ATLAS Upgrade Semi-leptonic VBS Studies

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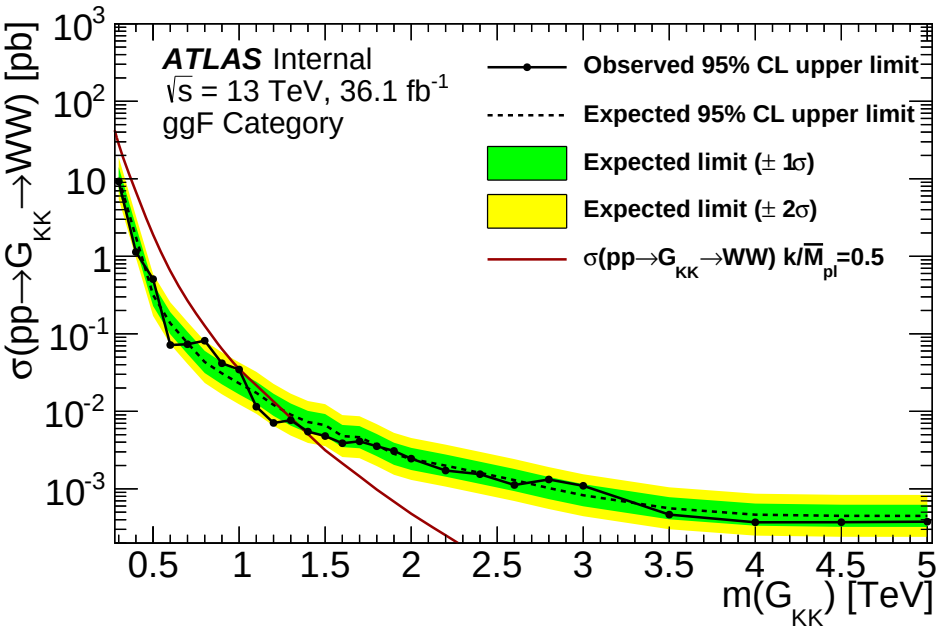
Overview of VV Semi-leptonic Plans

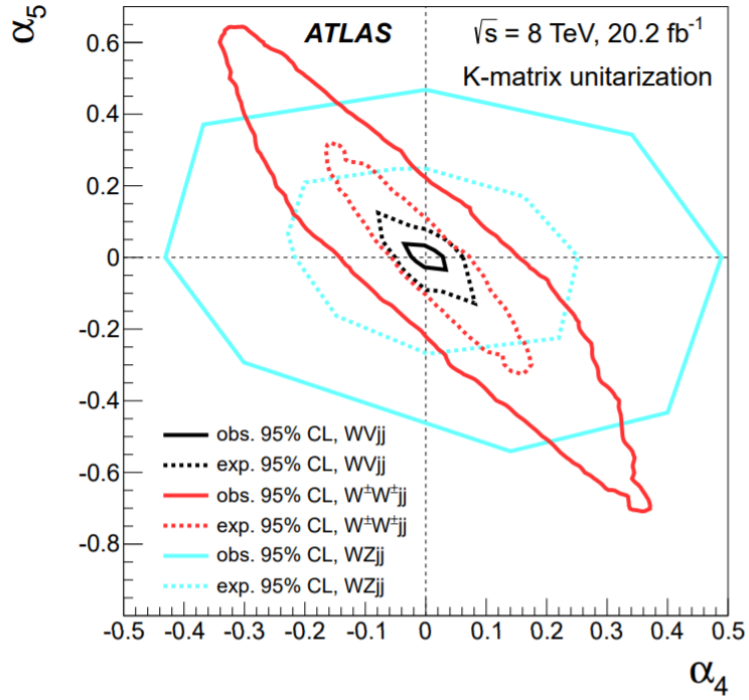
Exotics Side:

- Upgrade study of the exotic VV resonances in $\ell\nu qq$ $+\ell\ell qq$ $+\nu\nu qq$ channels with 300 and 3000fb^{-1}
- Heavily basing strategy off the 13TeV 36.1fb^{-1} results



SM Side:

- Interest in studies of SM VBS in semileptonic channels and aQGC search
- HE-LHC at 27TeV studies as well



Early HL-LHC studies

Analysis code all ready but bottleneck is currently lack of appropriate W+jets samples

