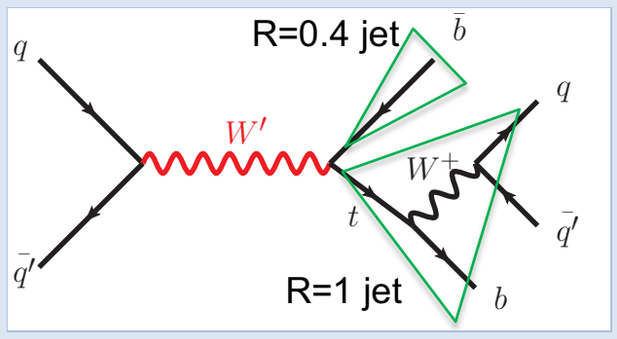
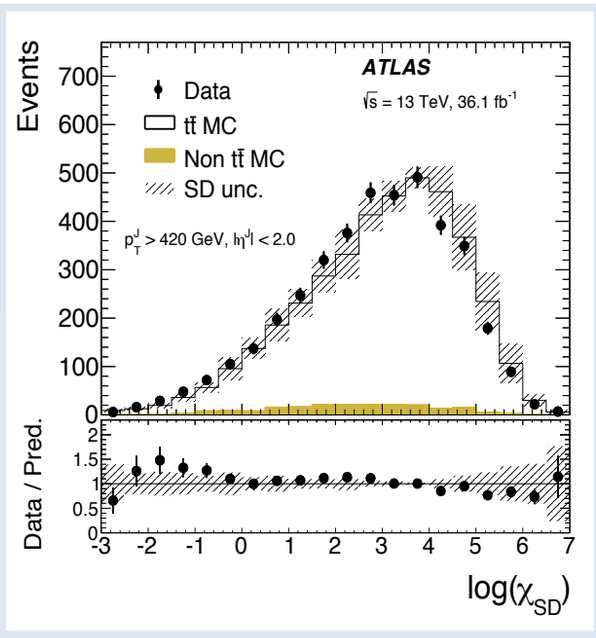
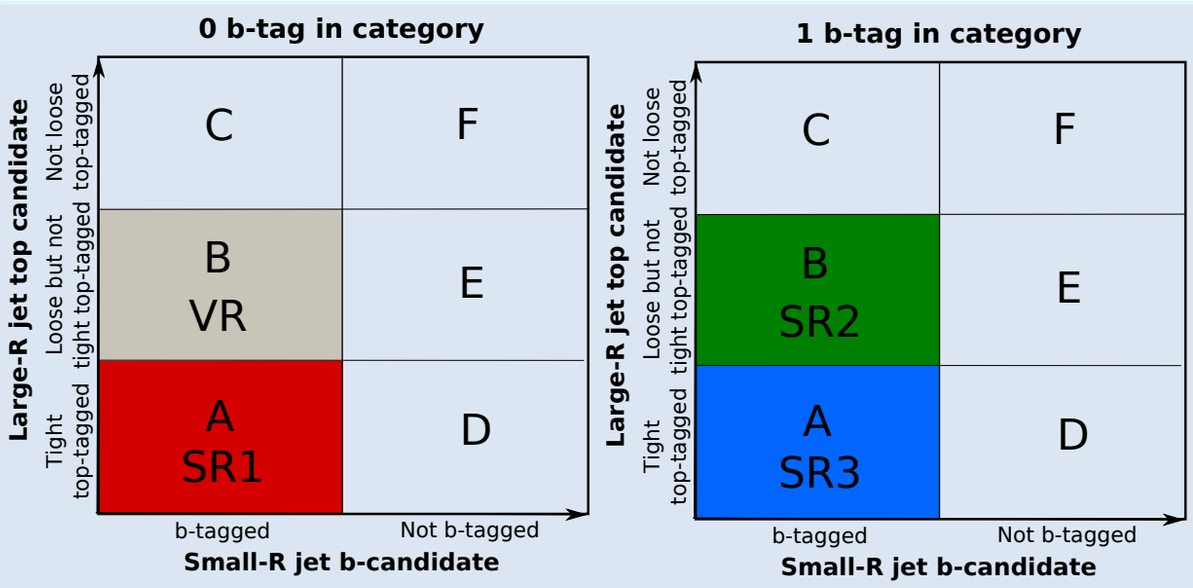
Search for W' to $t\bar{b}$ decays in the all-hadronic final state using the shower deconstruction top tagger in pp collisions at $\sqrt{s}$=13 TeV with the ATLAS detector



