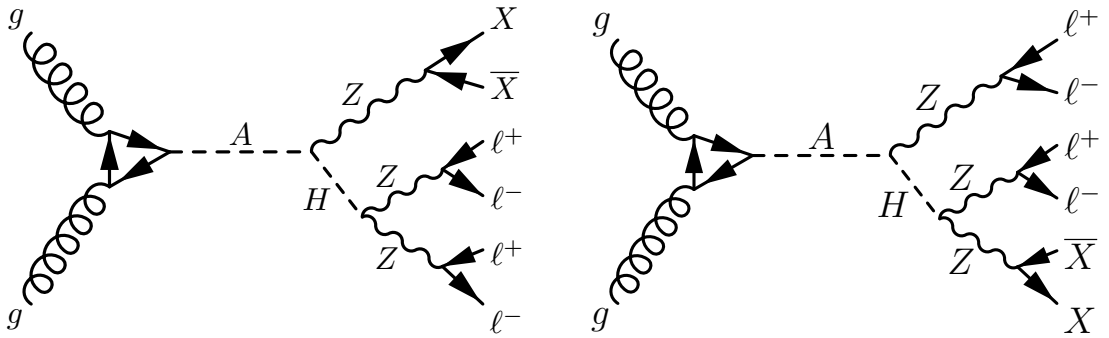
4ℓ+MET analysis status report with LW samples

Abdualazem Fadol Mohammed

April 13, 2023

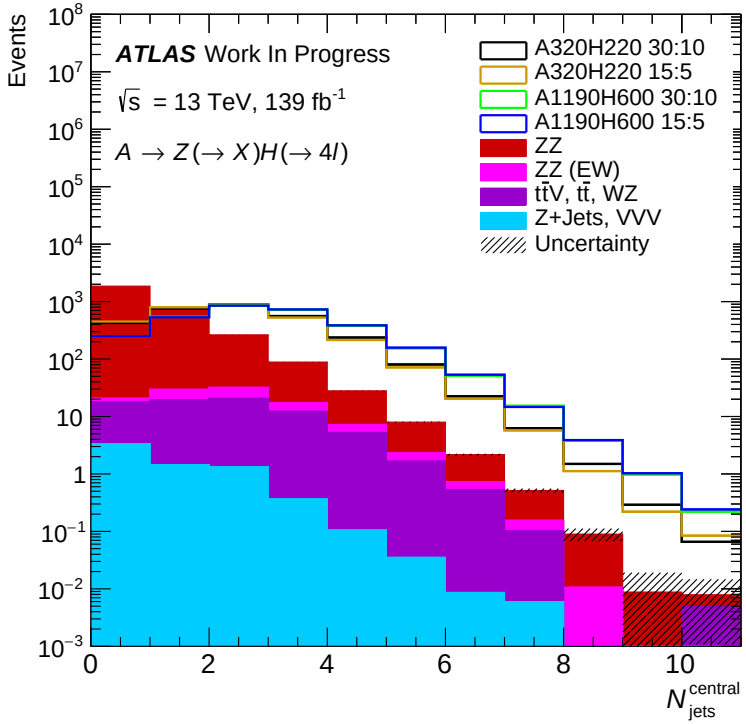
Introduction

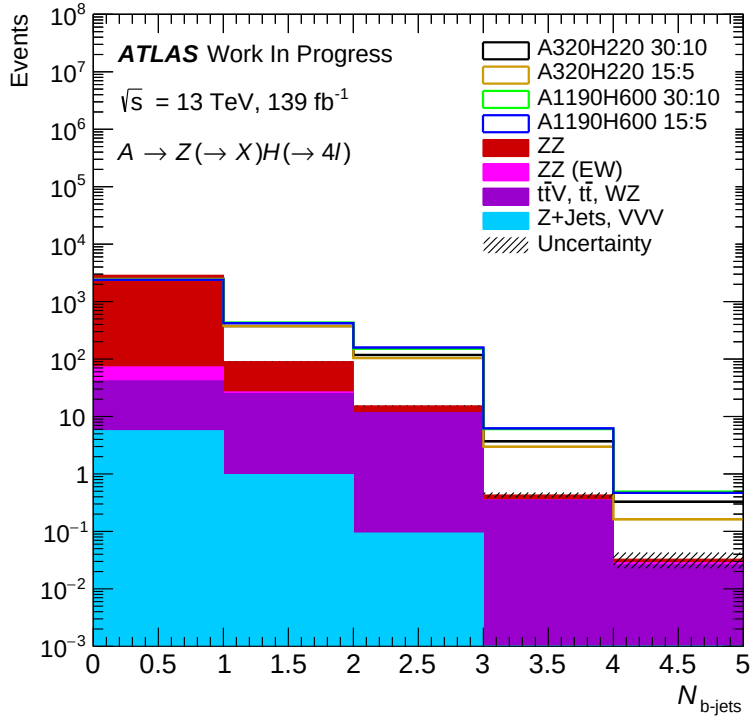
- We generated two mass points 320, 220 and 1190, 600 with $(\Gamma_A/m_A, \Gamma_H/m_H) = (30, 10)$ and $(\Gamma_A/m_A, \Gamma_H/m_H) = (15, 5)$.



