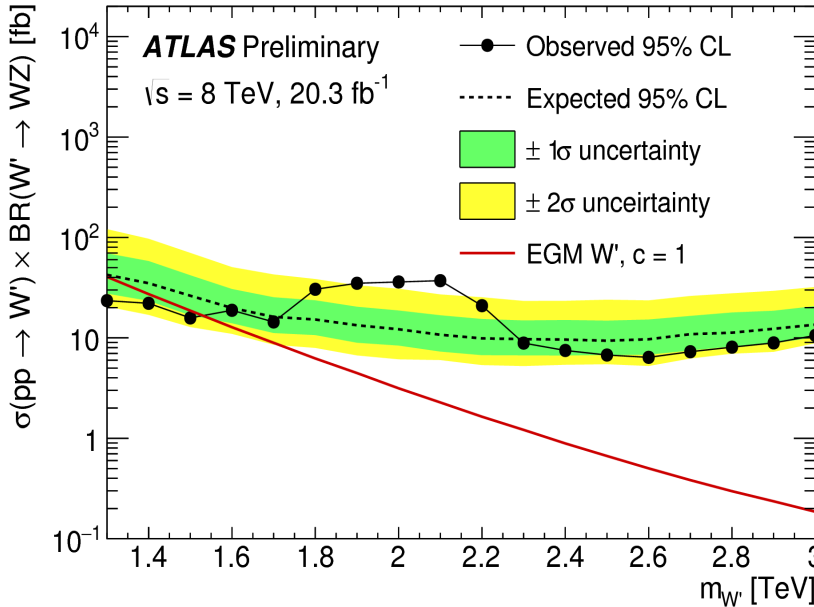


2 TeV diboson resonance: Summary of anomalies in Run-1 data

Full hadronic ATLAS search

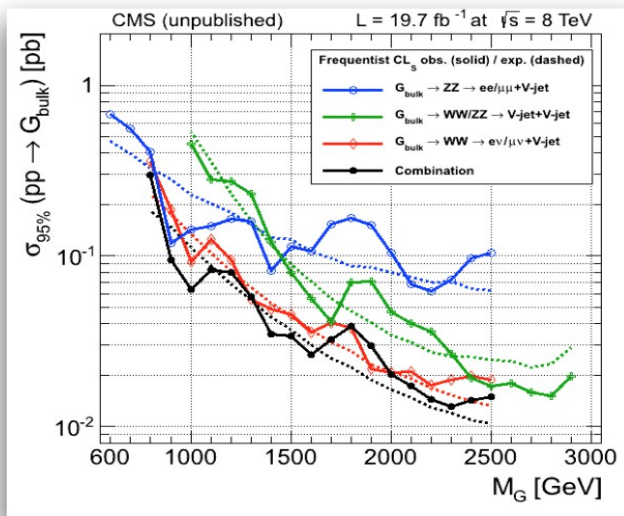
ATLAS vs CMS



- C/A R=1.2, split-filtered, $|\eta| < 2.0$, sub-jet p_T balance / **Trk. Multi./ Mass (2 overlapping mass window)**
- Trk mult. not always well modelled
- Tagging eff: 25-45% (p_T dependent)
- 2 leading jets with $|y_1 - y_2| < 1.2$: s-channel vs t-channel
- **Optimised using longitudinal polarised signal**

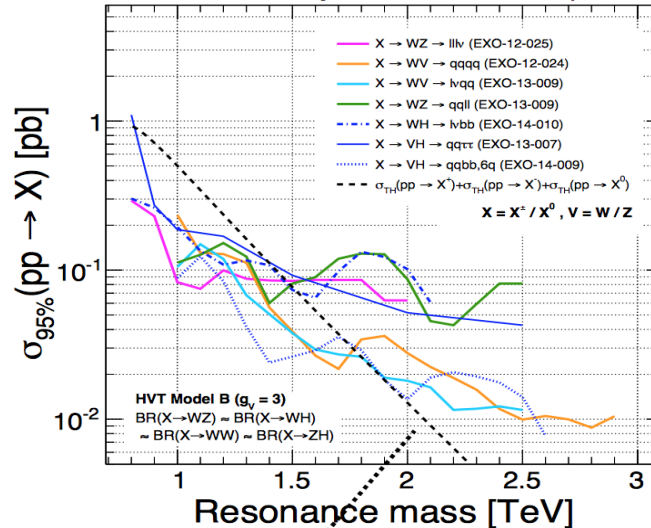
- C/A R=0.8, pruned, $|\eta| < 2.5$, τ_{21} / Mass (single mass window)
- Tagging eff.: 20-50% (p_T dependent)
- 2 leading jets with $|\eta_1 - \eta_2| < 1.3$
- **2 signal regions with different sensitivity for longitudinal and transverse polarised bosons**

