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General comment

Do we want to request the generation in DC06 of event samples WITH CP violation [at least for Bd]? Who is intrested in starting/continuing the work on Radiative corrections implementation in our MC?

Proper Time

Discussion:

- **To calculate the B propertime we need to know the mass of the B meson (PT=d*M/p)**. In order to perform the simultaneous fit we can consider the observable PT/M, which is independent on the mass hypothesis.
- In the simultaneous fit of B->hh we need to perform just a geometrical fit, requesting that both h+h- come from a common vertex, connected to the Primary Vertex by "a" decaying particle. In this way we don't make any choiche on the PID (mass) of the final or the decaying particles. This can be done by using the GlobalFitter and putting a nominal mass to the B particle: the geometrical fit is performed and PT/M and its error e_PT/M can be calculated in one step. Another approach is to perform VertexFitter and the LifetimeFitter in cascade, but in this way part of the correlations between measurement is lost and e_PT/M maybe less accurate.
- **In the simultaneous fit of all B->hh data the observable becomes PT/M and e_PT/M**. Depending on the PDF these values will be multiplied by the nominal mass value to get the right PT.

- How to extract the propertime error PDF from data?
- Do signal and and background have different e_PT/M distributions? MonteCarlo data show similar distributions for all the different signal channels. Concerning background, the statistics within the selection cut is too small to see any distribution. If selection cuts are relaxed, the ePT/M distribution differ from the signal one, but it depends significantly on the mass window.
    - So far we assume that signal and background have the same e_PT/M. Future tests will implement different distributions. Can we afford e_PT/M as mass dependent? [Argh]
    - On real data maybe we can directly use the ePT/M distribution on the "B" peak for signal and on a different window for the background (and maybe apply a deconvolution). What is the best mass window? If you enlarge toward low mass values you end up in a region with partially reconstructed decays that have a different e_PT/M...maybe a mass window at the right side of "B" mass is the best choice.
    - Any BIAS or Scaling Factors (SF) in the PT/M e_PT/M have to be determined in control channels. How to extract these informations from data?
    - **FITPull** method applied to prompt J/psi->mumu is valid to show up problems in the tracks measurement and errors. If there are BIAS or SF on the muons they can be corrected. The correction can be parametrized and applied to the track of the B->hh channels succesfully. In this way it has been shown that is is possible correct also BIAS and SF in PT/M and e_PT/M.
    - Different methods: study e_PT/M parametrization on J/psi mumu? (Ask Alison) Use prompt D?

- **ProperTime Acceptance function**: A precise determination of the acceptance function should be a an issue in case of Lifetime measuremtens. In case of asymmetries analyses it should be less critical (to prove with RooFit studies).
    - There's an ongoing study on how to implement the event by event algorithm: we should stay tuned for coming results
- How to evaluate the bias that comes from the trigger?
    - In order to evaluate the trigger acceptance the ratio of TIS and TOS might be used [but at the end we want the full acceptance not just the trigger one].
    - What about a strategy that: 1) evaluates the trigger acceptance 2) uses MC to evaluate post trigger effects? [discussion]
- Key point: calibration should be done with no cuts! And this is really problematic.
- One possible solutions is to use the lifetime measurement from others and build my acceptance function on top of the exponential decay with fixed lifetime. How much can we gain with this approach?

Proposed studies:

On separate Bd and Bs channels fits:

- Study the power of ev by ev error on PT.
- Verify that the use of a fixed sigma for Bd decays does not change anything [Stefania. This is reasonable since Bd oscillate slowly...] if so, Bd channels will determine wrong tagging fraction.
- Evaluate the correlation beetween the wrong tagging fraction and proper time resolution.
- Extract the SF on the Bs PTerr by fixing omega to the value that comes out from Bd studies and using a gaussian prior with the error extracted from Bd decays. [hypothesis: use only the Opposite side tagging, which is in common to Bd and Bs]
- Study the acceptance effect on CP parameters: changing the parameters and/or the analytical expression in generation/fit [define systematics from the acceptance]

On simultaneous fits (Bd and Bs):

- The PT implementation should be changed into a PT/M one [in order to be M independent when dealing with simultaneous fit]. Work needed in the FitCode [Alessio]
- A double gaussian resolution model needs to be checked for PT/M implementation
- need to include a different e_PT/M PDF distribution for the background. Work is needed in the fit code [Alessio] and validating data and performing tests [Stefania and Gabriele]

Tagging

Introduction:

- Several tagging algorithms are available (see Flavour Tagging page), while the Opposite side taggers are common to Bd and Bs channels, the Same Side ones differ: we can tag Bd (Bu) with Same Side pions, we can tag Bs with Same Side Kaons. Same Side pion tag has an effective efficiency of ~ 0.7 % while Same Side kaons has ~ 3%, giving a substantial contribution to Bs tagging.

