

# MSSM Higgs search via $b\bar{b}$ decay at CMS experiment

the 10<sup>th</sup> Conference of High Energy Physics of China

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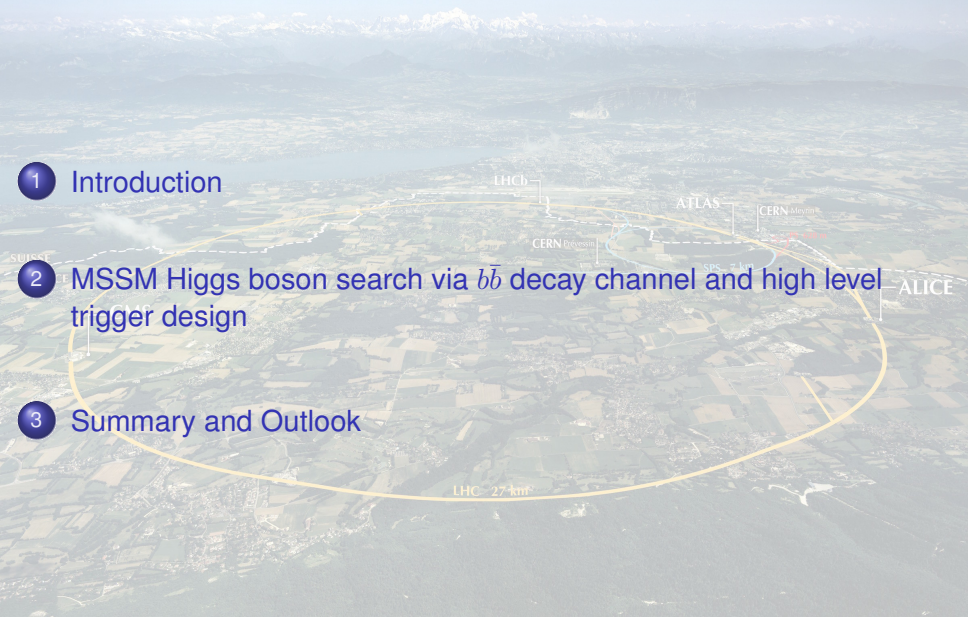
22/06/2018, Shanghai

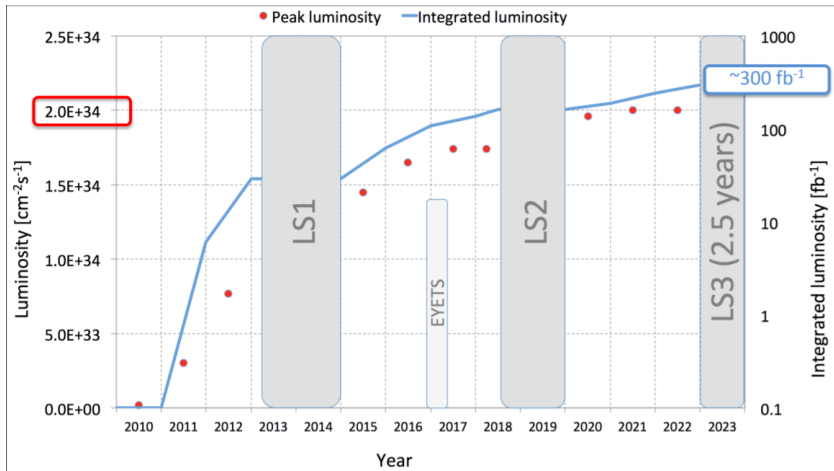


1 Introduction

2 MSSM Higgs boson search via  $b\bar{b}$  decay channel and high level trigger design

3 Summary and Outlook





around  $150\text{fb}^{-1}$  pp collision data with Run 2, and Run 3 is incoming ...



## Minimal Supersymmetric Standard Model

- MSSM model was originally proposed around 1981, [one of the originals](#), [a nice review](#) and [another nice review](#).
- MSSM has become one of the benchmark scenarios for searches of an extended scalar or pseudoscalar sector, triggering studies of other phenomenological models beyond standard model.

