Considerations on the Flavor assumptions proposal by the LHC EFT WG

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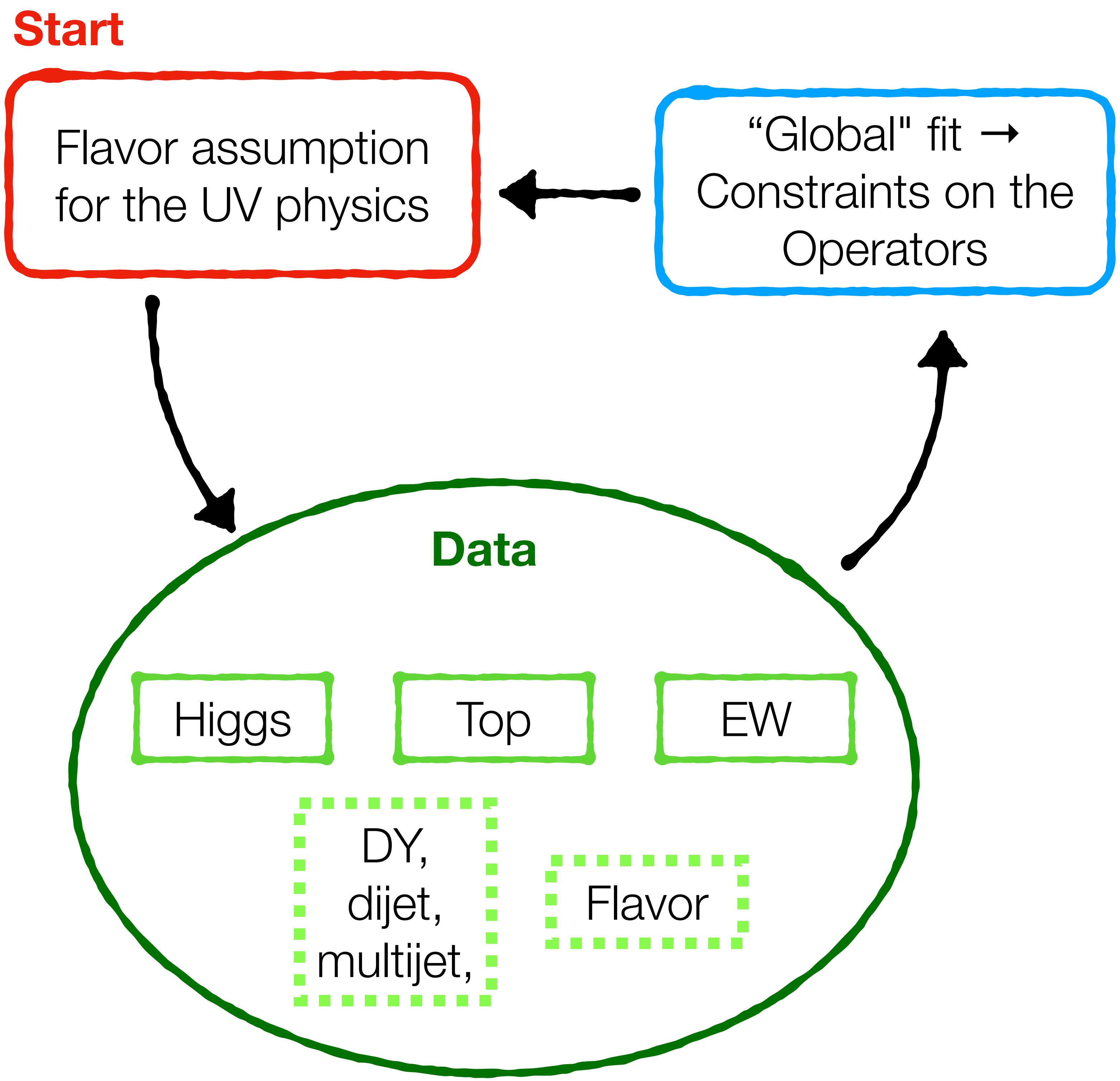
Flavor assumptions: a top-down approach



