Combination on hh pair productions

with WWyy, bbtautau, bbyy, bbbb final states

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14-01-2015

IHEP

Updates

- Previously, we have the non-zero mu and strange nuisance pulls when fitting to asimovData
- This comes from two facts:
  - bbbb workspace has a different asimov dataset than other channel, i.e. mu!=0, so now regenerate asimovData , and in the meanwhile, asking David to produce a workspace with mu set to 0 (unfortunately ws were produced wrongly Friday, David is debugging)
  - CombinationTool generates asimovData dependent on the dataset one passes to it, previously obsData, now using regenerated asimov from each subchannel
- Extending res combination 500, 800, 1000 GeV, including bbtautau, wwyy and bbbb
- Many thanks to Liron and Junichi:
  - bbH samples request: JOs ready, validated, approved, waiting for production https://its.cern.ch/jira/browse/ATLMCPROD-920
  - VBF samples request: LHE & JOs ready, validated, in review https://its.cern.ch/jira/browse/ATLMCPROD-957

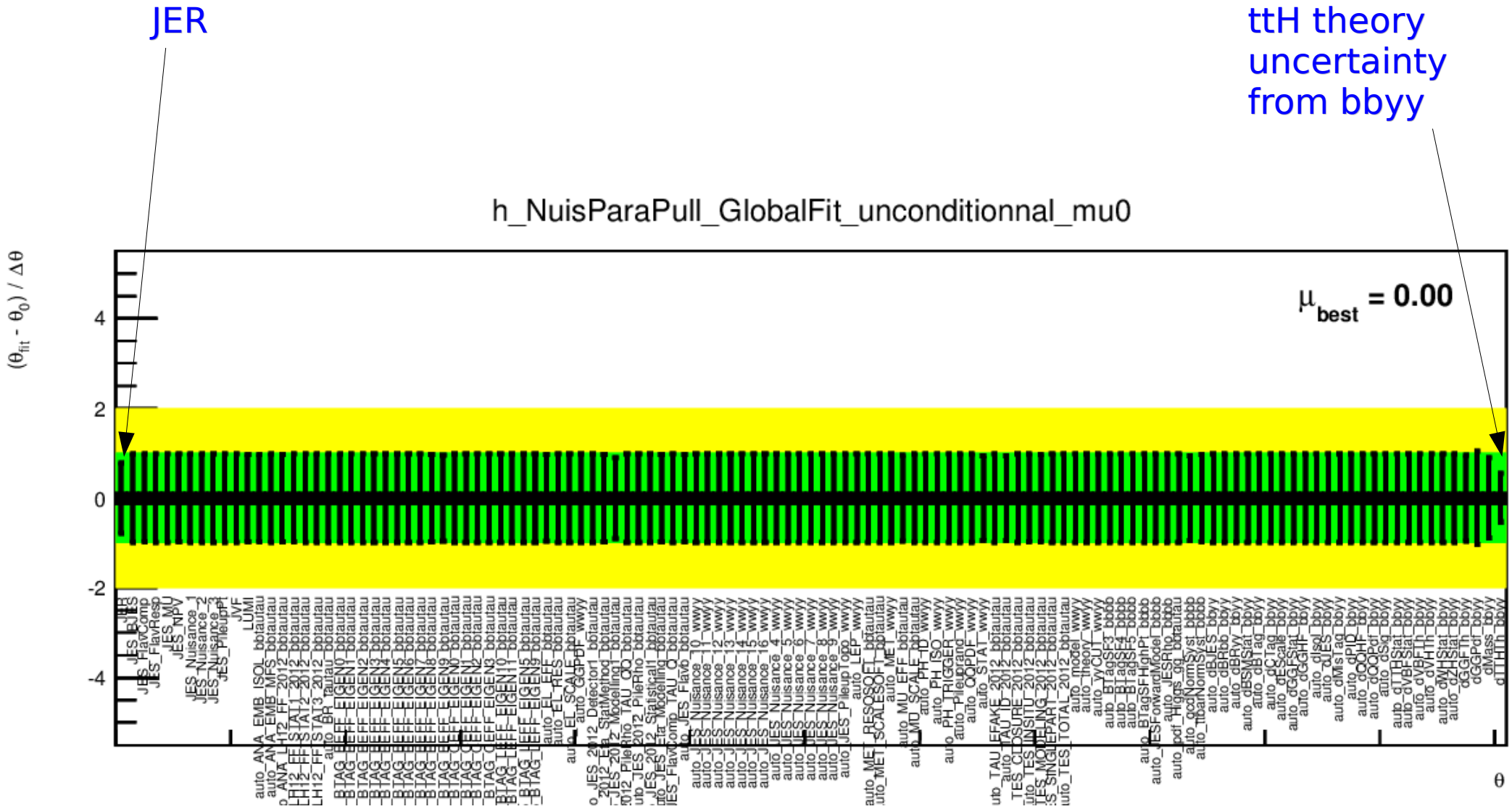
ws status

- As a reminder of the workspace currently in use:
  - bbbb: 4 weeks ago (new on Friday, but wrong...)
  - bbyy: 4 weeks ago
  - bbtautau: 4 weeks ago
  - wwyy: 3 weeks ago
- Thank all analyzers for providing the workspaces and welcome to any updates in them

Pull check - nonres

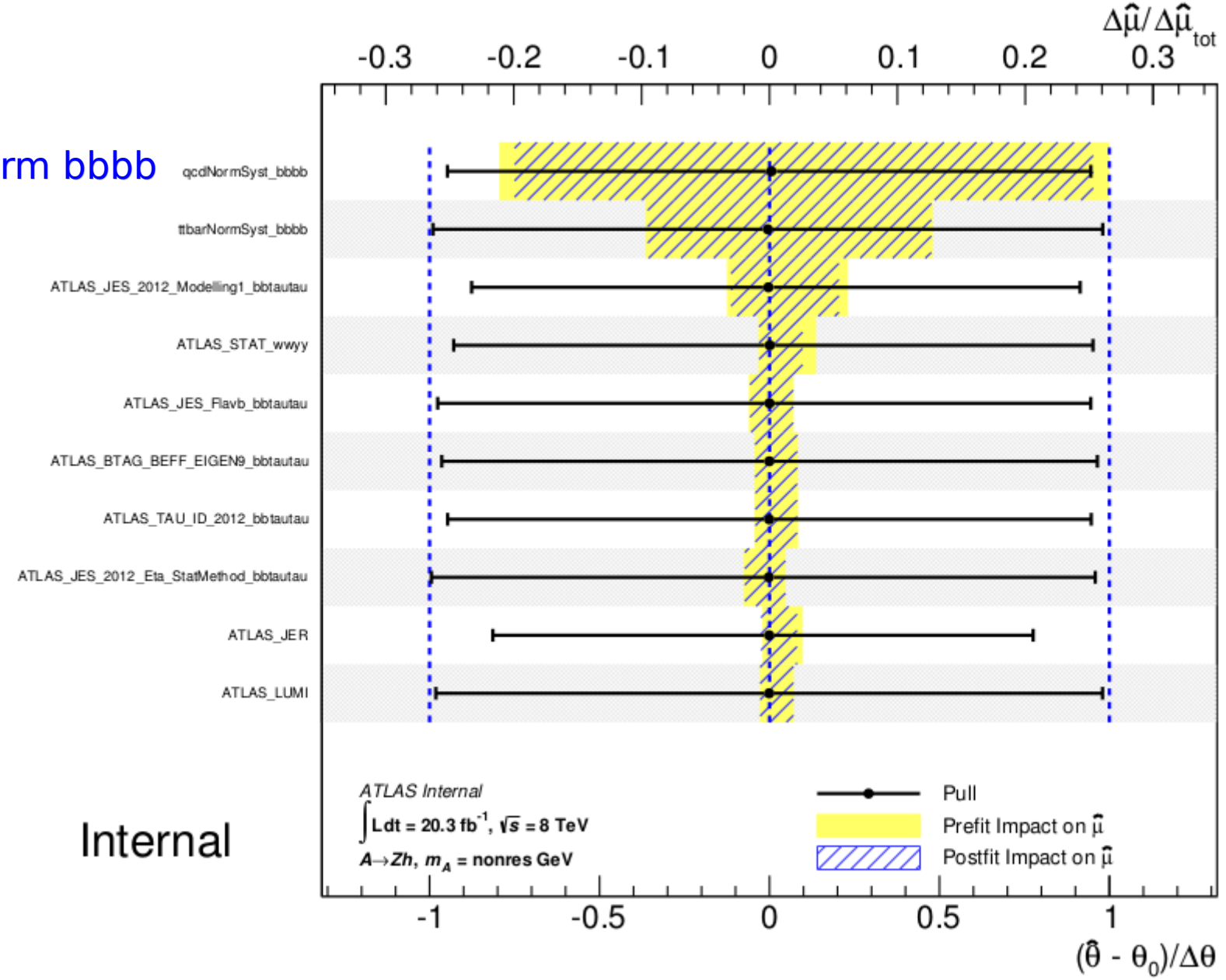
JER

ttH theory uncertainty from bbyy



Nuis ranking - nonres

QCD norm bbbb



Internal

Upper limits – nonres

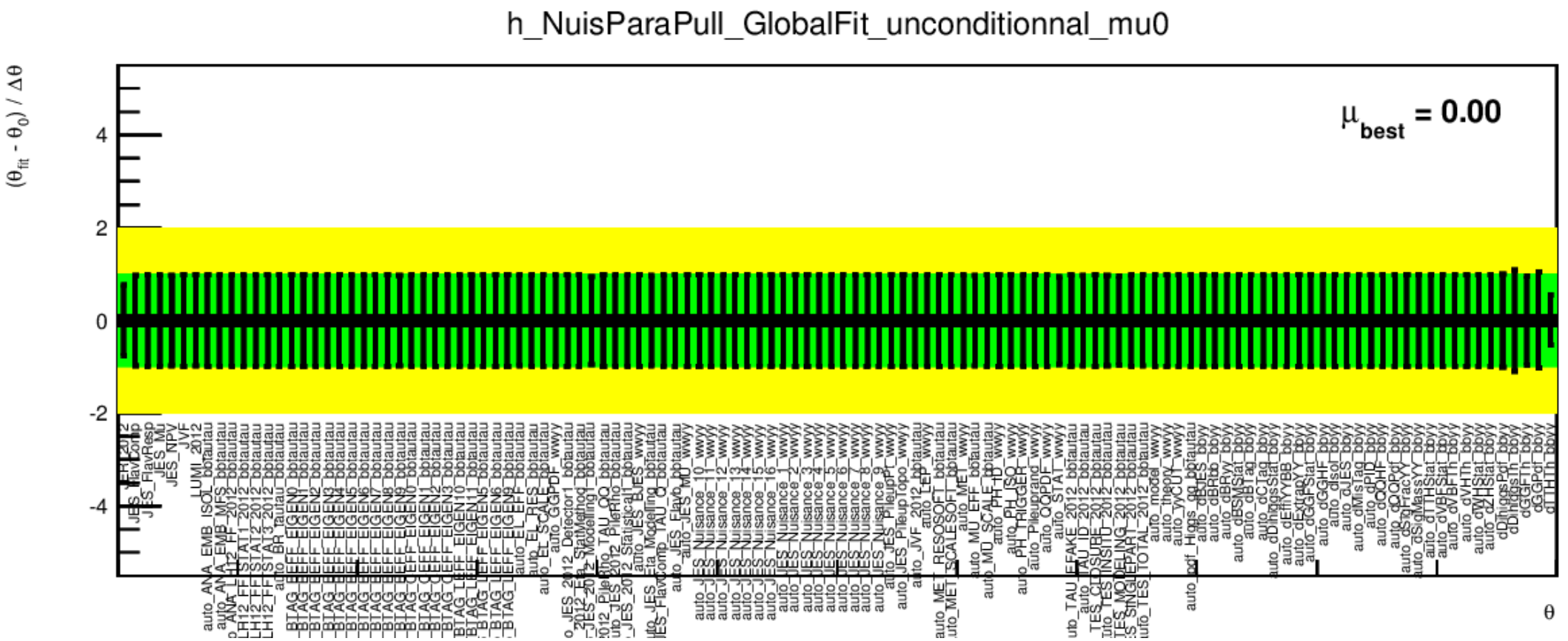
- Expected upper limits [pb] are extracted

	OBS	EXP	+2sig	+1sig	-1sig	-2sig
bbbb	- *no change*	0.594477	1.22232	0.853741	0.428353	0.319071
bbyy	- *no change*	1.07251	2.52278	1.62458	0.772804	0.575645
wwyy	- *no change*	6.56869	15.034	9.85594	4.7331	3.52558
bbtautau	- *no change*	1.54221	3.41345	2.2871	1.11125	0.827747
combined	- *new*	0.440953	0.892523	0.631221	0.317731	0.236671

proper asimovData is generated, comb limit exp ~0.55 -> 0.44
only bbtautau changed from limit exp 1.50 pb to 1.54 pb, previously

