

Weekly report

Xiaohu Sun

20-10-2015

IHEP

HH combination paper is approved!

- Congrats to all people who paid efforts to HH searches!

PRD DJ11717

Paper Final Publication			
Referee Report On	2015/09/24		PGCPCPubEdB
Journal Acceptance Date	2015/10/13		PGCPCPubEdB
Proofs On			PGCPCPubEdB
Final Journal Publication			
Inspire			

<https://atglance.web.cern.ch/atglance/analysis/detailAnalysis.php?readonly=true&id=4783>

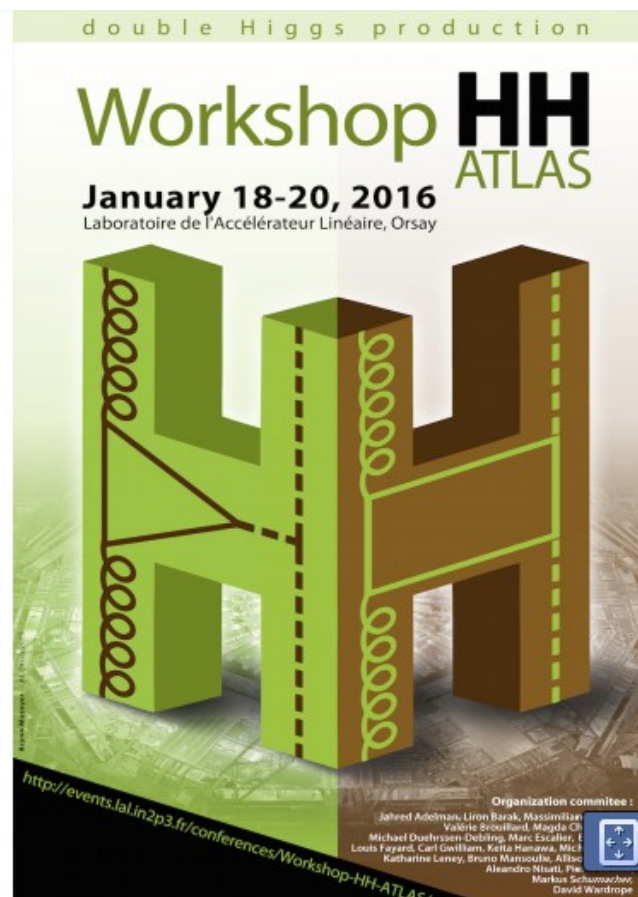
**Searches for Higgs boson pair production in the
 $hh \rightarrow bb\tau\tau, \gamma\gamma WW^*, \gamma\gamma bb, bbbb$ channels with the ATLAS
 detector**

The ATLAS Collaboration

HH workshop registration

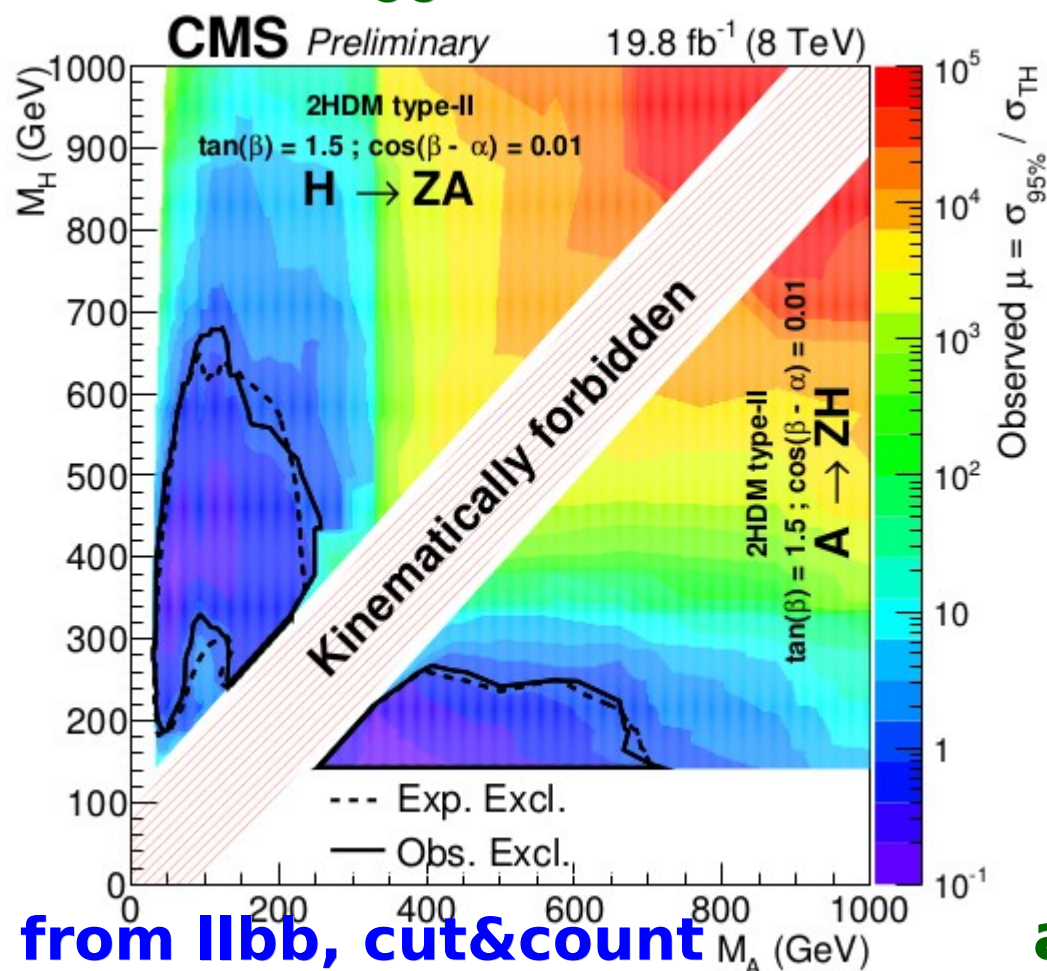
- HH Workshop registration is open now
 - <http://events.lal.in2p3.fr/conferences/Workshop-HH-ATLAS/>

