"Physics of the B-Factories": Progress since the KEK meeting

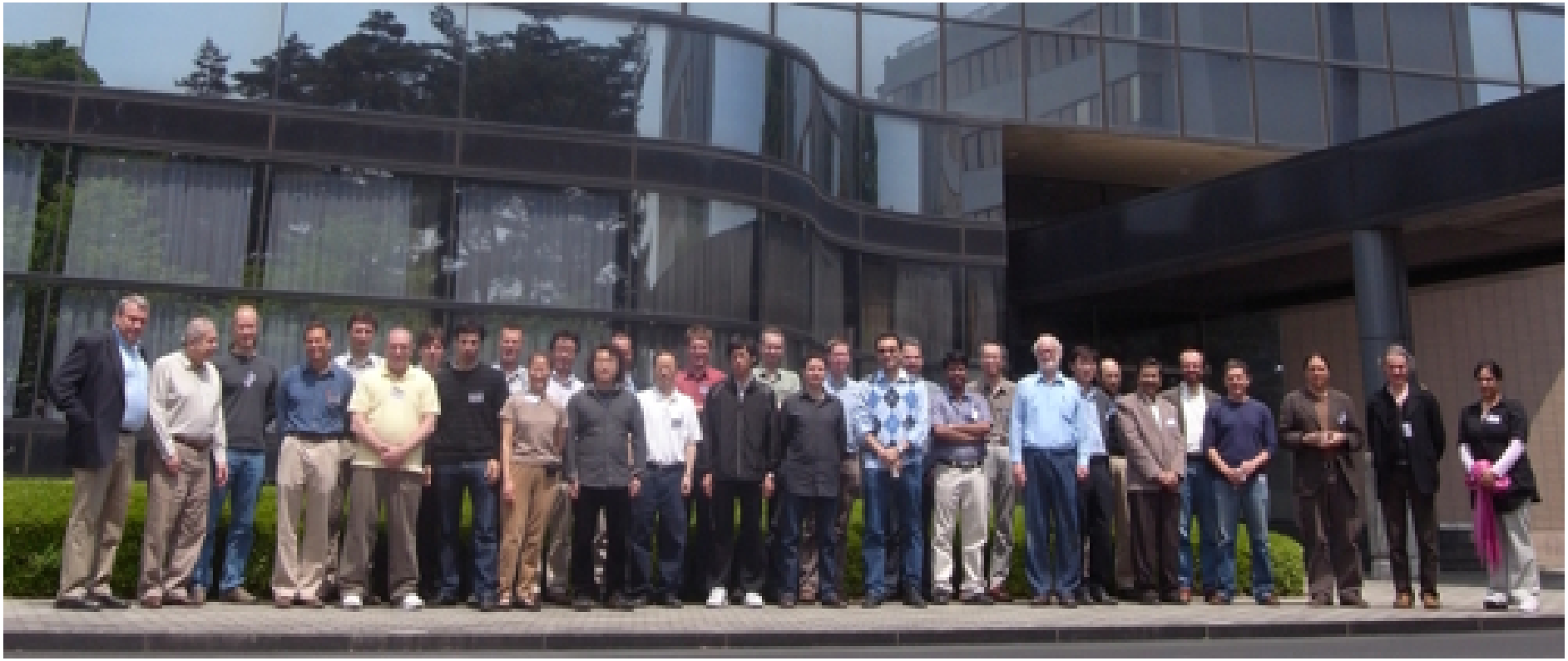
Bruce Yabsley

PBF Book Gen. Eds / Belle / University of Sydney High Energy Physics group

"Physics of the B-Factories",
3rd Workshop, Mainz 1st October 2010

Outline

The previous meeting: KEK, May 2010



Hypernews: the preferred means of communication

HyperNews

BFLB HyperNews at hypernews.slac.stanford.... http://hypernews.slac.stanford.edu/HyperNe...

BFLB HyperNews at hypernews.slac.stanford.edu Forum List by Category Member: homer (logout)

Forums by Category
Forums by Time Order
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Category: BFLB Organization

HyperNews Testing

Category: BFactory Legacy Book

Category: HyperNews

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Many thanks to Charlotte Hee and SLAC Computing for preparing this.

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Login to the BFLB HyperNews at hypernews.s... http://hypernews.slac.stanford.edu/HyperNe...

