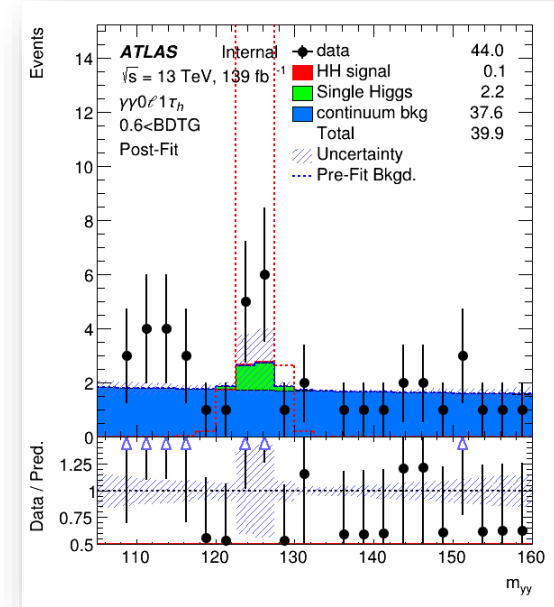
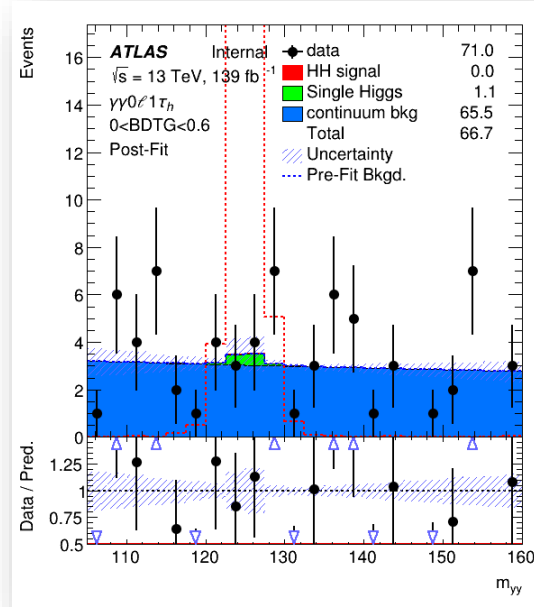
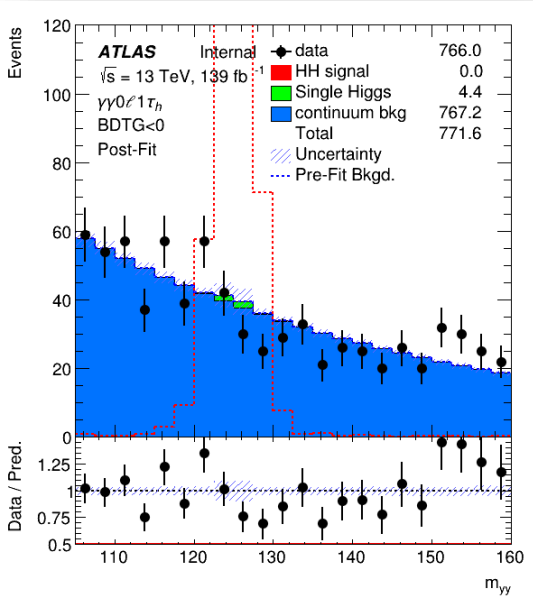