- Planning to have a dedicated ATLAS workshop on hh
 - Will focus on BSM but also cover longer-term SM hh
 - 18th – 20th Jan 2016 in Orsay, Paris
- Doodle to get a rough idea of numbers who may attend
 - <http://doodle.com/poll/s6gevubdgv2pbrzp>
 - Not a registration yet



2HDM xsec ntuples (AH split)

- A test production for AH mass split: A-ZH and H-ZA
- Newly added phase points @ **tan β =2**
 - <https://twiki.cern.ch/twiki/bin/viewauth/AtlasProtected/HiggsBSM2HDMRecommendations>



**RUN I from CMS
PAS HIG-15-001
(Z $\rightarrow$ ll, A/H $\rightarrow$ bb or $\tau\tau$)**

**it was missing in ATLAS
we would like to look at it
in RUN II**

~+~

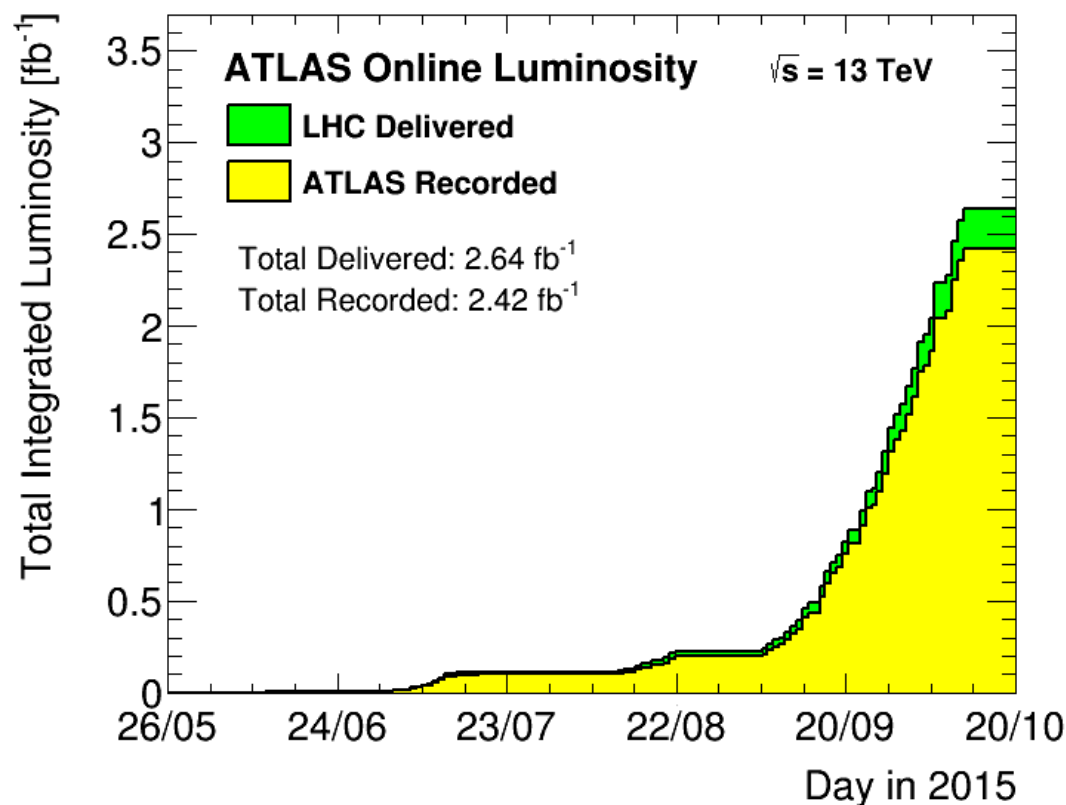
**started to
prepare theoretical xs&br
for A/H split**

**production is done
adding some points missing**

Data in wwww categories

- Run with HGam h008 MxAOD from eos system
 - `/eos/atlas/atlasgroupdisk/phys-higgs/HSG1/MxAOD/h008/data_25ns/`
- In total, 286.9 /pb 25ns was processed to MxAOD
- In total, 1.6M events
- With HGam sel:
- Previously, 50ns
668 evts ~ 84.6/pb
- Now, 25 ns
6814 evts ~ 286.9/pb

