

# Prospects of Exotic Higgs Decays in 2HDM at 100 TeV Collider

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17<sup>th</sup> April 2018

# Higgs Sector in 2HDM

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## Parameters

Higgs Boson Masses

$$m_h, m_H, m_A, m_{H^\pm}$$

Mixing Angles

$$\tan \beta = v_1/v_2, \cos(\beta - \alpha) \simeq 0$$

Soft  $Z_2$  breaking mass term

$$m_{12}^2$$

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### Type II 2HDM

- $\Phi_1$  couples to up-type quarks
- $\Phi_2$  couples to down-type quarks and leptons

# How to find the additional Higgses



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## Conventional Searches

### Neutral Higgs:

$$A/H \rightarrow bb, \tau\tau, WW, ZZ, \gamma\gamma$$

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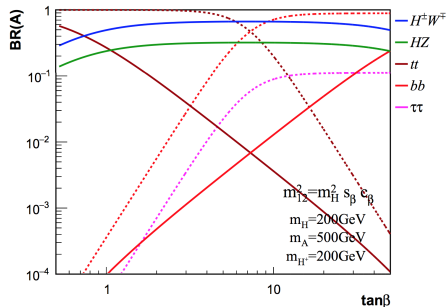
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## Branching ratios for $A$ decays



Felix et al., 1604.01406

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## Exotic Decay Searches

### Neutral Higgs:

$$A/H \rightarrow HZ/AZ \text{ (CMS/ATLAS)}$$

$$H \rightarrow hh \text{ (CMS/ATLAS)}$$

$$A/H \rightarrow H^\pm W$$

$$H \rightarrow H^+H^-/AA$$

### Charged Higgs:

$$H^\pm \rightarrow AW/HW$$

# Neutral Heavy Higgs Channel: $A \rightarrow HZ$

Gluon Fusion ( $gg \rightarrow A \rightarrow HZ$ )

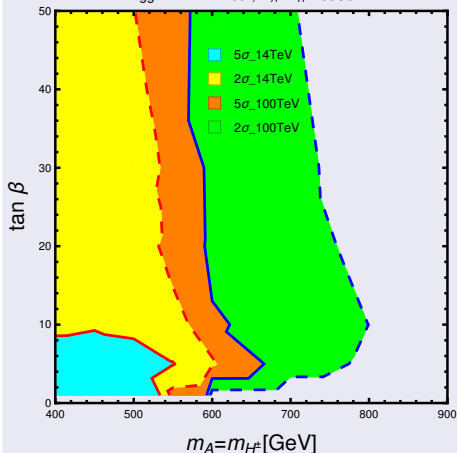
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$(H \rightarrow bb)(Z \rightarrow ll)$ :

dominating background:  $tt, Z/\gamma^* bb$

$gg \rightarrow A \rightarrow HZ \rightarrow b\bar{b}ll, m_A - m_H = 200 \text{ GeV}$



