# Weekly report

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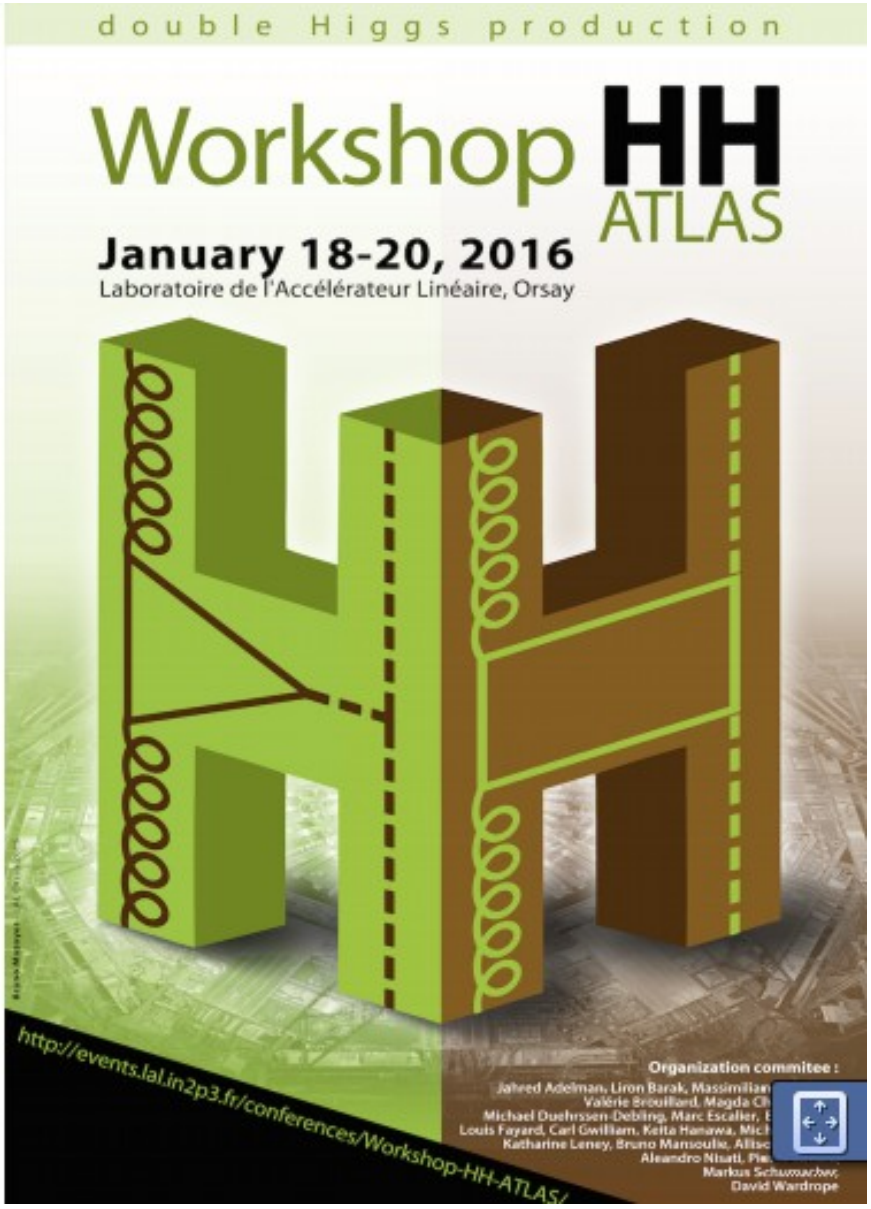
13-10-2015

