Installation of the workshop: objectives, agenda, experimental overview

Aoife Bharucha, Mark Goodsell,
Stéphane Monteil, Francesco Polci

Objectives

1) Gather the *french* community of the intensity frontier to think of the future landscape (exp. and th.) of our field.
2) Discuss the state of the art (LFU, rare decays, neutrinos, *CP* violation, edms …), the open questions and the perspectives
3) Build up an educated view of the diversity of the experimental programmes as a community.
4) Offer PhD., PostDocs and others a discussion platform on the future.
5) Gather inputs for the IN2P3 prospective days to be held in 2018.

The first half-day

- A wild card has been given to theoretical views on broad subjects which covers the frontiers of the GDR.
  - The challenged Lepton Flavour Universality in quark transitions
  - Neutrinos at large including cLepton Flavour Violation.
  - The *CP* violation in the quark sector.
  - Axions and dark sectors.
- Meant to:
  - Address the state of the art
  - Bring a point of view. Polarisation is good for the discussion.
  - Each speaker is expected to step on the feet of the others.

The first half-day

14:00	**Installation and objectives of the Workshop**	*Aoife Bharucha et al.*	
	13-2-005, CERN	14:00 - 14:25	
	Lepton Flavor Universality Violation	*Damir Becirevic*	
	13-2-005, CERN	14:25 - 15:05	
15:00	**Charged Lepton Flavor Violation**	*Ana M. Teixeira*	
	13-2-005, CERN	15:05 - 15:45	
	Coffee break	15:45 - 16:15	
16:00	**CP violation in the quark sector**	*Jérôme Charles*	
	13-2-005, CERN	16:15 - 16:55	
17:00	**Axions and dark sectors**	*Mark Dayvon Goodsell*	
	13-2-005, CERN	16:55 - 17:25	
	Axions and dark sectors searches	*Javier Redondo*	
	13-2-005, CERN	17:25 - 18:05	
18:00			

The second day

- The second day will serve as a review of the experimental programmes to come, which are on track or at the stage of projects.
- Not all are involving the *french* community, *e.g.* the kaon program, and the agenda might be incomplete. Still, we tried to provide a reasonable overview of the field.
- This is useful per se for the GDR project but can also serve as an input for the prospective days to come at IN2P3.
- Though we are expecting that speakers will defend bravely their own project, it is hoped that we can discuss frankly and straightforwardly the projects at hand.
- One objective of the workshop is that we build an educated view of the intensity frontier future as a community if possible.

The second day

09:00	**LHCb upgrades** *160-1-009, CERN*	*Renaud Le Gac* 09:00 - 09:30
	Belle II *160-1-009, CERN*	*Isabelle Ripp-Baudot* 09:30 - 10:00
10:00	**FCC** *160-1-009, CERN*	*Stephane Monteil* 10:00 - 10:30
	Coffee break	10:30 - 11:00
11:00	**SHIP** *160-1-009, CERN*	*Jacques Chauveau* 11:00 - 11:30
	Kaon physics *160-1-009, CERN*	*Matthew Moulson* 11:30 - 12:00
12:00	**nEDM experiments** *160-1-009, CERN*	*Guillaume Pignol* 12:00 - 12:30
	LFV experiments and g-2 *160-1-009, CERN*	*Frederic Kapusta* 12:30 - 13:00
13:00	**Lunch** *CERN*	13:00 - 14:00
14:00	**The gamma factory** *160-1-009, CERN*	*Mieczyslaw Krasny* 14:00 - 14:30

The second day

- The second day will be concluded by a round table with a wise panel composed by : Asmaa Abada, Alain Blondel, Augusto Ceccucci, Jacques Lefrançois and Javier Redondo.

Many thanks in advance for having accepted to bring your views in the discussion. The youngest of us are particularly encouraged to participate. This workshop is yours.

The future intensity experimental landscape

INTENSITY frontier GDR-InF

LHC(b) | LHC(b) upgrade(s) | Beyond LHCb | FCC injectors & FCC-*pp*

2019 - 8 /fb ~2025 - 50 /fb 2035 - 500 /fb 5000 /fb

2025 - 50 /ab 203? - 150 /ab

Belle II

Comet - Meg & friends.

KOTO - NA62 ...