CMS sees excess in similar regions: 1.8 vs 2.0 TeV



EXO-13-009 public twiki

CMS Preliminary 19.7 fb⁻¹ (8 TeV)



EXO14010 public twiki

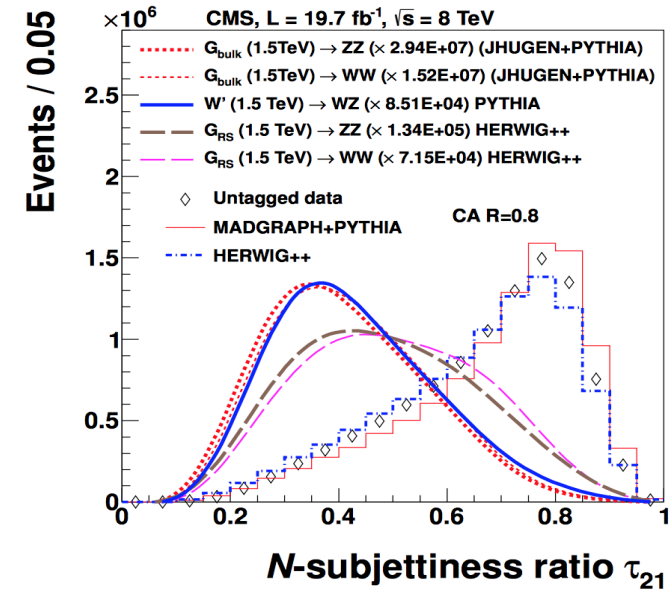
Consistency?

- Tension with $l\nu qq$ channel in ATLAS: no excess observed
- Shift could be explained by jet energy scale and resolution differences?
- Better sensitivity observed by CMS

Too early to conclude → We need Run-2!

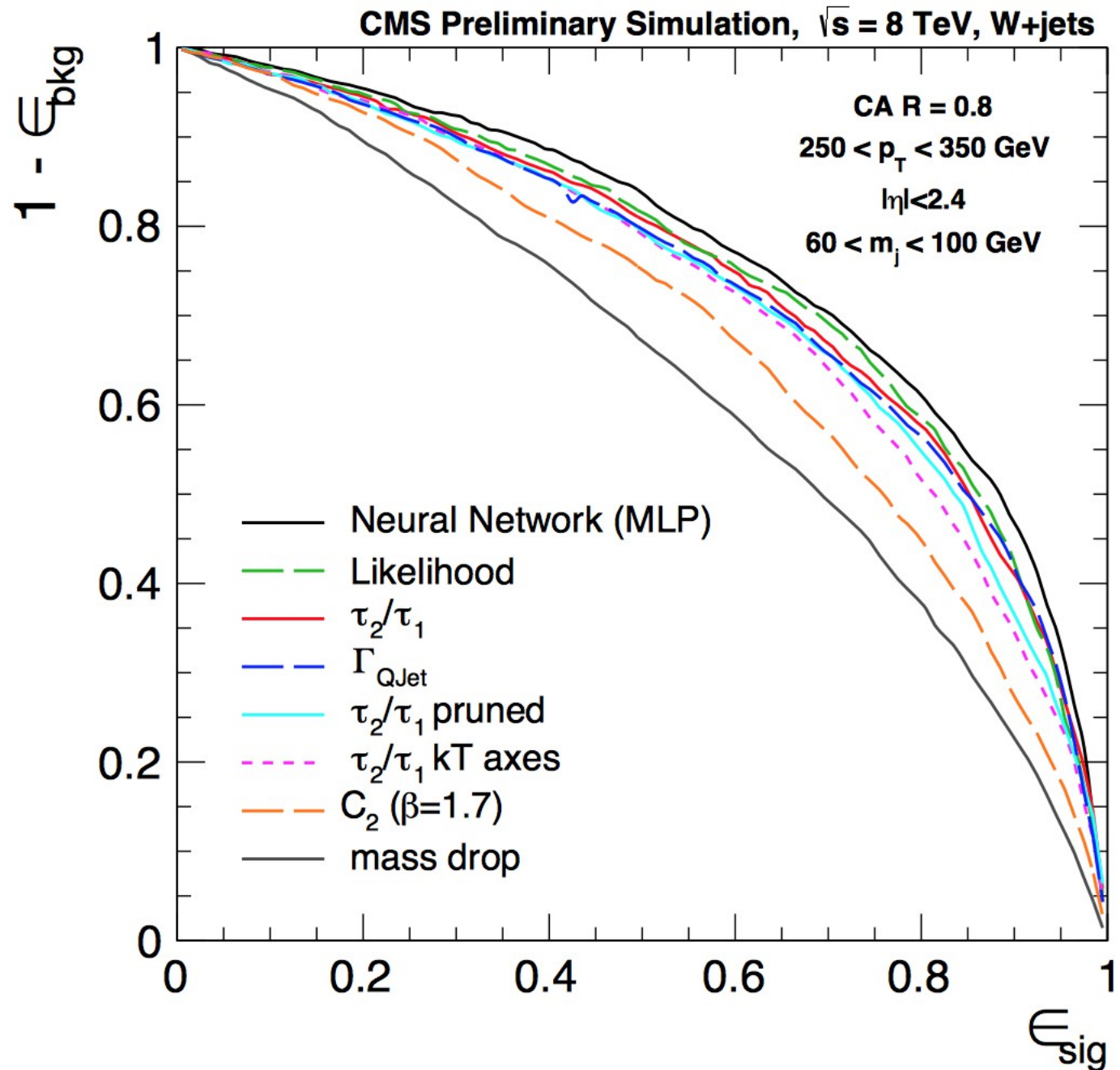
2 TeV diboson resonance: Experimental lessons from Run-1