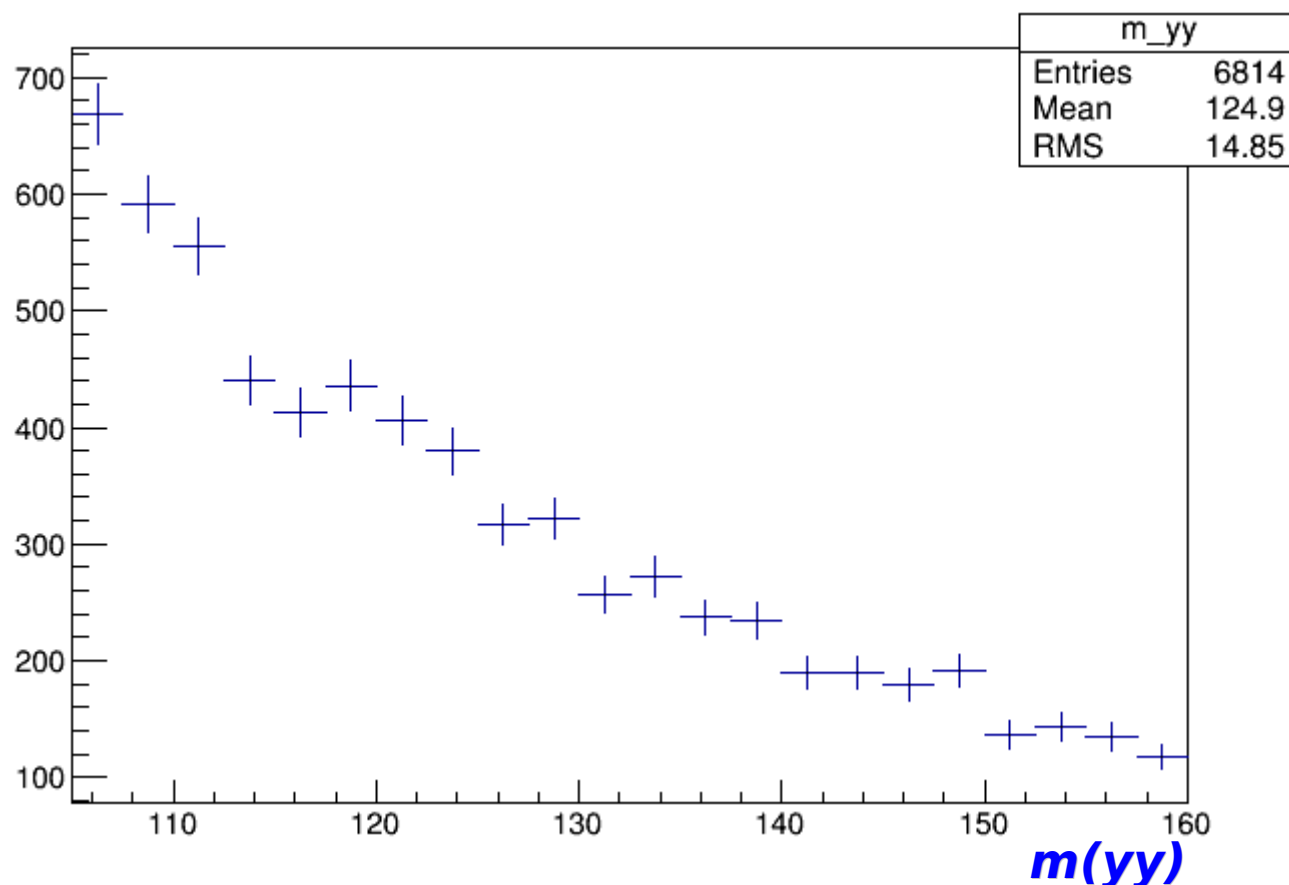
X10.2



yy events

- Selected yy events

x10.2



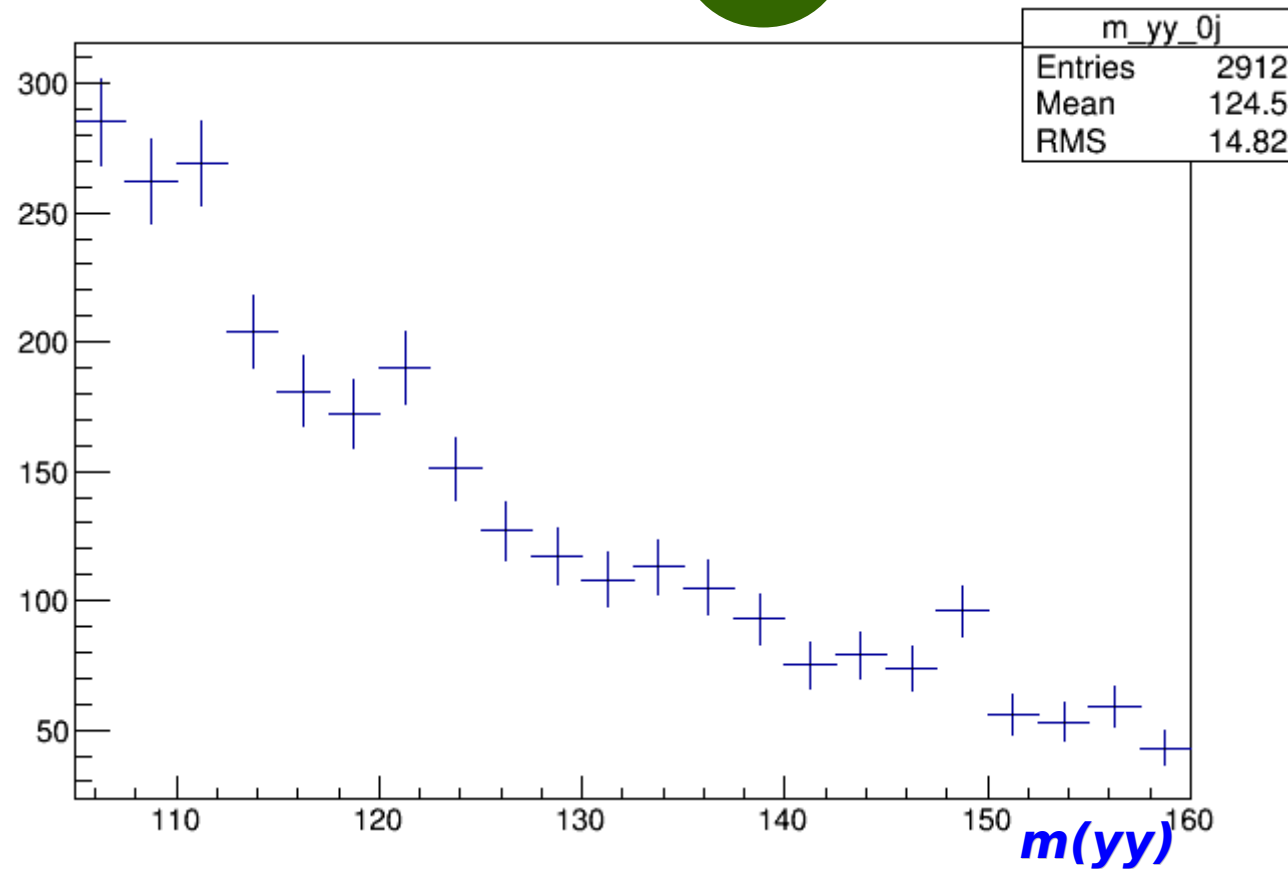
pre-sel

full-sel

- 1: all events
- 2: trigger
- 3: GRL
- 4: detector DQ
- 5: hasPV
- 6: 2 loose photons
- 7: e/γ ambiguity
- 8: tight
- 9: isolation
- 10: rel ET cuts
- 11: m_{YY} in 105-160 GeV