IHEP

# DiHiggs workshop 2016

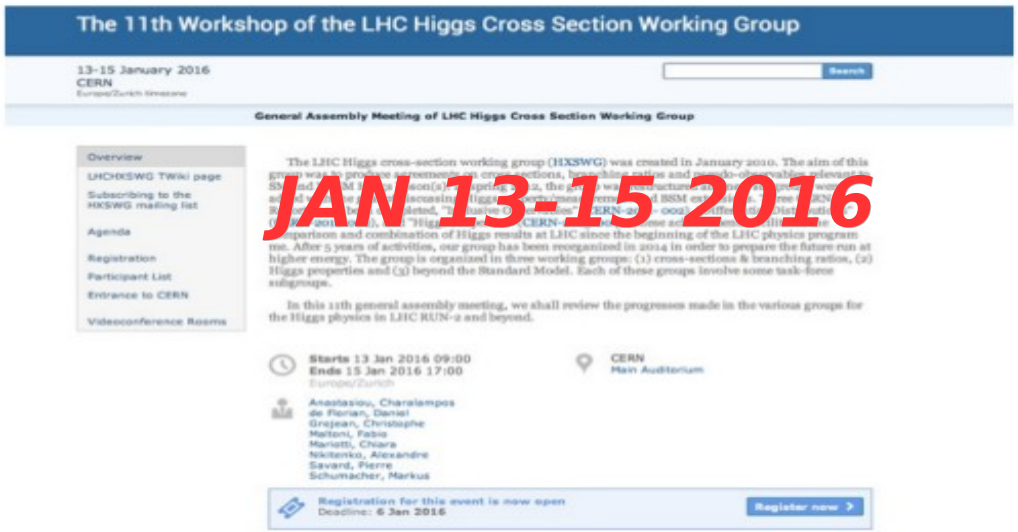
- Planning to have a dedicated ATLAS workshop on hh
  - Will focus on BSM but also cover longer-term SM hh
  - 18th – 20th Jan 2016 in Orsay, Paris
- Doodle to get a rough idea of numbers who may attend
  - http://doodle.com/poll/s6qevubdgv2pbrzp
  - Not a registration yet

# LHC Higgs XS working group

- Time line for CERN Report 4 (YR4)
  - An outline by July 31, 2015
  - A ***first draft*** by Nov. 15, 2015
  - CERN Report 4 should be finished by Jan. 31, 2016

## Next General Meeting




**SM parameters have been frozen in LHCHXSWG-INT-2015-006 Oct 12**

**which is used as inputs for various BSM studies**

# YR4

- I focus on WG3, i.e. **neutral extended scalar**
- We cover:
  - singlet
  - doublet
  - triplet
  - as well as CP-violating cases

