SuperB: Physics
Summary

Polarisation: τ g-2

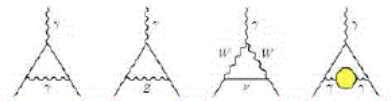
Benjamin Oberhof

Small beam-spot at SuperB could help resolve ambiguities in this measurement.

Want to measure different observables to disentangle electric and magnetic form factors

Interest of the Measurement

- Precision measurement of $a_{e,\mu,\tau} = (g_{e,\mu,\tau} - 2)/2$ → very sensitive test of SM
- Different contributions at loop level, dependence on fermion masses



- a_e and a_μ nowadays known with very high precision (see PDG)

$$a_e = (1159.6521810 \pm 0.0000007) \cdot 10^{-6}$$
$$a_\mu = (1165.92080 \pm 0.00054 \pm 0.00033) \cdot 10^{-6}$$

- Measurements of a_i for light leptons based on static interaction with an external field
  → impossible for the τ because of it's short lifetime $\tau = (290.6 \pm 1.0) \times 10^{-15}$
- The mesaurement from the DELPHI collaboration of $e^+e^- \to e^+e^-\tau^+\tau^-$ cross section at LEP2 (arXiv:hep-ex/0406010v1 (2004)) yelds
  $-0.052 < a_\tau < 0.013$ at 95% CL
- SM predicted value: $a_{SM,\tau} = 1177.21(5) \times 10^{-6}$, very precise, but not yet tested
- If Δa_μ measured by BNL-E821 due to SUSY even bigger effects expected on a_τ

3

Polarisation gives a factor of 3 improvement in precision of F_2 measurement.

g-2 at B-factories

- It is not possible to measure interaction of τ with an external field
  → we have to infer about a_τ from cross section and partial widths
- B-factories are (nearly..) an ideal laboratory:
  → high luminosity
  → high production cross section: 0.919 nb at $\sqrt{s} = 10.54$ GeV/c
  → negligible contribution from higher order diagrams at $\sqrt{s} \sim m(\Upsilon(4s))$
  → electro-weak interference effects well known and under control
- Main issues related to CM boost and detector resolution
- In principle different final states could be used for the measurement
- If we use final states in which both τs decay in two bodies we can also use spin correlations (hepex/0709.2496v1 (2007)), (JHEP01 (2009) 62)
  → possibility to study more observables with high statistics
- In this study we focused on processes of type $\tau^\pm \longrightarrow h^\pm \nu$
  in particular, at present, only $h^\pm = \pi^\pm$ has been investigated

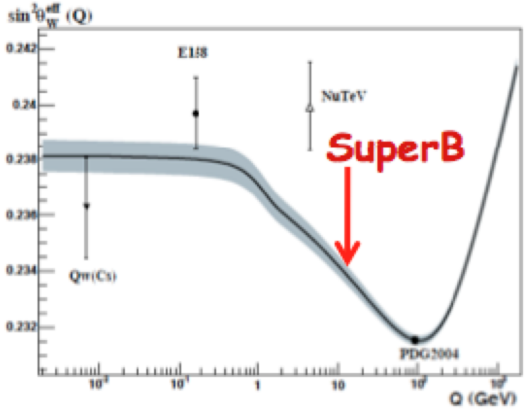
4

Polarisation: $\sin^2\theta_W$

SuperB EW Physics Update:
Is there a strong EW case for polarisaton at the charm threshold?

Michael Roney
University of Victoria

Running at charm threshold would give information near NuTeV Q^2



Summary

- We have a very rich EW programme at 4S 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
- EW case for running with polarization at charm threshold comes down to:
  - how much value is there in a low precision measurement at slightly lower Q^2 cf that at 4S or Z?