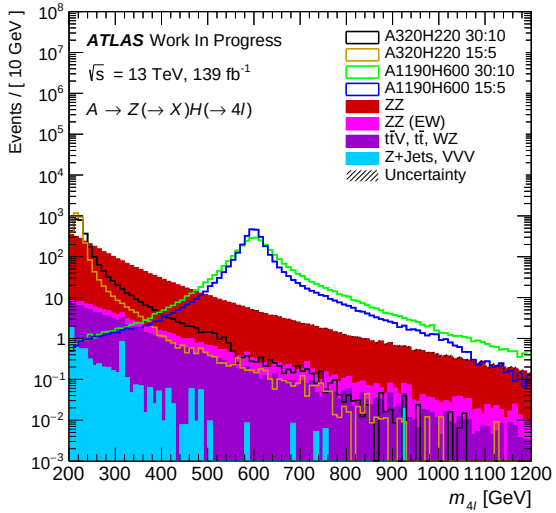
- So we checked kinematic distribution for these new sample with backgrounds.
- Including experimental and theory systematic uncertainties for the new LW sample.
- Calculated the upper limit for the LW and compare it to the NW.

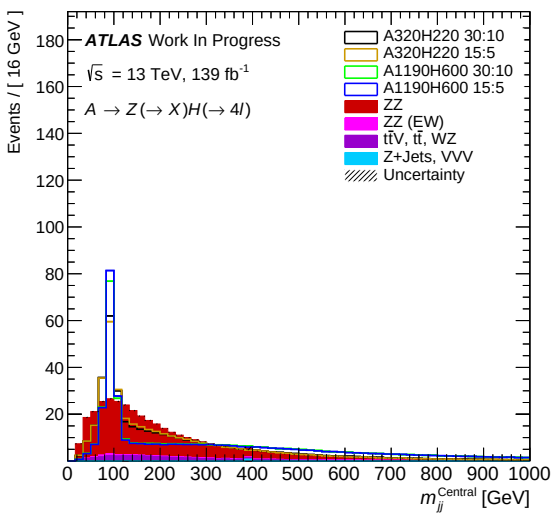
Signal vs backgrounds

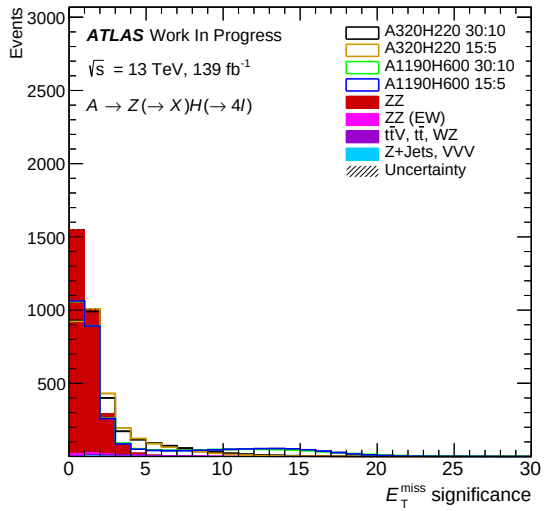


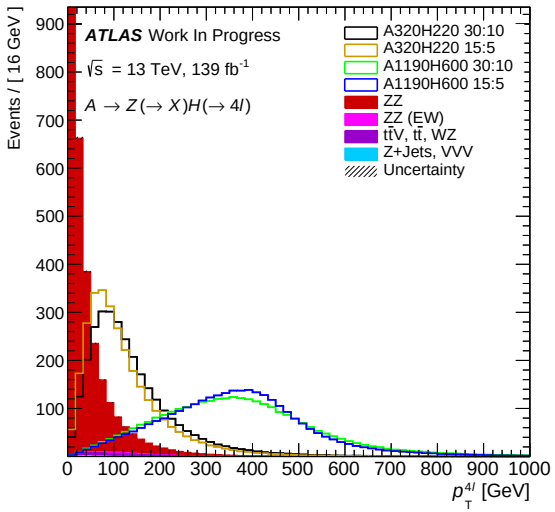


