GDR-InF "hands-on" project:

Combination and interpretation of experimental results

Summary (16 October 2020)

Subject

In precision flavour physics, one needs to study many small deviations from the Standard Model in many observables in order to determine whether they are only fluctuations or design a consistent pattern hinting at New Physics. Since large sets of data must be analysed altogether, it is important to have a common framework for all the measurements, keeping track of correlations among statistical and systematic uncertainties. Moreover, the sensitivity of the experimental results to the underlying theoretical assumptions must be taken into account.

In many of these situations experimentalists and theorists are led to exchange "private" information in a way that is not fully controlled, either to update data with respect to external inputs, to perform new averages between different experiments, or to interpret data in a way that was not foreseen by the original analysis.

We have tried to have a look at a few specific examples, in order to suggest ways to improve the exchange of information in our field.

Organisation

- ~~"Hand's on" project~~ ⇒ Informal discussions
- Indico : https://indico.in2p3.fr/event/22201/
- Mattermost : hands-on-combination-and-interpretation-of-exp-results
- 15 registered participants
- 3 meetings :
  - Wed., 30 Sept., Fri., 9 Oct., Wed. 14 Oct.
  - 1h - 1h30 each
  - 8-12 participants
  - discussed topics brought up by the participants

Some examples of discussed issues

- Update of results when external inputs are updated

  some tricky cases such as : LHCb $B_s \to \mu\mu$ [arXiv 1703.05747] using 2 normalisation modes

  ⇒ important that all necessary information is easily found in the publication, at the same level of the main result(s)

- Combination of distributions with different binning schemes

  ⇒ no clear way to solve this issue in a model-independent frame

- Data recasting
  - 'simple' cases : LHCb $B \to K^{*}\tau\mu$ or $B \to K\mu e$ signals simulated using a flat phase-space

  ⇒ limit on the BR can be reinterpreted a posteriori if the efficiency map is provided
  - neglecting the muon mass in $b \to s\ell\ell$ measurements has an effect in some q^2 bins

  ⇒ m_μ=0 assumption can be approximately relaxed in the measurement interpretation [arXiv 1510.04239]. It could be possible to do better by choosing a more suitable parametrisation of the data distribution

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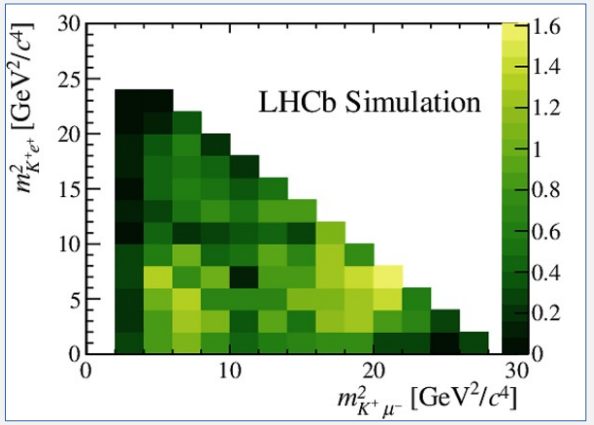
Efficiency map for $B \to K\mu e$



[arXiv 1909.01010]

Outcome

We agreed that there is room for improvement in the way that experimental results are published, to ease further updates, averages, and phenomenological interpretation.

For example experimental papers should make very clear which reported quantities are actually directly measured, and which ones depend on external inputs together with the complete information on how to reproduce them.

The recasting problem is a more delicate question, but case-by-case improvement is expected from a better exchange of information between experimentalists, theorists and members of averaging groups.

Recommendations for 'good practices' could be a way to implement these suggestions, and could be refined and spread by 'certified' averaging groups (HFLAV, PDG).