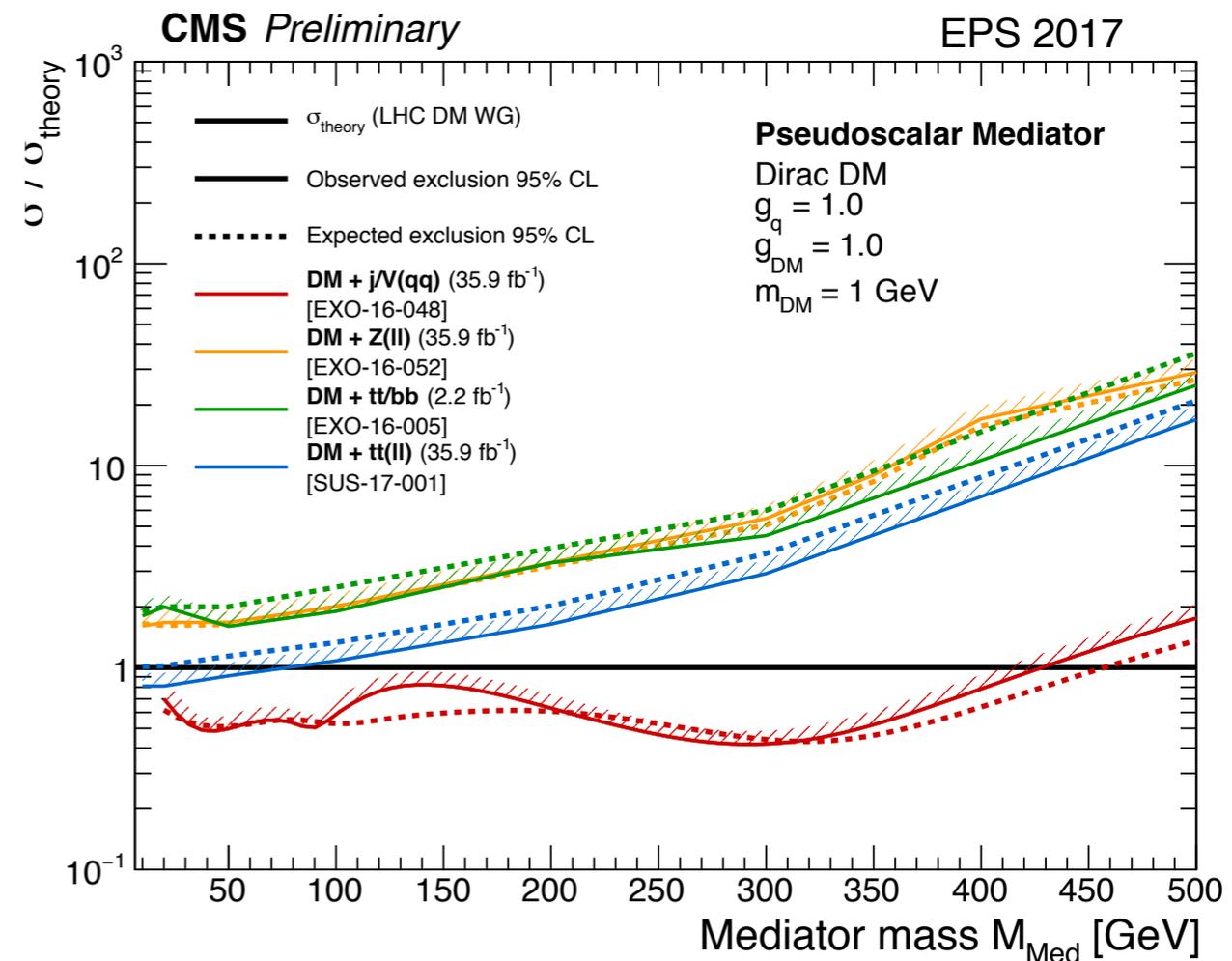
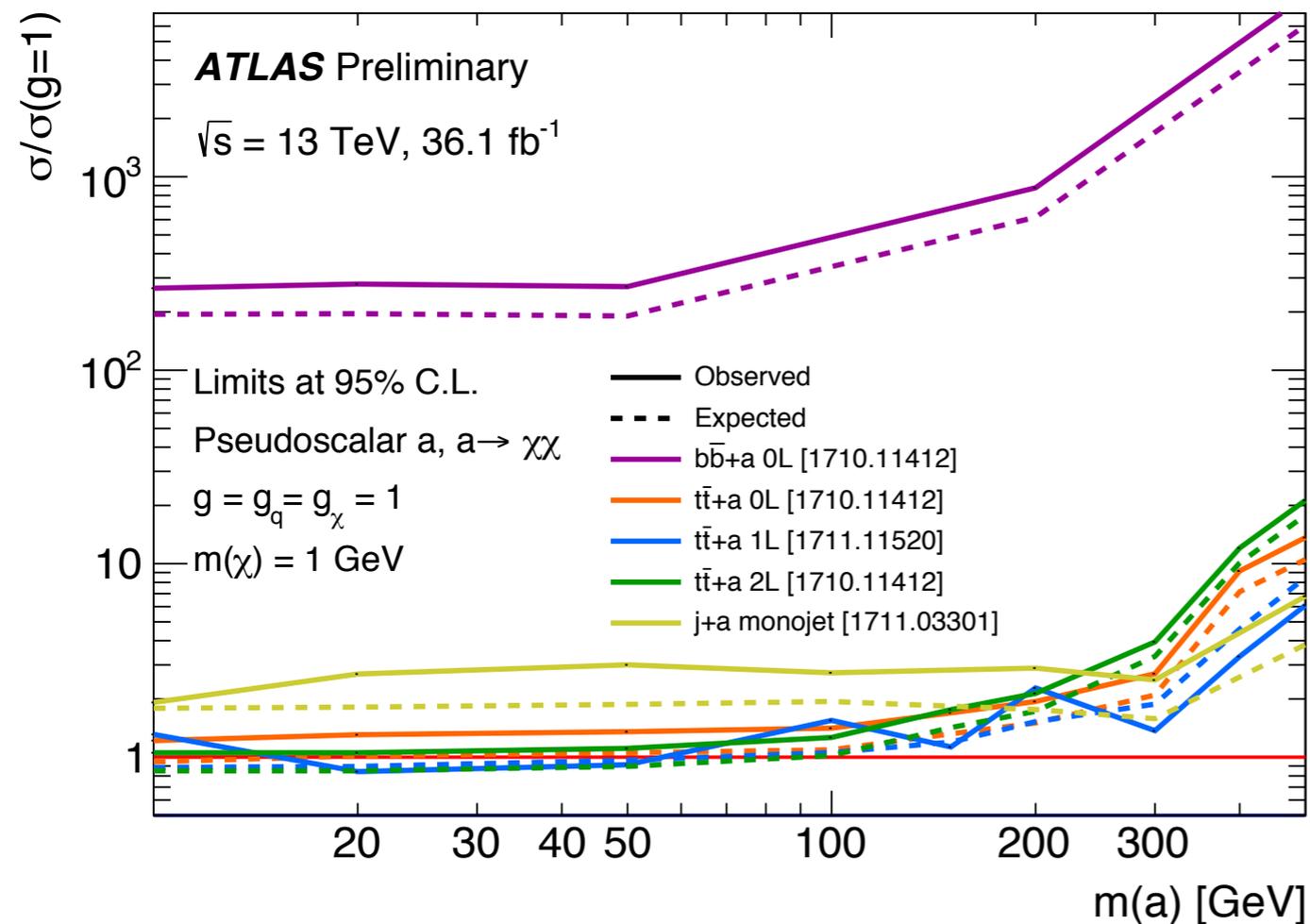