Signal vs backgrounds

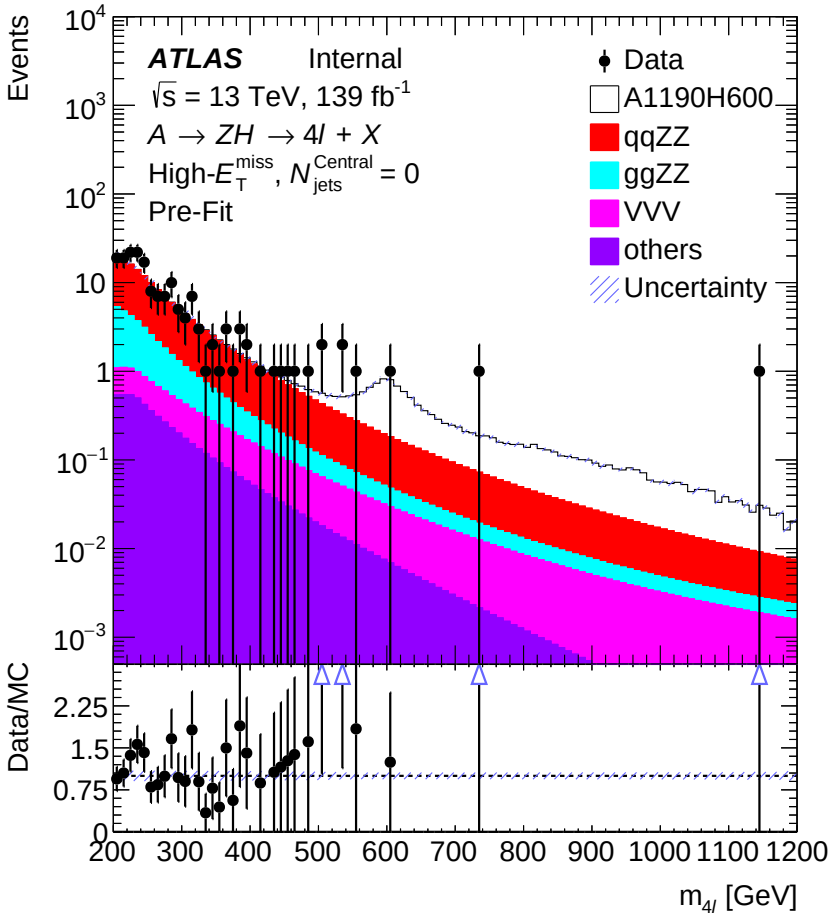


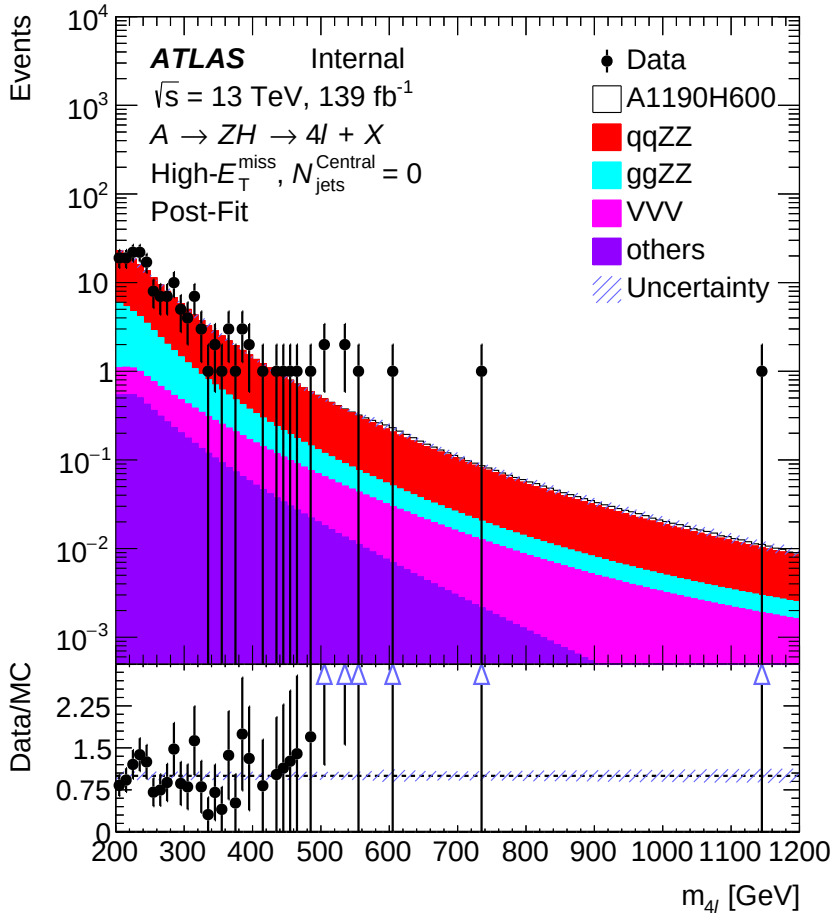






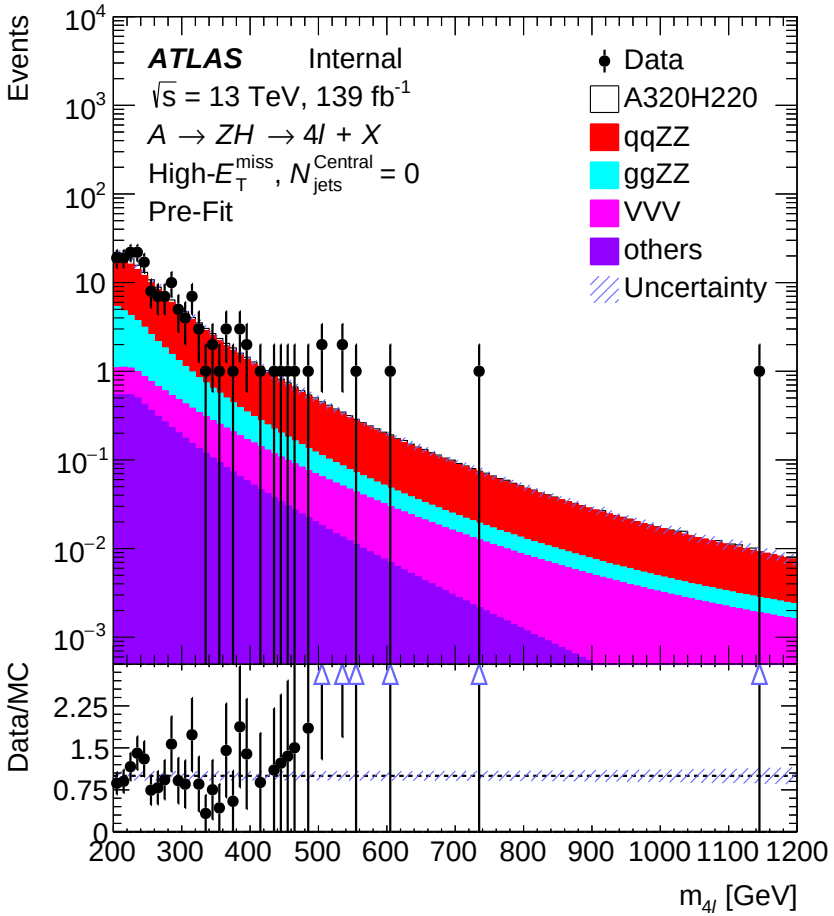
Fit results