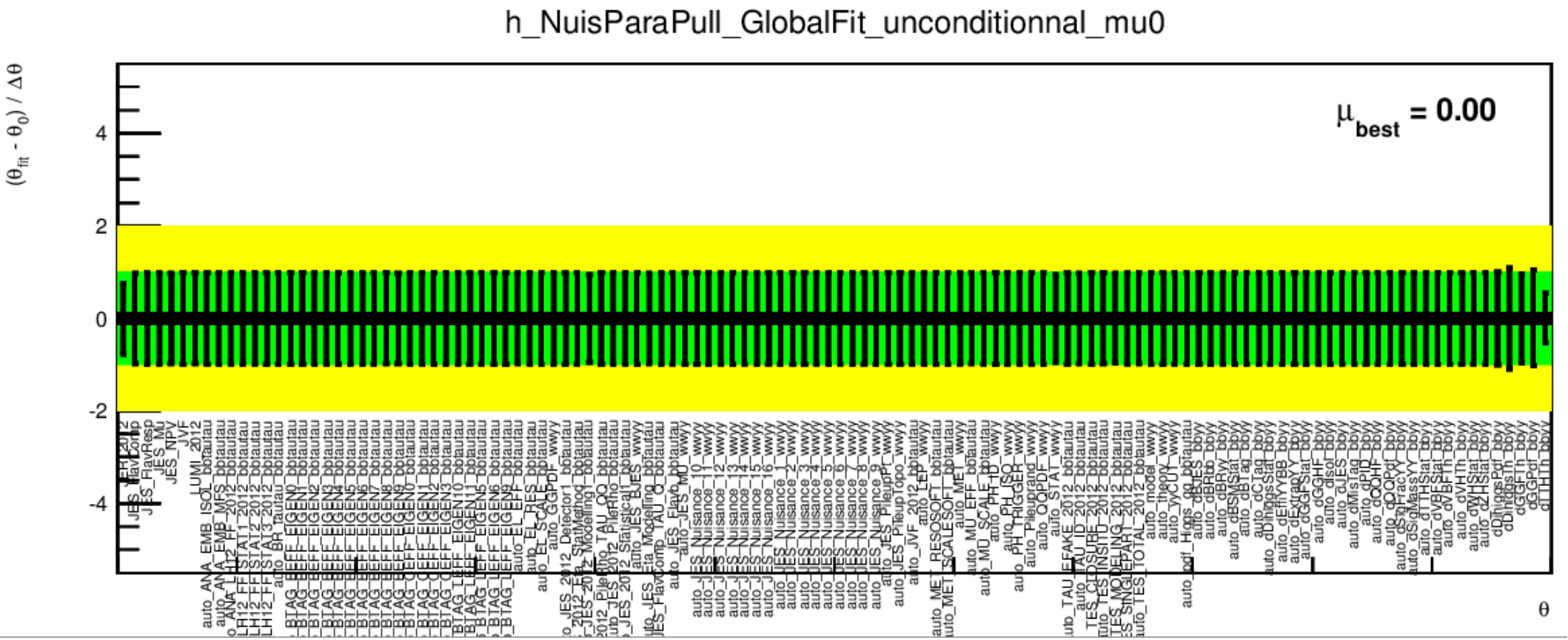
Pull check – 260 GeV

bbyy+bbtautau+wwyy



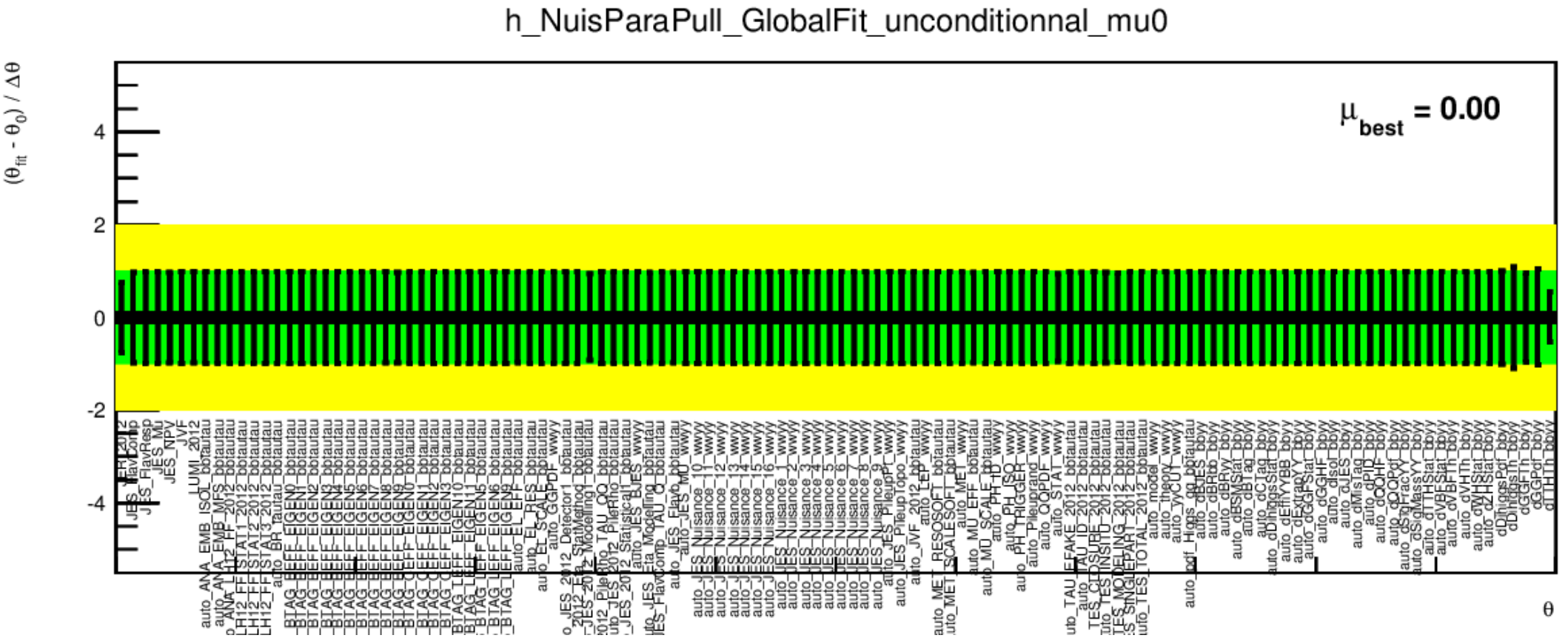
Pull check – 300 GeV

bbyy+bbtautau+wwyy



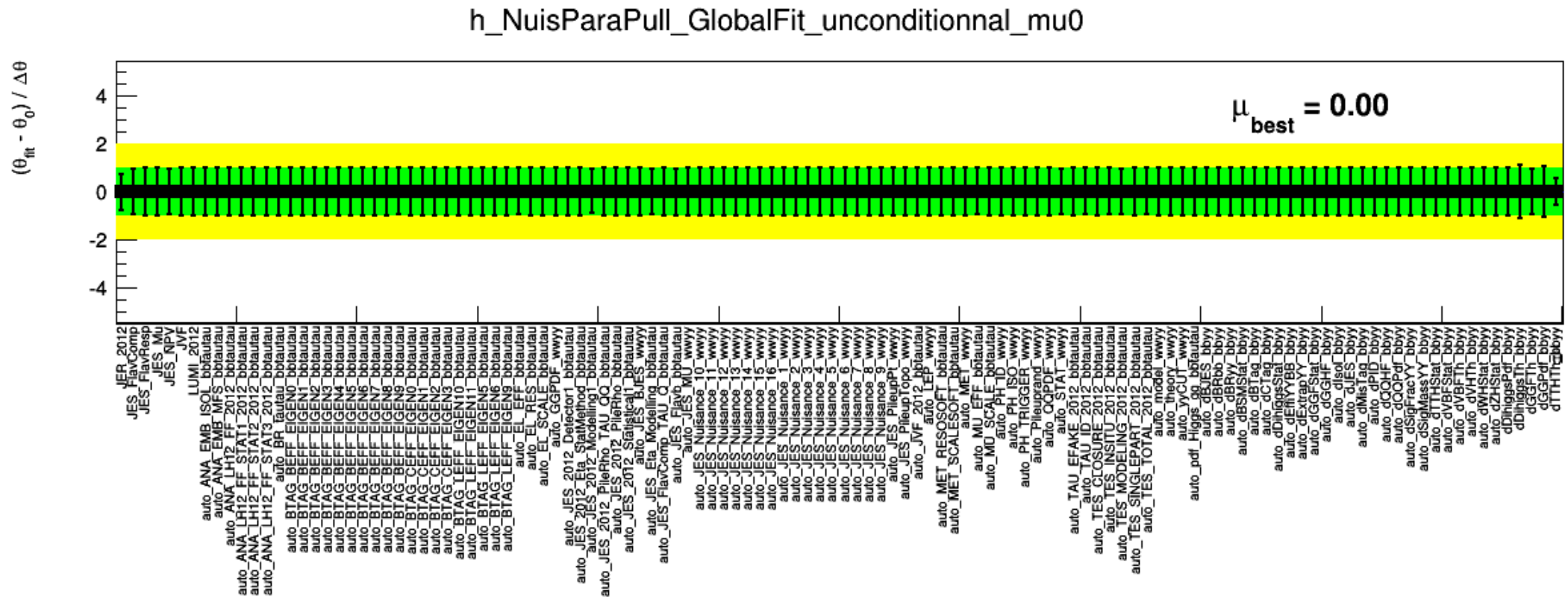
Pull check – 350 GeV

bbyy+bbtautau+wwyy



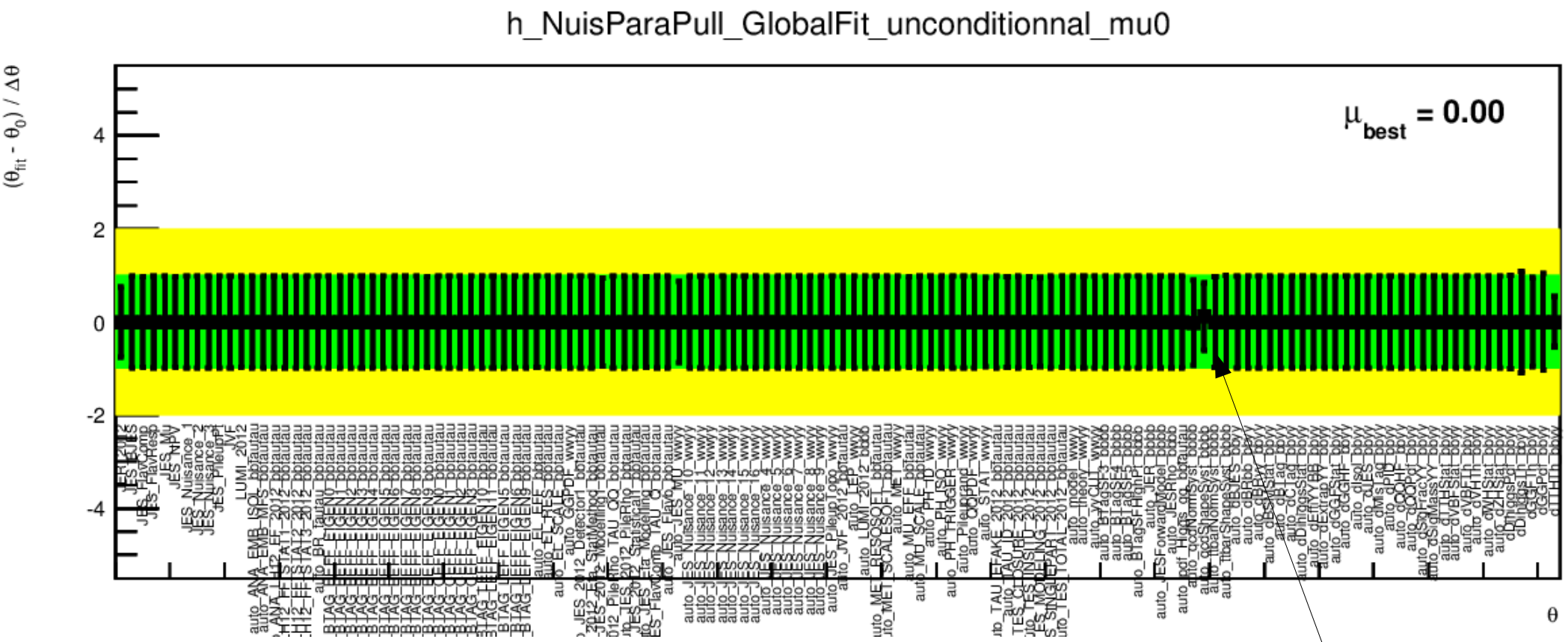
Pull check – 400 GeV

bbyy+bbtautau+wwyy



Pull check – 500 GeV

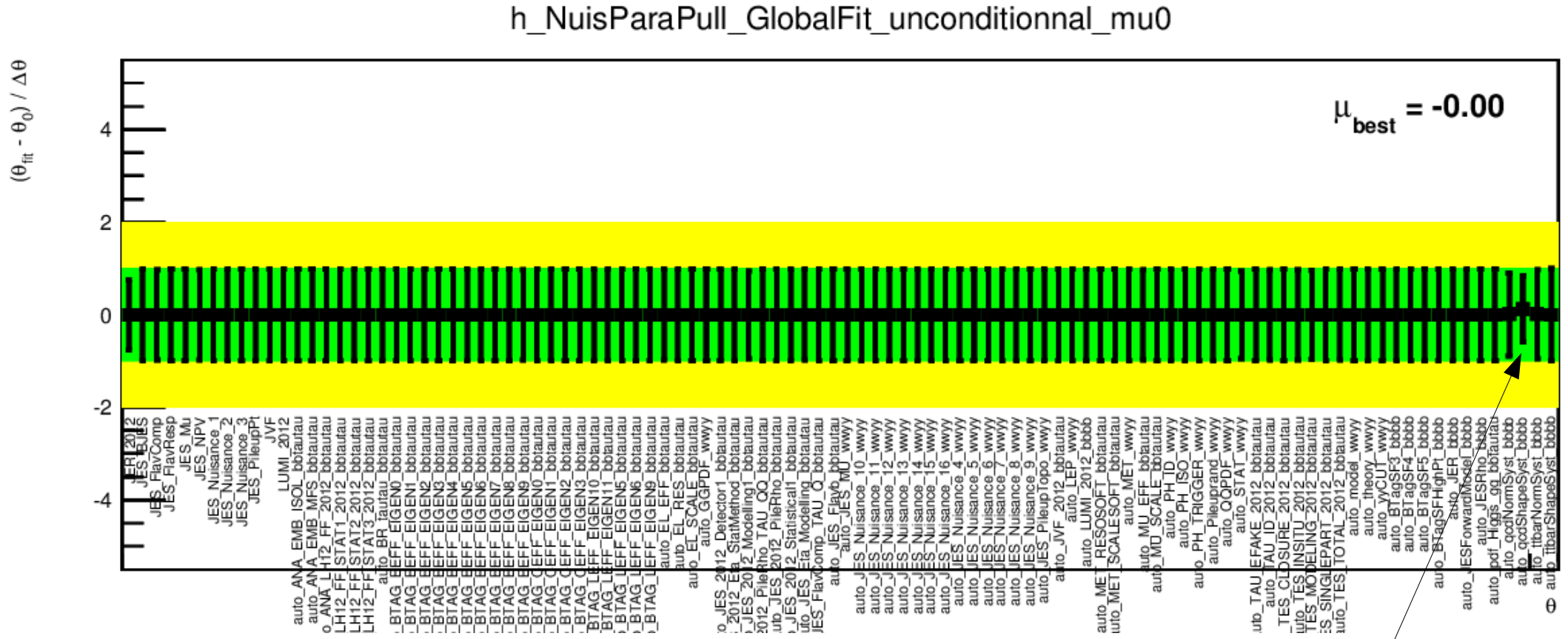
bbyy+bbbb+bbtautau+wwyy



