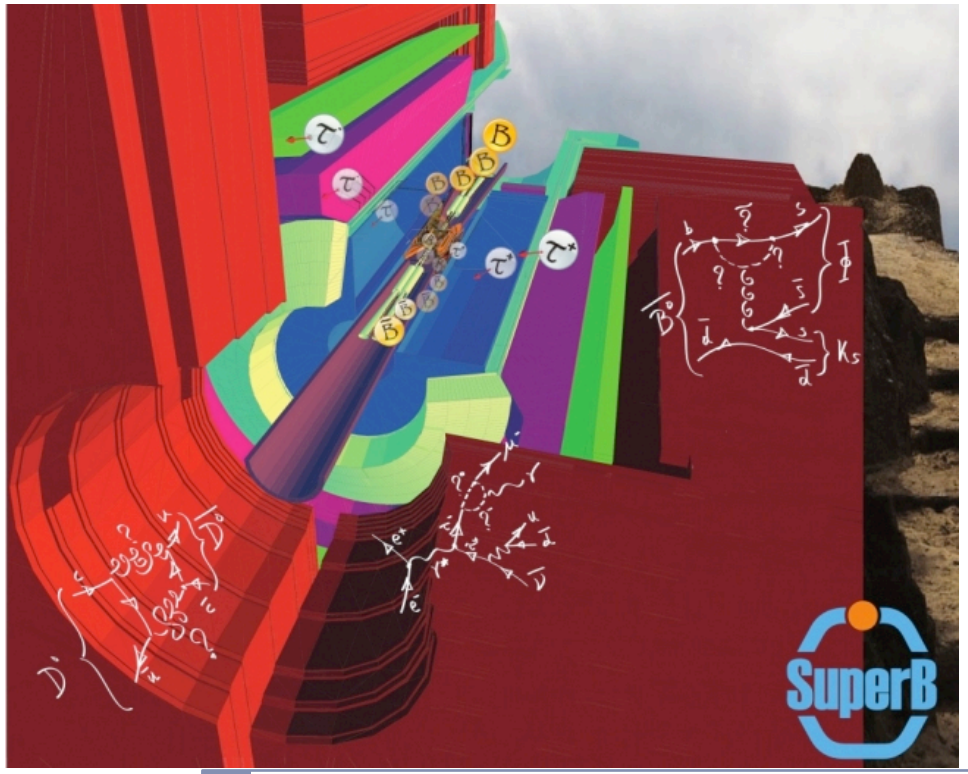

SuperB Physics Closeout

Adrian Bevan

1st SuperB Collaboration Meeting, London 13-16th Sept. 2011

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Queen Mary University of London

Changes since Elba

- Charm WG:
  - Nicola Neri and Miland Purohit have joined Brian.
- Mixing and CPV in B Physics:
  - Jure Zupan has joined AB.
- B_S:
  - Alexander Lenz has joined Alexey Drutskoy

Very active meeting

08:30	Charm: WP to TDR - New Thresholds (15') (Slides)	Brian Meadows (*University of Cincinnati*)
08:45	B Field studies (10') (Slides)	Daniel O'Hanlon (*Queen Mary, University of London*)
08:55	Penguins in D->hh decays (15') (Slides)	Adrian Bevan (*Queen Mary*)
09:10	Exclusive TD DK corr. & mixing reach (30') (Slides)	Mike Sokoloff (*U. Cincinnati*)
08:30	Sensitivity studies at threshold (20')	Fernando Martinez-Vidal (*Valencia*)
09:00	TDCPV (20')	Gianluca Inguglia (*Queen Mary University of London*)
16:00	B-> K phi phi at SuperB (20') (Slides)	Marcin Chrzaszcz (*Institute of nuclear physics*)
16:20	sin2theatW (20') (Slides)	Michael Roney (*University of Victoria*)
16:40	A FastSim example - Study of D0 mixing sensitivity at the Y(4S) (20') (Slides)	Rolf Andreassen (*University of Cincinnati*)

- Lots of charm (threshold running related studies)
- Starting to study triple product correlations (See Marcin's talk from yesterday) using $B \rightarrow \varphi\varphi K$
- Continuing to hone the precision EW programme: measure $_{ALR}$ and A_{FB}

- Matteo gave a very complete introduction to the FastSim yesterday

Tutorial description
The first part will be an overview of how FastSim works. The second part will be an interactive tutorial. The target is beginners.
The requirements to follow the second part interactively are:
-)having installed a test release _before_ the session, following the instructions in
http://mailman.fe.infn.it/superbwiki/index.php/FastSimDoc/Quick_tour
till the paragraph "Setup your test release" (those not having the release installed may still play with the output ROOT files, that will be linked)
-)having ROOT (>5.20 if possible) installed on the laptop.