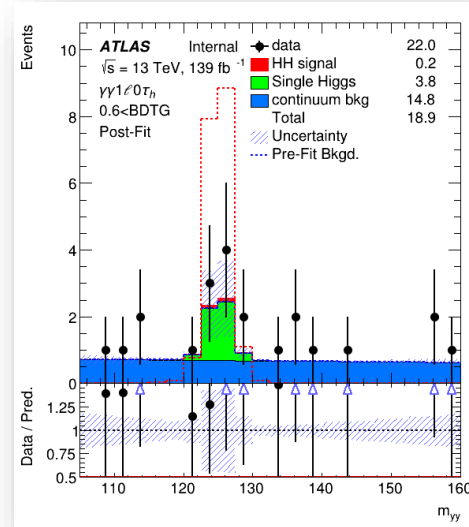
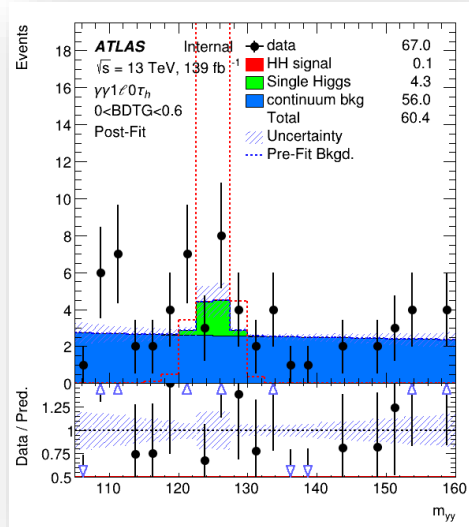
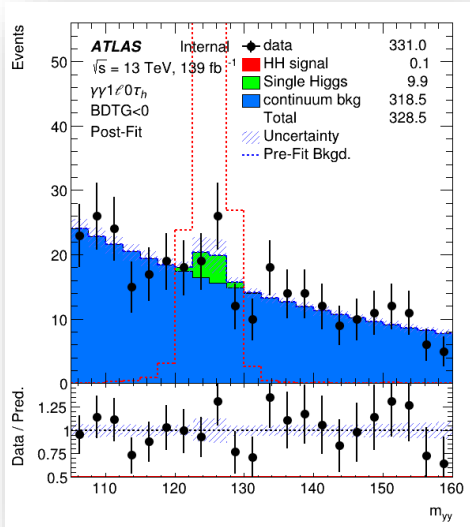
$m_{\gamma\gamma}$ distribution in whole region

$\gamma\gamma + 0l1\tau_h$: $m_{\gamma\gamma}$ distribution in different BDTG regions

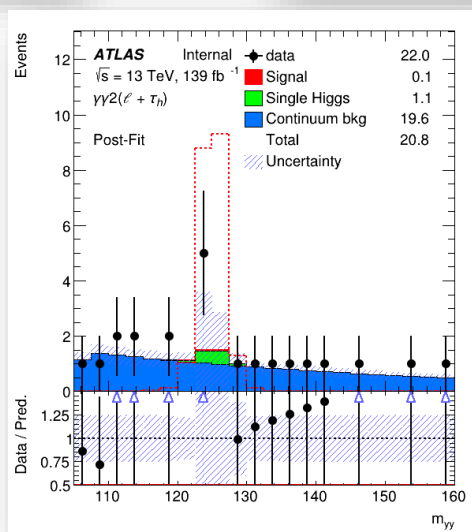


$m_{\gamma\gamma}$ distribution in whole region

$\gamma\gamma + 1l0\tau_h$: $m_{\gamma\gamma}$ distribution in different BDTG regions



$\gamma\gamma + 2L$:



Event yield entering in the fit

The event yields in MC signal, MC Single Higgs, Continuum Background modeling and the data in whole mass region($105 \text{ GeV} < m_{\gamma\gamma} < 160 \text{ GeV}$):

Channel	Regions	Signal	Single Higgs	Continuum B modeling	Total B	Data
$\gamma\gamma+1\ell 0\tau_{\text{had}}$	Loose BDTG region	0.07	9.91	318.39	328.30	331
$\gamma\gamma+1\ell 0\tau_{\text{had}}$	Medium BDTG region	0.09	4.35	55.96	60.30	67
$\gamma\gamma+1\ell 0\tau_{\text{had}}$	Tight BDTG region	0.23	3.78	14.84	18.62	22
$\gamma\gamma+0\ell 1\tau_{\text{had}}$	Loose BDTG region	0.03	4.35	766.87	771.23	766
$\gamma\gamma+0\ell 1\tau_{\text{had}}$	Medium BDTG region	0.03	1.13	65.51	66.64	71
$\gamma\gamma+0\ell 1\tau_{\text{had}}$	Tight BDTG region	0.12	2.22	37.57	39.79	44
$\gamma\gamma+2L$	Whole region	0.14	1.07	19.84	20.91	22

