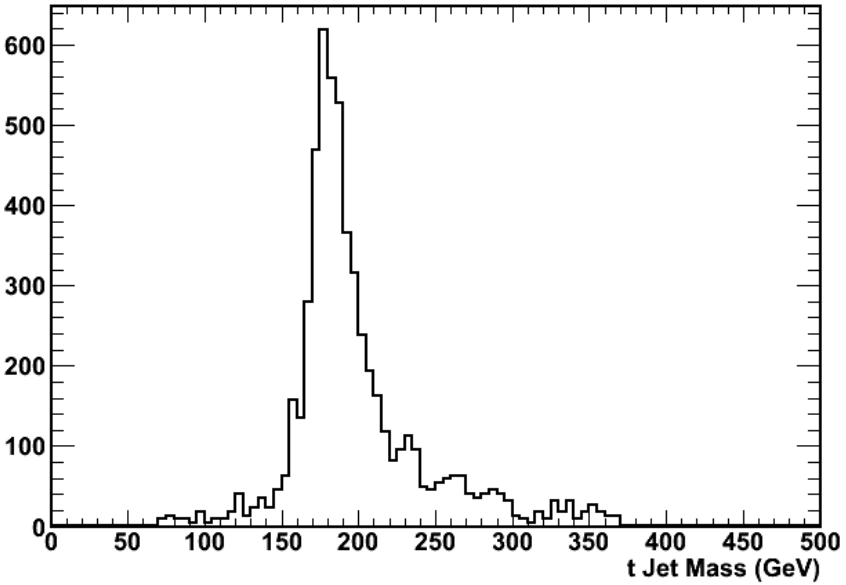
b-tag probability computed per jet using boosted decision tree strategy in TMVA package and then combined for di-jet events.



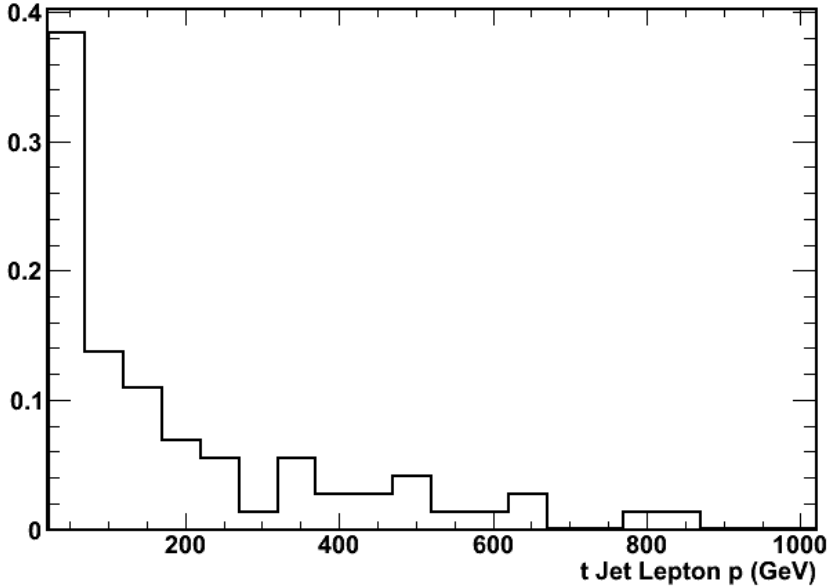
t Tagging of high energy jets

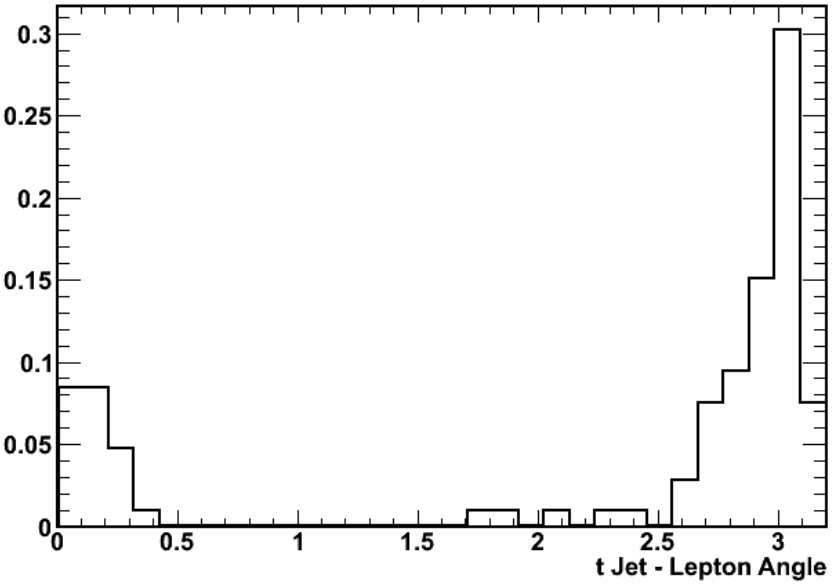
Identify top jet from b-tagging and jet mass in 2-jet event reconstruction