SHiP

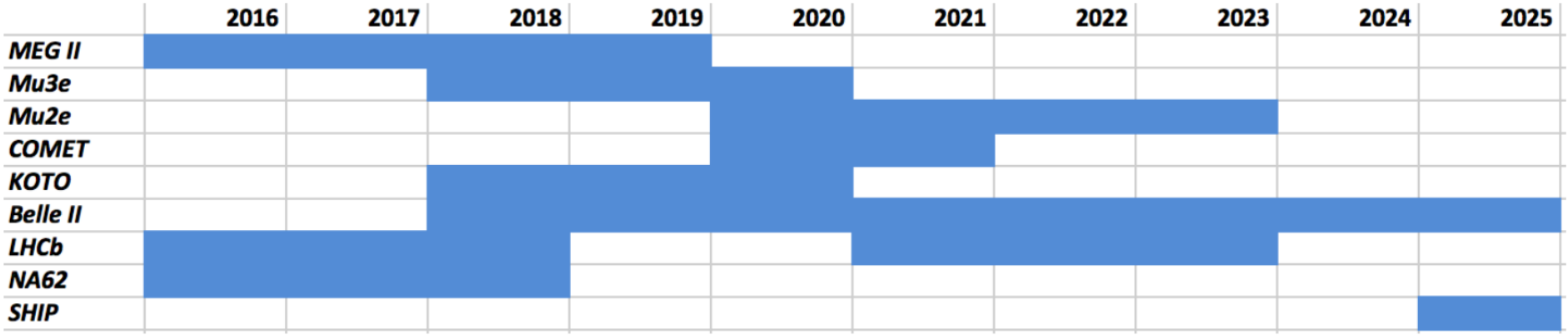
FCC-*ee*

Legend and disclaimer:

- on track or running
- foreseen projects
- timeline, lumi, omissions are mine.

The future intensity experimental landscape

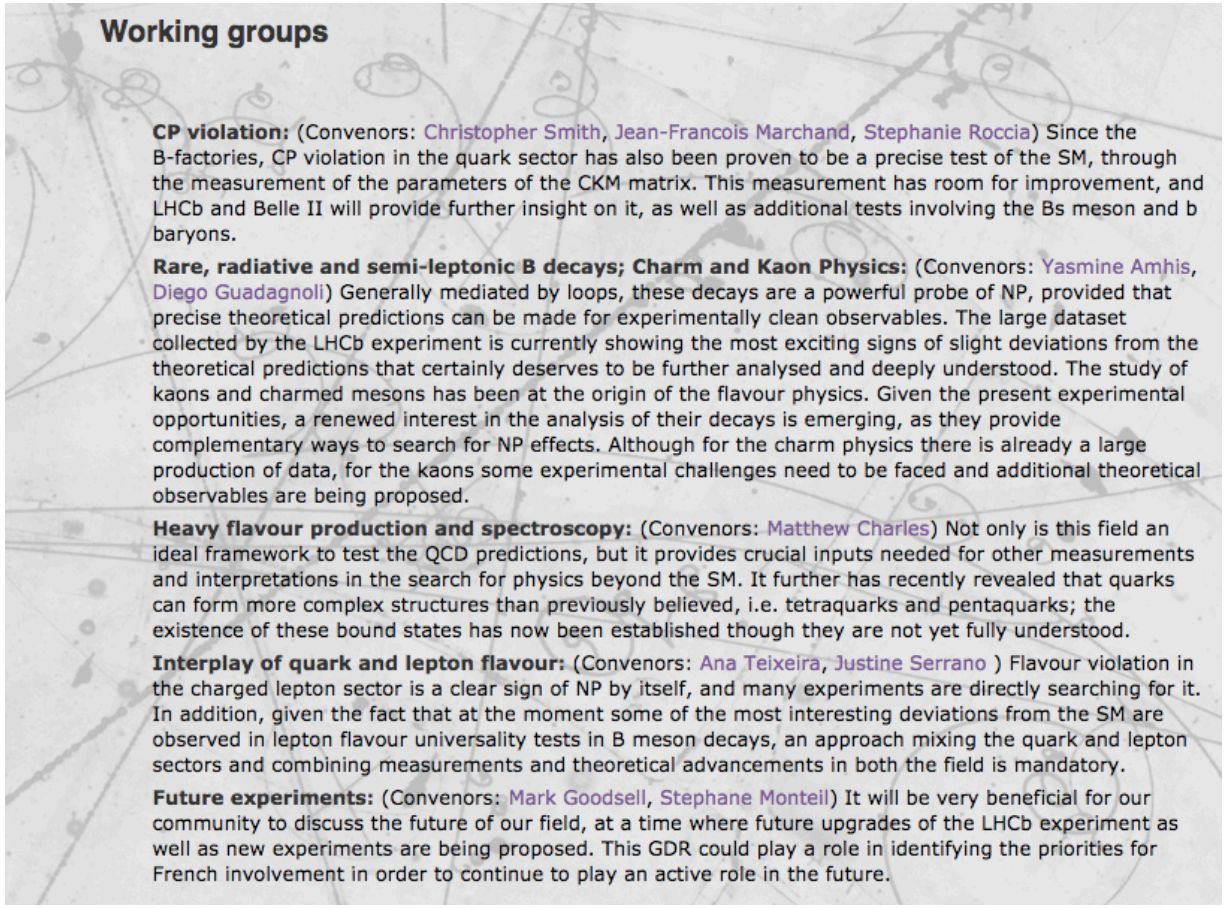
- This timeline came with the GDR-InF proposal



