

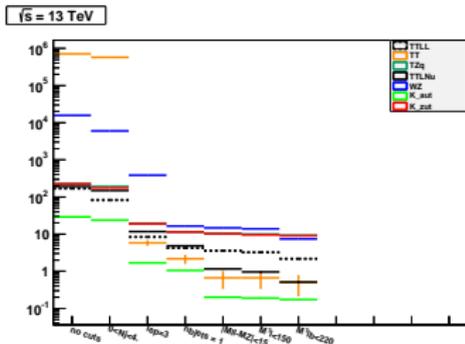
$TZ \rightarrow 3\ell @ \mathcal{L} = 100 \text{ fb}^{-1}$

$$K_{tZu} \simeq 2 \cdot 10^{-4} \text{ (the best limit)}$$

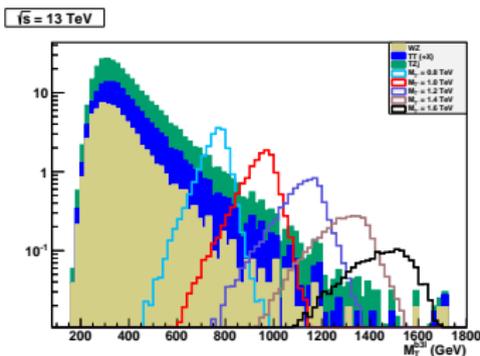
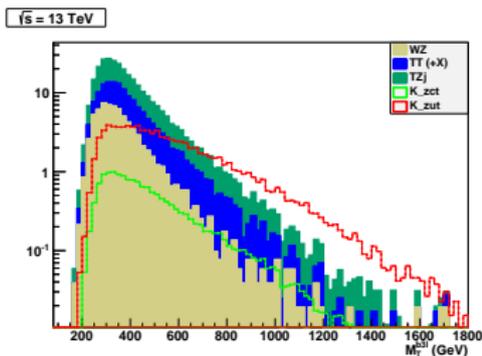
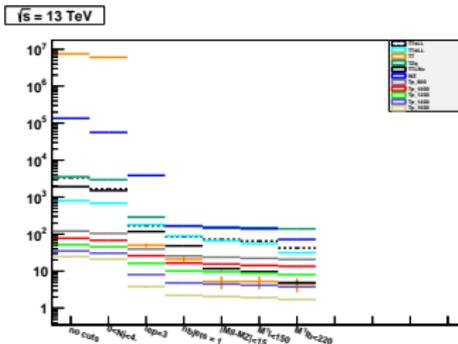
- $p_\ell^T > 20 \text{ GeV}$, $p_j^T > 40 \text{ GeV}$, CVSM b-tagging
- isolation: CONE03 with threshold = 0.1 (kills $t\bar{t}$ and DY)
- $N_b \equiv 1$, $1 \leq N_J \leq 3$ ($J = \text{light and b jets}$)
- Z candidate as pair of $e^+e^- (\mu^+\mu^-)$ closest to M_Z
- W and top mass reconstructed with transverse mass (sharper)
- Cuts optimised with Kevin's macro
 - $|M_{\ell^+\ell^-} - 91| < 15 \text{ GeV}$
 - $10 < M_{\ell_3}^T < 150$
 - $M_{b\ell_3}^T < 220$
- Attempt to use TMVA (BDT)

CutFlows

(Left) FCNC



(Right) T'



CutFlows table for T'

Background	no cuts	$1 \leq n_J \leq 3$	$n_\ell \equiv 3$	$n_b \equiv 1$
$t\bar{t}(+X)$	$7.5 \cdot 10^6$ (100%)	$6.1 \cdot 10^6$ (81.2%)	514.9 (0.09%)	243.8 (47.3%)
tZj	3521 (100%)	2953 (83.9%)	290.6 (9.8%)	170.0 (58.5%)
WZ	$1.4 \cdot 10^5$ (100%)	$5.7 \cdot 10^4$ (41.9%)	3883 (6.9%)	164.3 (4.2%)
Total	$7.6 \cdot 10^6$ (100%)	$6.1 \cdot 10^6$ (80.5%)	4689 (0.08%)	578.0 (12.3%)

$M_{T'}$ (GeV)	no cuts	$1 \leq n_J \leq 3$	$n_\ell \equiv 3$	$n_b \equiv 1$
800	119.7 (100%)	105.0 (87.8%)	39.3 (37.4%)	25.5 (64.8%)
1000	77.1 (100%)	67.8 (87.9%)	26.0 (38.4%)	16.4 (63.2%)
1200	52.0 (100%)	45.3 (87.2%)	16.1 (35.6%)	10.1 (62.4%)
1400	35.3 (100%)	30.5 (86.6%)	8.0 (26.1%)	4.8 (60.1%)
1600	24.5 (100%)	21.1 (86.0%)	3.8 (18.0%)	2.2 (58.3%)