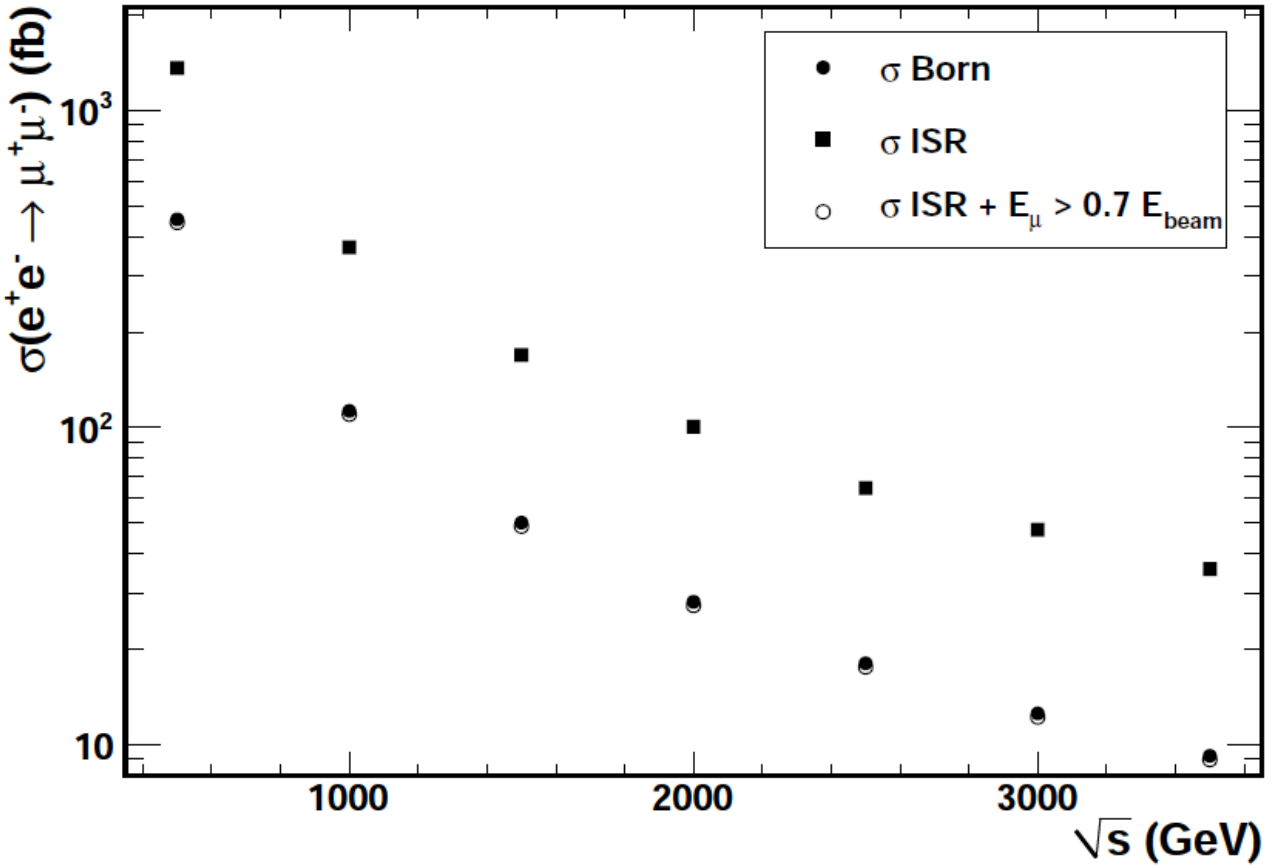
Tag charge from charge of lepton in t → bW → lν





Event Reconstruction

Reconstruct event as 2-jet event with anti-kt algorithm,
require both jets to fulfill $E_{jet} > 0.70\ E_{beam}$ to remove large beamstrhalung or ISR and $|\cos\theta| < 0.90$, apply flavour tagging, charge identification for asymmetries.



$\varepsilon_b = 0.65$ $\varepsilon_{top} = 0.50$

Observables

$$\sigma_{f\bar{f}} \qquad A_{LR} \qquad A_{FB}$$

$$e^+e^- \to f\bar{f}, \ (f = \mu, \ b \text{ and } t)$$

$$A_{LR}^{obs} = \frac{\sigma_{LR} - \sigma_{RL}}{\sigma_{LR} + \sigma_{RL}} P_{eff} \qquad P_{eff} = \frac{P_{e^+} - P_{e^-}}{1 - P_{e^+} P_{e^-}}$$

Channel	$\delta\sigma/\sigma$	δA_{FB}	δA_{LR}
$e^+e^- \to \mu^+\mu^-$	0.002	0.015	0.016
$e^+e^- \to b\bar{b}$	0.009	0.020	0.024
$e^+e^- \to t\bar{t}$	0.007	0.015	0.020