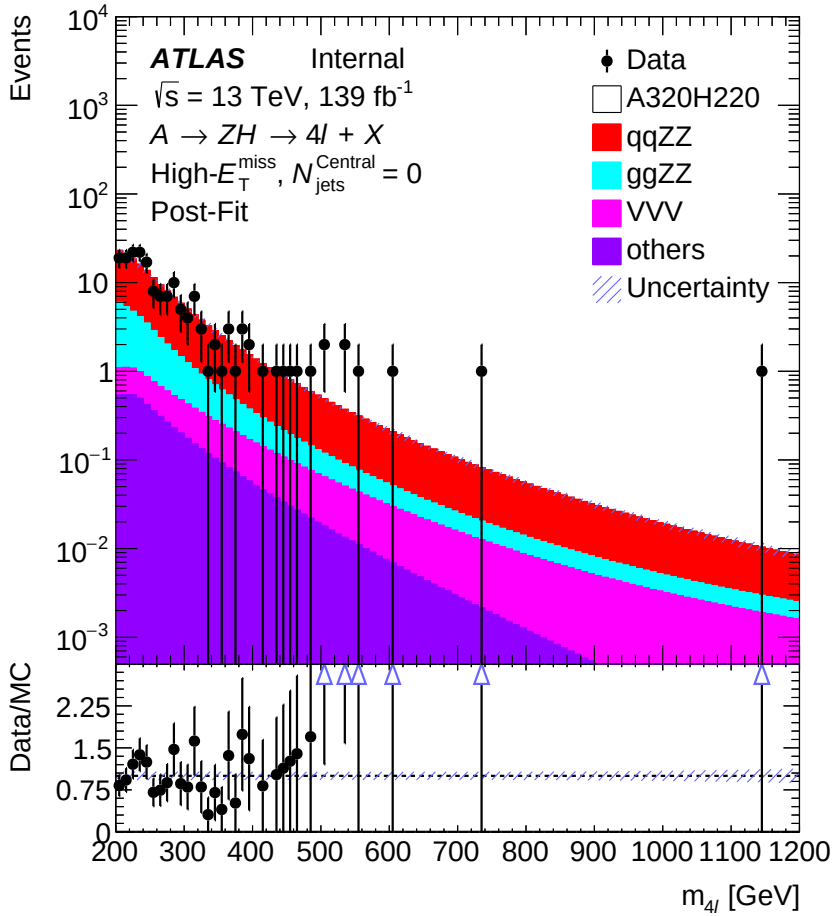




- A1190H600 with $(\Gamma_A/m_A, \Gamma_H/m_H) = (30, 10)$

Fit results

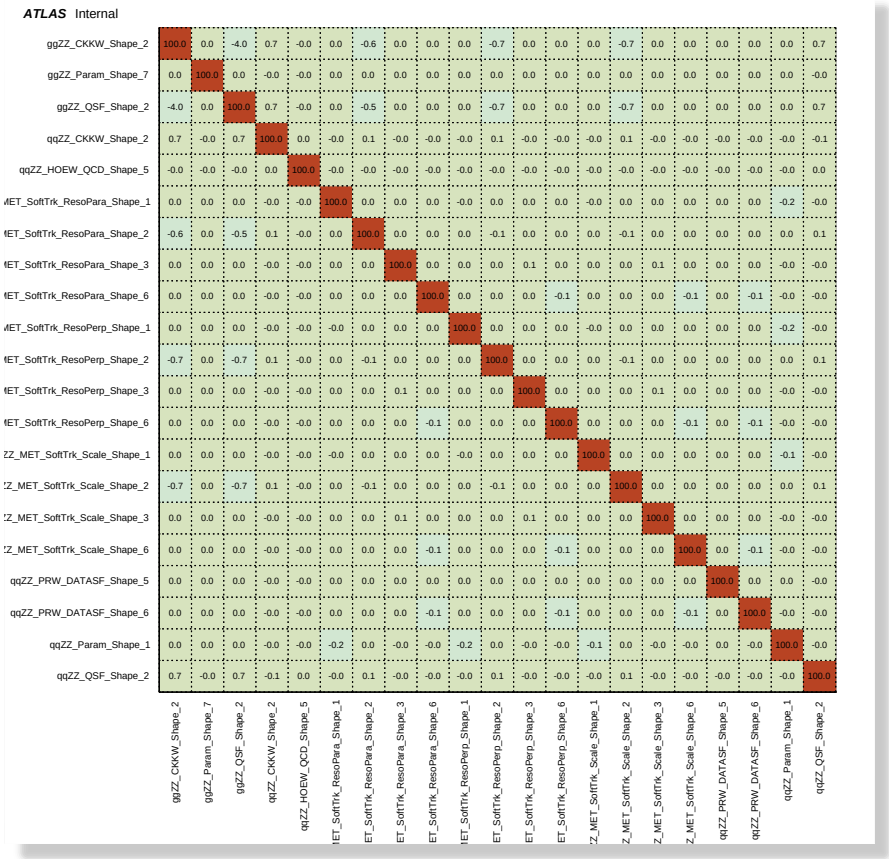




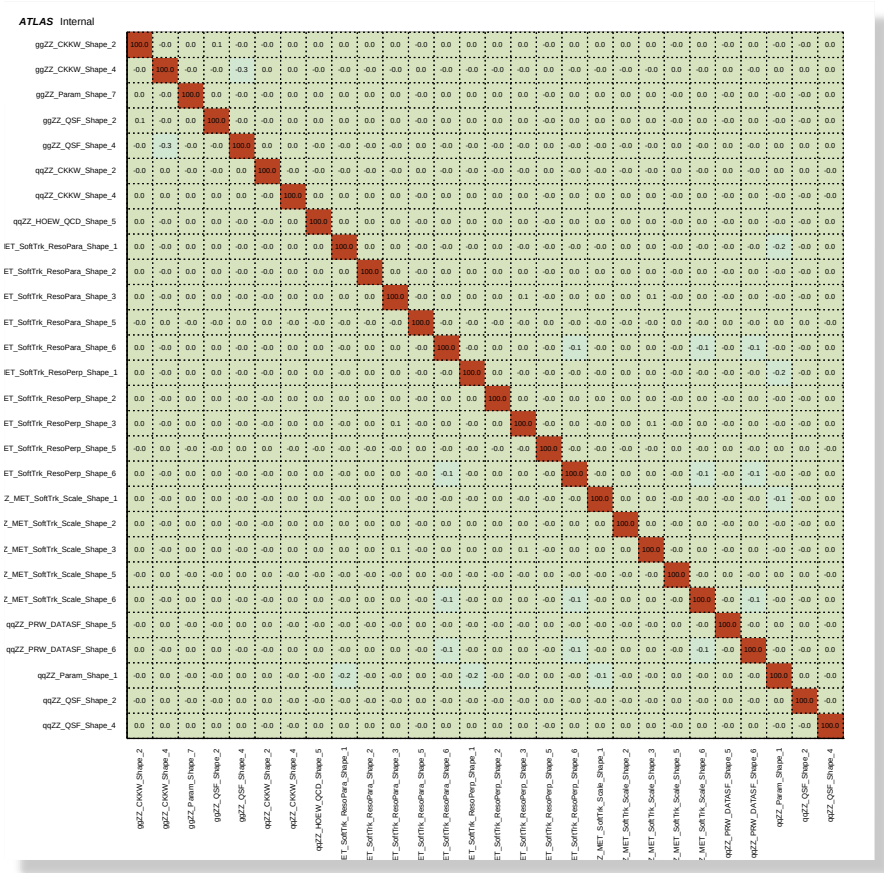