Let's take this WS occasion to gather our knowledge and update/complete the GDR-InF timescale of the intensity frontier experiments, including gamma factory, dark sectors, FCC experiments and …

The future intensity experimental landscape

- This workshop gathers the interests of each of the GDR working groups.



Working groups

CP violation: (Convenors: Christopher Smith, Jean-Francois Marchand, Stephanie Roccia) Since the B-factories, CP violation in the quark sector has also been proven to be a precise test of the SM, through the measurement of the parameters of the CKM matrix. This measurement has room for improvement, and LHCb and Belle II will provide further insight on it, as well as additional tests involving the Bs meson and b baryons.

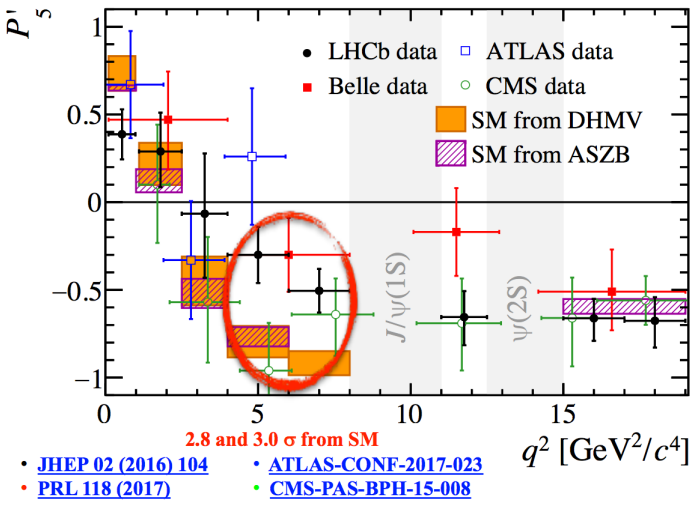
Rare, radiative and semi-leptonic B decays; Charm and Kaon Physics: (Convenors: Yasmine Amhis, Diego Guadagnoli) Generally mediated by loops, these decays are a powerful probe of NP, provided that precise theoretical predictions can be made for experimentally clean observables. The large dataset collected by the LHCb experiment is currently showing the most exciting signs of slight deviations from the theoretical predictions that certainly deserves to be further analysed and deeply understood. The study of kaons and charmed mesons has been at the origin of the flavour physics. Given the present experimental opportunities, a renewed interest in the analysis of their decays is emerging, as they provide complementary ways to search for NP effects. Although for the charm physics there is already a large production of data, for the kaons some experimental challenges need to be faced and additional theoretical observables are being proposed.