Login to the BFLB HyperNews at hypernews.slac.stanford.edu HyperNews Not Logged In (login)

Please enter your BFLB HyperNews at hypernews.slac.stanford.edu HyperNews User ID and Password.

User ID:

homer

HyperNews password:

••••••••

Login

IF NOT A MEMBER YET, APPLY HERE

You can apply for an account if you are not a member. If you have forgotten your password, contact chee@slac.stanford.edu for a new password.

After logging in you will be redirected to /HyperNews/BFLB/cindex

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Hypernews: the preferred means of communication

Hypernews: New member Application Form:

New Membership page for BFLB HyperNews at hypernews.slac.stanford.edu — Member: homer (logout)

This page describes how to register as a new member of the BFLB HyperNews at hypernews.slac.stanford.edu HyperNews. Once you are a member, this can be used to access all forums at this site.

- To **register** as a new member, first make up a User ID and enter it immediately below. Make it something that you can remember and easily type - it may be a "nickname". Then fill in the rest of the form. You *should* provide a Name since it is used to identify you in messages. You *must* provide a new password since it protects you from unauthorized use of your User ID. Finally, click on the Register button.

User ID (nickname, no spaces, no '@', case sensitive):
homer

Email and Subscription Options

BFLB HyperNews at hypernews.slac.stanford.edu will send you email each time you update your membership information. BFLB HyperNews at hypernews.slac.stanford.edu will also send you new postings via email if you "subscribe" to forums. A full internet Email address is required for this purpose. If you get a new email address, you can update your HyperNews email address here.

Email Address: (example: jdoe@my.home.net, case sensitive)
1. homer@slac.stanford.edu (Primary)
2.
3.
4.
5.

Hide my Email Address:
☐ Do not show my Email address in messages or member lists.

The CZAR will be Soeren PRELL with Charlotte and Homer as backups.

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Hypernews: New member Application Form:pg 2

Subscribe to:

- (•) Only what I specify in each forum.
- ( ) Nothing - Please **UNSUBSCRIBE** me from all forums at BFLB HyperNews at hypernews.slac.stanford.edu.

Personal Data

Please tell us about yourself. Your *Name* is used to identify you in your messages; otherwise your Email address or User ID is used. You can leave any of these fields blank, if you would prefer.

Name (example: John Doe):

Personal Home Page URL (example: http://my.home.net/):

Reason for This New Account: (example: referral, affiliation, etc) [Note: the account is moderated on this site.]

To specify your password, enter a new password here twice. You may use up to 8 characters. Note that BFLB HyperNews at hypernews.slac.stanford.edu does not store your password in unencrypted form, so if you forget it, you will need to ask for a new password.
DO NOT USE YOUR INTERNET LOGIN PASSWORD.

New Password:

New Password again:

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Hypernews: the preferred means of communication

Hypernews: New member Application Form:pg 3

Remember me:
(BFLB HyperNews at hypernews.slac.stanford.edu can use "cookies" to let your browser remember your login using your User ID and Password for some period of time. You must also enable cookies in your browser.)

- ○ Not at all.
- ◉ Until I quit my browser.

Now click "Register" to add new membership...

Register | Reset this Form to Initial Values

Access Restrictions at BFLB HyperNews at hypernews.slac.stanford.edu

- Anyone may register new members. Members may update their own info.
- Only administrators may reset passwords of members.
- Only members may read messages.
- Only members may add messages.
- Anyone may add subscriptions for notification. Once a member is subscribed, only that member may unsubscribe.
- Only members may delete their own messages.
- Only members may move or copy their own messages.
- Only administrators may create new forums. The owner of a forum is the administrator for it.

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Hypernews: the preferred means of communication

Example Confirmation Message:

Date: Thu, 29 Oct 2010 12:29:57 -0700
From: Soeren Prell <prell@iastate.edu>
To: hneal@in2p3.fr
Subject: New account 'hntest' is activated (BFLB HyperNews at hypernews.slac.stanford.edu)

Congratulations! Your account 'hntest' has been approved and activated.

You can change your membership info by visiting the URL:

http://hypernews.slac.stanford.edu/HyperNews/BFLB/SECURED/edit-member.pl?hntest

Write to prell@iastate.edu for assistance.

Note: Your User ID is "hntest",
but you can also use your Email address: "hneal@in2p3.fr".

