Weekly report

Xiaohu Sun
03-02-2015
IHEP

AZh combination https://cds.cern.ch/record/1754310?ln=en

- Draft 2.0 released to the collaboration on January 19th (https://indico.cern.ch/event/368789/ **public reading January 28th**)
  - Overall comments are positive
  - No show-stoppers in physics
  - Comments are mostly textual
- **Last week, additional comments on cosmetics**
- **Preparing all plots without "*Internal*"**

- Flipped and lepton-specific 2HDM added
- Width is now consistently taken into account
- b-associated production for llbb and vvbb is taken into account, by estimating the selection efficiency based on truth-level and full simulation studies

Analysis Team

[*email:* atlas-higg-2013-06-editors@cern.ch]

M. Bauce, M. Beckingham, L.S. Bruni, G. Carrillo-Montoya, P. de Bruin, Y. Fang, S. Giagu, F. Giuli, A. Goussiou, C. Gwilliam, G. Hamity, A. Law, H. Liu, X. Lou, A. McCarn (*), A. Mehta (*), A. Messina, A. Nisati, J. Qian, M. Rescigno (*), N. Rompotis (*), T. Schwarz, X. Sun, P. Thompson (*), M. Vanadia, T. Vickey, J. Wang (*),

(*): Contact Editors

Editorial Board

[*email:* atlas-higg-2013-06-editorial-board@cern.ch]

P. Kluit (*)
D. Varouchas
L. Chevalier
G. Facini

(*): EdBoard Chair

hh combination - updates

bbbb, bbyy
bbtautau, wwyy

- Updating limits with toys instead of asymmptotics, which is mainly driven by the fact that the statistics is really low and it is really a problem that asymmptotics cannot produce reasonable bands at +/- 2 sigma
- Many thanks to Liron and Junichi:
  - bbH samples request: JOs ready, validated, approved
    https://its.cern.ch/jira/browse/ATLMCPROD-920
  - VBF samples request: **AOD READY, asking for D3PD**
    https://its.cern.ch/jira/browse/ATLMCPROD-957
    https://prodtask-dev.cern.ch/prodtask/inputlist_with_request/1539/
  - WWyy background samples, ready with LHE files from Huijun
    https://its.cern.ch/jira/browse/ATLMCPROD-974
  - bbbb, bbyy, bbtautau, WWyy samples for RUN II are being requested, LHE files prepared by Jamie and Jahred, we will start a small production with DC14 13TeV, followed by a full production of MC15 in future
    https://its.cern.ch/jira/browse/ATLMCPROD-993

hh combination - ws status

- A reminder of the workspace updates in last week:
  - bbbb: no update
  - bbyy: no update
  - bbtautau: no update
  - wwyy: no update
- Thank all analyzers for providing the workspaces and welcome to any updates in them

Upper limits – nonres

- Expected upper limits [pb] are extracted
- Asymmptotics is implemented

	OBS	EXP	+2sig	+1sig	-1sig	-2sig
bbbb	-	0.594466	1.22212	0.853699	0.428346	0.319065
bbyy	-	1.00546	2.39049	1.52719	0.724492	0.539658
wwyy	-	6.56869	15.034	9.85594	4.7331	3.52558
bbtautau	-	1.54221	3.41345	2.2871	1.11125	0.827747
combined	-	0.440961	0.892447	0.631184	0.317737	0.236675

Latest with toys:

combined:	**-**	**0.446957**	**0.890753**	**0.644304**	**0.321053**	**0.255912**

P-values – nonres

- P-value scan as a function of signal strength

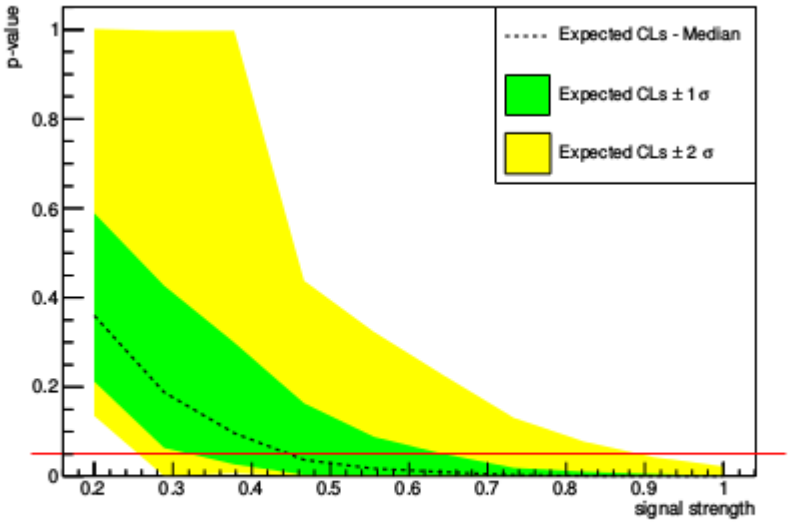
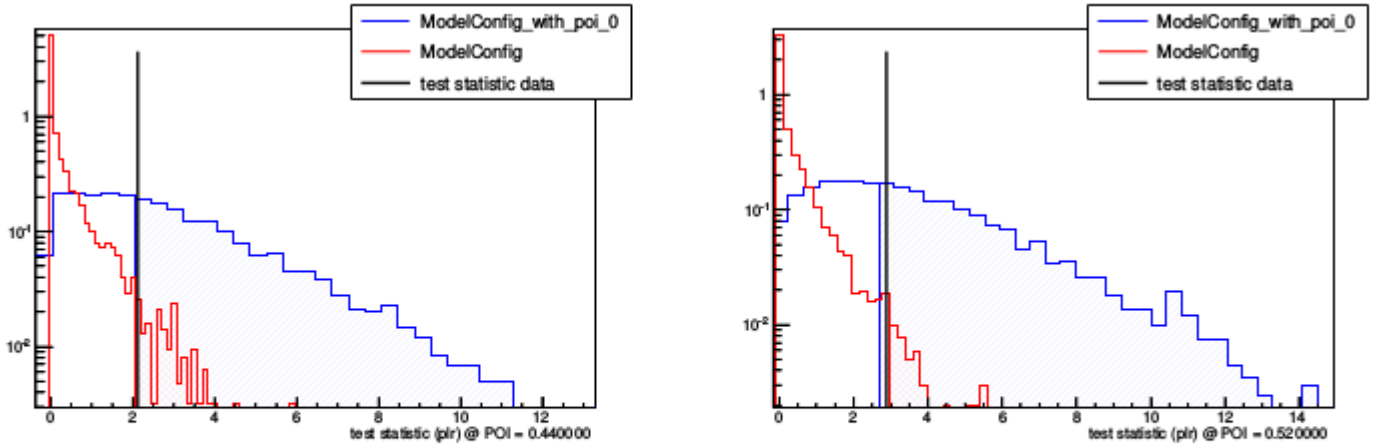


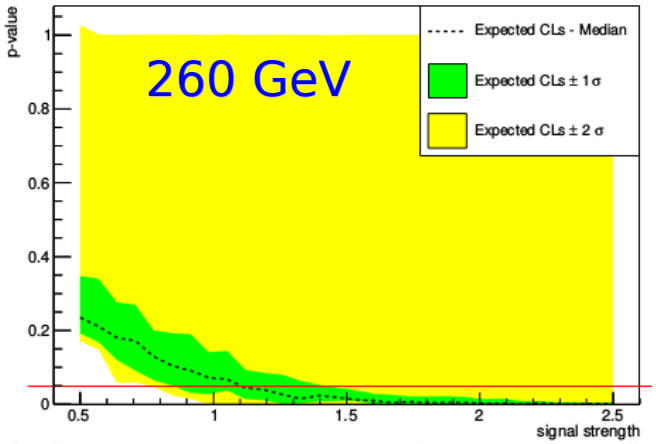
Figure 23: P-values as a function of signal strength for non-resonance

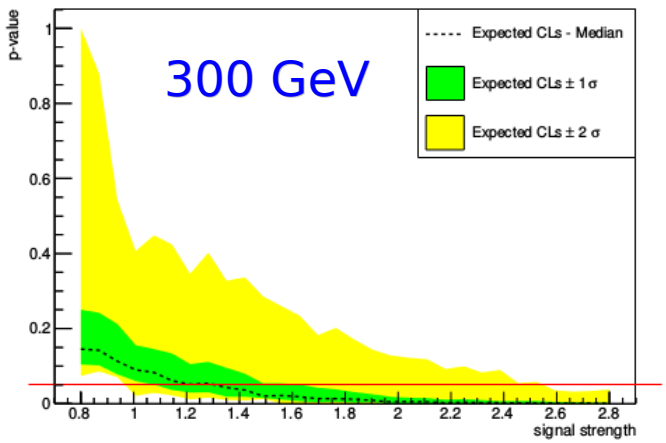


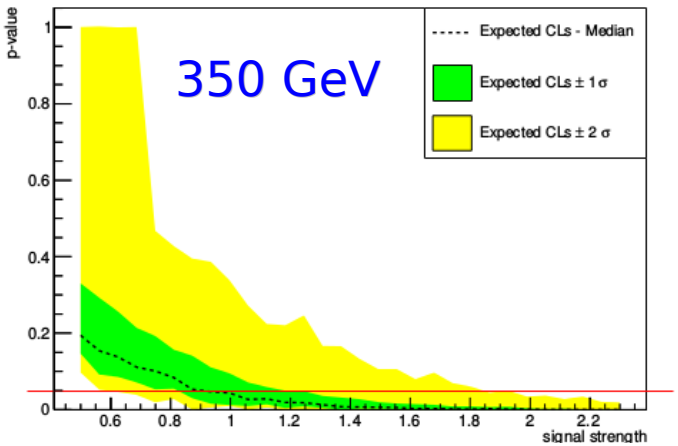
(a) (b)

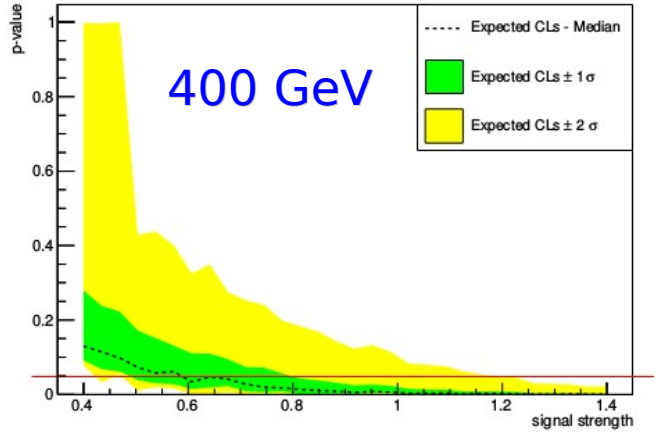
Figure 30: The distributions of test statistics with the assumed signal strengths which approach the threshold making p-values close to 0.05 in non-resonant search.

