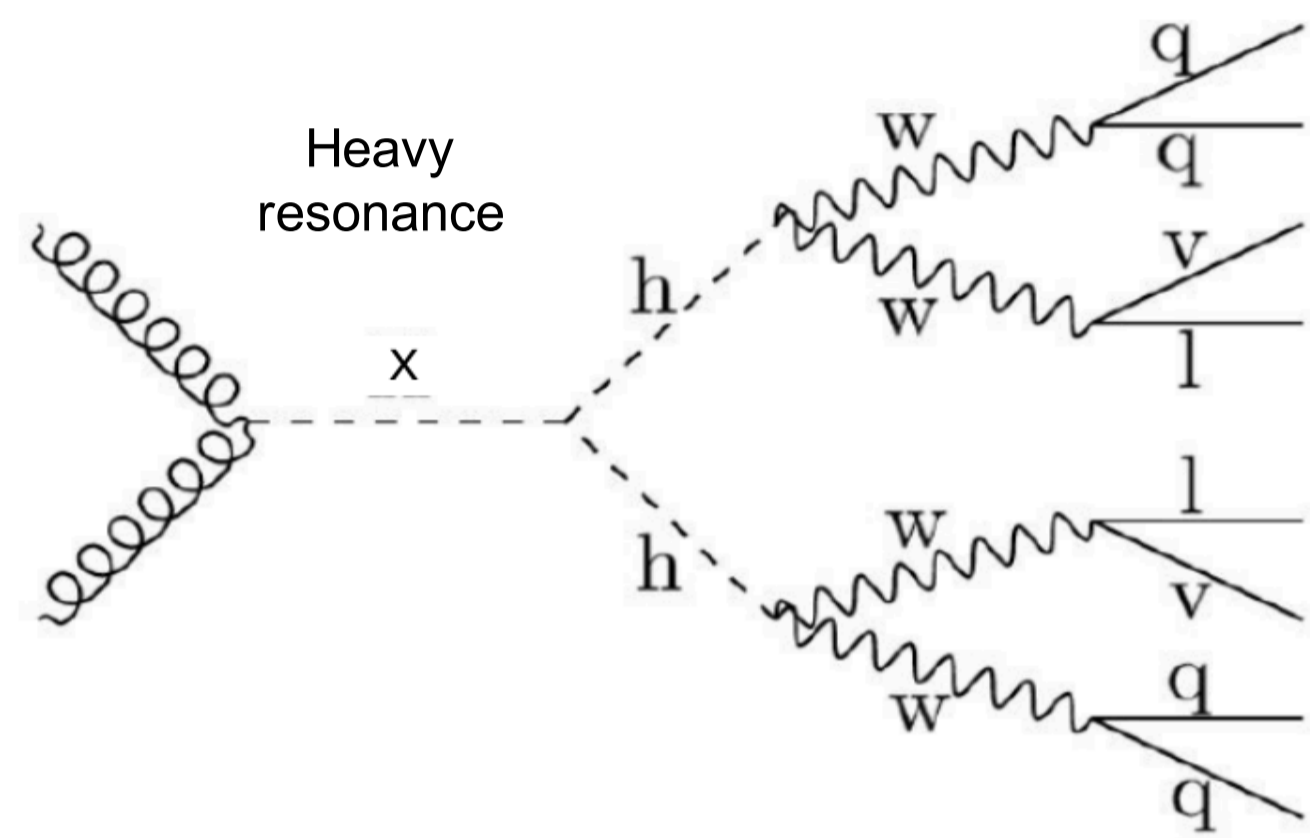


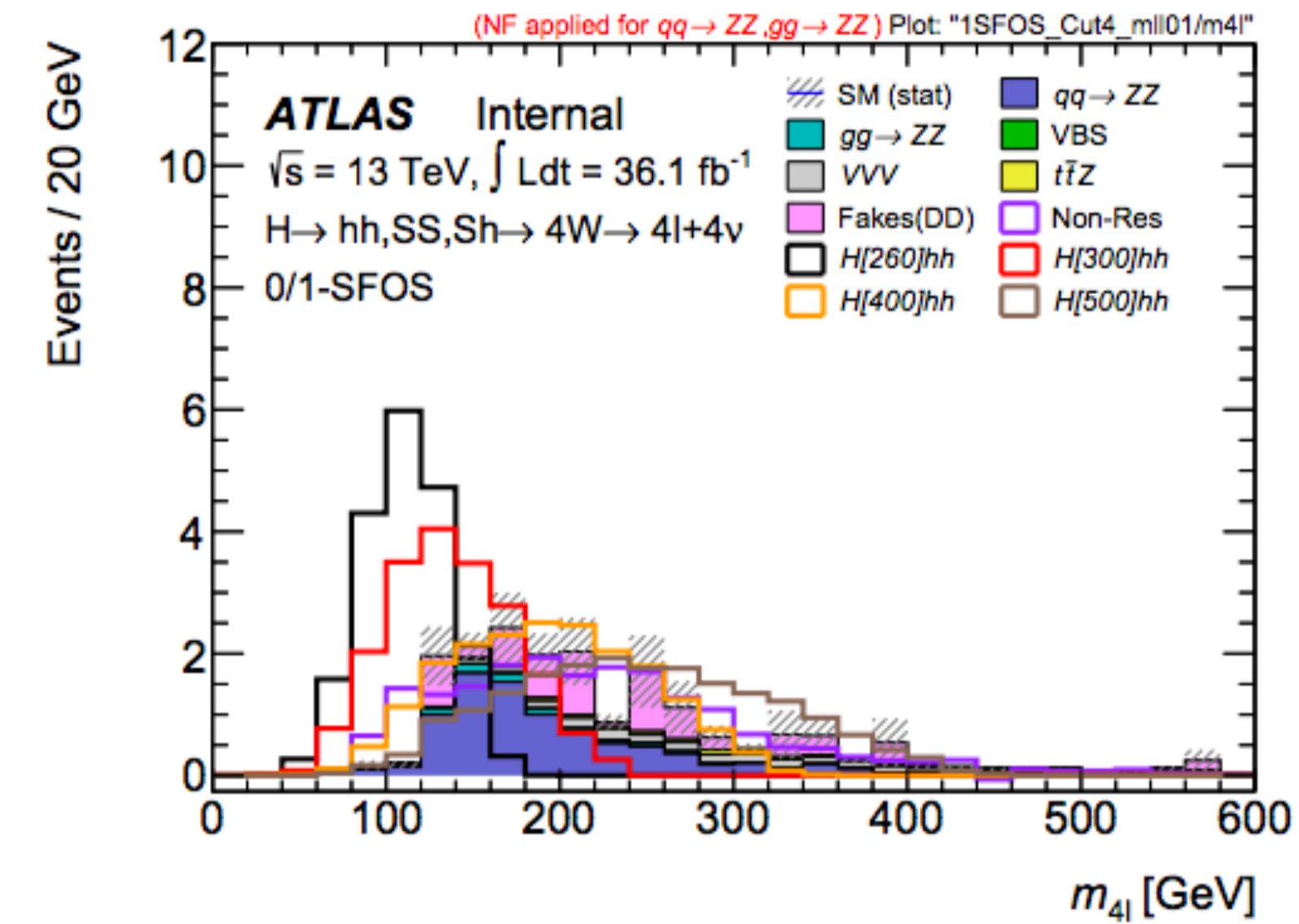
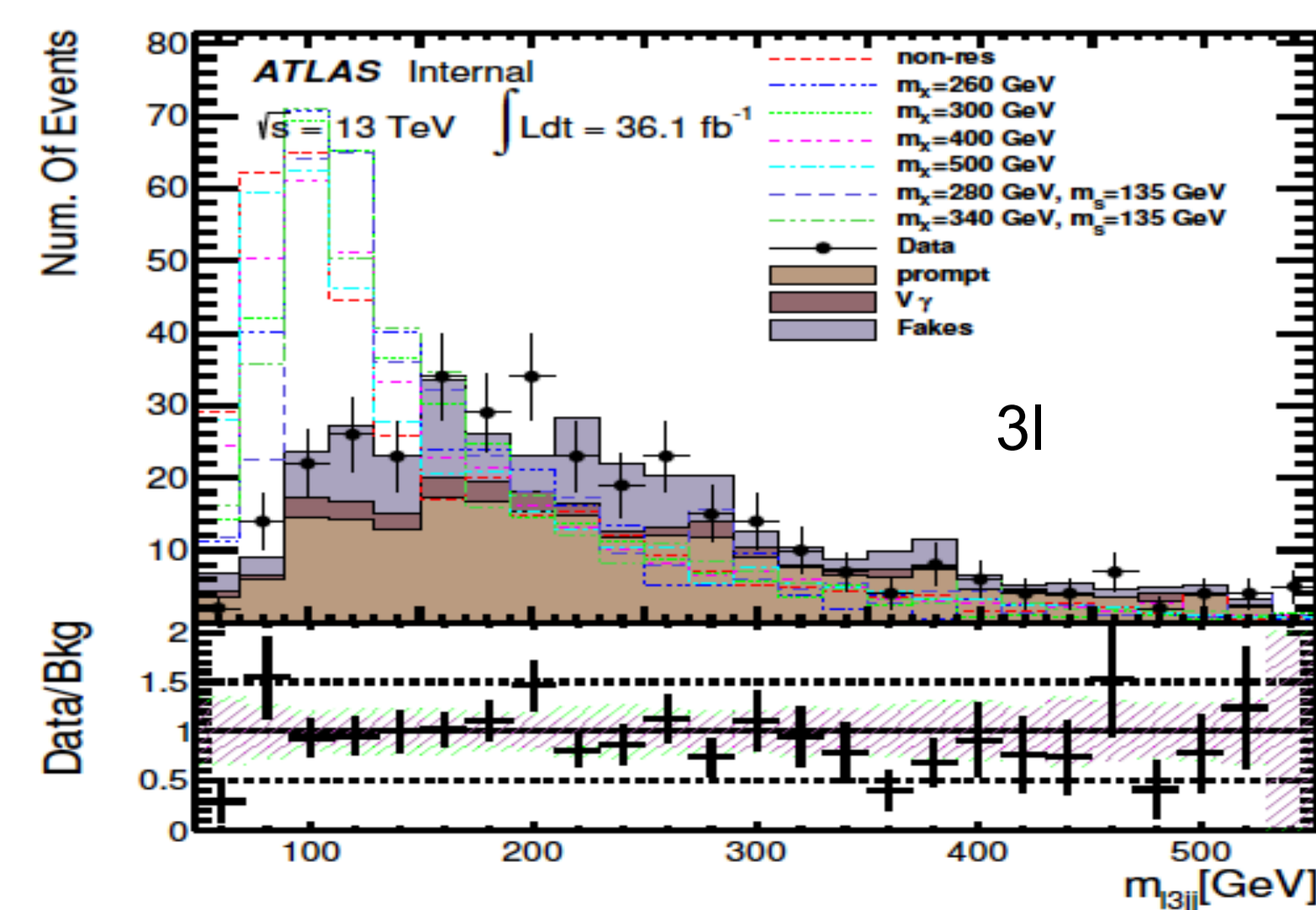
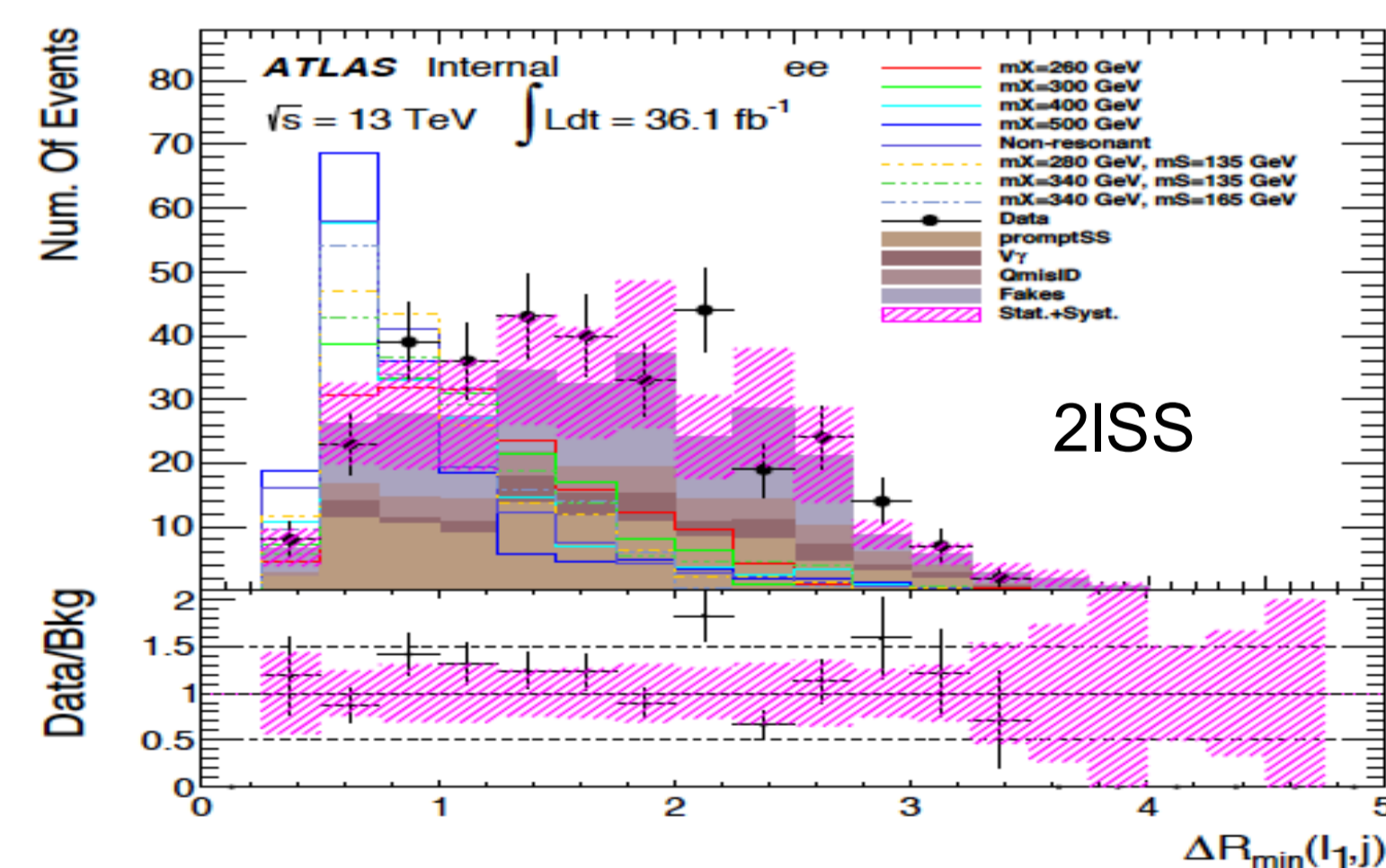
## Motivation



- The first ever search for di-higgs decaying to  $WW^*WW^*$  at any collider
- Reasonably clean signatures
  - 2ISS channel with two same-sign leptons, at least two jets and MET
  - 3l channel with a total lepton charge of  $\pm 1$ , at least two jets and MET
