Top 2011 highlights:

that is, interesting work for 2012

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About 2011 LHC results

Betting on your favourite numbers doesn't guarantee to win the prize

There were no compelling reasons —apart from optimism— to expect NP in the first half of 2011

We have no right to be pessimistic

Top 2011 *non*-discoveries

1. No top partners up to $\sim$ 500 GeV

   We didn't expect them lighter, except people working on 4^{th} family

2. No top anomalous couplings. Mixing SM-like

   Large deviations not expected since new quarks not seen

3. No resonant $t\bar{t}$ production.

   We had some hopes ...

4. No clue about the FB asymmetry

   Not so sad, NP still possible

An all-time classic: V_{tb}

Unofficial combination from single top @ Tevatron & LHC

CDF + D0	$V_{tb} = 0.88 \pm 0.07$	0908.2171
CMS	$V_{tb} = 1.14 \pm 0.22$	1106.3052
CMS	$V_{tb} \simeq 1.18^{+0.25}_{-0.17}$	from ATLAS-CONF-2011-101
average	$V_{tb} = 0.94 \pm 0.062$	

Not a striking deviation but still room for new physics

☞ Given the 'tension' in other fields, we should be very happy with this

$V_{tb} \sim 0.98$ expected for top partners with $M = 1$ TeV

An old idea: probing top mixing at ILC

$$\mathcal{L}_{W t_L b_L} = -\frac{g}{\sqrt{2}}\,\bar{b}_L\,\gamma^\mu\,V_L\,t_L\,W^-_\mu \qquad V_L = V_{tb} + C_{\phi q}^{(3,3+3)}\,\frac{v^2}{\Lambda^2}$$

$$\mathcal{L}_{Z t_L t_L} = -\frac{g}{2c_W}\,\bar{t}_L\,\gamma^\mu\,X^L_{tt}\,t_L\,Z_\mu \qquad X^L_{tt} = 1 + \left[C_{\phi q}^{(3,3+3)} - C_{\phi q}^{(1,3+3)}\right]\frac{v^2}{\Lambda^2}$$

$$\mathcal{L}_{Z b_L b_L} = -\frac{g}{2c_W}\,\bar{b}_L\,\gamma^\mu\,X^L_{bb}\,b_L\,Z_\mu \qquad X^L_{bb} = -1 + \left[C_{\phi q}^{(3,3+3)} + C_{\phi q}^{(1,3+3)}\right]\frac{v^2}{\Lambda^2}$$