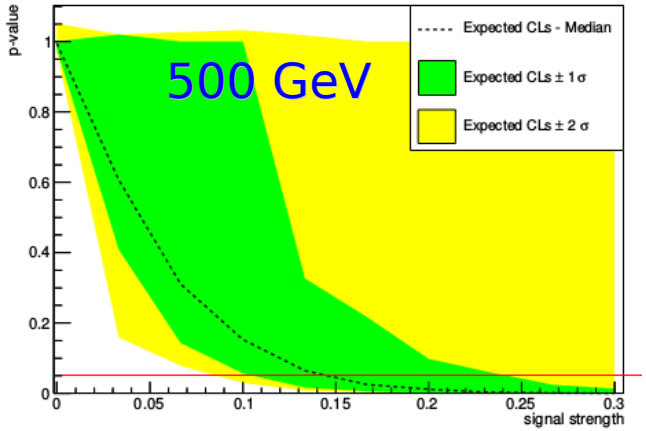
Upper limits – res

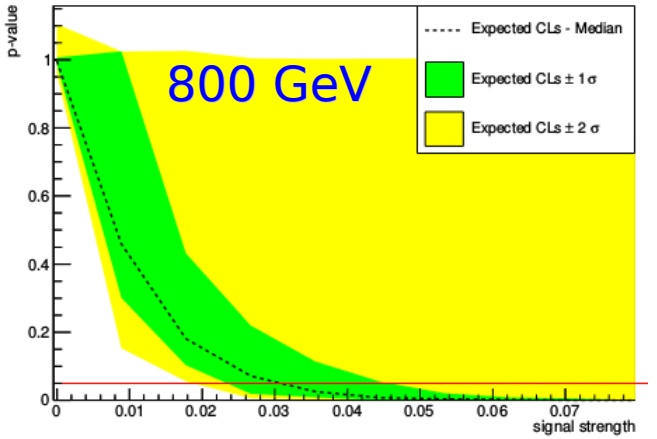






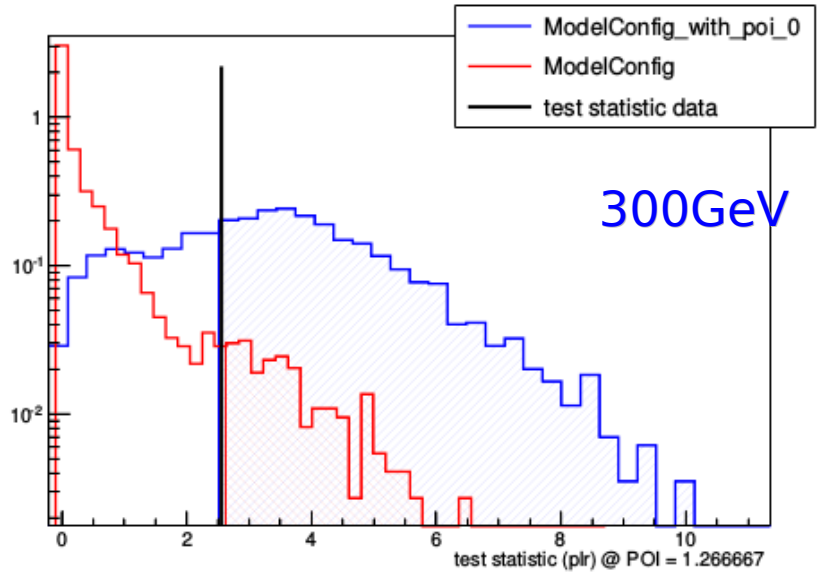


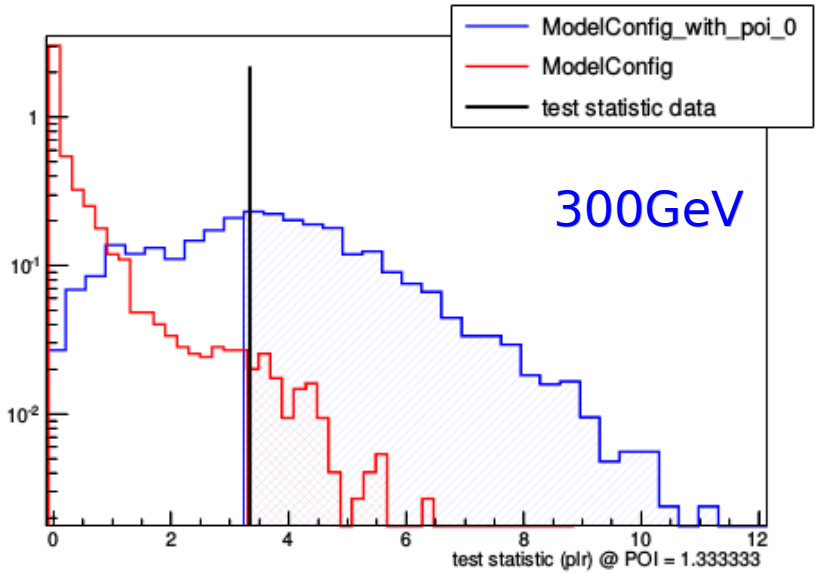


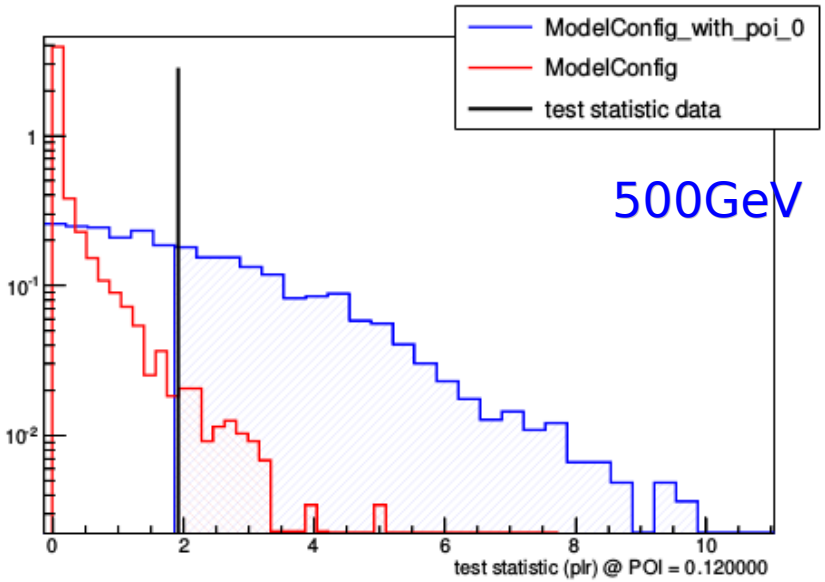


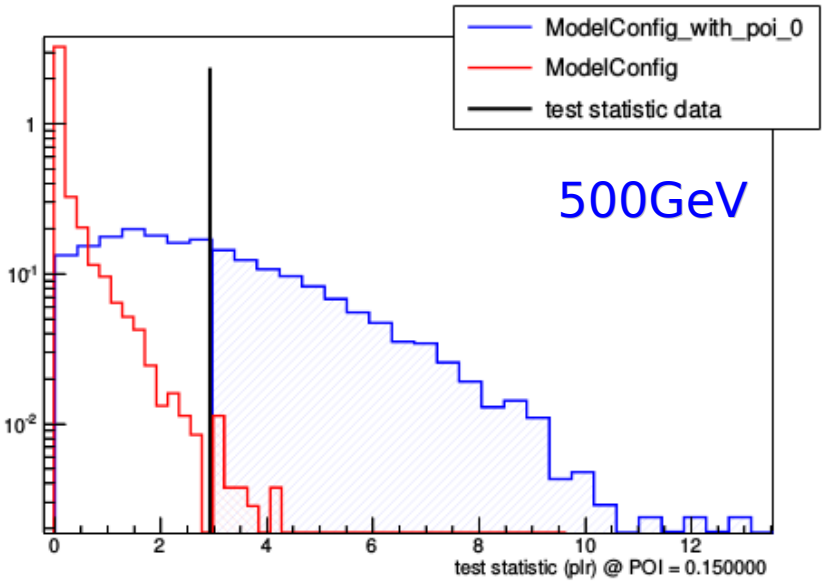
	Non-res	260 GeV	300 GeV	350 GeV	400 GeV	500 GeV	800 GeV
Median	0.446957	1.10437	1.30782	0.906961	0.64138	0.145739	0.0308631
Observed							
$+2\sigma$	0.890753	40.1069	2.45343	1.80654	1.15256	0.269386	0.0711108
$+1\sigma$	0.644304	1.41908	1.6332	1.18008	0.795221	0.242509	0.0454055
-1σ	0.321053	0.843504	1.0788	0.822841	0.486494	0.105814	0.0234135
-2σ	0.255912	0.774471	0.969368	0.617902	0.472225	0.0860546	0.0187549

