Impact of Energy of First Stage on Higgs Couplings

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The Study

- The goal: Evaluate how the choice of the energy of the initial stage influences the precision of Higgs couplings (at the initial stage only for now)
  - **Model-independent fit only**

- The strategy: Simply scale statistical uncertainty based on evolution of cross section for ZH and VBF as a function of energy, and based on impact of polarization - assume identical integrated luminosity for each energy
  - Note: For some couplings (in my example ττ) we assume only ZH measurements, so those do not profit from increased VBF - For bb both ZH and VBF are assumed
- VBF cross section evolution: x 1.71 [350 GeV -> 420 GeV], x 2.5 [350 GeV -> 500 GeV]
- ZH cross section evolution: x 0.68 [350 GeV -> 420 GeV], x 0.49 [350 GeV -> 500 GeV]
- Polarization 80%/0%: ZH x 1.12, VBF: x 1.8

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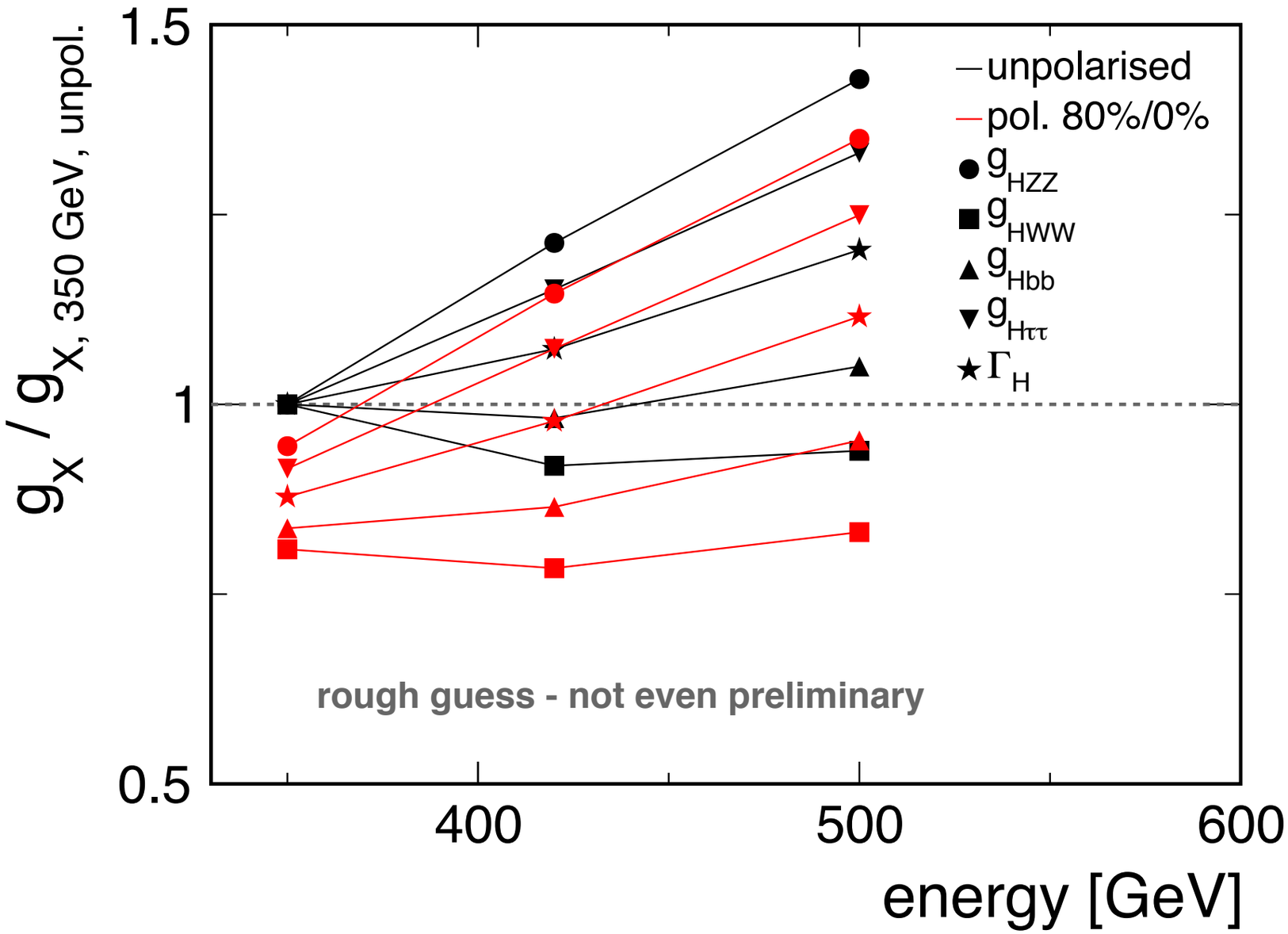
DISCLAIMER