*Dark matter production in  
association with a single  
top quark in 2HDM+a*

P. Pani and G. Polesello

arXiv:[1712.03874](https://arxiv.org/abs/1712.03874)

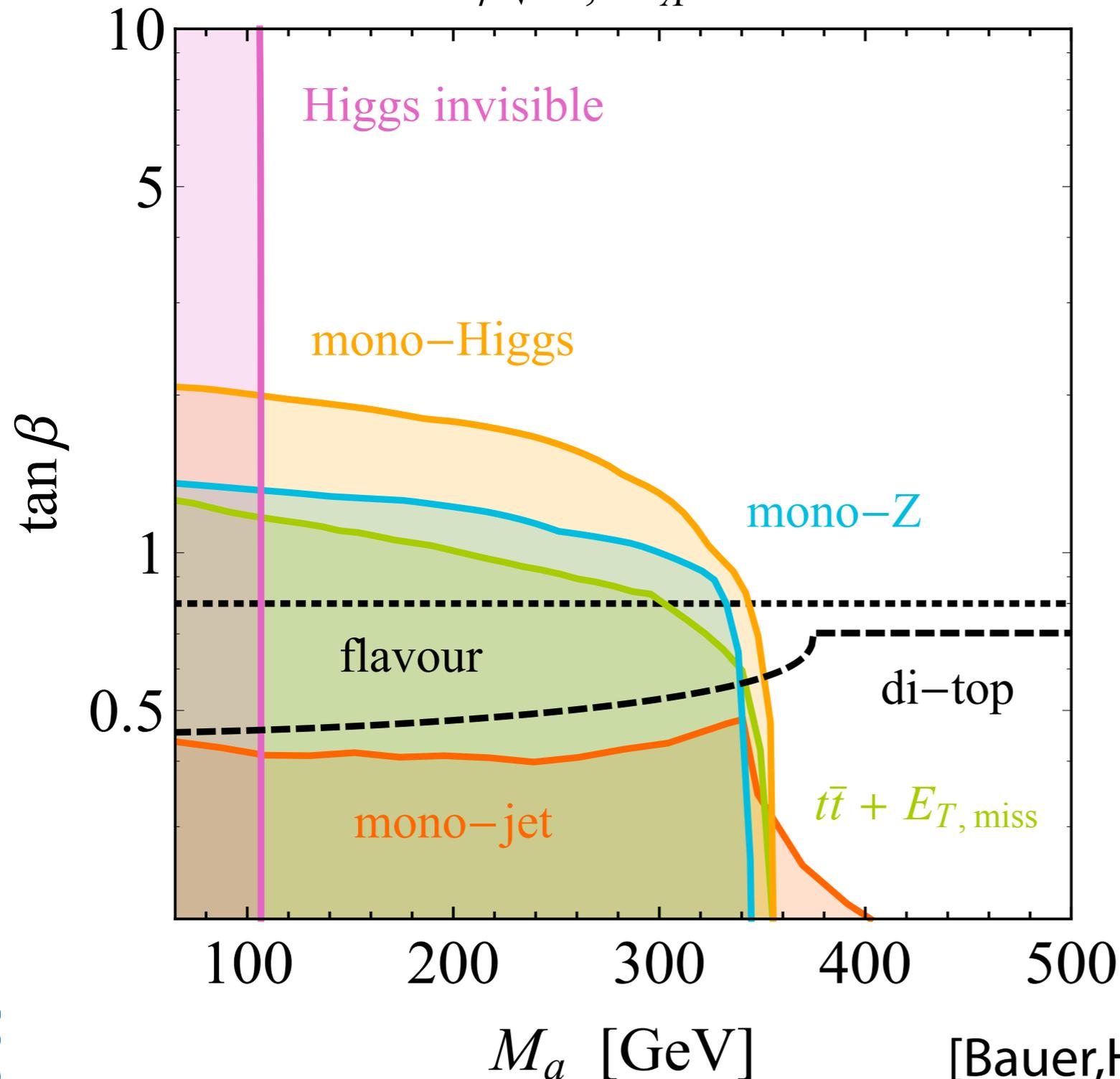
# Dark Matter with heavy quarks



- ★ Interesting signature with increasing sensitivity
- ★ So far considered: top and bottom pairs.

# 2HDM+a

$$\sin\theta = 1/\sqrt{2}, M_A = 500 \text{ GeV}$$

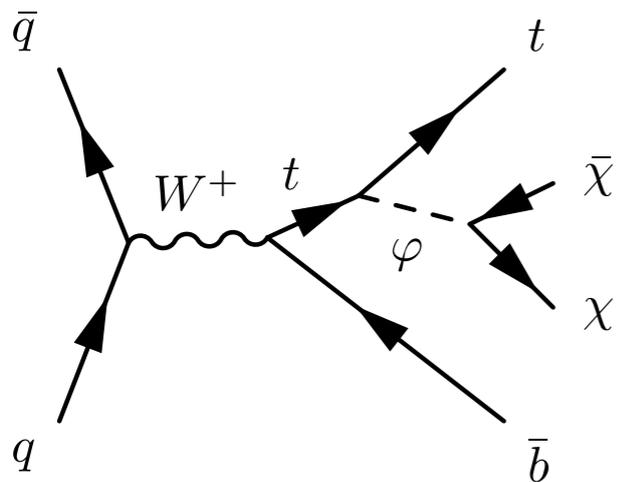


★ DM+tt very sensitive in certain parameter space (e.g.  $\sin\theta = 0.7$ )