TS distribution – res







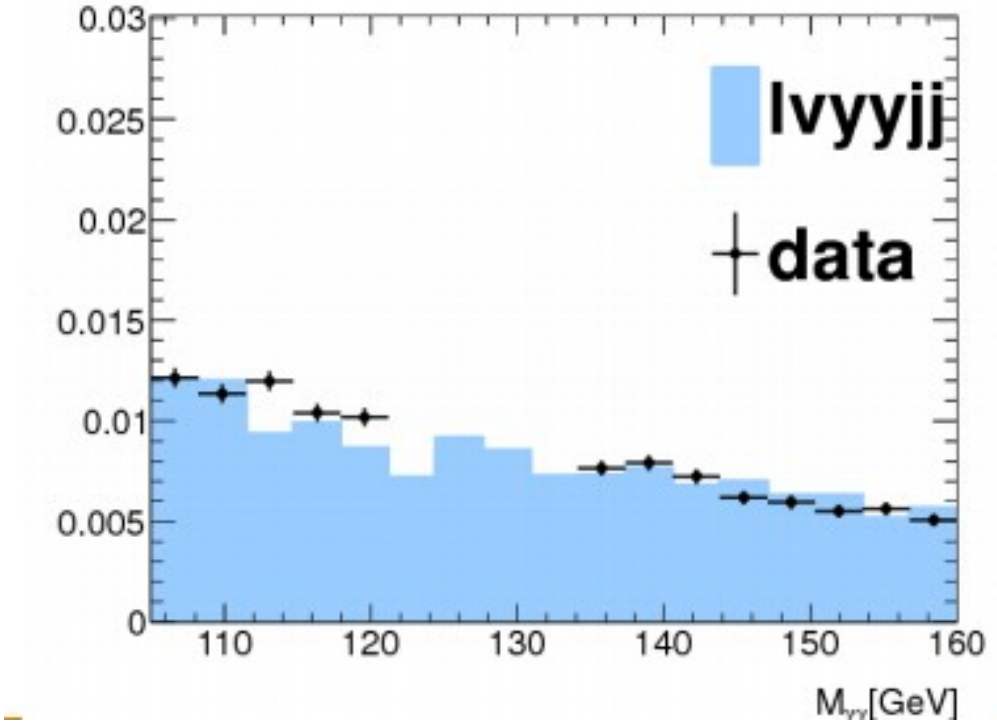


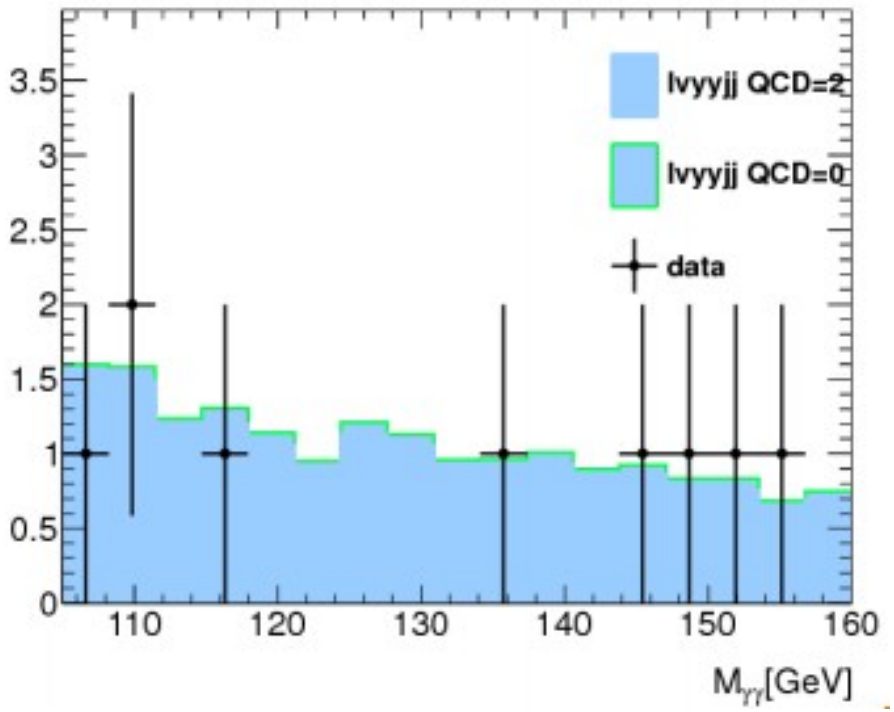
Summary

- WWyy status:
  - full analysis chain ready, readable INT draft in CDS, first/scond round EB questions done
  - need to polish INT note to make clearer description on the analysis structure
- bbtautau status:
  - recently, only document issue, fixing texting, adding plots etc.
  - full analysis ready and waiting for approval for opening the box recently
- combination status:
  - machinary running well, preliminary checks on nuisance parameters and limits, CDS entry is opened for a preliminary documentation
  - switching to toys, need to continue to document INT note
- paper preparation:
  - preliminary paper draft available, including full analyses and plots
  - on yyWW, finalizing the analysis and decide the plots (and tables)
  - on bbtautau, discussion of systematics, Keita send update, to be implemented soon
  - think about the interpretation of the results

backup

WWyy – cont. bkg components

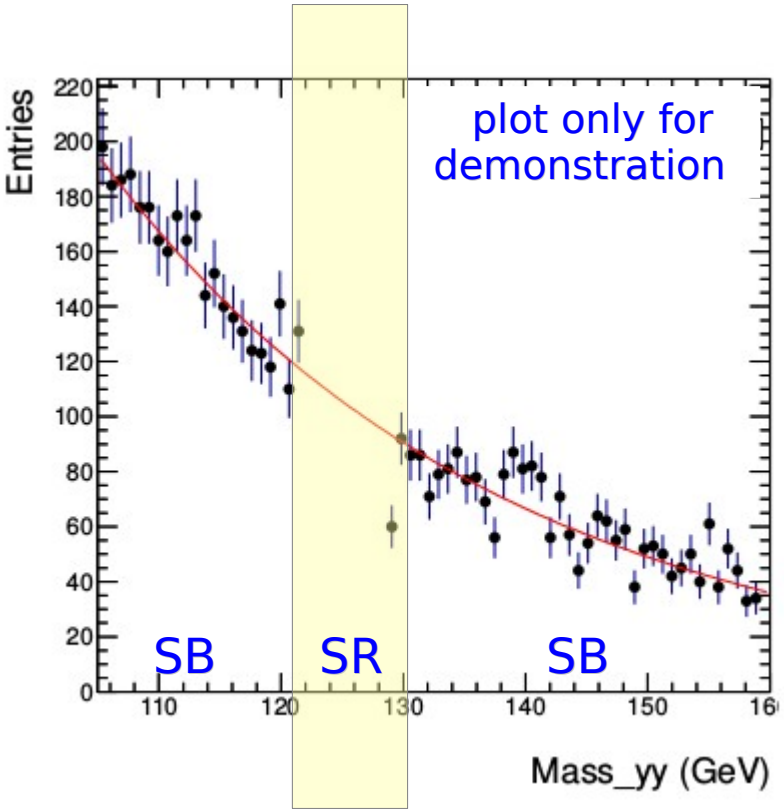




newly updated plots on cont. bkg components
only parton level information is used for these distributions
requesting fast simulations in parallel

Signal and background regions

- Backgrounds that are taken into account
  - **SM single Higgs** : MC estimation
  - **SM continuous backgrounds** : data driven from myy sideband (background region)

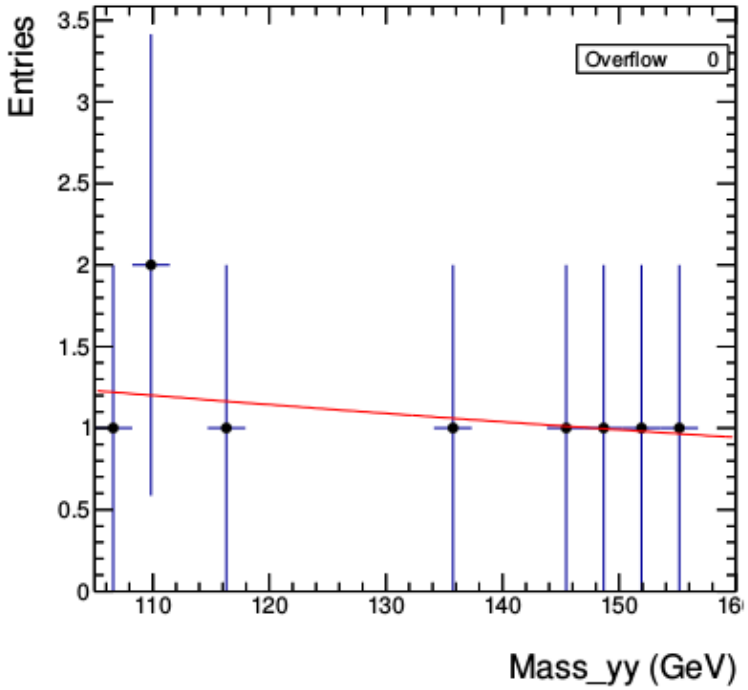


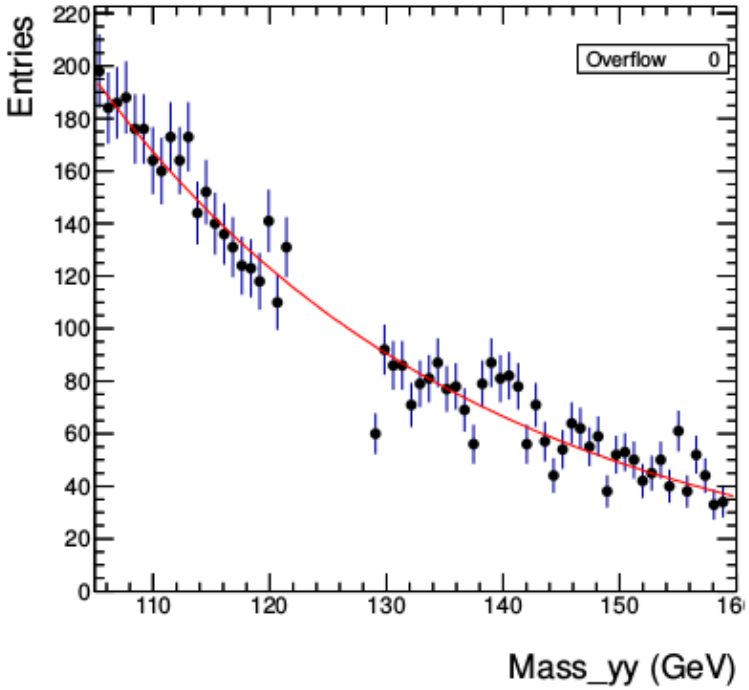
tight mass window

tight mass window: **signal** region
outside the window: **background** region
with all other cuts applied shown in previous page

Cont. bkg estimation

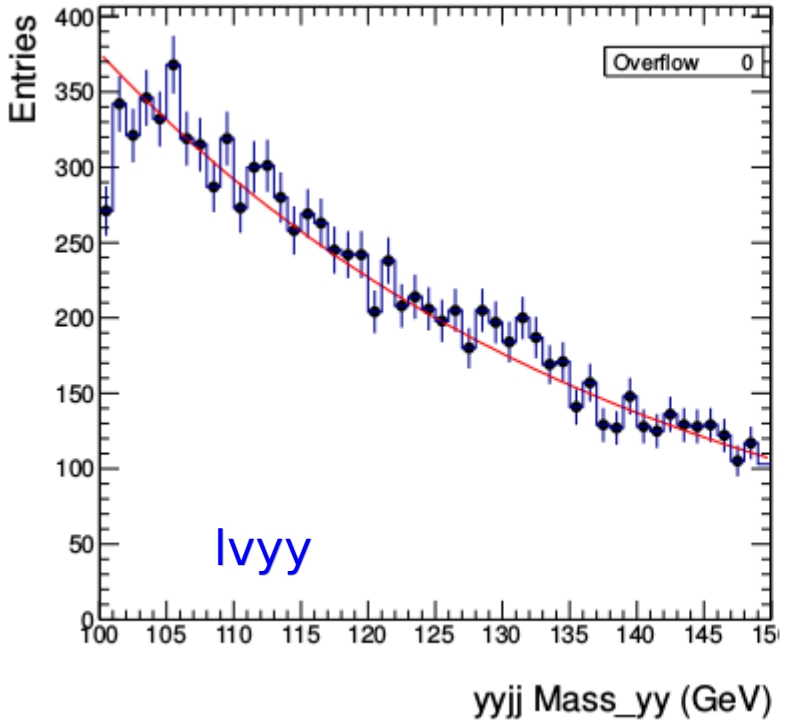
- after requiring lepton multiplicity, the statistics is extremely low in data, making the estimation of cont. background from sideband region very difficult and unreliable
- solution:
  - estimate the **efficiency of myy cut** from the sample before requiring lepton multiplicity
  - apply this **eff** to calculate the cont. bkg from sideband to signal region after lepton multiplicity requirement

