

# VBF Studies at HL-LHC

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# VBF MC Samples

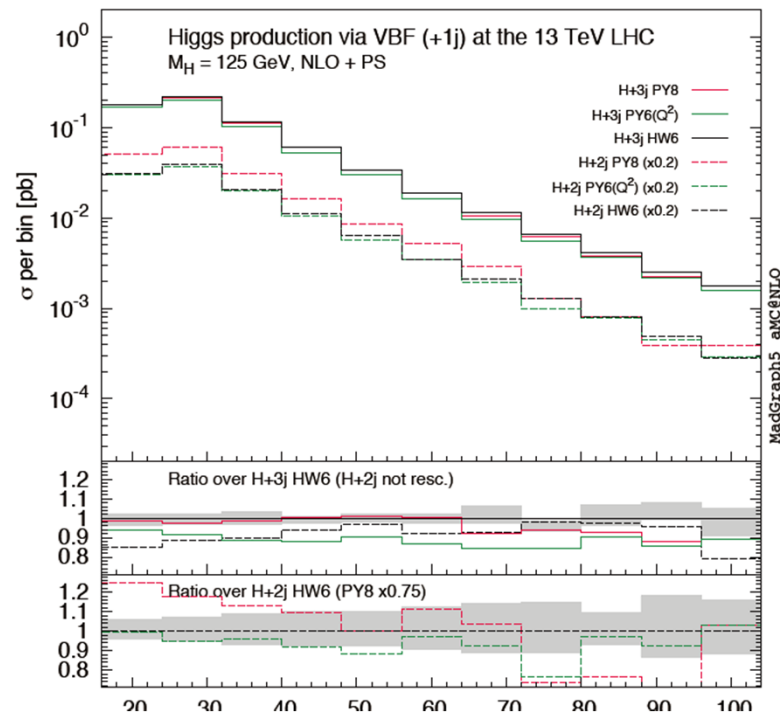
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- ⊙ Generator
  - ⊙ VBFNLO/HAWK interface with Herwig++
    - ⊙ arXiv:0707.038, arXiv:0710.4749 for HAWK
    - ⊙ PS matching undergoing
  - ⊙ aMC@NLO/POWHEG
    - ⊙ No EWK correction yet, will be added in future
- ⊙ NLO QCD correction +NLO Electroweak Correction + Parton Shower
  - ⊙ Previously without EWK NLO correction, but use HAWK (Higgs Attached to Weak bosons) 2.0 tool to do reweight
  - ⊙ Order of 5-10% for QCD and EWK correction
  - ⊙ Will reduce scale and pt reweight uncertainties

# VBF+3j

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- Predictions from different PS are brought closer by including NLO corrections
  - Will reduce the 3<sup>rd</sup> jet related variable uncertainties



# ggF+jets

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- ⊙ H+3 jets@ NLO in gluon-gluonfusion
  - ⊙ Significant reduction of scale uncertainties
  - ⊙ Important impact of NLO corrections on shapes with GGF
  - ⊙ Pt of H  $j_1$   $j_2$ -system for the first time computed with NLO accuracy

## H+3 jets

- Calculation setup so far:
  - B amplitudes: *Sherpa (Amegic)*
  - V amplitudes: *GoSam*
  - IRS amplitudes: *MG4/MadDipole*

PS integration: *Sherpa (BLHA)*

PS integration: *MadEvent*

Full NLO
- New ongoing calculation:
  - B amplitudes: *Sherpa (Comix)*
  - V amplitudes: *GoSam*
  - IRS amplitudes: *Sherpa (Comix)*

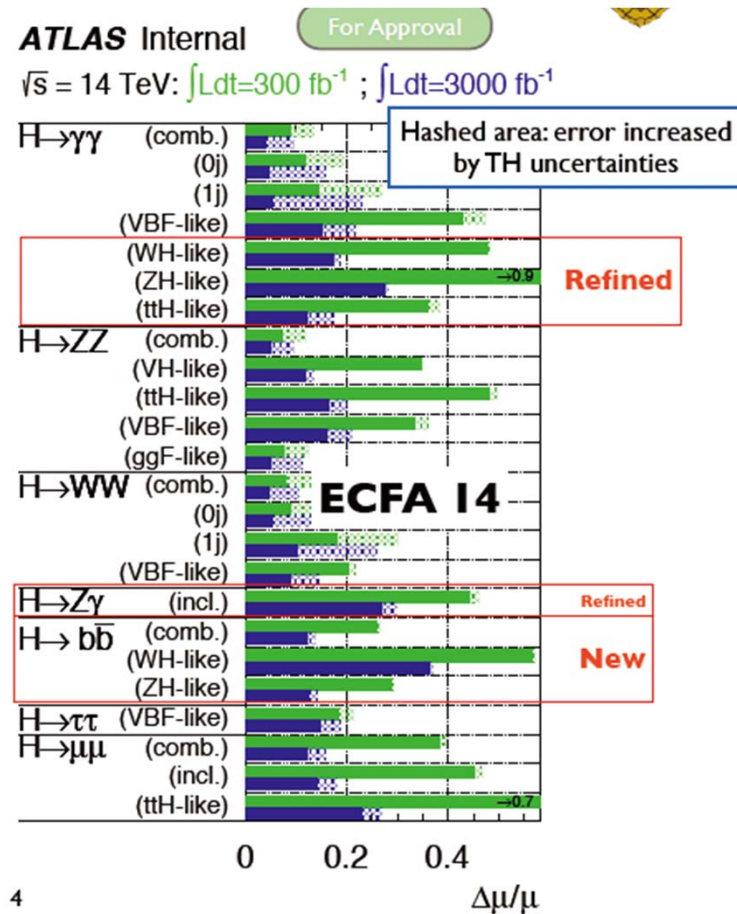
PS integration: *Sherpa (BLHA)*

Full NLO + merging + shower

# Projections for measurements of Higgs boson signal strengths

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◎ PUB note: <https://cds.cern.ch/record/1744007>



# Conclusion

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- ⊙ New prescription of VBF and ggF samples are expected to reduce
  - ⊙ VBF scale uncertainty
  - ⊙ VBF Pt reweight uncertainty
  - ⊙ VBF 3<sup>rd</sup> jet related variable uncertainty
  - ⊙ ggF+jets theory uncertainty
- ⊙ Results of prospects of coupling in 14TeV already done in combination group
  - ⊙ Need to check their pile-up specific application
  - ⊙ new systematics yet to be added