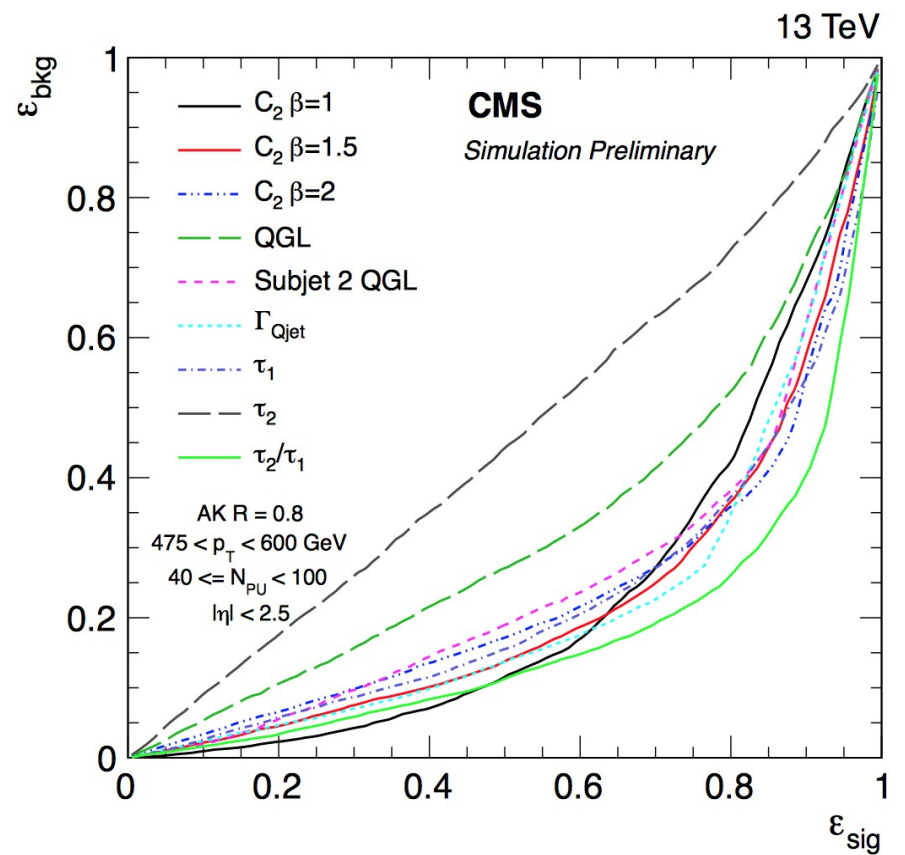
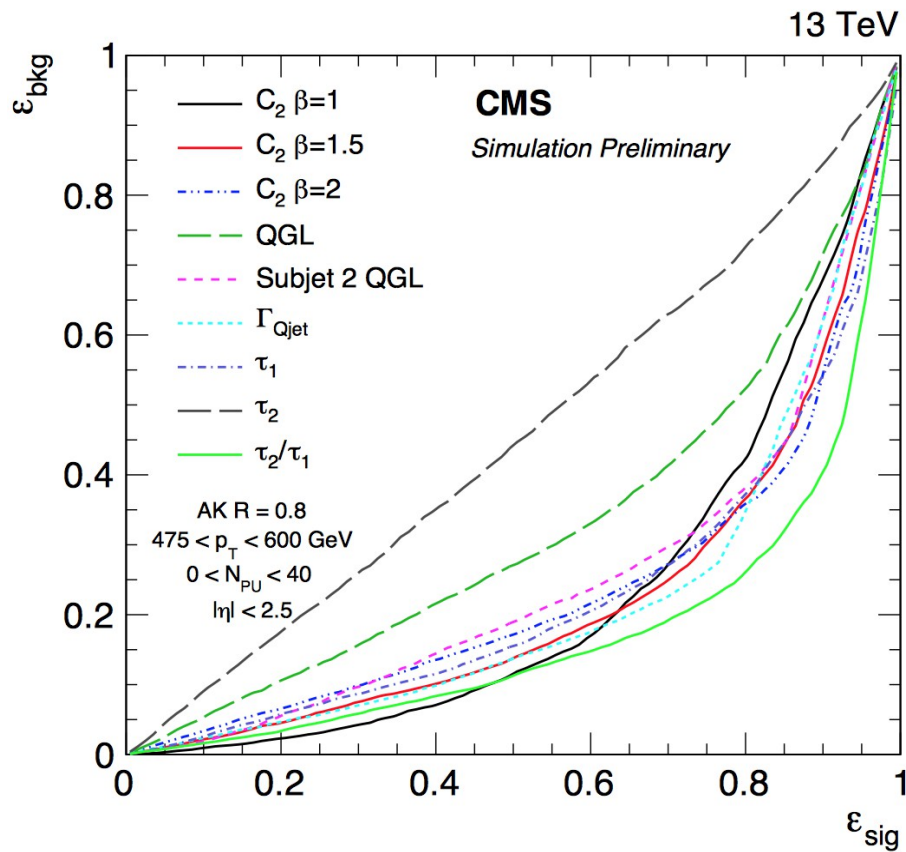
- Number of tracks is an interesting variable to study
 - A real W/Z boson decays to a color singlet qq state with the same multiplicity regardless of its energy
 - Independent from the calorimeter
- How does the selection behave for transverse and longitudinal polarised bosons?
 - CMS increased sensitivity seems to come from the loose tagged category with high efficiency for transversely polarised
 - A selection optimised for distinguishing the two cases should be investigated
- Can we still use same tagging strategy in Run-2?
 - Optimisation needed to adjust to new detector conditions
 - When will we run into detector limitations?
- Exploit boosted topologies for diboson resonance searches including Higgs
- Not so early in Run-2:
 - W/Z tagging discrimination



