

ATLAS Search of Dark Matter Produced in Association with a Hadronically Decaying Vector Boson

WSEDS2018, Guadeloupe islands, June 25th to June 29th, 2018



Latest result with 36 fb-1 of pp collision data at centre-of-mass energy of 13 TeV collected by ATLAS detector on LHC

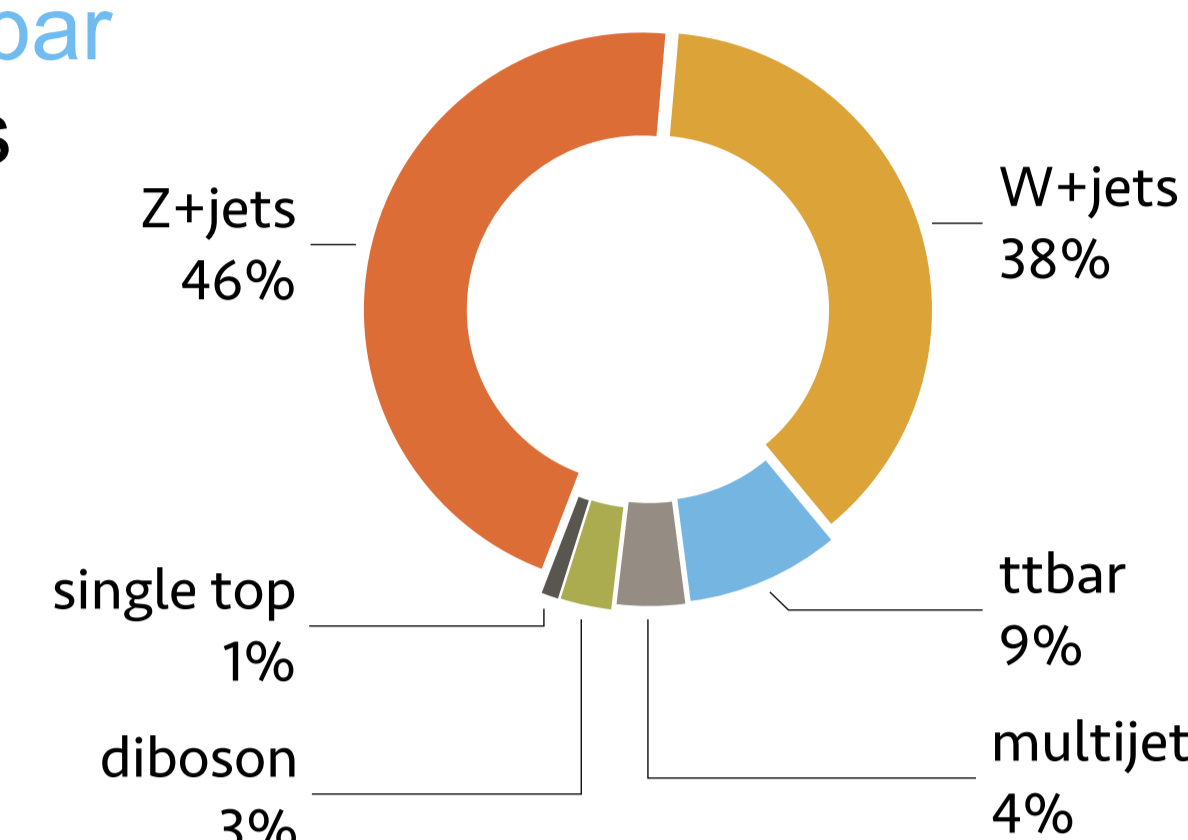
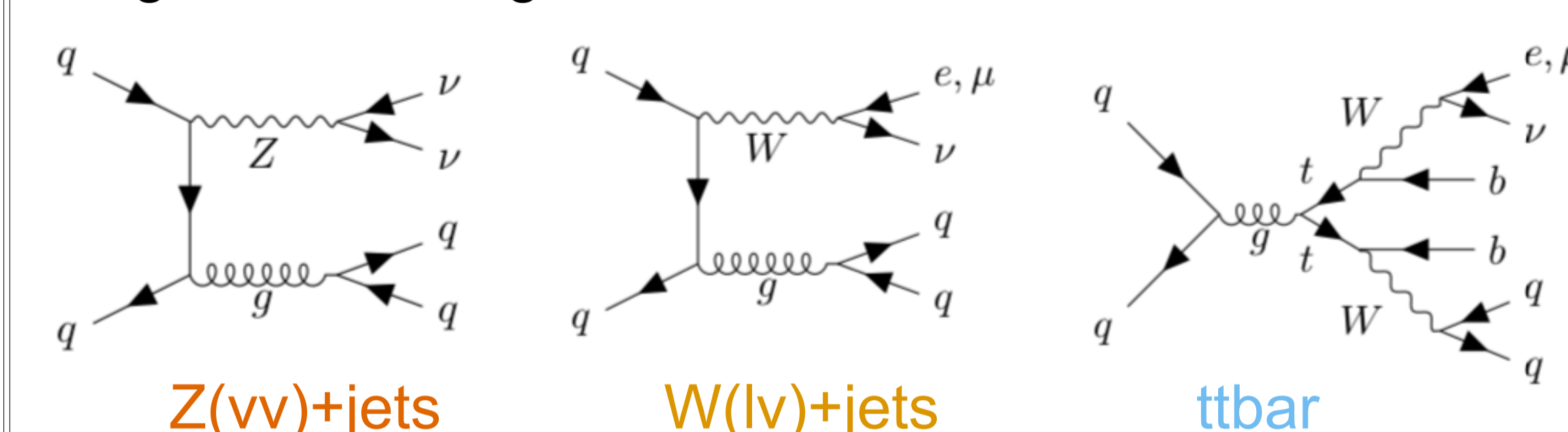
Search for weakly interacting massive particles (WIMPs)

