Interim recommendations to explore the coupling structure of a Higgs-like particle

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Scope of the document

Both experiments and the theory community are very interested in exploring the properties of the 125 GeV excess. The aim of the document on the "Higgs couplings" is:

- Define as exactly as possible the framework with which experiments extract coupling information:
  - Results using the same symbols should have the same content
  - Theory can understand, interpret and use quantitative results
- Define benchmarks for coupling "measurements":
  - Benchmarks need to be sensitive with current data
    $\rightarrow$ only 2-3 independent parameters can be fitted
  - Benchmarks should be as versatile as possible today
    $\rightarrow$ probe different possible deviation from the SM
    $\rightarrow$ keep SM assumptions on other aspects of Higgs physics
  - Experimental results should be directly suited for theory interpretation and comparison to BSM predictions:
    $\rightarrow$ avoid the need to use experimental signal strength μ
    information for all channels without correlations

Procedure for the document

There is a lot of pressure to finalize the recommendations as soon as possible
- Discuss framework and benchmarks today in the meeting and collect feedback from the theory and experiment communities (until early next week)
- Include feedback that helps
  - Better define the framework
  - Improve benchmarks to be more versatile, but still meaningful with current data
- For now we will not include
  - Spin/CP (will be a separate document)
  - Specific tests of BSM theories
  - BSM effective Lagrangian approaches and anomalous coupling discussions
- However: update the document once experimental or theory developments indicate an update is needed
- Send to arXiv

Spin/CP

- Discussion in the LM group focused mostly on the coupling strength sector

- Dedicated meetings on Spin/CP are planned for the near future (<1 month)

- Scope is to provide a similar recommendation document also for Spin/CP

BSM coupling fits

- The current LO motivated coupling fits are not the final answer, but suitable for now given the current data precision
  - This will hopefully not be the case for too long...

- If a deviation from the SM appears in the Higgs coupling sector, we will need to move to an improved procedure that is valid beyond the SM

- One can expect exciting discussions for the coming months (and years) with many proposals depending on experimental results
- Standard theory tools will need to evolve in parallel to allow precise calculations within agreed BSM model(s)

Future

How particle physics works:
- Experiments measure something
- Theory community hypothesizes on new physics
- Experiments pick up the hypotheses and search for "it"

Need to activate this loop in the Higgs sector
- Experiments measure coupling strength related information (later also Spin/CP, BSM anomalous couplings, ...)
- Theory communities who build BSM theories guided by the observations should provide feedback on implications on what new things experiments could observe (inside or outside the Higgs sector)

Summary

- **Submit coupling recommendation very soon**

- **Dedicated Spin/CP meeting(s) and recommendations**

- **Trigger BSM Higgs model discussion and experimental consequences**

Discussion of draft