Águila, Pérez-Victoria, Santiago, hep-ph/0007160, 0007316

JAAS 0811.3842

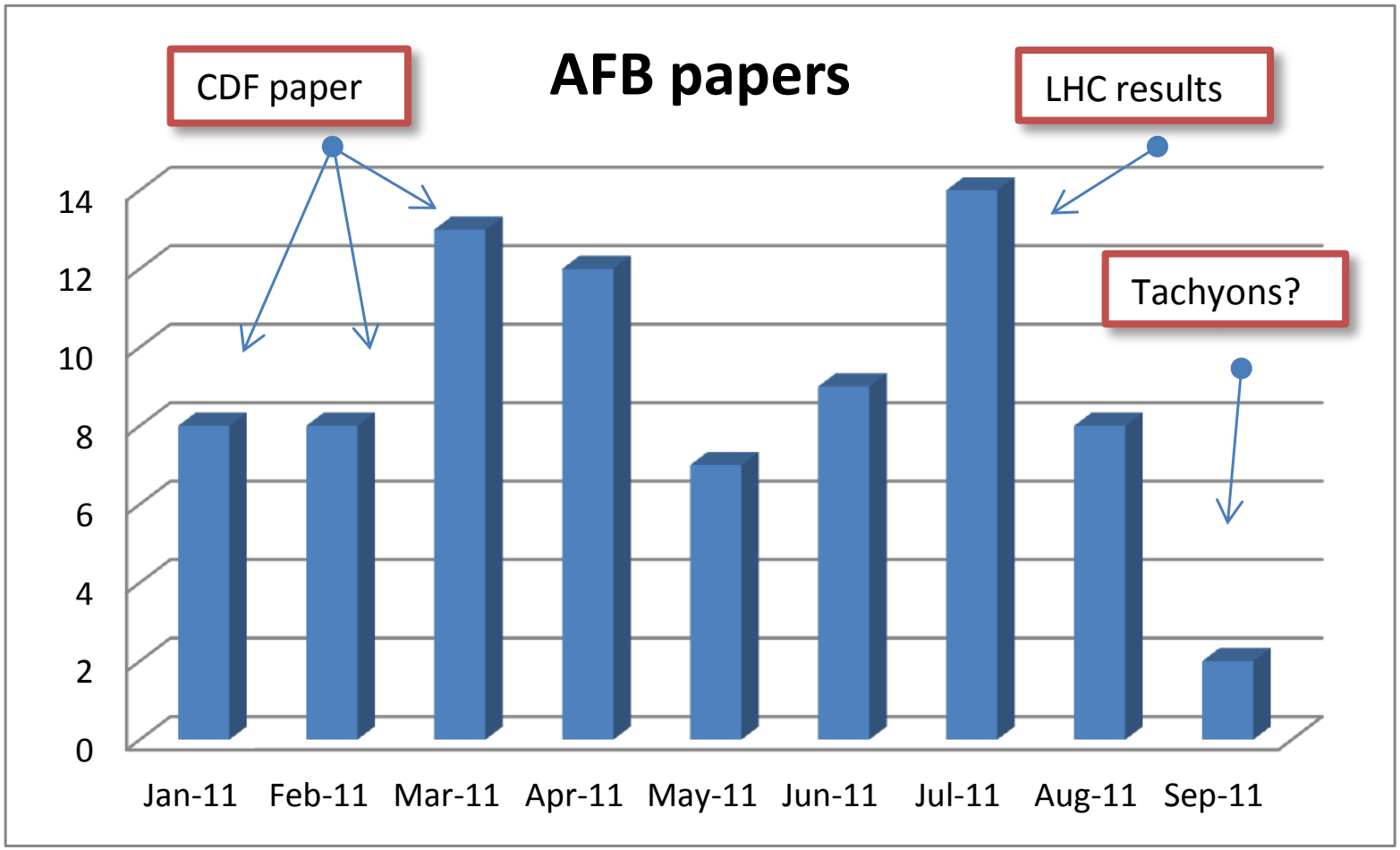
We know from LEP that $\delta(Zbb) \simeq 0$ ➙ $\delta(Ztt) = 2\,\delta(Wtb)$!

LHC *Wtb* measured with 5% accuracy

ILC *Ztt* measured with 2% accuracy

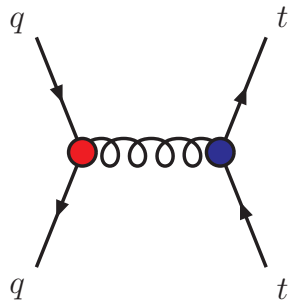
➙ ILC probes top mixing with 5× better precision!

2011 starring anomaly (for the moment): A_{FB}



☞ Granada: 2 groups with 9.9% of these

Most popular models . . .

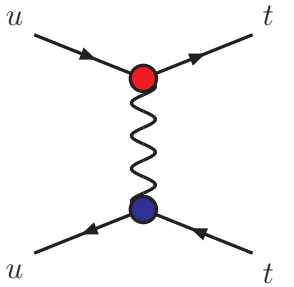


s channel:

$\mathcal{G}_\mu \sim (8,1)_0$

0809.3354 , 0906.0604 , 0911.2955 , 1007.0243 , 1011.6380 , 1011.6557 , 1101.2902 , 1101.5203 , 1103.0956 1104.1917 , 1105.3158 , 1105.3333 , 1106.0529 , 1106.4054 , 1107.0978 , 1107.1473 , 1107.2120 , 1107.5769 , 1109.0648

t channel:



$Z' \sim (1,1)_0$

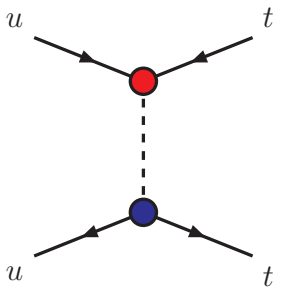
0907.4112 , 1101.4456 , 1101.5625 , 1102.0545 , 1103.1266 1103.4835 , 1104.1385 , 1104.3139 , 1106.5982 , 1108.0350 , 1108.1802

$W' \sim (1,1)_1$

0908.2589 , 1002.1048 , 1003.3461 , 1101.1445 , 1101.5392 , 1102.0279 1104.0083 , 1105.4606