My summary of this situation:

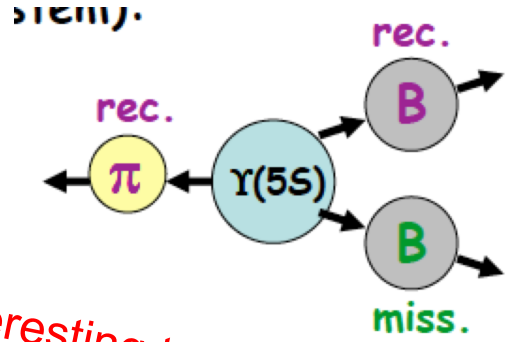
- There is clearly a compelling precision EW programme at the 4S that requires polarisation.
- There is no compelling reason to have polarisation at the ψ(3770).

5S: CP asymmetries at the 4S

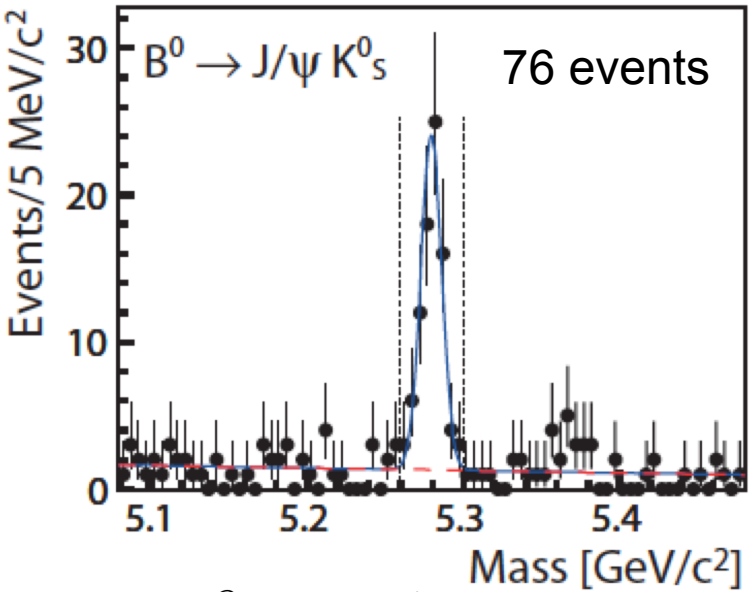
Alexey Drutskoy

arXiv:1201.3502 (Belle)

- Method to use π tagged 3 Body decays of the 5S to measure "time-dependent" CP asymmetries.
  - Pion charge tags B vs. B-bar.
  - Don't need to reconstruct vertices: could be useful for $\pi^0\pi^0$.



Interesting technique that could expand programme at 5S.



$$\sin 2\beta = 0.57 \pm 0.58 \pm 0.06$$

Charm TDCPV

Two activities on time-dependent CP violation studies for charm decays.

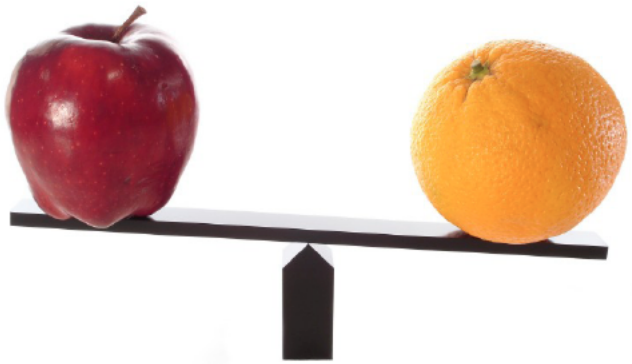
Different mode combinations studied.

Different luminosities assumed ...

Different projected sensitivities....

Q) Is there a problem?

Are we comparing apples to apples?