Section editors

Section editors			Mailing list of all section editors
A.The Facilities			
1	The *B*-Factories	Jonathan Dorfan	Hirotaka Sugawara
2	Detectors & Collaborations	Hiroaki Aihara William Wisniewski	Nicolas Arnaud
3	Summary of Data taking	Shoji Uno	Johannes Wicht
B.Tools and Methods			
4	Vertexing	Takeo Higuchi	Wouter Hulsbergen
5	Multivariate discriminants	Hidekazu Kakuno	Jose Ocariz
5.1	Analysis Optimization	Frank Porter	
5.2	Particle Identification	Alessandro Gaz	
5.3	Flavor Tagging	Joerg Beringer	Hidekazu Kakuno
5.4	Background discrimination		
6	B-meson reconstruction	Paul Jackson	Anze Zupanc
7	Mixing and time dependent analyses	Adrian Bevan	
8	Maximum-Likelihood fitting	Wouter Verkerke	
9	Angular Analyses	Georges Vasseur	
10	Dalitz Analysis	Thomas Latham	Anton Poluektov
11	Blind Analysis	Aaron Roodman	Alan Schwartz
12	Systematic error estimation	Wolfgang Gradl	

Section editors

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		Paolo Gambino (Vcb)	Zoltan Ligeti (Vub)
		Frank Tackmann (Vub)	
14.2	V_{td} and V_{ts}	Kevin Flood	Tobias Hurth
14.3	Hadronic *B* to charm decays	Martin Beneke	Richard Kass
14.4	Charmless *B* decays	Martin Beneke	Fergus Wilson
14.5	Mixing and EPR correlations	Soeren Prell	Bruce Yabsley
14.6	ϕ_1 or β	Ikaros Bigi	Yoshihide Sakai
		Owen Long	
14.7	ϕ_2 or α	Tagir Aushev	Yury Kolomensky
		Ikaros Bigi	
14.8	ϕ_3 or γ	Ikaros Bigi	Karim Trabelsi
		Fernando Martinez-Vidal	
14.9	CPT violation	Soeren Prell	Bruce Yabsley
14.10	Radiative and electroweak penguin decays	Tobias Hurth	Mikihiko Nakao
		Steve Playfer	
14.11	Leptonic Decays	Toru Iijima	Steve Robertson
14.12	Rare, exotic and forbidden decays	Youngjoon Kwon	Steve Robertson
14.13	Baryonic *B* decays	Roland Waldi	M.-Z. Wang

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		Pasha Pakhlov	
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		Antonio Pich	
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The standalone template

Contents

15.1 Conventional charmonium

Editors:
Riccardo Faccini (BABAR)
Pasha Pakhlov (Belle)
Nora Brambilla (theory)

The headings above were produced with the commands `\pbfshowsection{CCBAR}` and

```
\pbfshoweditors{Riccardo Faccini}
                {Pasha Pakhlov}
                {Nora Brambilla}
```

respectively for the *BABAR*, Belle, and theory editors of the section. They should be replaced with the label and editors' names of your own sectional unit. (A command `\pbfshowchapter` also exists.) Eventually these will set `chapter` and `section` counters to ensure proper labelling of subsections and so on, but currently they do not do so.

This template

This is the template for standalone writing and compilation of contributions to the book "Physics of the B-

The standalone template

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which should be sufficient to compile PDF output from the source, resolving all references, except for cases where certain errors have corrupted LaTeX files on a previous run. If this occurs, try

```
rm pbf-standalone.aux
./pbf-make
```

For contributors' convenience this template includes rules and examples on the following subjects:

- Citations
- Bibliographies
- Tables
- Figures
- Notational changes
- Sectioning, labels, and cross-references

Citations

The basic citation of a Belle paper, given by the command `\citepBelle{Seuster:2005tr}` and so on, looks like this: physics studies include charm fragmentation (Seuster, 2006) and B-meson branchings to final states including charmed-strange mesons (Joshi, 2010). Note that the "et al" is suppressed in the citation, and the label in the bibliography, to avoid tedium; of course it appears in the bibliography in the authorlist itself. If the authorname needs to be incorporated into the grammar of the sentence, then the alternative form `\citeBelle{Sahu:1996me}` is available: important technical measurements were made by Sahu (1996).

Citations of *BABAR* papers proceed in exactly the same customized format where a label resembling the standard citation is set off from the bibliographic entry, to make the (long!) list of papers easier to search. So, the theory work previously mentioned (Bigi and Sanda, 2000) has a label "Bigi and Sanda 2000:" followed by a newline, in the bibliography.