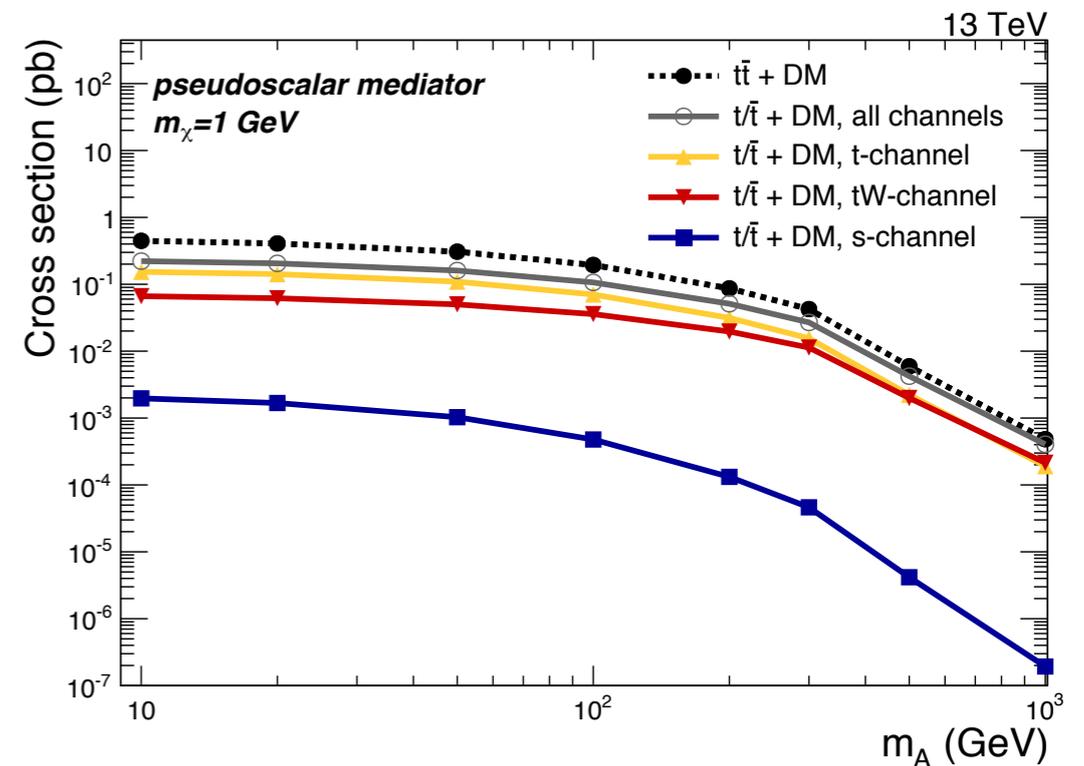
★ DM+bb interesting for high  $\tan\beta$

# Additional HF signatures?

- ★ Literature shows that t-channel single top is relevant for DM+p simplified models



[Pinna, Zucchetta,  
Buckley, Canelli]  
arXiv:1701.05195

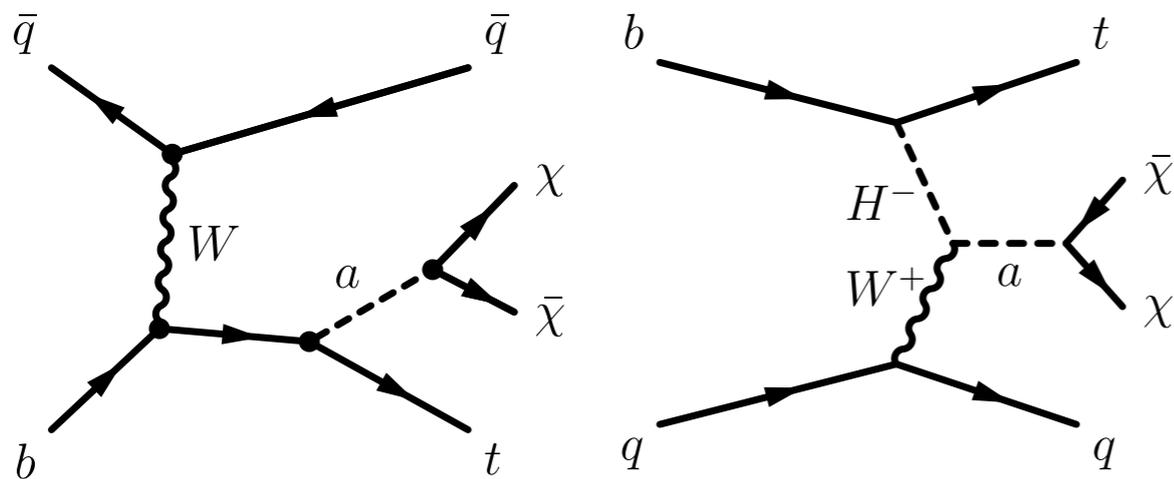


- ★ What about UV-complete models, e.g. 2HDM+a?
- ★ Interesting to investigate single top signatures in this context