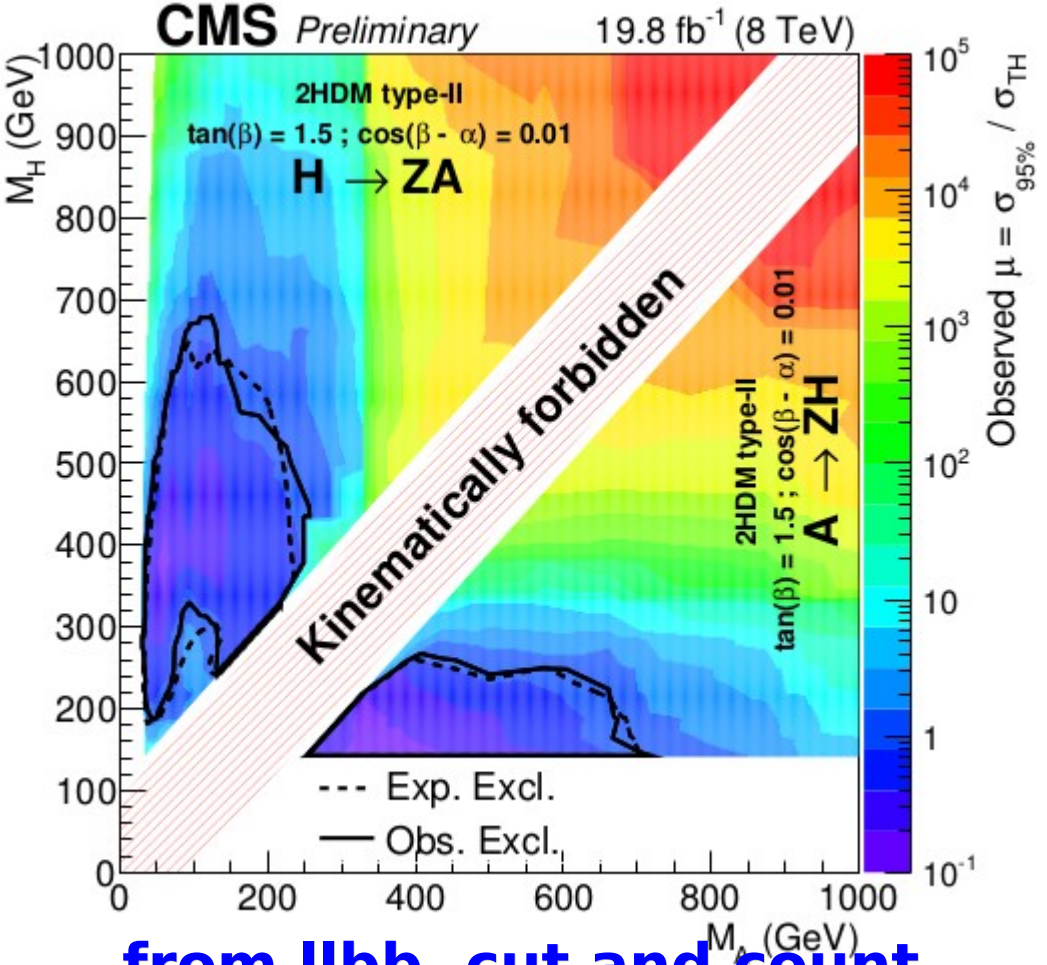
draft

# 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 xsec ntuples (AH split)

- A test production for AH mass split: A-ZH and H-ZA
- for Ch, in A-ZH, mH<mA, setting two cases mCh = min{mA,mH} and mCh = max{mA,mH}