Each bibliography is constructed from its own file, included in this distribution: `pbf-bib-babar.bib`, `pbf-bib-belle.bib`, and `pbf-bib-other.bib`. Each has been constructed from `SPIRES` output in `BibTeX` format. The *BABAR* and Belle files should be reasonably complete, but will of course need to be updated over time: contributors should make updates at need. (If the instructions in the header are followed, there should be no ambiguity about names.) The "other" papers bibliography is almost empty at present; in the full version on SVN it will evolve rapidly, with almost every contribution; for this standalone code, only occasional updates will be made.

Note that the title of the other-papers bibliography is not coming out as requested, due to some `multibib` feature: this will be fixed in a future update. Other known problems or omissions, to be fixed in future releases, include

- detail of citation of `arXiv`-only papers;
- details of the display of added notes in `.bib` files, which may be necessary for some references;
- construction of an index;
- active references → URLs in the bibliography (and active links within the document itself).

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Table 1. Example of a table summarizing quantities from more than one paper: adapted from Vasseur (2008). Measurements of *CP* parameters, branching fractions, and fractions of longitudinal polarization in the $B \to \rho\rho$ modes.

	BABAR	Belle	Average
$S_{\rho^+\rho^-}$	$-0.17 \pm 0.20 \pm 0.06$	$+0.19 \pm 0.30 \pm 0.08$	-0.05 ± 0.17
$C_{\rho^+\rho^-}$	$+0.01 \pm 0.15 \pm 0.06$	$-0.16 \pm 0.21 \pm 0.08$	-0.06 ± 0.13
$\mathcal{A}_{\rho^+\rho^0}$	$-0.12 \pm 0.13 \pm 0.10$	$+0.00 \pm 0.22 \pm 0.03$	-0.08 ± 0.13
$C_{\rho^0\rho^0}$	$+0.4 \pm 0.9 \pm 0.2$	$--$	$+0.4 \pm 0.9$
$S_{\rho^0\rho^0}$	$+0.5 \pm 0.9 \pm 0.2$	$--$	$+0.5 \pm 0.9$
$\mathcal{B}_{\rho^+\rho^-}$ $[10^{-6}]$	$25 \pm 2 \pm 4$	$23 \pm 4 \pm 3$	24 ± 3
$\mathcal{B}_{\rho^+\rho^0}$ $[10^{-6}]$	$17 \pm 2 \pm 2$	$32 \pm 7^{+4}_{-7}$	18 ± 3
$\mathcal{B}_{\rho^0\rho^0}$ $[10^{-6}]$	$0.8 \pm 0.3 \pm 0.2$	$0.4 \pm 0.4 \pm 0.2$	0.7 ± 0.3
$f_L^{\rho^+\rho^-}$	$0.99 \pm 0.02 \pm 0.02$	$0.94 \pm 0.04 \pm 0.03$	0.98 ± 0.02
$f_L^{\rho^+\rho^0}$	$0.90 \pm 0.04 \pm 0.03$	$0.95 \pm 0.11 \pm 0.02$	0.91 ± 0.04
$f_L^{\rho^0\rho^0}$	$0.70 \pm 0.14 \pm 0.05$	$--$	0.70 ± 0.15

should be ensured: Table 1 is an example at the limit of reasonable use.

– Tables spanning two columns can be implemented using the `table*` environment. They should be used sparingly, but in some cases cannot be avoided: Table 2 is an example.
– Extra vertical space throughout a table can be added by using *e.g.* `\renewcommand{\arraystretch}{1.4}` inside the floating `table` environment, just before the

