Talk Title
Lepton Flavour Universality: The Experimental View

25+5 min

From CMS

Sun, Jun 30, 12:31 PM
Georgios Karathanasis <georgios.karathanasis@cern (19 hours ago)
to Arnd, cms-conf-group-bph, cms-conf-group-exo, cms-conf-group-smp, cms-conf-group-hig, Jose

Hello,

Please take the RK summary plot from the paper (attached) and not PAS.
The plot in the attached paper omits the LHCb measurement published in Nat. Phys. 18 (2022) 277-282 (but the caption has not been updated since it still mentions three superseded results, while only two are shown). I feel the plot I use with all three superseded measurements is more informative and conveys the message of how difficult this measurements are.
Also there is the R(J/psi)->leptonic that can be added.
I included on the slide.

Best,
George

From LHCB

Renato Quagliani <renato.quagliani@cern.ch>
to Yiming, sevahsen@hawaii.edu, lhcb-sb-chair, lhcb-sb-belle2-talks

Dear Yiming, all

Here few comments from LHCb-RD side:

- In Slide 15, it might be better to quote RK*+ and RKShort rather than R(K*
Time ordered (first 2019 result and the 2022), quoting all three results.

- We suggest that the previous results are shown with the 'decay mode + integrated luminosity collected', since the RK*0 referenced is the one with Run1 only and the next slide shows the full dataset result. The link to RK*+ and RKshort is provided separately at the bottom of the page and probably deserve a separated bullet.
I put them in a bullet and indicated the sample for RK*0

If you plan to make such update [listing all the results from LHCb on the modes before the R(X) simultaneous one], we also think **R(pK)** might be of relevance to be mentioned [used Run1 + 2016 data].
You are right, I overlooked it. I'll mention it.

- Again on slide 15 it might be better to call the slide "b-> s ll LFU hope" if the speaker really wants the word "hope" in the talk.
I removed the word "hope". Now it is "b->sll signals"
In our opinion, being the angular analyses in muon channels still in tension to SM and having CMS recently obtained a very similar result to LHCb with much improved stat uncertainty, it would important to stress that given LFU holds but angular muon channel is still in tension, there are still quite some open questions on the table to answer. Moreover, it would be important to say also that the 'precision regime is not yet reached for LFU tests in b2sll as we need to go below 1% uncertainty to be in that regime and the latest LHCb measurement is at the 3-4 % level for the most significant mode-q2.

We agree that the talk is on LFU tests, but LFU tests with angles is also of relevance for b->s ll and given the current status with angular analyses we believe that a mention might be worth.

Agreed. I added the following bullet points on the summary plot:
- $b \to s\ell\ell$ still very interesting
- Some tension in angular analysis
- precision regime is not yet reached for LFU tests:
    - need to go below 1% uncertainty

Cheers
Renato for the RD and RD-sub-WG conveners.

Abhijit Mathad <abhijit.mathad@cern.ch> Tue, Jul 2, 4:51 PM (3 days ago)

to Yiming, sevahsen@hawaii.edu, lhcb-sb-chair, lhcb-sb-belle2-talks

Dear Francesco,

Thank you very much for compiling this excellent set of slides comprehensively covering LFUV from high pT to low pT to heavy flavour transitions!

I have a few general comments, particularly regarding the b -> c l nu transitions.
The slides currently have a strong Belle-II focus, which is understandable since you are representing Belle-II.
However, to provide a more balanced perspective, you might consider including the following LHCb contributions:

- When discussing the inclusive R(X) measurement by Belle-II, you could also mention the R(Lc) measurement by LHCb, given that we have access to a greater variety of B species.

I added a slide summarizing the LHCb measurements (from Marcello Rotondo's talk at FPCP 2024), including the R(Lambda c) and R(J/psi)

- In the section on angular coefficient analysis with light leptons at Belle-II, you could also cover the D* polarisation measurement by LHCb involving tau leptons in the final state.

While the D* polarization is very interesting, it is not directly relevant for LFUV, so I will not include it. In fact I will probably skip the last part on angular analysis because it does not really fit.

Regarding slide 24, could you please add next to the arXiv link that it has been submitted to PRL?
DONE

Also on slide 30, thank you for discussing the blinding and re-blinding of the R(X) measurement.
Life is hard for everybody….

Thank you again for these slides and enjoy the conference.

Best regards,
Abhijit

Comments from BELLE II

REHEARSAL (Comments by Kerstin Tackmann)

Francesco's talk

Detailed timing:

12:02 start of the talk

12:05 start p.6

12:07 start p.9

12:14 start p.15

12:17 start p.18

12:22 start p.21

12:29 start p.29

12:33 end of talk

-> 31 minutes -- need to reduce the amount of material a bit: we discussed to shorten the low energy part, where some of the results presented are not new and to not discuss the angular analysis, which would take quite some time to explain (it was already skipped in the rehearsal, so would add additional time if kept)

Here I decided to keep the low energy material but just go through the slides very quickly.

For the angular analysis, I will also keep the slides, but most likely skip them at the end, depending on the timing situation. If people are interested they will ask.

Comments on the slides

p.17:

-Flavors -> Flavor Done

p.19:

-Fix the notation: R(K), proper superscript for q^2, ... Done

p.21:

-The formulae are a bit blurry, can this be fixed? Done

-Fix table entry for R(Xe/mu), and it would be nice to have hyperlinks for the papers Done

-Table heading: BELLE/BELLE II -> Belle II if no results from BELLE Kept Belle for the angular coefficients result, although I will probably won't have time to discuss it.