1. DM production in associated with a hadronically decaying W/Z boson
2. SM-like Higgs boson decaying into a pair of DM particles
3. DM production in associated with a potentially new vector boson Z' (**FIRST TIME!**)

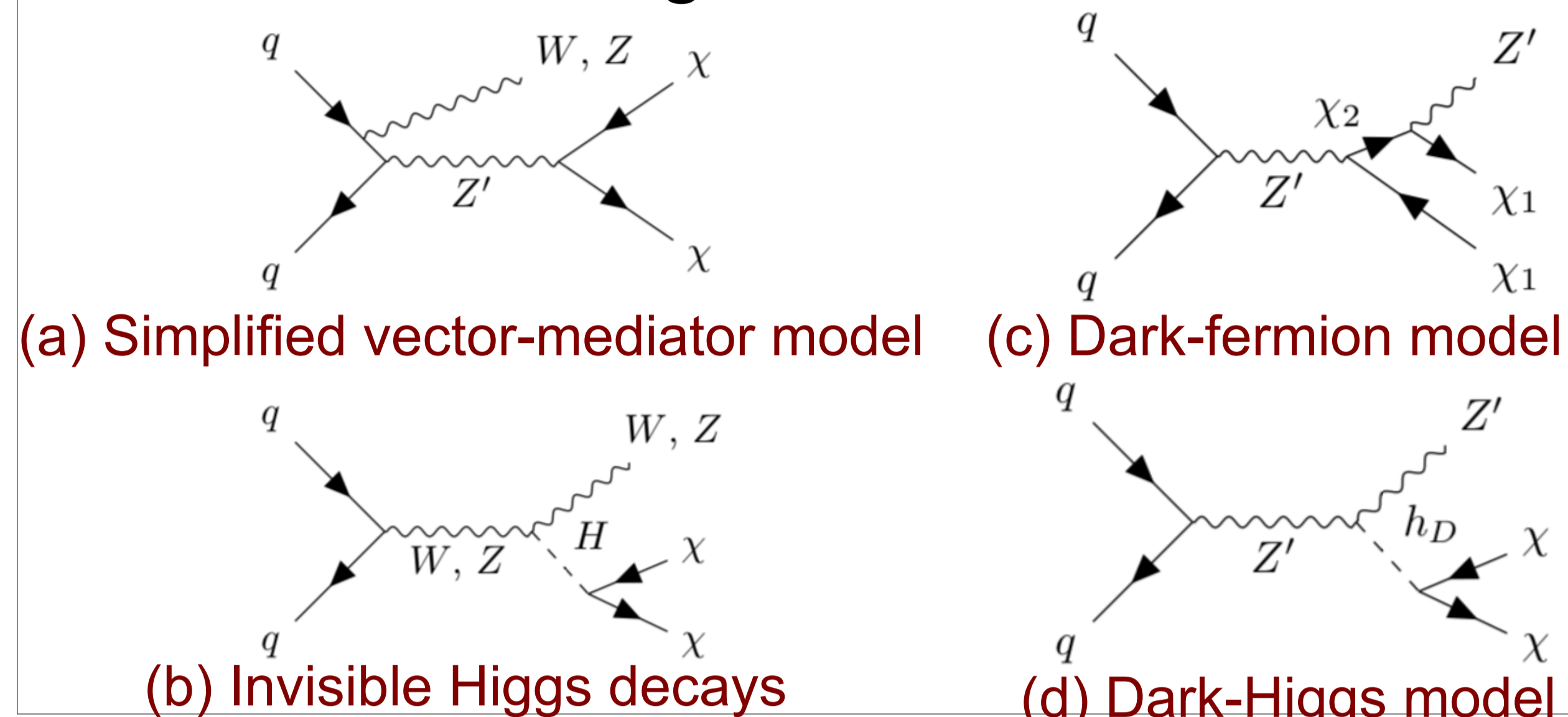
ATLAS-CONF-2018-005

Dominant backgrounds are Z(vv)+jets, W(lv)+jets and ttbar

Dedicated control regions with 1/2 leptons and 0/1/2 b-jets designed for background constraint



Signal models:



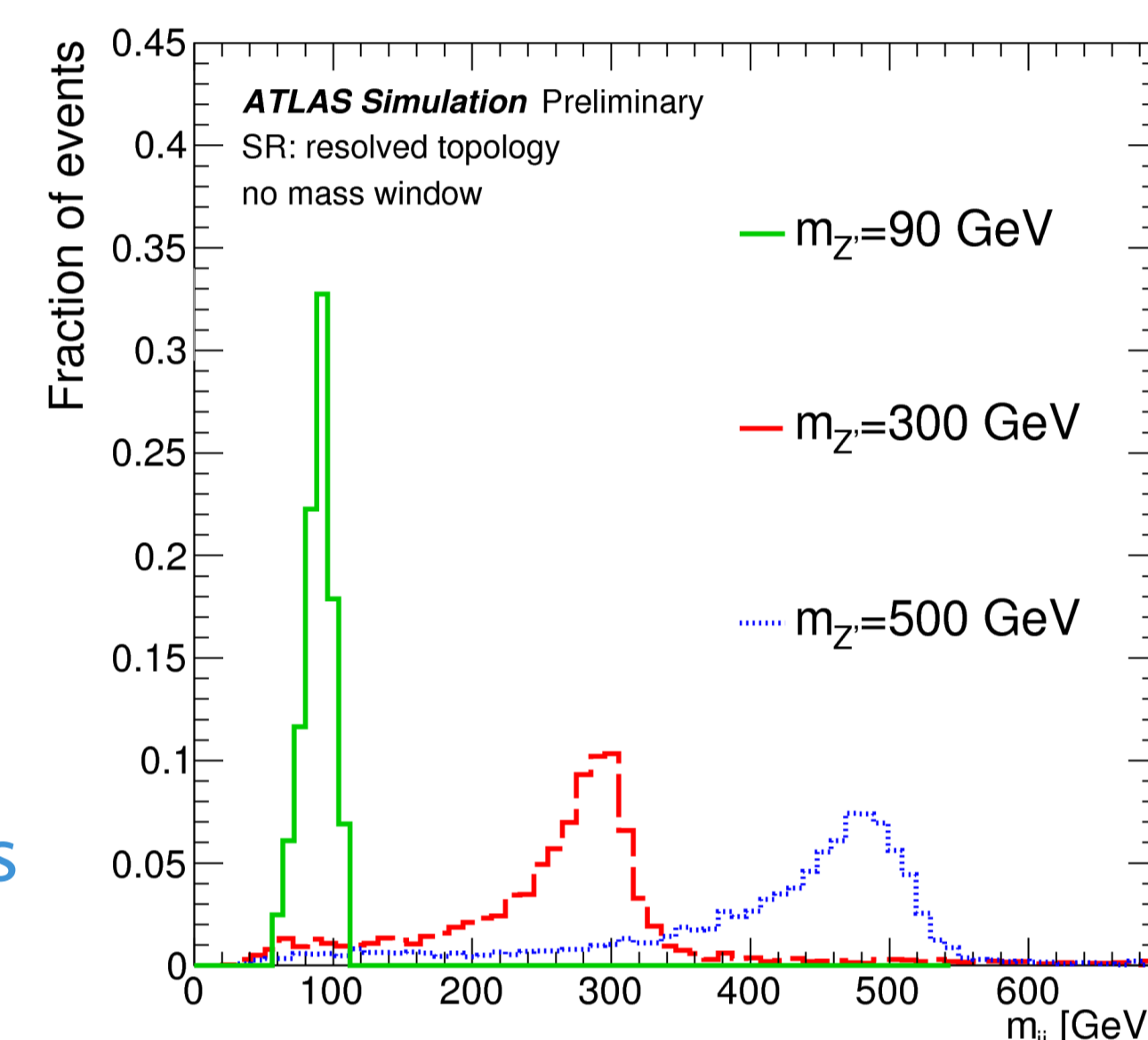