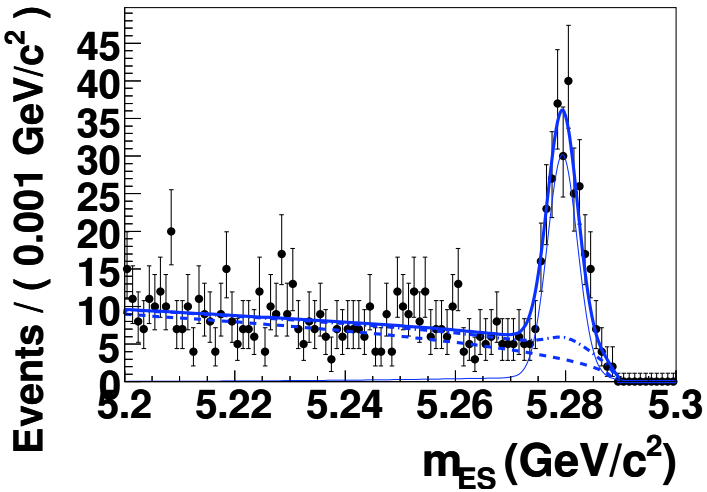

Fig. 1. Example of a `.pdf` plot constructed from an `.eps` original, with (1) the original notation M_{bc} changed to $m_{\rm ES}$ manually in the `.eps` file, and (2) the final version produced using `epstopdf` at the prompt on a Linux box. From Li (2008): $m_{\rm ES}$ distributions from $B^0 \to K^0_S\pi^+\pi^-\gamma$ events. Points with error bars are data. The curves show the results from the r dependent $m_{\rm ES}$ fit. The dashed and dash-dotted curves are the $q\bar{q}$ and all BG. The thin curve is the total signal including SCF and the thick curve is the total PDF.

Figures

To keep the length of the book within reasonable limits, we will need to be selective in the inclusion of figures; on the other hand, well-chosen and produced figures are irre-

The standalone template

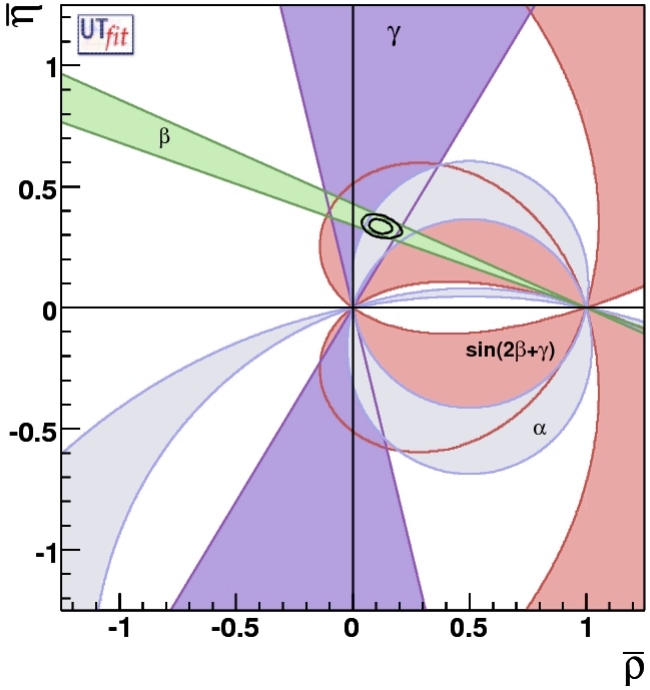

Fig. 2. Example of a `.jpg` figure from UTfit (Bona et al., 2010) current in June 2010: Allowed regions for $(\bar{\rho}, \bar{\eta})$, given by the measurements of $\sin 2\phi_1$, $\cos 2\phi_1$, ϕ_1 from $D^0\pi^0$, ϕ_2, ϕ_3, and $2\phi_1 + \phi_3$. (In the figure the alternative notation $(\beta, \alpha, \gamma) \equiv (\phi_1, \phi_2, \phi_3)$ is used.) The closed contours at 68% and 95% probability are shown. The full lines correspond to 95% probability regions for each constraint.