Background	$n_b \equiv 1$	$ M_{\ell+\ell^-}/\text{GeV} - 91 < 15$	$10 < M_{\ell_3}^T/\text{GeV} < 150$	$M_{b\ell_3}^T/\text{GeV} < 220$
$t\bar{t}(+X)$	243.8 (47.3%)	154.8 (63.5%)	135.1 (87.3%)	83.0 (61.5%)
tZj	170.0 (58.5%)	155.6 (67.2%)	148.7 (95.6%)	139.8 (63.7%)
WZ	164.3 (4.2%)	146.9 (89.4%)	138.2 (94.1%)	71.5 (51.7%)
Total	578.0 (12.3%)	457.2 (79.1%)	422.0 (92.3%)	294.3 (69.8%)

$M_{T'}$ (GeV)	$n_b \equiv 1$	$ M_{\ell+\ell^-} - 91 < 15$ GeV	$10 < M_{\ell_3}^T < 150$	$M_{b\ell_3}^T < 220$
800	25.5 (64.8%)	23.8 (93.6%)	22.2 (93.2%)	20.8 (93.6%)
1000	16.4 (63.2%)	15.4 (93.8%)	14.3 (92.4%)	13.4 (94.0%)
1200	10.1 (62.4%)	9.5 (94.2%)	8.7 (92.3%)	8.1 (92.3%)
1400	4.8 (60.1%)	4.5 (93.5%)	4.1 (92.1%)	3.8 (91.3%)
1600	2.2 (58.3%)	2.1 (93.3%)	1.9 (92.2%)	1.7 (90.0%)

MVA: BDT Variables

Variables for training:

- $M^T(b3\ell)$
- $p^T(\ell_1 + \ell_2)/M^T(b3\ell)$
- $\Delta\varphi(\ell_1, \ell_2)$
- $\Delta\varphi(t, Z)$
- $\Delta R(b, \ell_W)$
- $p_{J_1}^T/M^T(b3\ell)$
- $\Delta\varphi(Z, \cancel{p}^T)$
- $\Delta\eta(Z, \ell_W)$
- $\Delta\eta(b, \ell_W)$
- $\Delta\eta(\ell_1, \ell_2)$
- $\Delta\varphi(Z, \ell_W)$
- $p_{\ell_1}^T/M^T(b3\ell)$
- η_Z
- η_{top}
- $\Delta\eta(t, Z)$
- $\Delta\varphi(b, \ell_W)$
- η_j^{max}

After suitable cut (M_{tZ} or BDT output) to maximise significance:

Analysis		K_{tZu}	K_{tZc}	$M_{T'} = 0.8 \text{ TeV}$	$M_{T'} = 1.0 \text{ TeV}$	$M_{T'} = 1.2 \text{ TeV}$
C&C	S (ev.)	67.9	15.7	17.6	12.3	7.10
	B (ev.)	122.6	287.0	10.4	5.74	2.04
	σ	4.9	0.9	3.33	2.90	2.35
MVA	σ	6.5	1.1	3.40	2.99	2.40

Latest MVA comments

- taking the “ratios” ($p_{\ell_1}^T/M^T(b3\ell)$) removes correlations with $M^T(b3\ell)$
- still large correlations between η_Z , $\Delta\eta(Z, \ell_W)$, and $\Delta\eta(t, Z)$, between $p^T(\ell_1 + \ell_2)/M^T(b3\ell)$ and $p_{\ell_1}^T/M^T(b3\ell)$, between $\Delta\eta(Z, \ell_W)$, $\Delta\eta(t, Z)$, and η_{top} , and between $\Delta\eta(Z, \ell_W)$ and $\Delta\eta(t, Z)$
- η_j^{max} (largest jet rapidity) is very different for FCNC (but not for T')

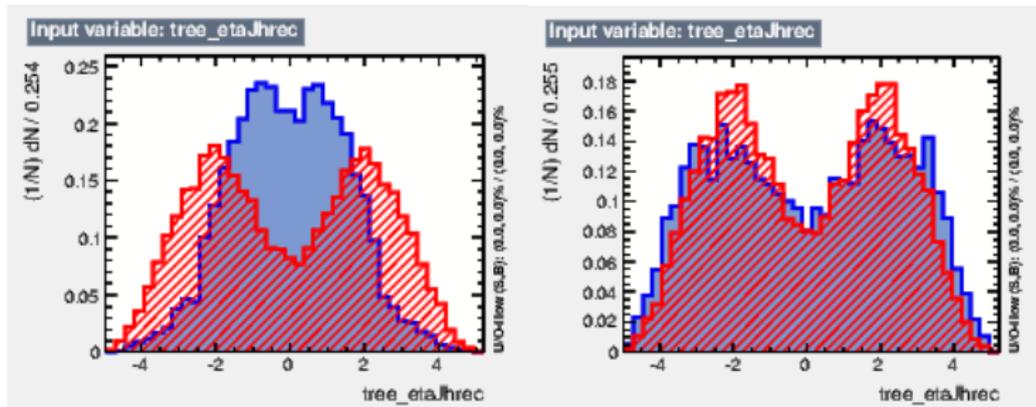


Figure: Red = bkg, blue = signal: FCNC (left) and T' (right)

- MVA gives major improvement for FCNC coupling, not for T'