- Using privately generated sample until then

Also have been developing statistics tools using simple `HistFactory`

Currently take major uncertainties derived from $13\mathrm{TeV}$ analyses:

- Normalization uncertainties on all background channels
- Major shape variation of $t\bar{t}$ and W+jets

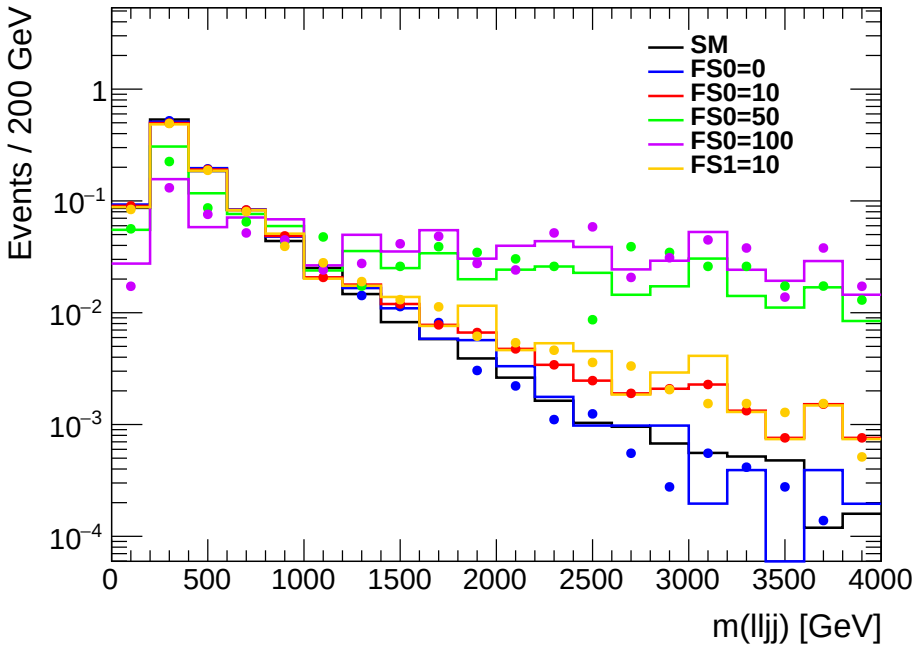
aQGC MC

- We want to generate VBS MC with aQGC EFT incorporated

$$\mathscr{L} = \mathscr{L}_{sm} + \sum_n \frac{f_n}{\Lambda^4} \mathscr{O}_n$$

- In Eboli model there are 21 dim-4 operators (Paper Link)
- Madgraph UFOs by authors available
- Issue is that generation takes a long time and is very inefficient
- Using Madgraph internal reweighting to reduce computation