  - 4l channel with a total lepton charge of 0
  - Main background comes from WZ/ZZ
- BSM models can significantly enhance the di-higgs production rate
  - non-resonant and resonant hh production (h represents SM higgs)  $m_X = 260, 300, 400$  and  $500$  GeV
  - **The first search for  $X \rightarrow SS$  model** (S represents a Higgs-like scalar)  $m_X = 340$  GeV,  $m_S = 135, 145, 155, 165$  GeV;  $m_S = 135$  GeV,  $m_X = 280, 300, 320, 340$  GeV
- Require the presence of at least two isolated leptons
  - $p_T > 10$  GeV
  - $|\eta| < 2.5$
  - Z veto
  - b-jet veto

## Optimisation

- Main background
  - Prompt background WZ/ZZ
  - Jet fake background
  - Charge mis-ID background (2ISS)
- Cut-based selections
- 2ISS
  - Split into  $ee$ ,  $e\mu$  and  $e\mu$  flavour channels
- 3l
  - Split into same-flavour opposite sign SFOS0 and SFOS12 categories
- 4l
  - Split into SFOS01 and SFOS2
- Exploit kinematic variables that reflect the mass of the Higgs, e.g. the invariant mass of all leptons; study the angular separation between the leptons or lepton jet



## Expected limits

- Simple counting experiment
- Systematic uncertainty dominated by fake background estimation and description of jet
- Non-resonant hh
  - 2ISS: 146 X SM hh
  - 3l: 112 X SM hh
  - 4l: 756 X SM hh
- Expected sensitivity to
  - $m_X > 400$  GeV for resonant hh searches
  - $m_S > 145$  GeV in the  $X \rightarrow SS$  model