qcd shape from bbbb

Pull check – 800 GeV

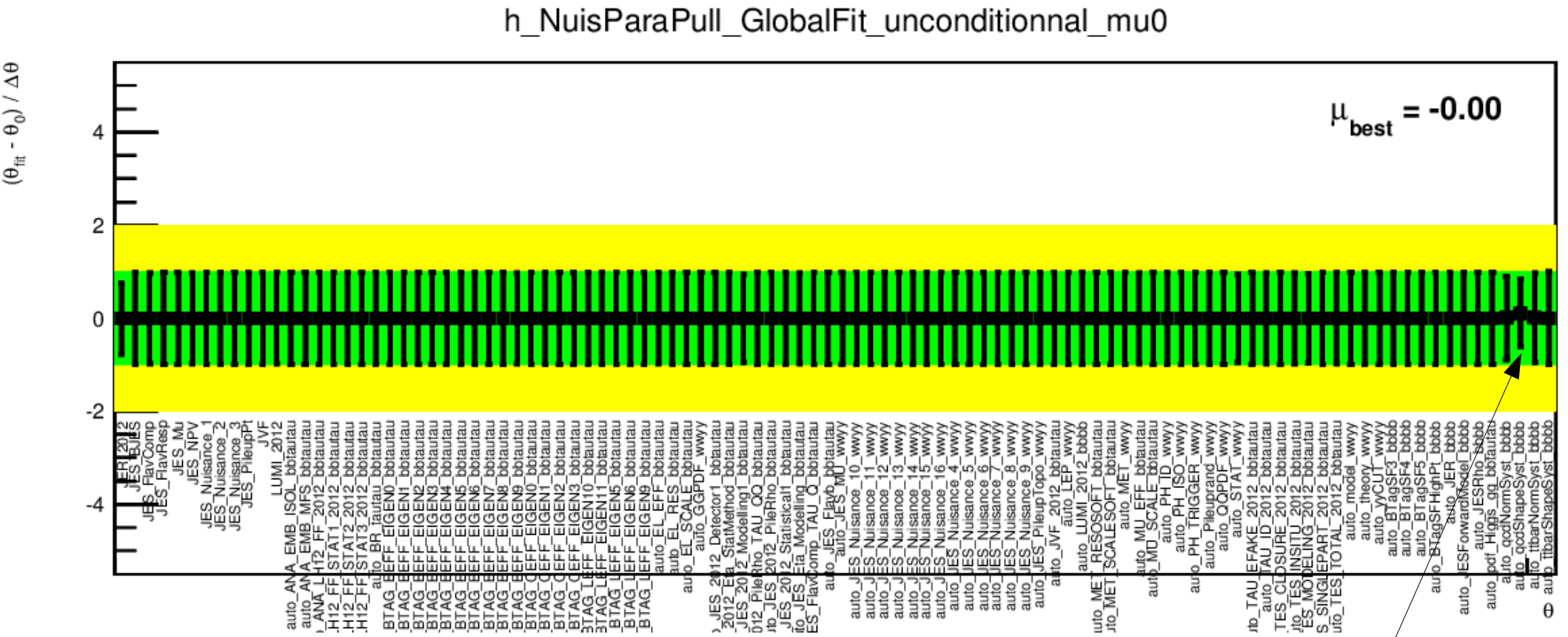
bbbb+bbtautau+wwyy



qcd shape from bbbb

Pull check – 1000 GeV

bbbb+bbtautau+wwyy



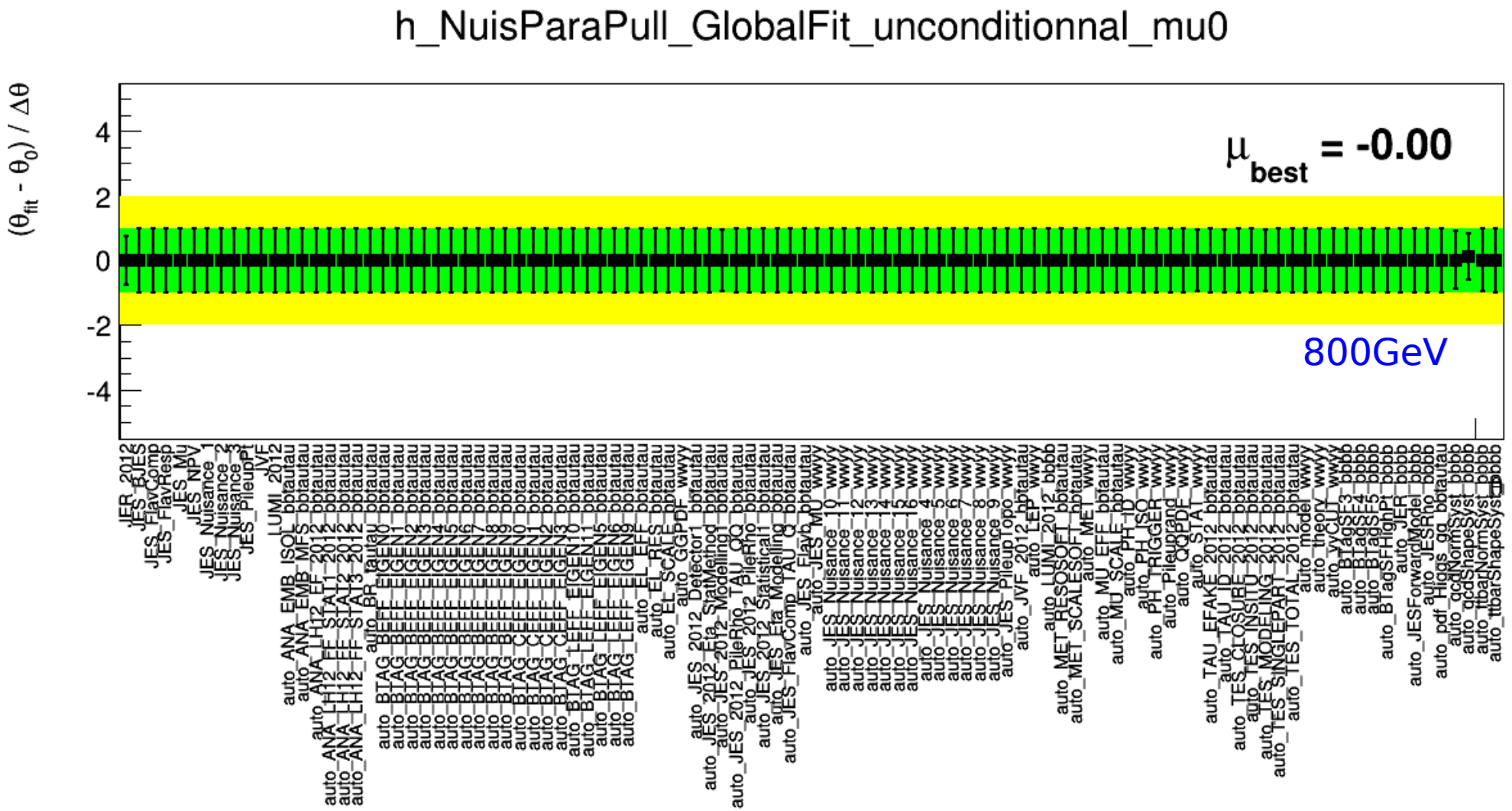
qcd shape from bbbb

Pull check – look into bbbb

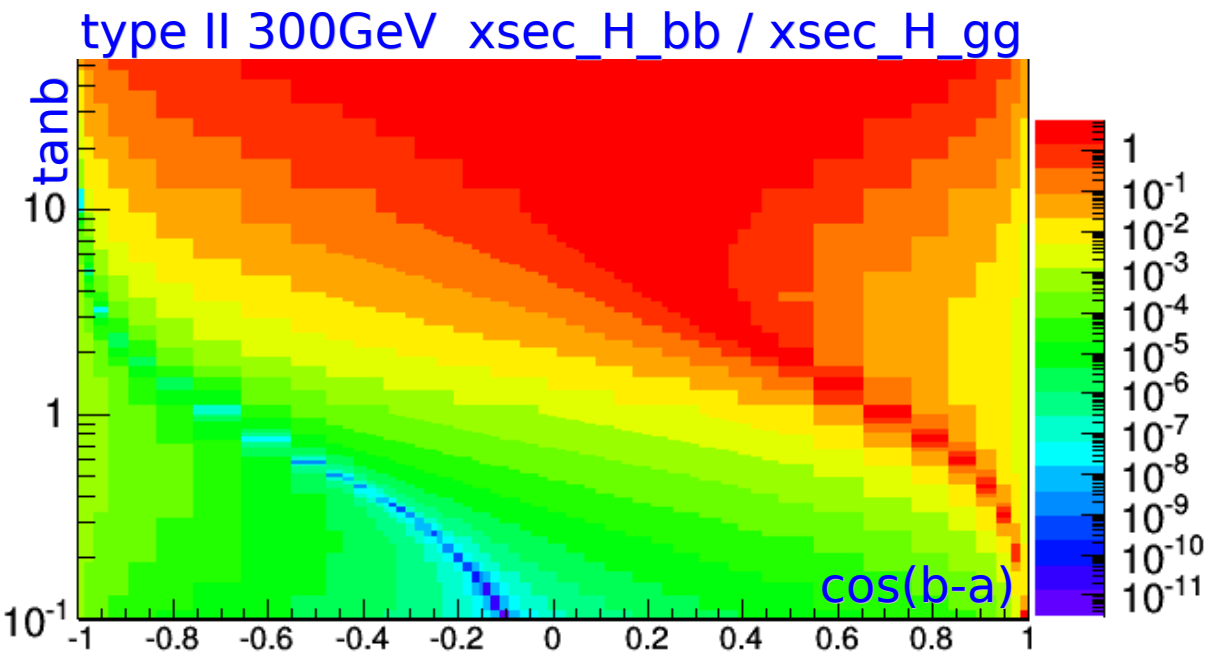
check bbbb channel alone

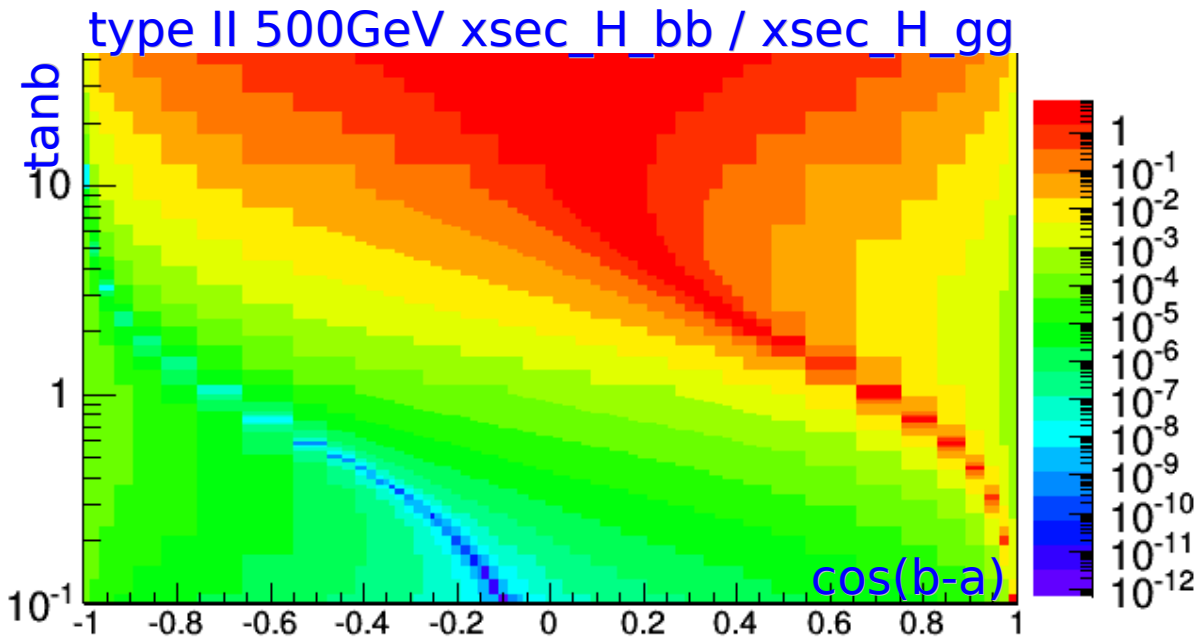
qcd shape from bbbb is behaving strangely