- The two Same Side algorithms can't be exchanged: SS pions on Bs, and SS kaons on Bd give random tags, if blindly added they would spoil the global performance. (Actually same side kaons are slightly anti-tagging on Bd, because they include some opposite side kaon, in events with b and bbar close by)

- For measuring the mistag rate of B->hh CP channels we need both Bd and Bs control channels. The first idea was to use Bd->K pi channel for Bd->pi pi and Bs->pi K for Bs-> KK. In this case the mistag can be determined in the fit itself to Bd->pi pi and Bd-> K pi (Bs->KK and Bs->pi K). However the statistics of Bs->pi K is much low, and the resulting uncertainty on the mistag will limit the resulting precision on Bs asymmetries. Since for the Opposite Side tag Bd and Bs channels are similar, one possibility is to use the Opposite Side mistag extracted from Bd->Kpi also for the Opposite Side mistag of Bs-> KK events. Only the SS mistag is determined differently. In this approach, where the determination of the OS mistag is done in the same B->hh fit, from Bd->Kpi events, the two tags (OS and SS) must be kept independent. Only events which have not been tagged by an OS tag will be subject of SS tagging. The splitting has to be optimized according to the purity of the two tags, however we loose some power in the events which could have double tagging.

- We can determine the mistag of Bs->KK events using another Bs control channel, like Bs->Dspi or Bs->Ds mu nu. In this case the mistag value is determined before the B->hh fit.

- Another approach is to fully determine the mistag before the fit. This can be done using B->Kpi events and other control channels. A mistag per event can be determined, which will be different in the Bd and the Bs case. This mistag can be used in the fit as an event-by-event weight, or to classify events in 4-5 categories, according to their mistag value, and perform a fit with tag-categories.

Discussion:

- Tagged sample
    - We proceed using the same set of tagging categories for Bd and Bs. We do not consider the SS tagging category for pions.
    - To use that information in the fit [SSkaon] a new category is needed [one more if also SSpion comes into play]. the SSkaon should be ran only if NO OS information can be extracted.
    - We should check that OS has the same omega for Bs and Bd!! [otherwise the simultaneous approach is screwed]
- UnTagged sample
    - Can be used to extract lifetime information.
    - Used for physiscs only if DeltaG is big enough.
    - Can be used to extract information about charge asymmetry: i separately fit the untagged sample, I do extract the charge asymmetry out of it, I build a prior and the run the simultanoues fit on tagged sample!
    - Can be used to extract acceptance if not used inside the fit: we know the lifetime, we assume no bias in the propertime, I make the ratio w.r.t to exponential decay and I have my acceptance function.
- Background
    - Combinatorial: Omega fixed(?) to 0.5

- Partially reconstructed: w = 0.5?

Proposed studies:

- [untagged sample] How to use the untagged sample in the analysis?
  - How much tagged and untagged samples do differ?
  - How much TIS and TOS proportions in the two samples are different?
  - Can we use the untagged sample to extract the acceptance on data [having fixed the mean life]?

- [tagged sample] Finish the study on per event omega! [The per event information needs to be recomputed also in the simultanoues approach and reorganization of tagging categories]
- Rewrite the tagging in categories.
- Determine the best tagging categories to be used in the fit.
- How to relate the omegaSS extracted in Dspi or Dsmunu events to Bs->KK?
- OS/SS category approach: try to optimize the splitting and quantify the lost in effective efficiency
- Check that OS has the same omega for Bs and Bd (when statistics on Bs->KK will be available)

PID and momentum

Pid Discussion and proposed studies:

- Run against all the possible D*
- Study - concentrate on D* and Bhh events!
- 1 suggested study: taking from MC truth all the kaons and pions from D* and Bhh and make comparisons of DLL and momentum distributions
- 2 suggested study: Apply selection [Raluca's one via joboptions], build efficiency curves and compare again D* and Bhh! Angelo will provide Bhh data after selection. We need to weight the spectra using momentum from B2hh
- Dll distributions needs to be provided in bins of momentum or acceptance

Momentum asymmetry Discussion:

- Currently taken from Bhh itself.
- Obtain the PDF for signal and background events [differences are expected: background distribution expected much broader...]
- How to extract this distribution on data?
- Can we use the mass windowd m>mbs to extract this function for the background?

Fit Code

Discussion:

- Code needs to be fully reviewed, compactified and speed needs to be improved [Alessio, Vincenzo and Angelo]
    - ♦ Possible handles: Find out an integral for the acceptance * Bdecay mode
    - ♦ Analytical integral for momentum asymmetry
    - ♦ Use of histograms The aim is to end up with a 1-2 hours fit!
- Comments in config file needs to be included in order to explain the meaning of all the parameters
- Add the scan for the likelihood for all the fitted parameters and the extraction of chi2
- So far the pid information should be taken as integrated over the momenta [only working solution so far], undimensional PDF not depending on momentum!

Fit strategies

- What can we fix as indipendent information and what needs to be fitted directly inside the simultaneous fit
- Use the Bd->Kpi with proper time event by event error to measure omega_opposite side and then use this measurement in the Bs->KK measurement [the found SF can be used for all channels _needs to be checked_]

Fit stability

- Ask to angelo what 'stability' studies have already been carried out for the TDR:
    - ♦ Varying fit initial parameters
    - ♦ Varying statistics
- Plan to have a fit version that can be used with RooMCStudy

To do:

- Add scale factor for gen event in BD and BS seprately

-- Main.asarti - 27 Oct 2006

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