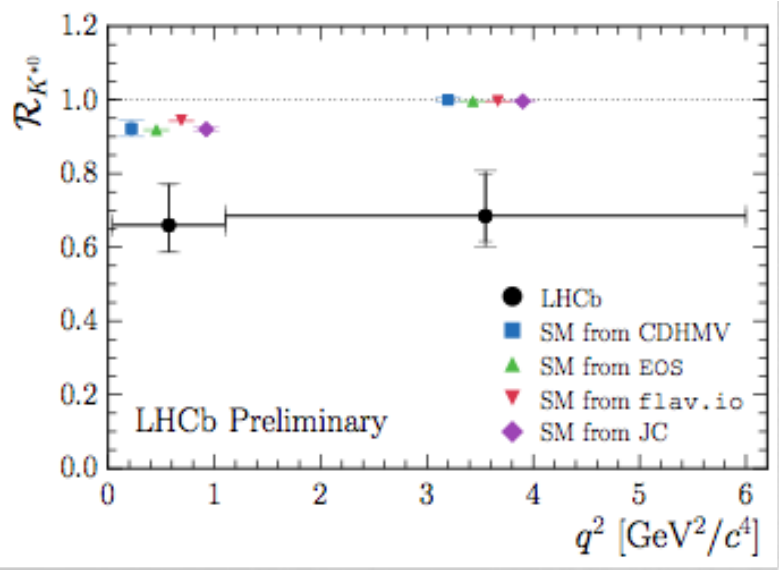
Heavy flavour production and spectroscopy: (Convenors: Matthew Charles) Not only is this field an ideal framework to test the QCD predictions, but it provides crucial inputs needed for other measurements and interpretations in the search for physics beyond the SM. It further has recently revealed that quarks can form more complex structures than previously believed, i.e. tetraquarks and pentaquarks; the existence of these bound states has now been established though they are not yet fully understood.

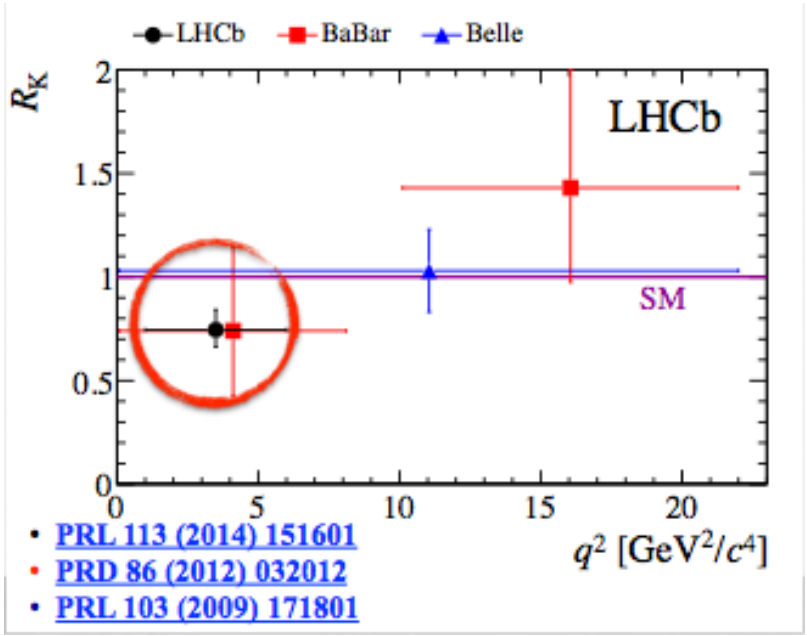
Interplay of quark and lepton flavour: (Convenors: Ana Teixeira, Justine Serrano) Flavour violation in the charged lepton sector is a clear sign of NP by itself, and many experiments are directly searching for it. In addition, given the fact that at the moment some of the most interesting deviations from the SM are observed in lepton flavour universality tests in B meson decays, an approach mixing the quark and lepton sectors and combining measurements and theoretical advancements in both the field is mandatory.