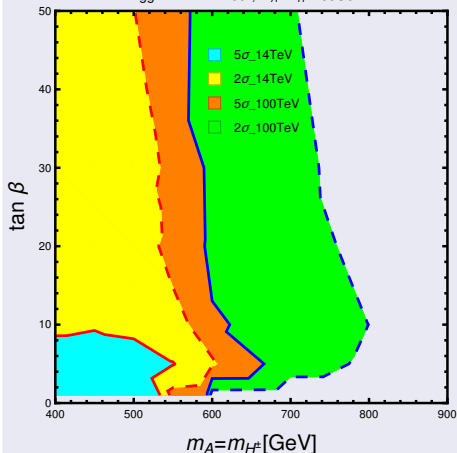
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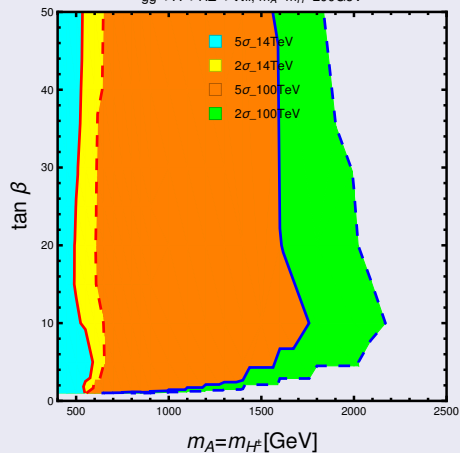
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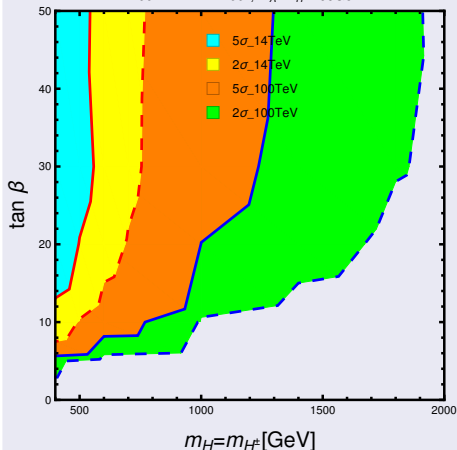
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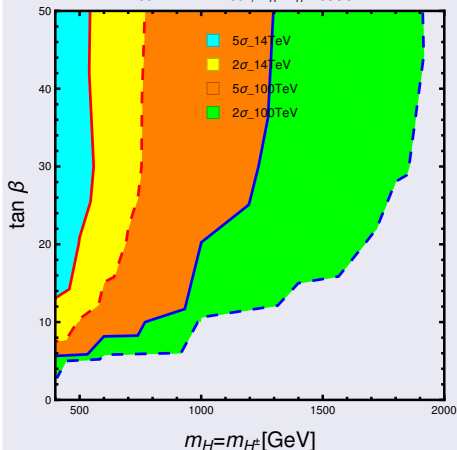
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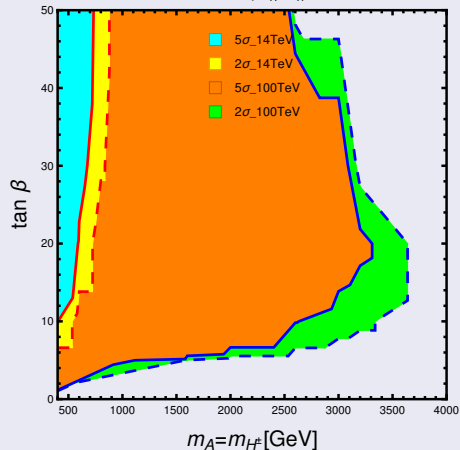
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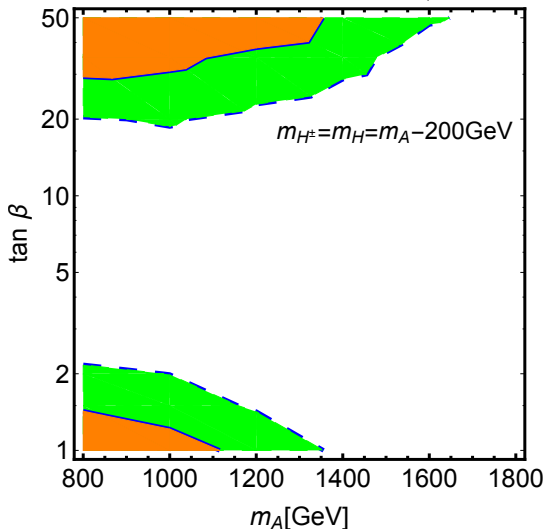
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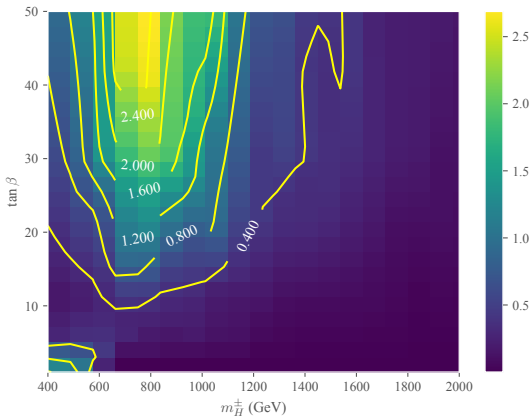
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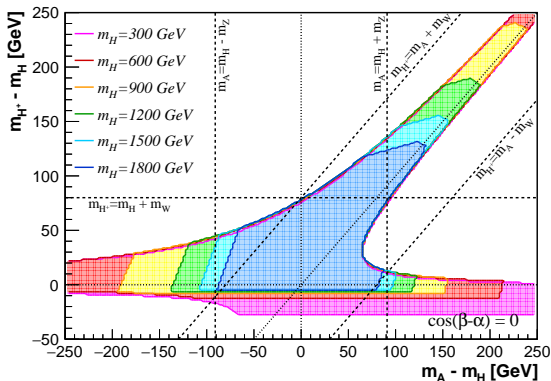
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Production: gluon fusion ( $gg \rightarrow A$ ) and bottom-quark annihilation ( $bb \rightarrow A$ )