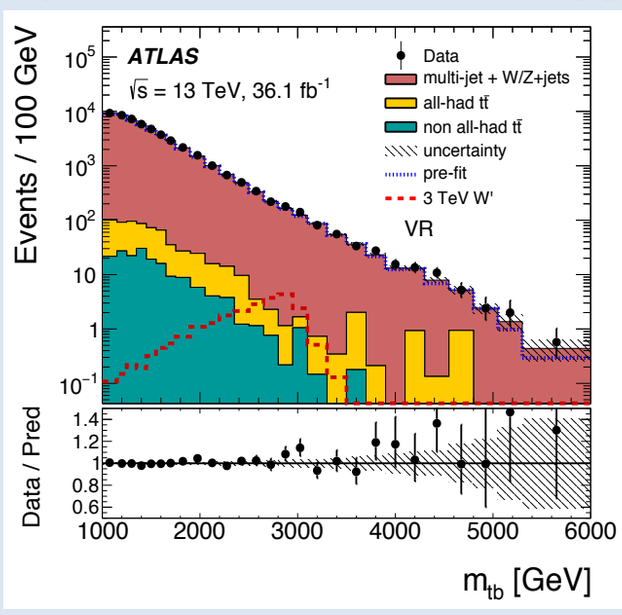


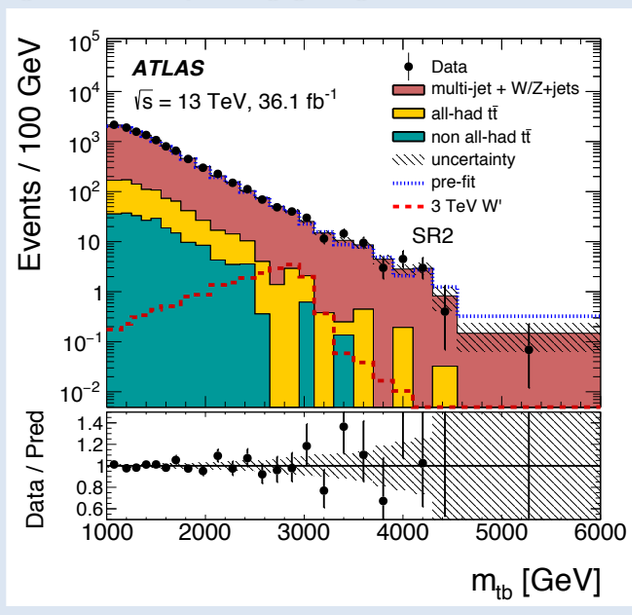
1) W' a mediator of a new charged vector current, can be massive enough to decay into a top quark and a b-quark
2) Extra dimensions, strong dynamics composite Higgs, or the Little Higgs predict new vector charged-current interactions
3) Specially interesting for models in which $m_v > m_{W'}$

Event reconstruction and selection	
Large-R jet (J) R=1	$p_{\mathrm{T}}^{J} > 420$ GeV, $\lvert\eta\rvert < 2.0$
Small-R jet (j) R=0.4	$p_{\mathrm{T}}^{j} > 25$ GeV, $\lvert\eta\rvert < 2.5$
Top-quark jet candidate ($J_{\mathrm{top}}^{\mathrm{cand}}$)	jet J with highest $m_j + 0.15 \times m_J$
b-quark jet candidate (j_b^{cand})	highest-p_{T} jet j with $p_{\mathrm{T}}^{j} > 420$ GeV, $\Delta R(J_{\mathrm{top}}^{\mathrm{cand}}, j) > 2.0$
Lepton veto	zero leptons with $p_{\mathrm{T}} > 25$ GeV, $\lvert\eta\rvert < 2.5$
b-quark jet candidate η	zero j_b^{cand} with $\lvert\eta\rvert > 1.2$
0 b-tag in	zero b-tagged jets j with $\Delta R(J_{\mathrm{top}}^{\mathrm{cand}}, j) < 1.0$
1 b-tag in	exactly one b-tagged jet j with $\Delta R(J_{\mathrm{top}}^{\mathrm{cand}}, j) < 1.0$



Systematics: Background dominated by uncertainties in the 2D sideband method and flavor tagging. Signal dominated by uncertainties in flavor tagging and top tagging