$\phi \sim (1,2)_{-\frac{1}{2}}$

1104.4782 , 1107.0841 , 1107.4350 , 1108.4005



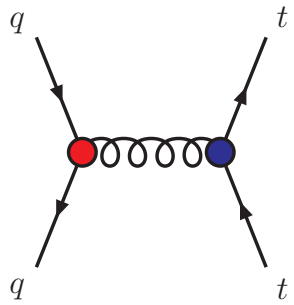
u channel:

$\omega^4 \sim (3,1)_{-\frac{4}{3}}$

$\Omega^4 \sim (\bar{6},1)_{-\frac{4}{3}}$

0911.3237 , 0911.4875 , 0912.0972 , 1007.2604 , 1102.3374 , 1102.4736 , 1103.2757 , 1108.4027

Most popular models . . . after 2011 LHC data



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$t\bar{t}$ tail $\sim$ SM

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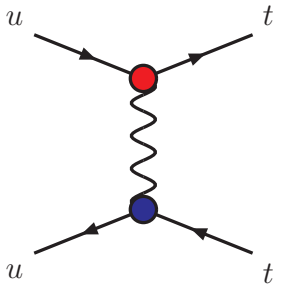
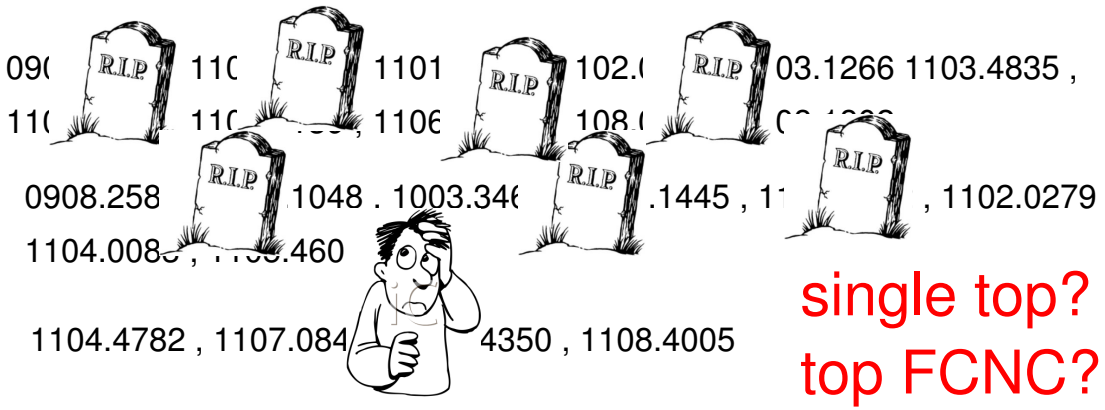


$Z' \sim (1,1)_0$

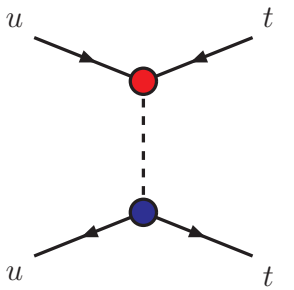
$W' \sim (1,1)_1$

$\phi \sim (1,2)_{-\frac{1}{2}}$

$A_C = -0.016$ (CMS), -0.024 (ATLAS)



single top?
top FCNC?



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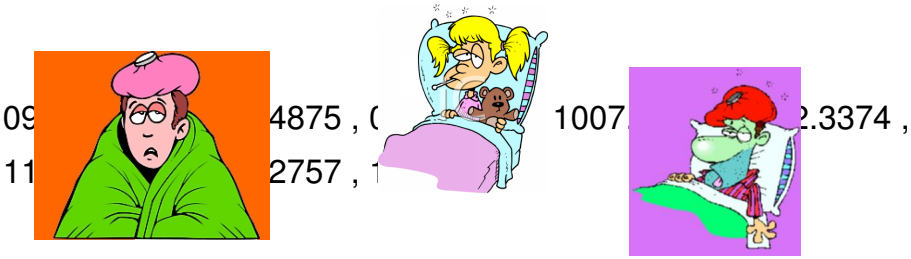


