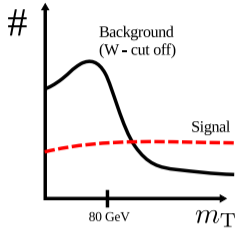


SEARCH FOR GLUINOS AND SQUARKS IN EVENTS WITH ONE ISOLATED LEPTON, AT LEAST 2-9 JETS AND MISSING TRANSVERSE MOMENTUM AT $\sqrt{s}=13$ TeV WITH THE ATLAS DETECTOR

Discriminating variables

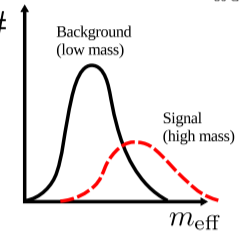
→ Transverse mass

$$m_T = \sqrt{2p_T^l E_T^{\text{miss}} (1 - \cos[\Delta\phi(p_T^l, p_T^{\text{miss}})])}$$



→ Effective mass

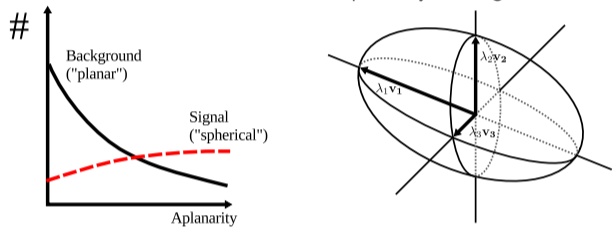
$$m_{\text{eff}} = p_T^l + \sum_{j=1}^{N_{\text{jet}}} p_{T,j} + E_T^{\text{miss}}$$



→ Aplanarity

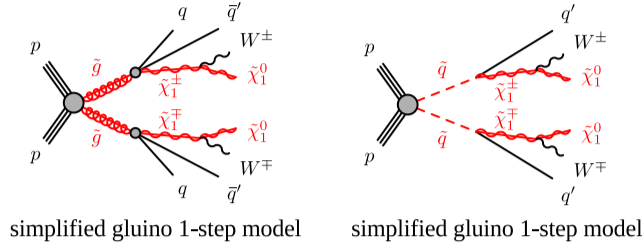
$$M_{\text{xyz}} = \sum_i \begin{pmatrix} p_{xi}^2 & p_{xi}p_{yi} & p_{xi}p_{zi} \\ p_{yi}p_{xi} & p_{yi}^2 & p_{yi}p_{zi} \\ p_{zi}p_{xi} & p_{zi}p_{yi} & p_{zi}^2 \end{pmatrix}$$

Sum over all jets + lepton (Lepton Aplanarity)
Aplanarity: 3rd eigenvalue of M_{xyz}



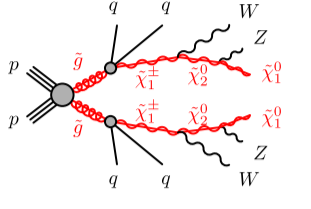
Inclusive 1-lepton search using full ATLAS 2015+2016 data Signal regions optimised for general scenarios

Benchmark models for 2-6-jet SRs



simplified gluino 1-step model simplified gluino 1-step model

Example for 9-jet SR



simplified gluino 2-step model

2J

4J high-x/low-x

6J

9J

$$\begin{matrix} m(\tilde{g}/\tilde{q}) \\ m(\tilde{\chi}^\pm) \\ m(\tilde{\chi}_1^0) \end{matrix} = \begin{matrix} \text{=====} \\ \text{=====} \\ \text{=====} \end{matrix}$$

- compressed spectra
- need additional jets to trigger
- soft lepton (6/7 GeV for e/ μ)
- high E_T^{miss} (430 GeV)
- low m_T cut (100 GeV)
- at least 2 jets

- partially compressed spectra
- hard lepton (35 GeV for e/ μ)
- high E_T^{miss} , m_T for high-x (300 GeV, 450 GeV)
- moderate E_T^{miss} , m_T for low-x (250 GeV, 150-450 GeV)
- at least 4 jets