-Angular analysis: D->D* Done

p.23:

-Could you make more clear which type of B are used in which measurement?

Indicated explicitely charge conjugation is implied, rewrote processes for clarity

p.24:

-It would be nice to have better resolution for plots? and/or increase their size Done

p.25:

-Quote the journal reference for the FEI paper Done

p.27:

- Just a note: Belle II result included here is not the newest, there has been a slight change in number

Added an annotation to avoid confusion

p.29:

-Clarify the notation for the lepton thresholds Done

p.31:

-Add reference for SM expectation Done

p.33:

-Accepted by PRL Done

Comments resolved before the Belle II rehearsal on July 8

Francesco Forti <Francesco.Forti@pi.infn.it> Mon, Jul 1, 11:20 AM (4 days ago)

to Slavomira, Sasha, Lu, Markus, Laura, prell, Kerstin

Dear Kerstin, thanks a lot for the comments.
Some replies below;

On Sun, Jun 30, 2024 at 10:30 PM Kerstin Tackmann <kerstin.tackmann@desy.de> wrote:
Dear Francesco,

thank you for making the slides available ahead of the rehearsal. I think they are very nice. I have a few comments/suggestions, which I hope are useful:

General:
-I think it would help to have transition slides when you switch to a new topic, following the outline on p.2.

You are right. Will do in the next version

-Your notation is a bit inconsistent in places, e.g. mu/e on p.8 and mu-e on p.9. I think it would help to harmonize that.

Fixed

p.6: The text for BES III and the table for BABAR/Belle are quite a bit to digest. I don't know how much you are planning to say here, but maybe this could be reduced a bit, or at least the text outside of the yellow box for BES III could be arranged in a more readable way.

Slides 6&7 are here more for reference. I will go through very quickly.
I fixed the readability of BES III numbers with a table

p.6+7: You are not mentioning ATLAS and CMS here, but I guess it is ok given that there are several talks on ATLAS and CMS results before your's.

ATLAS and CMS are well known, but in fact I was thinking of inserting a slide, just for symmetry with the other experiments.

p.8
-You define Re/mu, but then you give Rbare/mu -- why the change in notation? This is a bit confusing.
You are right. There are correction terms, which I don't want to cover in detail, but i included a small print to show that

-What are the numbers that you give for the coupling ratios? PDG averages? It would be good to make this a bit more clear.
Clarified

p.9:
-Is the ratio shown in the plot also a ratio of couplings? It would be good to make this more clear.
-References for the number and the plot?
Clarified, the plot is the ratio of BF. Addedd references.

p.10:
-A lot of numbers to digest and very small plots... Maybe it would make sense to reduce the amount of material here (and the other material can go to the backup).
-Reference(s)?

Indeed this is a lot of material, but it is there just to give the sense that measurements have been
done and they are consistent with the SM. I will not cover any detail.
References are all there, although they are not live links.

p.12:
-This is quite a lot of material (I am mostly referring to what you have on the left side). Maybe focus on a few results and put the rest into the backup?

Again the spirit is to show that measurements have been done. I am not sure what to remove.

-What is the formula on the bottom left (f(x)=....)? And something below that is cut off?
That is the f in the above formula to extract the ratio of couplings from the ratio of BF. I added some explanatory text and a connecting arrow to clarify

-You are connecting a number on the left to a point in the plot, but they are not the same (although close).
Yes, I don't know the reason for that last digit discrepancy, it must be some different approximation.

p.20:
-It looks a bit confusing that you have Bbar on the left, and B0 on the right. Is this really what is done (both charged and neutral B on the left, but always mu-) and only B0 on the right? If so, is there a particular reason for that?

~~This is indeed what is done. I think the reason is that LHCb is very charge-asymmetric in reconstruction~~
~~and analyses with opposite charges require special dedicated efforts. But I'll ask my LHCb friends for more information~~
Charge conjugation is implied everywhere. Clarified on the slide.

p.21:
-Why are you defining R again? Not repeating this would help to have this slide a bit less dense.
This is actually the RD(*)+ which is a first measurement with the D+ ground state. In previous measurements only
the D0 final state was used. But you are right it is too prominent. Reduced the size

p.22:
-This is a lot more detail than you have for many other analyses. Is this on purpose?
I am using my privilege as Belle II speaker. Also, these analyses are new and deserve more space.

p.23:
-Why are you defining R again?
In this case it is pointless, removed.

-The axis label of the right plot is partially cut off.
Fixed

p.24:
-It would be nice to point out the results that you showed in the slides before (e.g. adding arrows or such).

Good idea, will do

p.26:
-It would be good to explain the two values for the transverse momentum cuts.
-Why are you defining R again?
The cuts are used to reject misidentified leptons, which is different for e and muon. Added some text.
Here it is a different R, inclusive, so it is good redefine it

p.26/27:
-Also here you have quite a bit more detail than in most previous analyses. On purpose?
ditto

p.28:
-Why are you defining R again?
Removed (sorry, for all these multiple definitions...)

S.29:
-This is quite hard to follow from the slide itself, maybe it is better when it is explained during the talk.
-The plot isn't really understandable without the left side.

Indeed this slide is hard, but I have no time to elaborate. I will try to explain it, or if I am running late just skip it.

Thanks a lot for the very useful comments.