- yy+0jet events
- Previously 281, now 2912

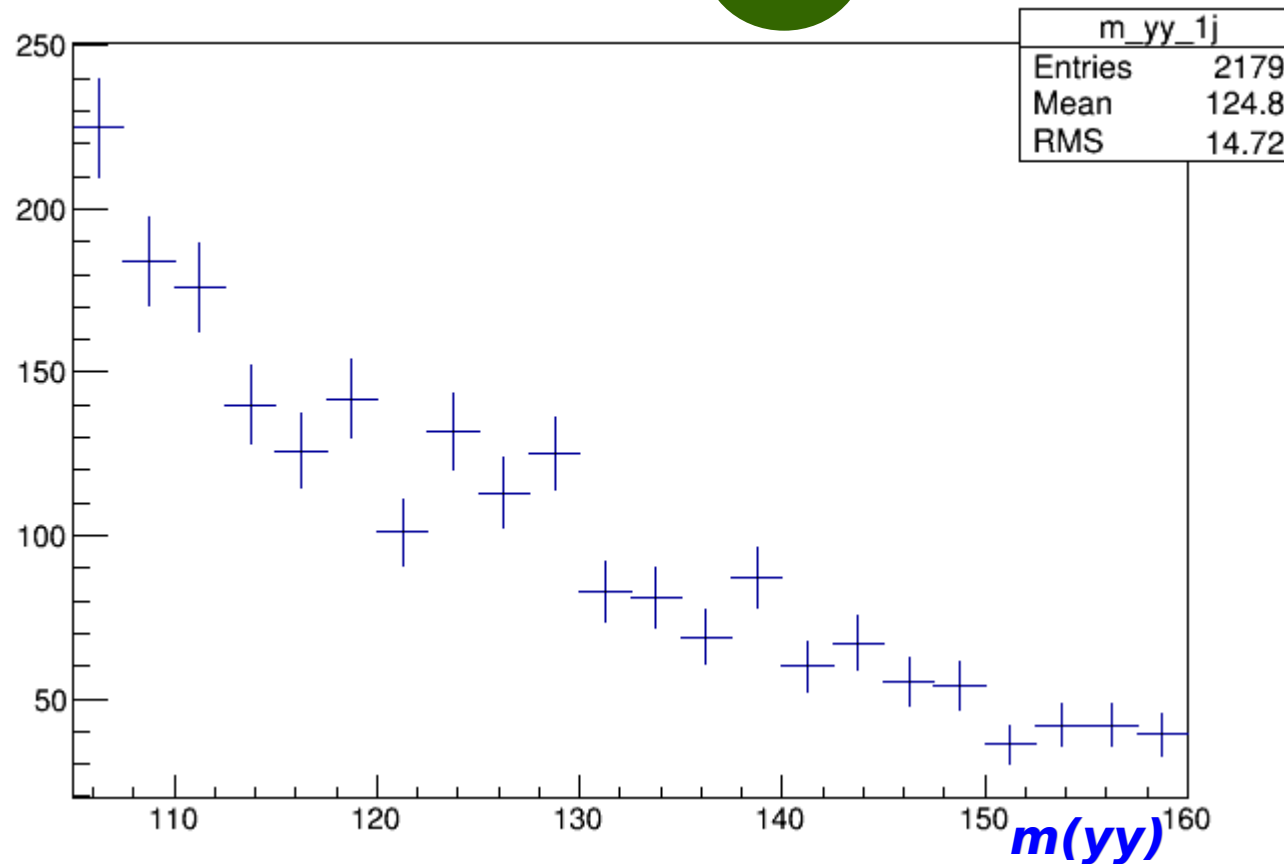
X10.4



yy + 1jet

- yy+1jet events
- Previously 208, now 2179