Final state:  $bb(H)ll(Z)$ ,  $\tau\tau(H)ll(Z)$  and  $tt(H)ll(Z)$

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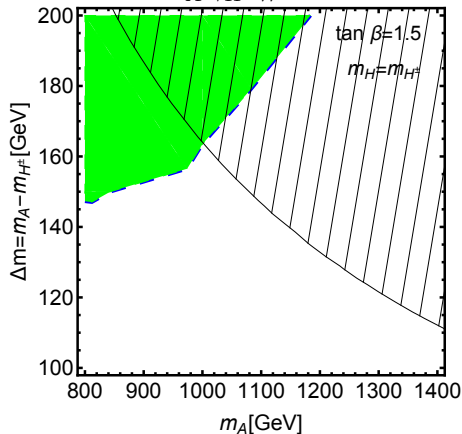
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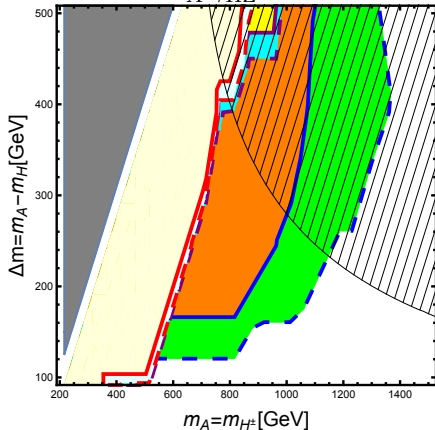
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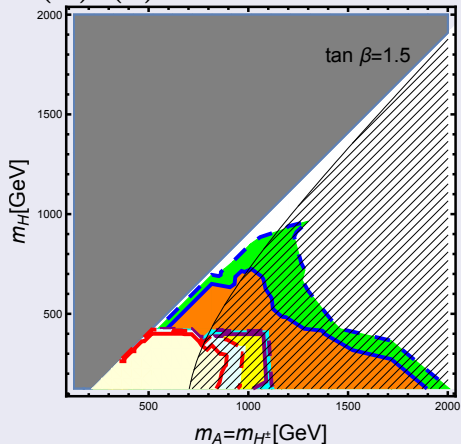
# Conclusion of Our Preliminary Results

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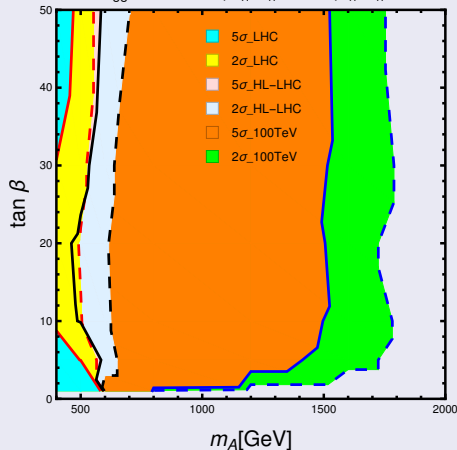
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