- A320H220 with $(\Gamma_A/m_A, \Gamma_H/m_H) = (30, 10)$

Fit results

Correlation matrix between NPs



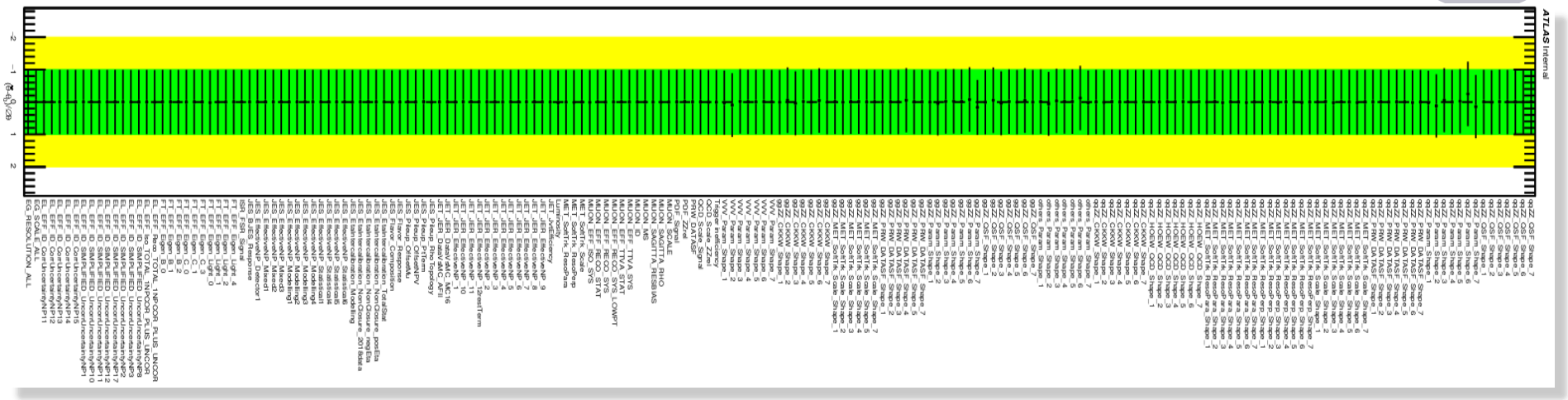
A320H220 with $(\Gamma_A/m_A, \Gamma_H/m_H) = (30, 10)$