qcd shape only exist in res workspace instead of nonres

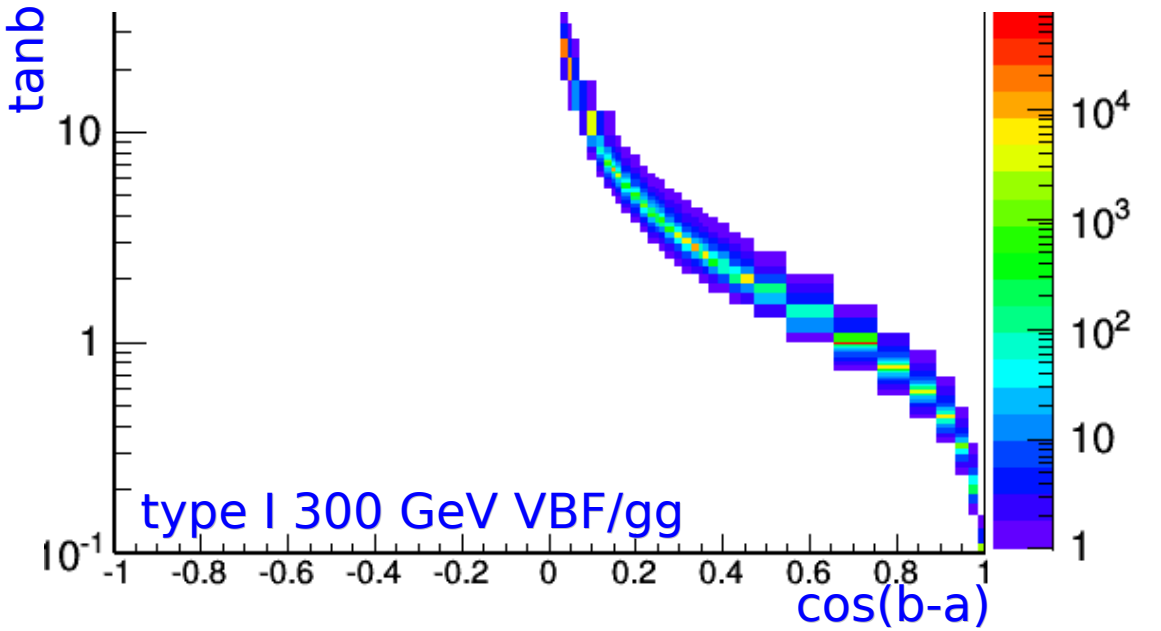


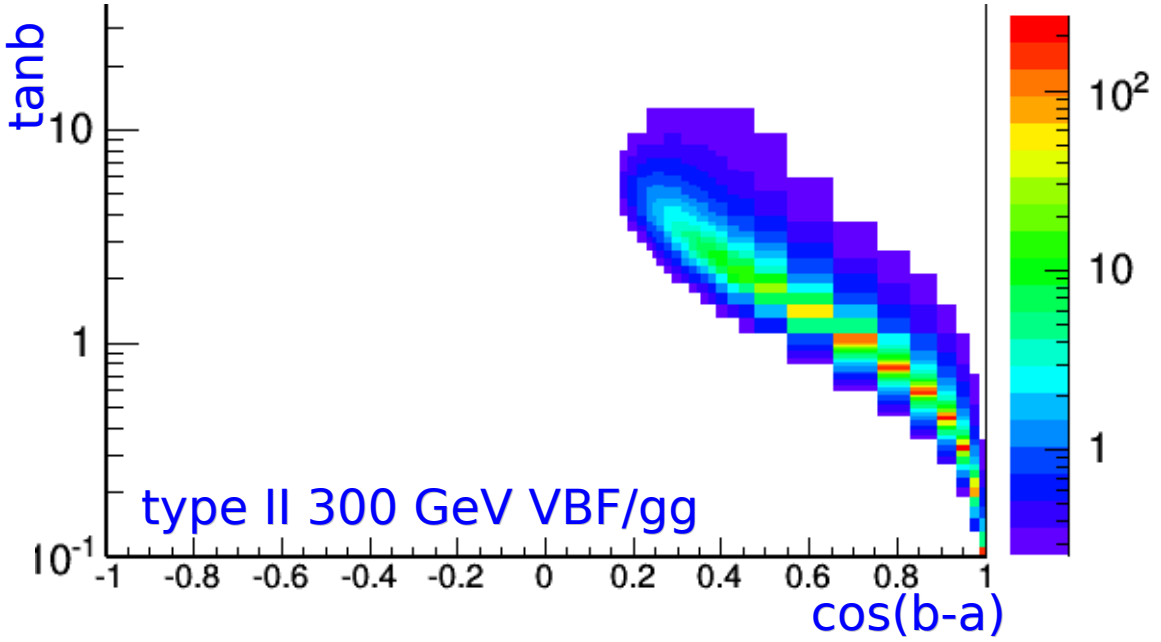
bbH production





VBF production





Summary

- nonres searches has all nuisance parameters behaving properly after regenerating asimov data in bbbb workspace
- the current nonres expected upper limit is ~0.44 with the main contribution from bbbb
- res searches has all nuisance parameter behaving properly from 260 to 400 GeV with bbyy+bbtautau+wwyy; qcd shape nuisance parameter does not behave properly since 500 GeV up to 1000 GeV where bbbb is also introduced in the combination
- the strange qcd shape nuisance parameter is due to mu != 0 in bbbb workspace
  - **SOLUTION: regenerate asimov firstly, rescale POI secondly (just tried, it works !)**
- bbH contribution is foreseen to contribute in high-tanb-central-cos(b-a) region in type II and IV
- VBF contribution is foreseen to contribute in a valley for all types

backup

Non-resonance

- Overview of nuisance parameters

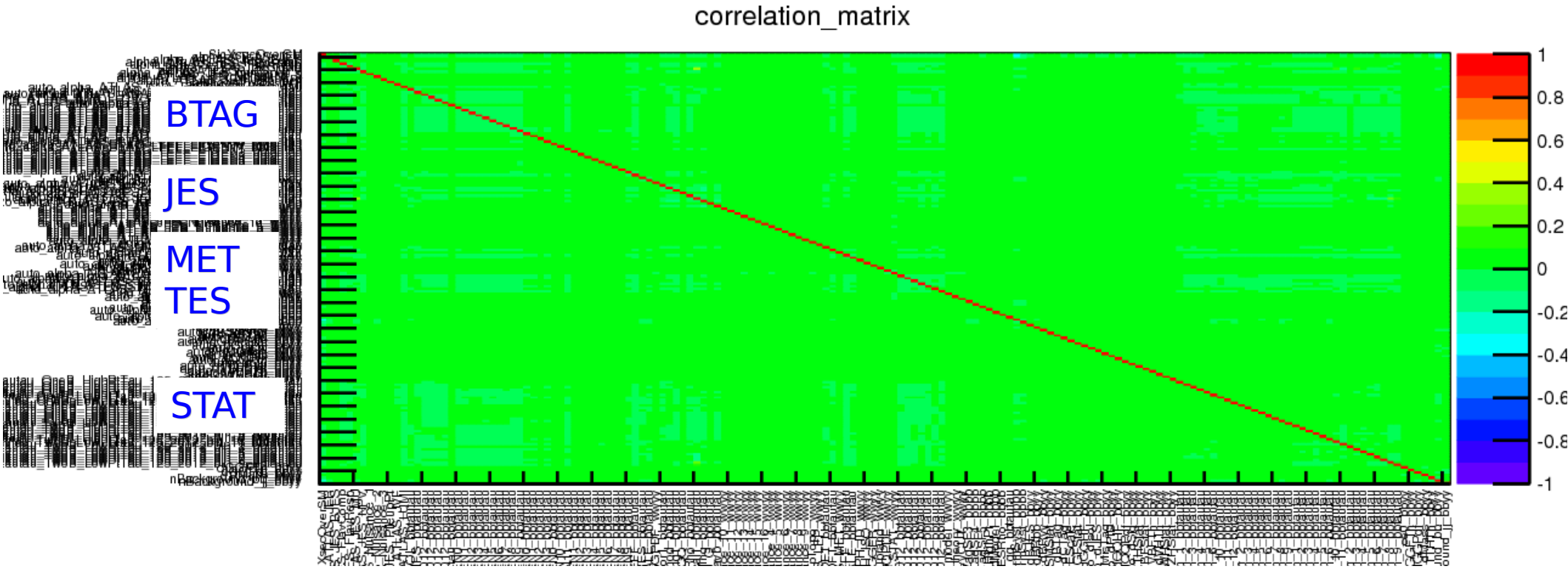
	channel	syst nui	stat nui	total nui
updates	**WWyy**	37	1	38
NEW	**bbtautau**	63	33	96
	bbyy	25	6	31
	bbbb	18	0	18
updates	**combined**	125	40	165

* correlations:

all channels: lumi
wwyy, bbyy/bb: JER (bbtautau no JER?)
wwyy, bbtt/bb: JES_FlavComp, JES_FlavResp, JES_NPV
wwyy, bbtt: JES_Mu, JVF
wwyy, bbbb: JES_BJES, JES_Nuisance_1/2/3, JES_PileupPt

Correlation check - nonres

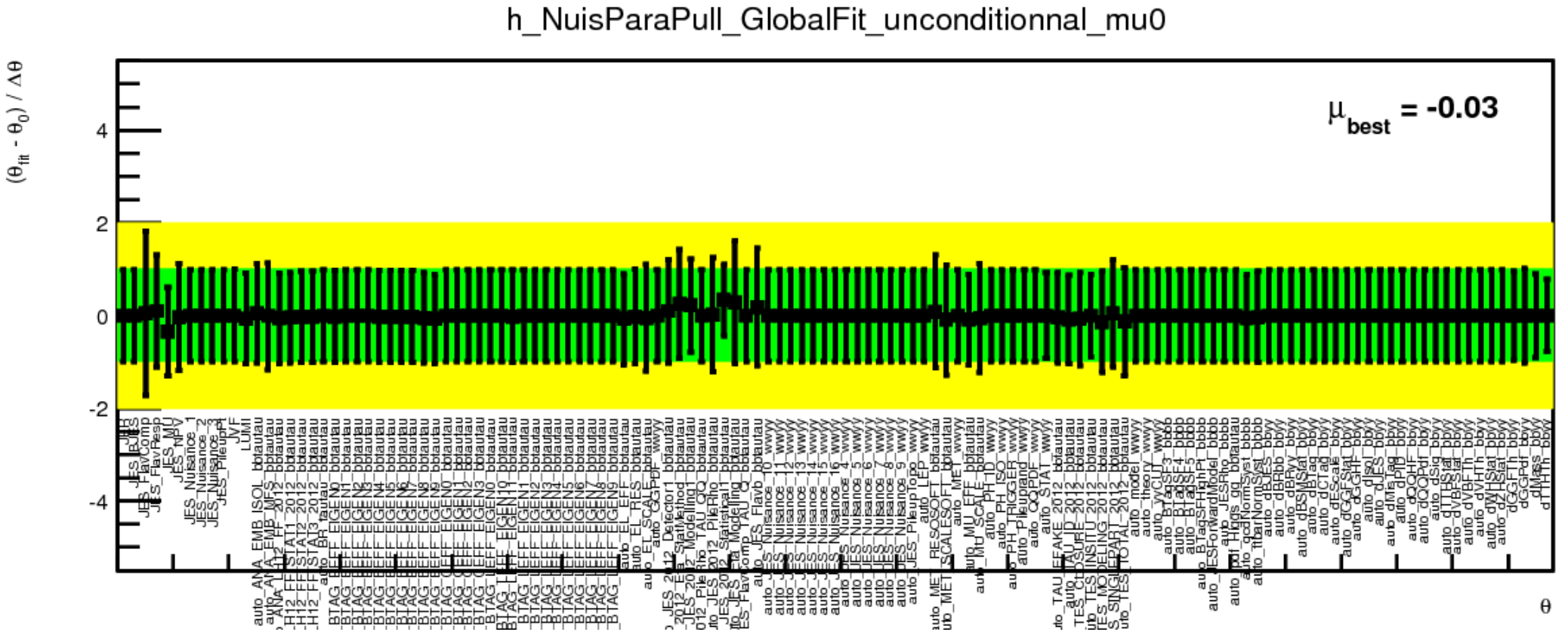
- check correlations in between each nuisance parameter



slight higher correlations come
mainly from tautau individual nuisance parameters

