



LHC-HH introduction

The 19th Workshop of the LHC Higgs Working Group

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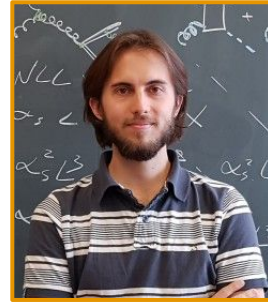
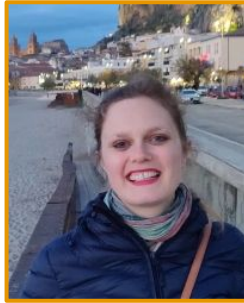
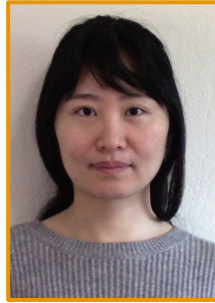
[lhc-higgs-hh-convener@cern.ch]

November 28th, 2022



LHC-HH leadership news

Stefano Manzoni takes over from Liza Brost as LHC-HH convener from ATLAS



ATLAS	CMS	THEORY
Stefano Manzoni (10/2022)	Nan Lu (08/2021)	Ramona Gröber (06/2018) / Javier Mazzitelli (06/2018) / Maggie Mühlleitner

Reach us at: lhc-higgs-hh-convener@cern.ch

Ongoing work in the LHC-HH cross group

task	status
ggF: top-quark mass renormalization scheme uncertainty	Phys. Rev. D 103, 056002 (2021)
ggF: NLO EFT frameworks and new shape benchmarks, HEFT vs SMEFT	In progress
ggF: combination of H and HH (in connection with WG2 activities)	In progress
ggF: cross section / MC for $gg \rightarrow H + bb$	In progress
ggF/VBF: cross section and MC prediction for various m_H values	In progress, need different coupling values
VBF: fiducial cross-sections vs. coupling modifiers	Need external inputs
VBF: cross-sections for ggF HH+2j at hard matrix-element	Ongoing. MC studies @ LHC-HH
Resonant: benchmarks for spin-0 HH, SH and SS to be probed with 100-300/fb, including interference with non-resonant HH	J. High Energ. Phys. 11 (2022)
Compositeness models: covered by EFT?	started

 = reports this week

 = needs personpower

Meetings in 2022

Higgs Pairs: May 30th - June 3rd, 2022 in Dubrovnik, Croatia

- 137 participants, 56 talks
- It was great to see so many of you in person, again!
- Many thanks to the organizers and session chairs



LHC-HH cross group meetings in 2022

- Topical meeting on resonant HH ([September 28th](#))
 - Goal for this meeting: work together to define which benchmarks are useful / how to apply them to analysis
 - experimental overview of the HH resonant analyses (joint ATLAS+CMS talk, Fabio Monti and Jana Schaarschmidt)
 - Resonant di-Higgs production in the context of extended scalar sectors (Duarte Azevedo)
 - Di-Higgs production at hadron colliders in the 2HDM: invariant mass distributions (Kateryna Radchenko)
 - Interference effects in BSM di-scalar production (Tania Robens)
 - **HHot topic: resonant/non-resonant HH interference**
 - [Previous open calls](#) for resonant benchmarks were met with enthusiasm from the theorists
 - Resonant benchmark [paper](#) from previous LHC-HH call (obeys current experimental constraints, can be probed in Run 3 dataset)

HH cross group meetings in 2022

- November 28th (today!)
 - **Parallel session #1: Lightning talks! (9:00-10:30 CET)**
 - Well-received at last winter's LHCHWG meeting, so we plan to keep a lightning talk session at future general meetings
 - New constraints on extended Higgs sectors from the trilinear Higgs coupling (Johannes Braathen)
 - Two-loop Yukawa corrections to double Higgs production (Kay Schönwald)
 - Triple Higgs production in the SM and in models with singlet NP scalars at proton-proton colliders (Gilberto Tetlalmatzi-Xolocotzi)
 - Invariant mass distribution of di-Higgs production at HL-LHC in the 2HDM (Kateryna Radchenko)
 - Search for the Higgs boson pair production in the $b\bar{b}\mu^+\mu^-$ final state at the LHC (Botao Guo)



HH cross group meetings in 2022

- November 28th (today!)
 - **Parallel session #2 (11:00-12:30 CET)**
 - Top Yukawa corrections (Michael Spira)
 - Higgs Pair Production in a Composite 2HDM (Felix Egle)
 - Linking Higgs pair production with an SFOEWPT in a 2HDM-EFT (Lisa Biermann)
 - NLO+PS study of bbH background to HH (Javier Mazzitelli)

HH cross group meetings in 2022

- November 28th (today!)
 - **Plenary session (16:00-18:00)**
 - ATLAS - experimental summary (William Balunas)
 - CMS - experimental summary (Torben Lange)
 - Benchmarking resonant di-Higgs production in extended scalar sectors (Duarte Azevedo)
 - HH at N3LO+N3LL (Ajath ABDUL HAMEED)
 - Effective Field Theories in Higgs boson pair production (Jannis Lang)



The traditional **DiHiggsmass** tree, back on display for the first time since 2019



BACKUP