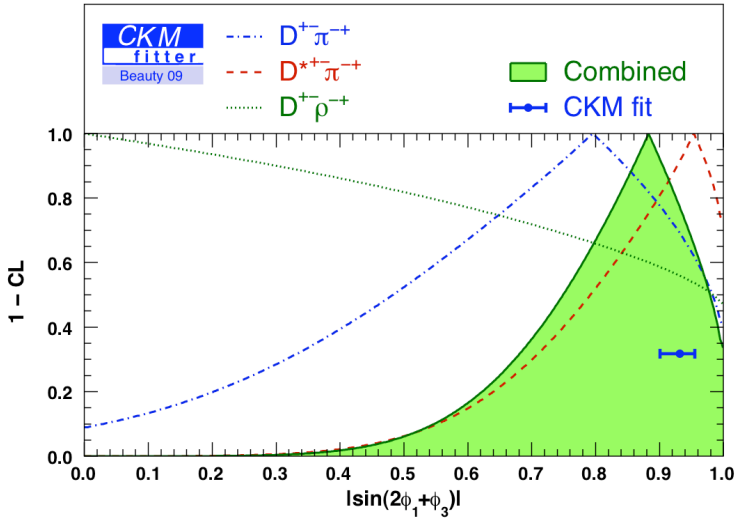

Fig. 3. Example of a `.png` figure, converted for this purpose from the original `.eps` file. From CKMfitter (Charles et al., 2005): Constraints on $|\sin(2\phi_1 + \phi_3)|$ from the measurement of time-dependent CP asymmetries in $D^{(*)}\pi(\rho)$; Summer 08 HFAG average including a preliminary Belle ICHEP08 update for $D^*\pi$ is used as input. The extraction of the UT-angle combination relies on $SU(3)$ symmetry for the estimates of the suppressed-to-leading amplitude ratios . . . (see further specifics *ad loc*: not relevant for this example).

- (ϕ_1, ϕ_2, ϕ_3) for the angles of the unitarity triangle;
- (S, C) for the coefficients of time-dependent CP violation;
- $m_{\rm ES}$ for the "mass" variable inherited from earlier B-

often be possible to edit notation by hand (e.g. Fig. 1), and/or using `pstoedit/xfig` or other simple programs. Plots produced under proprietary software (e.g. Adobe Illustrator) may need to be edited from source with those same programs, or otherwise remade from scratch. If the

Templates for individual sections & the full book

. . . see the LaTeX/style talk tomorrow afternoon

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Part A

The facilities

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The B-factories

Editors:
Jonathan Dorfan (BABAR)
Hirotaka Sugawara (Belle)

Text here.

Chapter 2

The detectors and collaborations

Editors:
Nicolas Arnaud and William Wisniewski (BABAR)
Hiroaki Aihara (Belle)

Text here.

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Part C

The results and their interpretation

Chapter 13

The CKM matrix and the Kobayashi-Maskawa mechanism

Editors:
Adrian Bevan and Soeren Prell (BABAR)
Boštjan Golob and Bruce Yabsley (Belle)
Thomas Mannel (theory)

Text here.

Chapter 14

B-physics

Text here.

14.4 Charmless B decays

Editors:
Fergus Wilson (BABAR)
Martin Beneke (theory)

Text here.

14.5 Mixing, and EPR correlations

Editors:
Soeren Prell (BABAR)
Bruce Yabsley (Belle)

Text here.

14.6 ϕ_1, or β

Editors:
Owen Long (BABAR)
Yoshihide Sakai (Belle)
Ikaros Bigi (theory)

Text here.

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Hisaki Hayashii (Belle)
Antonio Pich (theory)

Text here.

Chapter 18
QED and initial state radiation studies

Editors:
Fabio Anulli (BABAR)
Galina Pakhlova (Belle)

Text here.

Chapter 19
Two-photon physics

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Sadaharu Uehara (Belle)

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Chapter 20
$\Upsilon(5S)$ physics

Chapter 22
Global interpretation

22.1 Global CKM fits

Editors:
Gerald Eigen (BABAR)
Ryosuke Itoh (Belle)
Marcella Bona and Cecilia Tarantino (theory)

Text here.

22.2 Benchmark "new physics" models

Editors:
Emi Kou (theory)

Text here.

Bibliography: BaBar Publications

Bibliography: Belle Publications

SVN

. . . see the computing talk tomorrow afternoon

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09:20	Progress since KEK meeting (by B.Yabsley) (20')
09:40	Vertexing (by W.Hulsbergen) (20') (Slides) by EVO
10:00	Analysis optimization (by J.Ocariz) (10')
10:10	B reconstruction (by A.Zupanc) (20') (Paper; Slides)
10:30	Angular analyses (by G.Vasseur) (10') (Slides)
10:40	Coffee Break (20')
11:00	TDEP (by A.Bevan) (20') (Paper; Slides)
11:20	Systematic errors section discussion (by W.Gradl + all) (20')
11:40	CKM (by T.Mannel) (20') (Paper)
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13:00	Lunch (1h00')
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The content of the book

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14:50	phi1/beta (by A.Lazzaro) (10')
15:00	phi3/gamma (by F.Martinez-Vidal or K.Trabelsi) tbc (20') by EVO
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17:30	Adjourn (05')
19:30	Social Dinner (2h30')

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14:20	Computing (by A.Bevan) (20')
14:40	Closeout (by S.Prell) (20')
15:00	Adjourn (05')