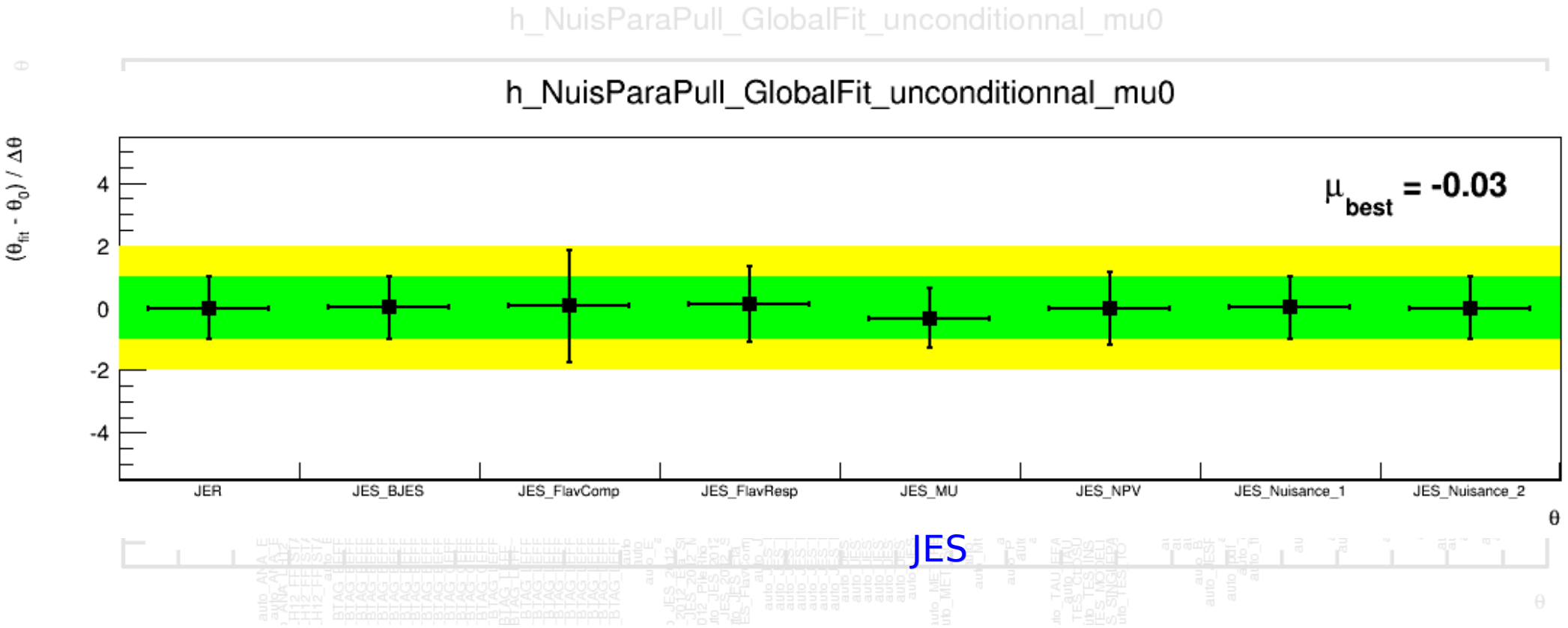
Pull check - nonres

- check pulls for each nuisance parameter



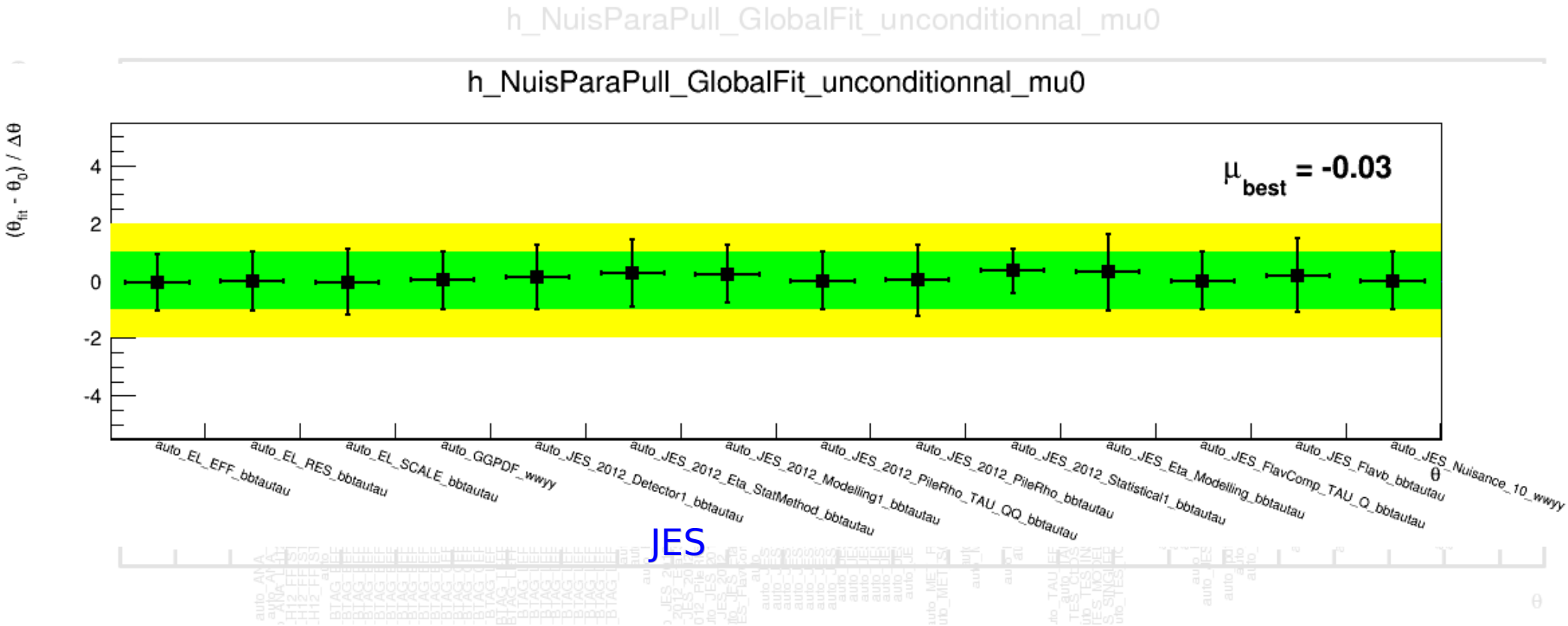
Pull check - nonres

- check pulls for each nuisance parameter



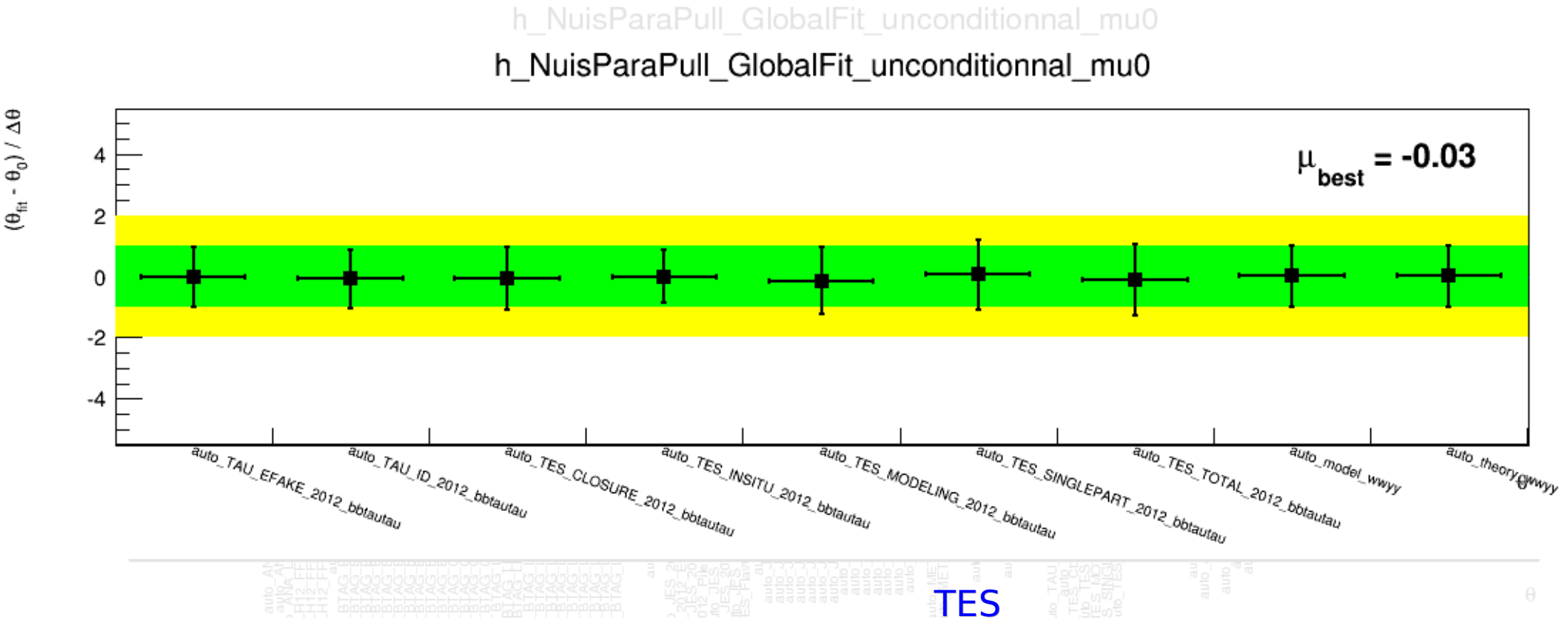
Pull check - nonres

- check pulls for each nuisance parameter



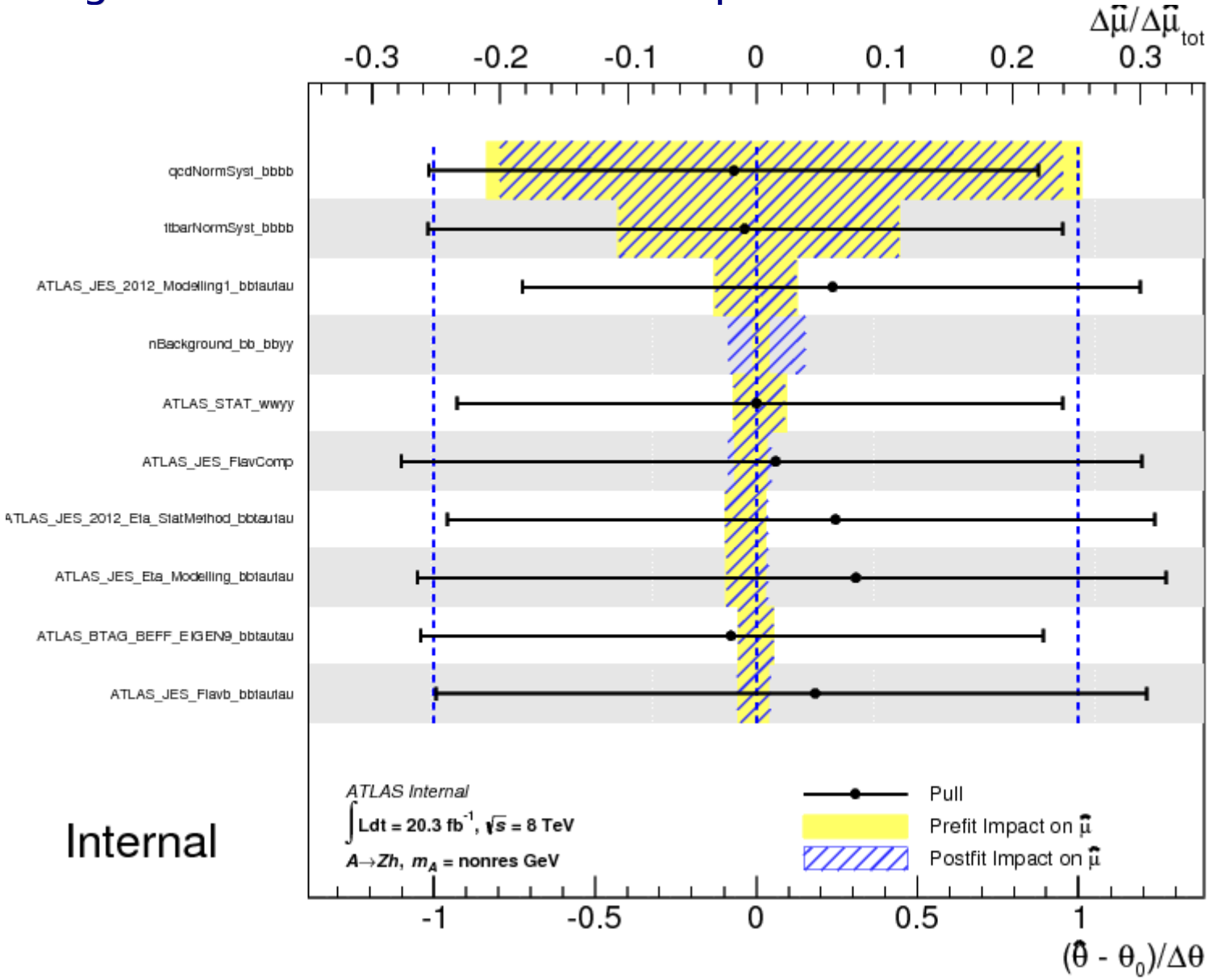
Pull check - nonres

- check pulls for each nuisance parameter



Significance check - nonres

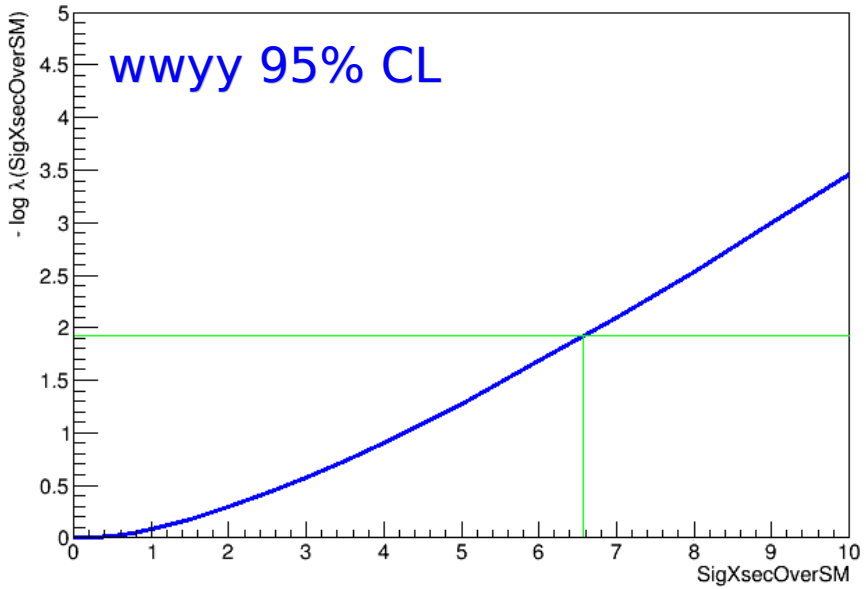
- check significance for each nuisance parameter