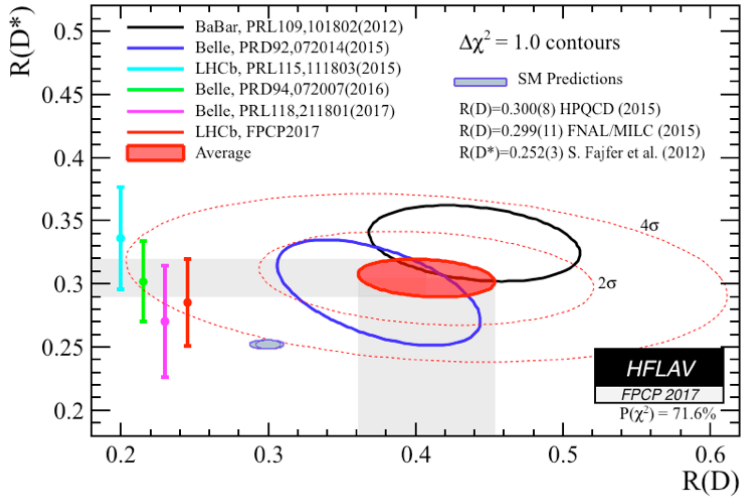
Future experiments: (Convenors: Mark Goodsell, Stephane Monteil) It will be very beneficial for our community to discuss the future of our field, at a time where future upgrades of the LHCb experiment as well as new experiments are being proposed. This GDR could play a role in identifying the priorities for French involvement in order to continue to play an active role in the future.