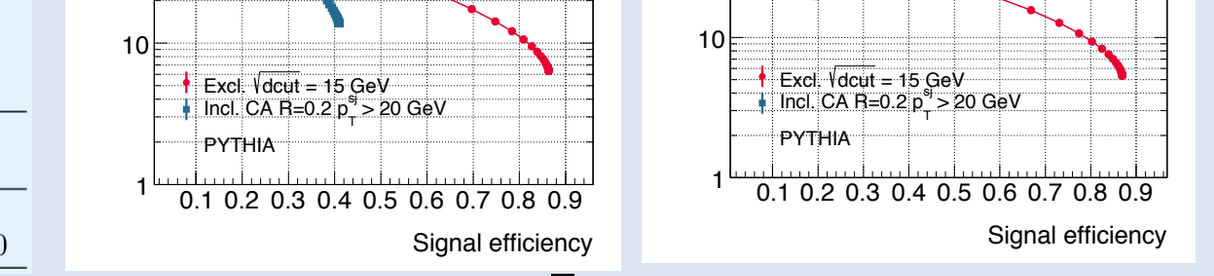
Invariant mass of the top and bottom system, after a binned max-likelihood fit to data

Simultaneous fit performed in three signal regions (SR), VR used for validation of results

Shower deconstruction (SD) algorithm to tag top jets

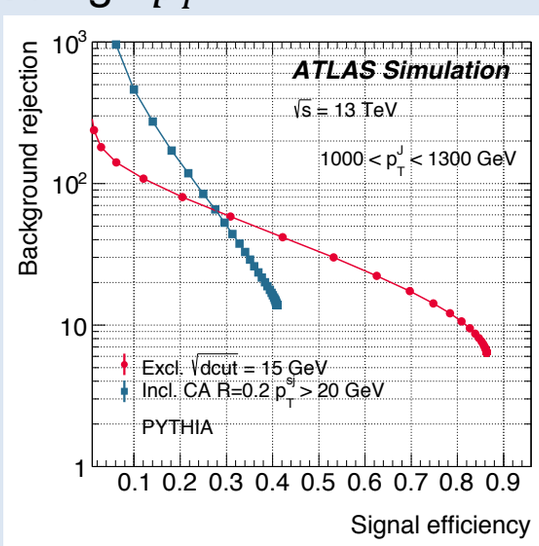
Likelihood χ_{SD} : signal- or background-like event

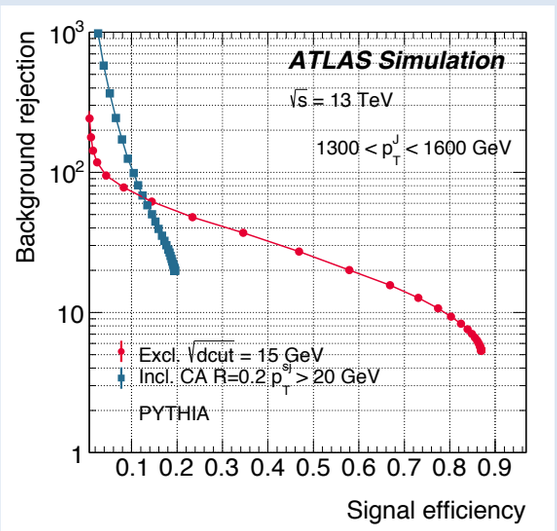
$$\chi_{\mathrm{SD}}(\{p_i^k\}) = \frac{\sum_{\mathrm{perm}}^{\text{max 6 subjets}} P(\{p_i^k\}|\text{top-quark jet})}{\sum_{\mathrm{perm}} P(\{p_i^k\}|\text{gluon/light-quark jet})}$$



Possible shower histories from a top-jet, two among hundreds with high probabilities

Improved SD top tagging performance (red curve) compared to Run 1 (blue curve)
Run 1: R=0.2 CA jets not enough to resolve top decay products at high p_T.
Current: defining exclusive kt subjets performs better at high p_T.

