STXS 1.3

Black: previously agreed on
Green: new, hopefully uncontroversial
Orange: under discussion

Concrete proposal, version 4

Based on the work of many people

STXS chat, 10.06.2024

ttH

Concrete proposal

- Add high pt bin at 650 GeV

- Make 450 bin solid

- Separate tH category

Agreed on previously

V(lep)H

Concrete proposal

- make 400 split solid

- add a solid split at 600 GeV
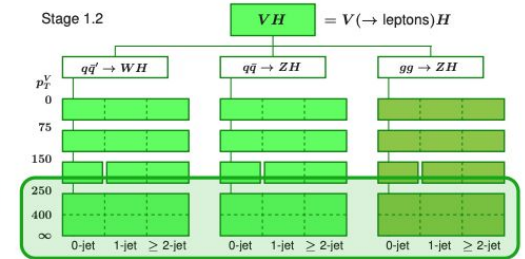
Agreed on previously
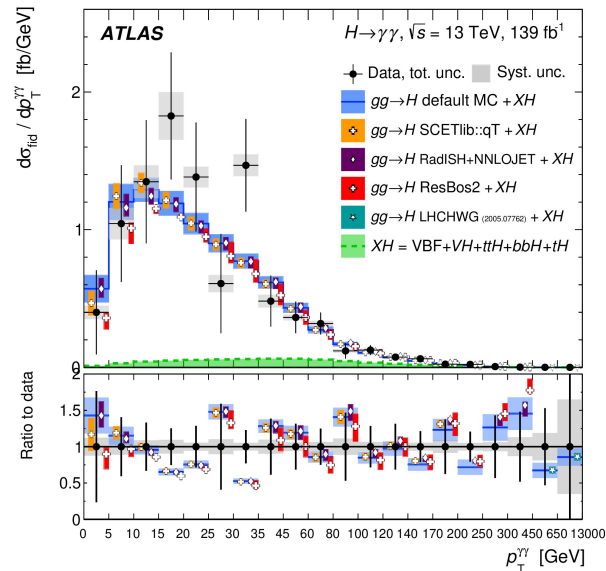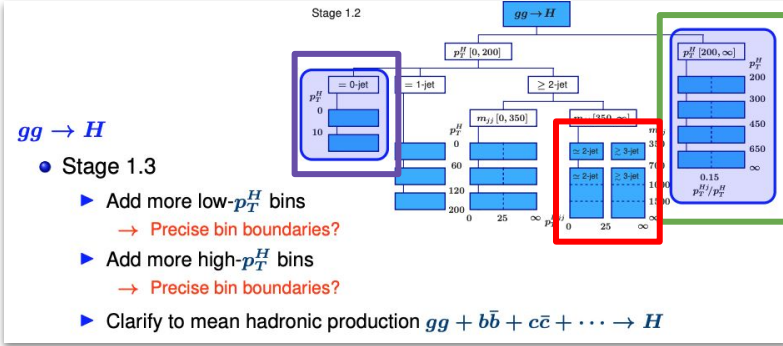
ggF - concrete proposal

0-jet bin
- Add additional split at 5, 15, 20, 25, 30
- 1-jet bin add split 0 - 30 - 60 to catch the turn on

High-pt bins
- add boundary at 1000 GeV

Split >=2 jet, mjj [350, inf] in 4 delta phi bins each (dashed or solid?) -> so 4*4 bins

qqHqq - still to be decided

Concrete proposal

Add a high pt bin ptH 200 - 450 - inf
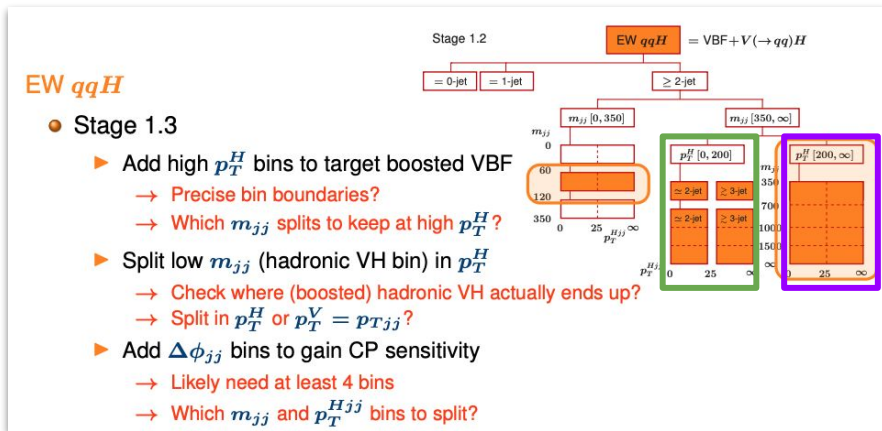(last bin: all dashed, no pTHjj)