Anomalies / LFU in quark transitions is challenged

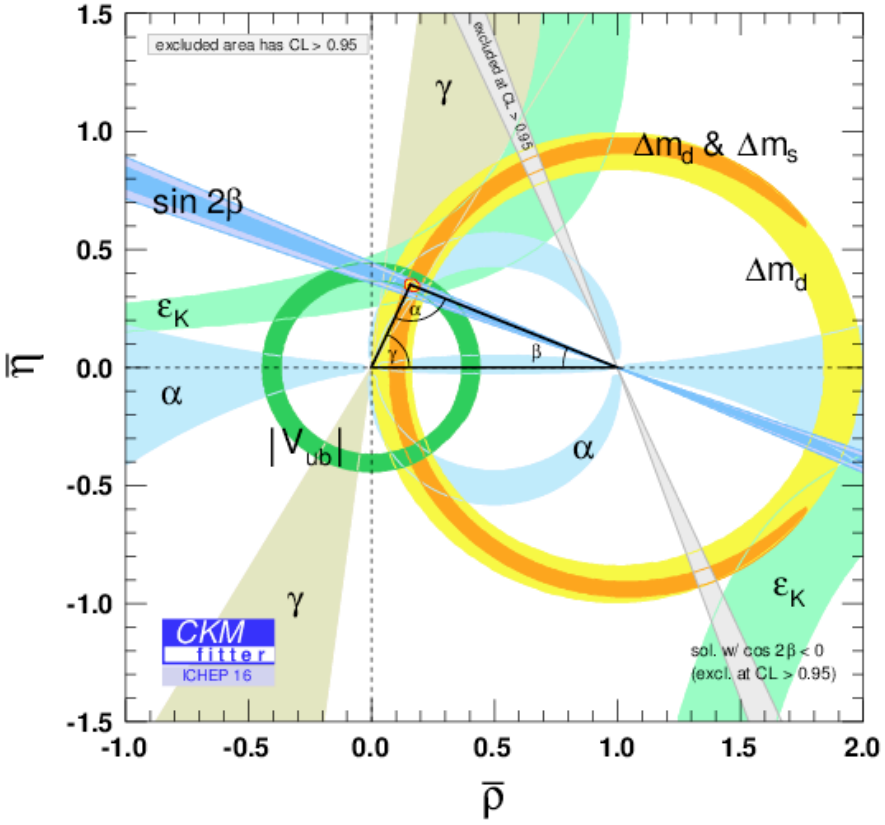






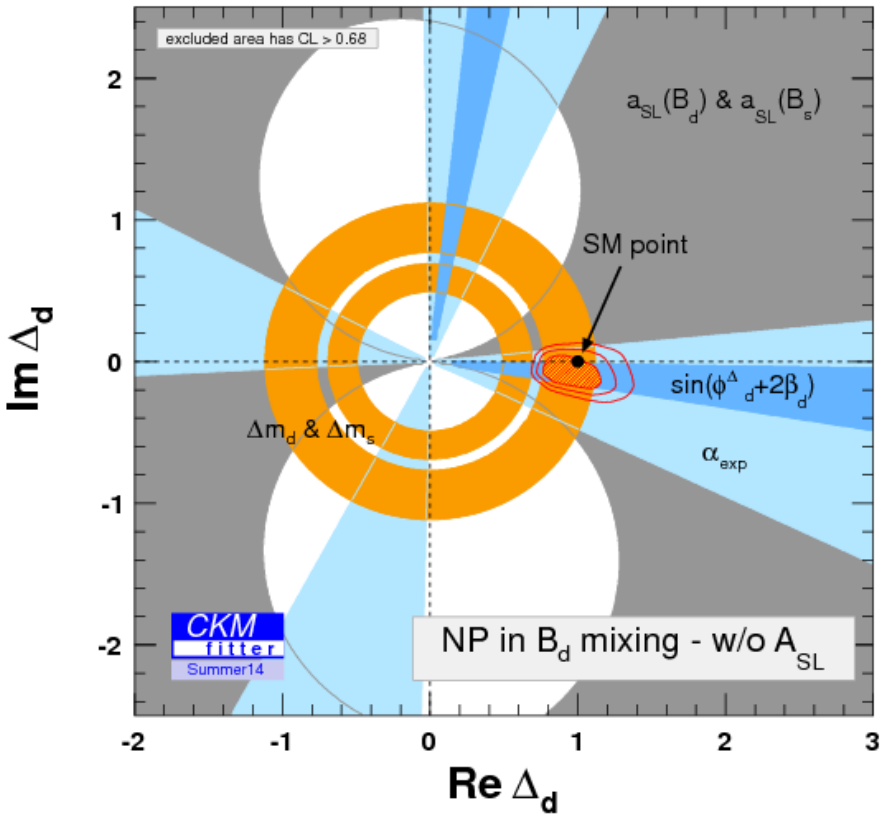


CKM



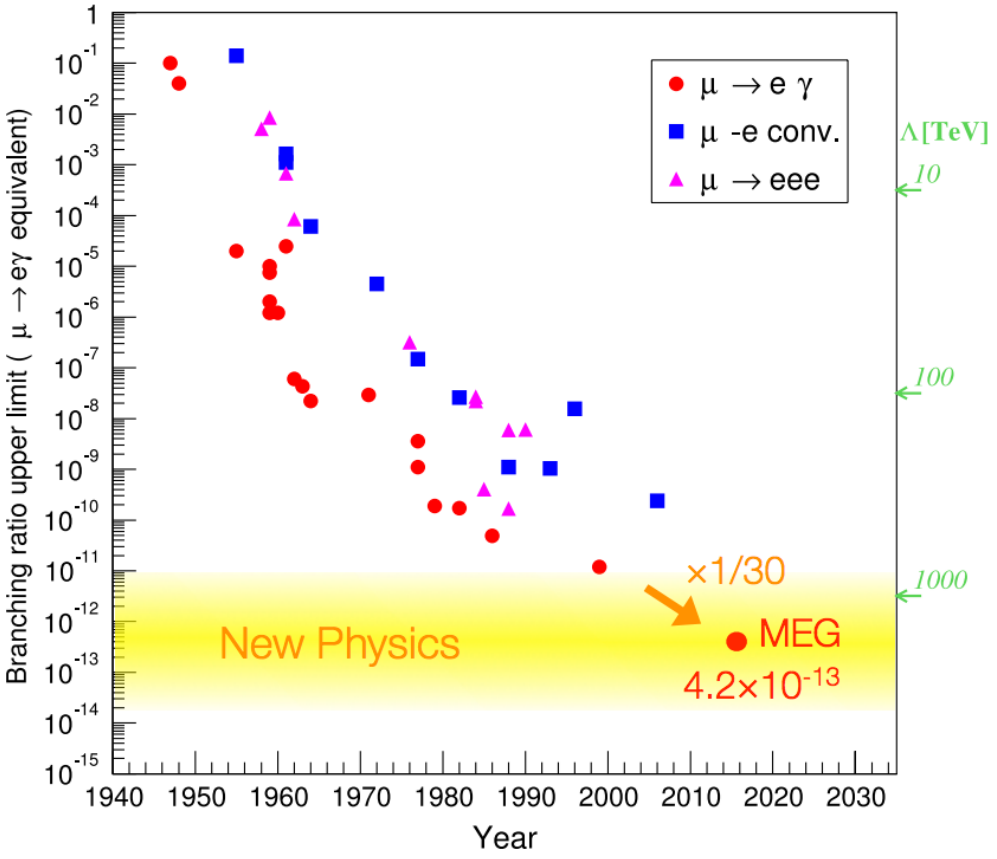
- The focus is not currently on the UT (though Belle II and LHCb improvements on *CP* observables should revive the subject). Yet, there are firm statements that can be drawn and can't be easily escaped
- CKM is at work in weak charged current quark transitions.
- The KM phase IS the dominant source of *CP* violation in *K* and *B* system.

