

Introduction to the HH discussion

(in the context of today's EF01 & EF02 joint meeting, H stands for the H125 boson)

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(on behalf of EF01 and EF02 conveners)

EF01 & EF02 Joint Meeting

May 27, 2020

Best strategies and ultimate sensitivities in

- measuring HH production (also HHH)
- extracting physics parameters of interest

Physics of interest:

- Establish $H^* \rightarrow HH$ (λ_H ; anything else to affirm SM-like production?). If not SM-like, challenge of disentangling BSM
- Search for resonant $X \rightarrow HH$. If seen, what can we learn about X and how well?
- Establish VVHH quartic couplings
- (Also, quartic HHHH coupling, $H^* \rightarrow HHH$)

Matrix of possibilities:

- **Colliders (HL-LHC, FCC-hh, FCC-ee, Linear ee, ep collider, muon collider, photon collider; beam polarizations, energy scans)**
- Final Higgs decay modes: $HH \rightarrow (xx)(yy)$
- Total cross sections
- Differential cross sections by HH observables: e.g., $p_T(HH)$, $m(HH)$, angular distributions for $(xx)(yy)$, etc.
- Exclusive production modes: e.g., $gg \rightarrow HH$, $VBF \rightarrow HH$, etc.
- Are there unexplored HH observables or analysis strategies that may be particularly sensitive to some specific BSM?

Best sensitivities via combinations

- Different experimental HH observables (also HHH)
- Including single-Higgs observables sensitive to the same physics of interest via loop corrections

It is important to keep in mind all colliders: The decision on the future collider will be based on a large number of considerations; in our specific, say HH, studies, we should not dismiss automatically any collider just because it may not appear to be competitive for the HH physics

Today we have three talks meant to be primers for discussion and thinking

Theoretical Opportunities in double Higgs production

Speaker: Christophe Englert

Experimental challenges in double Higgs production at HL-LHC

Speaker: Maria Cepeda (CERN)

New ideas about HH ¶

Speaker: Javier Duarte (University of California San Diego)

The matrix of possibilities is large: it is important to sort out

- what is already reasonably well studied (and we see no room for significant improvements)
- which promising opportunities remain underexplored or unexplored (both experimentally and theoretically)
- and which of such opportunities can be addressed on a time scale of one year

The July 9-10 Energy Frontier workshop (may change to last 3 shorter days)

- Each topical group will have a 2-hour parallel session
- EF01, EF02, EF04 sessions do not overlap in time

Please volunteer to give talks with your proposals/ideas