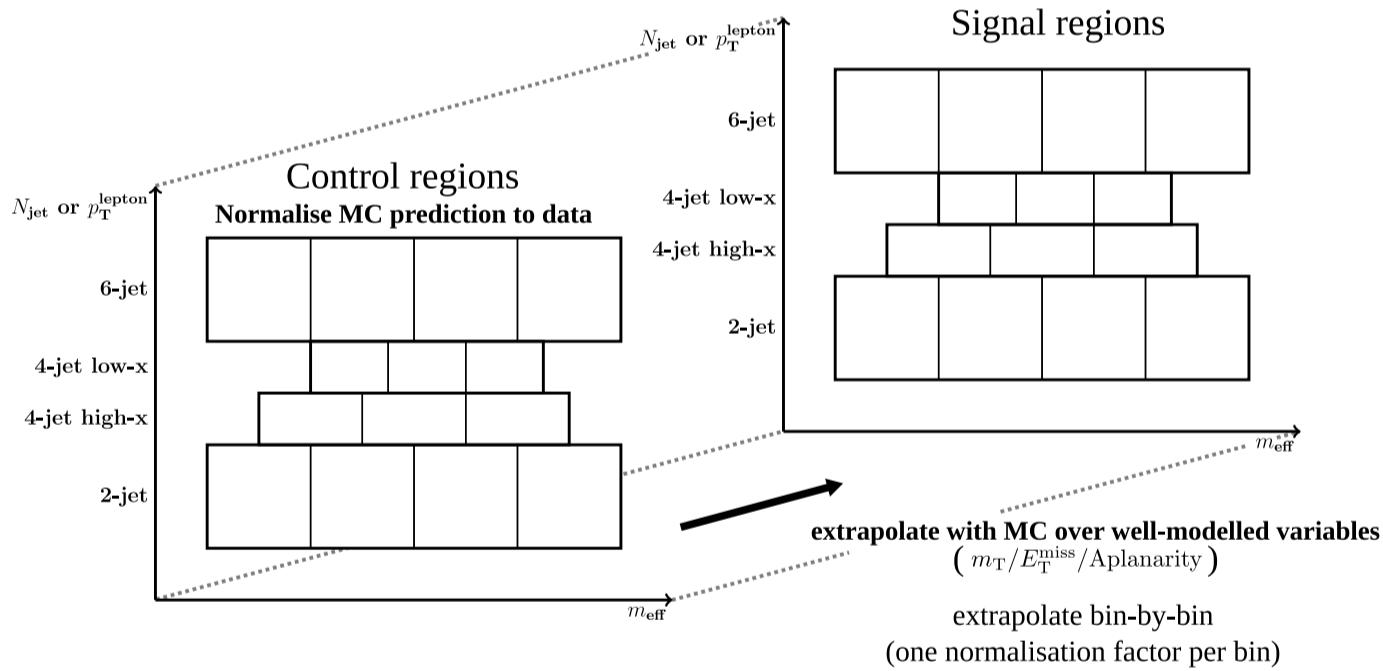
- large mass differences
- hard lepton (35 GeV for e/ μ)
- high E_T^{miss} (350 GeV)
- moderate m_T (175 GeV)
- at least 6 jets

- high jet multiplicity
- hard lepton (35 GeV for e/ μ)
- moderate E_T^{miss} (200 GeV)
- moderate m_T (175 GeV)
- at least 9 jets