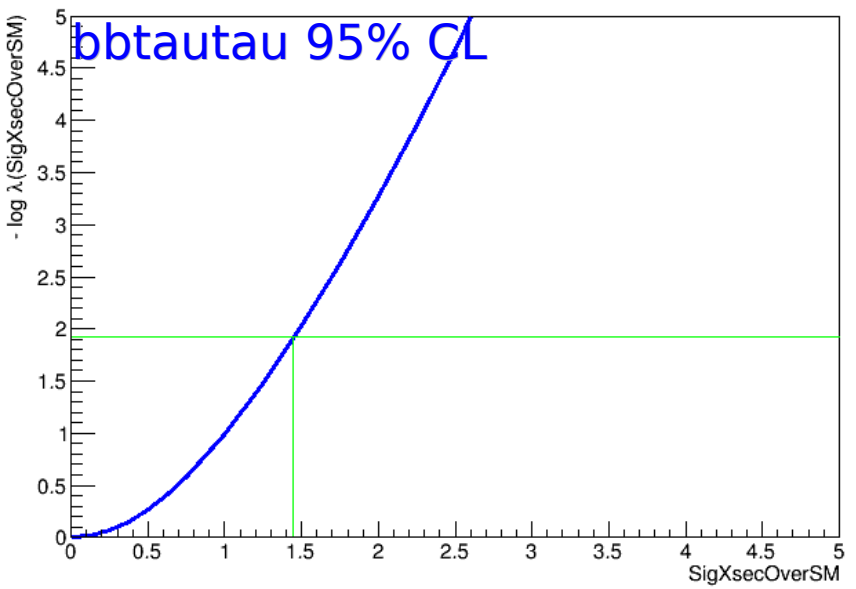


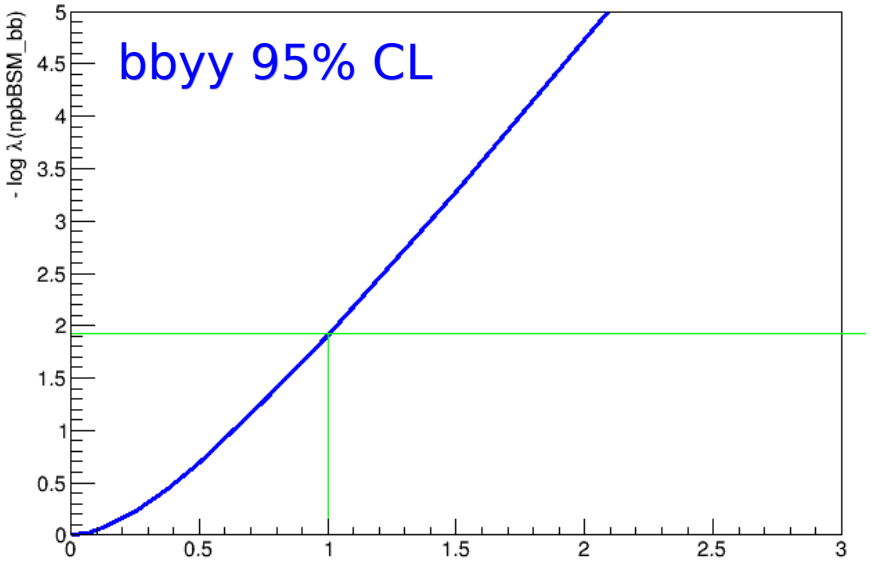
Internal

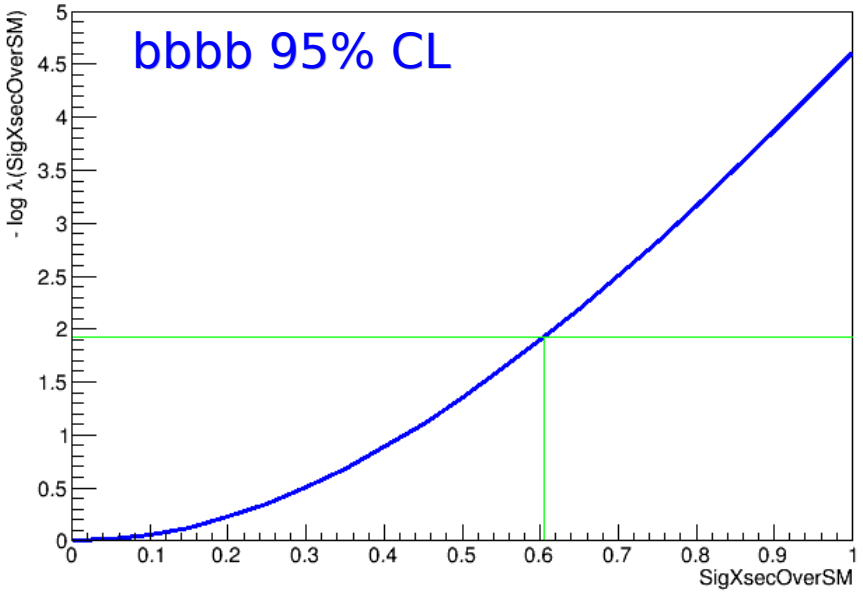
PLR curve check – nonres

- Check the profile likelihood ratio curve for individual channels



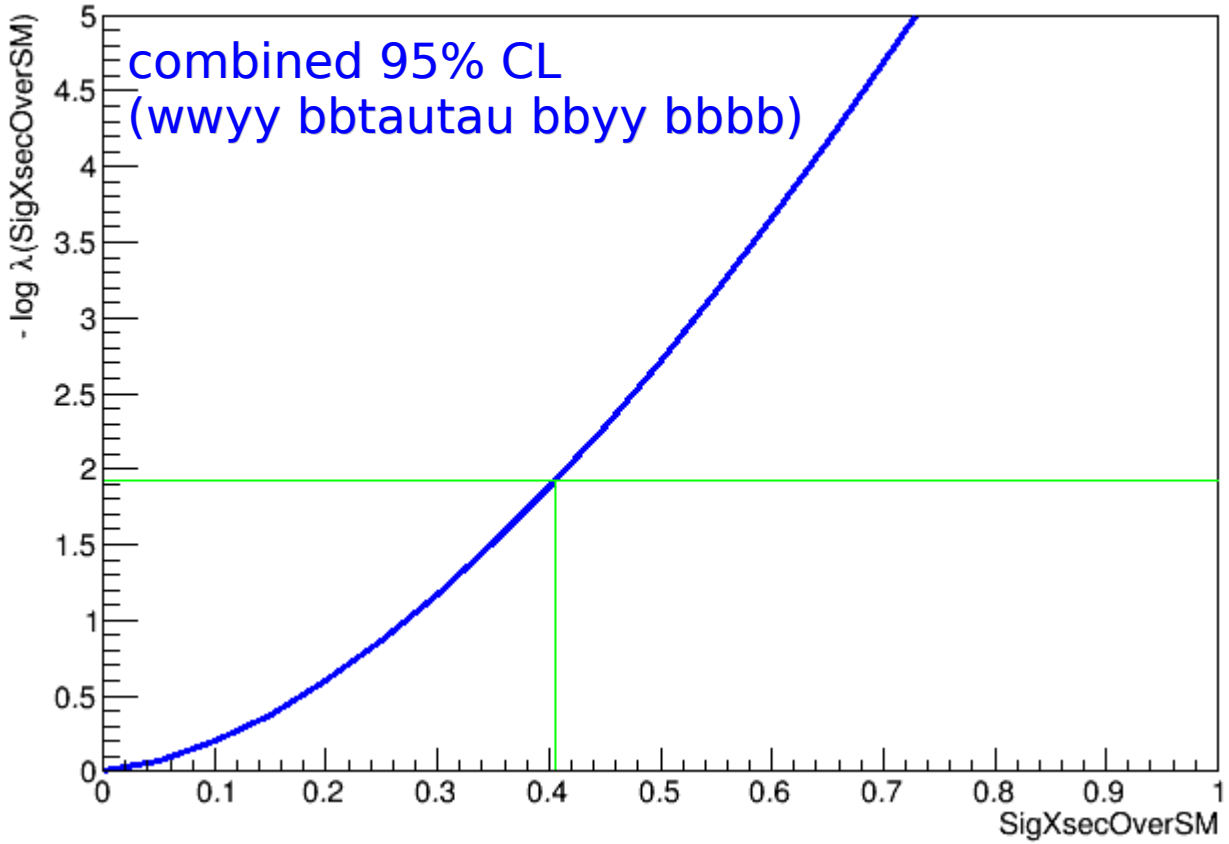






PLR curve check – nonres

- Check the profile likelihood ratio curve for combined



Upper limits – nonres

- Expected upper limits [pb] are extracted

	OBS	EXP	+2sig	+1sig	-1sig	-2sig
bbbb	-	0.594477	1.22232	0.853741	0.428353	0.319071
bbyy	-	1.07251	2.52278	1.62458	0.772804	0.575645
wwyy	-	6.56869	15.034	9.85594	4.7331	3.52558
bbtautau	-	1.50199	3.16927	2.1858	1.08226	0.806155
combined	-	0.454955	0.915959	0.649968	0.32782	0.244186

combined limit exp ~ 0.45 pb on xsec(hh)

Resonance

- Overview on nuisance parameters

channel	syst nui	stat nui	total nui
WWyy	37	1	38
bbtautau	64	26	90
bbyy	26	7	33
bbbb	-	-	-
comb	120	34	154

updates

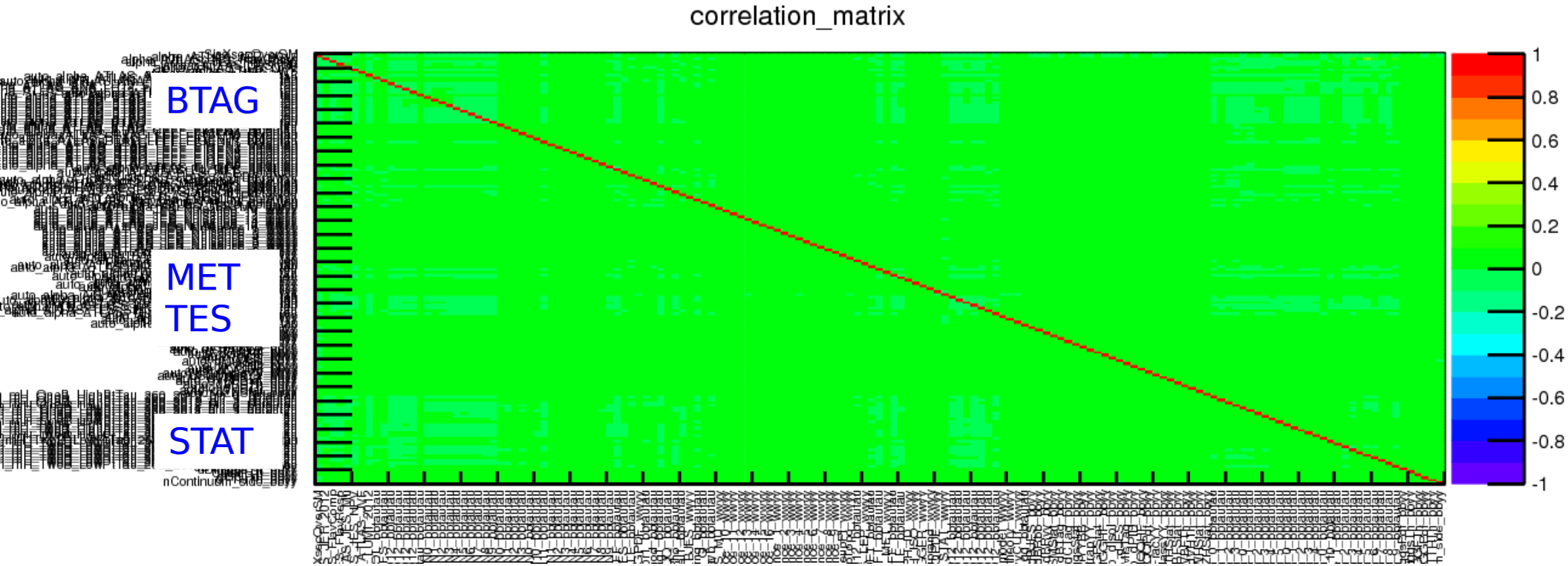
updates

* correlations:

all channels: lumi, JER
wwyy and bbbb: JES_FlavComp, JES_FlavResp, JES_Mu, JES_NPV, JVF

