TGCs sensitivities at 100 TeV from WW

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QCD, EW and tools at 100 TeV
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TGCs vs EFT approach

EFT approach

$$\mathcal{L} = \mathcal{L}_{SM} + \sum_i \frac{c_i}{\Lambda^2}\mathcal{O}_i + \cdots$$

$$V = \gamma, Z; W^{\pm}_{\mu\nu} = \partial_\mu W^{\pm}_\nu - \partial_\nu W^{\pm}_\mu, V_{\mu\nu} = \partial_\mu V_\nu - \partial_\nu V_\mu$$

$$\begin{aligned} \mathcal{O}_{WWW} &= \mathrm{Tr}[W_{\mu\nu}W^{\nu\rho}W^{\mu}_{\rho}] \\ \mathcal{O}_W &= (D_\mu\Phi)^\dagger W^{\mu\nu}(D_\nu\Phi) \\ \mathcal{O}_B &= (D_\mu\Phi)^\dagger B^{\mu\nu}(D_\nu\Phi) \end{aligned}$$

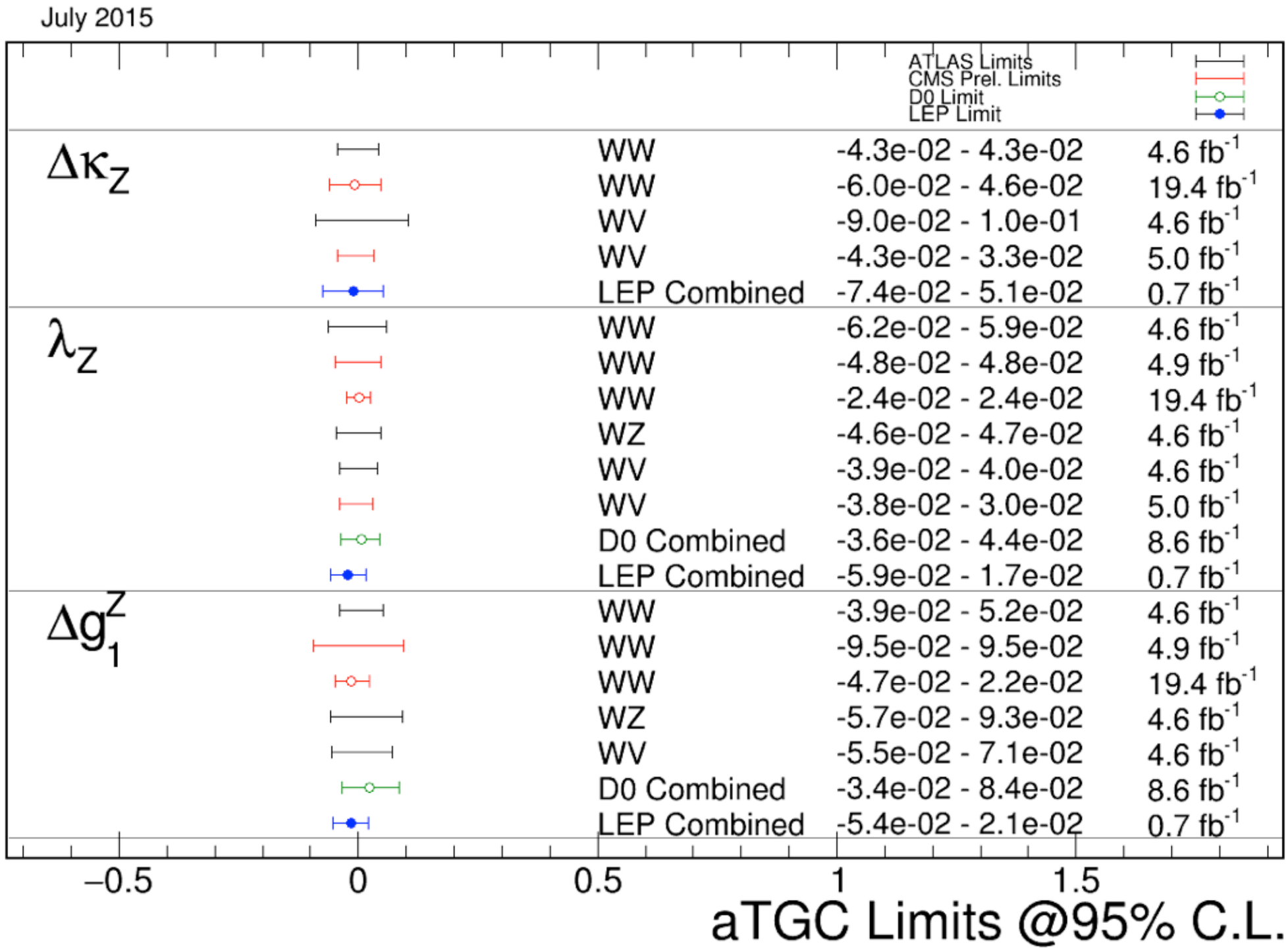
Anomalous TGCs

$$\mathcal{L} = ig_{WWV}\left(g_1^V(W^+_{\mu\nu}W^{-\mu} - W^{+\mu}W^-_{\mu\nu})V^\nu + \kappa_V W^+_\mu W^-_\nu V^{\mu\nu} + \frac{\lambda_V}{M_W^2}W^{\nu+}_\mu W^{-\rho}_\nu V^\mu_\rho\right)$$

Can be related via

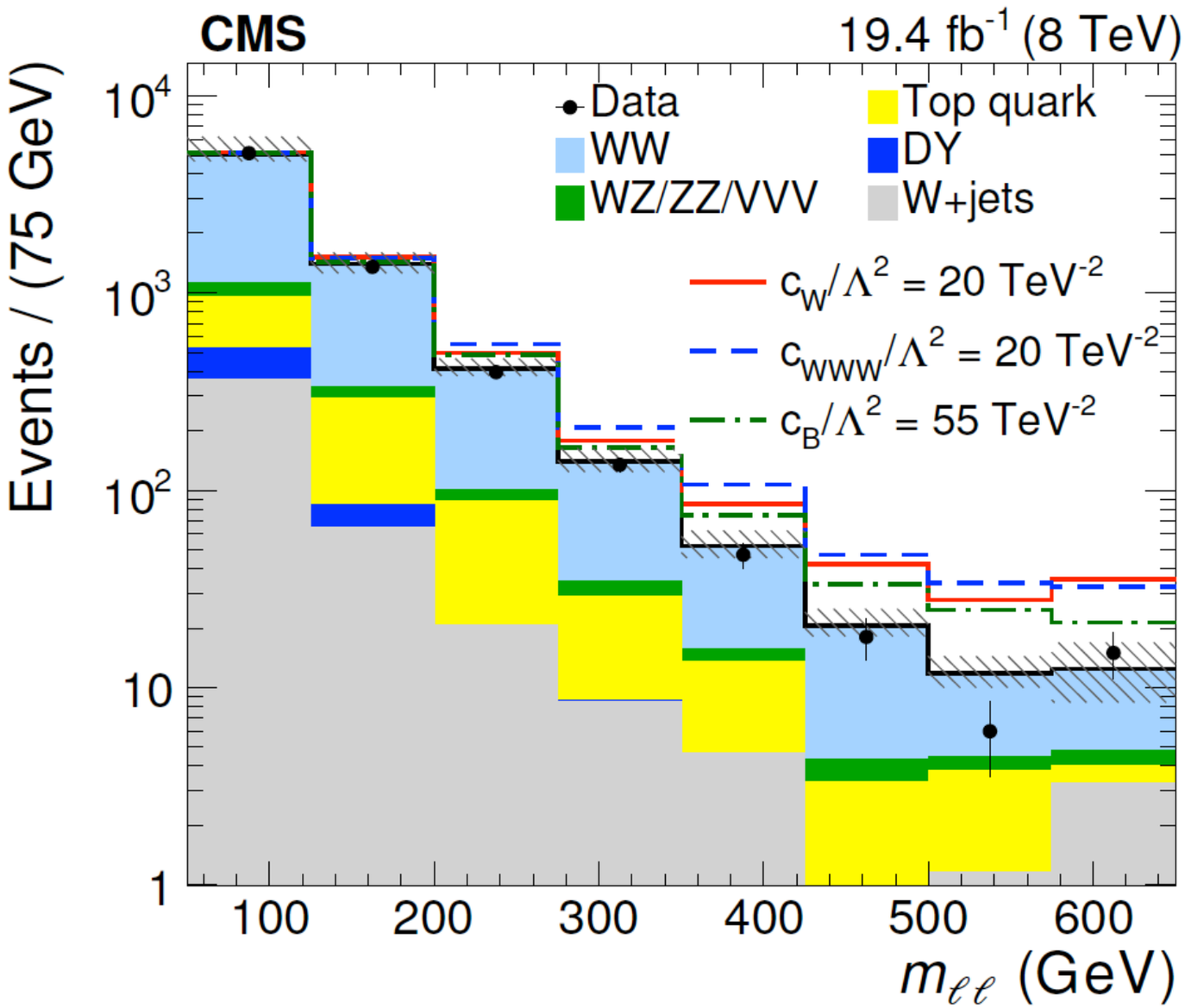
$$\begin{aligned} g_1^Z &= 1 + c_W\frac{m_Z^2}{2\Lambda^2} \\ \kappa_\gamma &= 1 + (c_W + c_B)\frac{m_W^2}{2\Lambda^2} \\ \kappa_Z &= 1 + (c_W - c_B\tan^2\theta_W)\frac{m_W^2}{2\Lambda^2} \\ \lambda_\gamma &= \lambda_Z = c_{WWW}\frac{3g^2m_W^2}{2\Lambda^2} \end{aligned}$$