Mixing observables in MFV scenarii



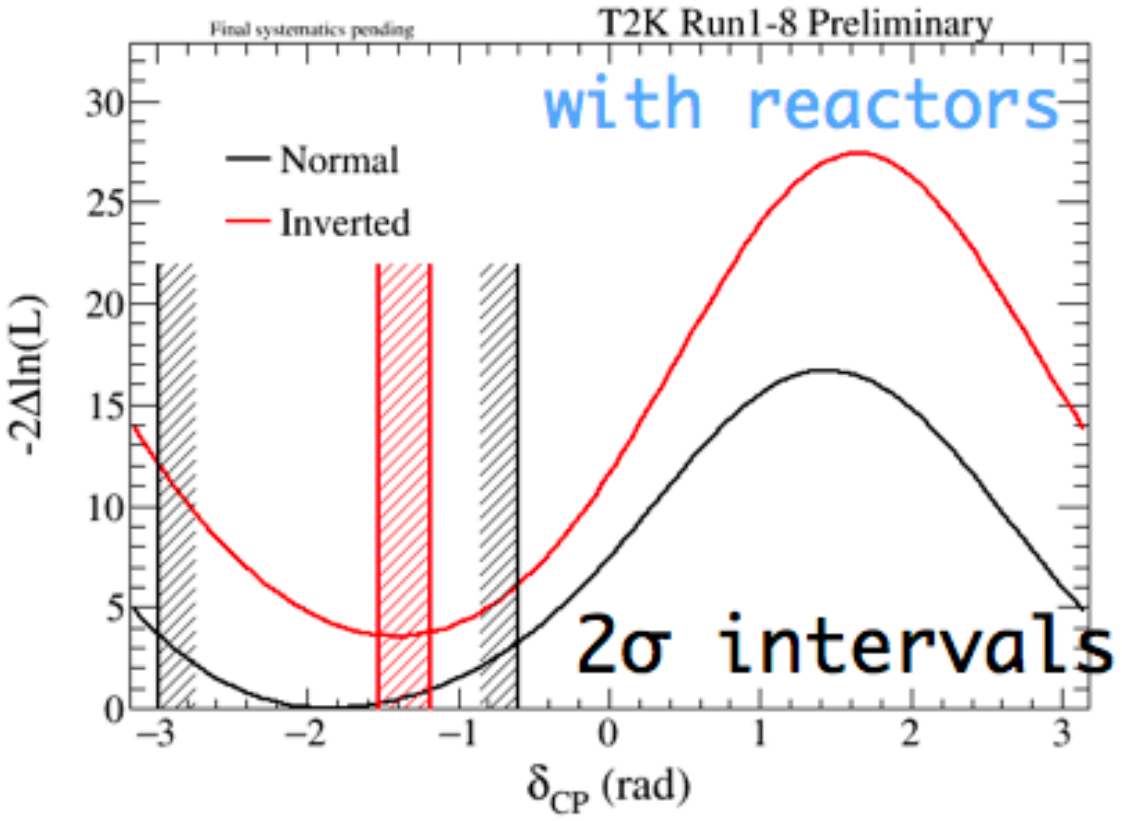
- The SM stands tight in this dimension as well.
- There is still however sizeable room for BSM contributions in $\Delta F = 2$ quark transitions.