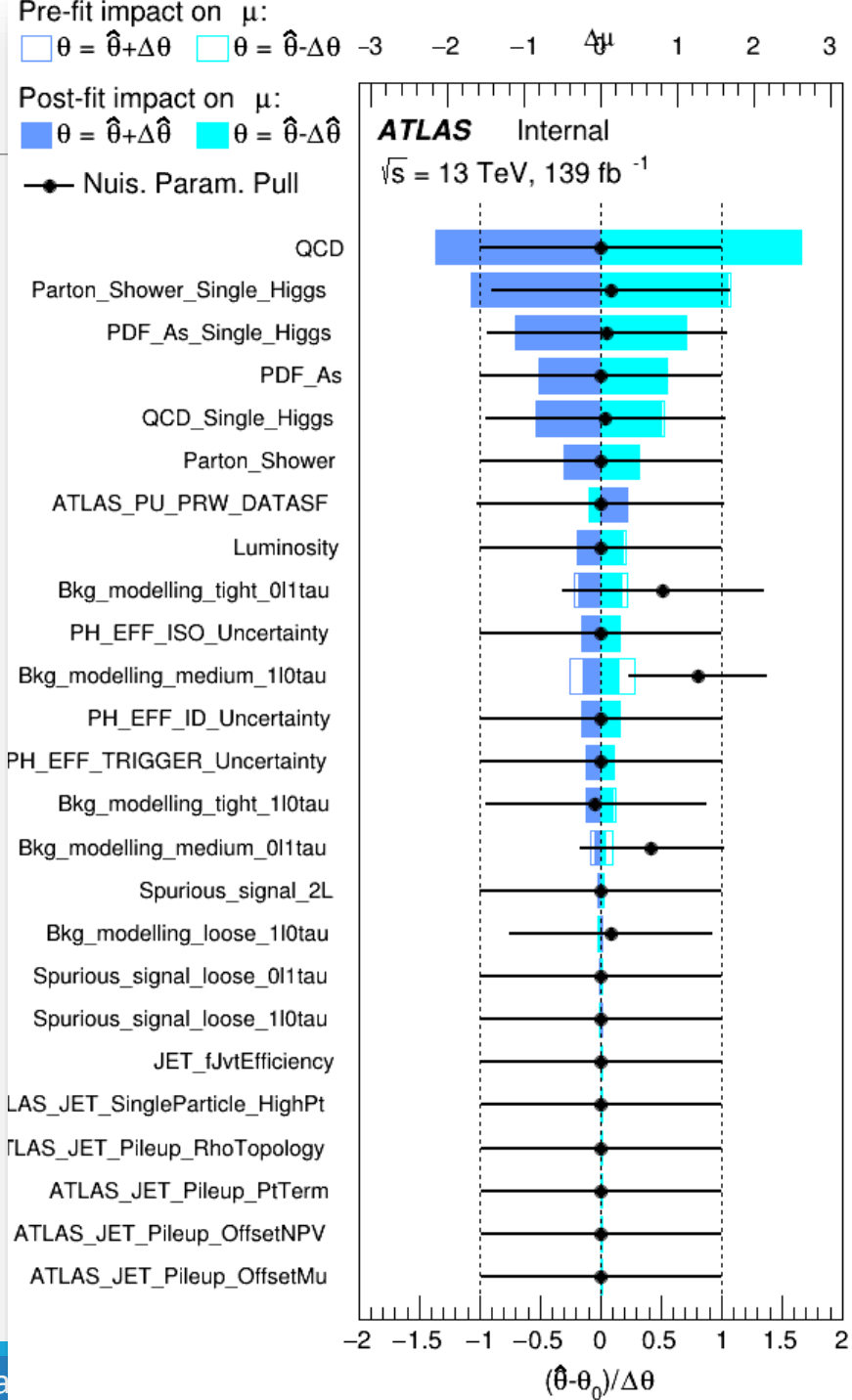
In signal region($120 \text{ GeV} \leq m_{\gamma\gamma} \leq 130 \text{ GeV}$):

