

EF01 Kick-off Meeting

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EF01: Higgs Properties

- **Much work has been done**, and our goal is to build on existing work and identify areas where the physics landscape has changed or there are missing experimental or theory studies
- Goal is to **identify opportunities** with different future high energy accelerators (pp, e^+e^- , ep) to explore Higgs physics and the underlying electroweak symmetry breaking
- **Wide mandate**: ~All high energy Higgs physics is in EF01 (SM) and EF02(BSM)
- Clearly, there is overlap with precision measurements that are sensitive to Higgs effects (Intensity frontier group)

EF01: Higgs Boson Properties and Couplings

- **Higgs mass:** What is ultimate precision?
- **Higgs width:**
 - What are prospects at future hadron colliders and e^+e^- colliders—how do assumptions vary?
 - What improvements on current studies can we envision, both theoretically and experimentally?
 - Compare Higgs width from direct measurements and Higgs width inferred from global fits at future machines

Use existing studies to make consistent comparisons between opportunities

EF01: Higgs Boson Properties and Couplings

- **Higgs production modes:**
 - Are there theory and experimental advances in ttH, VH, gluon fusion, VBF studies since ESG?
 - How can we better include both inclusive and **differential measurements** into extractions of Higgs properties?
 - What experimental measurements will be limited by theory? **Can we make a Snowmass wish list? (both for e^+e^- and pp?)**
 - What are opportunities for measurements of Higgs couplings at large Q^2 , via correlations among different processes and kinematical regimes?
 - Is there an optimal way to present data?

This effort has a large overlap with LHC HXSNWG, FCC working groups and e^+e^- study groups

EF01: Higgs Boson Properties and Couplings

- Anomalous Higgs couplings, including **CP violating couplings**, and connection to global EFT fits (EF04)
- Extraction of **Higgs coupling properties**
 - Higgs couplings must be determined in a big picture framework including VV, tt, EWPO....
 - This is part of a **global analysis** with EF04 and it will be a joint effort, with EF01 responsible for the Higgs portion of the study
- **Rare decays**, including $H \rightarrow \mu\mu$, $H \rightarrow cc$
- How well can $H \rightarrow$ invisible be measured? And what are the assumptions?
- What is ultimate precision on loop induced decays?

EF01: Higgs Boson Properties and Couplings

- **Double Higgs production**, both resonant and non-resonant
 - Are there missing experimental studies?
 - Is there missing theory?
 - How to optimally include double Higgs limits in fits using single Higgs data?
 - Can we construct benchmark points?
- Clear overlap with EF02 on resonant HH production and joint meetings planned
 - Are there unexplored signatures? Production of different mass Higgs? Or non-SM decays?
- Has the physics landscape changed since ESG?

Going forward

- Energy frontier kick-off, May 21
- Next meetings of EF01
 - May 27, Joint with EF02 on di-Higgs production
 - June 10, Discussion of differential Higgs measurements and needed theory and experimental inputs

If you would like to give a presentation at our meetings, please email us
We plan further surveys of existing work

Going forward

- Please contribute. **Snowmass is open to all!**
- Please suggest topics for our bi-weekly meetings (volunteer yourself or someone else)
- Please fill out questionnaire about your possible efforts (**THIS IS NOT A COMMITMENT!**)
- We plan to begin by discussing and **reviewing** existing efforts to see where we can contribute
- Today:
 - European Strategy Group effort on Higgs properties
 - e^+e^- effort on (selected topics) of Higgs physics

Communication

- Email: SNOWMASS-EF01-Higgs_properties@fnal.gov
- Slack channel: ef01-Higgs_properties
- Information on TWIKI: <https://snowmass21.org/energy/higgs>
- Meetings calendar:
https://snowmass21.org/energy/start#topical_group_pages