Current bounds



Current CMS bounds from WW

CMS 1507.03268



The corresponding 95% confidence level intervals are $-5.7 < c_{WWW}/\Lambda^2 < 5.9\,\text{TeV}^{-2}$, $-11.4 < c_W/\Lambda^2 < 5.4\,\text{TeV}^{-2}$, $-29.2 < c_B/\Lambda^2 < 23.9\,\text{TeV}^{-2}$, in the HISZ basis.

Our very preliminary 100 TeV study

Look at pp → WW at NLO (LHE event level) with in the following setup

Lepton cuts: $p_{t,l} > 20GeV \quad |\eta_l| < 2.5$

Jet veto (to reduce top background): $p_{t,j} < 30GeV$

PDFs: NNPDF30_nlo_as_0118

Start with three cases

$$\frac{c_W}{\Lambda^2} = 0.1\,TeV^{-2}$$

$$g_1^Z \sim 4 \cdot 10^{-4}$$

$$\kappa_\gamma = \kappa_Z \sim 3 \cdot 10^{-4}$$

$$\frac{c_B}{\Lambda^2} = 0.3\,TeV^{-2}$$

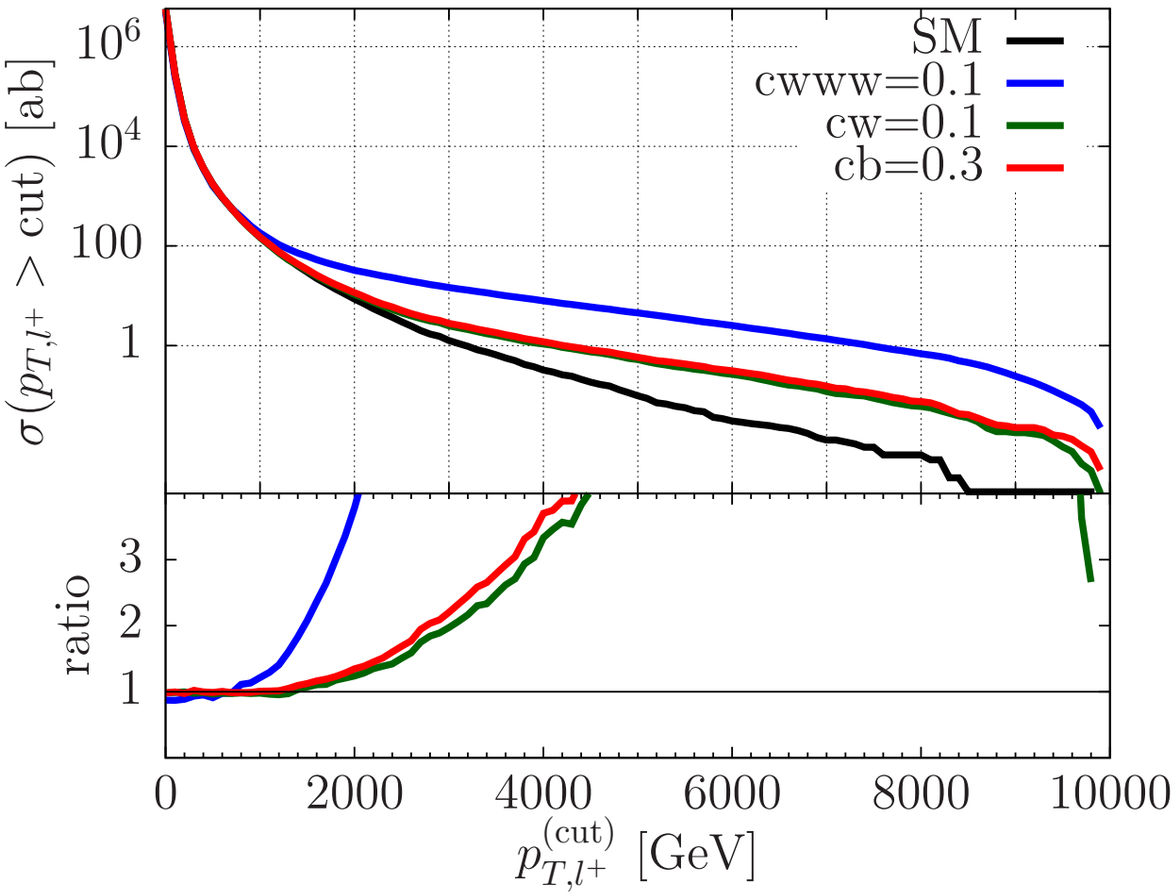
$$\kappa_\gamma \sim 9 \cdot 10^{-4}$$

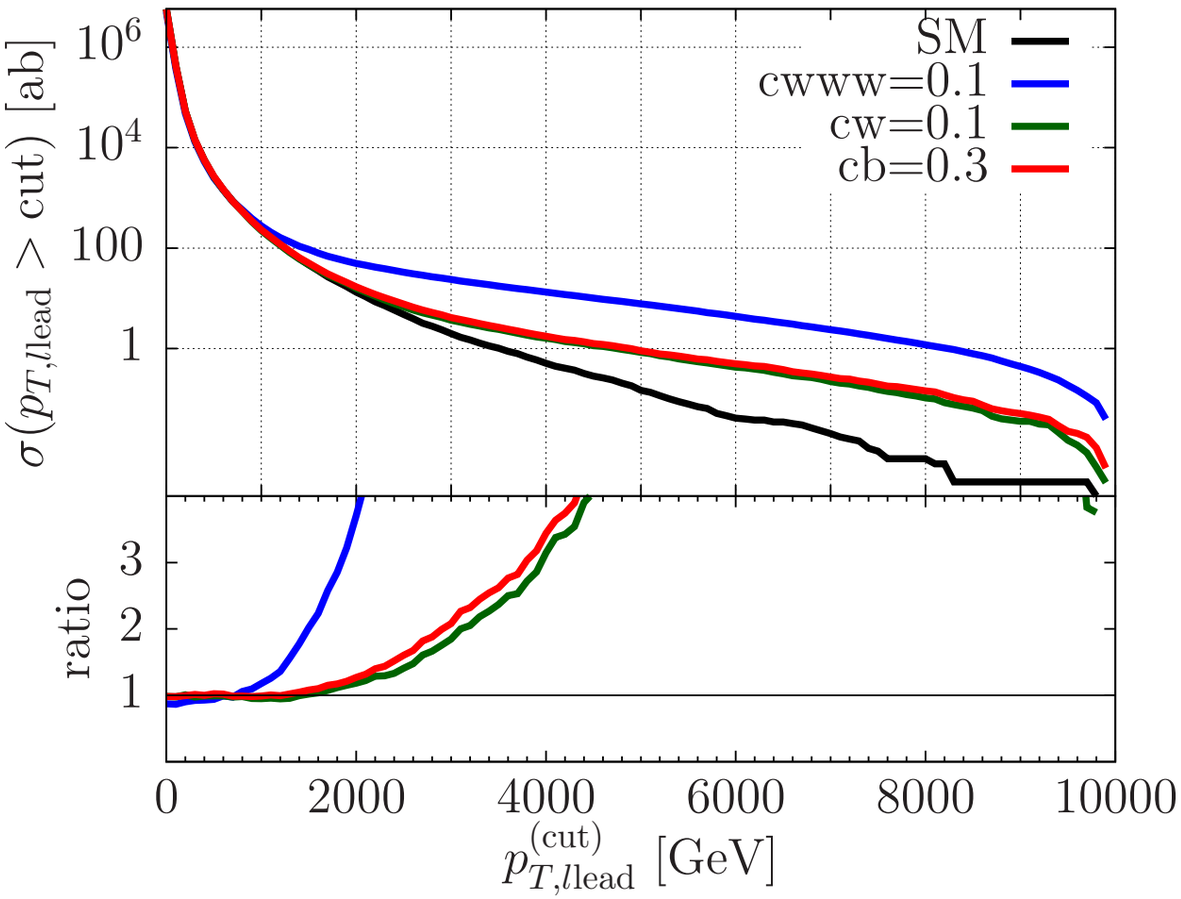
$$\kappa_Z \sim -3 \cdot 10^{-4}$$