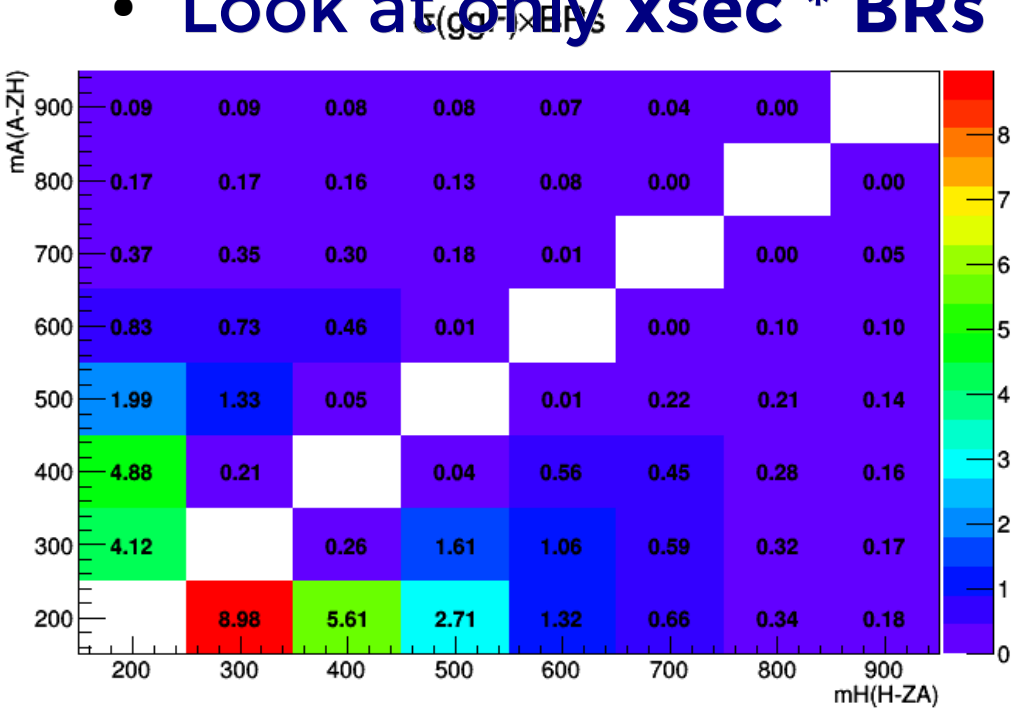

from llbb, cut and count

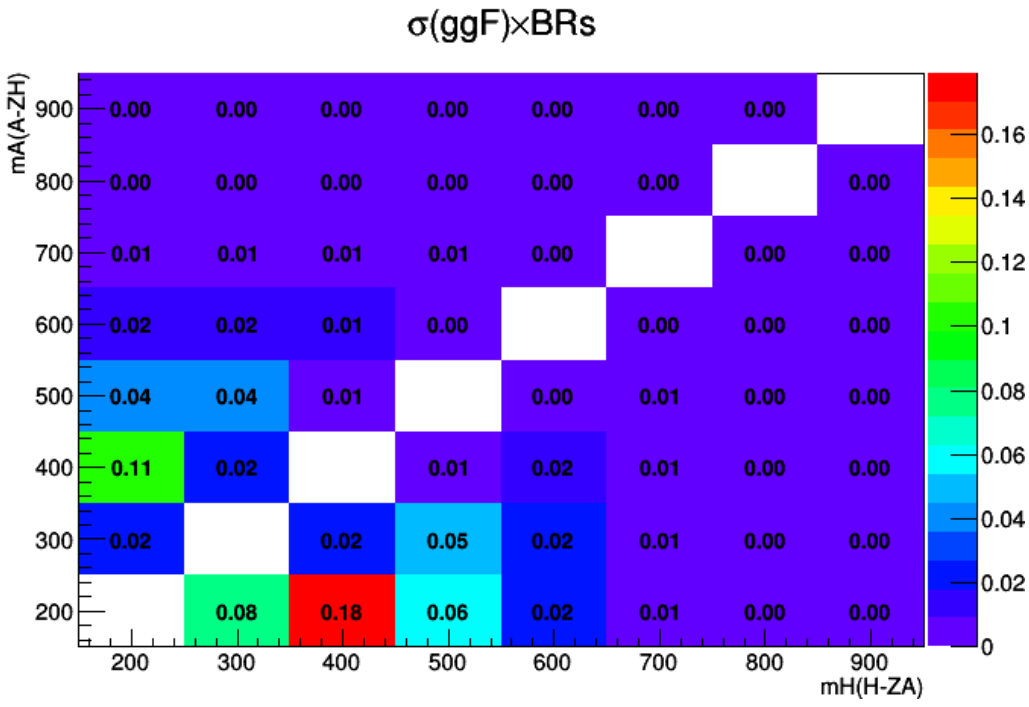
**RUN I from CMS**
**PAS HIG-15-001**
**(Z→ll, A/H→bb or ττ)**

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

# 2HDM AZH HZA (mCh=max{mA,mH})

- Type II, both close in SM alignment, different tb
- Look at only **xsec * BRs**