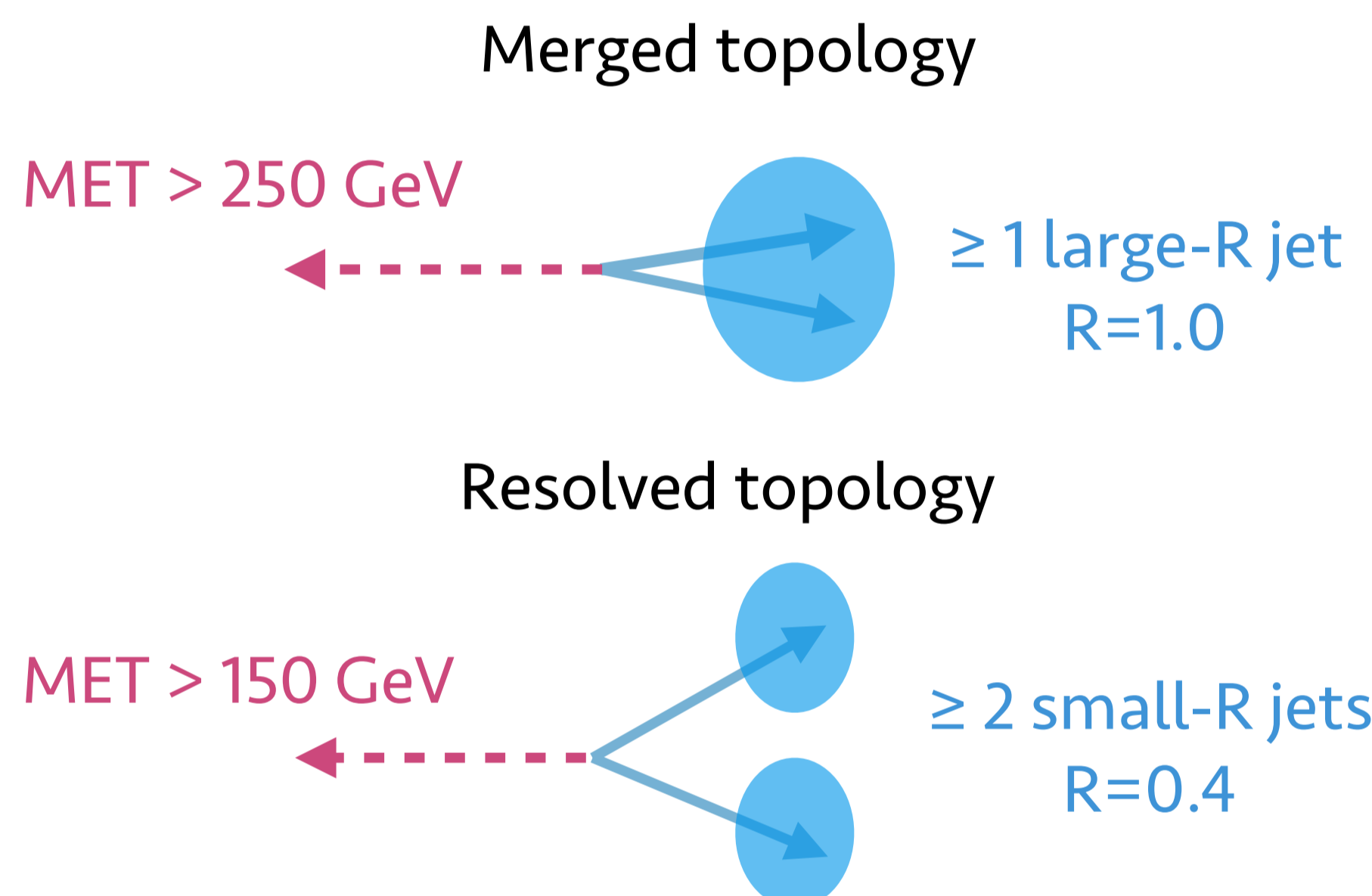
Signal region event selection:

