EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH (CERN)

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Template for writing LHCb papers

The LHCb collaboration[†]

Abstract

Guidelines for the preparation of LHCb documents are given. This is a "living" document, that should reflect our current practice. It is expected that these guidelines are implemented for papers already before they go into the first collaboration wide review. Please contact the Editorial Board chair if you have suggestions for modifications. This is the title page for journal publications (PAPER). For a CONF note or ANA note, switch to the appropriate template by uncommenting the corresponding line in the file `main.tex`.

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LHCb collaboration

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The author list for journal publications is provided by the Membership Committee shortly after 'approval to go to paper' has been given. It will be made available on the page `http://www.physik.uzh.ch/~strauman/forMemCo/LHCb-PAPER-XXXX-XXX/` . The author list should be included already at first circulation, to allow new members of the collaboration to verify whether they have been included correctly. Before every new circulation and before submitting, check if the author list has been updated, since occasionally a misspelled name is corrected or associated institutions become full members. In case line numbering doesn't work well after including the authorlist, try moving the `\bigskip` after the last author to a separate line.

The authorship for Conference Reports should be "The LHCb collaboration", with a footnote giving the name(s) of the contact author(s), but without the full list of collaboration names.

1 Introduction

This is the template for typesetting LHCb notes and journal papers. It should be used for any document in LHCb [1] that is to be publicly available. The format should be used for uploading to preprint servers and only afterwards should specific typesetting required for journals or conference proceedings be applied. The main Latex file contains several options as described in the Latex comment lines.

It is expected that these guidelines are implemented for papers already before they go into the first collaboration wide review.

This template also contains the rules for how publications and conference reports should be written. Through the symbols defined in `lhcb-symbols-def.tex` it should be easy to follow the majority of requirements set out here.

The front page should be adjusted according to what is written. Default versions are available for papers, conference reports and analysis notes. Just comment out what you require in the `main.tex` file.

2 General principles

The main goal is for a paper to be clear. It should be as brief as possible, without sacrificing clarity. For all public documents, special consideration should be given to the fact that the reader will be less familiar with LHCb than the author.

Here follow a list of general principles that should be adhered to:

1. Choices that are made concerning layout and typography should be consistently applied throughout the document.

2. Standard English should be used (British rather than American) for LHCb notes and preprints. Examples: colour, flavour, centre, metre, modelled and aluminium. Words ending on -ise or -isation (polarise, hadronisation) can be written with -ize or -ization ending. The punctuation normally follows the closing quote mark of quoted text, rather than being included before the closing quote. Footnotes come after punctuation. Papers to be submitted to an American journal can be written in American English instead. Under no circumstance should the two be mixed.

3. Use of jargon should be avoided where possible. “Systematics” are “systematic uncertainties”, “L0” is “hardware trigger”, “penguin” diagrams are best introduced with an expression like “electroweak loop (penguin) diagrams”.

4. Latex should be used for typesetting. Line numbering should be switched on for drafts that are circulated for comments.

5. The abstract should be concise, and not include citations or numbered equations, and should give the key results from the paper.

6. Apart from descriptions of the detector, the trigger and the simulation, the text should not be cut-and-pasted from other sources that have previously been published.

7. References should usually be made only to publicly accessible documents. References to LHCb conference reports and public notes should be avoided in journal publications, instead including the relevant material in the paper itself.

8. The use of tenses should be consistent. It is recommended to mainly stay in the present tense, for the abstract, the description of the analysis, *etc.*; the past tense is then used where necessary, for example when describing the data taking conditions.

9. It is recommended to use the passive rather than active voice: "the mass is measured", rather than "we measure the mass". Limited use of the active voice is acceptable, in situations where re-writing in the passive form would be cumbersome, such as for the acknowledgements. Some leeway is permitted to accommodate different author's styles, but "we" should not appear excessively in the abstract or the first lines of introduction or conclusion.

10. A sentence should not start with a variable, a particle or an acronym. A title or caption should not start with an article.

3 Layout

1. Unnecessary blank space should be avoided, between paragraphs or around figures and tables.

2. Figure and table captions should be concise and use a somewhat smaller typeface than the main text, to help distinguish them. This is achieved by inserting `\small` at the beginning of the caption. Figure captions go below the figure, table captions go above the table.

3. Captions and footnotes should be punctuated correctly, like normal text. The use of too many footnotes should be avoided: typically they are used for giving commercial details of companies, or standard items like coordinate system definition or the implicit inclusion of charge-conjugate processes.[1]

4. Tables should be formatted in a simple fashion, without excessive use of horizontal and vertical lines. See Table 1 for an example.

5. Figures and tables should normally be placed so that they appear on the same page as their first reference, but at the top or bottom of the page; if this is not possible, they should come as soon as possible afterwards. They must all be referred to from the text.