3rd SuperB Collaboartion Meeting- LNF- ITALY 19-23/03/2012

Time-Dependent Studies Comparison

Sensitivity studies on mixing and CP violation in charm at Ψ(3770) and Υ(4S) at SuperB

M. Giorgi[1], F. Martínez-Vidal[2], N. Neri[3], A. Oyanguren[2], M. Rama[4], P. Ruiz[2], P. Villanueva[2]

[1] Università and INFN Pisa, [2] IFIC Valencia, [3] INFN Milano, [4] INFN Laboratori Nazionali di Frascati

The Time-Dependent CPV in Charm

A. Bevan[1] , G. Inguglia[1] , B. Meadows[2]
[1] Queen Mary, University of London
[2] University of Cincinnati

Queen Mary University of London

22-03-2012
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Results agree well with common inputs.

A number of approximations need to be studied and relaxed over the coming months...

Charm TDCPV / Vertexing

Gianluca Inguglia

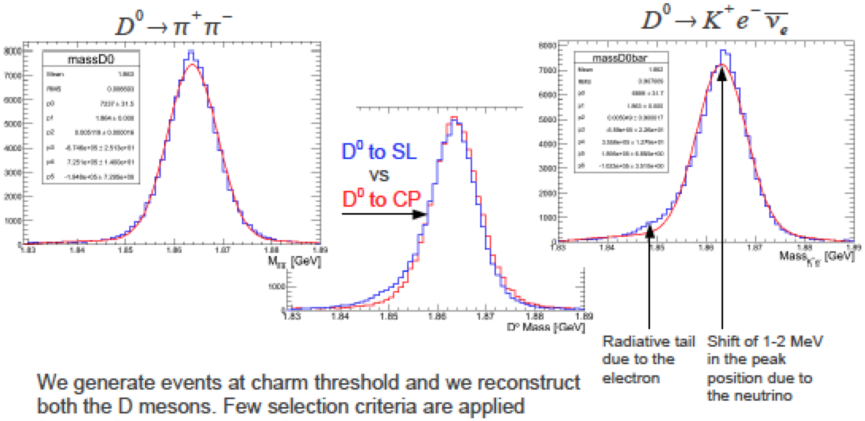
First look at a fast-sim analysis

Goal: include resolution effects in numerical estimates.

ψ(3770) mass needs updating in pdt.table

Correlated D^0 mesons: (tentative of) Mass reconstruction, βγ=0.56

$e^+e^- \to \Psi'' \to D^0\ \overline{D^0} \to \pi^+\pi^-\ K^+e^-\overline{\nu_e}$



We generate events at charm threshold and we reconstruct both the D mesons. Few selection criteria are applied (mass, charge, momentum).

Also gave a quick talk on vertexing tools within SuperB.

Goal: document vertexing tools we've inhereted from BaBar and develop an understanding of behaviour with FastSim.

Pro:

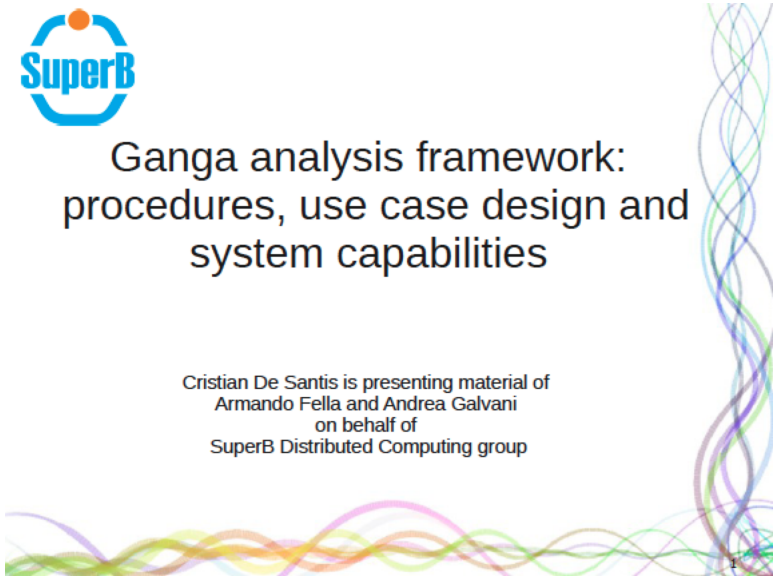
Gianluca is not from BaBar (fresh view)

Con:

Can't read BaBar tutorials (yet)

MC Production

- Updates from Elisa and Marcin on plans
  - Analyses on track for inclusion in production:
    - Recoil analyses
    - B to φφK
    - τ to 3μ
  - Some other analyses are experiencing delays: Hope that we will be able to include these.