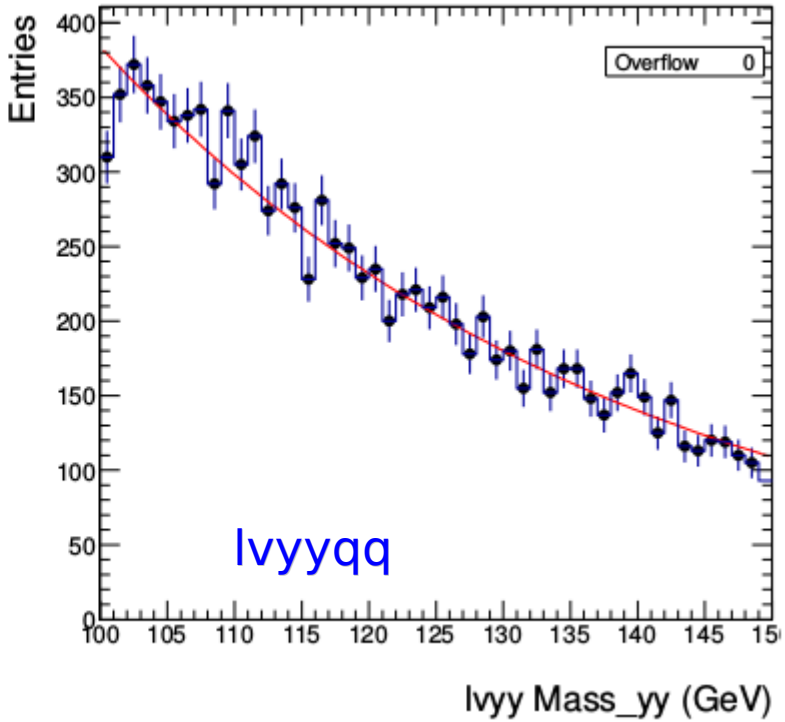




Validate eff – N_lep independent

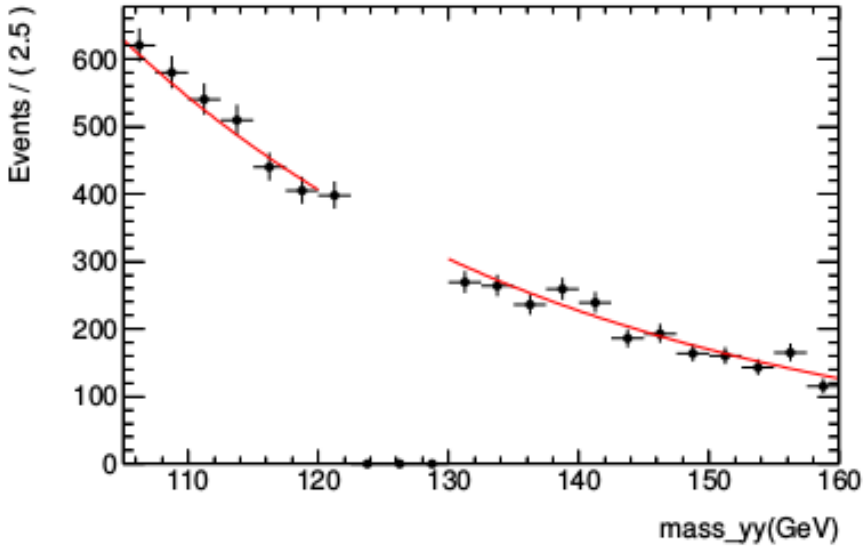
- validate the efficiency of myy cut is independent of asking or not asking leptons in the events
- using samples of lvyy and lvyyqq, one calculate the eff
  - eff(myy) in lvyy = 12.7076%
  - eff(myy) in lvyyqq = 12.7547%
- **1%** difference is taken into account as syst uncertainty



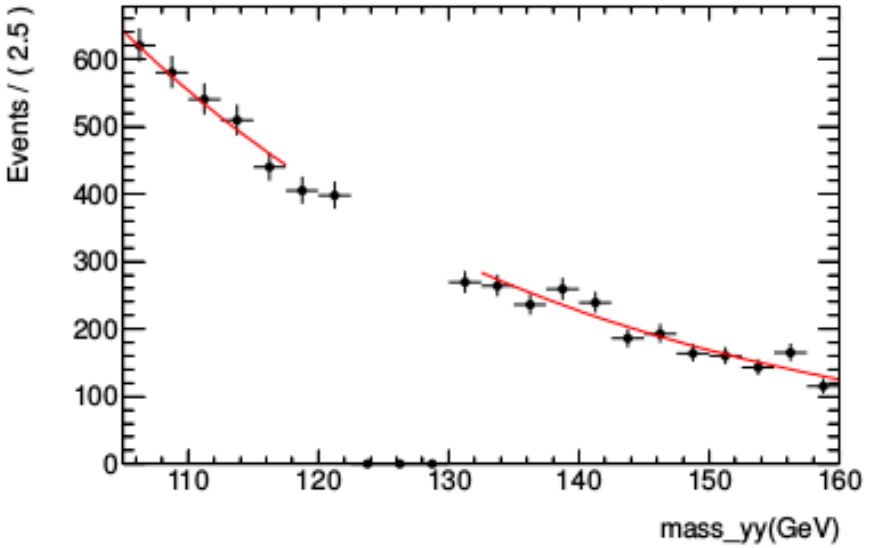


Validate eff – SB-def independent

- validate the efficiency of myy cut is independent on the definitions of background control region
- using different bkg region definitions, one calculate the eff
  - eff(myy) from !(120,130) : 12.7746%
  - eff(myy) from !(117.5,132.5) : 12.7727%



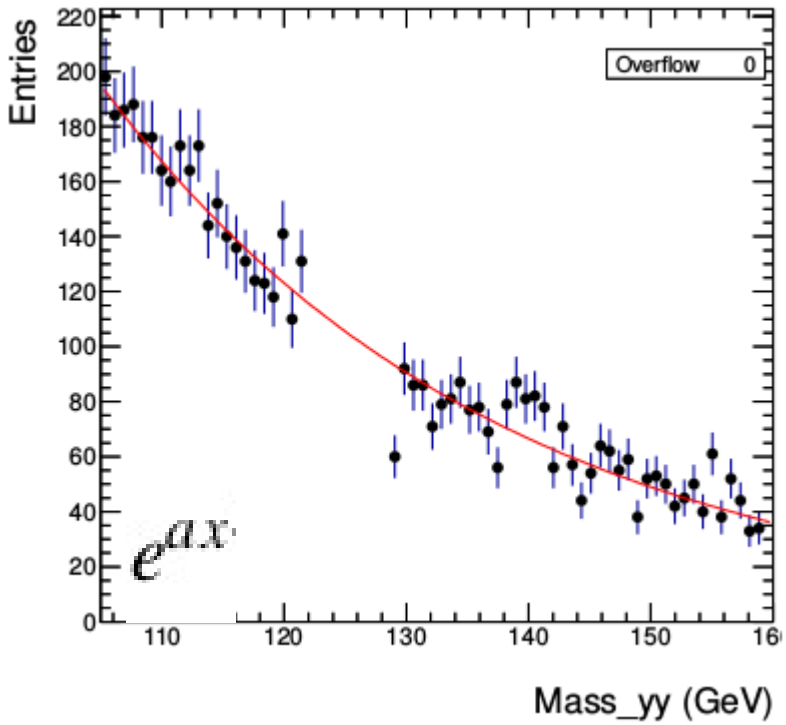
bkg region !(120,130)

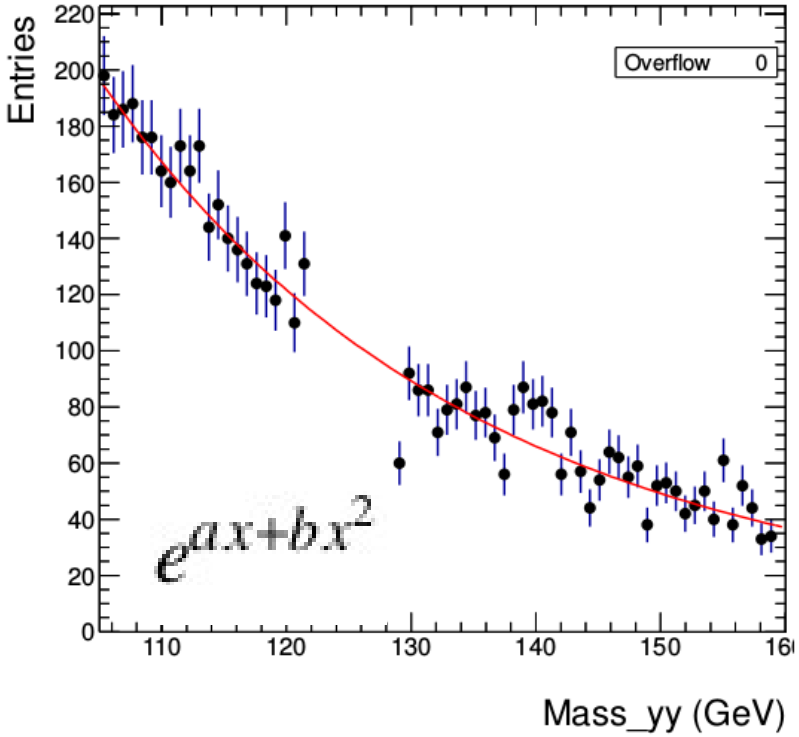


bkg region !(117.5,132.5)