$$\frac{c_{WWW}}{\Lambda^2} = 0.1\,TeV^{-2}$$

$$\lambda_\gamma = \lambda_Z \sim 4 \cdot 10^{-4}$$

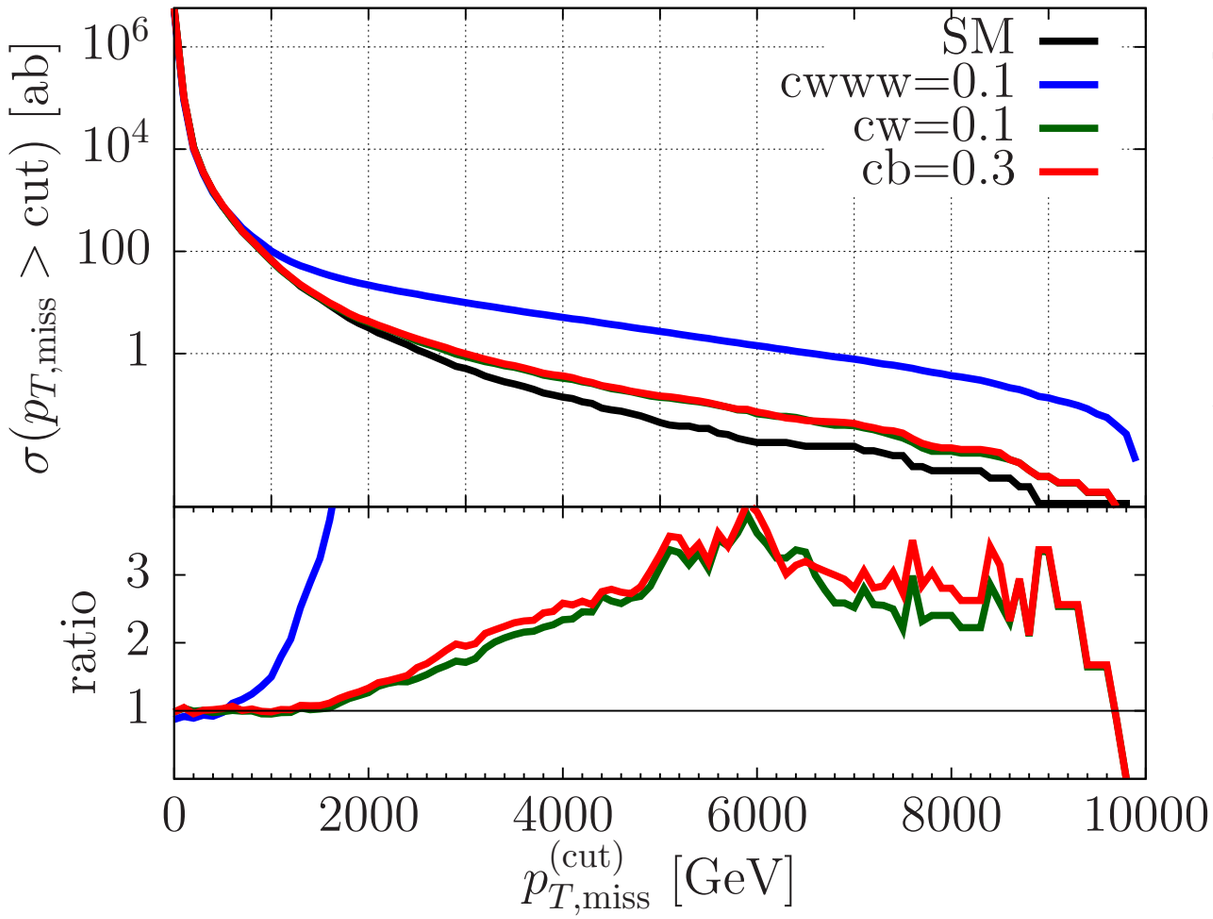
Integrated distributions

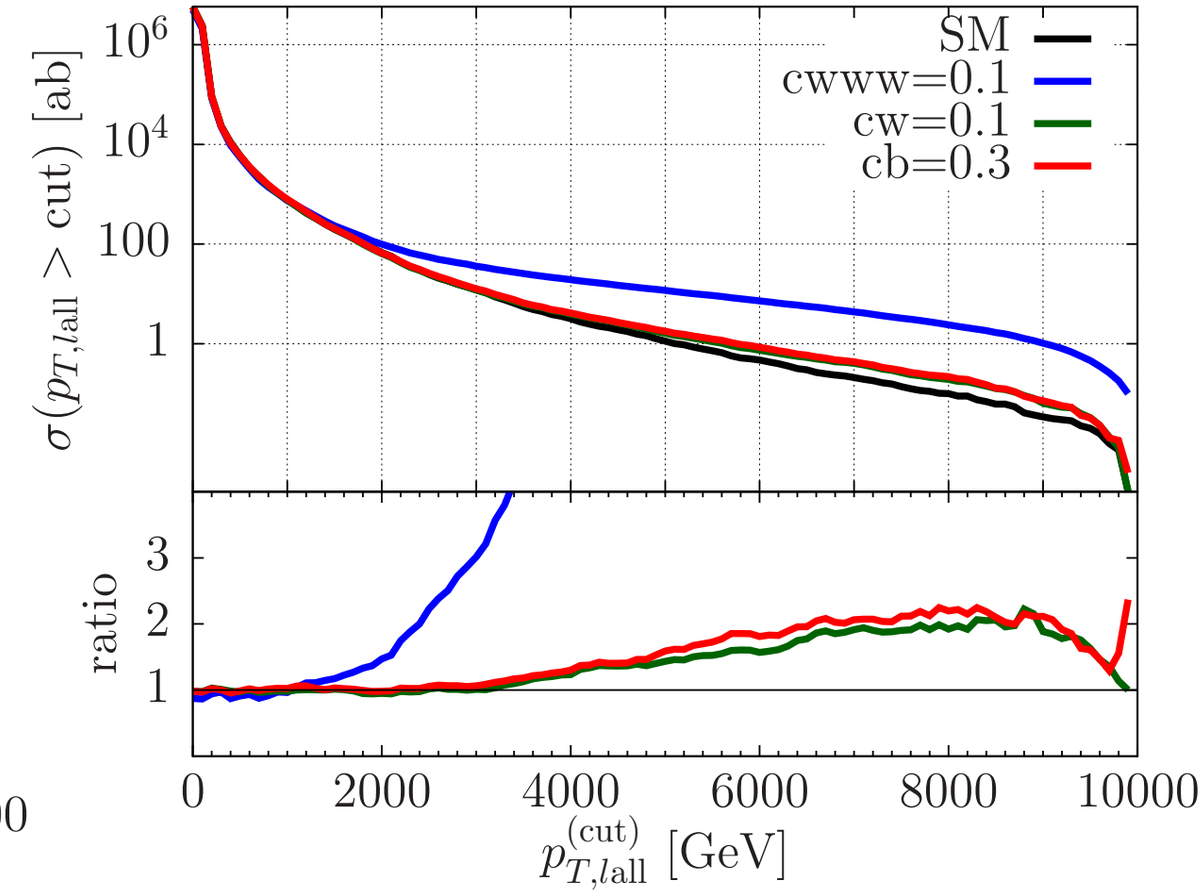




Look at integrated rates. Shown number of events assuming one ab^{-1} of integrated luminosity