### via fermionic decays

■ MSSM H to  $\tau\tau$  ■ MSSM H to  $b\bar{b}$  ■ MSSM H to  $\mu\mu$

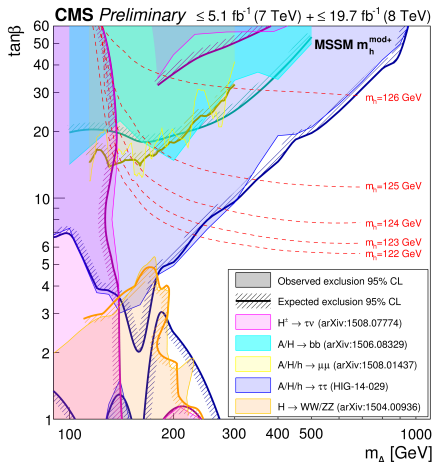


### via bosonic decays

■ BSM/MSSM H to ZH ■ BSM X to ZZ  
■ BSM X to WW ■ BSM X to HH



- Charged MSSM/BSM Higgs Boson search via  $\tau\nu$ ,  $t\bar{b}$  etc.



one of the benchmark MSSM scenarios accommodating the discovery of H(125) as one of neutral MSSM Higgs ...



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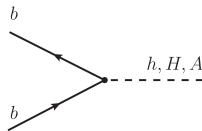
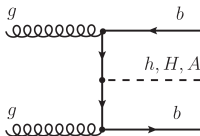
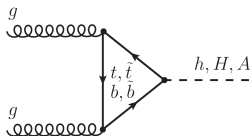
Introduction

2

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3

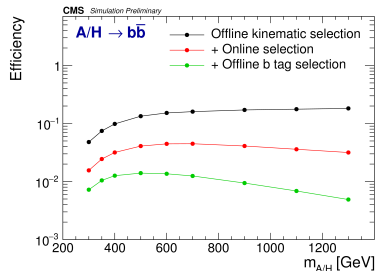
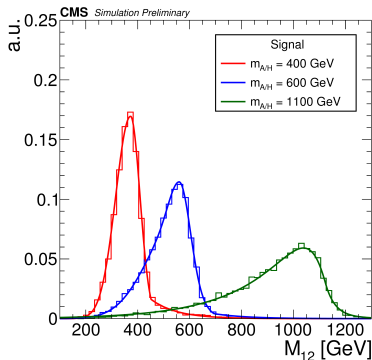
Summary and Outlook



- Left: leading order MSSM Higgs Boson production with gluon fusion process.
- Middle: leading order MSSM b associated Higgs Boson production.
- Right: additional leading order MSSM Higgs Boson production with five-flavor scheme.



CMS-PAS HIG-16-018, submitted to JHEP



Game changing contribution with new trigger design!

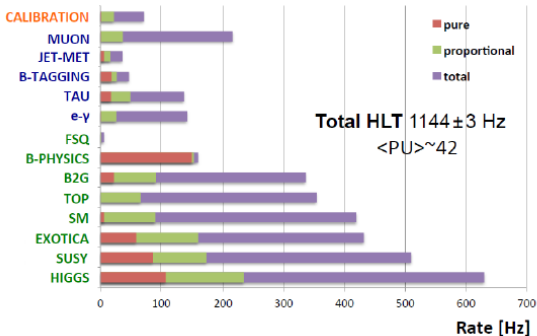


## Main Paths (Path Designer, Ye Chen)

- HLT\_DoubleJetsC100\_DoubleBTagCSV\_p026\_DoublePFJetsC160
- HLT\_DoubleJetsC100\_DoubleBTagCSV\_p014\_DoublePFJetsC100MaxDeta1p6

Selection	Higher Mass Region	Lower Mass Region
L1	DoubleJetC100	DoubleJetC100
L2 CaloJet	100GeV	100GeV
$p_T$ of the BTag candidates	80 GeV	80 GeV
Double Online BTag Discriminators	0.78	0.84
$p_T$ of Double L3 PFJets	160 GeV	100 GeV
$ \Delta\eta _{max}$ of L3 PFJets pair	none	1.6
Rate for 7e33	6.1 Hz	7.7 Hz
Rate for 1.4e34	9.9 Hz	13.3 Hz
Pure Rate for 1.4e34	6.7 Hz	13.2 Hz