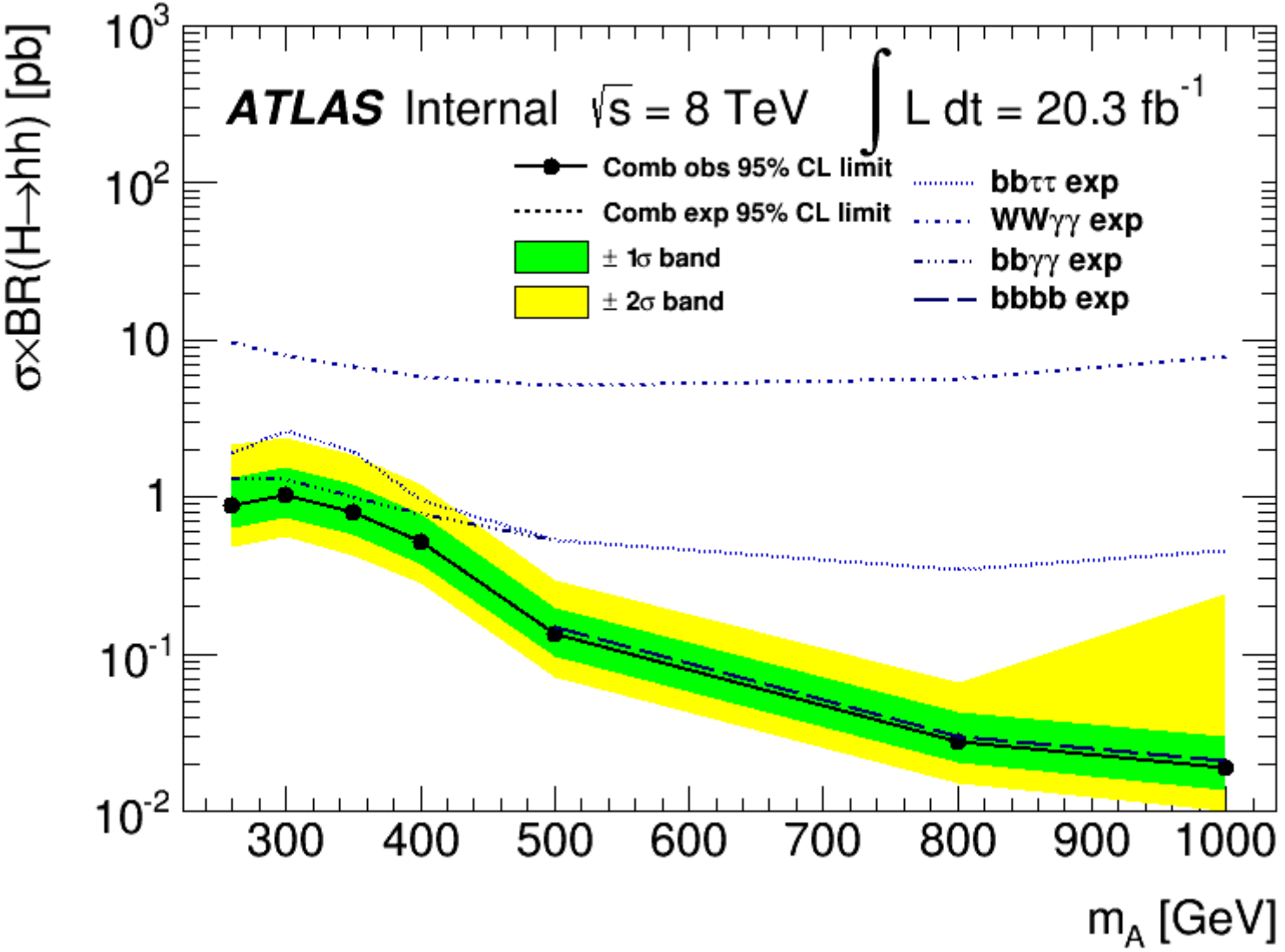
Validate eff – model independent

- an exponential function is used to model the cont. bkg from sideband: **exp(ax)**
- alternatively, function **exp(ax+bx^2)** is tested for modeling
- no difference is seen between two modelings