[Pani, Polesello] arXiv:1712.03874

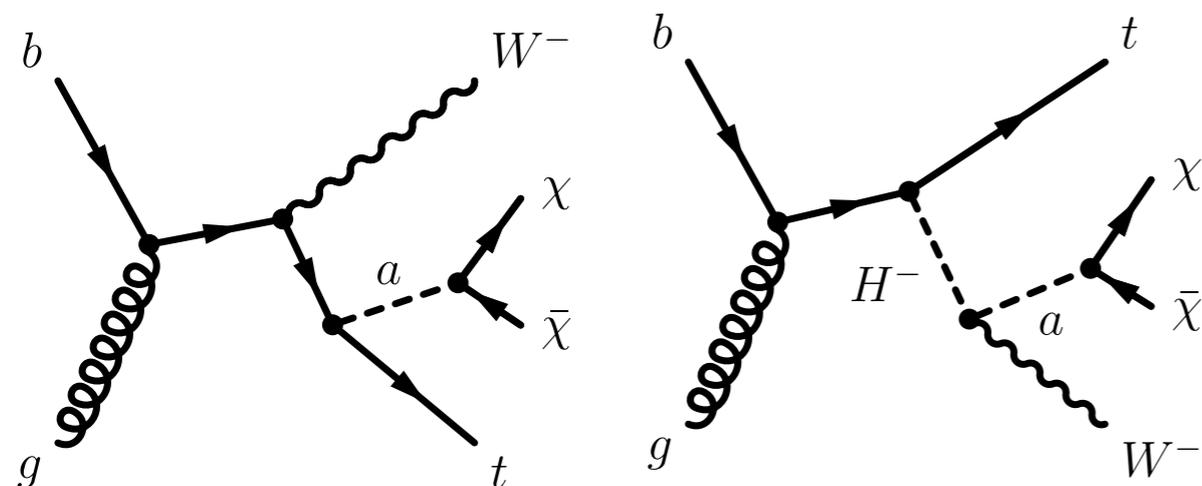
# Single top+a production

## t-channel



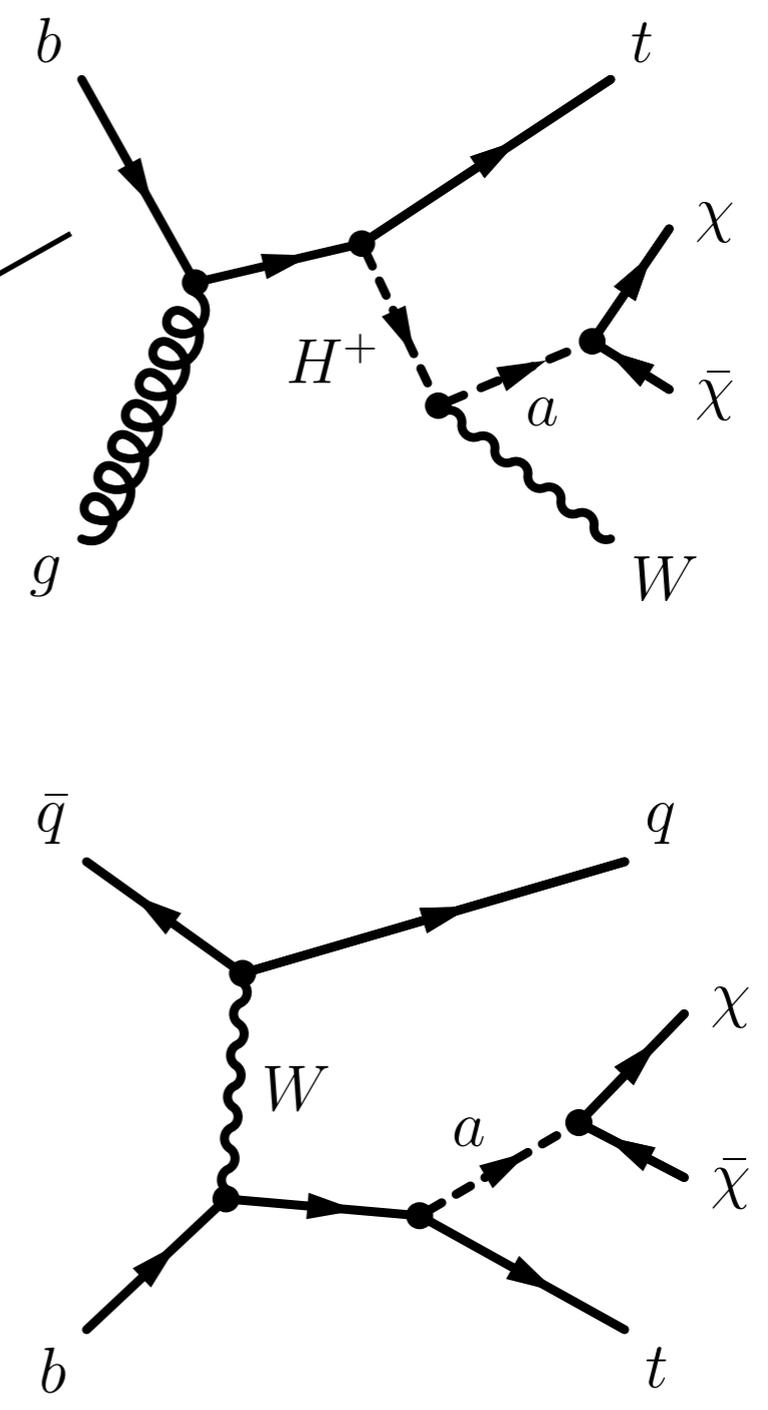
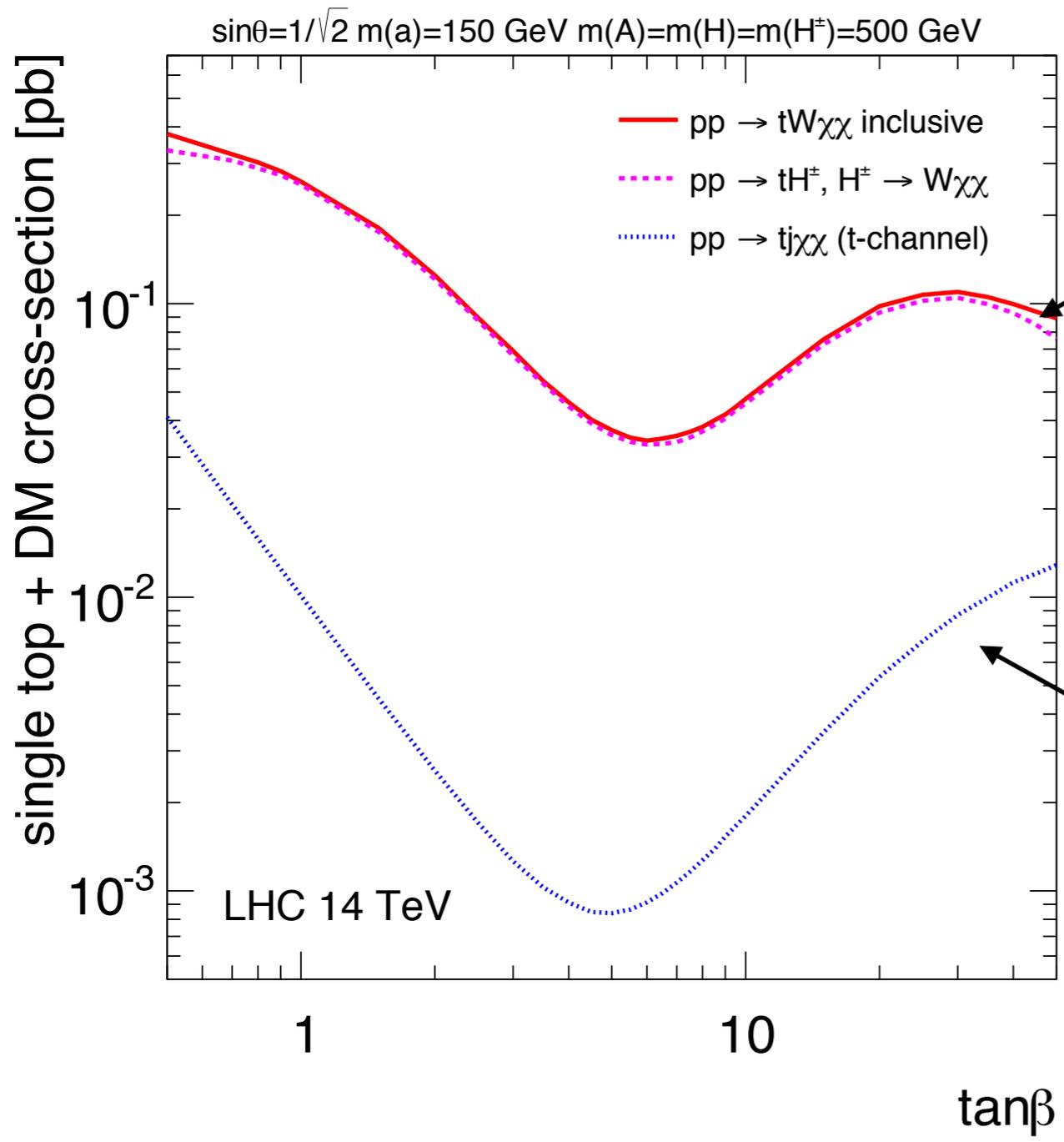
- ★ Left-side diagram divergence is cured by negative interference with right-side diagram

## Wt-channel



- ★ For  $m(H^\pm) < 1 \text{ TeV}$  the cross section is dominated by  $H^\pm$  on-shell production
- ★ For  $m(H^\pm) \rightarrow \infty$  t-channel dominates again