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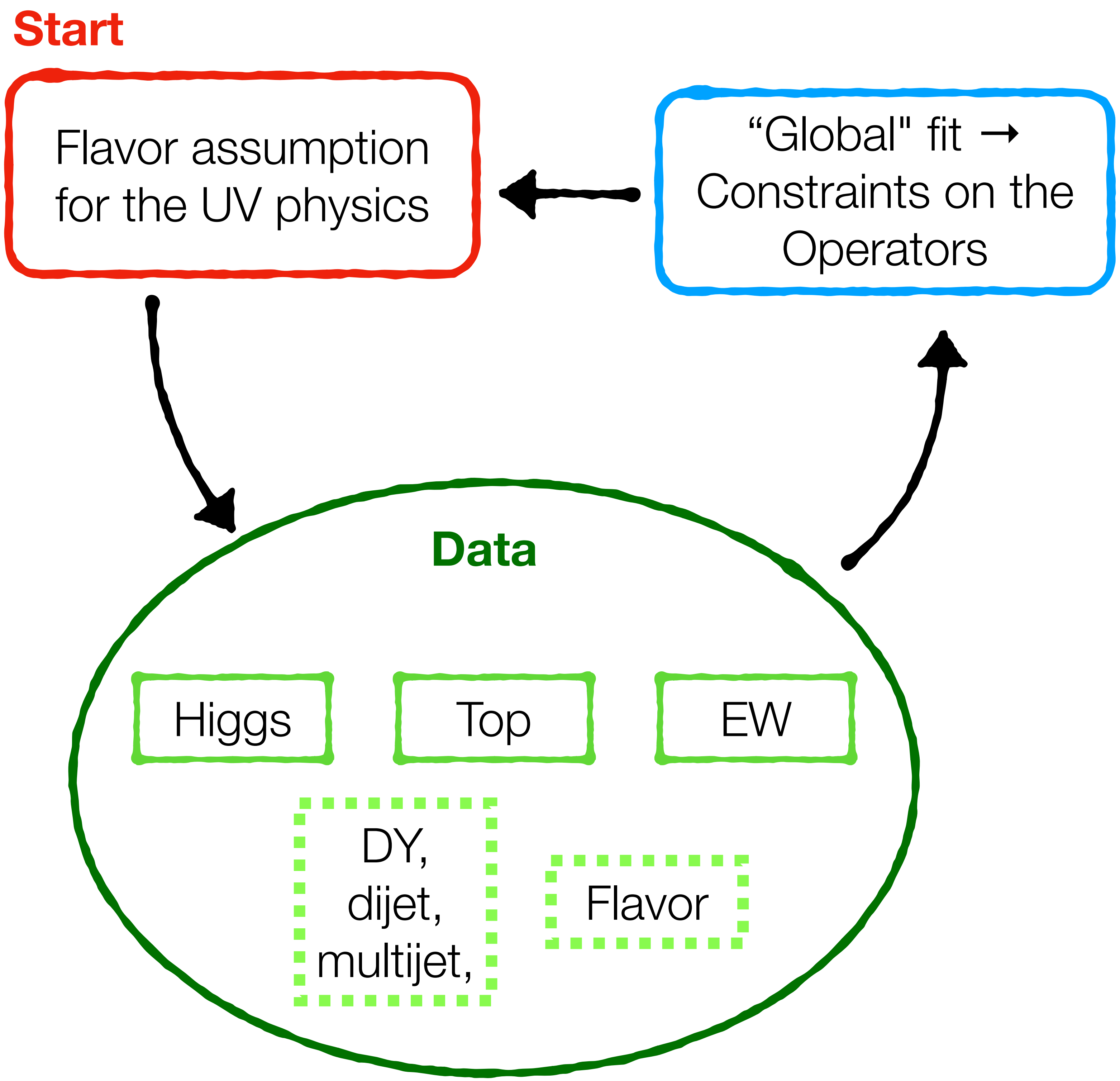

PROS

- Limit the Nr. of operators, globally
- Optimise the sensitivity on the specific theories that satisfy the assumptions