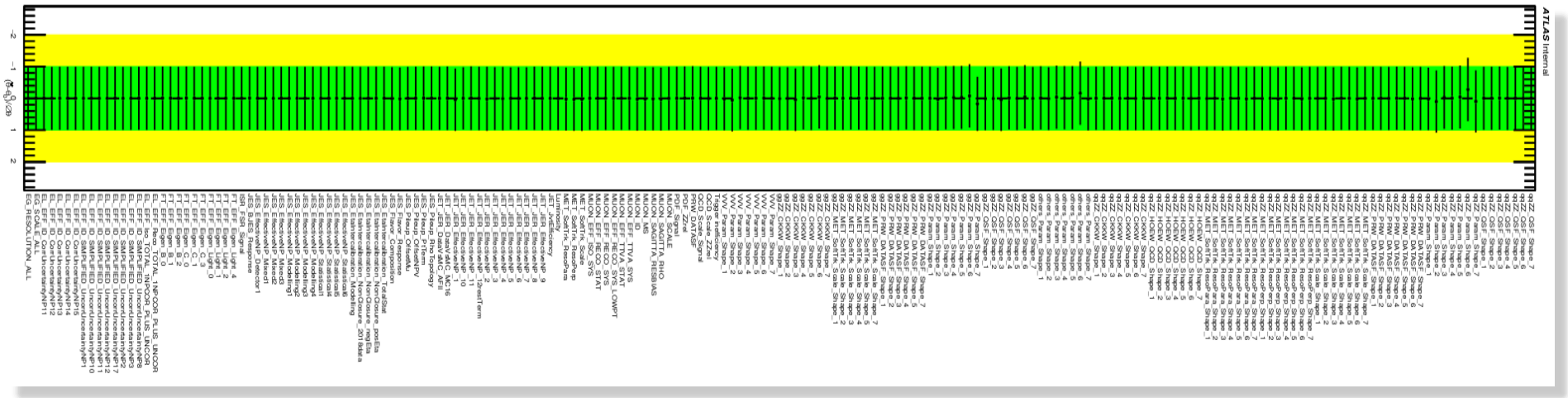
A1190H600 with $(\Gamma_A/m_A, \Gamma_H/m_H) = (30, 10)$

Fit results

Pull plots



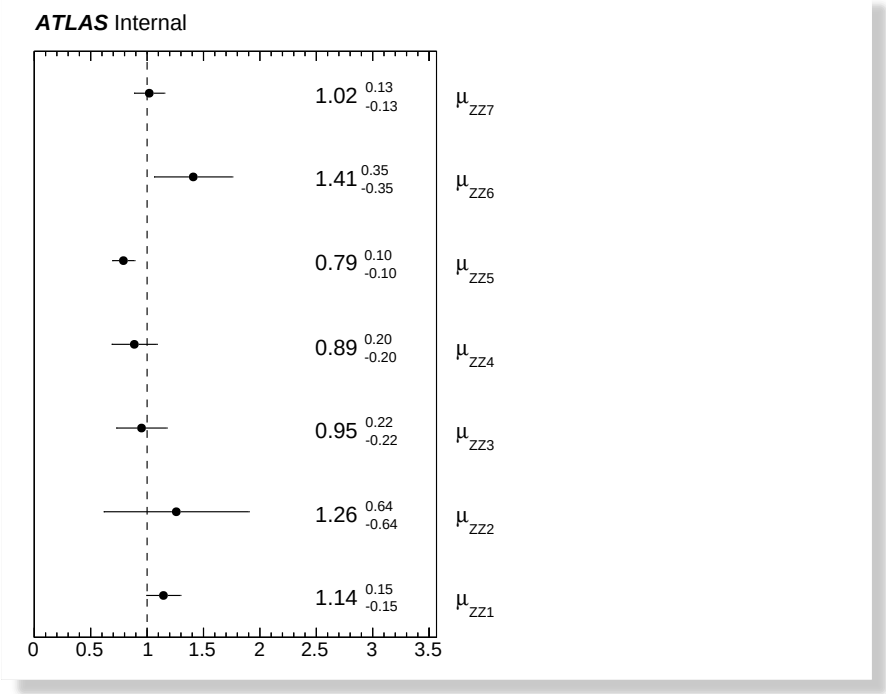
A320H220 with $(\Gamma_A/m_A, \Gamma_H/m_H) = (30, 10)$