Integrated distributions





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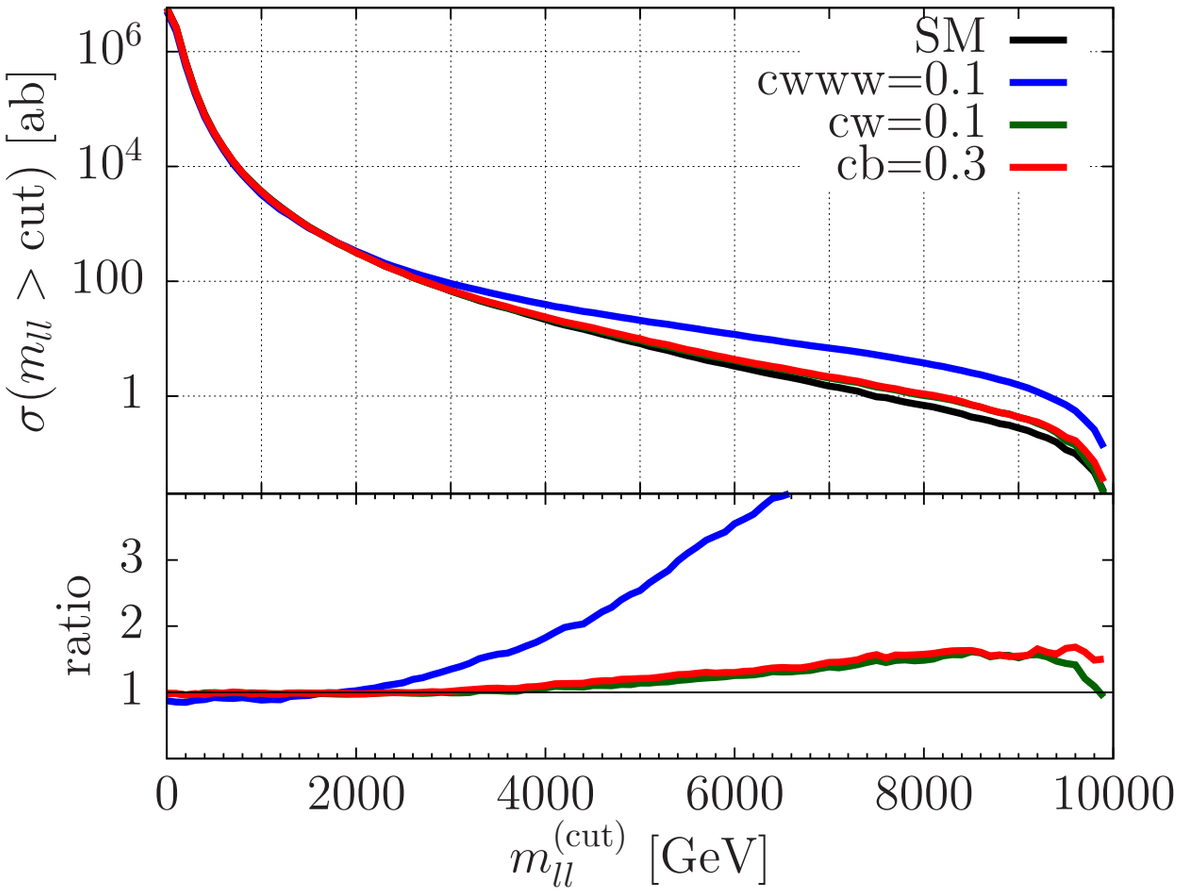