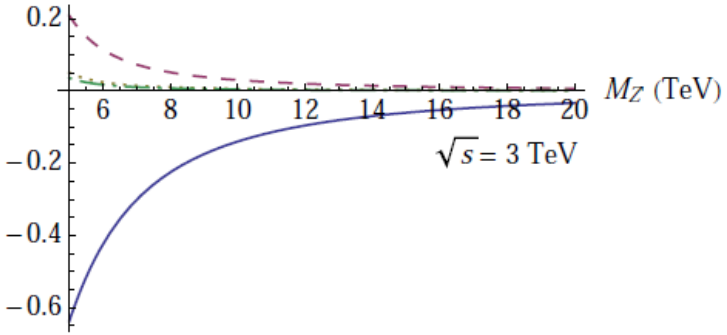
Models implemented in CompHep and CalcHep, polarisation implemented, part of CalcHep files generated using FeynRules in Mathematica

"Minimal" Z' models

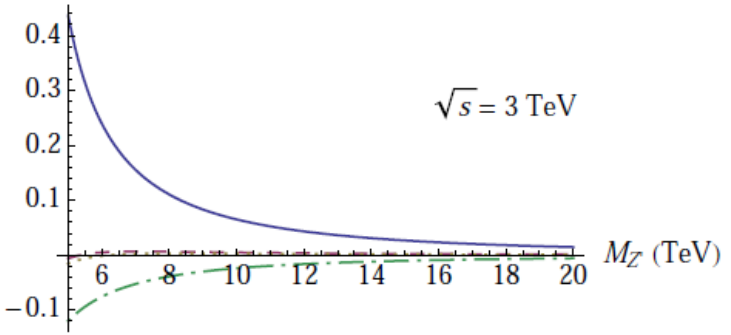
$$\mathcal{L}_{int}^{Z'} = i g_Z Z'_\mu \bar{f} \gamma^\mu (\tilde{g}_Y Y + \tilde{g}_{BL}(B-L)) f$$

U(1) type	Charge Assignment
Y-sequential	$\tilde{g}_{BL} = 0$
B-L	$\tilde{g}_Y = 0$
Right-handed	$\tilde{g}_Y = -\tilde{g}_{BL}$
Left-Right	$\tilde{g}_Y = s_W \alpha,\ \tilde{g}_{BL} = -\frac{s_W}{2\alpha}(1+\alpha^2)$
$E_6 - \chi$	$\tilde{g}_{BL} = \frac{5}{2\sqrt{6}} s_W, \quad \tilde{g}_Y = -(4/5)\tilde{g}_{BL}$

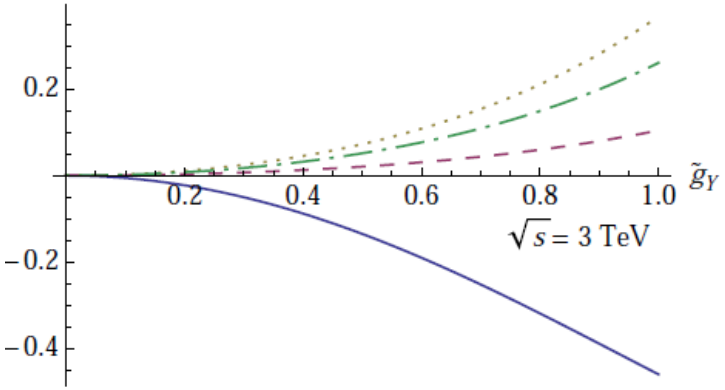
Z'_{B-L}, $e^+e^- \to \mu^+\mu^-$, $\tilde{g}_{BL} = \sqrt{5/8}\, s_W$



Z'_{B-L}, $e^+e^- \to b\,\bar{b}$, $\tilde{g}_{BL} = \sqrt{5/8}\, s_W$



Z'_Y, $e^+e^- \to \mu^+\mu^-$, $M_{Z'} = 10$ TeV



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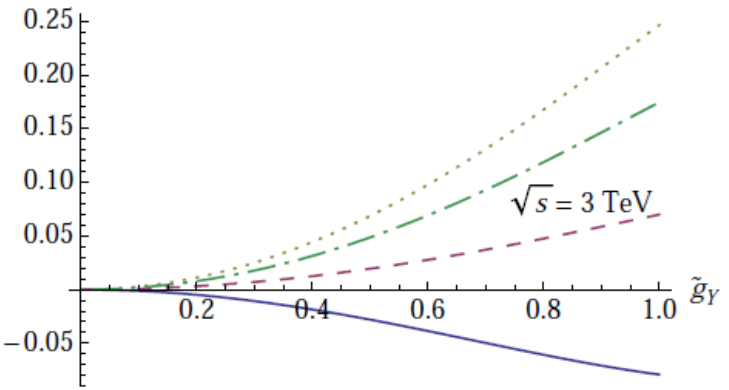