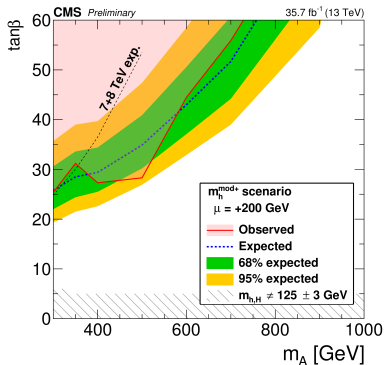
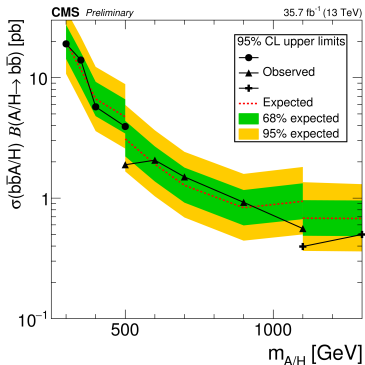
Leads to one publication and one public result for CMS.



## CMS Rate in 2016

- Well behaved MSSM Hbb triggers along the line.

In charge of Higgs Trigger Commission in 2017 and 2018.

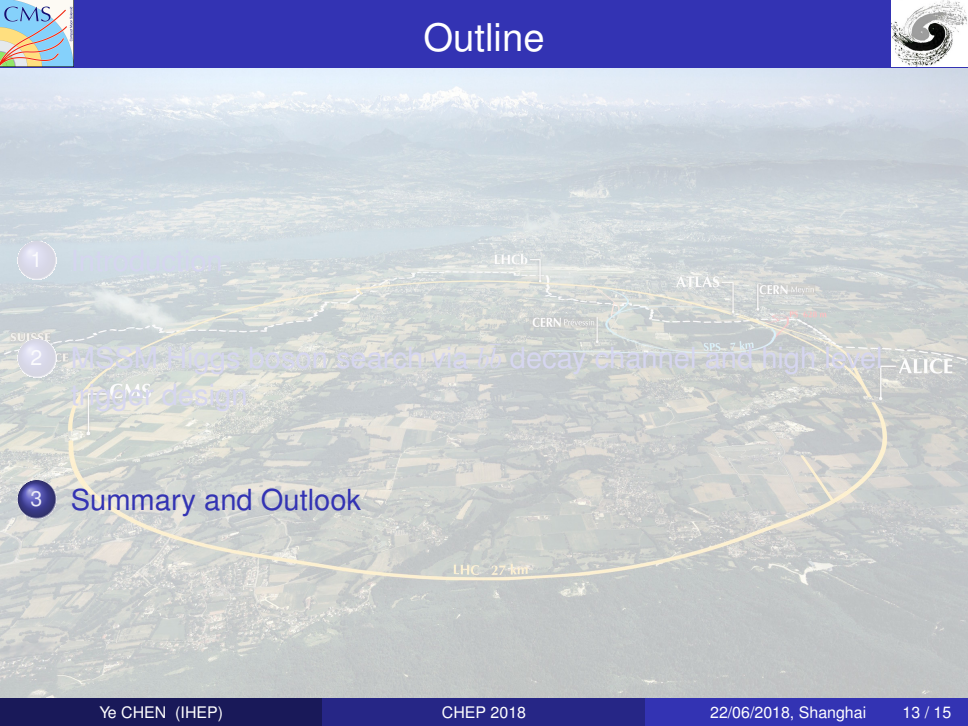


- LMT only, baseline analysis strategy determined by me in 2015.

**Game changing contribution with new trigger design!**



- Searching scope: MSSM Higgs mass region [500,1000] GeV.
- Targeting for dataset of year 2015/2016 and possibly year 2018.
  - PAS only results for 2020 International/Local summer conference.
- 2015-2016 data triggered by MSSM Hbb High mass trigger will be revisited with legacy reconstruction.
- Extrapolating the search to Run 3 and beyond ...



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## Summary

- Game changing contribution to MSSM Hbb JHEP paper on trigger design and analysis strategy determination.
- With current statistics, no hint for new physics was shown yet.

## Outlook

- **Run 2:** it is still possible to encounter something new with CMS Run 2 data, or at least get a better understanding of MSSM Higgs physics.
- **Run 3:** The current ongoing effort of MSSM Hbb search and trigger design for sure worthing to be extrapolated to Run 3. 2020 is not that far from now ...

Thanks for your attention!