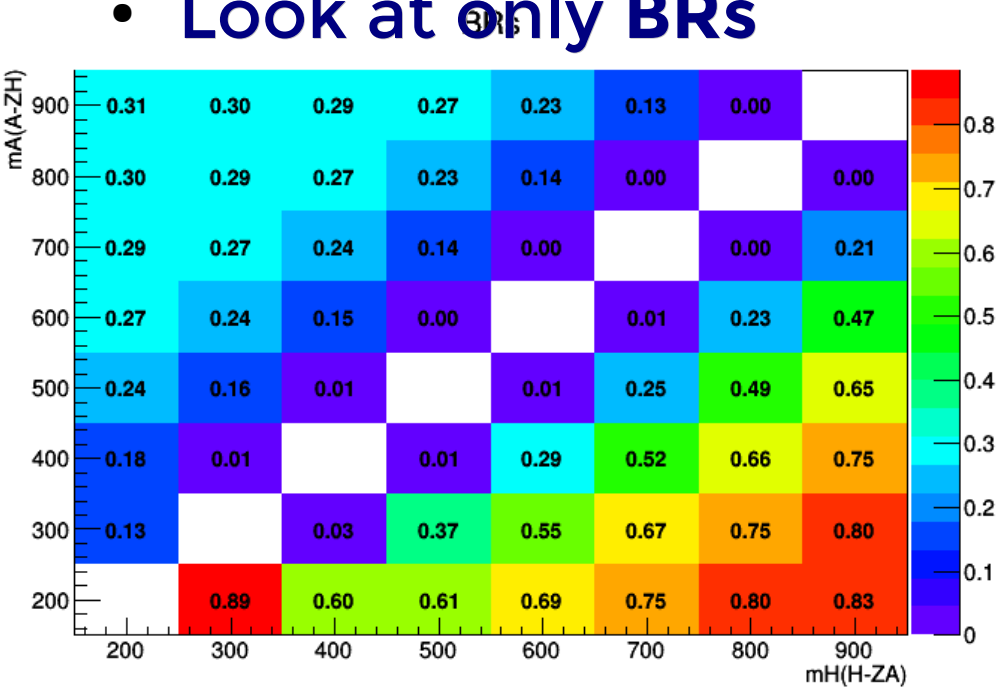




***type II, tb=1.0 cos(b-a)=0***

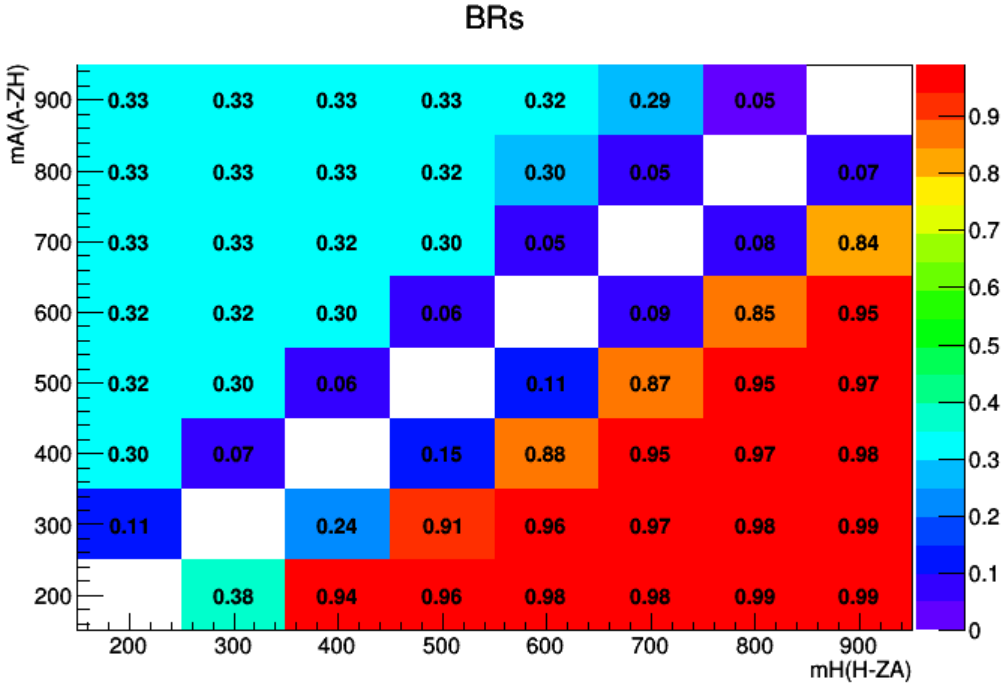
***type II, tb=10.0 cos(b-a)=0***

# 2HDM AZH HZA (mCh=max{mA,mH})

- Type II, both close in SM alignment, different tb
- Look at only **BRs**