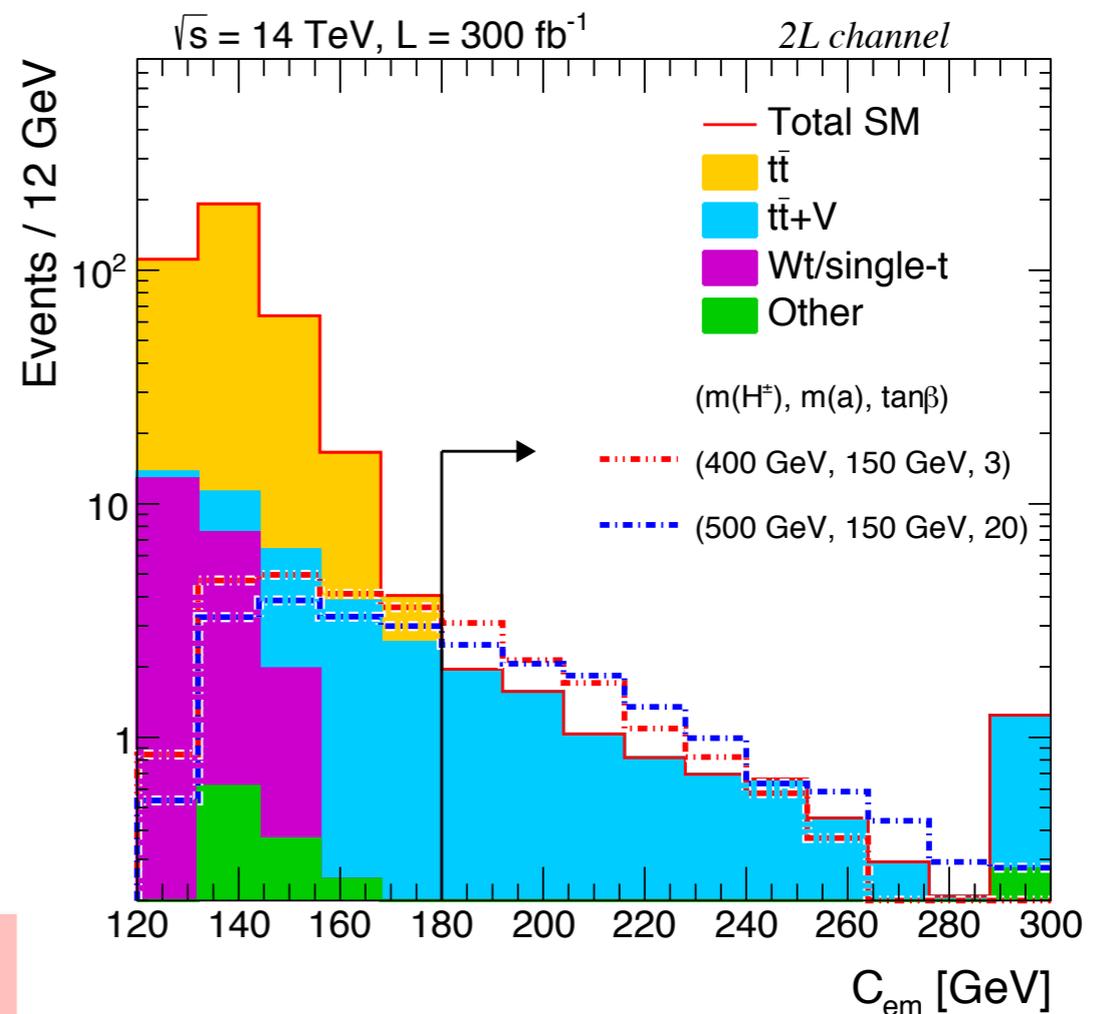
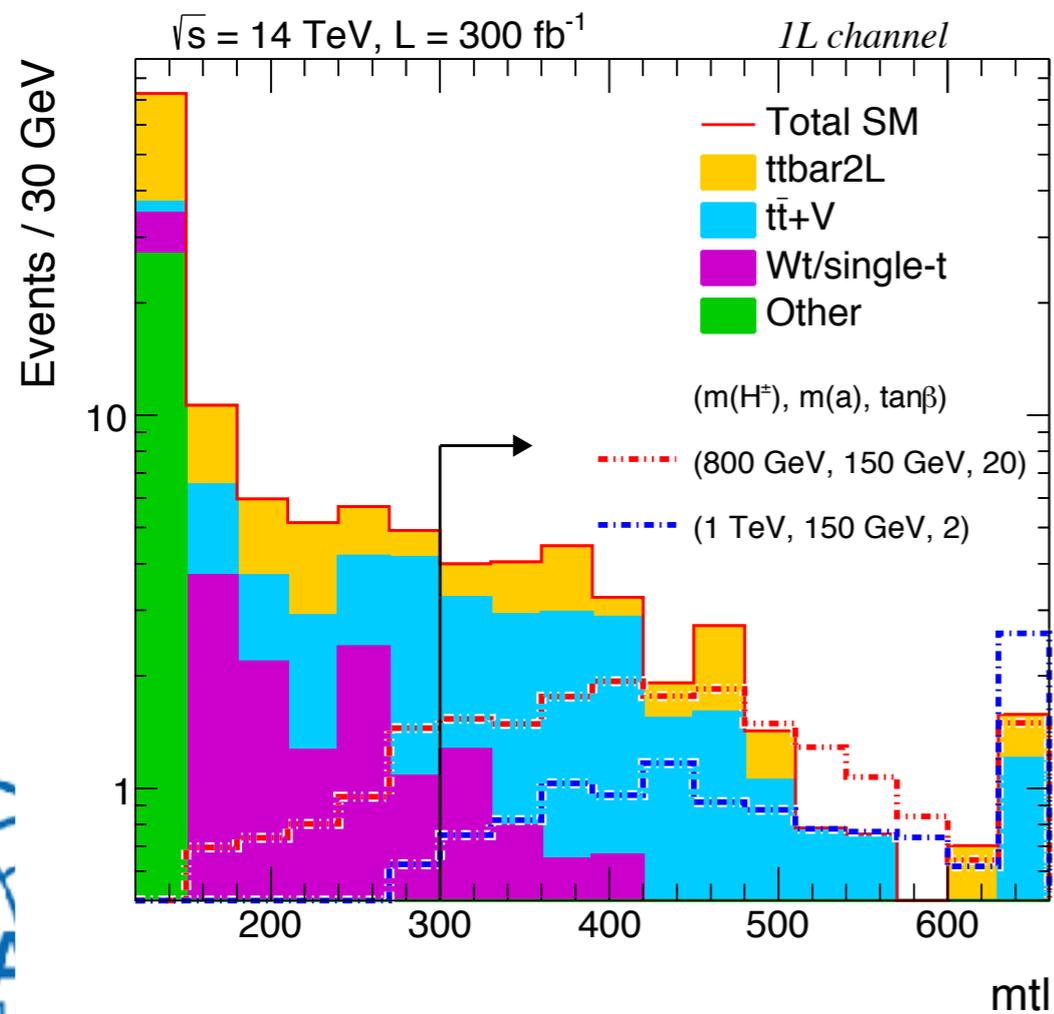
# Single top+a production - $m(H^\pm) = 500 \text{ GeV}$