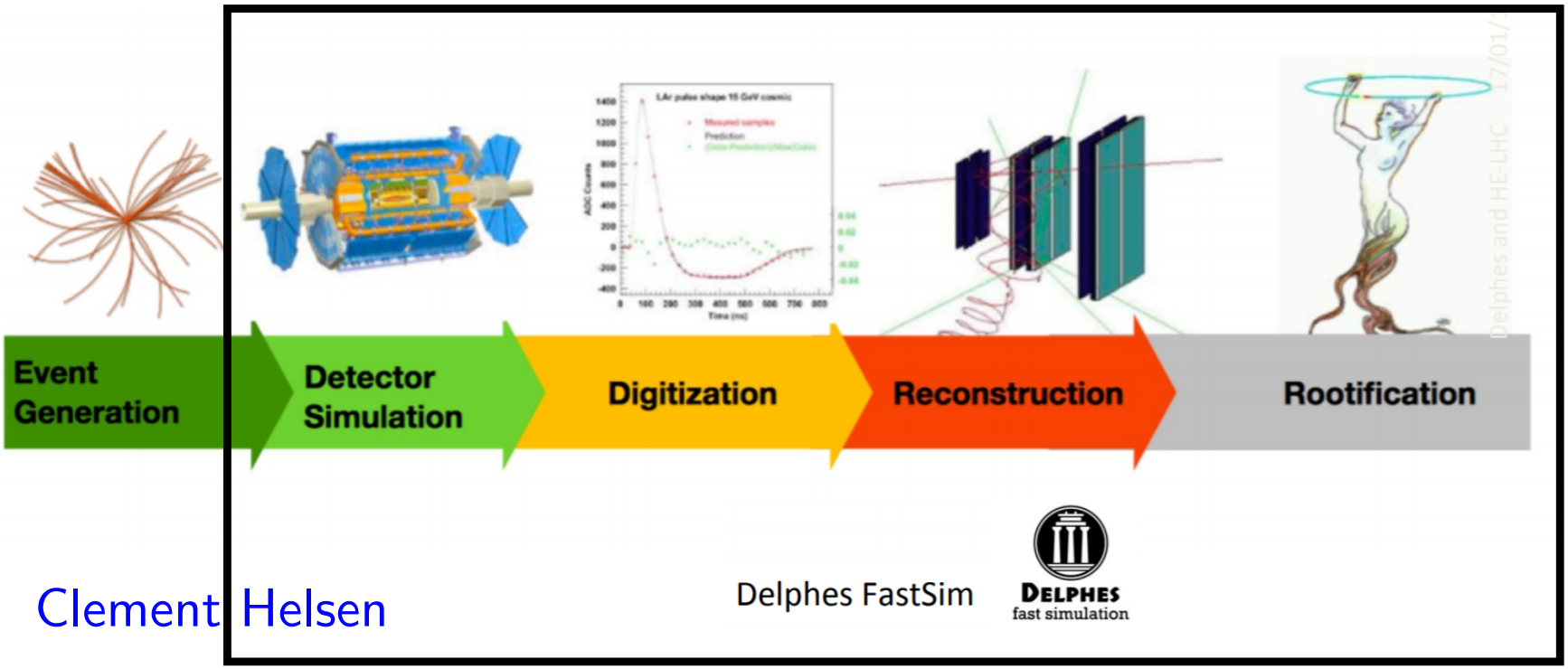
Invariant mass of VV pair under aQGC



points=simulated distributions
lines=reweighted distributions

HE-LHC studies

For HE-LHC 27TeV analysis will use Delphes framework

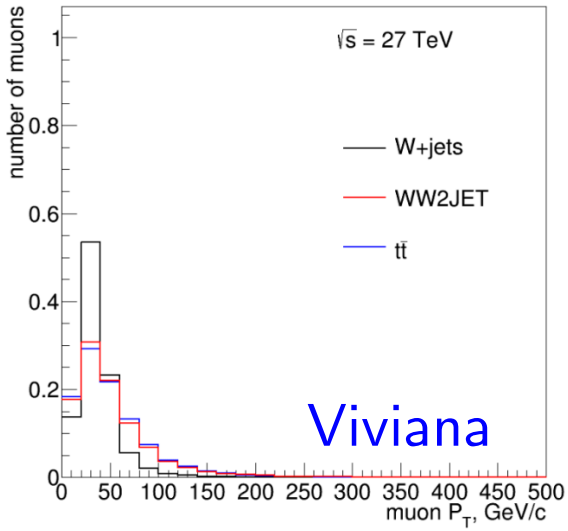


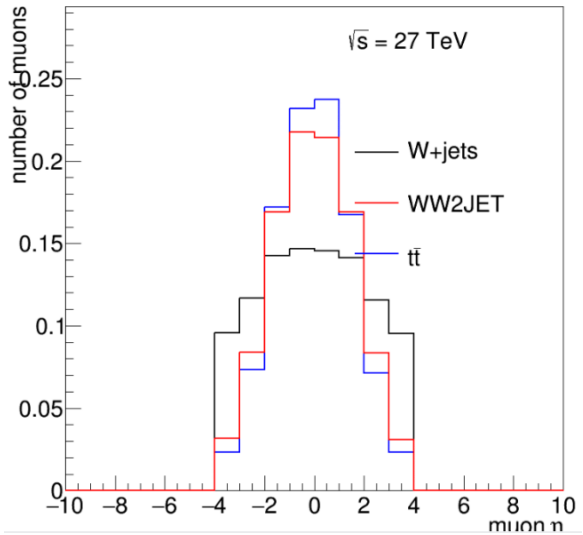
Clement Helsen

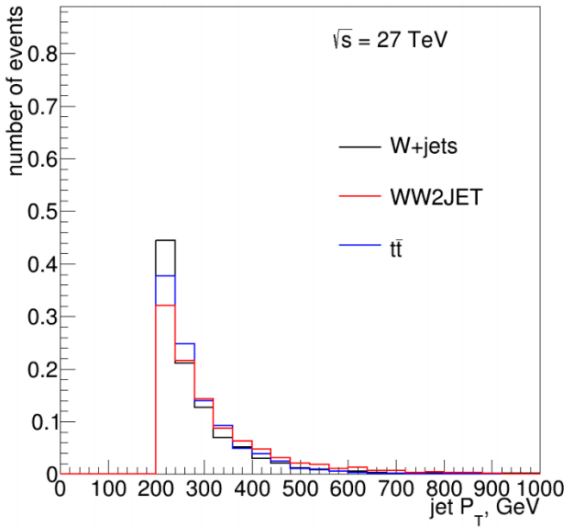
Currently generating MC privately and validating results of generator and Delphes