- at least one large-R jet or two small-R jets
- MET above 250 GeV (150 GeV) in merged (resolved) topology
- categorised into 0/1/2 b-tagged region

- angular requirement
- in the vector boson mass window
- lepton veto

Signal signature in ATLAS detector

large missing transverse momentum (MET) + W/Z/Z' boson reconstructed as one large-R jet (merged) or two small-R jets (resolved)



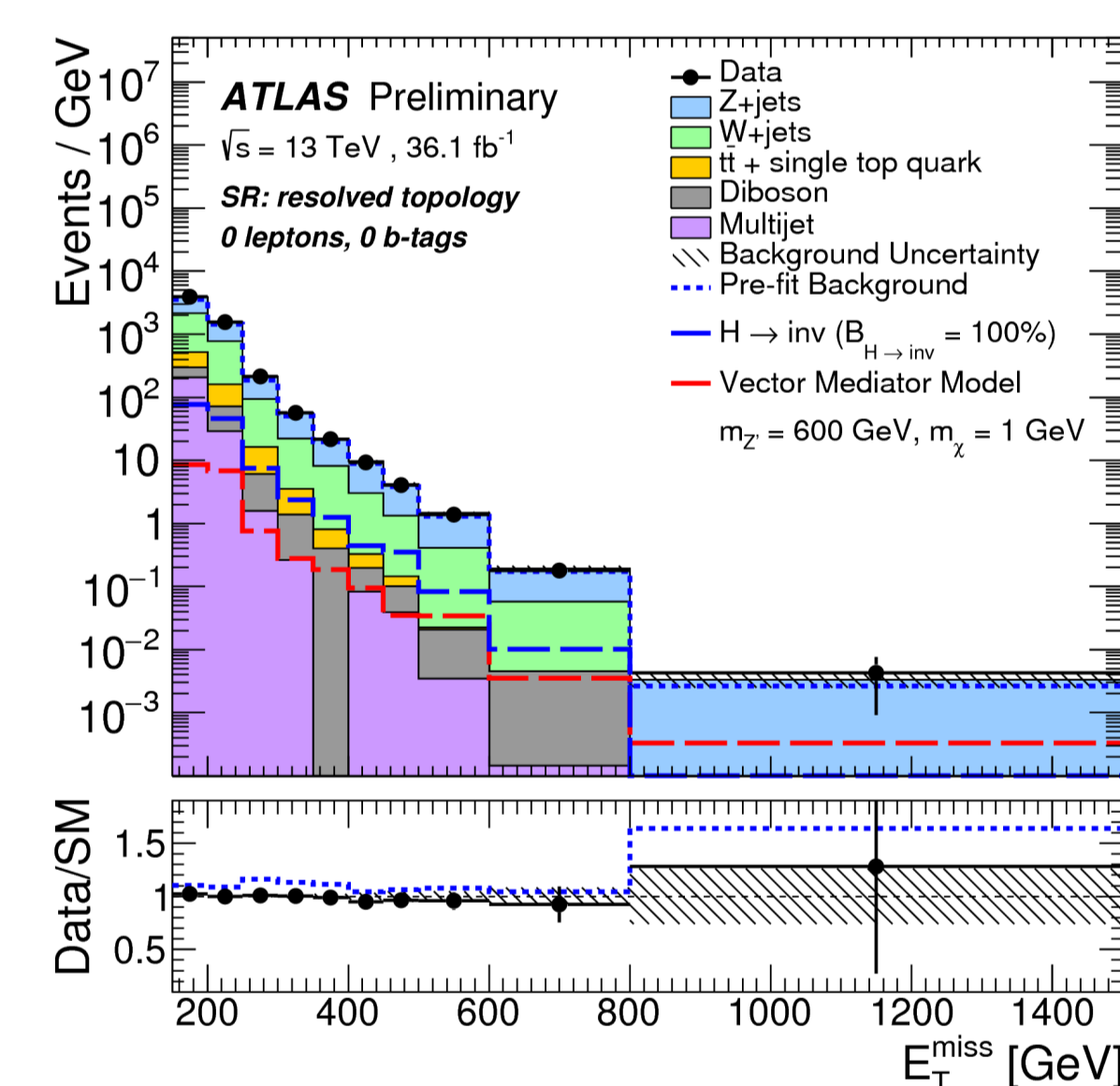
Statistical analysis: a profile likelihood fit to the data on the discriminate variable MET is performed

$$\mathcal{L}(\mu, \theta) = \prod_j^{N_{\text{categories}}} \prod_i^{N_{\text{bins}}} P(N_{ij} | \mu S_{ij}(\theta) + B_{ij}(\theta)) \prod_k^{N_{\text{nuisance}}} \mathcal{G}(\theta_k)$$

