

Area 3: Experimental Measurements and Observables

Links to previous Area 3 meetings:

Jan. 11, 2021: <https://indico.cern.ch/category/12671/>

Feb. 22, 2021 (Joint Area 3-4 meeting): <https://indico.cern.ch/event/1007581/>

Links to previous LHC EFT WG general meetings:

Oct 19-20, 2020: <https://indico.cern.ch/event/943996/>

May 3, 2021: <https://indico.cern.ch/event/1016713/> ← Find the Area notes here

Please add below any comments or suggestions related to the Area 3 activities and the Area 3 note draft, indicating your name and email so we can contact you in case of doubts.

Please use the following format: Comment - Name (Email)

Comments/Suggestions:

Juan Rojo (j.rojo@vu.nl) Some comments and suggestions concerning what could be included in the Area 3 note draft are the following:

- A first piece of useful information is the sensitivity of a given measurement of a specific observable associated to a given channel (using the note terminology) on a given Wilson coefficient. This question has different answers, depending on whether one considers a single coefficient at a time or multiple of them.
- A possible common tool to quantify this information is the Fisher information matrix (information geometry) combined with the principal component analysis. The diagonal entries of the fisher matrix quantify the relative sensitivity of given measurement/observable/channel to a given Wilson coefficient, setting all other coeffs to zero. Then the PCA tells us how this information is “spread out” once multiple directions in the parameter space are activated at once. I think that considering multiple directions is really important: individual sensitivity can be rather misleading, with individual bounds differing by very large amounts from the global marginalised ones.

- From the practical point of view, we need to agree on which statistical tools can be used to quantify sensitivity. Then agree on the dataset to be considered, and also how granular the comparison can be. In the most extreme case, one can consider the bin-by-bin sensitivity, but then one loses information on correlations (and with more than 300 points in the global EFT fit this is not very practical)
- Concerning delivery, more information is always better. Specifically, experiments should always deliver the full covariance matrix with the breakout of individual systematics. Eventually, collaborations may transition to releasing full likelihoods, but this will still take some time I presume.
- It would be nice to start on some activity of moderate scope, for example looking only at top quark data, to set up the tools, interfaces, and data formats. Different groups use different tools to quantify sensitivity so we need to agree on a specific one, and check that everyone gets the same “physical interpretation”, else we would not be making any progress.
- At the end of the day, what we want for this Area 3 note is an extensive analysis which compares the relative strengths and weaknesses of measurement/observables/channels such that guidance to inform future efforts from the experiments are informed. Very importantly, the conclusions of the sensitivity depend on the underlying settings of the EFT calculations: one gets quite different messages e.g. in linear and in quadratic fits, so also here we must decide what to do.
- Furthermore, while all these sensitivity tools provide useful info, at the end of the day the most effective way of quantifying sensitivity is to actually carry out EFT fits. One needs to verify that the “lessons” learned from this various statistical sensitivity tools are then reproduced when the actual fit is carried out.