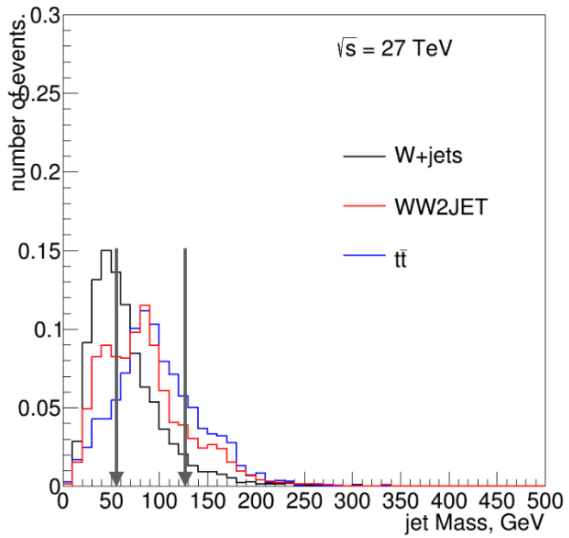
Distributions at 27TeV

Some distributions for $t\bar{t}$, W+jets, and EWK VBS signal



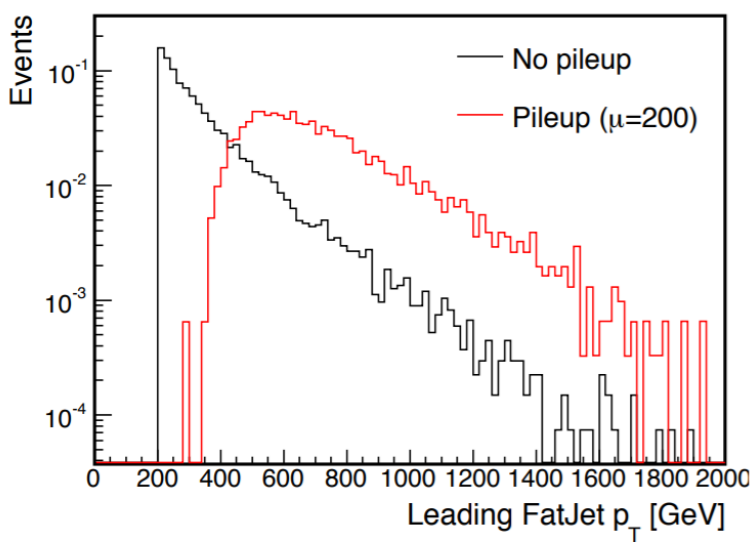


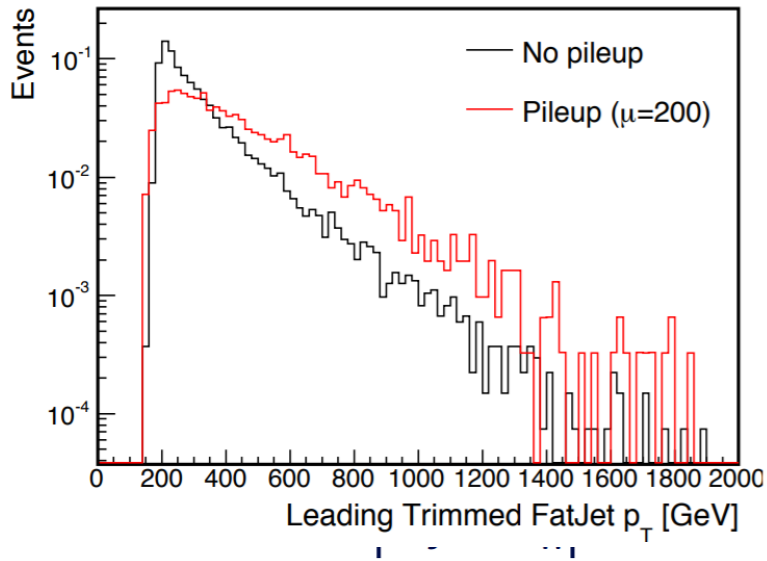


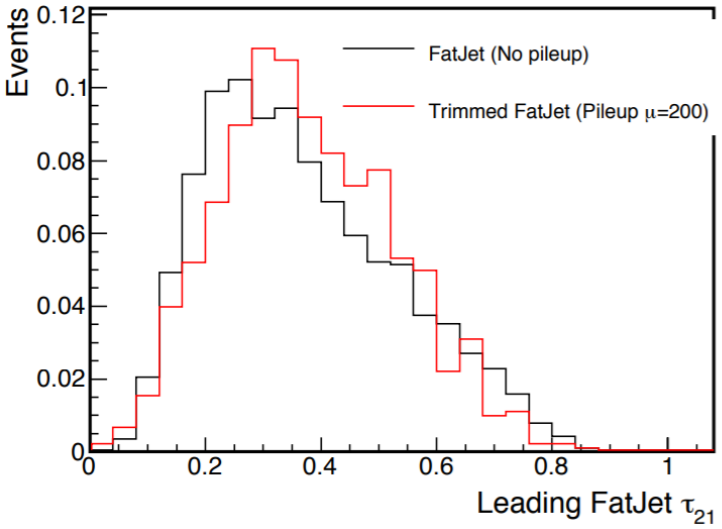


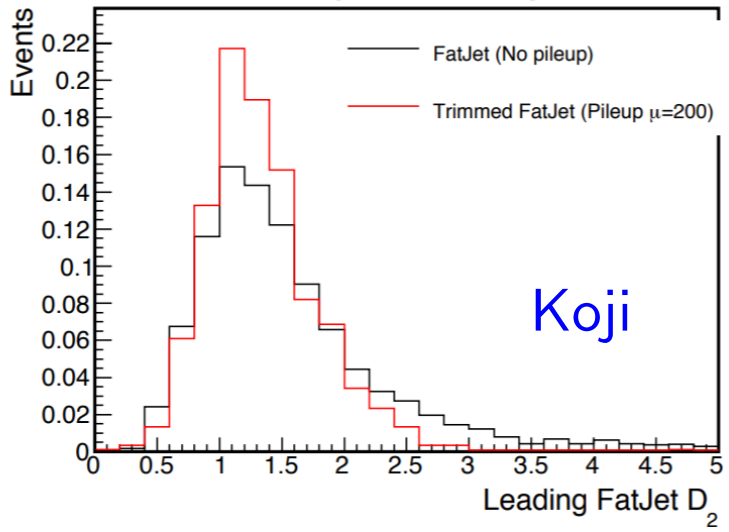
Pile-up Effects at 27TeV

Top Row: The effects of trimming on fat-jets





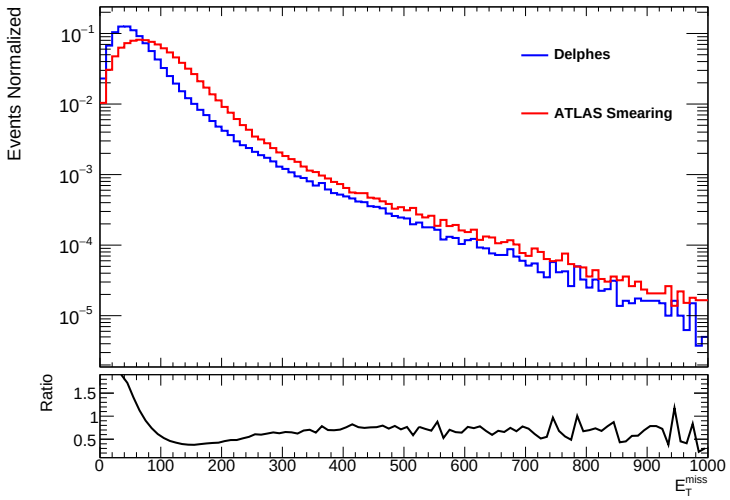


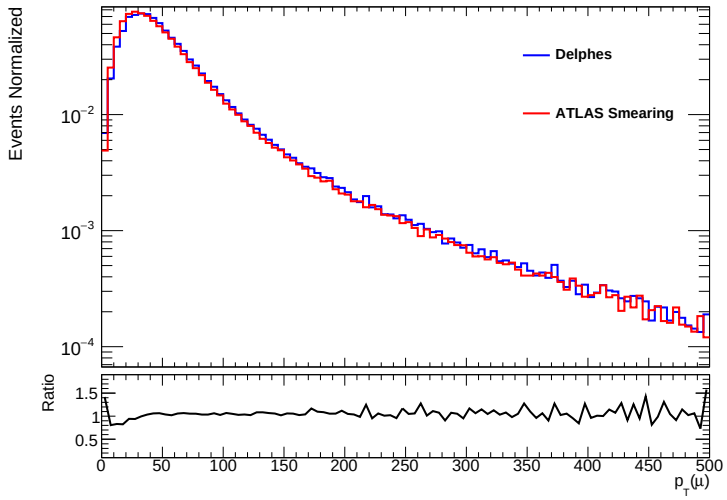