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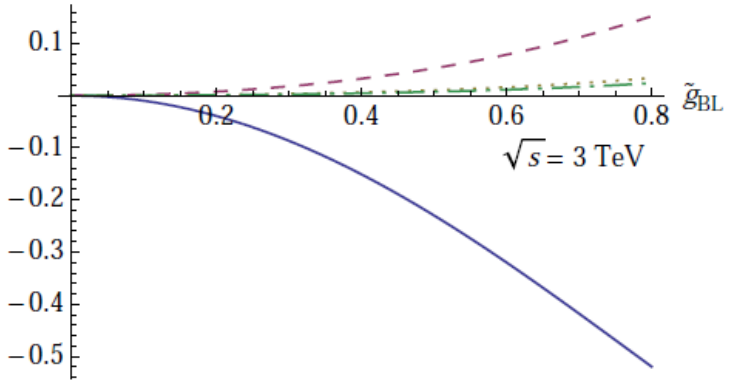

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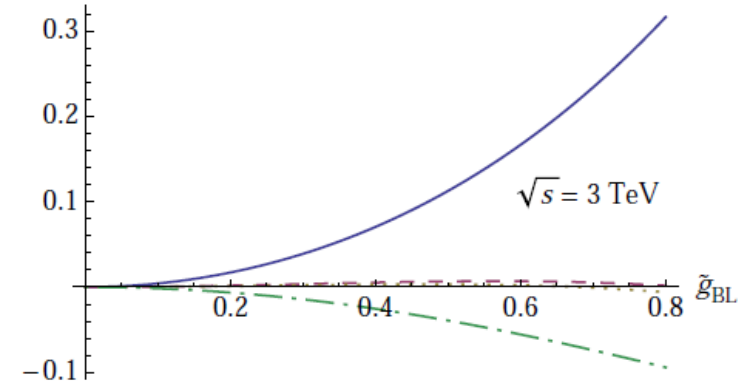
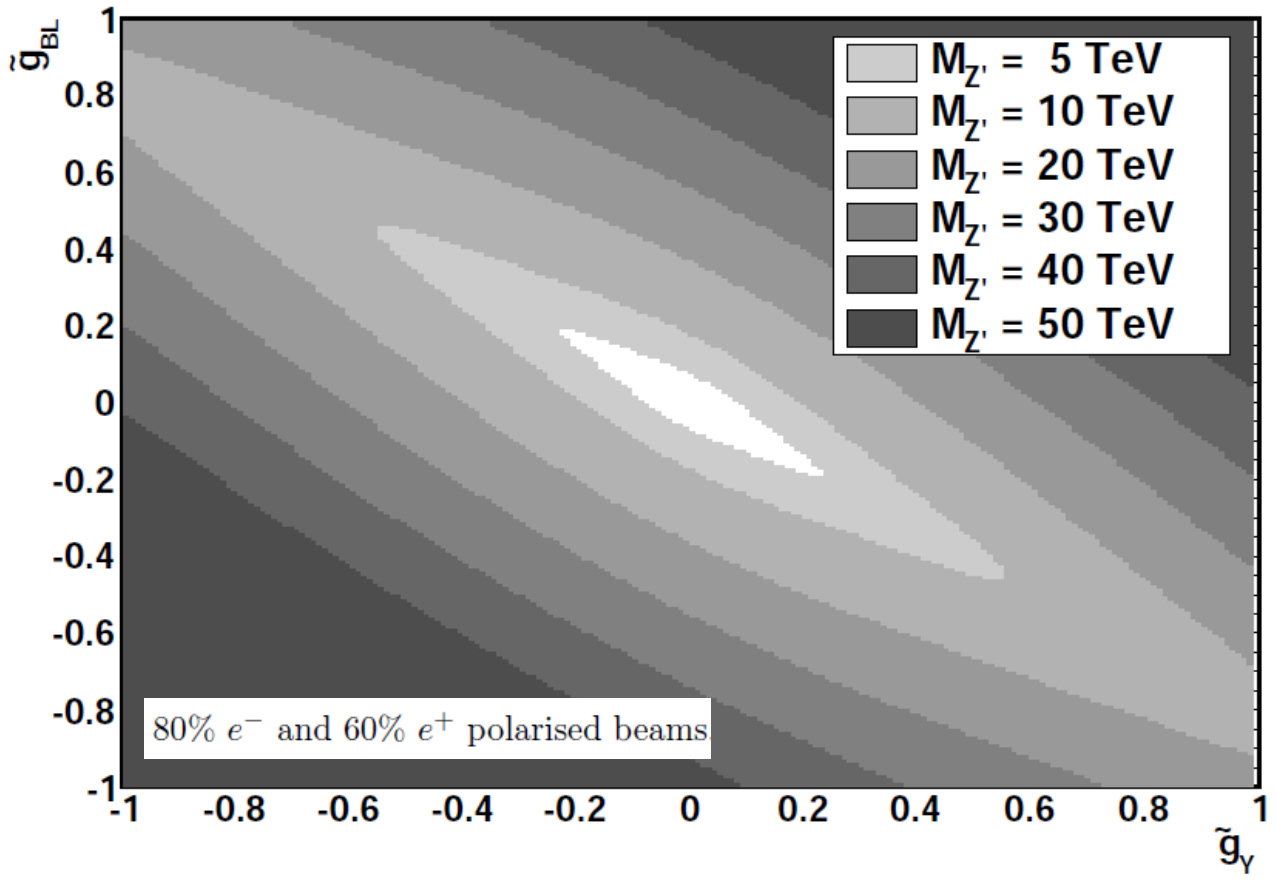