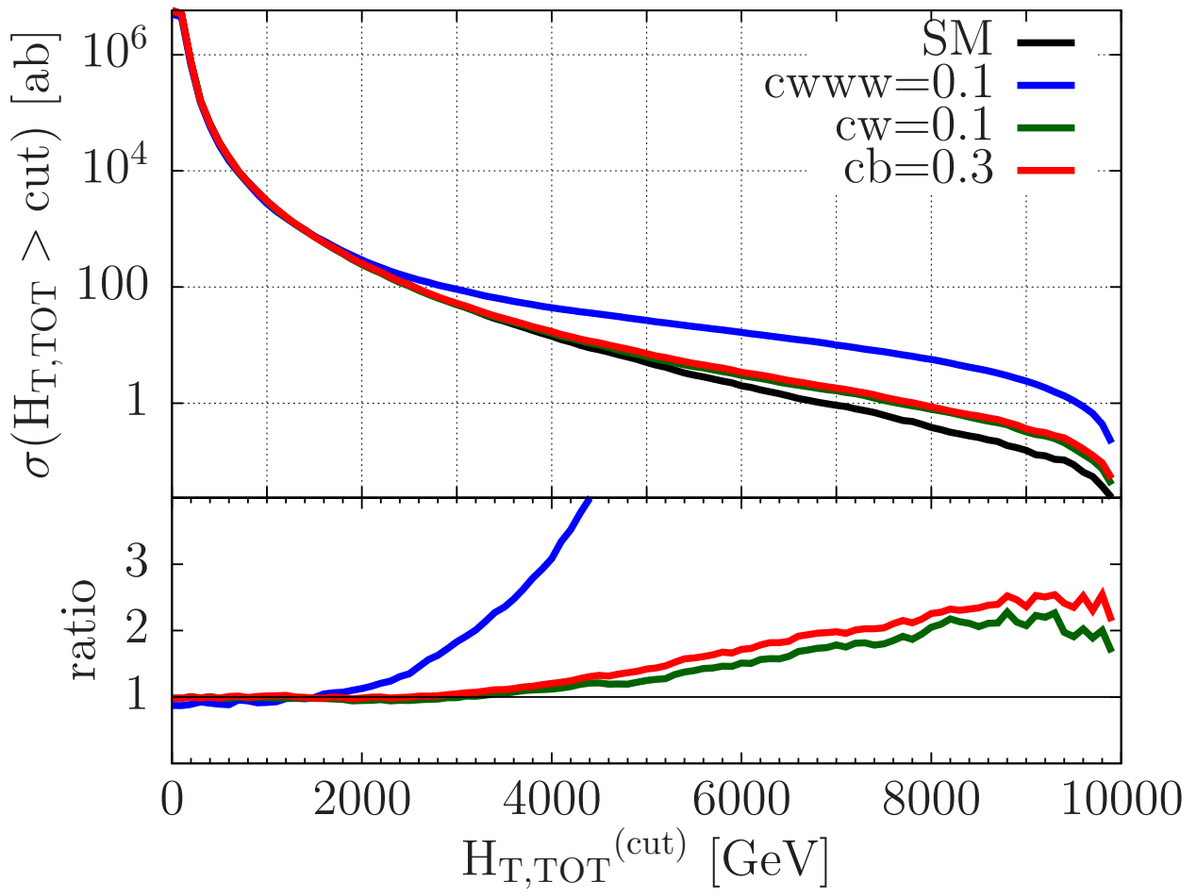

Look at integrated rates. Shown number of events assuming one ab^{-1} of integrated luminosity

Prospects

- Look at accessible limit for c_{WWW}. What is the lowest value for which you see one event per ab^{-1}?
- Is our jet-veto sufficient to get rid of backgrounds?
- For O_W and O_B, does the dominant contribution come from terms with derivatives of the Higgs field?
- Look at other processes ($WZ, W\gamma$, ...). Any volunteer?

Other benchmark results

hep-ph/0204087

Coupling	14 TeV $100\ \text{fb}^{-1}$	14 TeV $1000\ \text{fb}^{-1}$	28 TeV $100\ \text{fb}^{-1}$	28 TeV $1000\ \text{fb}^{-1}$	LC $500\ \text{fb}^{-1}$, 500 GeV
λ_γ	0.0014	0.0006	0.0008	0.0002	0.0014
λ_Z	0.0028	0.0018	0.0023	0.009	0.0013
$\Delta\kappa_\gamma$	0.034	0.020	0.027	0.013	0.0010
$\Delta\kappa_Z$	0.040	0.034	0.036	0.013	0.0016
g_1^Z	0.0038	0.0024	0.0023	0.0007	0.0050