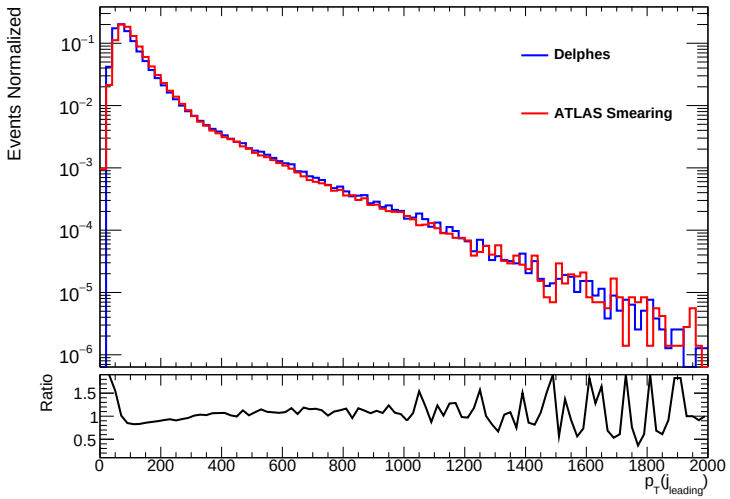
Bottom Row: The effects of pile-up on substructure variables

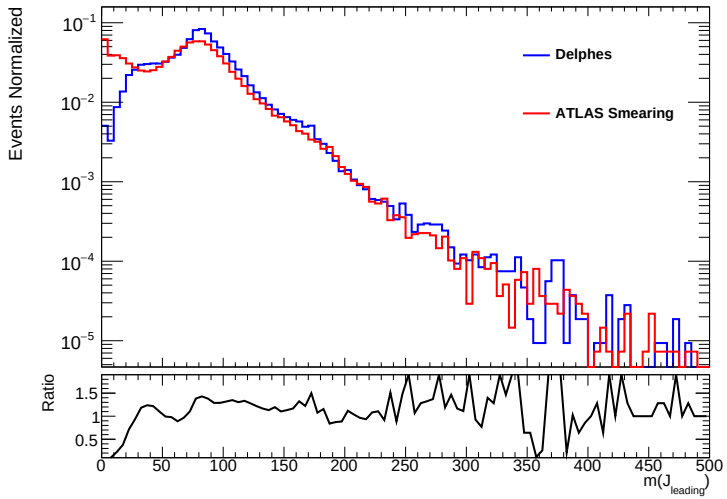
Delphes vs ATLAS Smearing Functions

Delphes at 14TeV agrees well with ATLAS smearing function









Only major difference is $E_{\mathrm{T,miss}}$ which is probably due to Delphes particle-flow calculation

Summary

Studies planned for LHC Yellow-Report:

- VBS semileptonic VV and aQGC search
  - Investigating possibility of separating longitudinal component
  - Also exotic $VV \rightarrow$ semileptonic resonance search
- HL-LHC at $300/3000\mathrm{fb}^{-1}$ with ATLAS smearing
- HE-LHC at $27\mathrm{TeV}$ with Delphes

Status:

- HL-LHC Studies:
  - Waiting on V+jets MC
  - Most of the machinery ready
- HE-LHC Studies:
  - Privately validating MC
  - Several studies investigating Delphes and pile-up effects
- Write-up strategy still to be decided