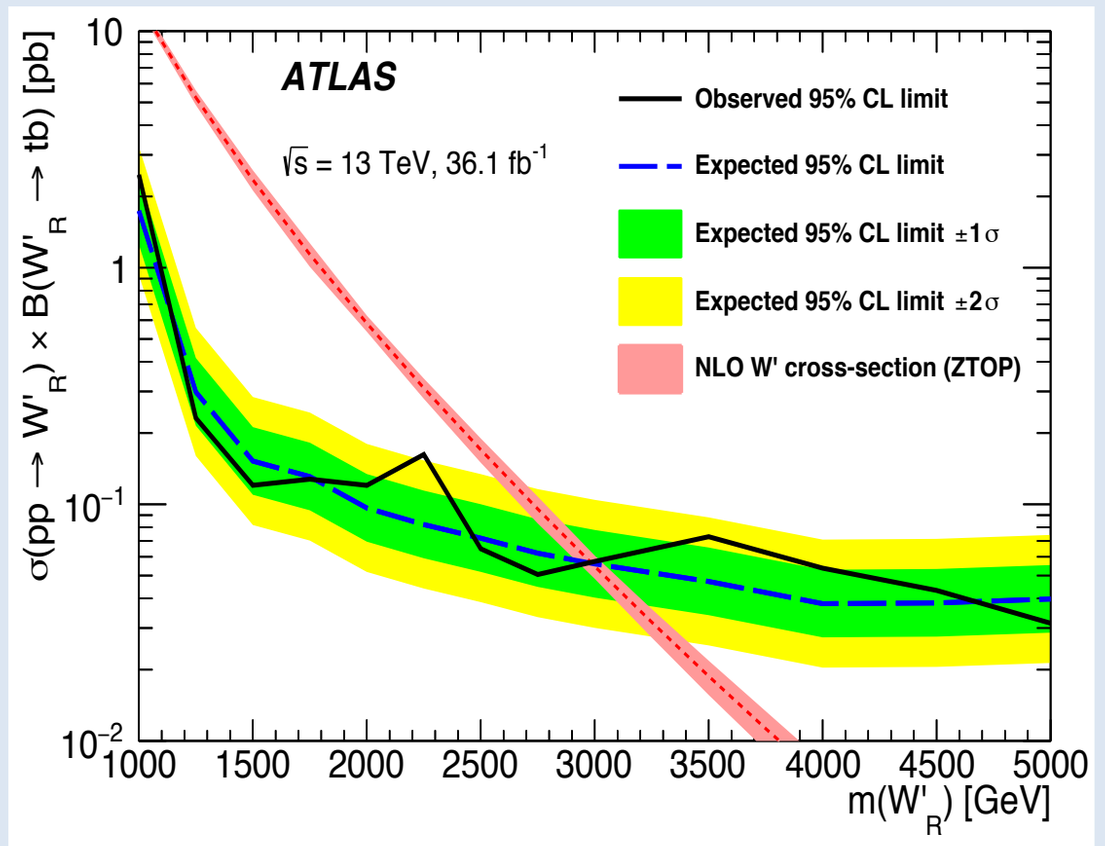




Background: MC for $t\bar{t}$ (4-25%) and 2D sideband method for Multijet (~75-99%)+W/Z+jets (~1%)
$t\bar{t}$ subtracted from regions C,D,E and F for the Multijet estimation

$$N_{\mathrm{A}}^{\mathrm{bkg}} = R_{\mathrm{A}}^{\mathrm{corr}} \cdot \frac{(N_{\mathrm{C}}^{\mathrm{data}} - N_{\mathrm{C}}^{t\bar{t}}) \cdot (N_{\mathrm{D}}^{\mathrm{data}} - N_{\mathrm{D}}^{t\bar{t}})}{N_{\mathrm{F}}^{\mathrm{data}} - N_{\mathrm{F}}^{t\bar{t}}} \text{ and } N_{\mathrm{B}}^{\mathrm{bkg}} = R_{\mathrm{B}}^{\mathrm{corr}} \cdot \frac{(N_{\mathrm{C}}^{\mathrm{data}} - N_{\mathrm{C}}^{t\bar{t}}) \cdot (N_{\mathrm{E}}^{\mathrm{data}} - N_{\mathrm{E}}^{t\bar{t}})}{N_{\mathrm{F}}^{\mathrm{data}} - N_{\mathrm{F}}^{t\bar{t}}}$$

$$R_{\mathrm{A}}^{\mathrm{corr}} = \frac{N_{\mathrm{A}}^{\text{dijet MC}} \cdot N_{\mathrm{F}}^{\text{dijet MC}}}{N_{\mathrm{C}}^{\text{dijet MC}} \cdot N_{\mathrm{D}}^{\text{dijet MC}}} \text{ and } R_{\mathrm{B}}^{\mathrm{corr}} = \frac{N_{\mathrm{B}}^{\text{dijet MC}} \cdot N_{\mathrm{F}}^{\text{dijet MC}}}{N_{\mathrm{C}}^{\text{dijet MC}} \cdot N_{\mathrm{E}}^{\text{dijet MC}}}$$



Observed m(tb) spectrum is consistent with a background-only hypothesis, cross-section limits are set excluding W'R (L) bosons below 3.0 (2.9) TeV (at 95% CL).

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