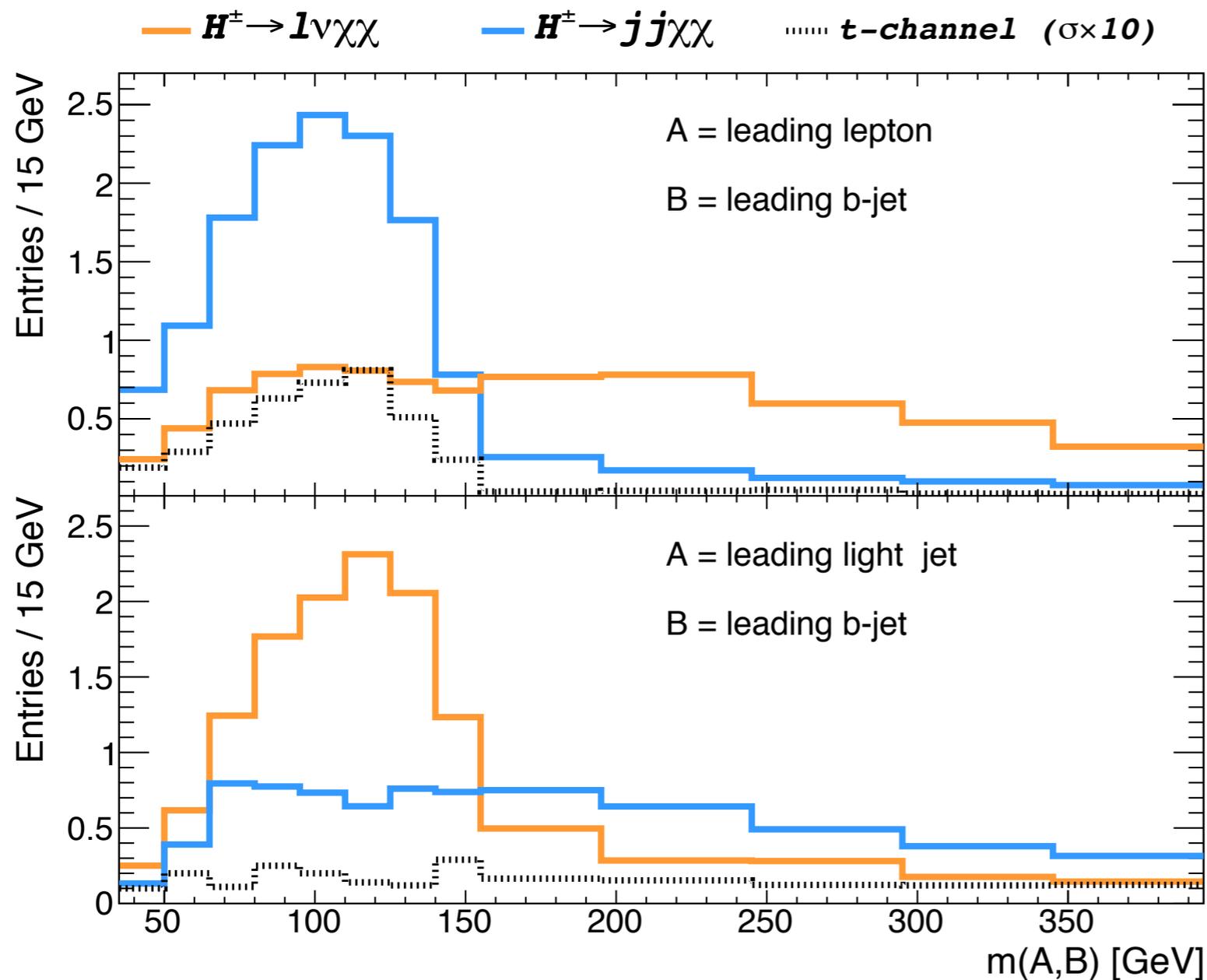


# Sensitivity prediction: 14 TeV and 300fb<sup>-1</sup>

- ★ Study experimental sensitivity with simulated samples and parametrized detector smearing.
- ★ Considered both 1-lep and 2-lep final states.
- ★ Main discrimination from kinematic end-points of transverse and stransverse masses.