***type II, tb=1.0 cos(b-a)=0***

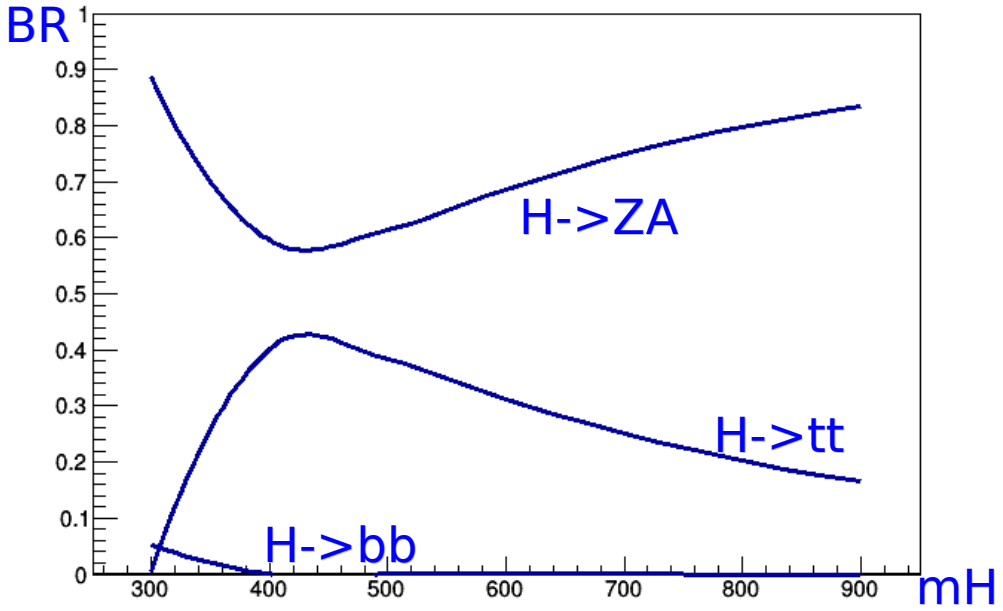



***type II, tb=10.0 cos(b-a)=0***

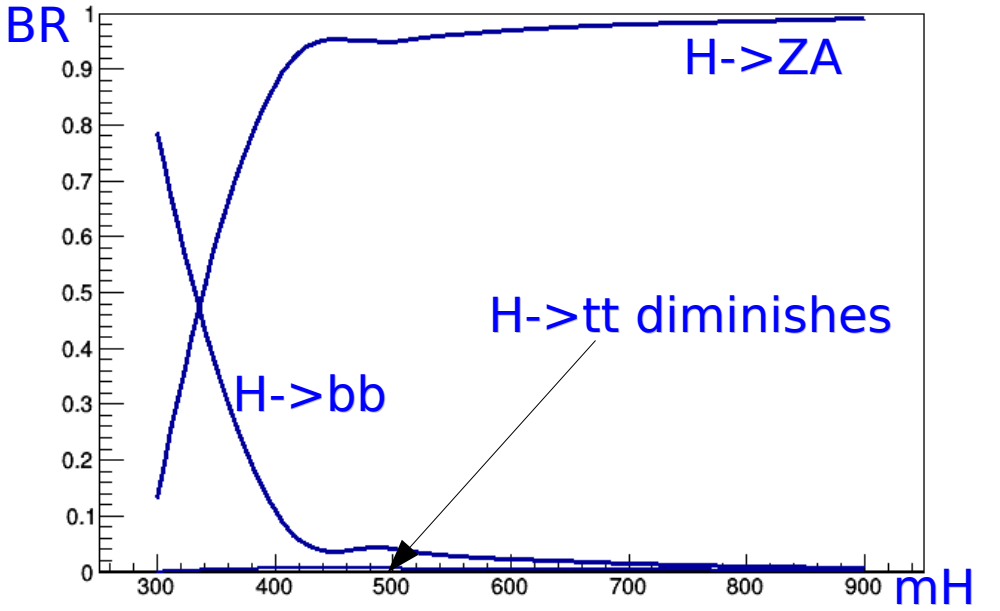
***The shift of BR peak to higher values when fermion couplings***

# 2HDM AZH HZA (mCh=max{mA,mH})

- Type II, both close in SM alignment, different tb
- Look at ***H -> XX*** **BRs**