Channel	Regions	Signal	Single Higgs	Continuum B modeling	Total B	Data
$\gamma\gamma+1\ell 0\tau_{\text{had}}$	Loose BDTG region	0.07	9.65	67.23	76.87	75
$\gamma\gamma+1\ell 0\tau_{\text{had}}$	Medium BDTG region	0.09	4.27	10.89	15.16	22
$\gamma\gamma+1\ell 0\tau_{\text{had}}$	Tight BDTG region	0.22	3.73	2.89	6.62	10
$\gamma\gamma+0\ell 1\tau_{\text{had}}$	Loose BDTG region	0.02	4.21	161.93	166.14	154
$\gamma\gamma+0\ell 1\tau_{\text{had}}$	Medium BDTG region	0.03	1.10	12.75	13.84	18
$\gamma\gamma+0\ell 1\tau_{\text{had}}$	Tight BDTG region	0.12	2.19	7.31	9.49	13
$\gamma\gamma+2L$	Whole region	0.14	1.04	4.18	5.22	6

Fit results

Upper limit with all sys uncertainties

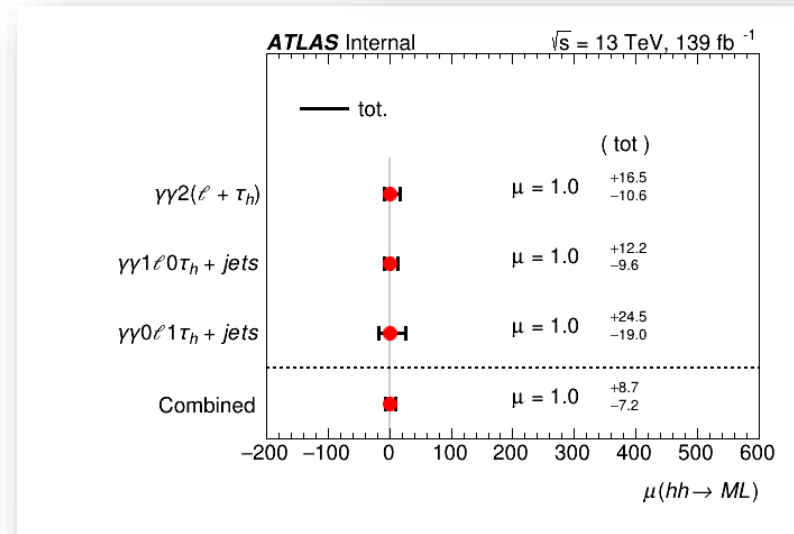
	-2σ	-1σ	Expected	$+1\sigma$	$+2\sigma$	Observed
$\gamma\gamma+1\ell 0\tau_{\text{had}}$	14.32	19.23	26.68	39.53	59.17	45.70
$\gamma\gamma+0\ell 1\tau_{\text{had}}$	29.25	39.27	54.50	80.98	121.70	100.50
$\gamma\gamma+2L$	20.51	27.53	38.21	57.76	89.47	48.36
Combined	10.02	13.46	18.67	27.48	40.66	39.98