qqHqq - still to be decided

Concrete proposal

Add a high pt bin ptH 200 - 450 - inf
(last bin: all dashed, no pTHjj)

Delta phi
Low pt: Current 4 nominal bins (undashed)
with 4 deltaPhi each (-pi, -pi/2, 0, pi/2, pi)
(keep remaining mjj bins dashed)

High pt (200-inf (will turn into 450)):
Analog deltaPhi splits to low pt

Stage 1.2   EW qqH = VBF+$V(\to qq)H$

= 0-jet   = 1-jet   ≥ 2-jet

m_{jj} [0, 350] m_{jj} [350, ∞)

EW qqH

- Stage 1.3
  ▶ Add high p_T^H bins to target boosted VBF
    → Precise bin boundaries?
    → Which m_{jj} splits to keep at high p_T^H?
  ▶ Split low m_{jj} (hadronic VH bin) in p_T^H
    → Check where (boosted) hadronic VH actually ends up?
    → Split in p_T^H or $p_T^V = p_{Tjj}$?
  ▶ Add $\Delta\phi_{jj}$ bins to gain CP sensitivity
    → Likely need at least 4 bins
    → Which m_{jj} and p_T^{Hjj} bins to split?

p_T^H [0, 200] p_T^H [200, ∞)

What is more important:
deltaPhi or mjj?

2nd option: Keep mjj 1 TeV
split, don't split the bins above in
deltaPhi

qqHqq - what to do with the boosted channel?

Option 1: Reshuffling (see Zhi's talk) - seems transparent for current binning, but problems at very high pt

Option 2: In the mjj 0-350 bin introduce a split at ptH = 200 GeV, duplicate all mjj bins(0 - 60 - 120 - 350)

Option 3: split 1 jet bin in small R jet mass and in pTH
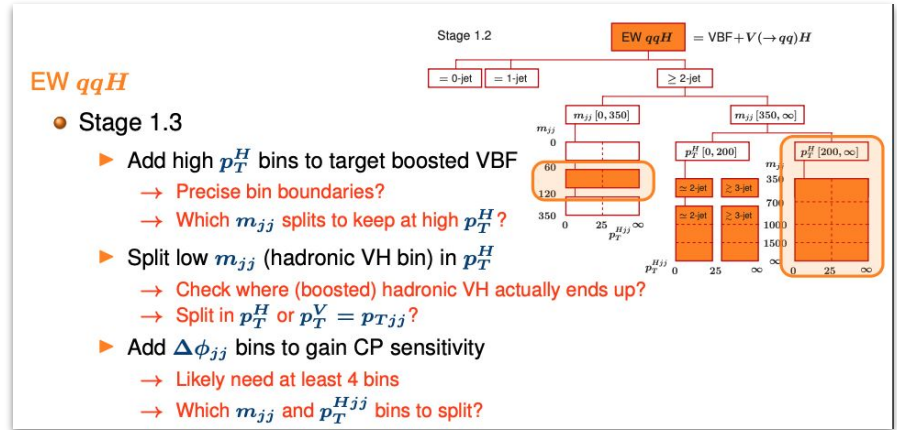
Option 2 and 3 do not capture majority of boosted events, but are also much simpler and backward-compatible changes

How to publish the STXS binnings

- For STXS 1.1, paper on the arXiv:
  https://arxiv.org/abs/1906.02754

Proposal:
- STXS 1.2 not documented yet => update/add to the 1.1 paper
- STXS 1.3 separate paper (due to different author lists and the changes being relatively big)?

=> submit all of them to SciPost!