Sensitivity to Z' minimal model through EW Fits at 3 TeV 2 ab^{-1}



Two-sector Composite Higgs Model (*)

ED model with two sectors:
"elementary" SM like with no Higgs
"composite" with Higgs bi-doublet and extended fermion sector

Fermions of 1st and 2nd generation are elementary due to small Yukawa couplings

$$(Y_u^{SM})_{ij} = \sin\varphi_{Q\,L\,i}(Y_{*U})_{ij}\sin\varphi_{U\,R\,j}$$

Fermions of 3rd generation are composite

$$\frac{\sqrt{2}m_t}{v} \simeq \sin\varphi_{Q\,L3}Y^*_{U33}, \qquad \frac{\sqrt{2}m_b}{v} \simeq \sin\varphi_{Q\,L3}Y^*_{D33}\sin\varphi_{b\,R3}$$

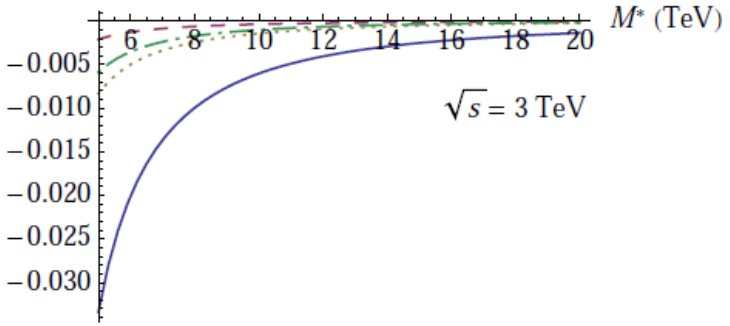
Assume new fermion scale m* > new vector boson mass M*

Assume three free parameters g^*, Y_{*U33} and M^*

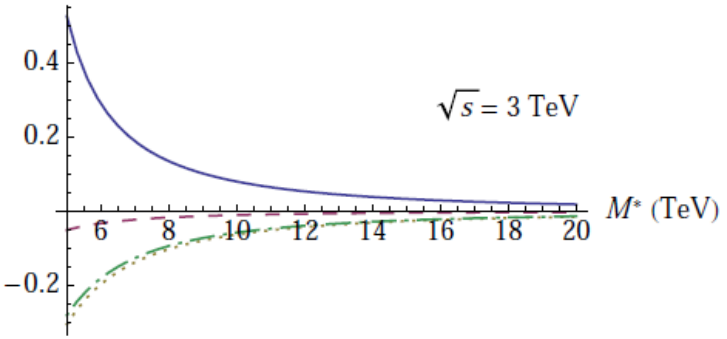
Interesting model emphasising EW observables in top sector.

(*) R. Contino, T. Kramer, M. Son *et al.*, JHEP **0705** (2007) 074. [hep-ph/0612180]

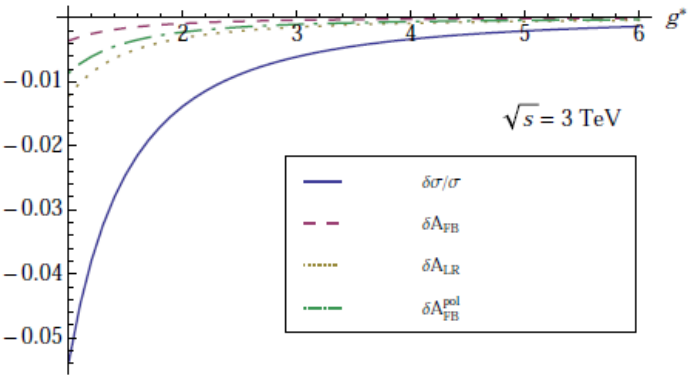
ECHM, $e^+e^-\to\mu^+\mu^-$, $g^*=3$, $Y^*=3.5$