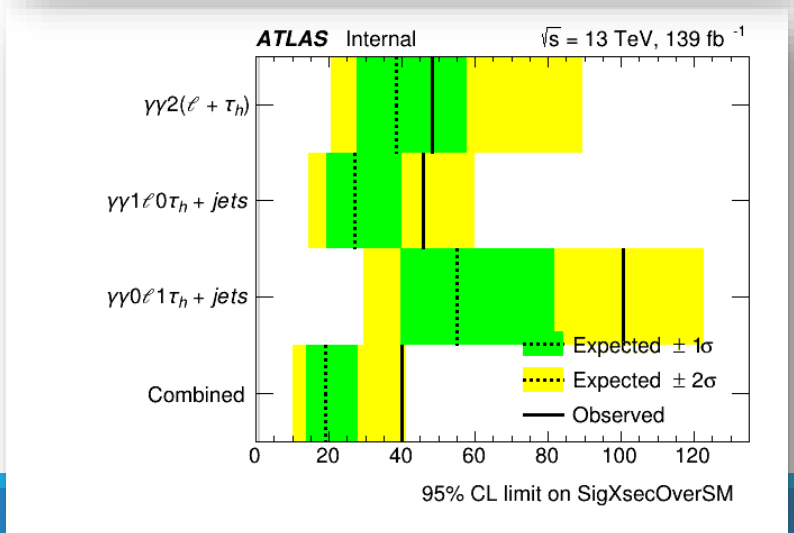
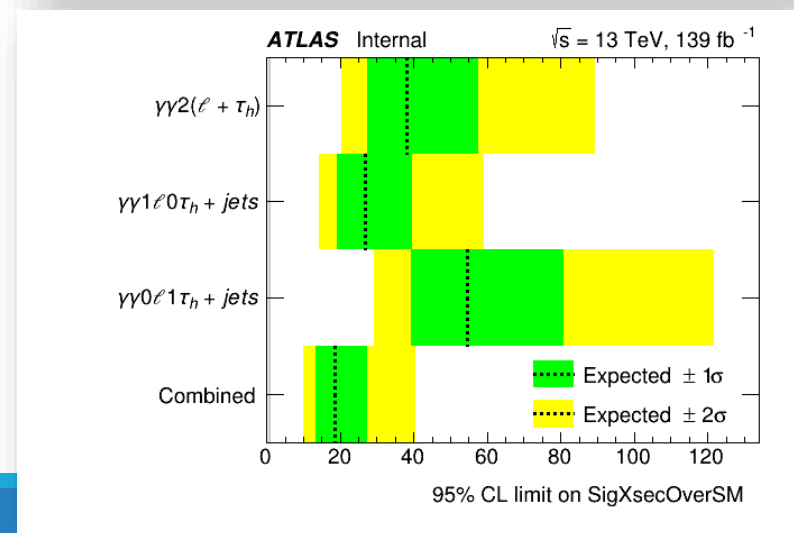
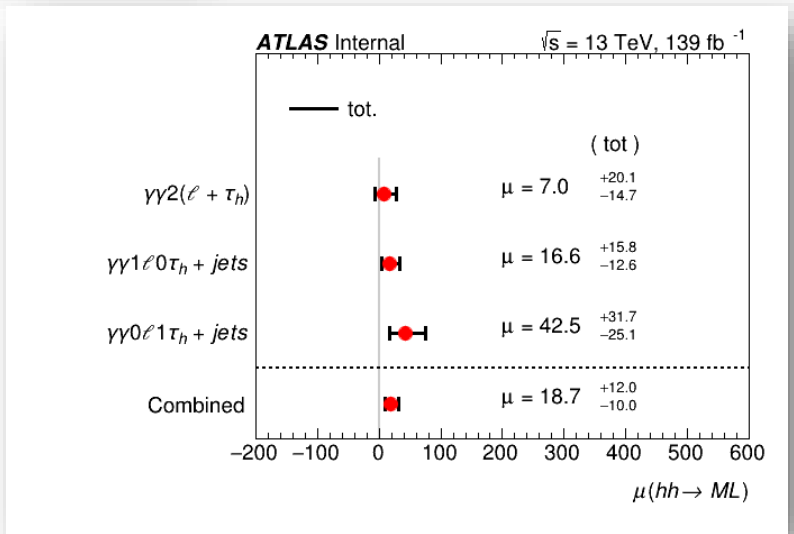
Fit results