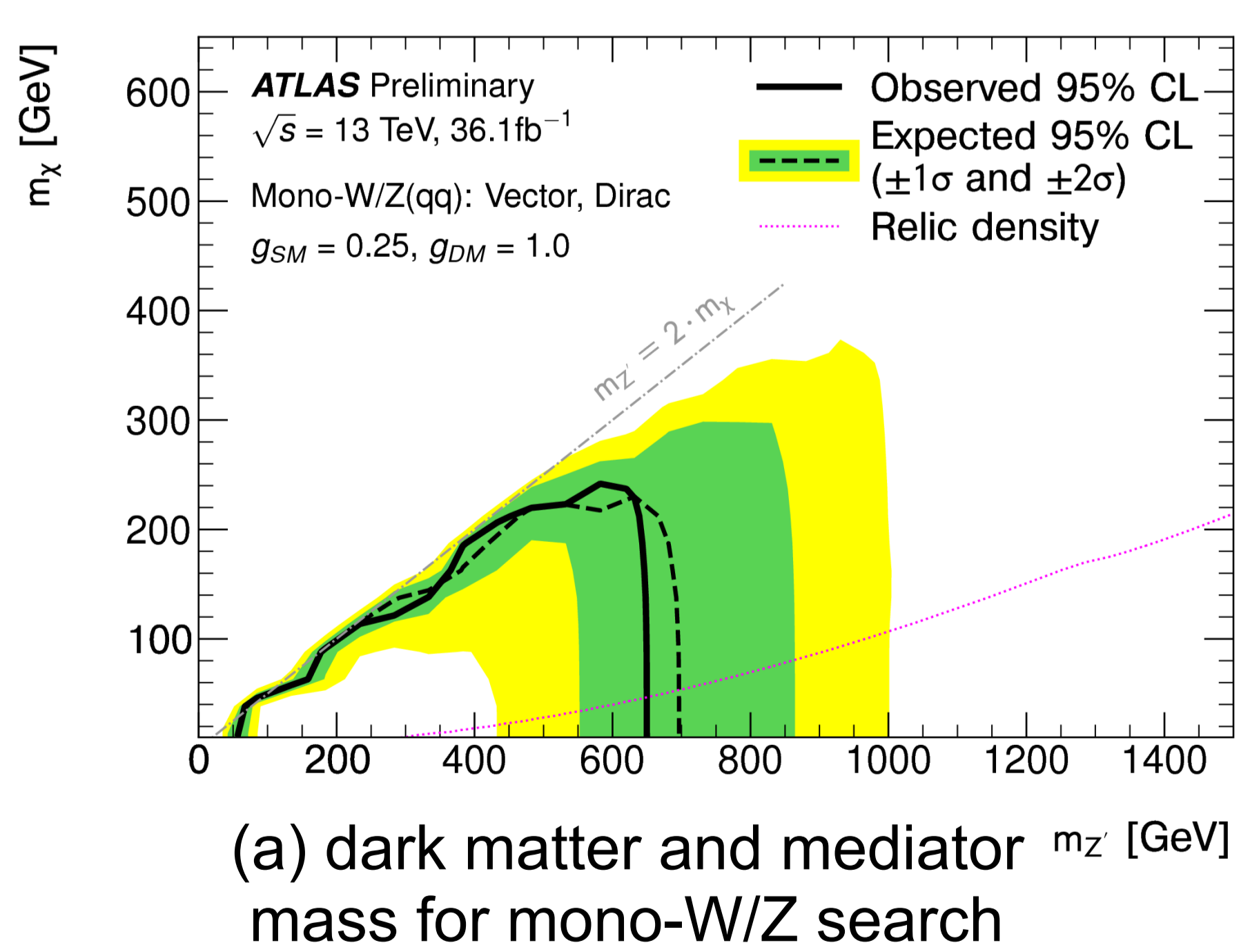
SR plus CR, observed event, expected signal and background, Gaussian function for constraint on nuisance parameter, Poisson distribution, signal strength, nuisance parameters for background normalisation and systematic uncertainties

Uncertainties

- data statistical uncertainty
- systematic uncertainty (experimental + modelling)
 - large-R jet, small-R jet
 - MET and MET trigger
 - b-tagging, leptons, luminosity
 - signal modelling
 - background modelling
 - MC statistical uncertainty



