



Implications of LHCb Measurements and Future Prospects

10-11 November 2011 CERN

Topic list for
CP violation measurements in
B sector at LHCb



Motivation

- Long-term: model-independent search for NP
- Near to medium term: need prioritization to optimize our use of manpower & bandwidth
- What we hope to work out with theorists
 - Where is NP most likely to be seen given the current situation
 - What size of NP signals can we still expect? and how clean are they?
 - Where is work needed in experiment and/or theory?
- A list of CPV measurements in B sector to motivate discussions. New ideas welcome!

B_s mixing

- CP violating phase ϕ_s from $B_s \rightarrow J/\psi \phi$
 - Expect $\sigma(\phi_s) \sim 0.07$ with 2 fb^{-1} from scaling
 - Ambiguity removal: in progress
 - Penguin pollutions: need work. How robust is the proposed method using SU(3)? What to measure? Precision needed? Other ideas?
- CP violating phase ϕ_s from $B_s \rightarrow J/\psi f_0(980)$
 - Precision will improve
 - How big is the hadronic uncertainty ?

B_s mixing (II)

- More channels to measure ϕ_s
 - $B_s \rightarrow J/\psi\eta, J/\psi\eta'$
 - $B_s \rightarrow \psi(2s)\phi$
 - $B_s \rightarrow D_s D_s$
- A_{fs}^s in $B_s \rightarrow D_s \mu\nu$
 - Experimentally challenging, expect results in 2011/2012
 - Exploring same physics as ϕ_s ?
 - Any NP possibility to have large semileptonic asymmetry as D_0 measured and small CP asymmetry in ϕ_s ?

$b \rightarrow s$ penguin decays

- $B_s \rightarrow \phi\phi, K^{*0}\bar{K}^{*0}$
 - NP affects different polarizations in the same way?
Measure ϕ_s assuming SM
 - Weak phase difference between polarizations? Measure triple product asymmetry
 - What are the theoretical predictions and uncertainties?
- $B^0 \rightarrow \phi K^{*0}$
 - triple product asymmetry
- What does direct CP asymmetries in these channels tell us?
- Experimentally challenging: $B^0 \rightarrow \phi K_S, B^0 \rightarrow \eta' K_S$

CKM angle gamma

- Tree diagram decays
 - $B \rightarrow DK$: many modes ...
 - $B_s \rightarrow D_s K$
 - 5 degree precision of gamma free of NP effects can be expected with 2fb^{-1} collected in 2011/2012
- $B \rightarrow hh$
 - Affected by NP in $b \rightarrow uus$ penguin
 - Can extract gamma assuming SM
 - Other measurements: ϕ_s and effective lifetime of $B_s \rightarrow KK$
 - How sensitive to NP? Uncertainties of method?
 - What is the best way of using these decays? E.g. directly comparing CP asymmetries with predictions?

CPV in other channels

- Direct CP asymmetries in $B^0 \rightarrow K^* \gamma$
 - Theoretical uncertainties under control?
- CP asymmetries in $B^0 \rightarrow K^* \mu \mu$
 - To be discussed in rare decay session
- Direct CP asymmetries in b-baryon decays?
 - What is the chance on NP?

More remarks

- We are preparing for 2012 data analysis
 - Try to prioritize the items on the list according to their physics potentials
 - Is there anything else we can/should do in 2011/2012?
- Before the workshop, we would like to know
 - what you think are interesting topics to discuss
 - what you would like to contribute to
- From the workshop, we wish to hear
 - specific answers to our questions
 - also new ideas beyond our list