11:00 FastSim Tutorial (1h30') (Slides) Matteo Rama (*LNF*)

- John Ellis gave a nice overview of SUSY after 1/fb of LHC data before lunch.

- + a number of discussions on some technical/documentation issues and the December workshop ...

From Brian

WP – Known Short Falls (Need to be done)

- Few Fastsim simulations exist
  - Mixing in $D^0 \rightarrow K_s\pi^+\pi^-$ at Y(4S)
  - Preliminary feasibility study of $D^0 \rightarrow \mu^+\mu^-$ at Ã(3770)

Rolf's talk

- Studies at Y(4S):

  Mixing
  - Use of other modes to find x and y are all estimated from Babar analyses
  - Do not include measurement of |q/p|, arg {q/p} from D^0 -$\bar{D^0}$ asymmetries

  Rare decays
  - Realistic understanding reach for $D^0 \rightarrow \mu^+\mu^-$, $D^0 \rightarrow \gamma\gamma$ $D^0 \rightarrow h^+\ell^+\ell^-$, $D^0 \rightarrow \rho^0\ell^+\ell^-$
- Running at $\psi(3770)$ ~DD threshold
  - QC phase measurements - how to include them in 4S mixing measurements
  - Better estimates for $\sigma(A_{SL})$
  - Rare decays such as $D^0 \rightarrow \mu+\mu^-$, $D^0 \rightarrow \gamma\gamma$
  - How to use time-dependent decay correlations

Mike, Gianluca, Adrian, Fernando talks

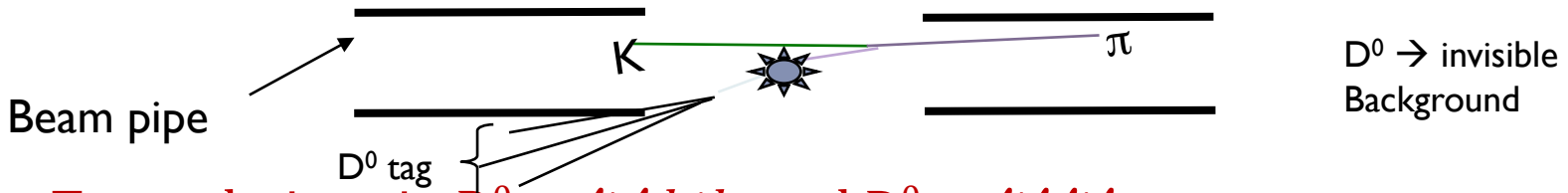
- Use of other thresholds (D_s, Λ_c ?)

Elaborate in thistalk

From Brian

Other Studies

- Various physics items added since the WP
  - D^0 -> invisible , γ + invisible, "X^0" + invisible at BOTH Y(4S) and threshold.



  - T-correlations in $D^0 \to \ell^+ \ell^- h^+ h^-$ and $D^0 \to \ell^+ \ell^- \ell^+ \ell^-$
    - IFF we ever find any such events, of course !!
  - CPT Violation
  - Charm baryons
  - Run at D_s threshold too – $f(D_s)$ and semi-leptonic decays (V_{cs})
  - Time-dependent quantum correlated decay studies
    - Various double-tagged combinations

From Marcin

Motivation

T-Odd correlations $\overrightarrow{p_i} \cdot (\overrightarrow{\epsilon_i} \times \overrightarrow{\epsilon_j})$ in two body decays were studied by the BaBar Colaboration[1] .

Three body decays provide more T-odd correlations, one of the simplest is: $\overrightarrow{s_i} \cdot (\overrightarrow{p_j} \times \overrightarrow{p_k})$.

An example decay which provides this kind of correlation is:

$$B^{\pm} \rightarrow K^{\pm}\phi\phi$$

Results

- Signal efficiency ~16%
- Continuum background fully suppressed
- After this simple selection one can expect 3,5k events a year(10 ab^-1). Much better than LHCb! =)
- Should be able to perform studies of angular
- distributions =>T Violation measurement feasible.