All regions require exactly one isolated electron or muon

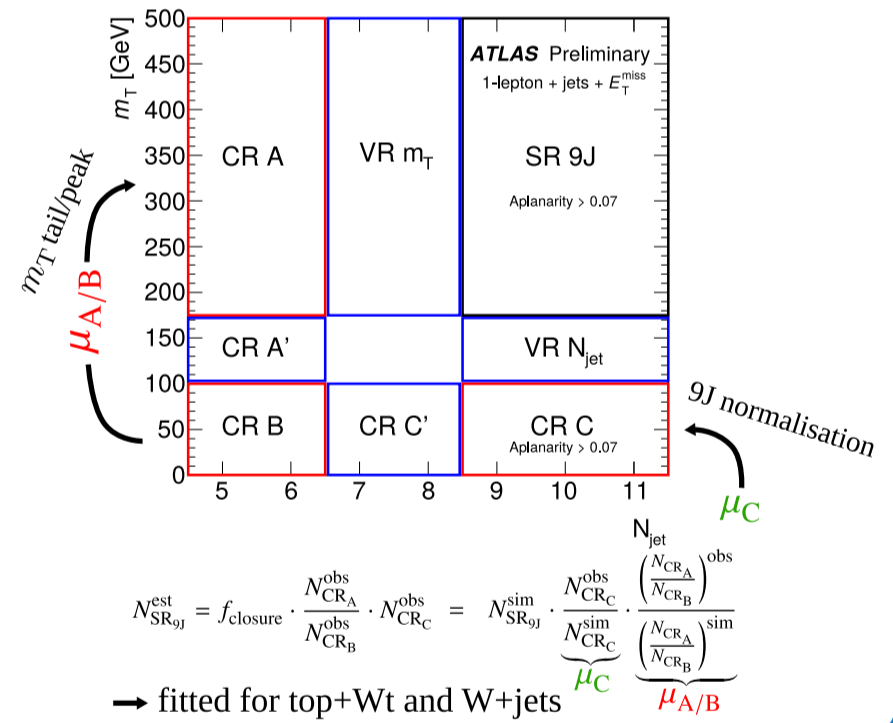
2-6-jet Background estimation

Same binning in N_{jet} and m_{eff} for signal and control regions

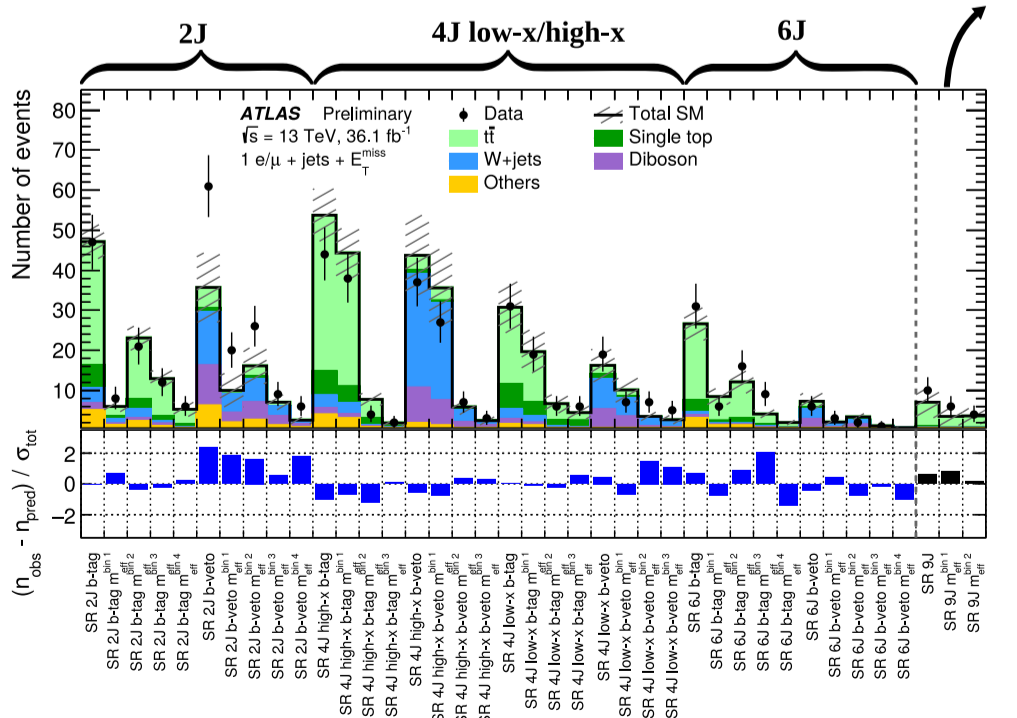


9-jet background estimation

m_T approximately invariant for different number of jets!
→ fit tail/peak ratio in low number of jet events