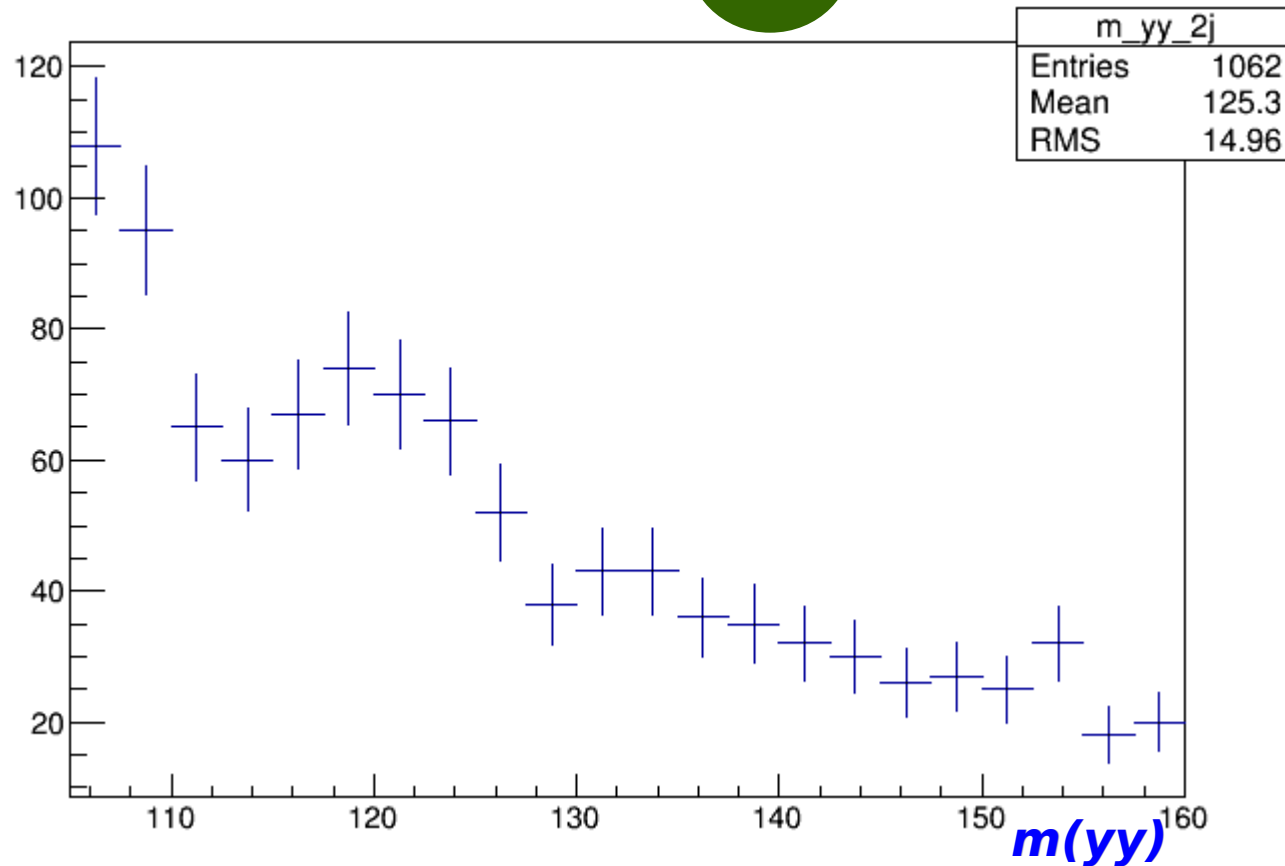
X10.5



yy + 2jet

- yy+2jet events
- Previously 108, now 1062

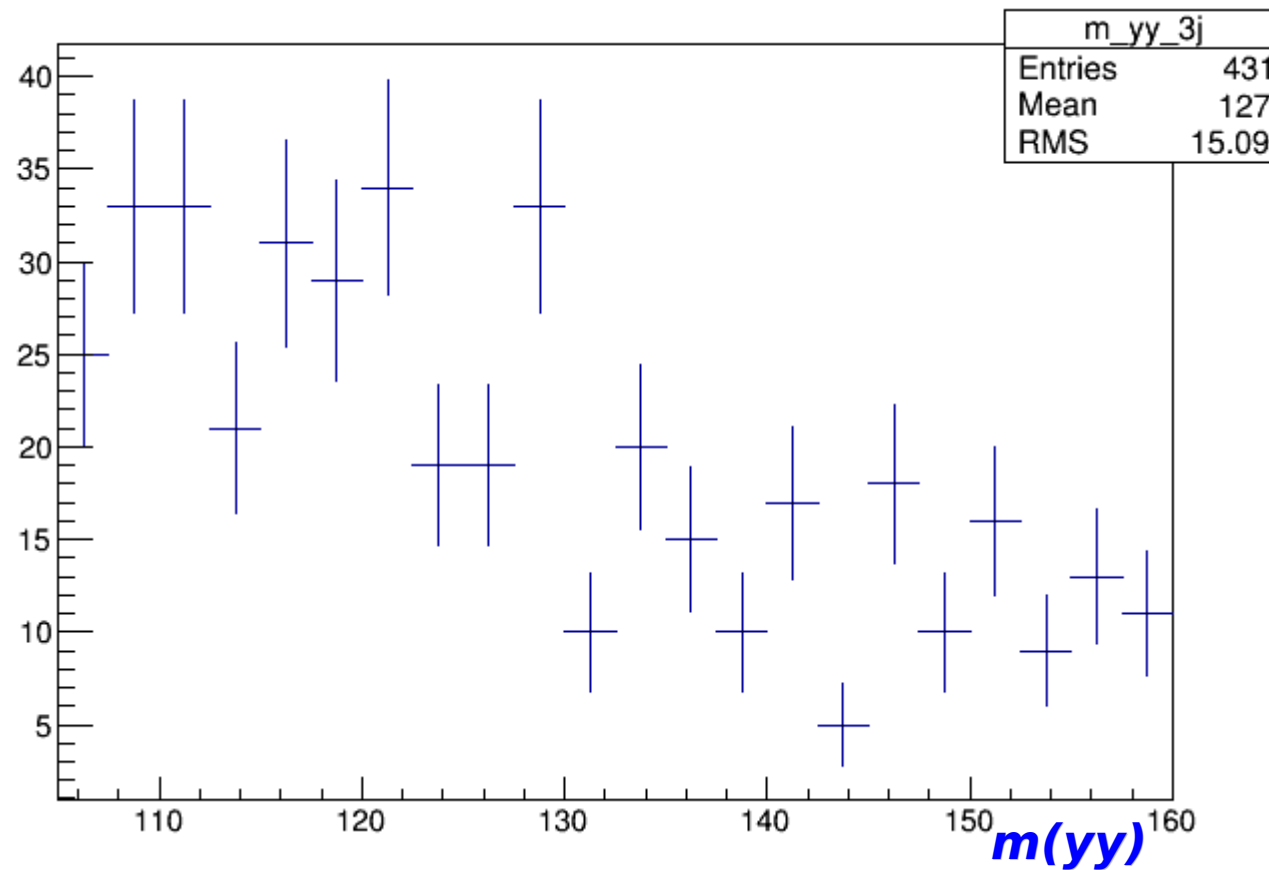
X9.83



