
Feedback on STXS from discussions within ATLAS

Not "ATLAS feedback" but a collection of points that have come up in discussions and could be useful to discuss

Nicolas Berger (LAPP) summarizing contributions from Roberto Di Nardo, Hongtao Yang & others.

Granularity

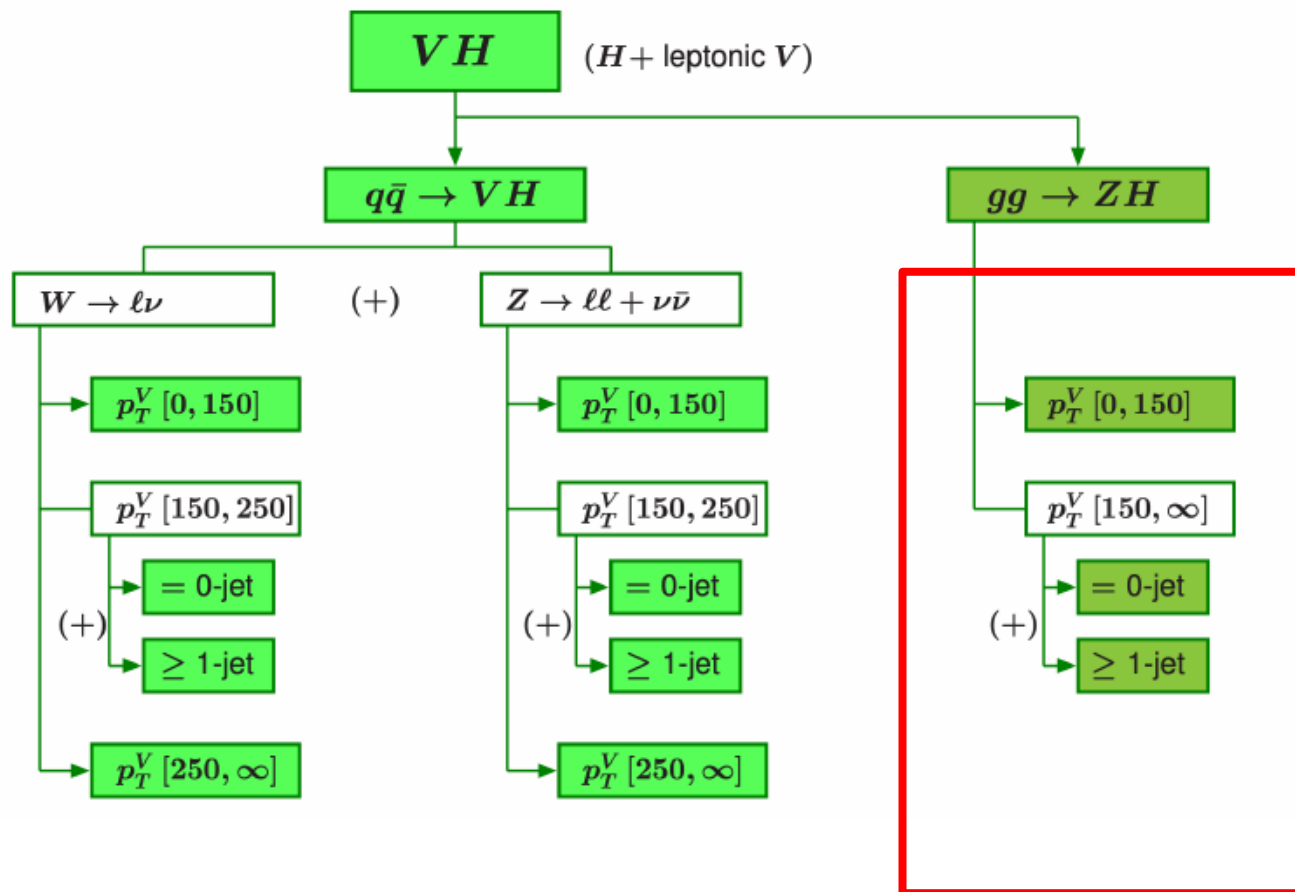
- With Run 2 stats, full stage 1 granularity leads to very large uncertainties.
⇒ *Need to merge bins to recover sensitivity*
 - In current combination, require **expected uncertainty < 100%**, relax for interesting bins (high p_T^H , p_T^V or p_T^{j1})
 - ATLAS tool to inject additional theory unc. due to merging STXS bins
- Modeling of uncertainties is non-trivial
 - $\#(\text{STXS bins}) \times \#(\text{reco. categories}) \times \#(\text{syst. sources})$ numbers to manipulate
 - Bookkeeping is not trivial
 - Needs large MC stats, not always there in corners of phase space
- **Would be good to have a splitting that is adapted to the expected luminosity**
- **What to do with regions that cannot be measured ?**
Better to fix to SM, or merge with a close-by measurable region ? (or something else ?)