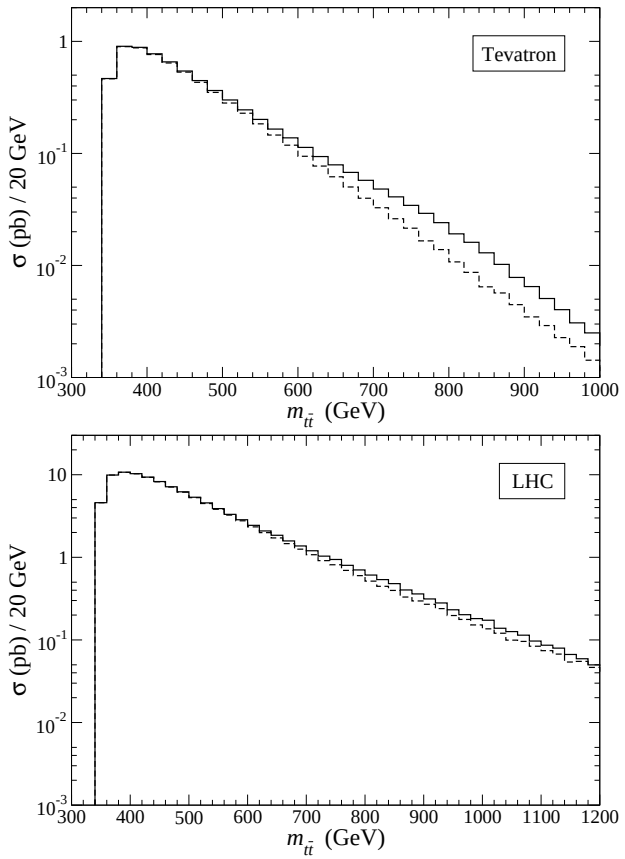
New trends: Models without a large $t\bar{t}$ tail

Example: "light" gluons with masses $M \lesssim 1$ TeV

Barceló et al. 1106.4054, Tavares & Schmaltz 1107.0978

Álvarez et al. 1107.1473, JAAS & Pérez-Victoria 1107.2120

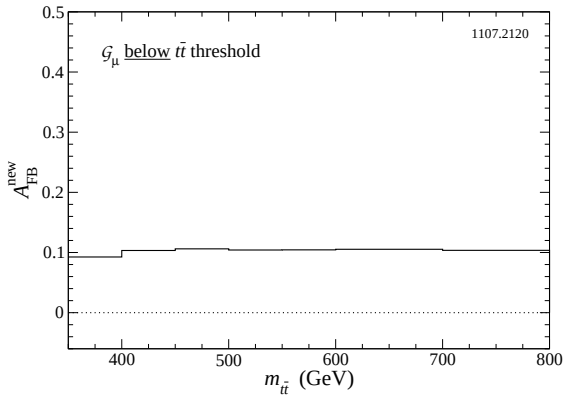
- invisible at Tevatron if very wide
- even more at LHC (*gg* fusion)
- diverse A_{FB} profiles vs $m_{t\bar{t}}$ possible: can reproduce either CDF or D0



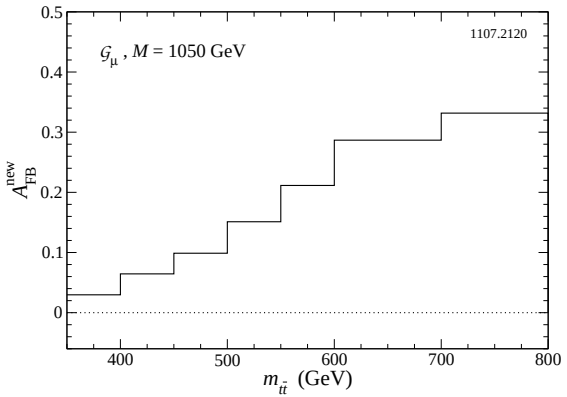
A_{FB} profiles: from D0's flat to CDF's camel