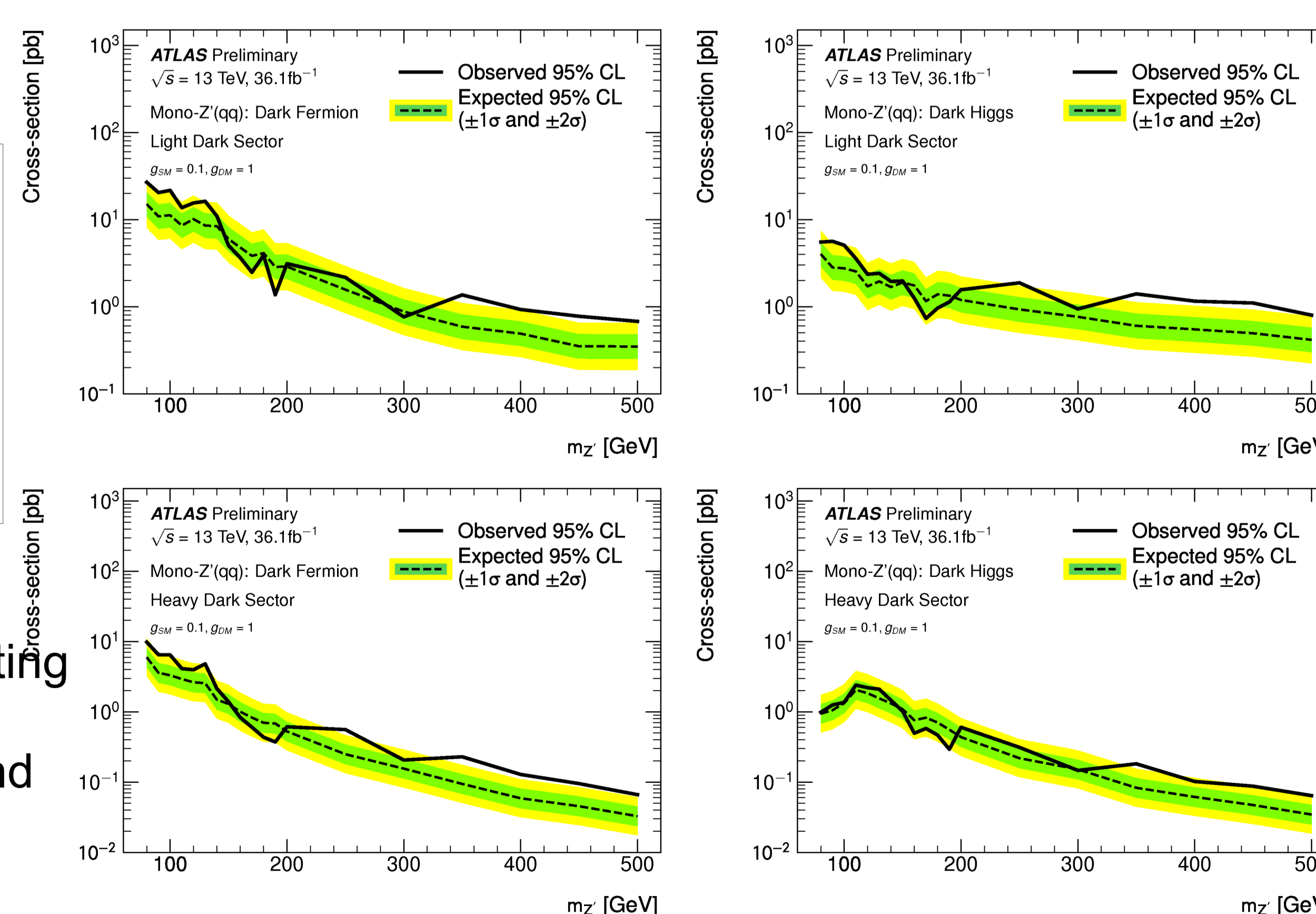
Results: Upper limit on signal strength at 95% CLs for each signal model and interpreted them into limits on:



	observed	expected	+1σ	-1σ
limit on BR(H->inv)	0.83	0.58	0.81	0.42

(b) branching ratio of H->invisible decay

(c) cross section for mono-Z' search targeting dark-fermion model (left) and dark-Higgs model (right) in light dark scenario (top) and heavy dark scenario (bottom)



Conclusions:

- Exclusion for simplified vector-mediator model of $m_{z'}$ of up to 650 GeV for m_χ of up to 250 GeV
- Upper limit on $B_{H \rightarrow \text{invisible}}$ set to 0.83 (0.58) for observed (expected) data
- Exclusion of cross section for dark-fermion model in light and heavy dark sector scenarios are in range 0.68 - 27 pb and 0.066 - 9.8 pb
- Exclusion of cross section for dark-Higgs model in light and heavy dark sector scenarios are in range 0.80 - 5.5 pb and 0.064 - 2.4 pb