This is just to give an impression - not a thorough study!
Based on cross-section numbers read from a plot
Ignoring energy dependence of efficiencies, backgrounds, …

The Results



- Slight improvement of g_{HWW} due to increase in VBF, very slight improvement of g_{Hbb}
- Everything else suffers - 20% deterioriation of g_{HZZ} from 350 GeV to 420 GeV
  - total width also gets worse - ~ 8% degradation from 350 GeV to 420 GeV

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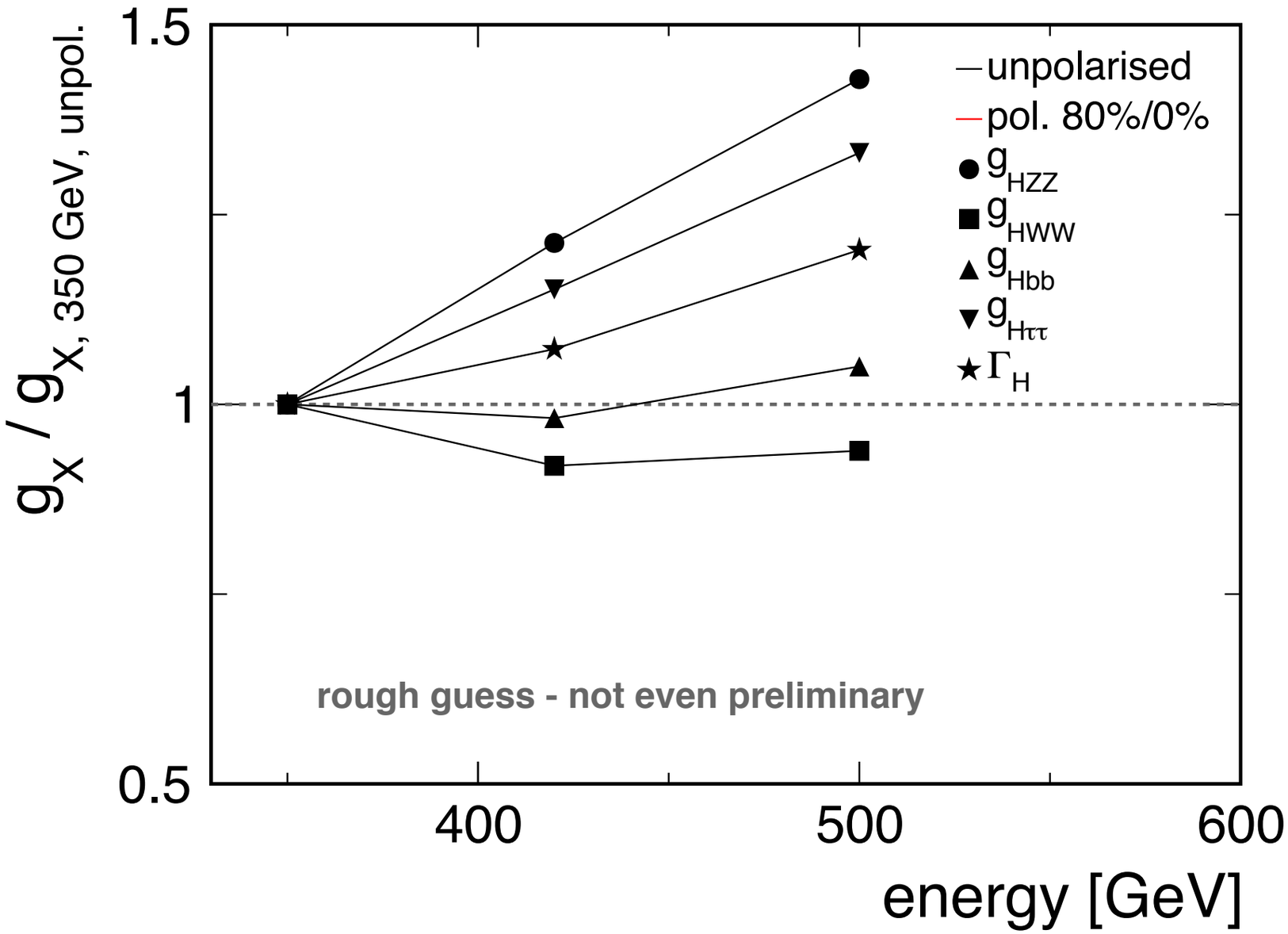