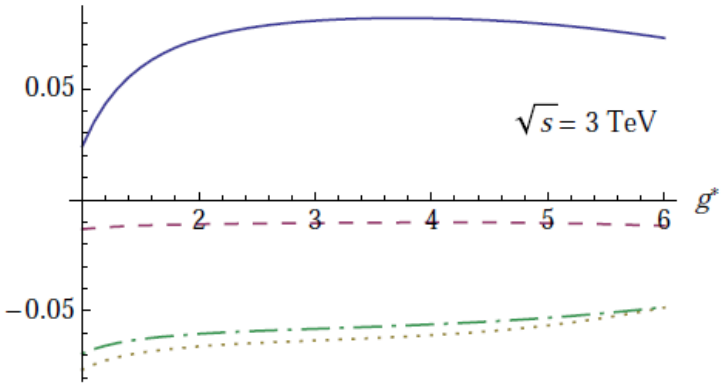
ECHM, $e^+e^-\to t\,\bar{t}$, $g^*=3$, $Y^*=3.5$



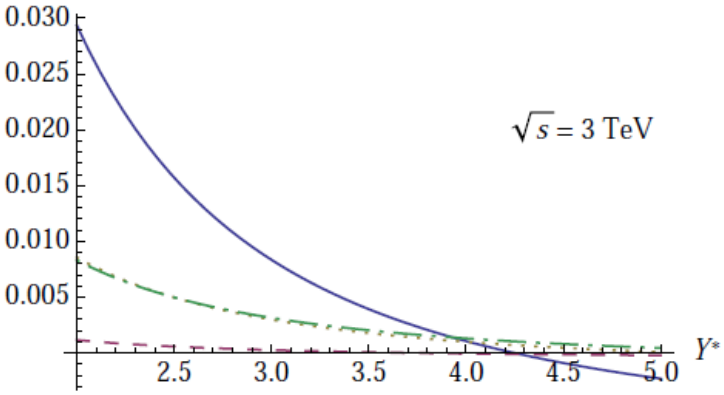
ECHM, $e^+e^-\to\mu^+\mu^-$, $M^*=10$ TeV, $Y^*=3.5$



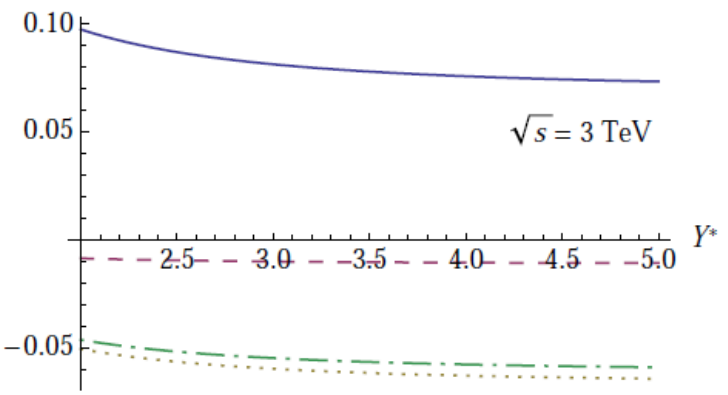
ECHM, $e^+e^-\to t\,\bar{t}$, $M^*=10$ TeV, $Y^*=3.5$



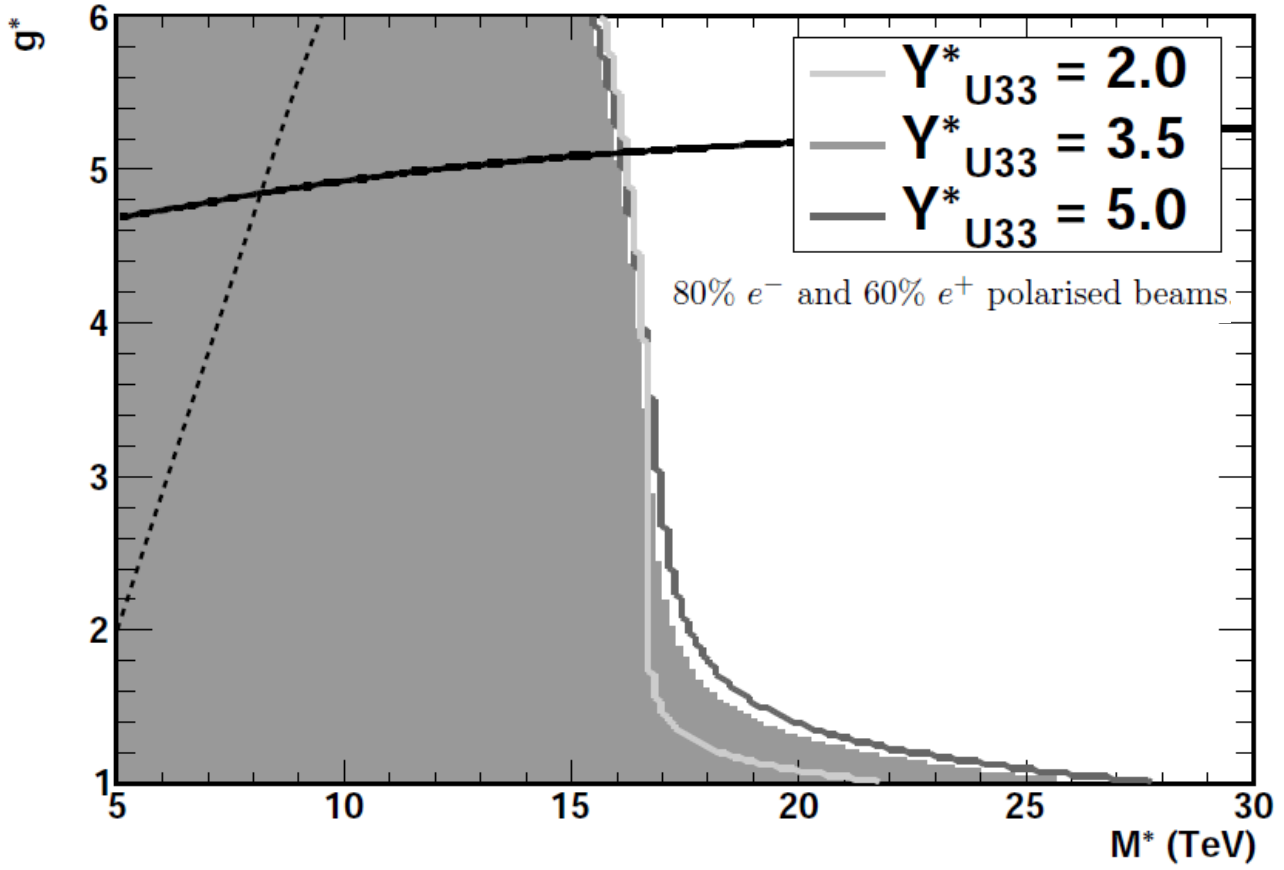
ECHM, $e^+e^-\to b\,\bar{b}$, $M^*=10$ TeV, $g^*=3$