	-2σ	-1σ	Expected	$+1\sigma$	$+2\sigma$	Observed
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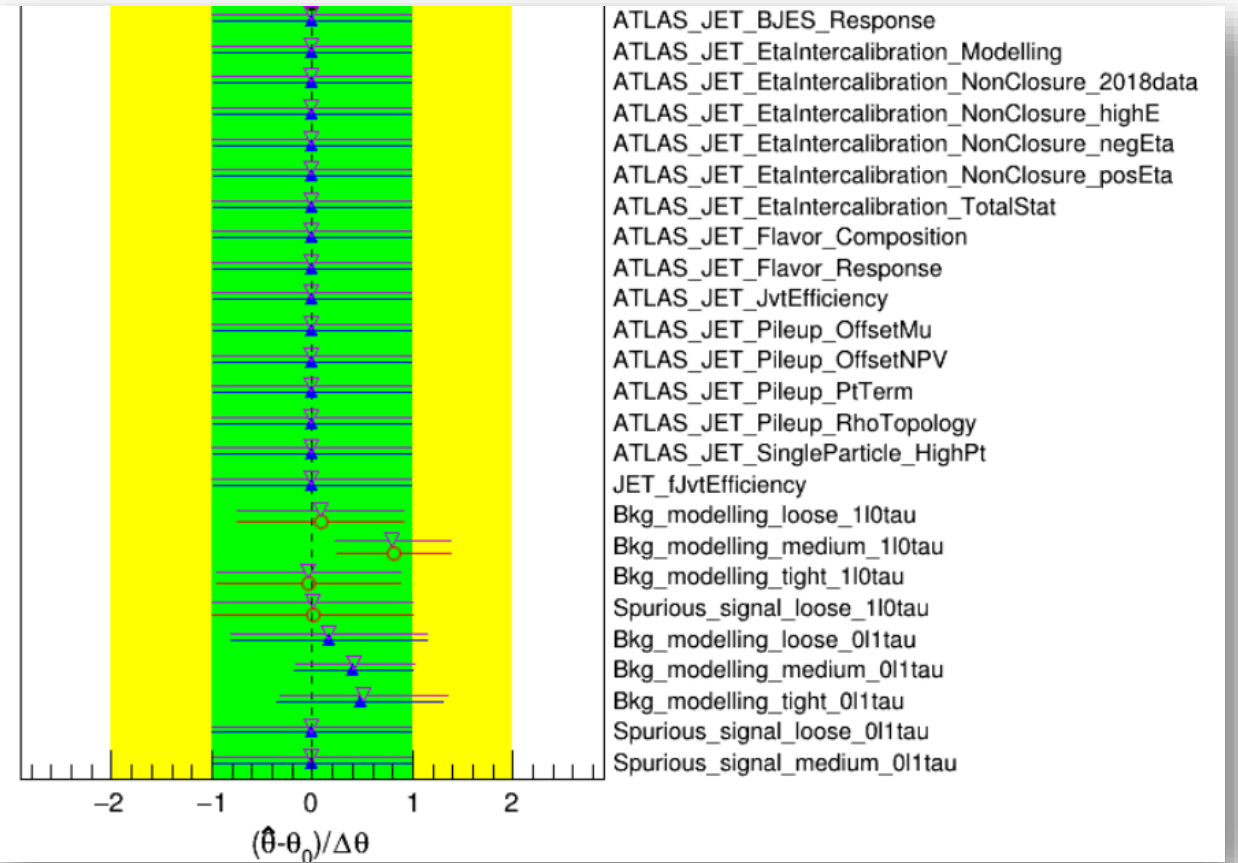
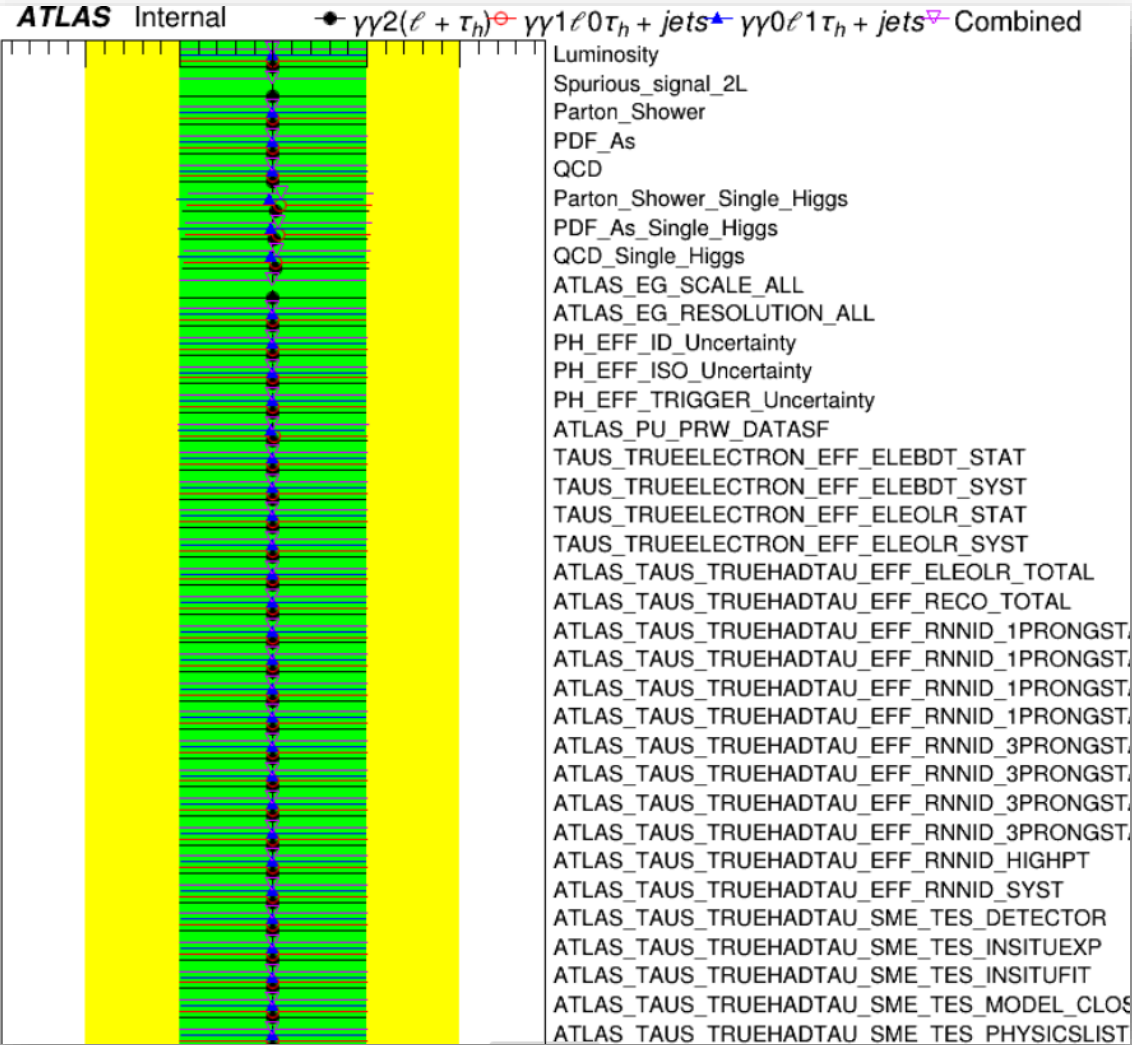
Expected:



Observed:



Fit results



Questions from di-higgs conveners

◆ 1. Do you understand why the impact of the PS uncertainty is much larger on Single Higgs compared to HH?

I'm not sure about it, need to do more check

◆ 2. How is it calculated? (the plots shows a blue band but we assume that this is just a plotting leftover and you consider only the 1sigma variation and then symmetrise in the fit?)

Which one? But indeed, I consider only the 1sigma variation (blue one) and then symmetrise in the fit.

◆ 3. Which processes are included in the single Higgs background?

INT note table3

343981	ggH	POWHEG + PYTHIA8	PDF4LHC15NNLO	AZNLO
346214	VBF	POWHEG + PYTHIA8	PDF4LHC15NLO	AZNLO
345318	W^+H	POWHEG + PYTHIA8	PDF4LHC15NLO	AZNLO
345317	W^-H	POWHEG + PYTHIA8	PDF4LHC15NLO	AZNLO
345319	$qq \rightarrow ZH$	POWHEG + PYTHIA8	PDF4LHC15NLO	AZNLO
345061	$gg \rightarrow ZH$	POWHEG + PYTHIA8	PDF4LHC15NLO	AZNLO
346525	$t\bar{t}H$	POWHEG + PYTHIA8	NNPDF3.0NLO	A14
345315	$b\bar{b}H$	POWHEG + PYTHIA8	NNPDF3.0NLO	A14
346188	tHbj four flavour	MADGRAPH5_AMC@NLO + PYTHIA8	NNPDF3.0NLO	A14
346486	tHW	MADGRAPH5_AMC@NLO + PYTHIA8	NNPDF3.0NLO	A14

◆ 4. Make sure that all the checks you documented in the slides are also documented in the note.

All of them are in the note