# Kinematic considerations of the 1-lep channel

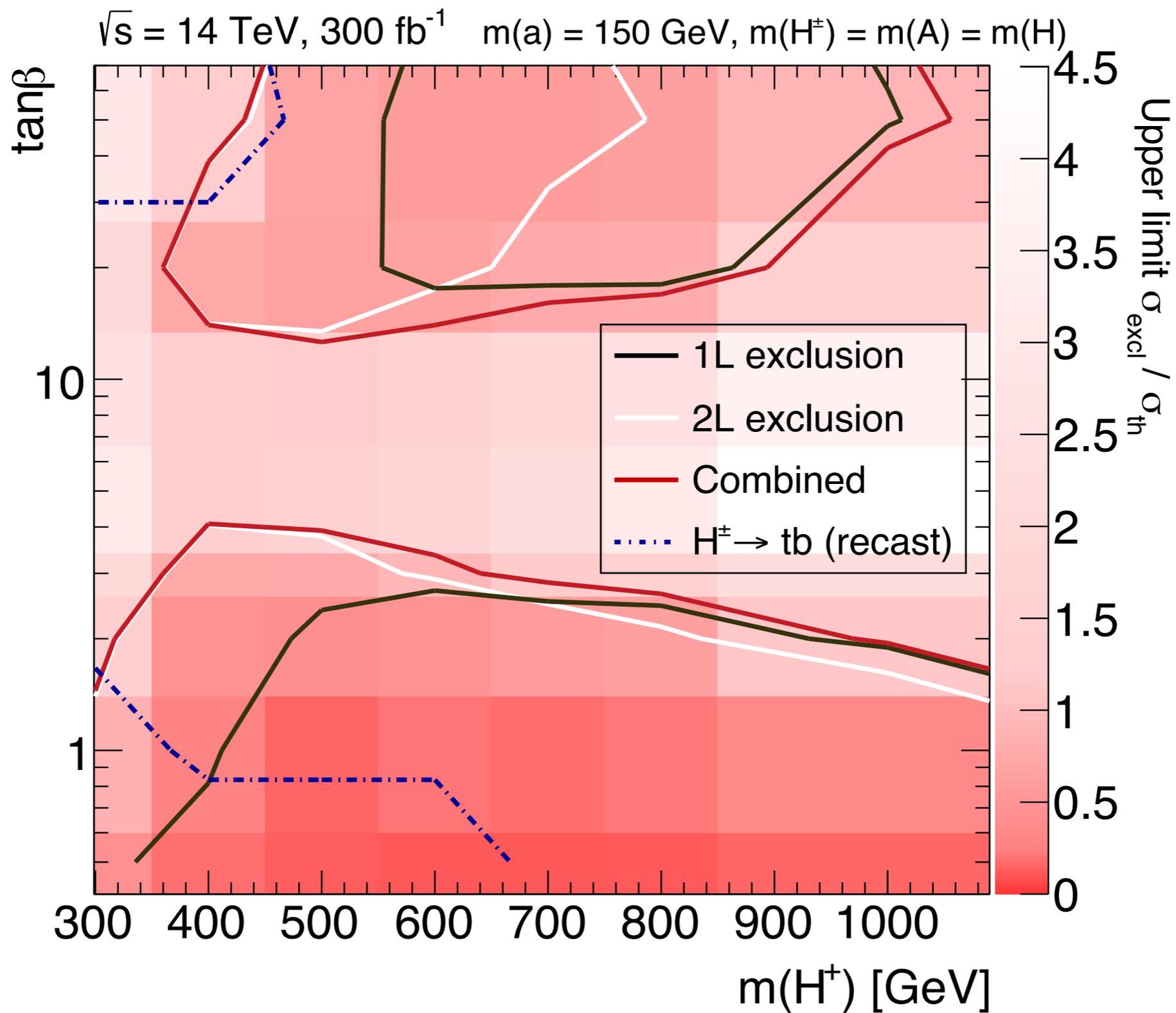


Considered selection:

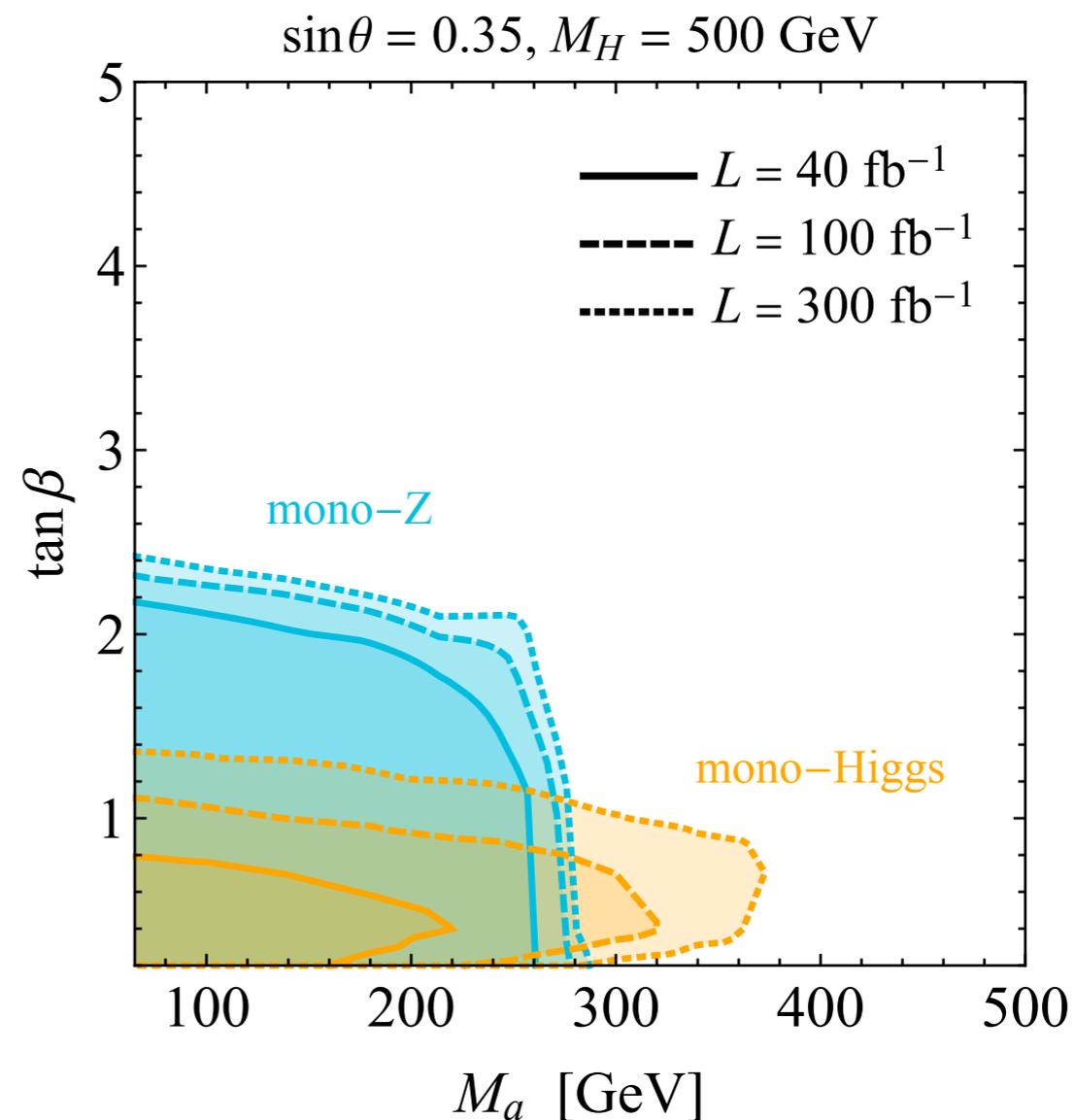
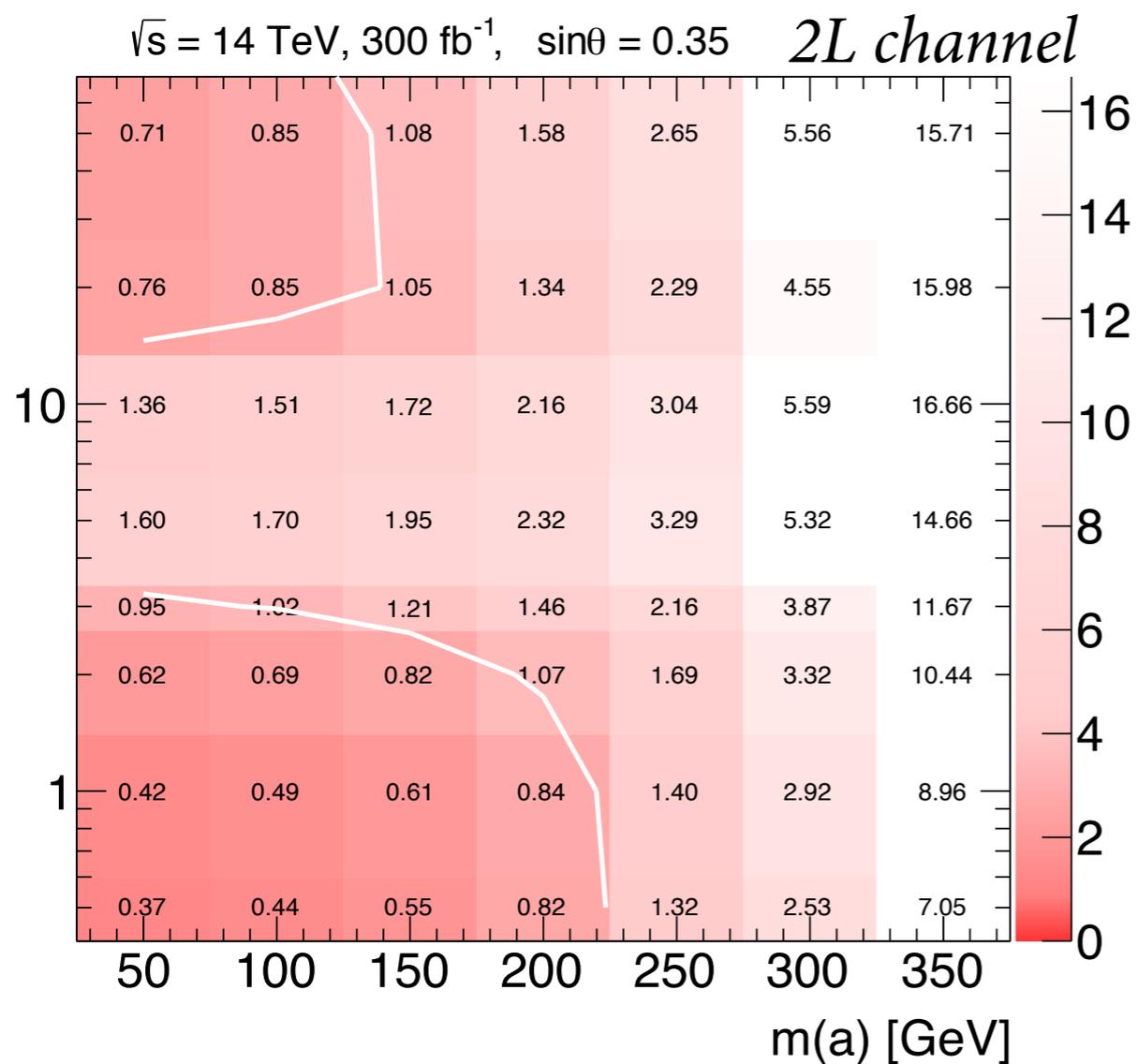
- $m(\text{bjet}, \text{lep}) > 160 \text{ GeV}$
- $m(\text{bjet}, \text{jet}) < 150 \text{ GeV}$