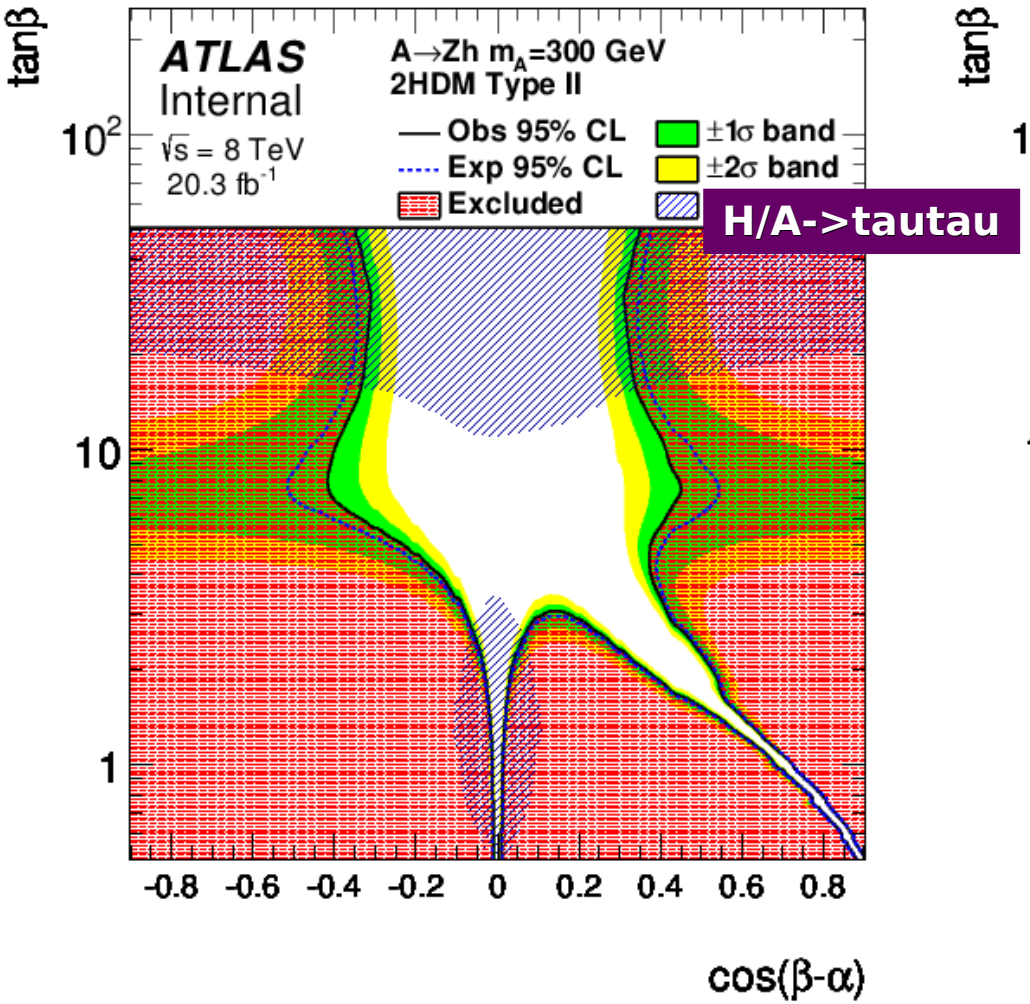
Upper limits – res

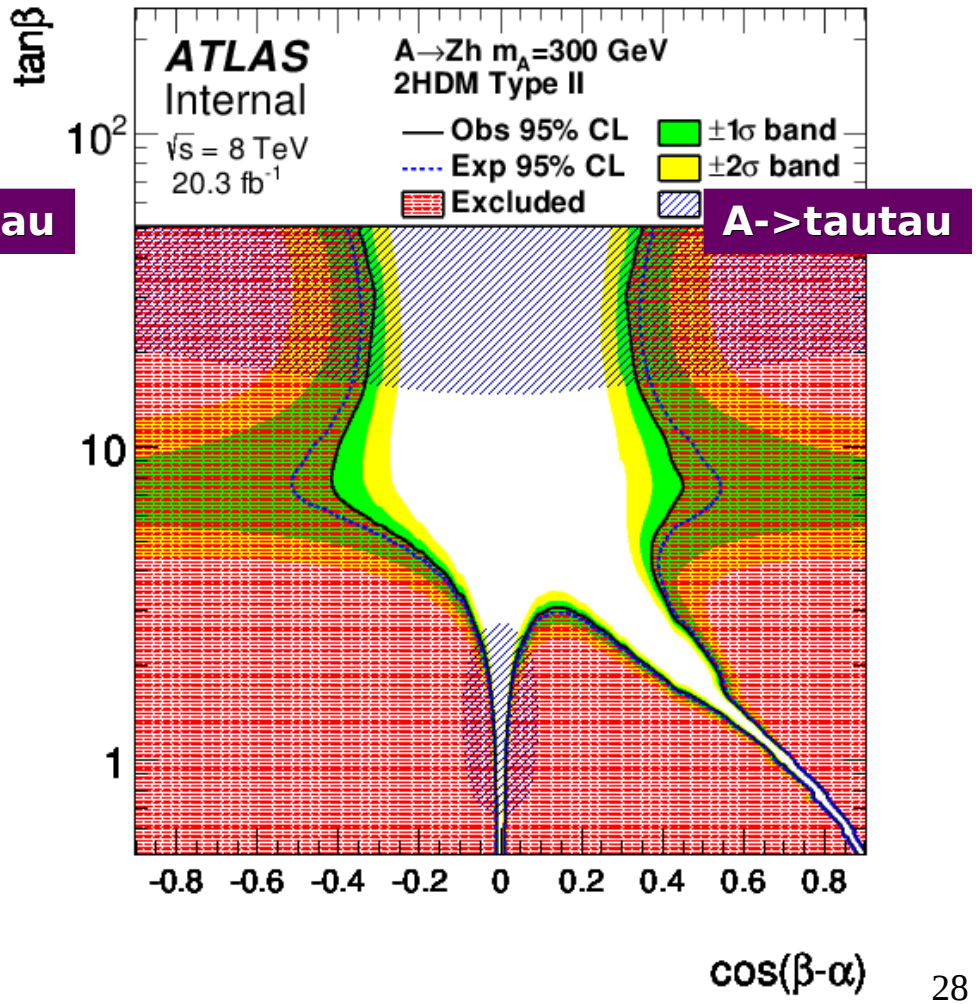


toys will be used instead of asymmptotics

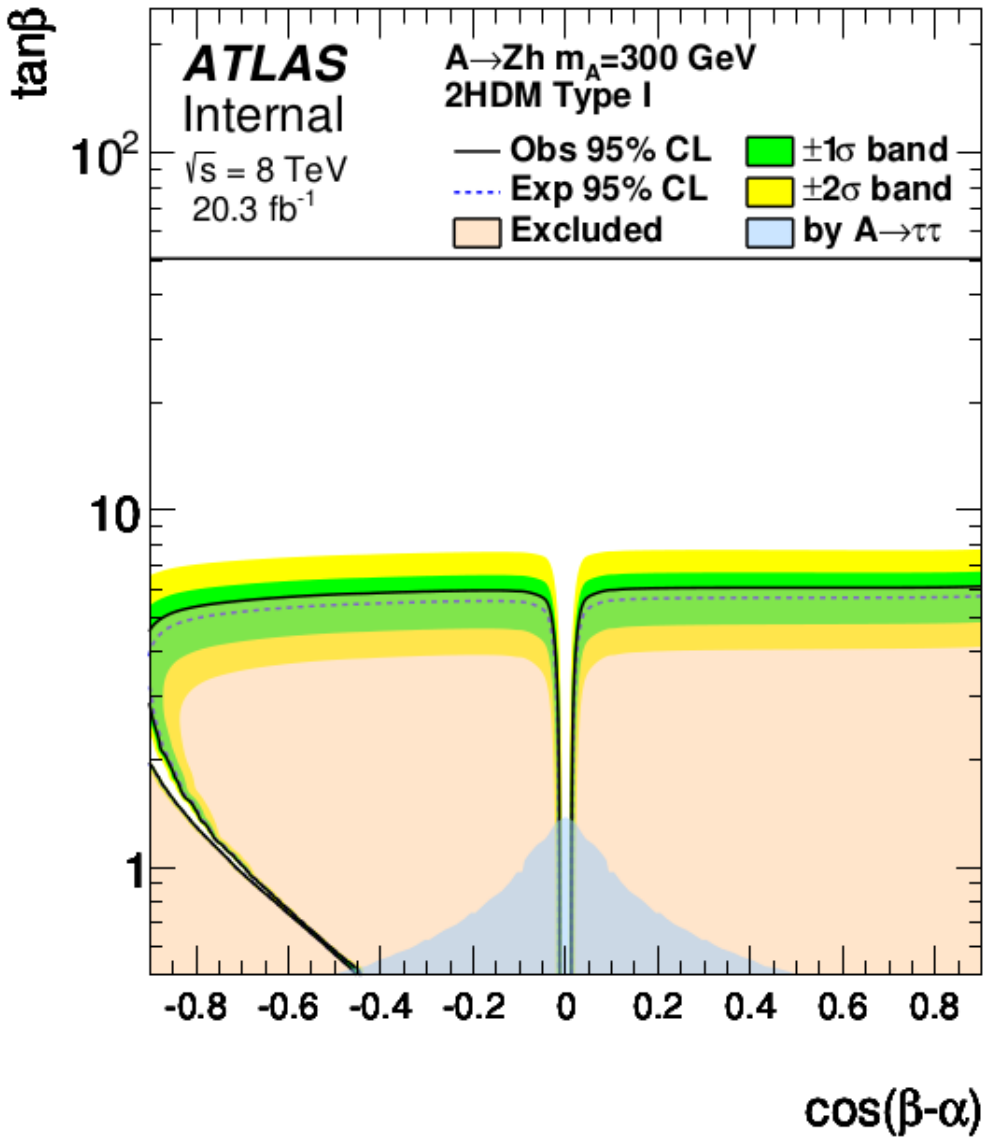
H/A -> tau tau effects

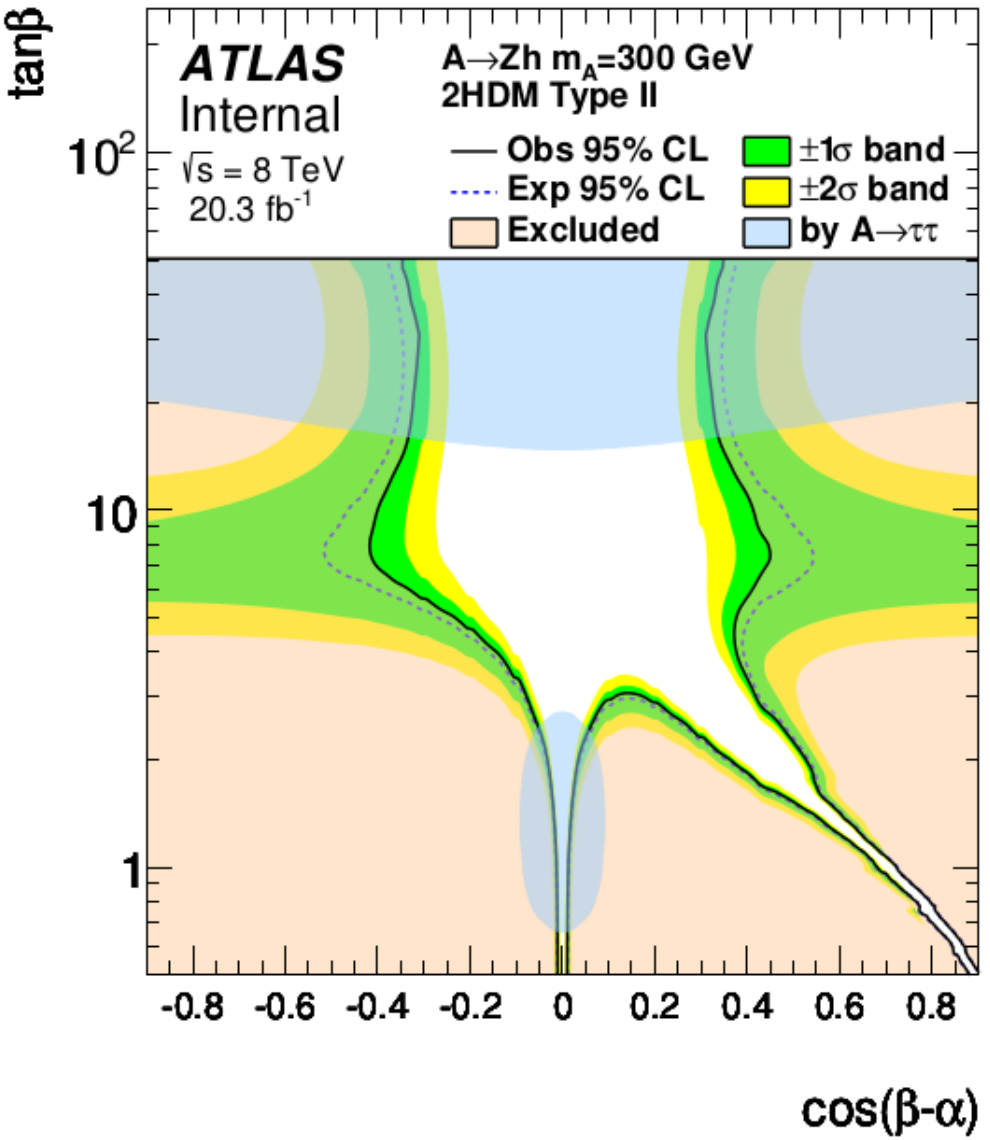
- Proposed by Marumi, the overlaid A->tautau exclusions are asked to be compared with H/A->tautau exclusions
-