yy + 3jet

- yy+3jet events
- Previously 46, now 431

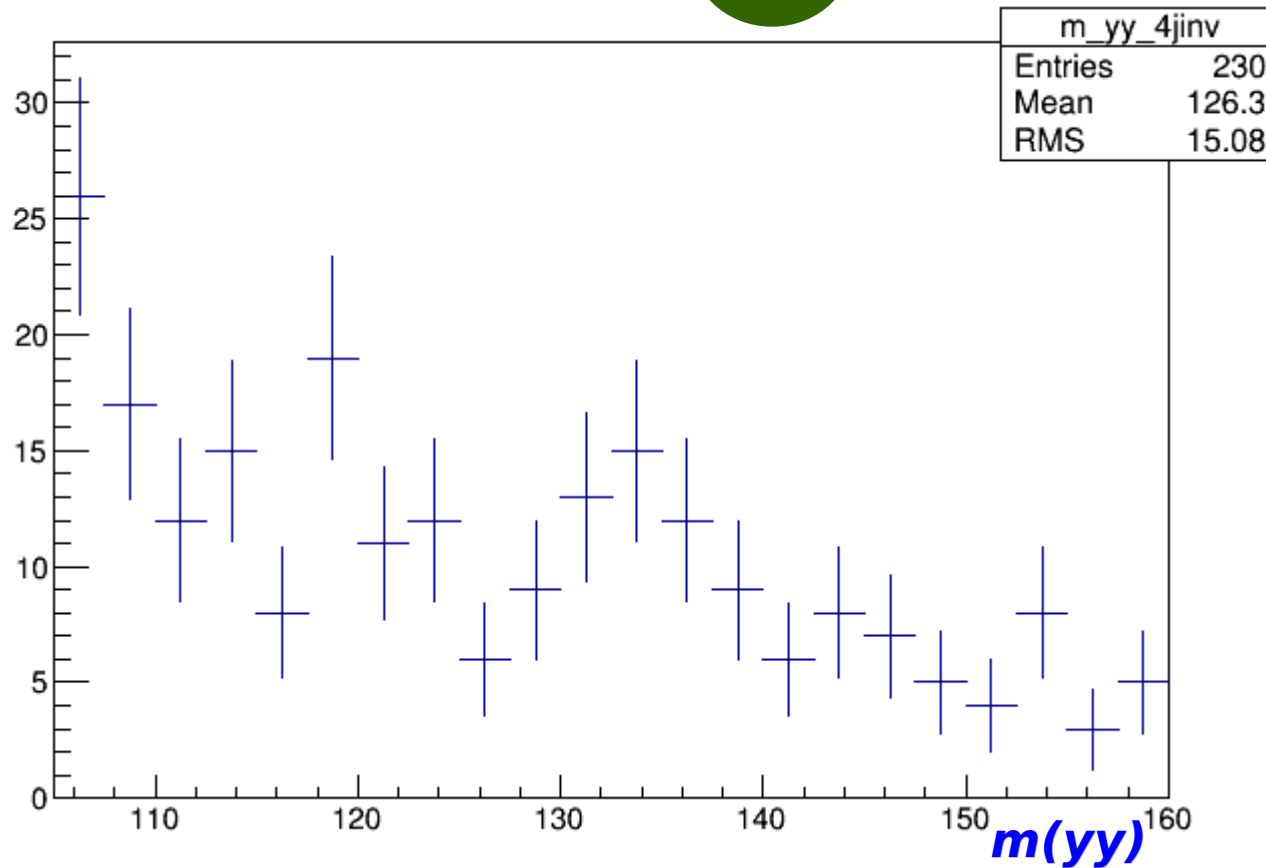
X9.37



yy + 4jet inclusively

- yy+4jet inclusively events