- ★ Enhancement of  $H^\pm$  semi-leptonic decays
- ★ 50% of resonant signal and all  $t$ -channel is rejected (definitely possible to improve!)

# Results 1

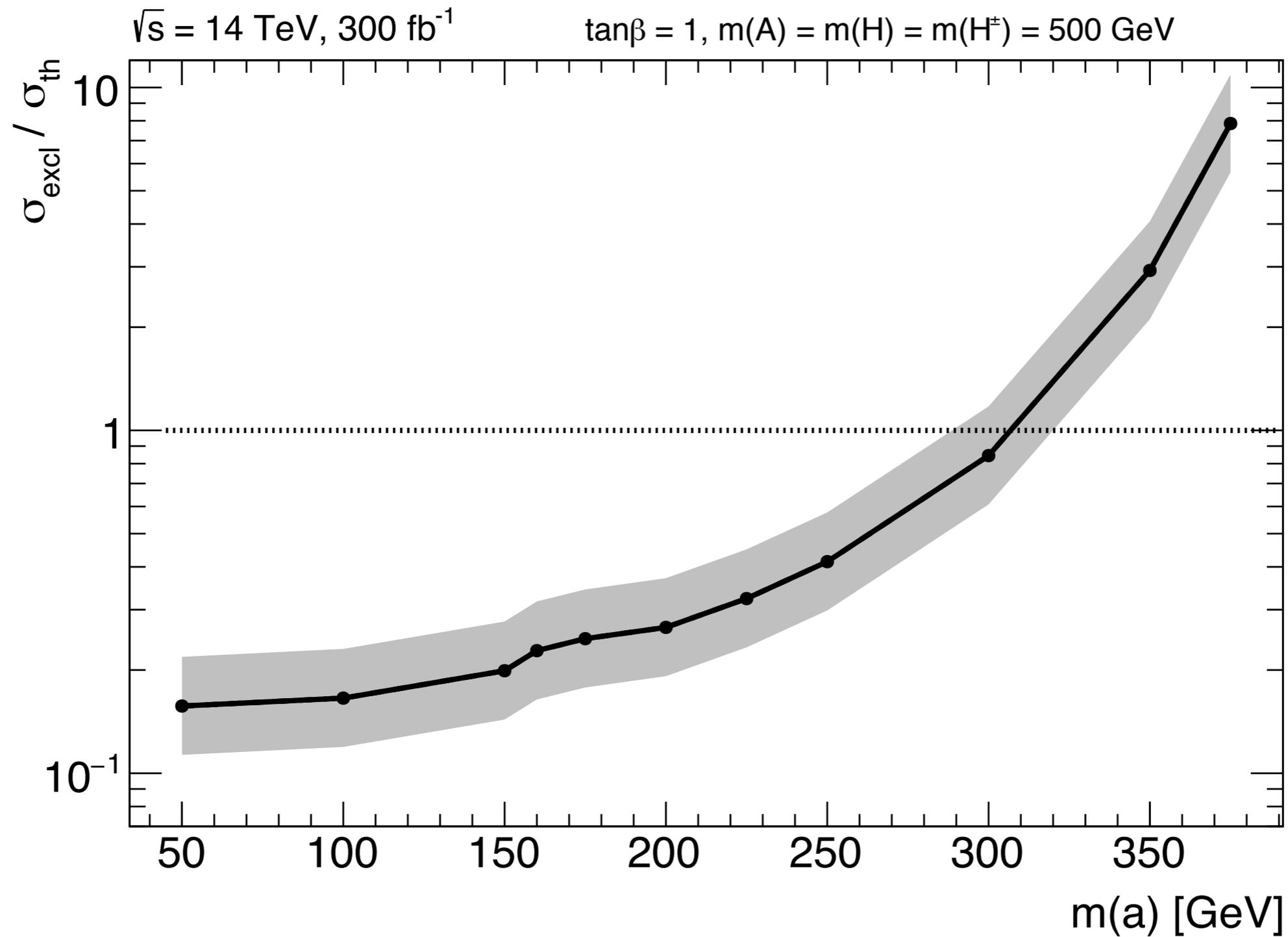


# Results 2 - comparison with monoH/Z



[Bauer,Haisch,Kahlhoefer]  
arXiv:1701.07427

# Results 3 - dependence on $m(a)$



# Proposal for white paper and conclusions

- ★  $tW+DM$  signature is extremely interesting to probe  $2HDM+a$  parameter space and experimentally quite uncovered.
- ★ It could be proposed/highlighted also in the white paper.
- ★ Propose to add scan #2 (slide 11)
- ★ Working to show also sensitivity on scan #3 ( $\sin\theta$  scan).
- ★ Small summary text already available.

*The End*

**Thanks for your  
~~attention~~  
patience**

**Any question ?**

# Backup