***type II, tb=1.0 cos(b-a)=0***
***mA=200GeV***




***type II, tb=10.0 cos(b-a)=0***
***mA = 200GeV***

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

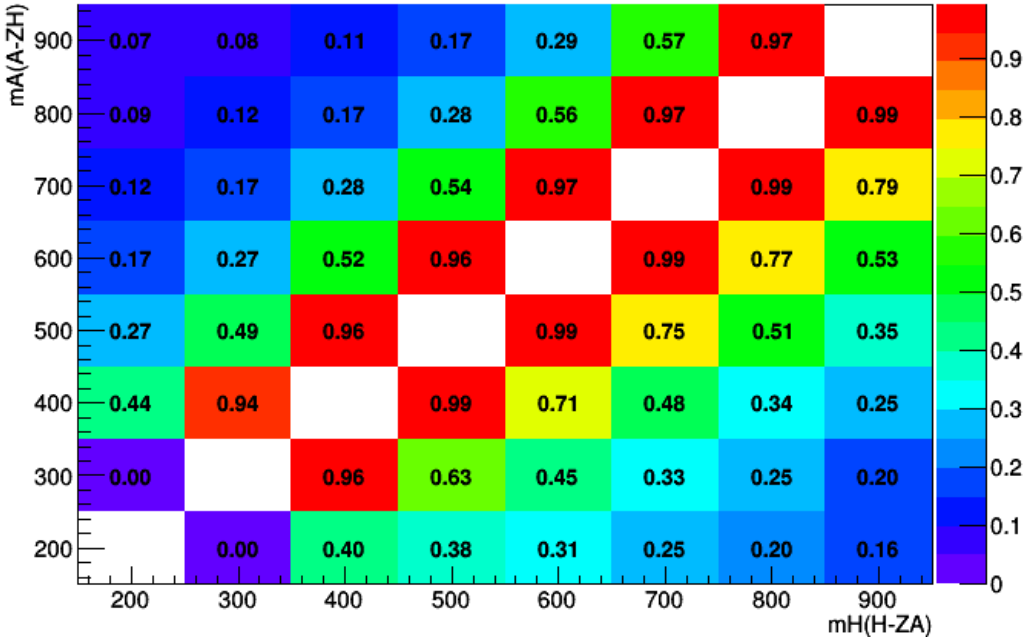
**coupling between A and up-type quark**

*cos(b-a)=0, sin(b-a)=1, coupling ~ 1/tb*
*low tb, high coupling, A/H->tt contributes after m(tt) threshold*
*high tb, low coupling A/H->tt diminishes*

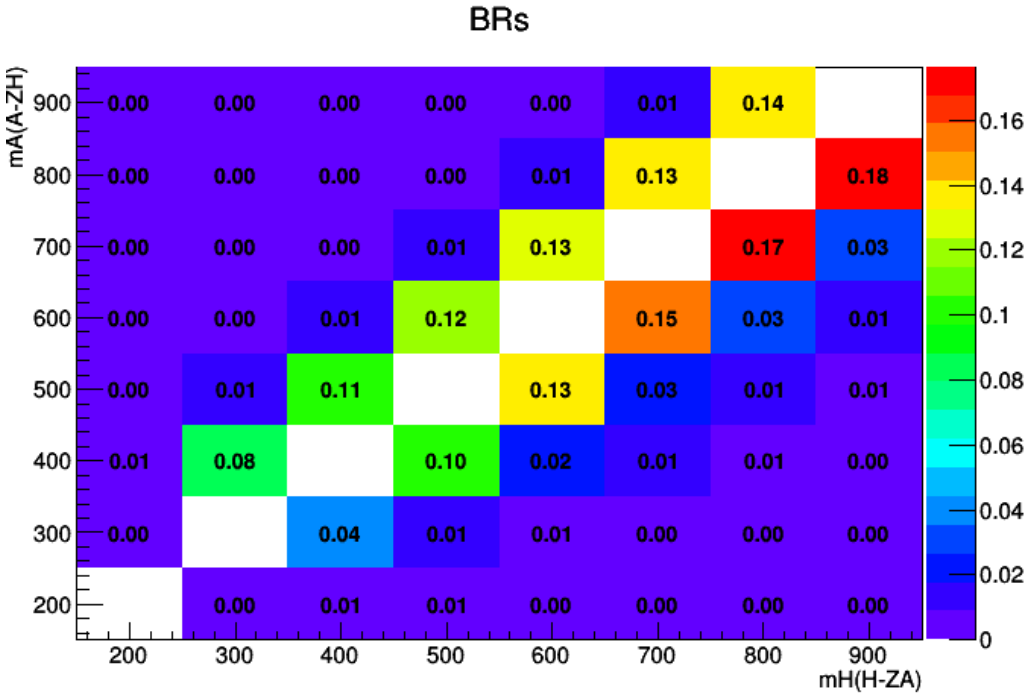
# Backup

# 2HDM AZH HZA (mCh=max{mA,mH})

- Type II, both close in SM alignment, different tb
- Look at ***A/H -> tt*** **BRs**




***type II, tb=1.0 cos(b-a)=0***




***type II, tb=10.0 cos(b-a)=0***

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

**coupling between A and up-type quark**

*cos(b-a)=0, sin(b-a)=1, coupling ~ 1/tb*
*low tb, high coupling, A/H->tt contributes after m(tt) threshold*
*high tb, low coupling A/H->tt diminishes*

# bak

- bak