- Previously 27, now 230

X8.51

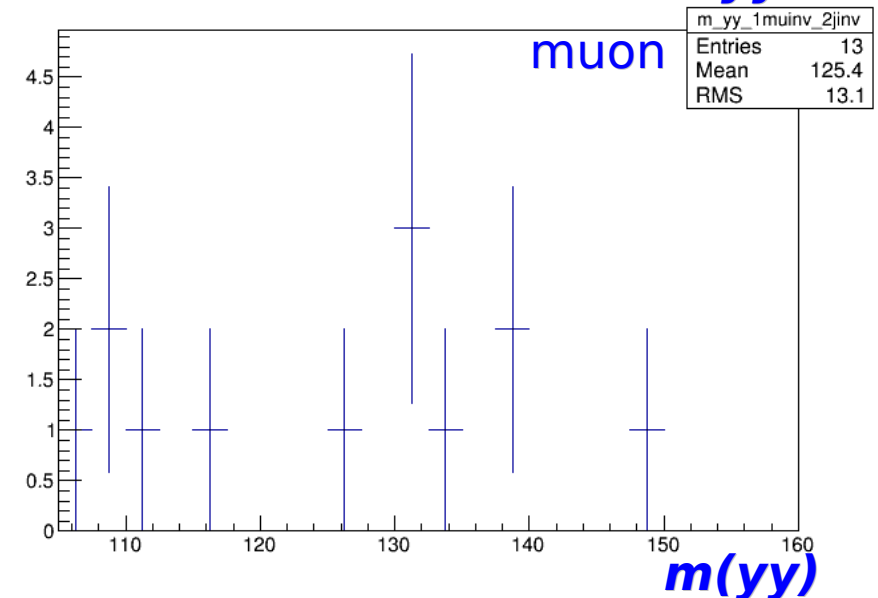
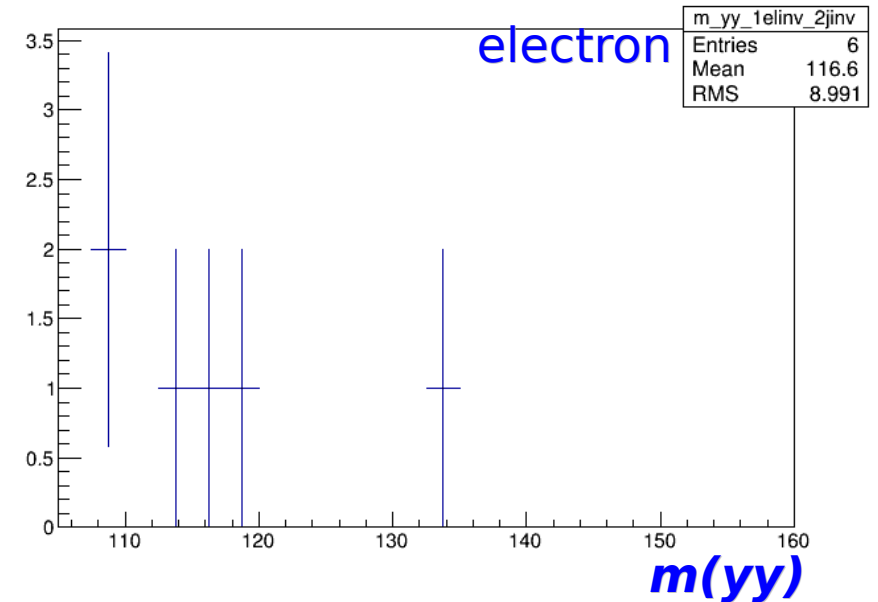
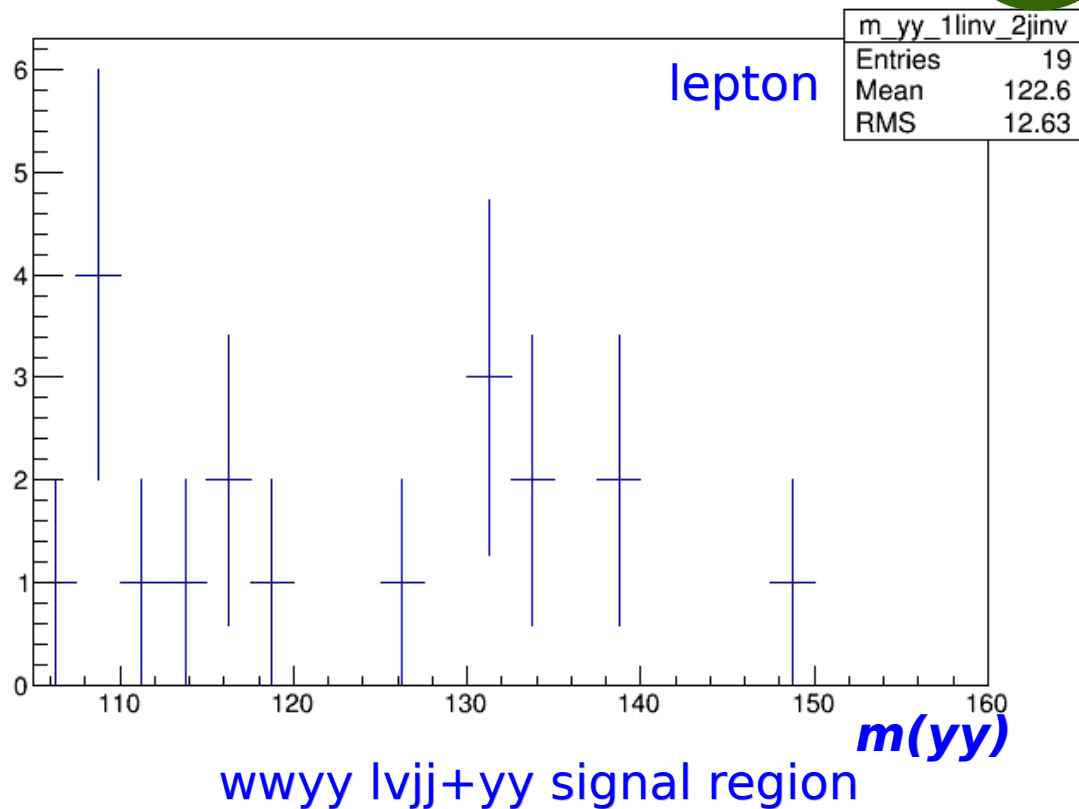


