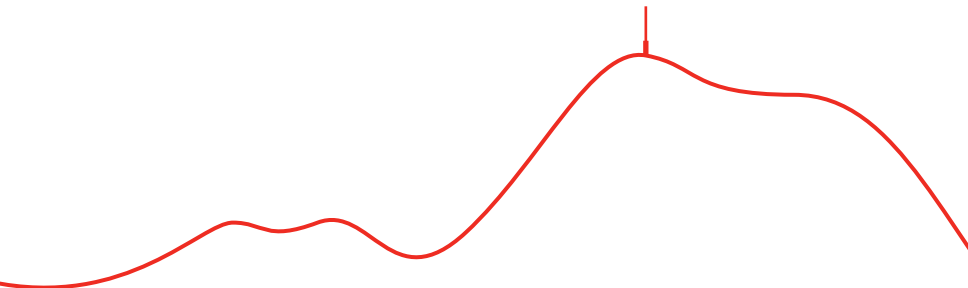


EFT interpretation in $t\bar{t}HH$

M2 internship proposal



EFT (Theory)

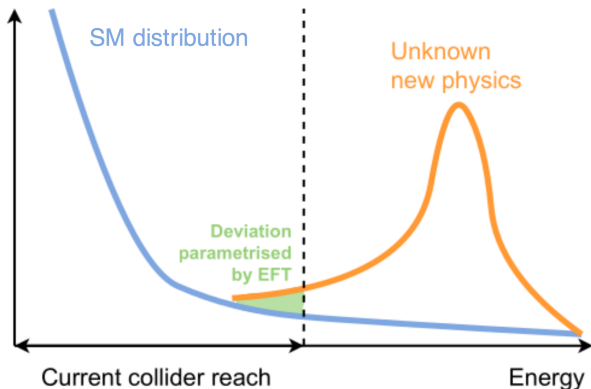
Effective field theories (EFT) are a way to parametrize the effects of new physics in a model-independent way.

$$\mathcal{L} = \mathcal{L}_{\text{SM}} + \sum_{d=5}^{\infty} \sum_i \frac{c_{i,d}}{\Lambda^{d-4}} \mathcal{O}_i^{(d)}$$

It consists in adding higher-dimensional d operators to the SM Lagrangian, with coefficients c_i and a scale Λ .

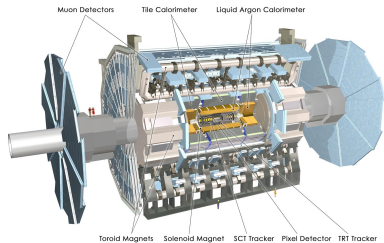
This can be done in different basis, and sometimes under some approximations...

EFT (Experimental)

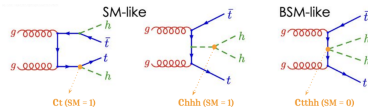


Deviations can already be observed !

ttHH in ATLAS



- ATLAS is a general-purpose detector at the LHC
- ttHH is a rare process in the SM
 - Sensitive to new vertices and couplings
 - Can be used to test EFT predictions which can modify the kinematics of the final state and the cross-section



Tasks

Your tasks will include:

- Production of simulated events for the $t\bar{t}HH$ process (using the MadGraph Monte Carlo generator)
- Study the impact of EFT operators on the cross-section of the $t\bar{t}HH$ process
- Study the impact of EFT operators on kinematics of the $t\bar{t}HH$ process
 - Producing histograms of kinematic variables for different values of the EFT coefficients (using the ROOT framework)
 - Study the differences of different parametrisations (basis) of the EFT operators
 - Identify relevant variables sensitive to EFT effects

Contacts

Supervisors :

- Adrien AURIOL (adrien.auriol@cern.ch)
- Romain MADAR (romain.madar@cern.ch)

Context :

- Work within the ATLAS group at LPCA
- If you are interested and did not apply yet, please do so by the end of **Friday 6th December** as we already had a lot of candidates
 - Please include your M1 marks and the M2 marks you already have (even if they are not official yet) together with a CV in your application
- Continuation in PhD possible for the successful candidate, but funded via the École Doctorale.

Feel free to ask any question now or via email! :)