[1] If placed at the end of a sentence, the footnote symbol normally follows the punctuation; if placed in the middle of an equation, take care to avoid any possible confusion with an index.

Table 1: Background-to-signal ratio estimated in a $\pm 50\,\mathrm{MeV}/c^2$ mass window for the prompt and long-lived backgrounds, and the minimum bias rate.

Channel	$B_{\rm pr}/S$	$B_{\rm LL}/S$	MB rate
$B_s^0 \to J/\psi\,\phi$	1.6 ± 0.6	0.51 ± 0.08	~ 0.3 Hz
$B^0 \to J/\psi\,K^{*0}$	5.2 ± 0.3	1.53 ± 0.08	~ 8.1 Hz
$B^+ \to J/\psi\,K^{*+}$	1.6 ± 0.2	0.29 ± 0.06	~ 1.4 Hz

6. If one or more equations are referenced, all equations should be numbered using parentheses as shown in Eq. 1,

$$V_{us}V_{ub}^* + V_{cs}V_{cb}^* + V_{ts}V_{tb}^* = 0\ . \tag{1}$$

7. Displayed results like

$$\mathcal{B}(B_s^0 \to \mu^+\mu^-) < 1.5 \times 10^{-8} \text{ at } 95\% \text{ CL}$$

should in general not be numbered.

8. Numbered equations should be avoided in captions and footnotes.

9. Displayed equations are part of the normal grammar of the text. This means that there should not be a colon before the equation, and the equation should end in full stop or comma if required when reading aloud. The line after the equation should only be indented if it starts a new section.

10. Sub-sectioning should not be excessive: sections with more than three levels of index (1.1.1) should be avoided.

11. Acronyms should be defined the first time they are used, *e.g.* "Monte Carlo (MC) events containing a doubly Cabibbo-suppressed (DCS) decay have been generated." The abbreviated words should not be capitalised if it is not naturally written with capitals, *e.g.* quantum chromodynamics (QCD), impact parameter (IP), boosted decision tree (BDT). Avoid acronyms if they are used three times or less. A sentence should never start wit an acronym and its better to avoid it as the last word of a sentence as well.

4 Typography

The use of the Latex typesetting symbols defined in the file `lhcb-symbols-def.tex` and detailed in the appendices of this document is strongly encouraged as it will make it much easier to follow the recommendation set out below.

1. LHCb is typeset with a normal (roman) lowercase b.

2. Titles are in bold face, and usually only the first word is capitalised.

3. Mathematical symbols and particle names should also be typeset in bold when appearing in titles.

4. Units are in roman type, except for constants such as c or h that are italic: GeV, GeV/c^2. The unit should be separated from the value with a protected space ("~") or a thin space ("\,"), and they should not be broken over two lines. It is recommended to keep the factors of c for masses and momenta, *e.g.* $m = 3.1\,\text{GeV}/c^2$ (or $\text{GeV}c^{-2}$). However, if they are dropped this should be done consistently throughout, and a note should be added at the first instance to indicate that units are taken with $c = 1$.

5. The % sign should not be separated from the number that precedes it: 5%, not 5 %. A thin space is also acceptable: 5 %, but should be applied consistently throughout the paper.

6. Italic is preferred for particle names (although roman is acceptable, if applied consistently throughout). Particle Data Group conventions should generally be followed: B^0 (no need for a "d" subscript), $B^0_s \to J/\psi\,\phi$, $\overline{B}{}^0_s$, (note the long bar, obtained with `\overline`, in contrast to the discouraged short `\bar{B}` resulting in $\bar{B}$), $K^0_{\rm S}$ (note the uppercase roman type "S"). This is most easily achieved by using the predefined symbols described in Appendix C. Unless there is a good reason not to, the charge of a particle should be specified if there is any possible ambiguity ($m(K^+K^-)$ instead of $m(KK)$, which could refer to neutral kaons).

7. Decay chains can be written in several ways, depending on the complexity and the number of times it occurs. Unless there is a good reason not to, usage of a particular type should be consistent within the paper. Examples are: $D^+_s \to \phi\pi^+$, with $\phi \to K^+K^-$; $D^+_s \to \phi\pi^+$ ($\phi \to K^+K^-$); $D^+_s \to \phi(\to K^+K^-)\pi^+$; or $D^+_s \to [K^+K^-]_\phi\pi^+$.

8. Variables are usually italic: V is a voltage (variable), while 1 V is a volt (unit). Also in combined expressions: Q-value, z-scale, R-parity *etc.*

9. Subscripts and superscripts are roman type when they refer to a word (such as T for transverse) and italic when they refer to a variable (such as t for time): $p_{\rm T}$, Δm_s, $t_{\rm rec}$.