Correlation check - mH260

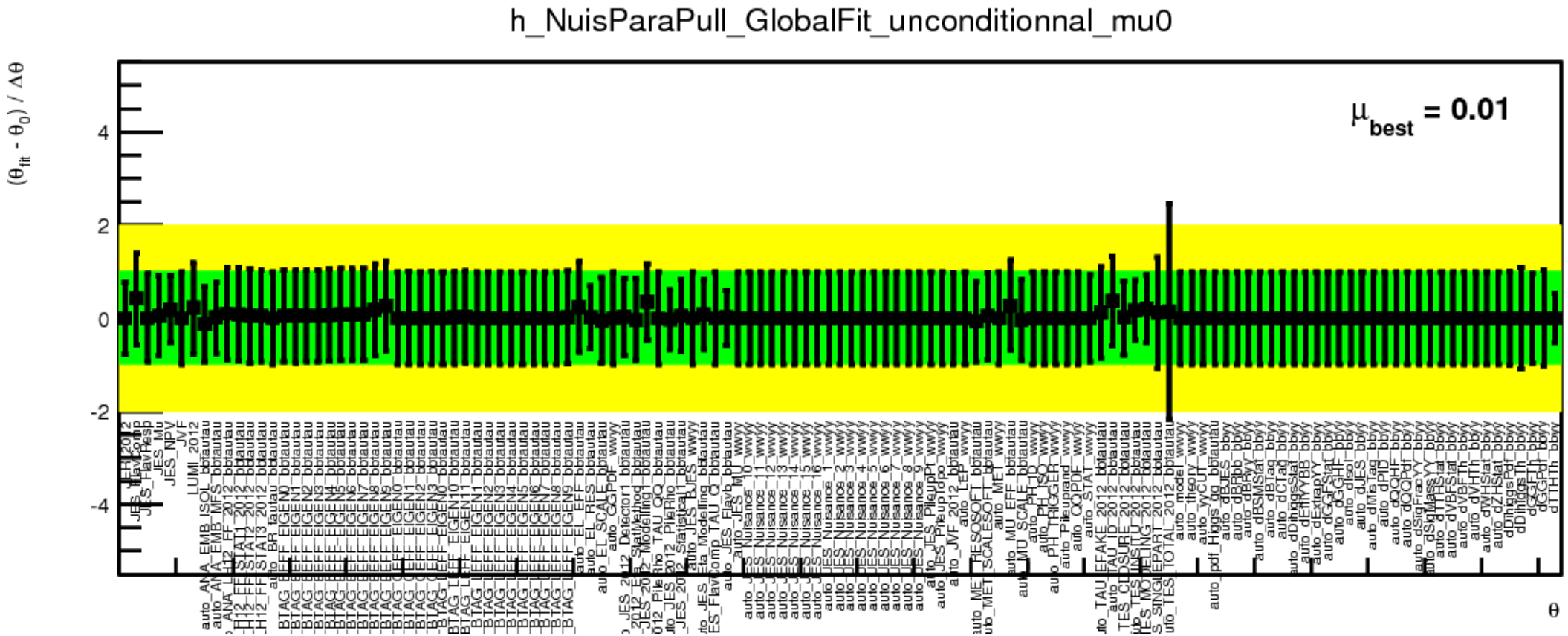
- check correlations in between each nuisance parameter



slight higher correlations come
mainly from tautau individual nuisance parameters

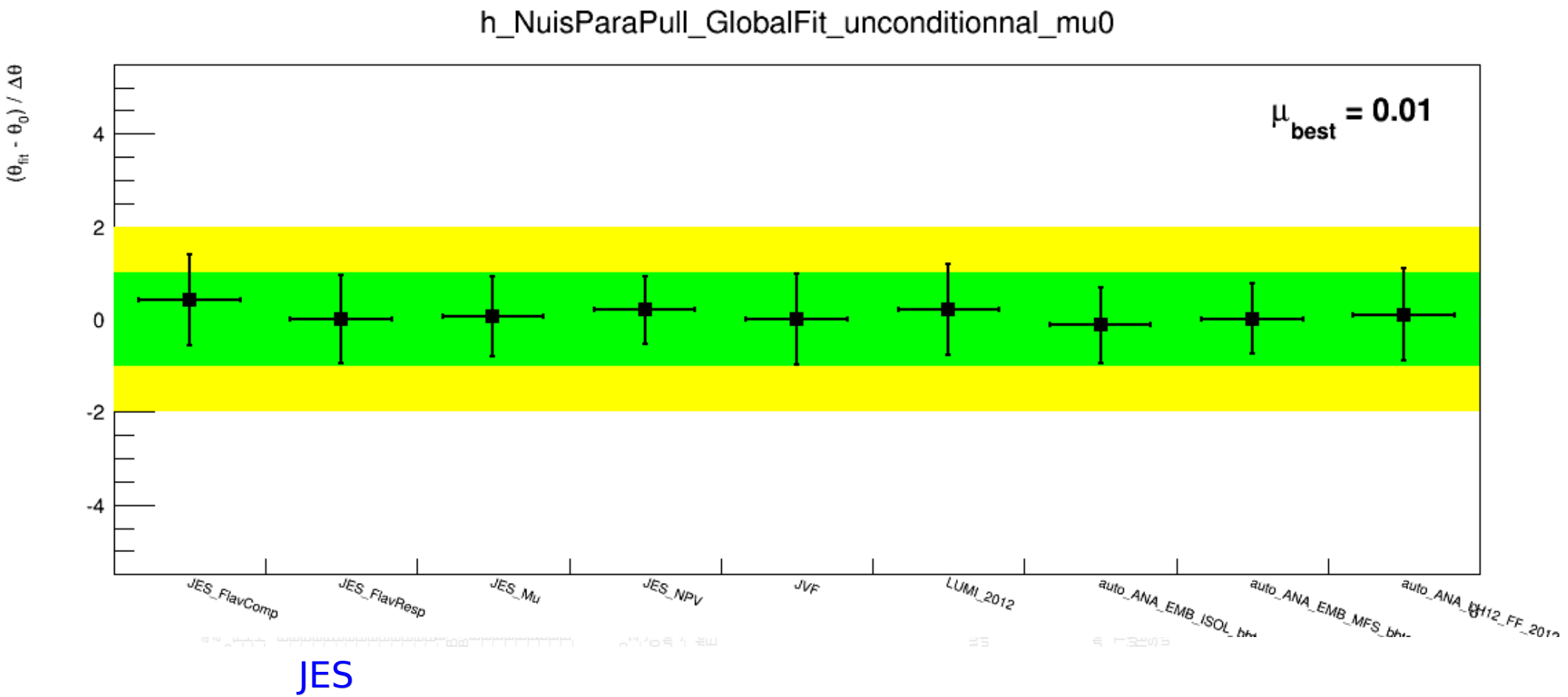
Pull check - mH260

- check pulls for each nuisance parameter



Pull check - mH260

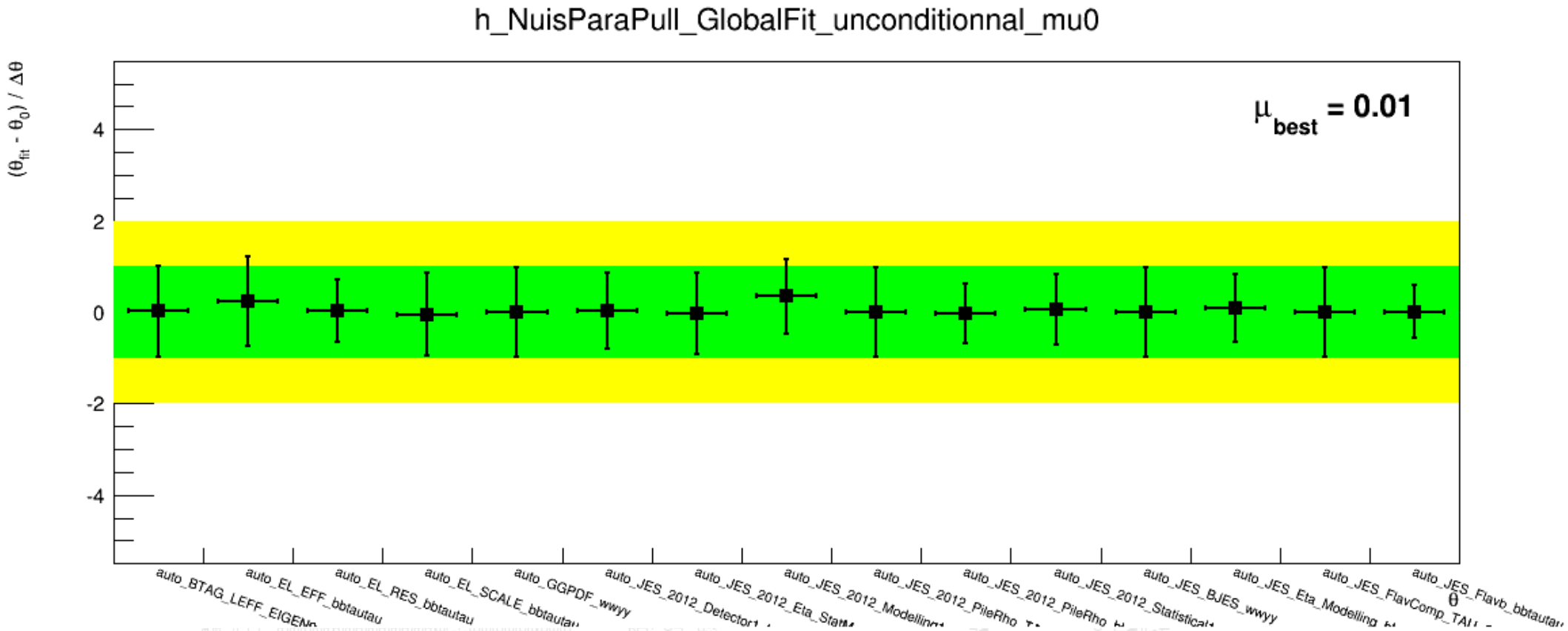
- check pulls for each nuisance parameter