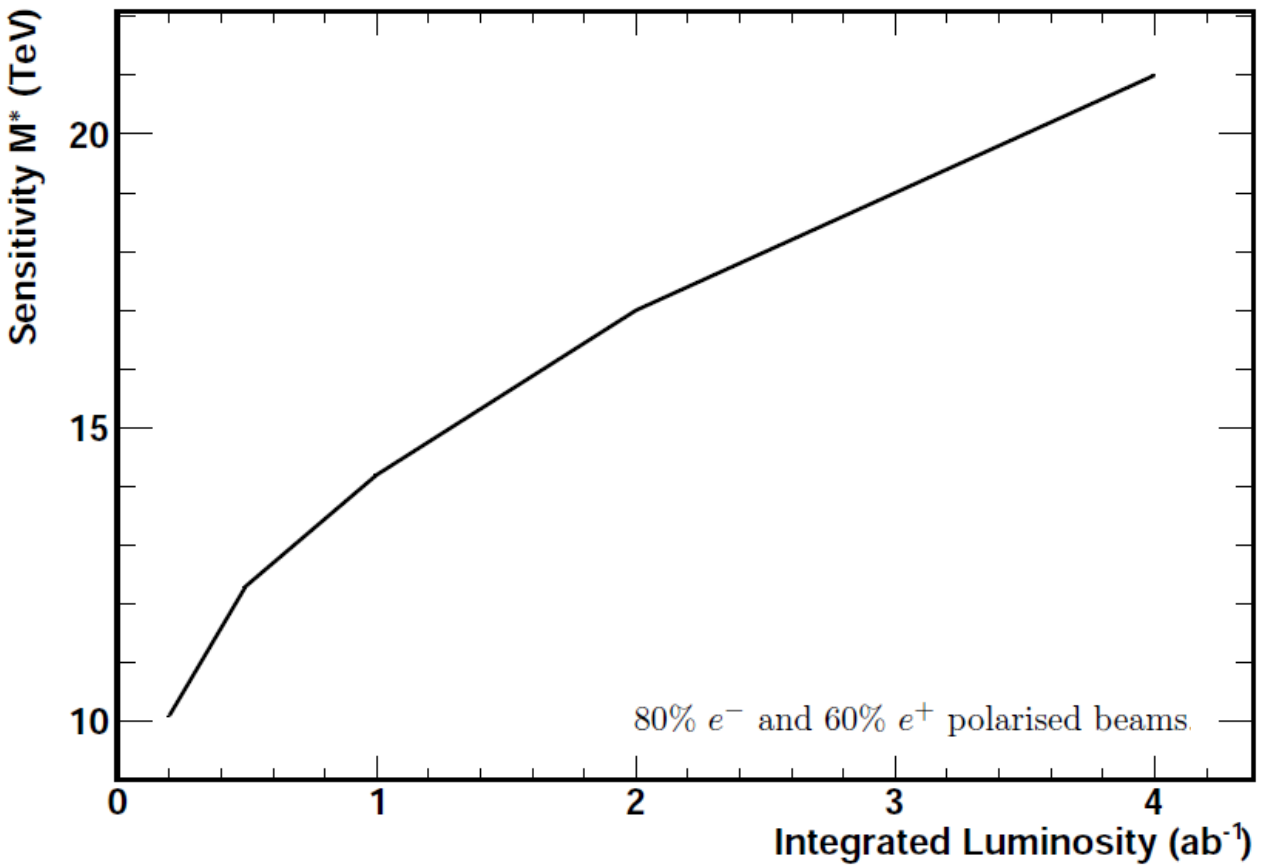
ECHM, $e^+e^-\to t\,\bar{t}$, $M^*=10$ TeV, $g^*=3$