Distributed analysis tools are now in place: we will need to learn how to use these to study files produced in the next data production.

Opportunities (I)

- A few of our young post-docs have moved on, so there are a number of important studies that would benefit from additional manpower.

- In particular if you are interested in joining in the effort for
  - polarisation/τ physics: contact Mike Roney & Alberto Lusiani
  - B_s physics: contact Alexey Drutskoy
  - V_{ub}: contact John Walsh

  about important channels to study.

Some other ideas for areas of study can be found in the Physics talk slides from Tuesday.

Opportunities (II)

- Some of you may have students who need to analyse data for their thesis. You might consider having them work on SuperB and analyse BaBar data for their thesis:
  - Contact Abi Soffer (abi@slac.stanford.edu)
  - https://bbr-wiki.slac.stanford.edu/bbr_wiki/index.php/Physics/Analyze_This!

- Partial list of *partially complete* analyses:
  - $B \to D_{sJ} D$
  - Search for non-Abelian dark gauge boson
  - Polarisation of $B \to \psi(2S) K^*$
  - Study of $e^+e^- \to \psi K^+ K^-$
  - Study of $e^+e^- \to J/\psi \to \gamma\phi\phi$ via ISR
  - Search for dark photon in $\pi^0 \to e^+e^-\gamma$

  These are in varying stages of completeness most having ntuples ready.

Documentation

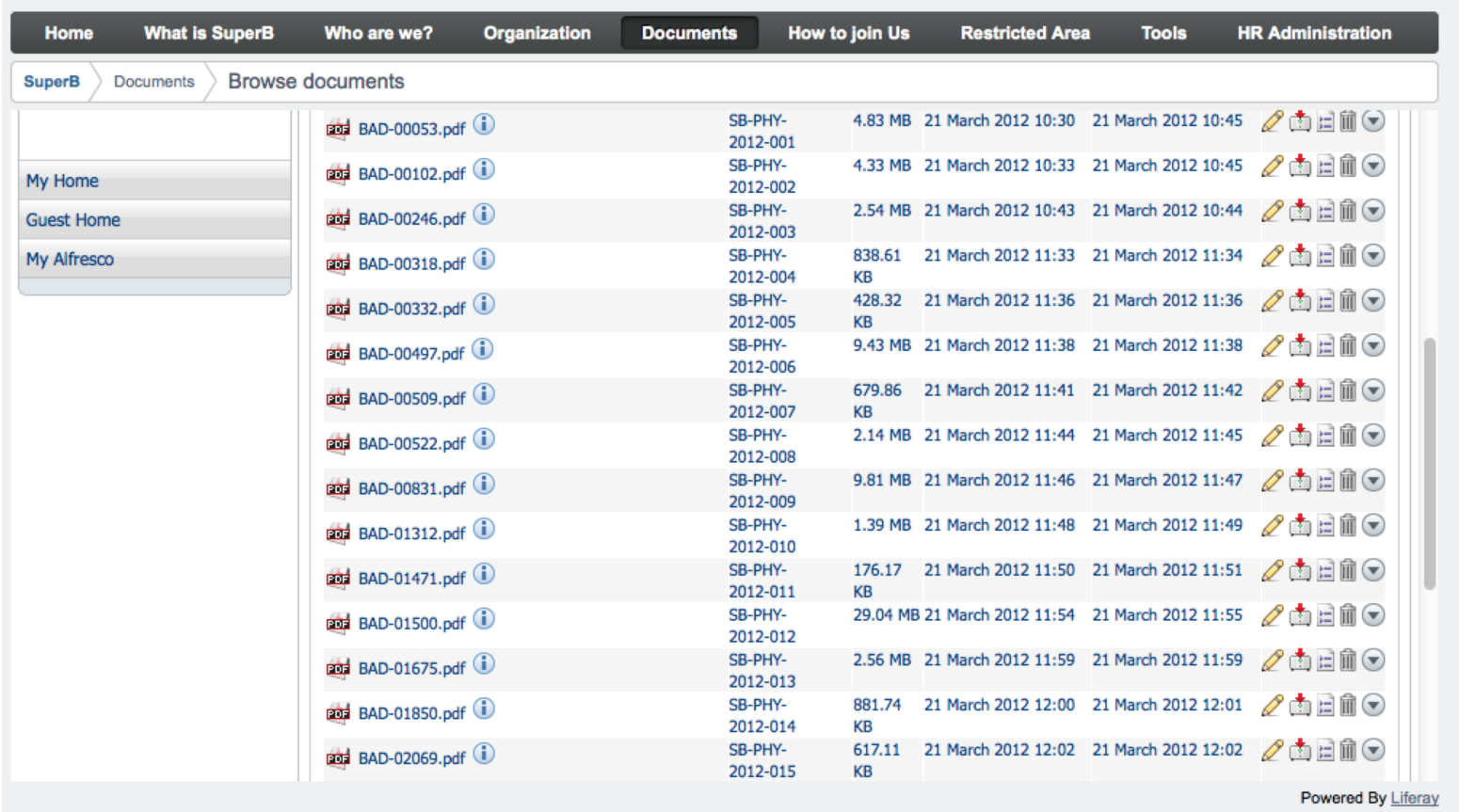
- As part of the tools effort Matteo is building a team of people to oversee tools we use.
- We now have permission from BaBar to migrate