Too early to conclude → We need Run-2!

Extra material



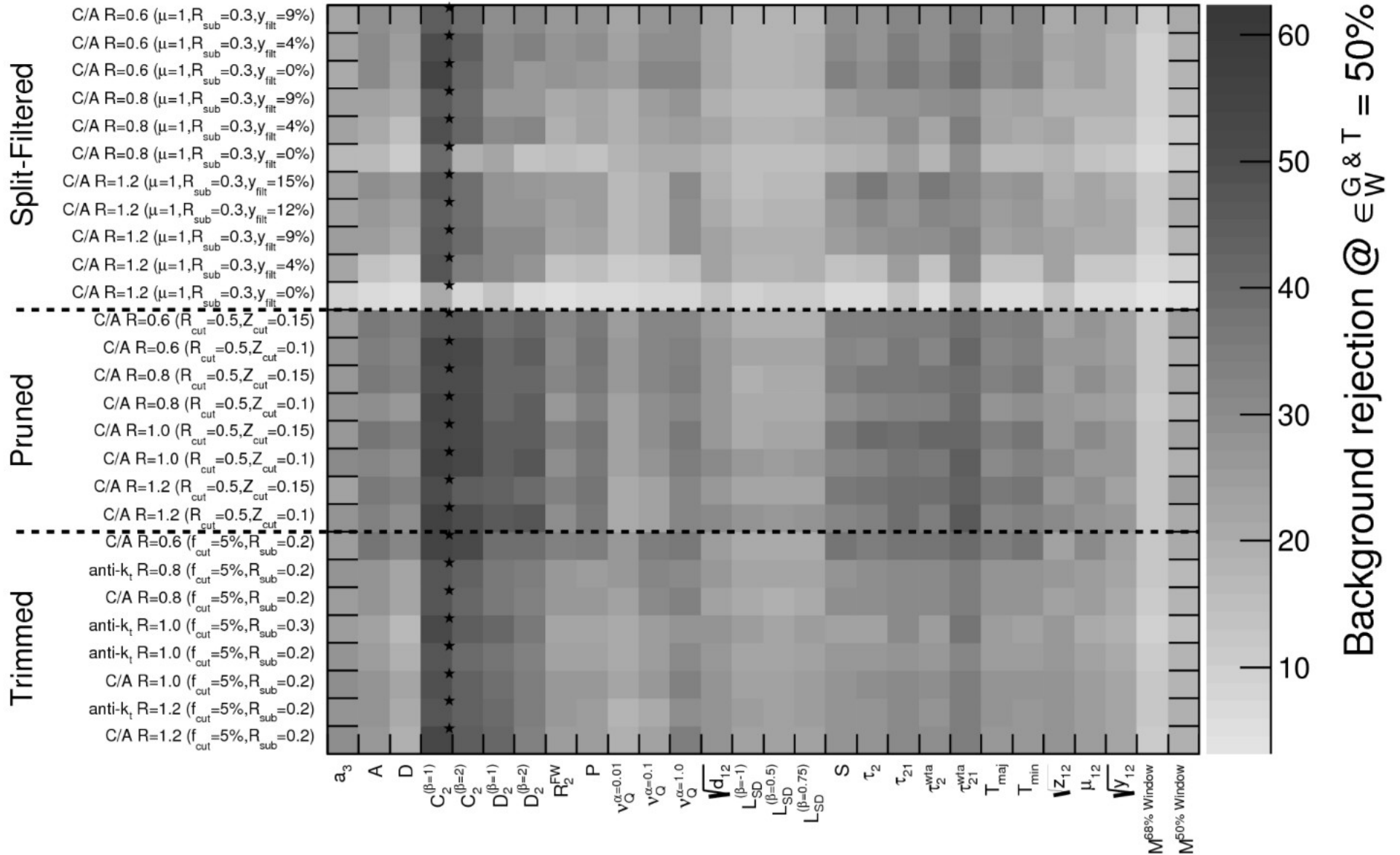


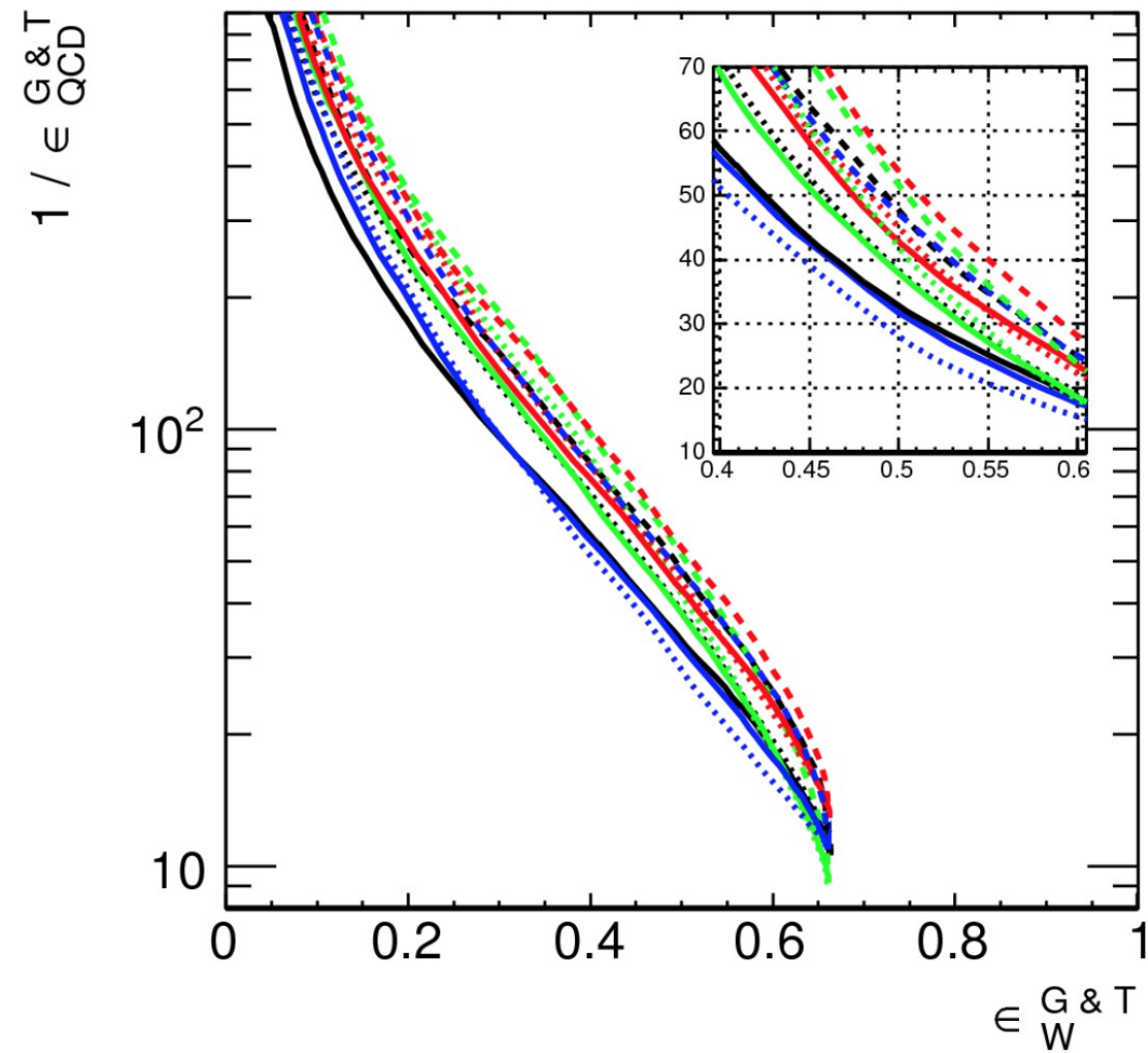
<https://twiki.cern.ch/twiki/pub/CMSPublic/PhysicsResultsJME14002/>