Sensitivity to ECHM Model through EW Fits at 3 TeV 2 ab^{-1}

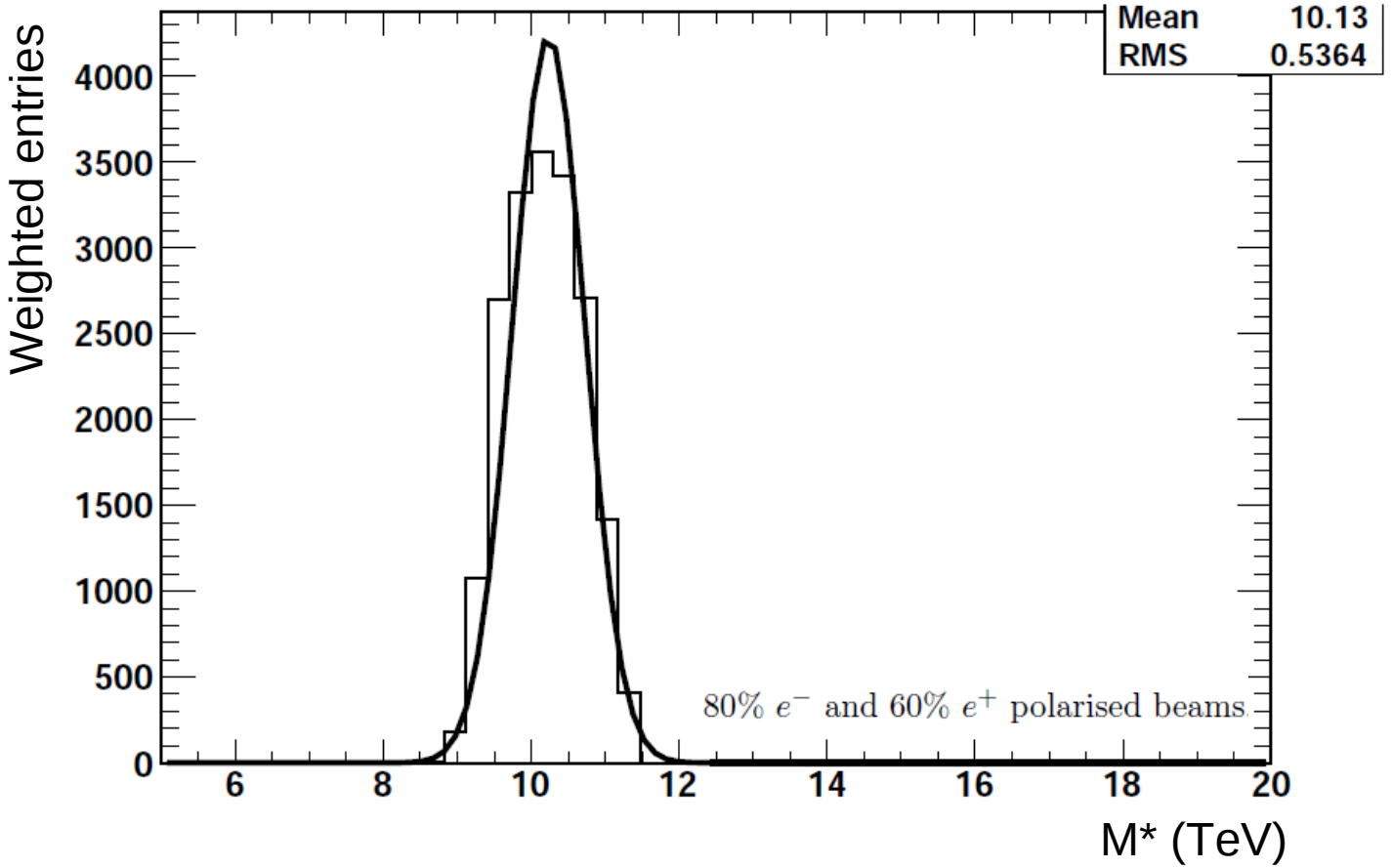


Sensitivity through EW Fits at 3 TeV vs integrated luminosity



Sensitivity to Mass scale in ECHM Model through EW Fits at 3 TeV 2 ab^{-1}

Assume 1 specific parameter set,
Scan over 3-parameter phase space,
Impose compatibility withEW observables of assumed point within exp. accuracy,
Plot pdf of M* with entries weighted by prob obtained in the scan:



Assumed M* = 10 TeV
Reconstructed M* = (10.1 +/- 0.5) TeV