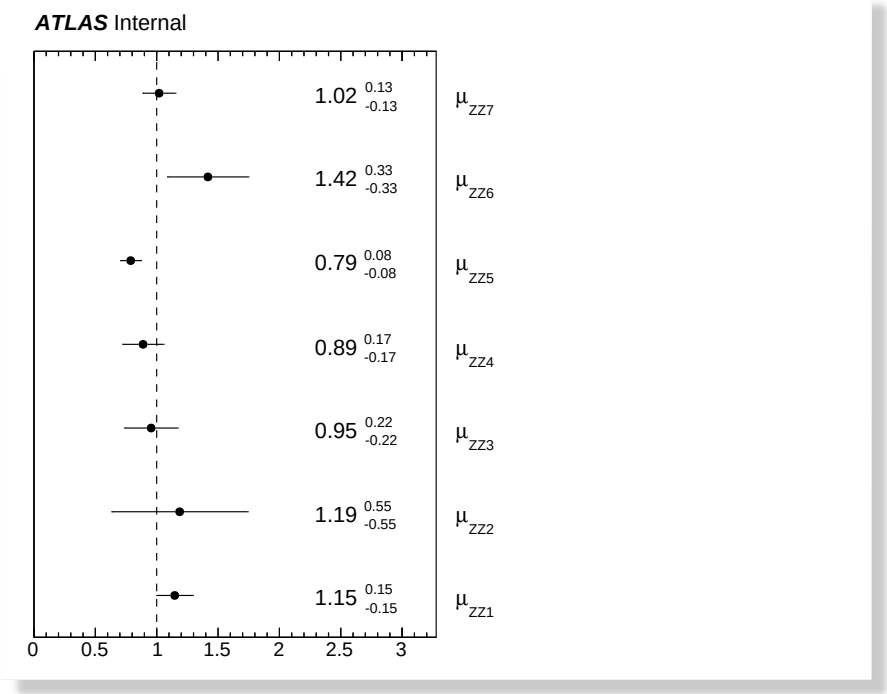
A1190H600 with $(\Gamma_A/m_A, \Gamma_H/m_H) = (30, 10)$

Fit results

Background normalisation in different region



A320H220 with $(\Gamma_A/m_A, \Gamma_H/m_H) = (30, 10)$



A1190H600 with $(\Gamma_A/m_A, \Gamma_H/m_H) = (30, 10)$

Upper limits
LW limit vs NW limit

Upper limit [fb]	A320H220			A1190H600			Fraction	
	LW: 30, 10	LW: 15, 5	NW	LW: 30, 10	LW: 15, 5	NW	LW: 30, 10	LW: 15, 5
Expected	0.563	0.463	0.280	0.085	0.077	0.045	1.9/1.9	1.6/1.7
Observed	0.510	0.411	0.224	0.118	0.106	0.061	2.3/1.9	1.8/1.7

Summary

- We selected $(m_A, m_H) = (320, 220)$ and $(1190, 600)$ GeV mass points for each of the $A \to Z(\to X)H(\to 4\ell)$ and $A \to Z(\to 2\ell)H(\to 2\ell + X)$ signal models to be generated.
- The widths for the A and H are as follows:
  - A widths: 30% and 15%
  - H widths: 10% and 5%
- The upper limit decreases as the natural width of the A and H bosons increases. A $A \to ZH \to 4\ell + X$ signal produced A and H bosons with natural width of 15% and 5% (30% and 10%), respectively, of their experiment mass resolution has upper limit reduced by a factor 1.7 (1.9) from the narrow width case.

Additional slides
Categorisation