JES

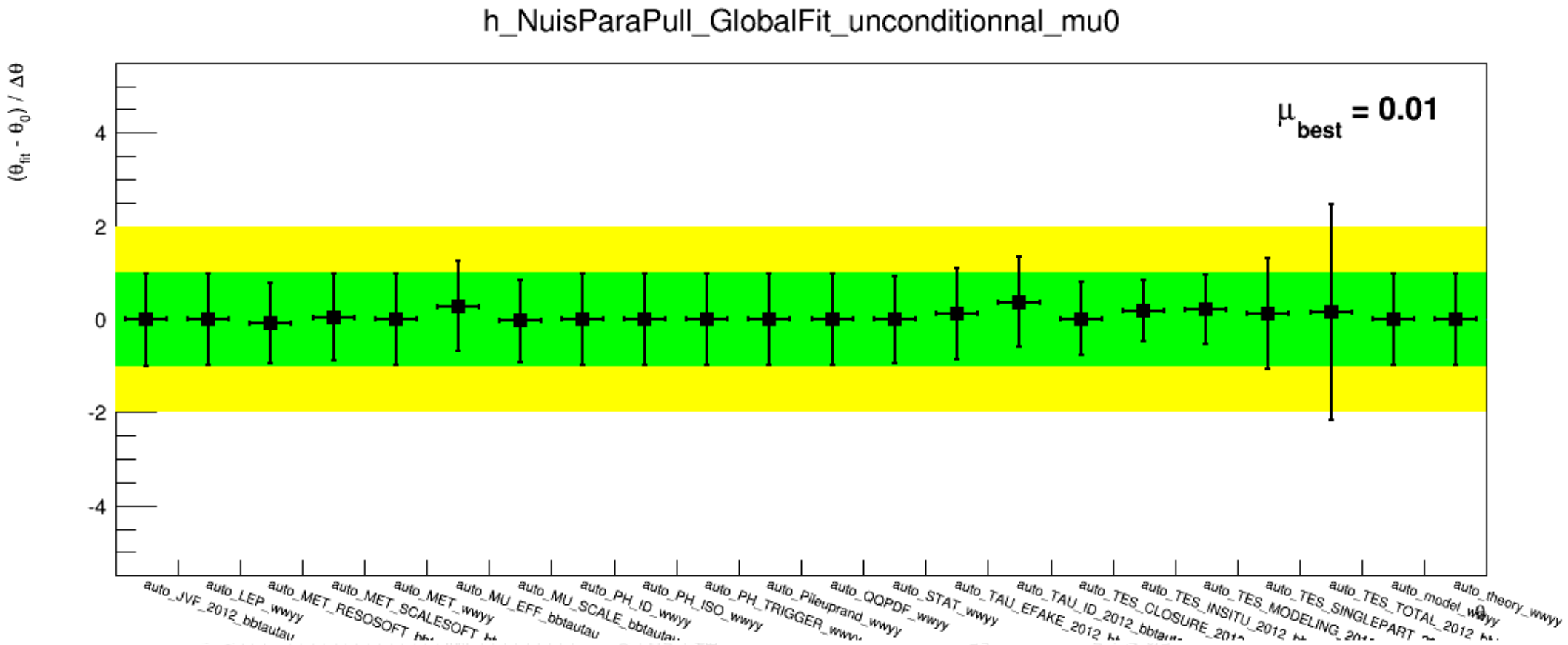
Pull check - mH260

- check pulls for each nuisance parameter



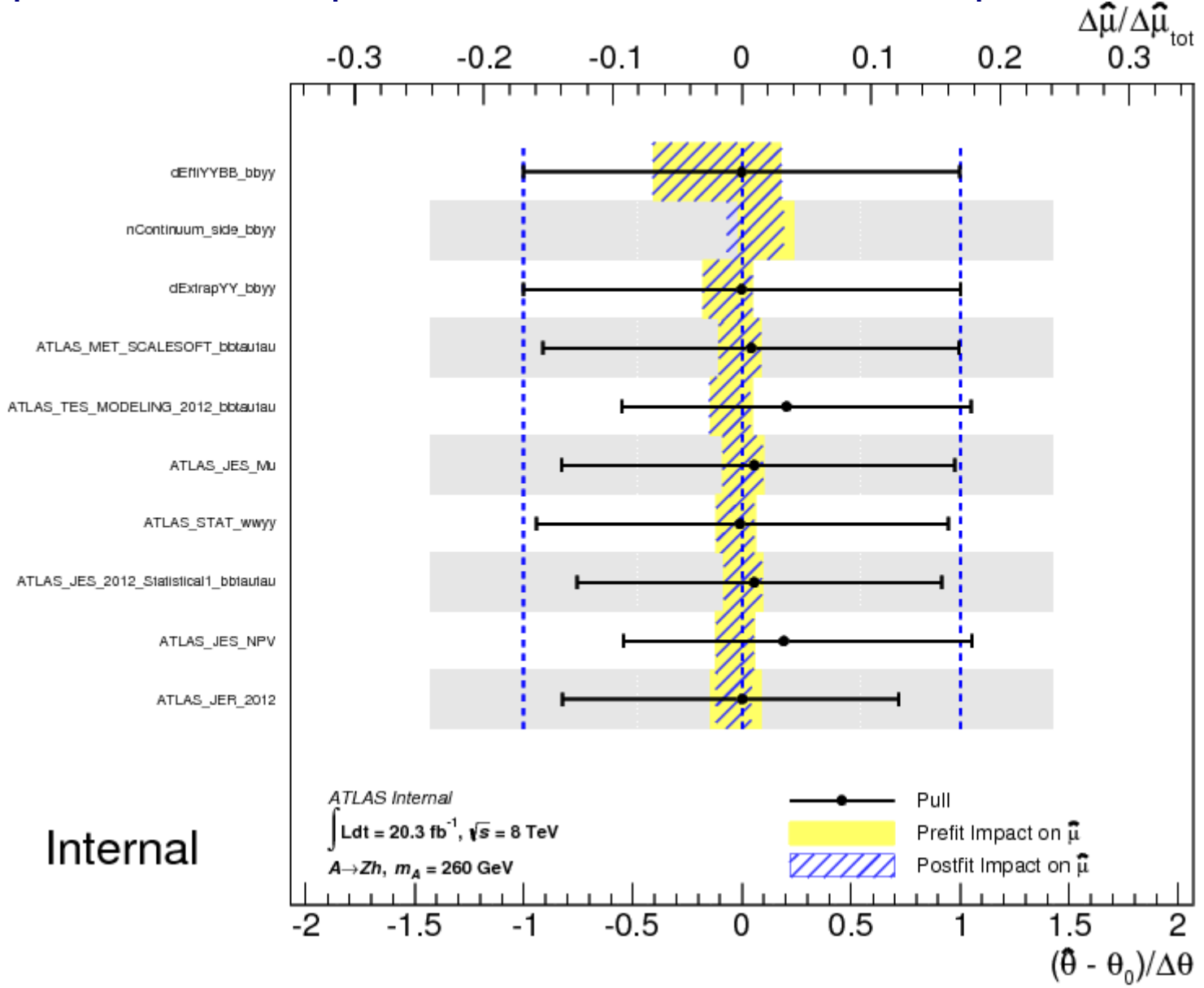
Pull check - mH260

- check pulls for each nuisance parameter



Significance check - mH260

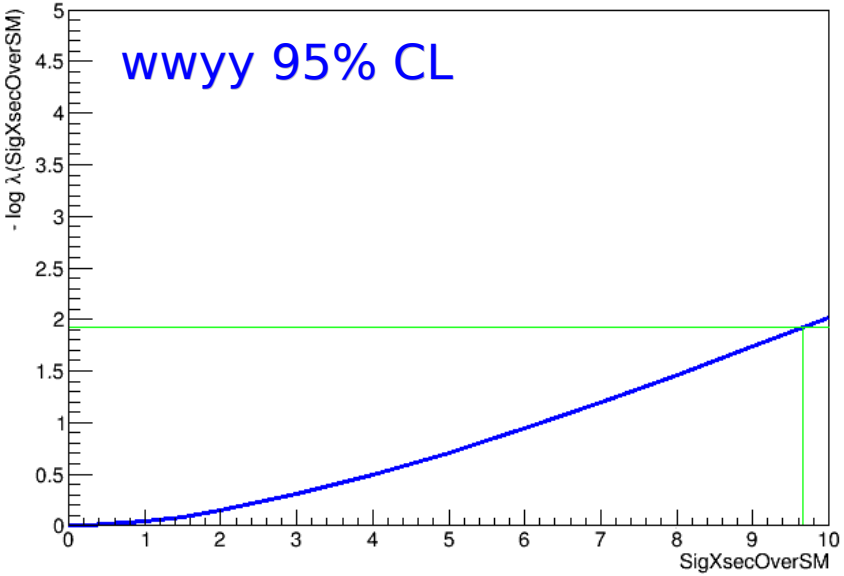
- Top 10 nuisance parameters in the order of impact on POI

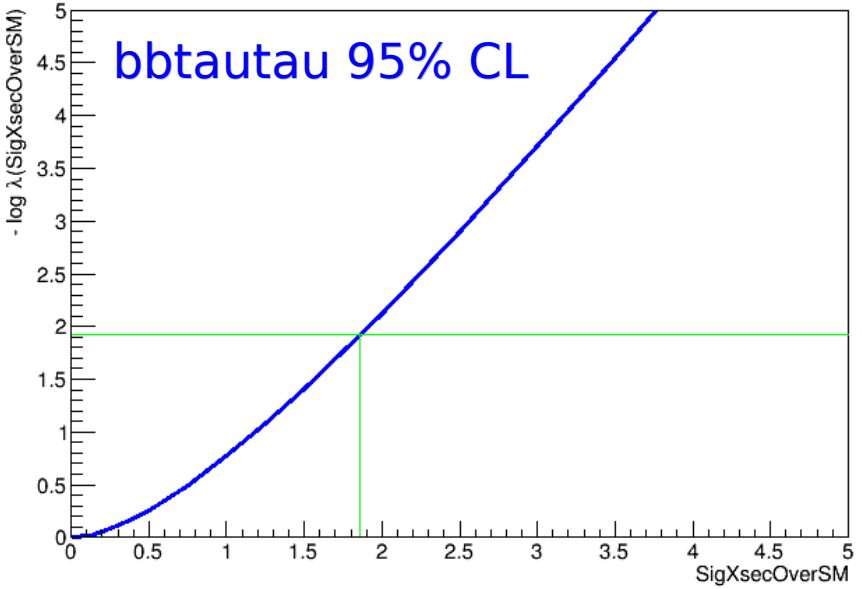


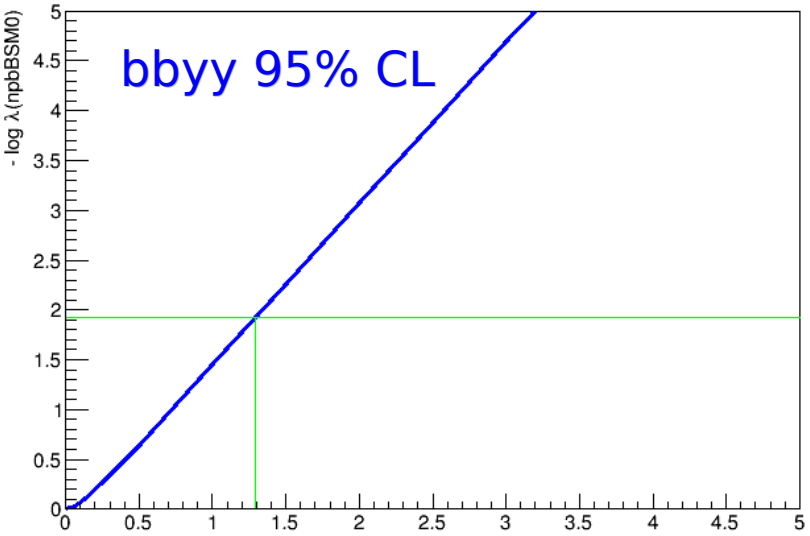
Internal

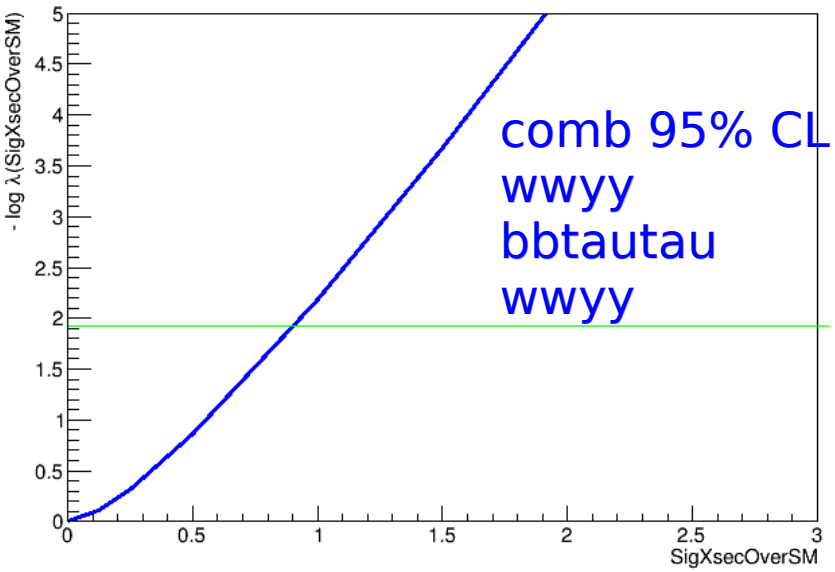
PLR curve check – mH260

- Check the profile likelihood ratio curve for individual channels

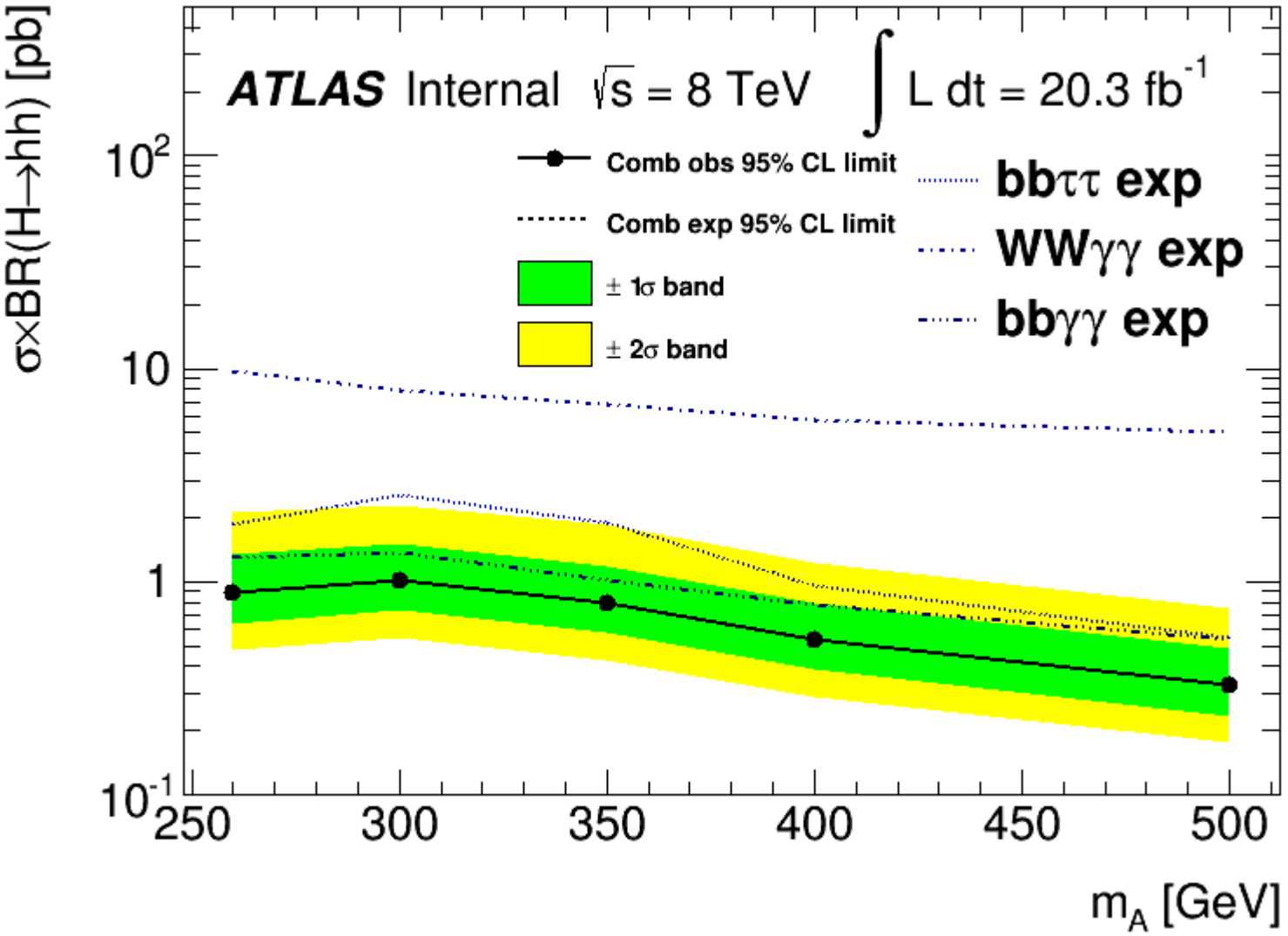








Expected upper limits – res



Interpretations

- Some thoughts in advance to the stage of interpretation
- 2HDM and others ...
- the branching ratios: light Higgs h->yy/WW/bb/tautau
- the width effects:
- b-associated production: preparing JO for all channels
- overlay with AZh or A->tt or others from H->WW/ZZ etc.

$y_{\mathrm{2HDM}}/y_{\mathrm{SM}}$	2HDM 1	2HDM 2	2HDM 3	2HDM 4
HVV	$c_{\beta-\alpha}$	$c_{\beta-\alpha}$	$c_{\beta-\alpha}$	$c_{\beta-\alpha}$
HQu	$c_{\beta-\alpha} - s_{\beta-\alpha}/t_\beta$	$c_{\beta-\alpha} - s_{\beta-\alpha}/t_\beta$	$c_{\beta-\alpha} - s_{\beta-\alpha}/t_\beta$	$c_{\beta-\alpha} - s_{\beta-\alpha}/t_\beta$
HQd	$c_{\beta-\alpha} - s_{\beta-\alpha}/t_\beta$	$c_{\beta-\alpha} + t_\beta s_{\beta-\alpha}$	$c_{\beta-\alpha} - s_{\beta-\alpha}/t_\beta$	$c_{\beta-\alpha} + t_\beta s_{\beta-\alpha}$
HLe	$c_{\beta-\alpha} - s_{\beta-\alpha}/t_\beta$	$c_{\beta-\alpha} + t_\beta s_{\beta-\alpha}$	$c_{\beta-\alpha} + t_\beta s_{\beta-\alpha}$	$c_{\beta-\alpha} - s_{\beta-\alpha}/t_\beta$

backup