

LHC EFT WG

Third area 1 meeting

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with Ilaria Brivio, Sally Dawson, Jorge de Blas, Pietro Govoni, Pierre Savard
on behalf of WG conveners

2020-10-20: [First general meeting](#)

2020-12-07: [First area 1 meeting](#)

2021-01-19: [Second area 1 meeting](#)

2021-05-03: [Second general meeting](#)



Area 1. EFT formalism

a. Bases, notations, inputs^{***}

common conventions, translations, common EW inputs

preliminary note

here

b. Assumptions^{***}

flavour structures, classes of BSM, symmetries

c. Truncation, uncertainties, validity^{**}

linear/quadratic, double ins., dim-8, trunc. errors, etc.

preliminary note

here

d. Theory constraints^{**}

unitarity, positivity, incorporation in fits

Meeting plan

1. Quick refresher on the notes
2. Feedback from ATLAS & CMS
3. Written comments and discussion points
4. Discussion

The screenshot shows a Zoom meeting agenda for 'Area 1, EFT formalism' on Monday, 28 June 2021, from 14:00 to 18:00 CEST in Zurich. The meeting is moderated by Gauthier Durieux. The agenda includes:

- 14:00 - 14:15 Introduction**
- 14:20 - 14:40 Feedback from ATLAS** (Speaker: Hannah Milder)
- 14:50 - 15:10 Feedback from CMS** (Speaker: Alexander Josef Grobjan)
- 15:20 - 15:30 Summary of points for discussion**
- 15:35 - 16:35 Discussion**

Electroweak input parameters

Options for EFT at the LHC

Include non-inputs as constraints!

$\{\alpha, G_\mu, m_Z\}$

$\{G_\mu, m_Z, m_W\}$

$\{\alpha, m_Z, m_W\}$

+used for EWPO
in the past+

+used in tools+

–less used–

+most precise inputs+

– m_W measurements actively pursued–

–EFT dependent W pole–

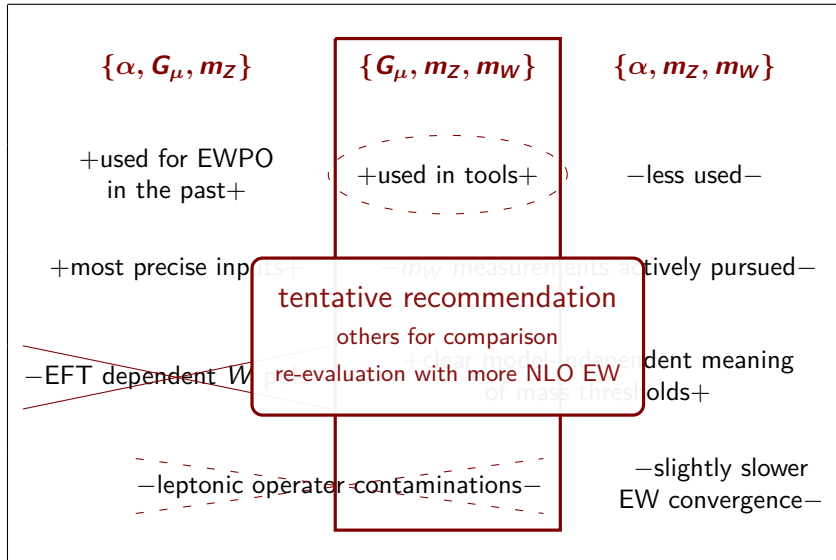
+clear model-independent meaning
of mass thresholds+

–leptonic operator contaminations–

–slightly slower
EW convergence–

Options for EFT at the LHC

Include non-inputs as constraints!



Truncation, uncertainties, validity

Common ground

1. dim-6 truncation in the near future
EFT validity = dim-6 matches full model
2. well-defined squares of single dim-6 insertions “(dim-6)²”
translatable exactly between dim-6 bases
3. required UV assumptions to compare dim-6 and -8 magnitudes
UV-dependent EFT validity (e.g. using a *power counting*)

Theory proposals A & B

based on [HXS WG '16], [LHC TOP WG '18]

A: [proposal](#), [video](#), [slides](#), Contino, Falkowski, Goertz, Grojean, Maltoni, Panico, Riva, Wulzer
B: [proposal](#), [video](#), Degrande, Maltoni, Mimasu, Vryonidou, Zhang

1. multi-dimensional likelihoods in EFT space

→ interpretability required for validity

2. quadratic [default] vs. linear comparison

→ qualitative validity: *broad* or *restricted*

3. control over probed scale

(e.g. sliding upper cut= $E_{\text{cut}}=M_{\text{cut}}=\text{clipping}$, double differential, etc.)

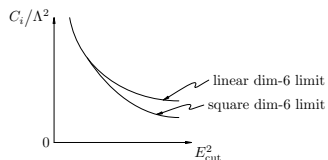
→ re-design analyses, also for sensitivity

→ global combinations?

4. interpretation & validity *a posteriori*

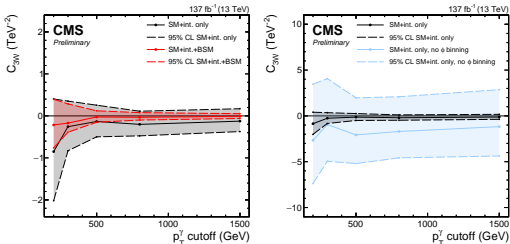
→ retain UV independence till then

→ quantifying dim-8?

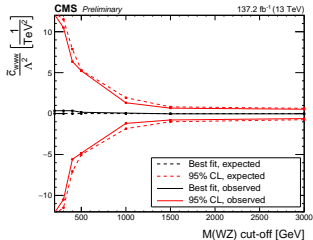


Clipping implementation examples

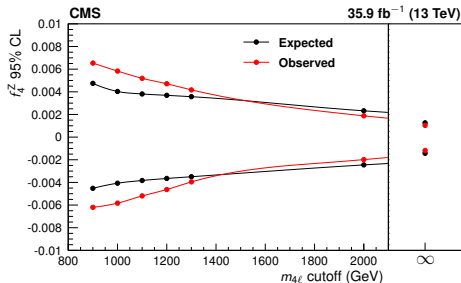
$W\gamma$ [CMS-SMP-20-005]



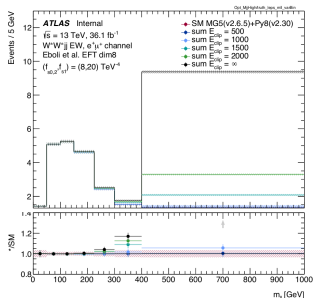
WZ [CMS-SMP-20-014]



ZZ [CMS-SMP-16-017]



same-sign WW [ATLAS]



Theory proposal C

1. $(\text{dim-6})^2$ as proxies for dim-8 interferences
2. many models encompassed in one power counting rule
 → models to be covered?
3. signal: linear dim-6
 unc.: known $(\text{dim-6})^2 + \text{dim-8}$ estimates
4. unc. fed into EXP analyses
 → folding-in UV assumption for dim-8 estimate
5. unc. = $\pm(\text{dim-6})^2 \times \left(1 + \sqrt{N_8} \frac{g_{\text{SM}}^2}{c_6 \Lambda^2} \sqrt{1 + \frac{1}{c_6^2 \Lambda^4}}\right)$
 → models covered?

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