Relation to production modes

- Some technical difficulties from STXS Stage 0 bins not matching the usual production modes (VH(had) grouped with VBF, except $gg \rightarrow ZH$ with ggF):
 - Need to run on several samples to get the full contributions to a given Stage 0 bin
 - ⇒ Internally, use a “Stage 1+” parameterization with e.g. separate qq2Hqq_VBF, qq2Hqq_WH, qq2Hqq_ZH components
- **Ideal would be to have common definition between STXS and generators (one way or the other)**
- **If separate definitions retained, should ensure STXS uses unambiguous names (e.g. not use VBF to refer to $qq \rightarrow Hqq$)**

VH Binning

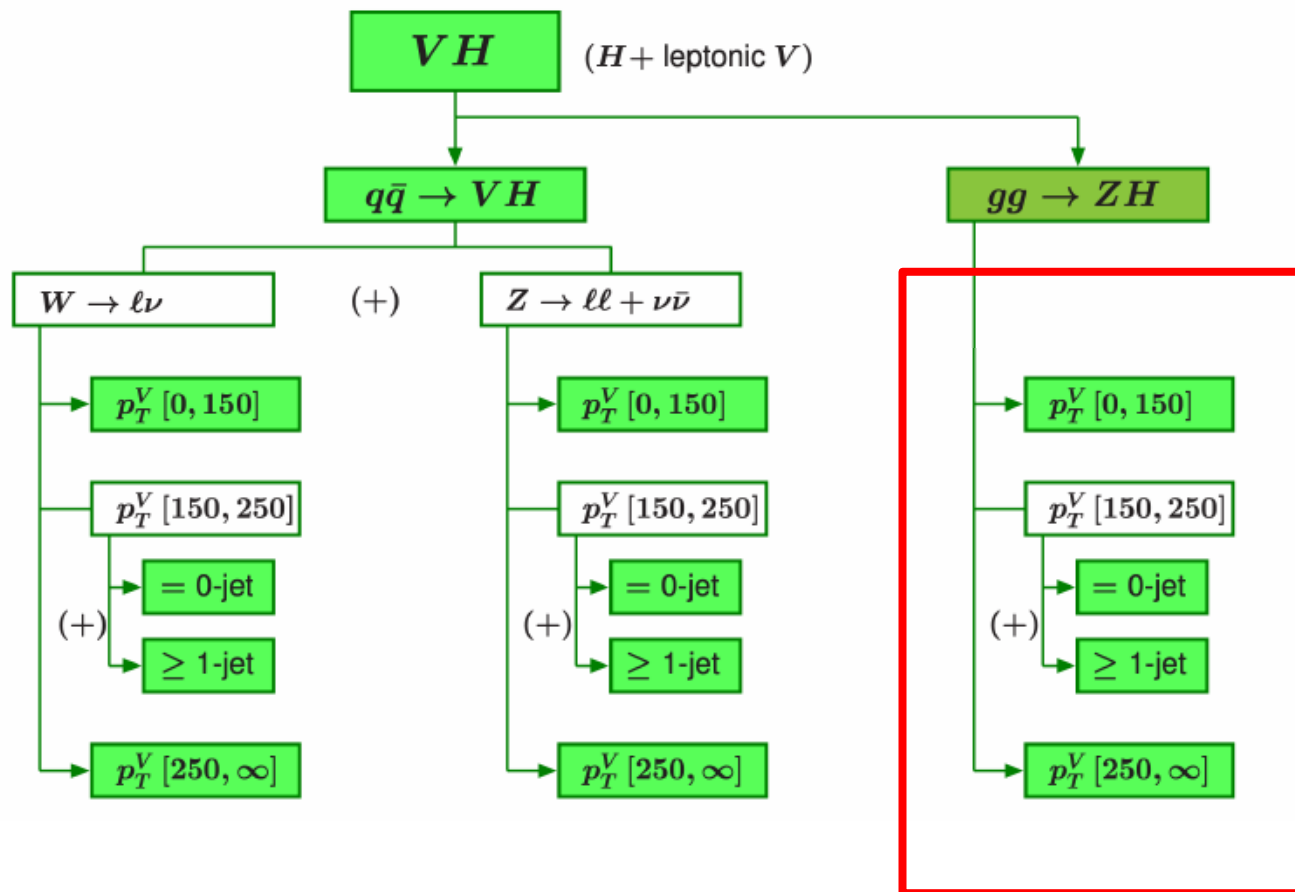
- Sensitivity dominated by VH(bb) in near future
 - Cutting on Higgs p_T instead of vector boson p_T ?
 - ggZH binning should be harmonized to qqZH, as experimentally we cannot separate them



- In any case, binning and analysis selection should match closely
- Apply same binning on V(had)H or even merge had and lep channel to VH?

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Theory Uncertainty in Complex Selections

In coupling analysis, the selections are in general complicated, and they are not always aligned with STXS binning

→ e.g. using MVA with many input variables which are not all used in defining STXS bins

⇒ Additional theory modeling uncertainty needed in such cases

Would be good to get feedback from theory community on how to handle such additional uncertainties

Need to understand if additional variables should be included

→ e.g. for VH, or VBF ?