Latest MEG results



A neutrino highlight

First indication of *CP* violation from T2K and reactor experiments. Interesting prospects for the long-baseline experiments (T2K-II, HyperK, DUNE)



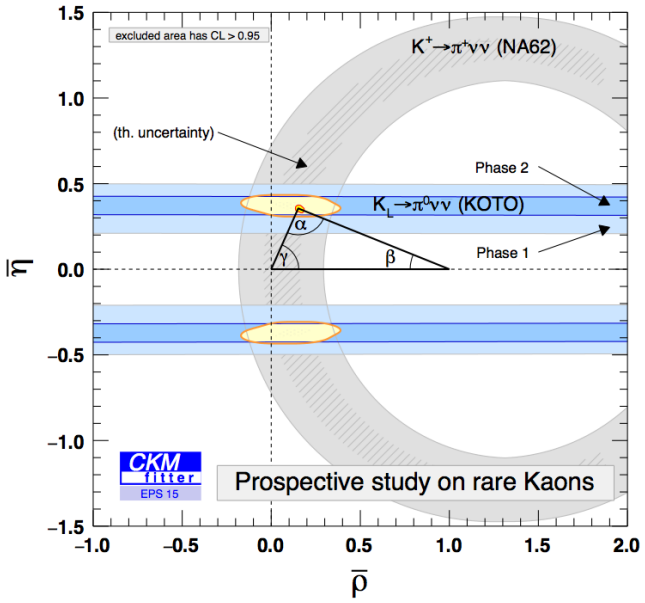
Ultimate objective

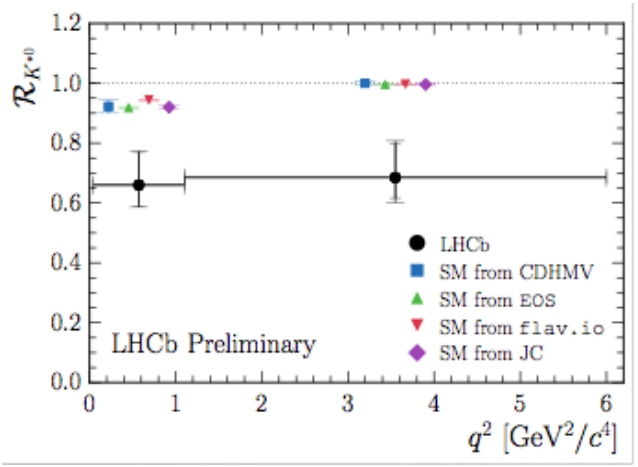
We are interested in interplays at large in this Workshop.

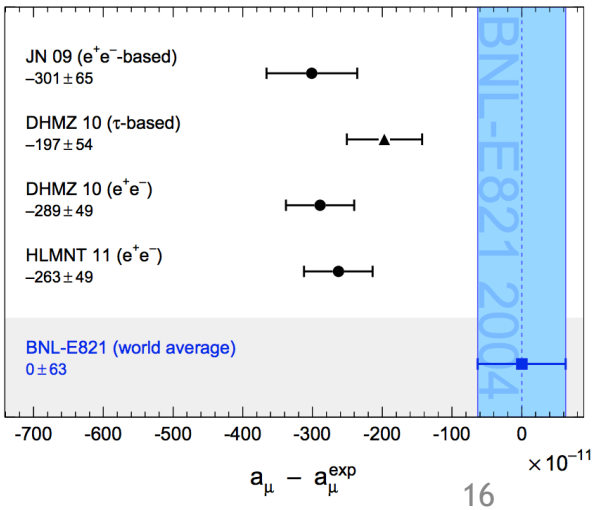
Theories / experiments Quarks / Leptons

Light flavours / Heavy flavours Dark / Visible

Colliders / *beyond colliders*







Outcome of the workshop

- This workshop is the first opportunity in the context of the GDR-InF to think about the future of the intensity frontier.
- Other moments are foreseen: workshops on specific topics and the general GDR-InF meeting that will take place in autumn.
- Let's start collecting the outcome of these discussions in a document that could eventually serve as guideline for the in2p3 prospectives.
- Your participation and your involvement in the documentation process is essential and welcome!

Agenda / Miscellanea

- There are coffee breaks foreseen to continue the discussion.
- Interrupting the speakers is good (unless it is specified beforehand).
- We'll be tomorrow in the room 160-1-009.
- No social dinner at the agenda. Dissemination in Geneva's nature.
- Vidyo attendance might be significant. We'll try to pay attention.
- Let's try to have a memorable scientific moment !