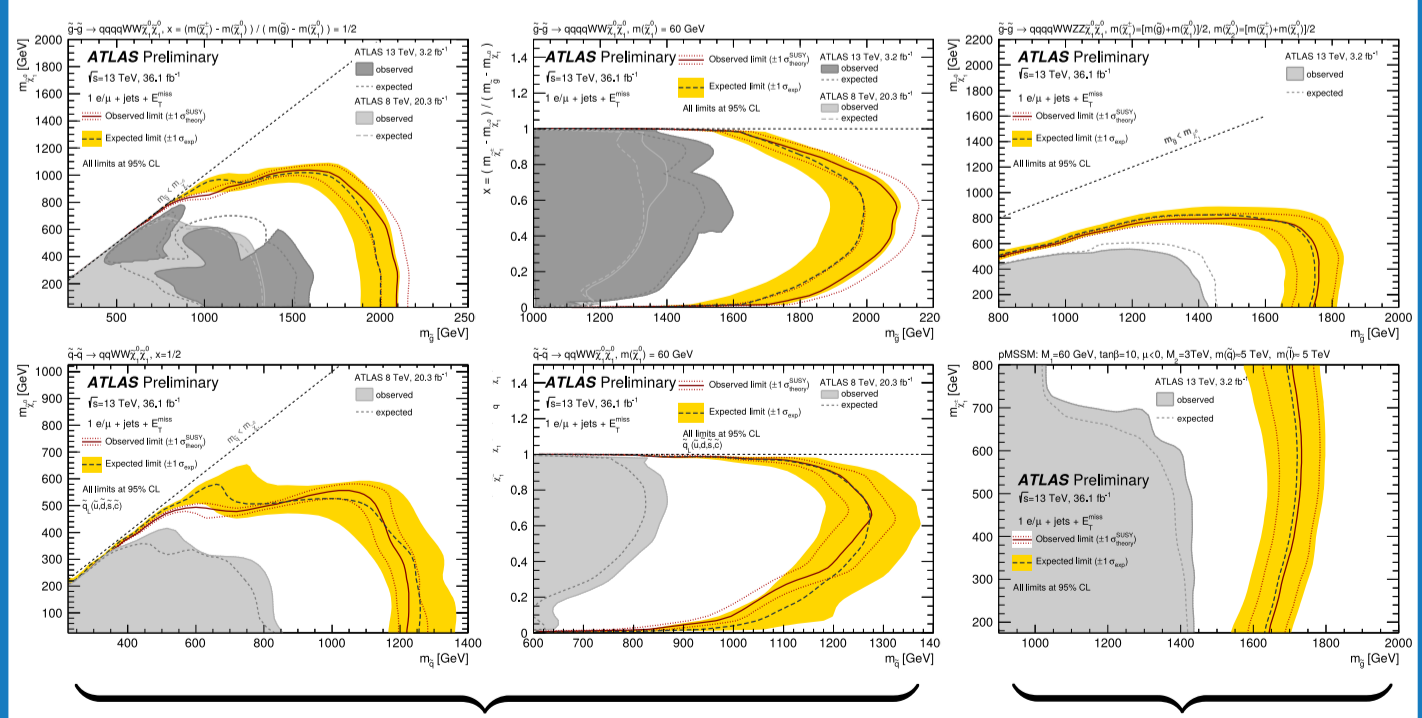


Signal regions after fit



- combined fit in b-tag/b-veto and effective mass (9J fitted separately)
- no significant excess over SM expectation

Exclusion limits on benchmark models



→ limits up to 2.1 TeV (gluinos), 1.3 TeV (squarks)