ATLAS Simulation Preliminary Jet 4-momentum not calibrated

$\sqrt{s}=8$ TeV $|\eta^{\text{Truth}}| < 1.2$, $350 < p_T^{\text{Truth}} < 500$ GeV, M Cut

★ = Optimal substructure variable for jet algorithm





ATLAS Simulation Preliminary

$\sqrt{s} = 8 \text{ TeV}$ Jet 4-momentum not calibrated

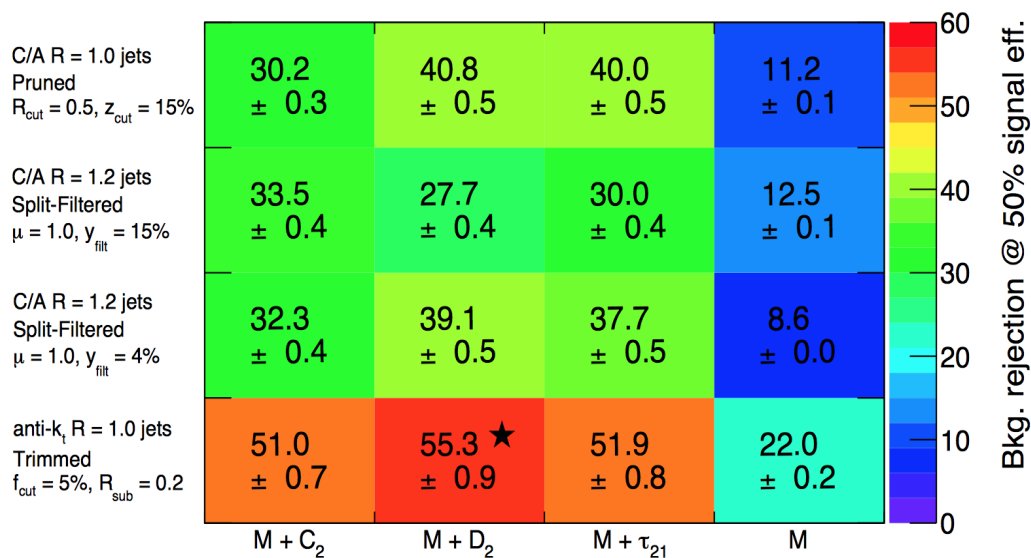
$|\eta^{\text{Truth}}| < 1.2$, $350 < p_{\text{T}}^{\text{Truth}} < 500 \text{ GeV}$, M Cut

