Summary of the FCPPL flavor session

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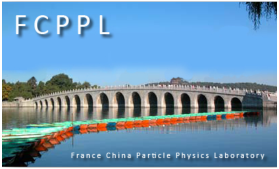
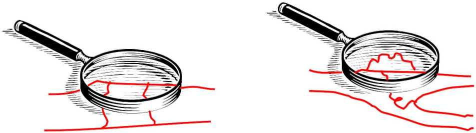


Flavor physics: WHAT, WHY, HOW ?

1. WHAT: Quarks and leptons exist in 6 “flavors” (u, c, t, d, s, b) and (e, μ, τ, ν_e, ν_μ, ν_τ).
2. WHY:
   - Flavor is at the heart of the Standard Model, involving 22 of the 28 free parameters (masses and mixing of fundamental fermions, CP violation)
   - Flavor physics loop processes (box and penguins) are sensitive to energy scales well beyond the ones of the accelerators, thanks to virtual contributions



$\rightarrow$ Indirect search for New Physics

3. HOW:
   - Compare precise theoretical predictions with precise experimental measurements
   - LHCb, Belle, BaBar, ATLAS, CMS, NA62, BESIII, neutrinos experiments, ...!

FCPPL "flavor" projets

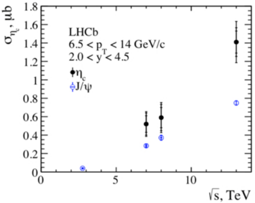
Four FCPPL projects ongoing and 4 talks this morning:

- Sergey Barsuk (IJCLab), Jibo He (UCAS);
  "Charmonia in LHCb"
- Halime Sazak, Vincent Tisserand (LPC), Daniel Decamp, Stephane T'Jampens (LAPP), Shunan Zhang, Zhenwei Yang (Peking Univ.), Zirui Wang (Tsinghua Univ.), Dong Ao, Wenbin Qian, Xiaokang Zhou (UCAS);
  "$B_{(s)} \to DKK$ at LHCb"
- Zirui Wang, Liming Zhang (THU), Patrick Robbe -IJCLab);
  "Simulation study of the LHCb Calo upgrade II"
- Manqi Ruan, Zhenwei Yang (IHEP);
  "Flavor physics at CEPC"

FCPPL "flavor" projets: Charmonia in LHCb

Proponents: Sergey Barsuk (IJCLab), Jibo He (UCAS)

- Main current results:
  - Systematic studies of charmonium production via decays to hadrons (η_c and χ_c states), 3 LHCb papers and two theory/phenomenology papers published, including numerous first or most precise measurements. Comparison to theory models, improving theory approaches, constraining long-distance matrix elements.
- Short/mid/long term prospects within FCPPL:
  - Finalize analysis ongoing analyses (dedicated triggers in 2018), in particular $\eta_c(2S)$ production against that of $\psi(2S)$Study low-pT range to better extract the slope of the x-section ratios (ratio of Colour Singlet/Colour Octet predictions). Rapidity dependence to strongly reduce scale uncertainty as proposed jointly with theorists who are part of this project. Prepare triggers for Run 3 to explore production in the extended range and study double-charmonium ($2\eta_c$ vs. $\eta_c + J/\psi$ vs. $2J/\psi$) production. Long-term: η_b production - low x-section, but precious to constraint theory.



FCPPL “flavor” projets: $B_{(s)} \to DKK$ modes at LHCb

Proponents: Halime Sazak, Vincent Tisserand (LPC), Daniel Decamp, Stephane T’Jampens (LAPP), Shunan Zhang, Zhenwei Yang (Peking Univ.), Zirui Wang (Tsinghua Univ.), Dong Ao, Wenbin Qian, Xiaokang Zhou (UCAS) Also Stefania Ricciardi from RAL.

- Main current results:
  - Paper on γ sensitivities with $B_s^0 \to D^{(*)}\phi$ this year
  - Analyses under LHCb WG review: branching fraction measurements of $B_{(s)} \to D^{(*)}\phi$ and observation of $B_s^0 \to D_{s1}(2536)K$
  - Analysis on the way: γ measurements with $B_s^0 \to D^{(*)}\phi$ Run 1-2 data
- Short/mid/long term prospects within FCPPL:
  - Short term: Finalized the two ongoing analyses under WG review and publish them
  - Mid term: Finalized the γ measurements with Run 1-2 data
  - Long term: Amplitude analyses with $B_{(s)} \to DKK$
  - γ measurements with $B_s^0 \to D^{(*)}\phi$ with Run 3-4 data
  - γ measurements with $B_s^0 \to D_{s1}(2536)K$

FCPPL “flavor” projets: Simulation study of the LHCb Calo upgrade II

Proponents: Zirui Wang, Liming Zhang (THU), Patrick Robbe -IJCLab)

- Main current results:
  - Participated to the preparation of the Framework TDR for LHCb upgrade II by preparing a fast simulation framework (stay of Zehua Xu at IJCLab Orsay in 2019), and then using it to determine the requirements for the timing resolution of the detector (about 20 ps). Studied the possibility to have a timing layer in Silicium or a full Silicium-Tungstene calorimeter and applied it to physics channels ($B_s^0 \to J/\psi\pi^0$, $B \to D^{*0}K$, ...)
- Short/mid/long term prospects within FCPPL:
  - Short term: plan to build a prototype of the Silicium timing layer and study the requirements of the electronics.
    The simulation work will be continued to also determine the characteristics of the detector.

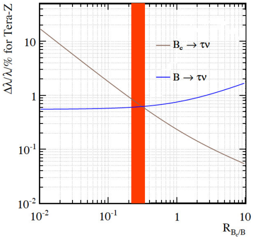
FCPPL “flavor” projets: Flavor physics at CEPC

Proponents: Manqi Ruan, Zhenwei Yang (IHEP)

- Short/mid/long term prospects within FCPPL:

  The CEPC is a promising flavor factory, it can bring critical information on top of existing flavor factories. Explored the key detector performances and precisions of Physics benchmarks, the former shows strong significant advantages compared to existing flavor factories, while the latter shows that many measurement could boost the current precision by $\sim$1 order of magnitude.

  Plan to continue, and to summarize the study with the CEPC Flavor White paper.



Relative $B_C \to \tau\nu$ signal strength versus “$B_C \to \tau\nu$ over $B \to \tau\nu$ ratio”.

A relative precision of percentage level is achievable. The red band show the SM prediction.