

Oxford Multi-Higgs

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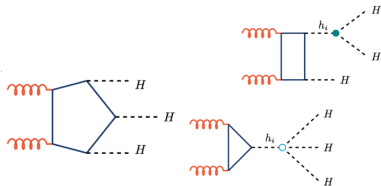
Multi-Higgs Production

Our experience:

- BSM broadly: SUSY, dark matter (James: LPC DM WG convenor)
- ATLAS di-Higgs (esp. $hh \rightarrow bbbb$)
- Currently exploring BSM hhh in ATLAS
- Machine learning techniques (Holly: Schmidt AI Fellowship)

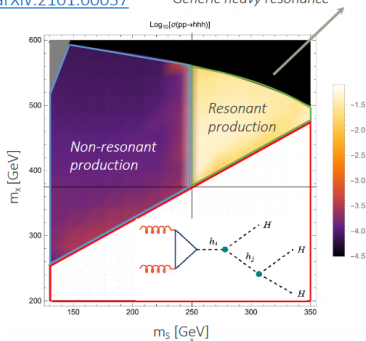
Motivation:

- Study tri-Higgs production, ability to constrain quartic coupling at FCC (with and independently of trilinear).
- Also interested in hh final states, will depend upon personpower/timescales, would like to look into ultimate potential from $\gamma\gamma\tau\tau$.

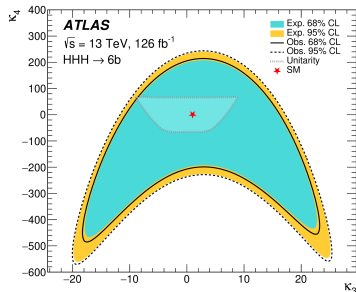


[arXiv:2101.00037](https://arxiv.org/abs/2101.00037)

Generic heavy resonance



- Involved in recent ATLAS [paper](#)
- Also exploring dataset-wide graph networks ([1912.10625](#))
- Very rare process ($\sigma = 0.079$ fb at LHC (13 TeV, NNLO).
 - ▶ Direct probe of λ_4 , not directly accessible at FCC-ee.
- Starting with $4b2\tau/2b4\tau$ final state (11k, 1.1k events at $30ab^{-1}$).
- Also impact of running energy/scenarios



2411.02040

Samples

Signals

- hhh ($\rightarrow 2\tau 4b, 4\tau 2b$).
- hh ($\rightarrow \tau\tau\gamma\gamma$)

Backgrounds

- $2\tau 4b$: $tt + bb$ (i.e. $WWbbbb$), tth/Z , hh , ZZZ , $Z/h/\text{gamma}+\text{jets}$
- $4\tau 2b$: $ZZ/hh + bb$, ttZ/h , $tttt$, VVV
- $\tau\tau\gamma\gamma$: $tt + \gamma\gamma$, ZH , $Z+\text{jets}$, $Z\gamma+\text{jets}$, tth/Z ,
- From inexperienced reading of DB here:
<https://fcc-physics-events.web.cern.ch/fcc-hh/LHEevents.php>
- Many of the key ones exist: (tt , ttV/h , ZH , VVV , 4-top)
- May need: $ZZ(+bb)$, $tt + bb$, photon samples ($Z\gamma$, $Z\gamma\gamma?$)
- Will follow up when more confident!