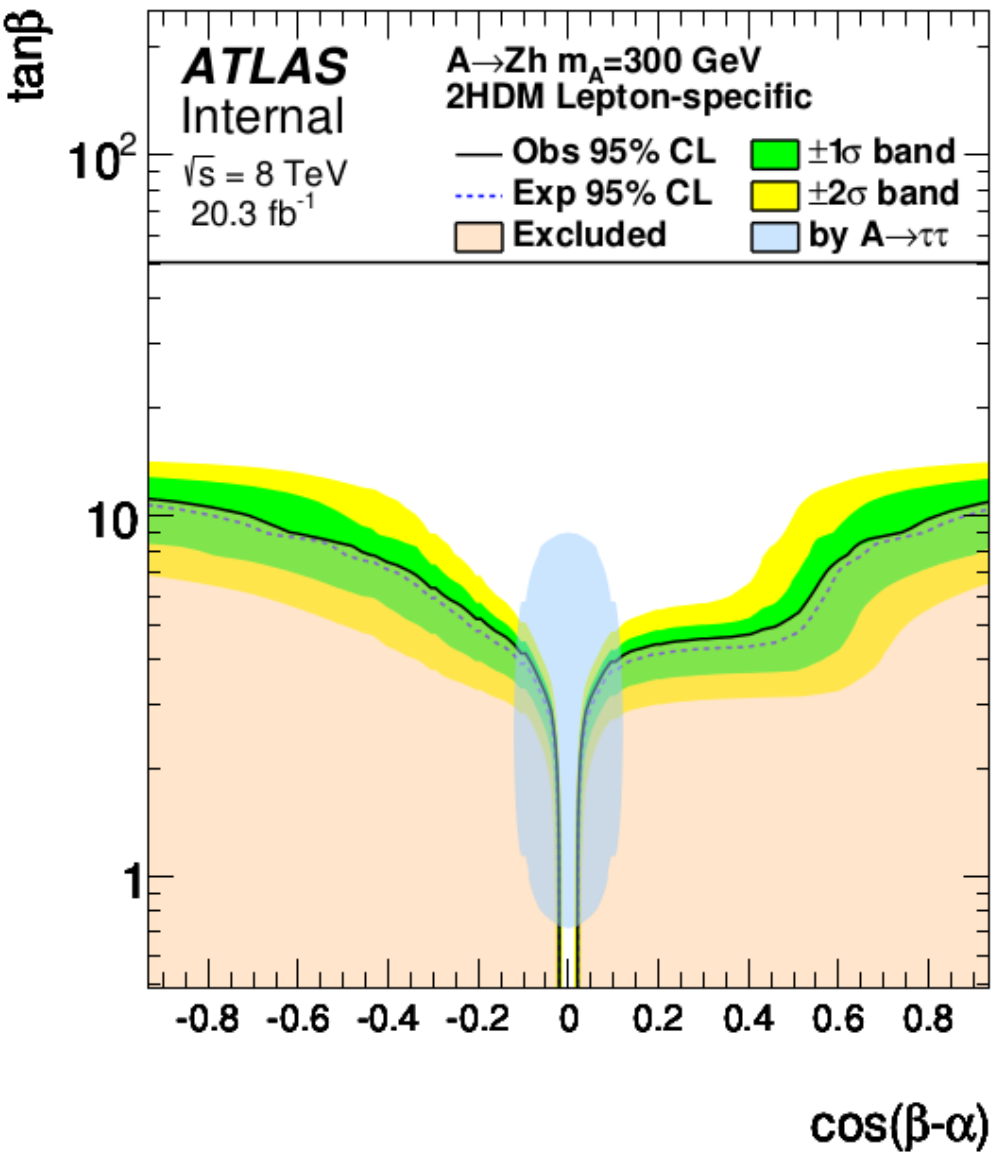


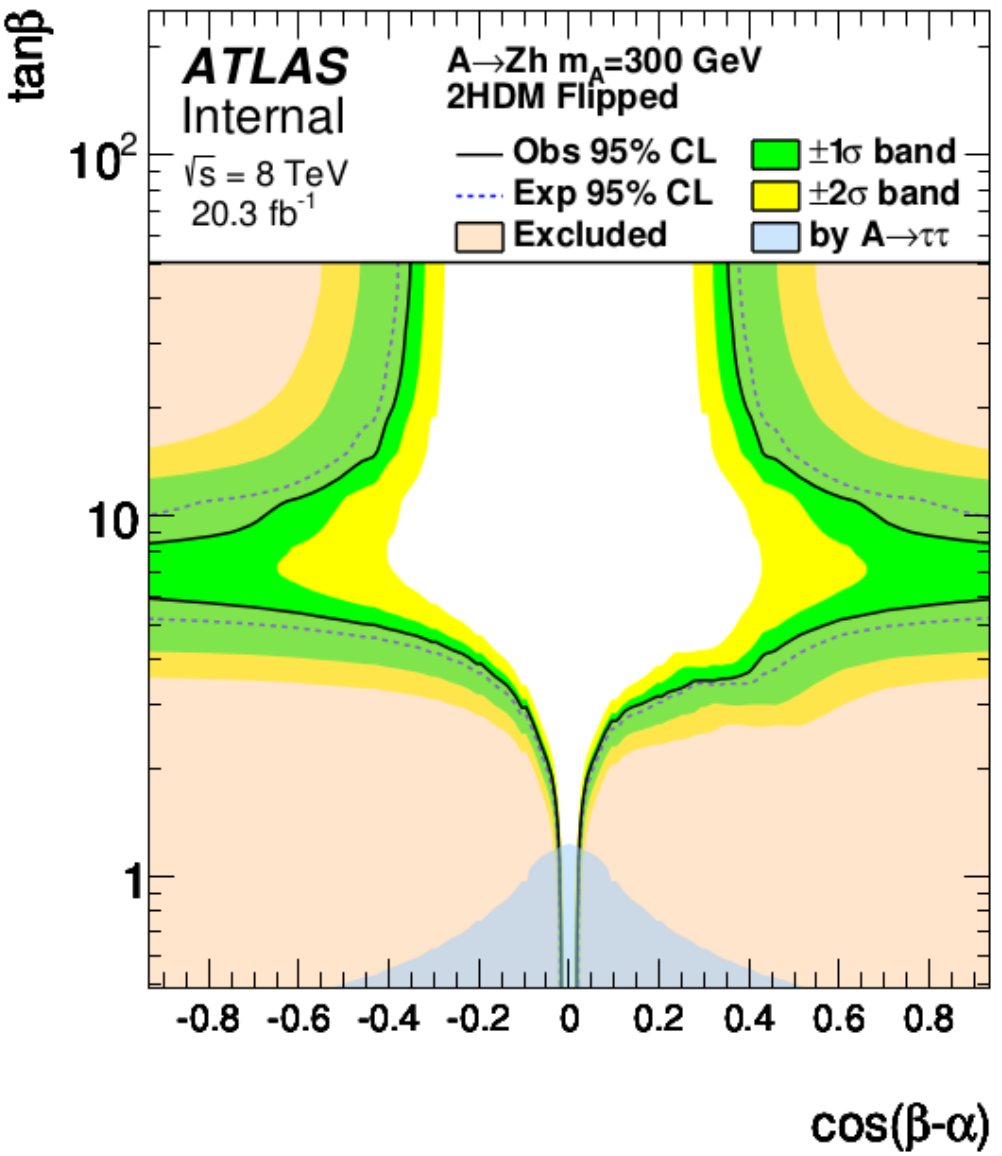
2HDM


ATLAS
Internal
√s = 8 TeV
20.3 fb-1
A→Zh mA=300 GeV
2HDM Type I
Obs 95% CL
Exp 95% CL
Excluded
±1σ band
±2σ band
by A→ττ
tanβ
10²
10
1
-0.8 -0.6 -0.4 -0.2 0 0.2 0.4 0.6 0.8
cos(β-α)

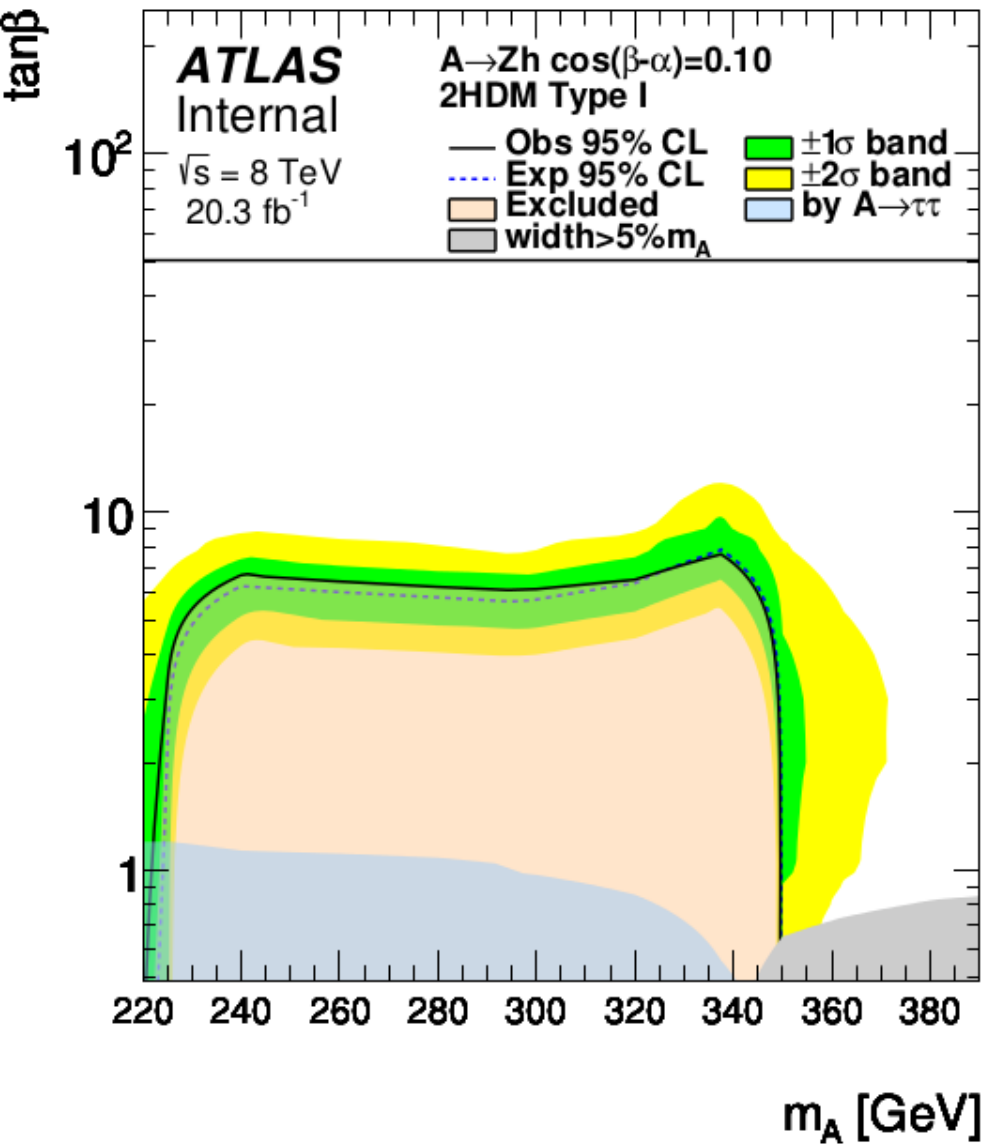

ATLAS
Internal
√s = 8 TeV
20.3 fb-1
A→Zh mA=300 GeV
2HDM Type II
Obs 95% CL
Exp 95% CL
Excluded
±1σ band
±2σ band
by A→ττ
tanβ
10²
10
1
-0.8 -0.6 -0.4 -0.2 0 0.2 0.4 0.6 0.8
cos(β-α)

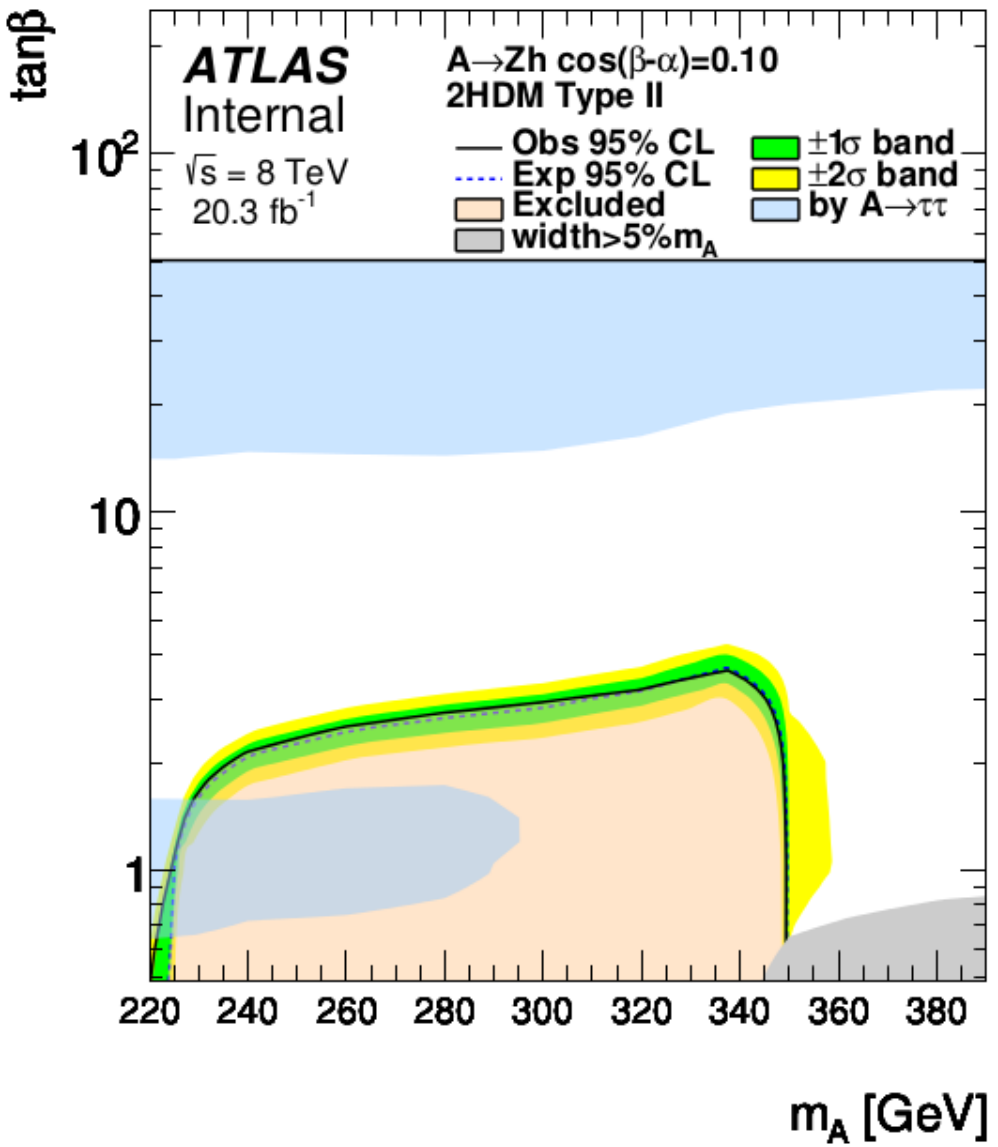
2HDM


ATLAS
Internal
√s = 8 TeV
20.3 fb-1
A→Zh mA=300 GeV
2HDM Lepton-specific
Obs 95% CL
Exp 95% CL
Excluded
±1σ band
±2σ band
by A→ττ
tanβ
10²
10
1
-0.8 -0.6 -0.4 -0.2 0 0.2 0.4 0.6 0.8
cos(β-α)