[1] BABAR Collaboration, J.G. Smith, hep-ex/0406063, contribution to Moriond QCD proceedings;BELLE Collaboration, K. Abe et al., hep-ex/0408141.

From Mike

Summary

- We have a very rich EW programme that gives unprecedented precision measurements of the vector coupling via A_{LR} –for mu, tau, charm and b fermions – the best place for b's
- A_{FB}: gives us g_A, but NOT the weak mixing angle
- tau polarisation FB asymmetry gives us precision beam polarization measurement

Can directly measure polarisation of the beams AT the IP, so don't have to rely on the Compton polarimeter and extrapolating the measured polarisation at some source point to the IP.

UVic

Physics tools

Many opportunities to contribute:

- detector response simulation in FastSim (SVT, DCH, DIRC, EMC, IFR)
- PID selectors
- simulation of background
- physics analysis tools (tagging, vertexing, …)
- development of ‘skims’ for physics studies
- documentation

for more information contact Matteo Rama

Tools Documentation

- Discussion on migrating tools documentation from BaBar to SuperB:
  - Covered under code transfer agreement,
- SuperB would benefit from the following
  - Workbook
  - Vertexing
  - SimpleComposition
  - BtaTupleMaker
- Aim: Provide detailed instructions on how to use BetaCode, tcl and get started.
- Would need some minor reworking of the workbook to remove any BaBar-specific information.
- Would need to be private.
- Need a volunteer to do the work: Please contact Matteo

Request for BaBar internal documentation

- Not covered by code transfer agreement
  - All technical documents

BAD #	Title
53	Choice of Kinematic Variables in B Meson Reconstruction---Take 3
102	Vertexing
509	sPlots
522	EvtGen documentation
1657	A Likelihood-based Charm Flavor Tag
2082	Studies towards an improved tagging algorithm: Tag
246, 332, 497, 1471	Related to backgrounds and trickle injection impacting upon data quality
1500	PID
2126	Summary of Upsilon(2S) Counting
2186	Offline measurement of recorded BaBar luminosity in R24
+ Statistics WG recommended practice document	

- Will request these from BaBar to be placed in the private alfresco document repository as internal SuperB notes: Need SuperB note naming scheme.

Regular (bi-weekly) physics meetings

- These are starting up again.
  - Tuesday: 17:00 (Roma) / 16:00 UK / 08:00 West Coast
  - Regular intervals: meeting every 2 weeks
- Work toward the December physics workshop
  - Elucidate new areas of the programme
  - Hone physics interpretation in light of summer conference results
  - Develop tools for future physics studies.
- Meetings will be via EVO, listed on Indico:
  - http://agenda.infn.it/categoryDisplay.py?categId=480

December workshop: 11th & 12th December, LNF

- Day 1
  - Welcome: Aims/intro
  - DESY sll workshop summary
  - WG5 session
    - Precision EW
    - Dark Forces (possibly)
  - b→sγ session
    - Theory + Expt overview, esp A_{CP}
  - $B_{u,d,s}$ session(s)
    - Bs→gg &/or ASL Fast Sim progress
    - b→sll inclusive/exclusive FastSim progress
- Day 2
  - Charm
    - TDCPV progress
  - tau
    - LFV/CPV
  - Planning Session
    - Discuss tools required, and what FastSim mode studies we need for TDR/ Book
  - TDR chapters/Physics Impact Document/Elba planning session

Will also have a few sessions during the CM.

Currently have one room booked for both days: all plenary.

+ 2 additional parallel session rooms requested for Monday morning.

Interim updates

- On the timescale of the December meeting we will have a honed interpretation of the physics programme accounting for the current constraints from the LHC.
- Also need to be mindful of the potential from 2012 data taking at the LHC (e.g. using a sensible value for Λ_{NP}).

- We have considerable levels of activity that will lead to a broader understanding of the programme by the end of the year.
  - Interim updates should be prepared as and when necessary.

- Long term goal is the SuperB physics book a few years from now.

TDR Contributions

- Need to work with the detector and accelerator teams to prepare:
  - Physics chapter for the detector TDR: an overview of the whole programme.
  - Physics motivation for the accelerator features: (i) 4S running (+ adjacent resonances), (ii) Physics requirements for polarisation, and (iii) Physics programme at charm threshold.