

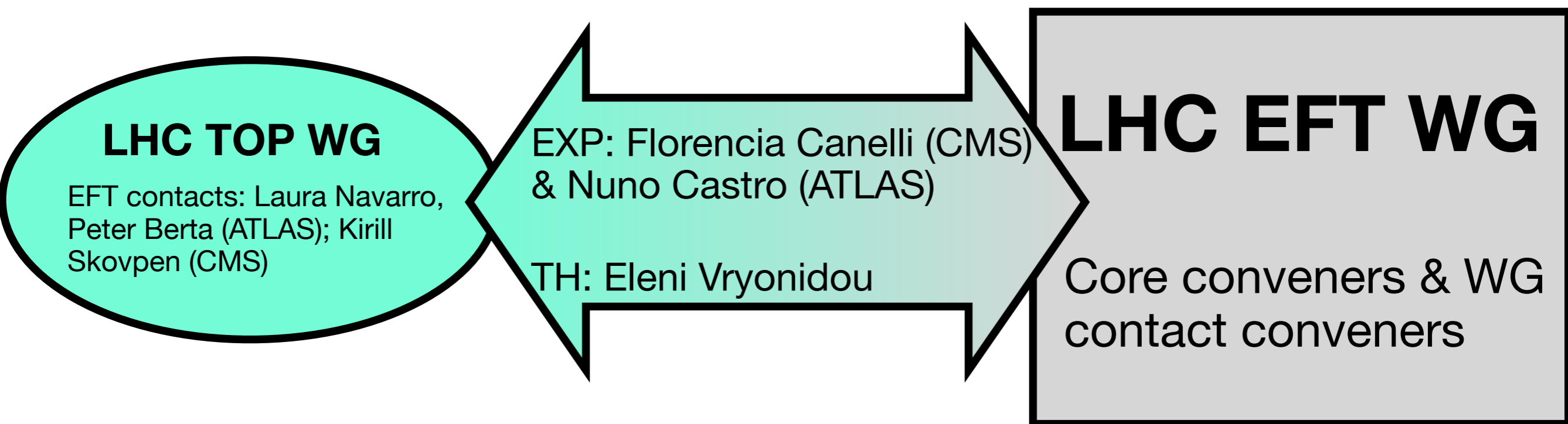
Report on 1st EFT workshop

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LHC EFT WG

- Established in Summer 2020 to bring together LHC experiments & Theory community towards “global” EFT interpretation of LHC data.
- Full mandate & list of 15 conveners at <https://lpsc.web.cern.ch/lhc-eft-wg>
- Draft document outlining the targets and priorities for the WG: <http://cern.ch/go/P7sV>
 - Up for discussion in the first General Meeting

Organisation



First General meeting

Agenda

Held on October 19-20: indico.cern.ch/e/943996

- Introduction & Theory overview
- Report on EFT efforts in ATLAS & CMS
- Reports on EFT activities in the LHC Electroweak, Higgs and Top groups
- Talks on related but external topics:
 - EFT projections for the European Strategy
 - LHC Reinterpretation Forum
 - Non-LHC EFT inputs, especially flavour
- EFTWG goals & priorities

EFT WG organisation

1. EFT Formalism
2. Predictions and Tools
3. Experimental measurements and observables
4. Fits and related systematics
5. Benchmark scenarios

EFT WG efforts

First outline of the WG activities and targets

(larger # of *s reflects higher level of priority)

1. EFT Formalism

The starting point for the calculations and fits: what operators, what bases, what perturbation orders, how to combine operators of different dimensions, what constraints to be put in the EFT bases preparation, practical considerations in connection to experimental analyses, flavour and symmetry assumptions. The following issues will be discussed:

- **SMEFT bases/notation/normalization/input schemes**, etc (***) : common conventions, consistency checks among the experiments and streamlining translations among conventions will be required, before any combination is considered. These will be defined on a case by case basis, depending on the specific set of observables included in a given combination.
- **Assumptions about the flavour symmetries, and other symmetries like CP**
- **Definition of scenarios, also for the purposes of doing fit with limited data, and as benchmarks for the presentation of experimental results**
- Truncation, quadratic dependences, double insertions, dimension eight contributions, uncertainty prescription, EFT validity (information required from experiments to ensure validity at the interpretation stage) (**)
- TH constraints (unitarity, positivity, etc.) and incorporation into fit results (**)
- Consideration of beyond-SMEFT EFT frameworks, where relevant

2. Predictions and tools

Addressing all issues of how to simulate EFT and generate events; understanding of the limitations of the models and agreements on the way to proceed in the EFT publications and calculations. Identification and estimation of all relevant theory systematics, and calculation in a form which is usable in likelihood fits by the experimental community; investigation of matters related to the computational limitations in the events production for experimental analyses.

- Guidance
 - **Availability (analytic & numeric), usage, assumptions, uncertainties, interplay of tools (**)**
 - Reweighting techniques to reduce the full detector simulation sample size (and validation of those techniques) (***)
 - **Higher-order corrections in SM couplings (**)**
- Deliverables
 - **Cross-validation at tree and loop levels (**)**
 - Common MC generation and/or settings across experiments
 - Observable calculations (including e.g. fiducial cross-sections, see [Area 3.](#)) and analytical parameterizations (also to NLO), comparisons between tools, uncertainties (**)
 - Tools to relate parameters, measured quantities, etc

Future Plans

Meetings on all the 5 areas

– Call for contributions sent out on the lhc-eftwg@cern.ch egroup.

See next slide for dates & organizers.

– Meetings will be held remotely on Zoom (European afternoon)

• Goals:

– Gather & review inputs on topics

– Define short term deliverables & work plan. → Follow up with topical meetings, and converge to documents or recommendations

Planned Meetings

Organisers

1. Dec. 7: EFT Formalism

Ilaria Brivio, Sally Dawson, Gauthier Durieux, Pierre Savard

2. Dec. 14: Predictions and tools

Ilaria Brivio, Céline Degrande, Pietro Govoni, Giovanni Petrucciani, Eleni Vryonidou

3. Jan. 11: Experimental measurements and observables

Nuno Castro, Pietro Govoni, Andrei Gritsan, Eleni Vryonidou

4. Jan. 27: Fits and related systematics

Nicolas Berger, Florencia Canelli, Nuno Castro, Jorge de Blas, Giovanni Petrucciani

5. Feb. 8: Benchmark scenarios from UV models

Sally Dawson, Admir Greljo, Kristin Lohwasser

Indico: <https://indico.cern.ch/category/12671/> (empty for now)

Future Directions for top WG

How to improve EFT top experimental analyses?

- * Beyond the current approaches in top EFT efforts, should one consider Simplified Template Cross-Sections like in Higgs?
 - * STXS approach to be explored by ATLAS & CMS
- * Consider ML optimised observables to maximise sensitivity
- * Include maximal information in analyses: parametrisation of background, acceptance, and unfolding correction and consider making likelihood available from detector level results
 - * Common format to facilitate combinations with other analyses
- * Optimisation of tools usage to accommodate increasing number of operators: e.g. reweighting (compatible with NLO predictions?)
- * Higher order effects in EFT: so far mostly LO predictions
 - * Plan to include NLO QCD when possible (arXiv:2008.11743)
 - * Expect recommendation of top WG

Discussion points shared by all WGs

Topics to be addressed by the EFT WG

- * Higher-order terms in $1/\Lambda$ expansion: dim6 quadratic terms, dim6 double insertions/dim8 operators etc (CMS exploring multiple dim6 insertions-typically linear and quadratic fits compared)
- * EFT validity and EFT uncertainties
- * Higher order corrections in SM couplings: QCD and EW corrections for EFT?
- * How to facilitate global combinations going beyond Top-only or Higgs-only or EW-only?
- * How to reliably include non-LHC data: EWPOs, Flavour, low energy experiments?