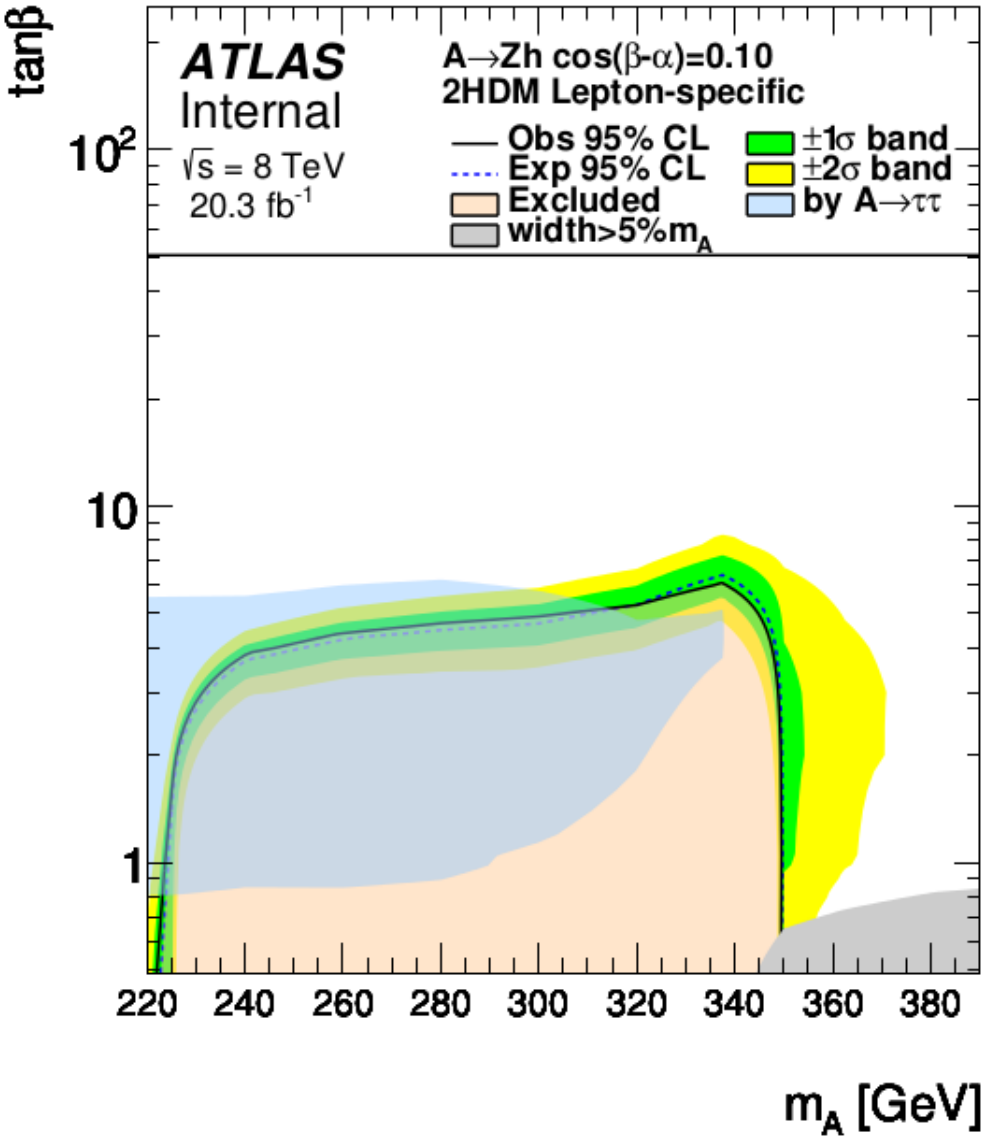

ATLAS
Internal
√s = 8 TeV
20.3 fb-1
A→Zh mA=300 GeV
2HDM Flipped
Obs 95% CL
Exp 95% CL
Excluded
±1σ band
±2σ band
by A→ττ
tanβ
10²
10
1
-0.8 -0.6 -0.4 -0.2 0 0.2 0.4 0.6 0.8
cos(β-α)

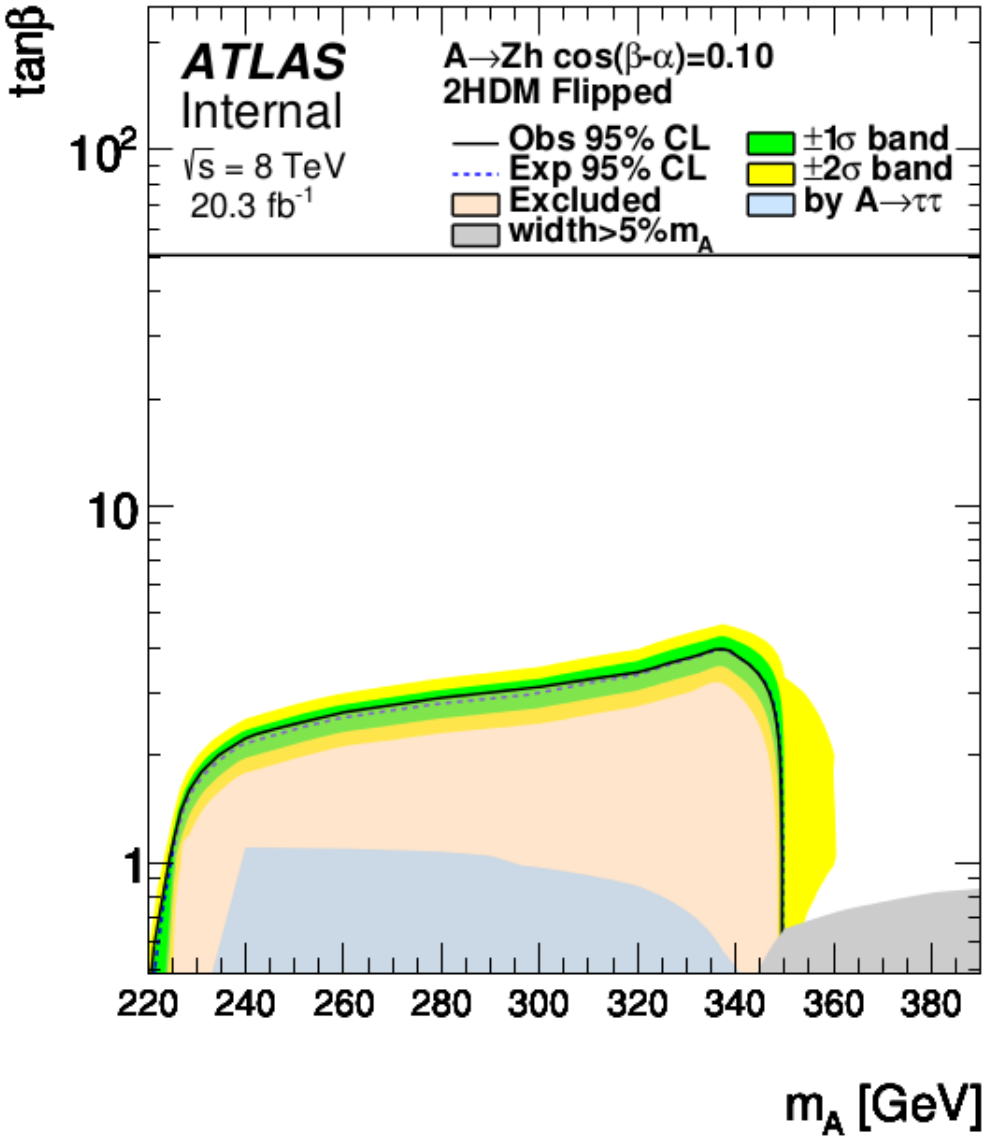
2HDM


ATLAS
Internal
√s = 8 TeV
20.3 fb-1
A→Zh cos(β-α)=0.10
2HDM Type I
Obs 95% CL
Exp 95% CL
Excluded
width>5%mA
±1σ band
±2σ band
by A→ττ
tanβ
10²
10
1
220 240 260 280 300 320 340 360 380
mA [GeV]


ATLAS
Internal
√s = 8 TeV
20.3 fb-1
A→Zh cos(β-α)=0.10
2HDM Type II
Obs 95% CL
Exp 95% CL
Excluded
width>5%mA
±1σ band
±2σ band
by A→ττ
tanβ
10²
10
1
220 240 260 280 300 320 340 360 380
mA [GeV]

2HDM


ATLAS
Internal
√s = 8 TeV
20.3 fb-1
A→Zh cos(β-α)=0.10
2HDM Lepton-specific
Obs 95% CL
Exp 95% CL
Excluded
width>5%mA
±1σ band
±2σ band
by A→ττ
tanβ
10²
10
1
220 240 260 280 300 320 340 360 380
mA [GeV]


ATLAS
Internal
√s = 8 TeV
20.3 fb-1
A→Zh cos(β-α)=0.10
2HDM Flipped
Obs 95% CL
Exp 95% CL
Excluded
width>5%mA
±1σ band
±2σ band
by A→ττ
tanβ
10²
10
1
220 240 260 280 300 320 340 360 380
mA [GeV]