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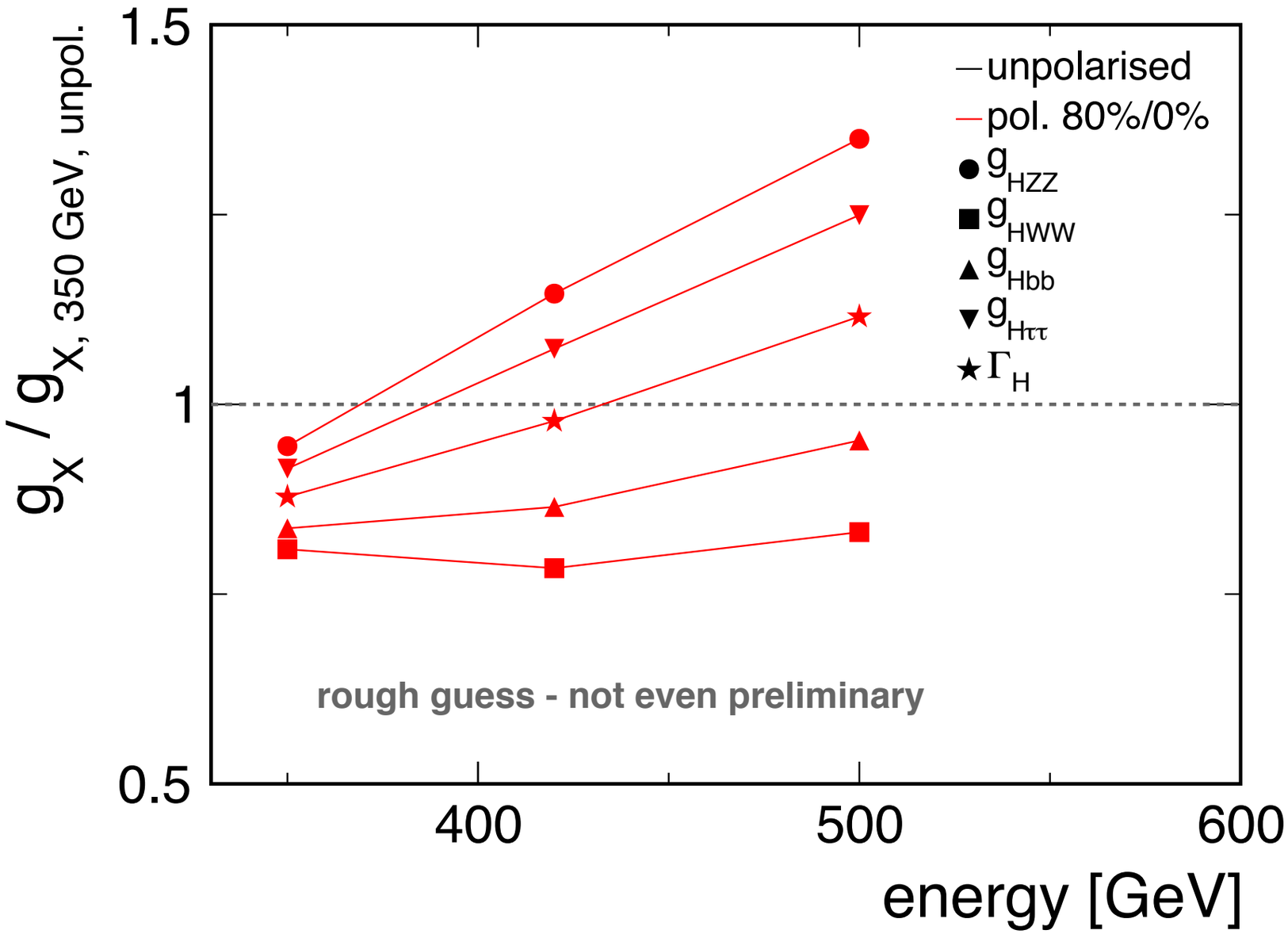