Sustainable model

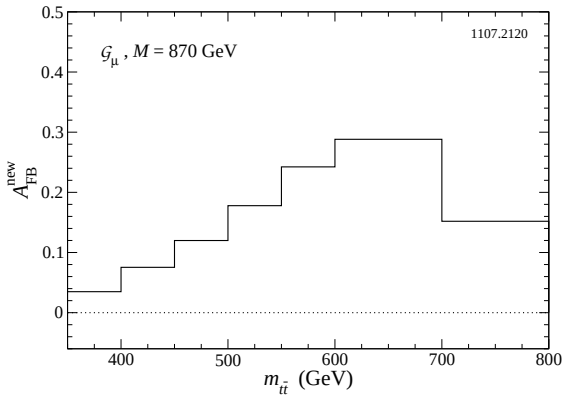
flat



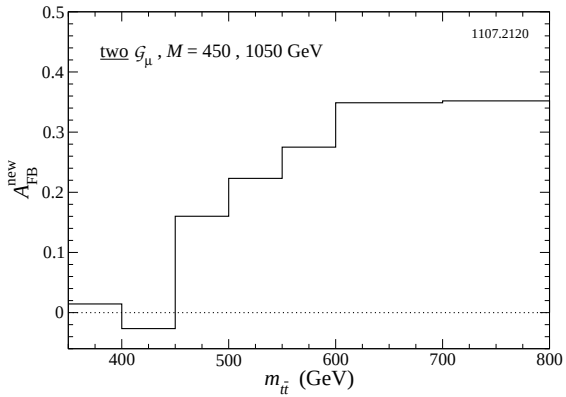
rising



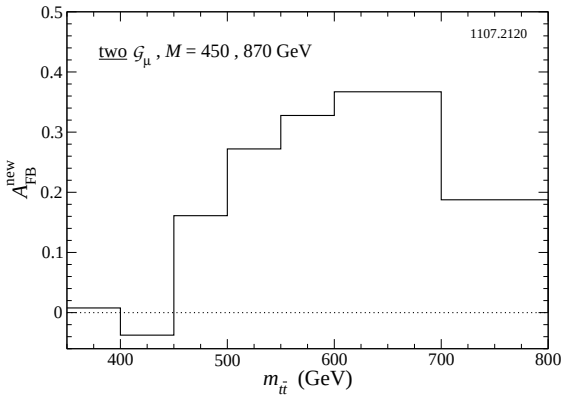
hill



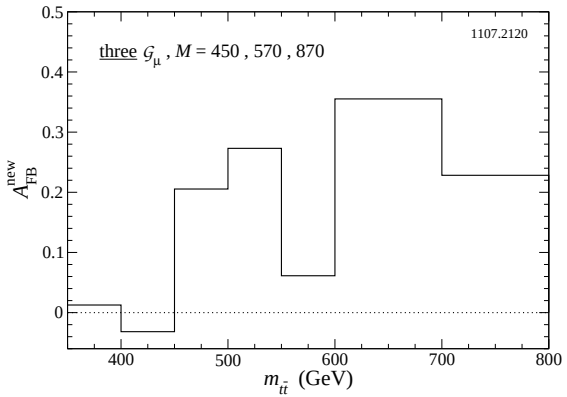
dip-rising



dip-hill



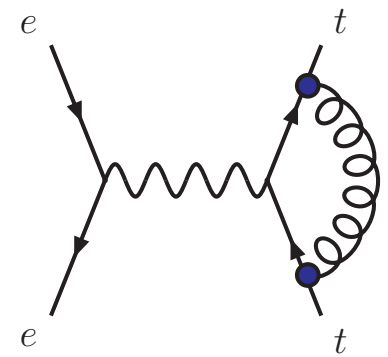
camel



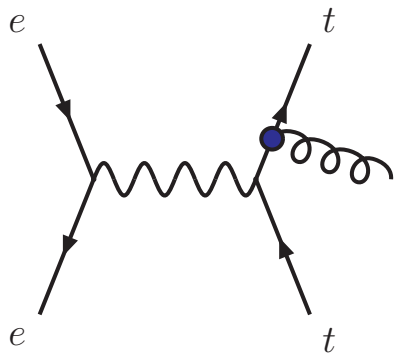
Flat profile: the candidate

Flat profile is in agreement with D0 & CMS and will survive LHC

Gluon $\mathcal{G}_\mu$ with $M \sim 300$ GeV, large coupling to top: candidate for ILC



$t\bar{t}$ at threshold or at 500 GeV



$t\bar{t}\mathcal{G}_\mu$ at 1 TeV

So, what?

- This was not an extensive summary. It only covers the aspects of top physics I find most interesting and relevant for ILC
- In particular, the FB asymmetry has been the starring anomaly of 2011 with 81 papers and even more citations to the CDF result
- Even for this ‘hadronic’ process, ILC might have a word, especially if nothing is seen at LHC but the anomaly persists at Tevatron
- Anyone interested? We are open to collaboration