- $C_2^{(\beta=1)}$
- $D_2^{(\beta=1)}$
- τ_{21}^{wta}
- with anti- k_t $R=1.0$ jets
 Trimmed ($f_{\text{cut}}=5\%$, $R_{\text{sub}}=0.2$)
- $C_2^{(\beta=1)}$
- $D_2^{(\beta=1)}$
- τ_{21}^{wta}
- with anti- k_t $R=1.0$ jets
 Trimmed ($f_{\text{cut}}=5\%$, $R_{\text{sub}}=0.3$)
- $C_2^{(\beta=1)}$
- $D_2^{(\beta=1)}$
- τ_{21}^{wta}
- with C/A $R=1.0$ jets
 Pruned ($R_{\text{cut}}=0.5$, $Z_{\text{cut}}=0.15$)
- $C_2^{(\beta=1)}$
- $D_2^{(\beta=1)}$
- τ_{21}^{wta}
- with C/A $R=1.2$ jets
 Split-Filtered ($\mu=1$, $R_{\text{sub}}=0.3$, $y_{\text{filt}}=15\%$)

ATLAS Simulation Preliminary

$\sqrt{s} = 13$ TeV ★ = Optimal grooming + tagging combination

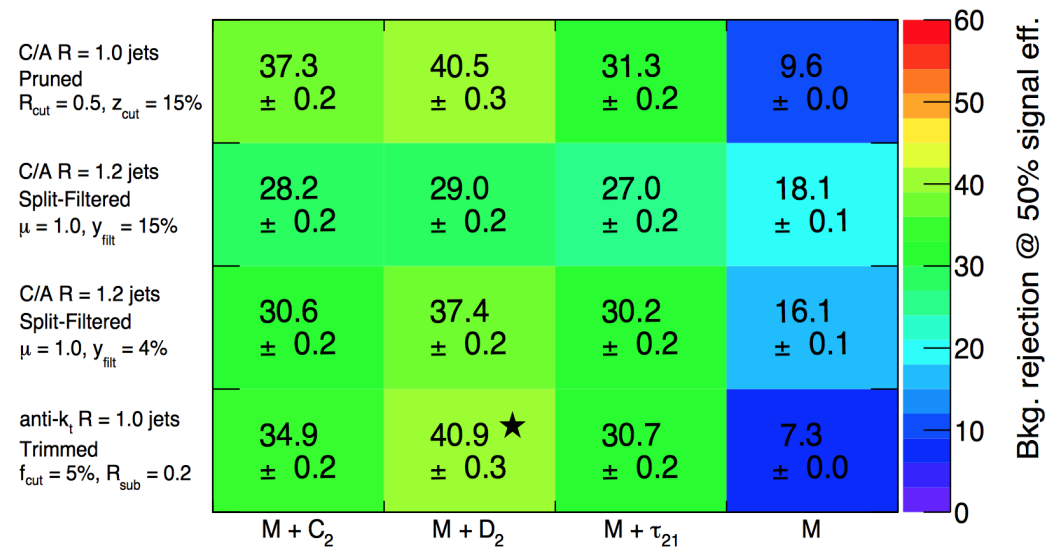
$|\eta^{\text{Truth}}| < 2.0, 200 < p_T^{\text{Truth}} < 350$ GeV, M^{Reco} Cut W-jets



ATLAS Simulation Preliminary

$\sqrt{s} = 13$ TeV ★ = Optimal grooming + tagging combination

$|\eta^{\text{Truth}}| < 2.0, 1500 < p_T^{\text{Truth}} < 2000$ GeV, M^{Reco} Cut W-jets



<https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/PUBNOTES/ATL-PHYS-PUB-2015-033/>