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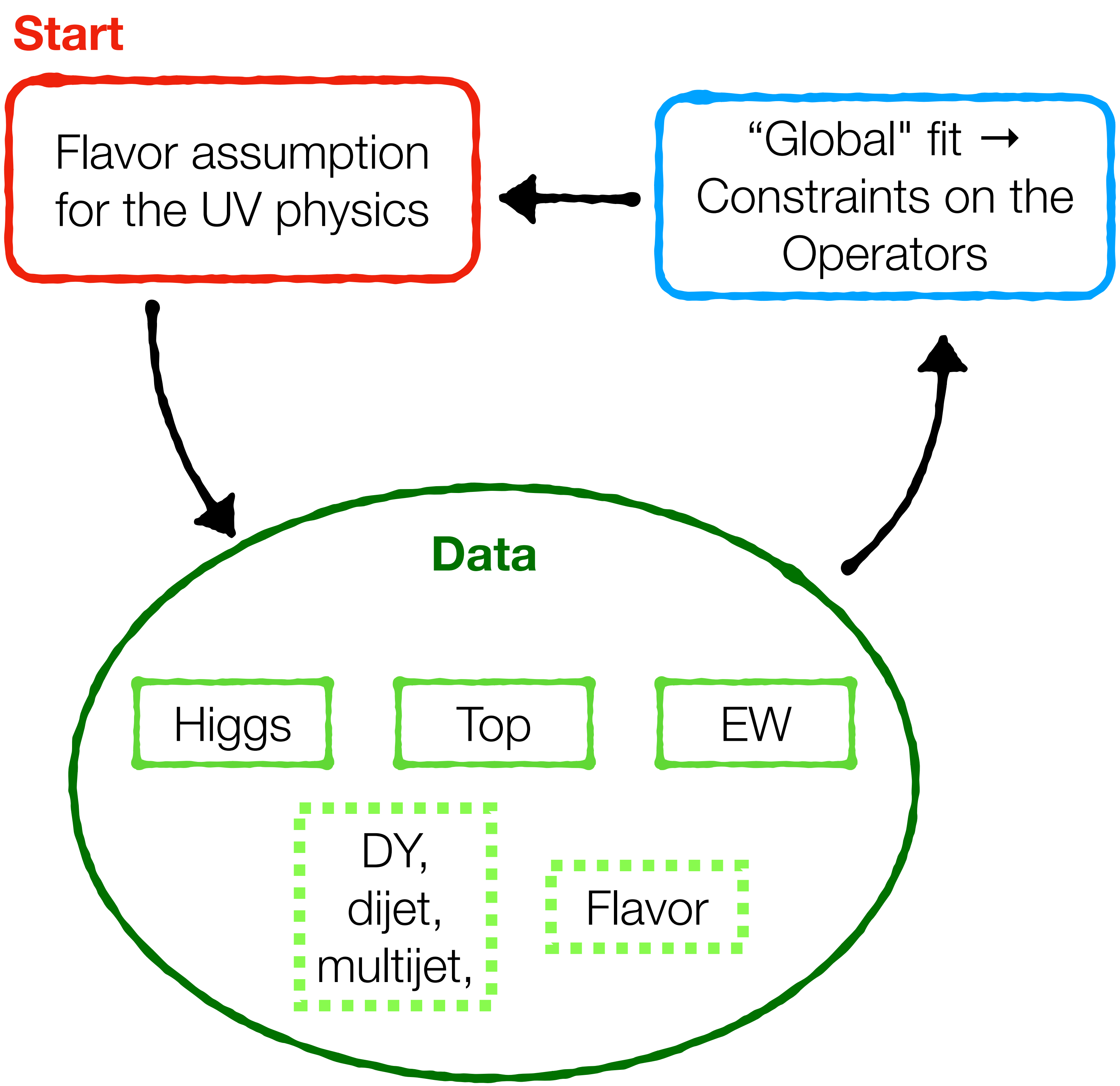

PROS

- Limit the Nr. of operators, globally
- Optimise the sensitivity on the specific theories that satisfy the assumptions

CONS

- Need to choose (and stick to) a specific flavor assumption
- Realistically, only a few simple choices can be implemented

We don't know what New Physics will look like

- It will not be possible to generalise the assumption at a later time

Alternative: bottom-up

Each process in each of these classes typically receives **relevant** contributions from **a few dim-6 operators**

1. Assume **M_{NP} ≳ 1 TeV** (i.e. assume EFT is valid, neglect dim-8 operators)

2. For each process include contributions from **ALL RELEVANT operators**
   (e.g. operators that give a measurable contribution assuming a large but reasonable coefficient, like $C \sim (4\pi)/M_{NP}^2$, or coefficient as big as allowed by other data — flavor, LEP, etc..)

3. Given the data of that process, one obtains a likelihood for the coefficients contributing:

$$\mathcal{L}_p(C_i)$$

4. Combine all the likelihoods from all Higgs, EW, Top (etc.) processes

$$\mathcal{L}_{SMEFT}(C_i) = \prod_{p \in \{\text{Higgs, Top, EW, High-pT, flavor}\}} \mathcal{L}_p(C_i)$$

UV assumptions can then be implemented (and changed) **a posteriori** to check specific scenarios.

Alternative: bottom-up

Start

Data

Higgs | Top | EW | DY, dijet, multijet, | Flavor

Likelihoods from each process are combined into classes of processes

$$\mathcal{L}_{Higgs} \quad \mathcal{L}_{Top} \quad \mathcal{L}_{Z\to\bar{\psi}\psi} \quad \mathcal{L}_{W\to\bar{\psi}\psi} \quad \mathcal{L}_{TGC} \quad \mathcal{L}_{DY} \quad \ldots$$

Which are then combined into a global likelihood

$$\mathcal{L}_{SMEFT}(C_i) = \prod_{P \in \{Higgs,\, Top,\, EW,\, High\text{-}p_T,\, flavor\}} \mathcal{L}_P(C_i)$$

Doable?

Why not?

It has **already been done** (with different approaches) for a large class of flavour + Z-pole observables by the *Flavio* + *Wilson* + *Smelli* and *HEP-fit* projects

de Blas et al. 1910.14012; Aebisher, Kumar, Stangl, Straub 1810.08132, 1804.05033, 1810.07698 https://flav-io.github.io/

Flavio

Featured processes

- B^0, B_s, K^0, and D^0 mixing
- Rare inclusive and exclusive B decays
- Semi-leptonic B, D, and K decays
- Lepton flavour violating τ and μ decays
- Z pole electroweak precision tests
- Lepton anomalous magnetic moments
- Paramagnetic and neutron electric dipole moments

The extra effort that might be needed to set-up such an approach will be compensated by the greater generality and usefulness of the result.