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The Details - Unpolarized

350 GeV:

gHZZ: 1 +- 0.00827211
gHWW: 1 +- 0.0178434
gHbb: 1 +- 0.0198335
gHcc: 1 +- 0.0322964
gHtt: 0 +- 0
gHtautau: 1 +- 0.037132
gHmumu: 0 +- 0
width: 1 +- 0.0499271
gHgg: 1 +- 0.0363021
gHgamgam: 0 +- 0

420 GeV:

gHZZ: 1 +- 0.0100315
gHWW: 1 +- 0.0163999
gHbb: 1 +- 0.0194738
gHcc: 1 +- 0.0365317
gHtt: 0 +- 0
gHtautau: 1 +- 0.0427571
gHmumu: 0 +- 0
width: 1 +- 0.0535635
gHgg: 1 +- 0.0416961
gHgamgam: 0 +- 0

500 GeV:

gHZZ: 1 +- 0.011817
gHWW: 1 +- 0.0167521
gHbb: 1 +- 0.0208241
gHcc: 1 +- 0.0419428
gHtt: 0 +- 0
gHtautau: 1 +- 0.0494364
gHmumu: 0 +- 0
width: 1 +- 0.0600854
gHgg: 1 +- 0.0481629
gHgamgam: 0 +- 0

The Details - Polarized

350 GeV:

gHZZ: 1 +- 0.00781642
gHWW: 1 +- 0.0144361
gHbb: 1 +- 0.0165937
gHcc: 1 +- 0.0292488
gHtt: 0 +- 0
gHtautau: 1 +- 0.0339896
gHmumu: 0 +- 0
width: 1 +- 0.0438488
gHgg: 1 +- 0.0331793
gHgamgam: 0 +- 0

420 GeV:

gHZZ: 1 +- 0.00947893
gHWW: 1 +- 0.0139917
gHbb: 1 +- 0.0171531
gHcc: 1 +- 0.0338716
gHtt: 0 +- 0
gHtautau: 1 +- 0.0398505
gHmumu: 0 +- 0
width: 1 +- 0.0488332
gHgg: 1 +- 0.0388336
gHgamgam: 0 +- 0

500 GeV:

gHZZ: 1 +- 0.011166
gHWW: 1 +- 0.0148397
gHbb: 1 +- 0.0188902
gHcc: 1 +- 0.0392491
gHtt: 0 +- 0
gHtautau: 1 +- 0.0463894
gHmumu: 0 +- 0
width: 1 +- 0.0557017
gHgg: 1 +- 0.0451772
gHgamgam: 0 +- 0

Conclusions

- No conclusions - but clearly this is not a simple, straightforward issue…