BAD 53 Choice of Kinematic Variables in B Meson Reconstruction---Take 3
BAD 102 Vertexing
BADs 246, 332, 497, 1471 Related to backgrounds and trickle injection impacting upon data quality
BAD 318 Recommended Statistical Procedures for BaBar
BAD 509 sPlots
BAD 522 EvtGen documentation
BAD 831 Describes the standard ISR NTUPLEs used in BaBar for events where the ISR photon is reconstructed
BAD 1312 Related to the luminosity measurement
BAD 1500 PID
BAD 1675 A Likelihood-based Charm Flavor Tag
BAD 1850 Related to the luminosity measurement
BAD 2069 Hadronic and Gamma-Pair Event Selection for Upsilon(3S) Counting
BAD 2126 Summary of Upsilon(2S) Counting
BAD 2186 Offline measurement of recorded BaBar luminosity in R24
BAD 2082 Studies towards an improved tagging algorithm: Tag

to alfresco. Expect this to happen over the coming week.

Documentation

- These BADS are now in Alfresco:



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Documentation

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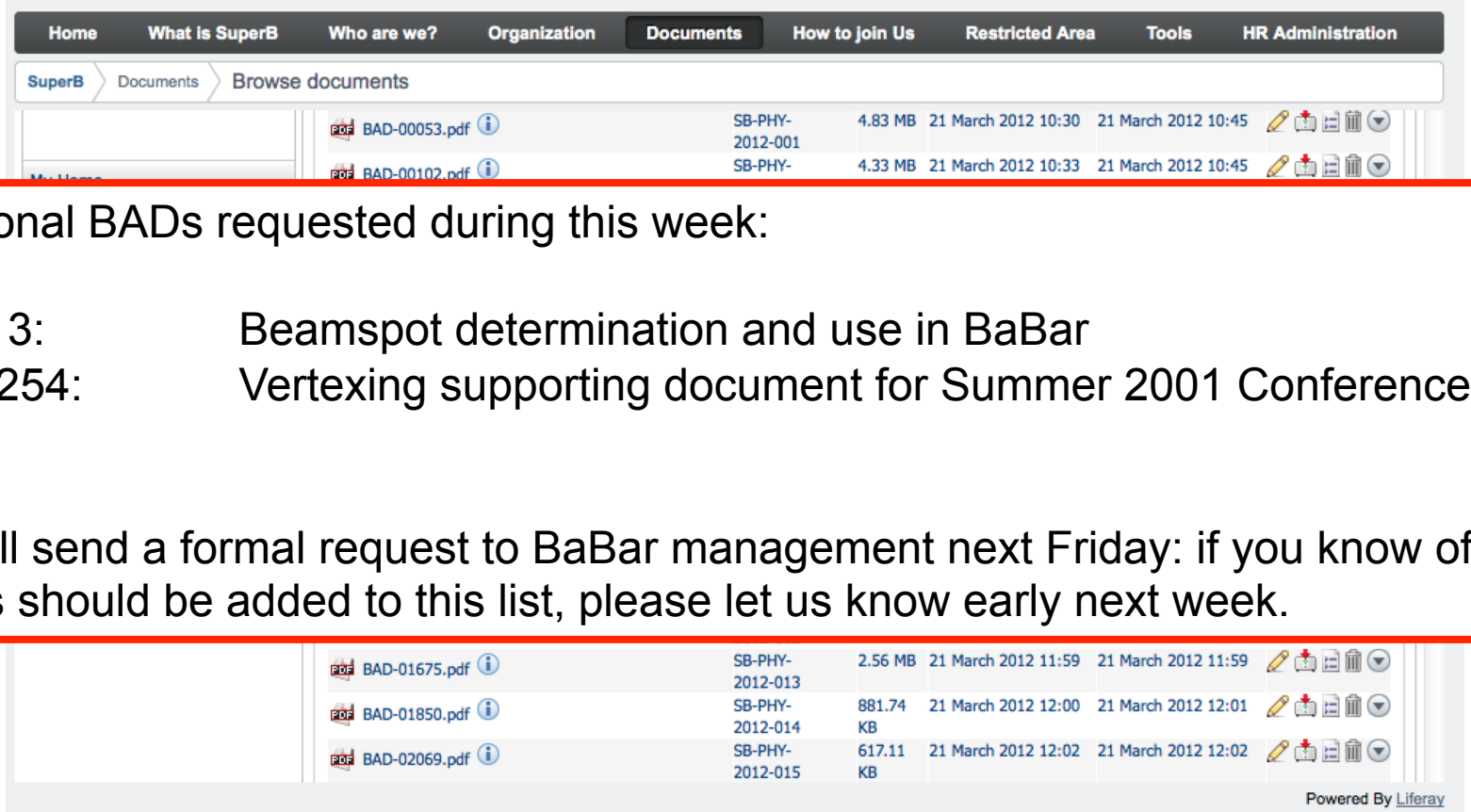

Additional BADs requested during this week:

BAD 13: Beamspot determination and use in BaBar
BAD 254: Vertexing supporting document for Summer 2001 Conferences

We will send a formal request to BaBar management next Friday: if you know of BADs should be added to this list, please let us know early next week.

- The default view doesn't help understand what document is what. Stefano will work on improving the information shown.

A first analysis note ?

- An interesting comment was raised in one of the parallel sessions:
  - It would be useful to have a SuperB note describing the analysis studies being done by some groups so that people can understand what is being done, comment and help improve our understanding of the physics.

- We completely agree that it will be beneficial for us to start doing this soon.

Elba Physics workshop

See Francesco for details

- Discussed physics activities associated with the workshop.
  - Foci are: B_s, Charm and polarisation physics
  - Will also have reports from working groups on activities
  - Plan to invite external speakers on

$$B_s \rightarrow \mu^+\mu^-$$

$$\Delta A = A_{KK} - A_{\pi\pi}$$

+ Charm results from BES III

  - + theorists

See parallel session talk for summary of discussion