wwyy jjjj+yy signal region

yy + 1lep + 2jet inclusively

- yy+ 1lep+ 2jet inclusively events
- Previously 2, now 19

X9.5



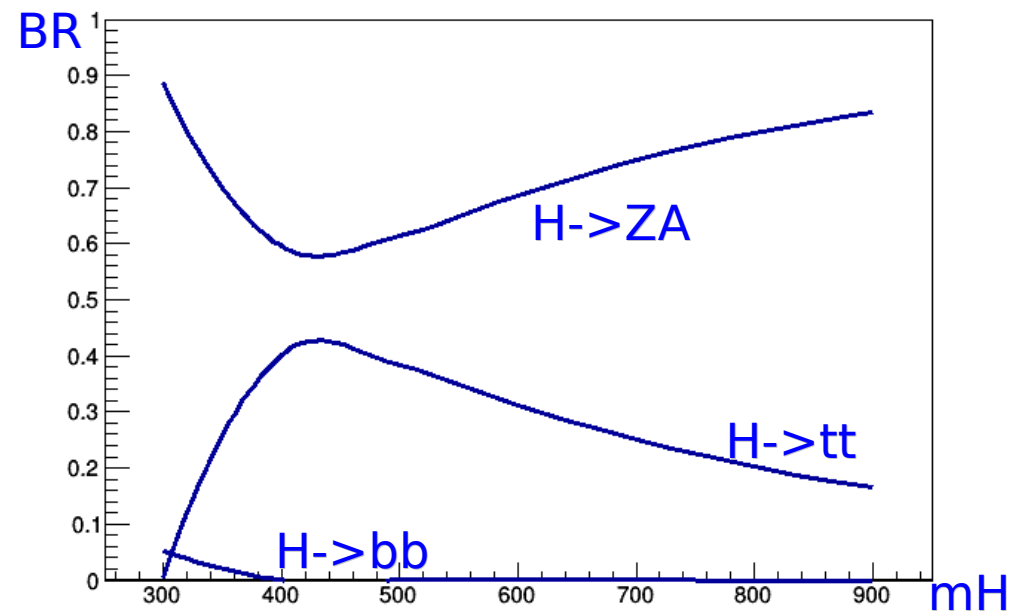
Backup

2HDM xsec calculation

- Having produced series of 2HDM xsec for RUN I analyses, I continued to take responsibility of **2HDM ntuple production for RUN II** for both ATLAS and the LHC
- <https://twiki.cern.ch/twiki/bin/viewauth/AtlasProtected/HiggsBSM2HDMRecommendations>
- <https://twiki.cern.ch/twiki/bin/view/LHCPhysics/LHCHXSWG2HDM>
- **13TeV Update:**
 - **SM** parameters follow latest recommendation from LHC Higgs working group:
<https://cds.cern.ch/record/2047636/files/LHCHXSWG-INT-2015-006.pdf>
 - Latest sw versions: **2HDMC** version 1.7.0, **SusHi** version 1.5.0
 - Latest **SM WH/ZH** xsec that will be rescaled to BSM
 - Latest **4FS (gb+gt interference) + 5FS** matching for b-associated productions

2HDM AZH HZA ($m_{Ch} = \max\{m_A, m_H\}$)

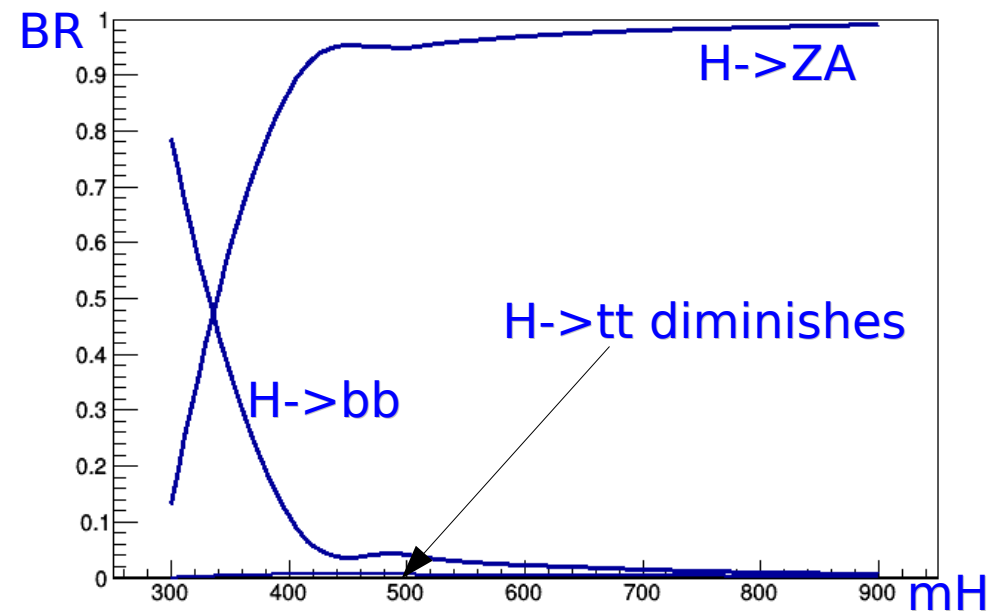
- Type II, both close in SM alignment, different t_b
- Look at $H \rightarrow XX$ BRs



**type II, $t_b=1.0$ $\cos(b-a)=0$
 $m_A=200\text{GeV}$**

$$c_{\beta-\alpha} = s_{\beta-\alpha}/t_\beta$$

coupling between A and up-type quark



**type II, $t_b=10.0$ $\cos(b-a)=0$
 $m_A = 200\text{GeV}$**

$\cos(b-a)=0$, $\sin(b-a)=1$, coupling $\sim 1/t_b$
low t_b , high coupling, $A/H \rightarrow tt$ contributes
after $m(tt)$ threshold
high t_b , low coupling $A/H \rightarrow tt$ diminishes

- bak