10. Standard function names are in roman type: *e.g.* cos, sin and exp.

11. Figure, Section, Equation, Chapter and Reference should be abbreviated as Fig., Sect. (or alternatively Sec.), Eq., Chap. and Ref. respectively, when they refer to a particular (numbered) item, except when they start a sentence. Table and Appendix are not abbreviated. The plural form of abbreviation keeps the point after the s, *e.g.* Figs. 1 and 2. Equations may be referred to either with ("Eq. (1)") or without ("Eq. 1") parentheses, but it should be consistent within the paper.

12. Common abbreviations derived from Latin such as "for example" (*e.g.*), "in other words" (*i.e.*), "and so forth" (*etc.*), "and others" (*et al.*), "versus" (*vs.*) can be used, with the typography shown, but not excessively; other more esoteric abbreviations should be avoided.

13. Units, material and particle names are usually lower case if spelled out, but often capitalised if abbreviated: amps (A), gauss (G), lead (Pb), silicon (Si), kaon (K), but proton (p).

14. Counting numbers are usually written in words if they start a sentence or if they have a value of ten or below in descriptive text (*i.e.* not including figure numbers such as "Fig. 4", or values followed by a unit such as "4 cm"). The word 'unity' can be useful to express the special meaning of the number one in expressions such as: "The BDT output takes values between zero and unity".

15. Numbers larger than 9999 have a comma (or a small space, but not both) between the multiples of thousand: *e.g.* 10,000 or 12,345,678. The decimal point is indicated with a point rather than a comma: *e.g.* 3.141.

16. We apply the rounding rules of the PDG [2]. The basic rule states that if the three highest order digits of the uncertainty lie between 100 and 354, we round to two significant digits. If they lie between 355 and 949, we round to one significant digit. Finally, if they lie between 950 and 999, we round up and keep two significant digits. In all cases, the central value is given with a precision that matches that of the uncertainty. So, for example, the result 0.827 ± 0.119 should be written as 0.83 ± 0.12, 0.827 ± 0.367 should turn into 0.8 ± 0.4, and 14.674 ± 0.964 becomes 14.7 ± 1.0. When writing numbers with uncertainty components from different sources, *i.e.* statistical and systematic uncertainties, the rule applies to the uncertainty with the best precision, so $0.827 \pm 0.367\,(\text{stat}) \pm 0.179\,(\text{syst})$ goes to $0.83 \pm 0.37\,(\text{stat}) \pm 0.18\,(\text{syst})$ and $8.943 \pm 0.123\,(\text{stat}) \pm 0.995\,(\text{syst})$ goes to $8.94 \pm 0.12\,(\text{stat}) \pm 1.00\,(\text{syst})$.

17. When rounding numbers, it should be avoided to pad with zeroes at the end. So 51237 ± 4561 should be rounded as $(5.12 \pm 0.46) \times 10^4$ and not 51200 ± 4600.

18. When rounding numbers in a table, some variation of the rounding rules above may be required to achieve uniformity.

19. Hyphenation should be used where necessary to avoid ambiguity, but not excessively. For example: "big-toothed fish" (to indicate that big refers to the teeth, not to the fish), but "big white fish". A compound modifier often requires hyphenation (*CP*-violating observables, *b*-hadron decays, final-state radiation), even if the same combination in an adjective-noun combination does not (direct *CP* violation, heavy *b* hadrons, charmless final state). Cross-section, cross-check, and two-dimensional are hyphenated. Semileptonic, pseudorapidity, multivariate, multidimensional, and reweighted are single words and should not be hyphenated.

20. Minus signs should be in a proper font (-1), not just hyphens (-1); this applies to figure labels as well as the body of the text. In Latex, use math mode (between `$$`'s) or make a dash ("`--`"). In ROOT, use `#font[122]{-}` to get a normal-sized minus sign.

21. Inverted commas (around a title, for example) should be a matching set of left- and right-handed pairs: "Title". The use of these should be avoided where possible.

22. Single symbols are preferred for variables in equations, *e.g.* $\mathcal{B}$ rather than BF for a branching fraction.

23. Parentheses are not usually required around a value and its uncertainty, before the unit, unless there is possible ambiguity: so $\Delta m_s = 20 \pm 2\,\text{ps}^{-1}$ does not need parentheses, whereas $f_d = (40 \pm 4)\%$ or $x = (1.7 \pm 0.3) \times 10^{-6}$ does. The unit does not need to be repeated in expressions like $1.2 < E < 2.4\,\text{GeV}$.

24. The same number of decimal places should be given for all values in any one expression (*e.g.* $5.20 < m_B < 5.34\,\text{GeV}/c^2$).

25. Apostrophes are best avoided for abbreviations: if the abbreviated term is capitalised or otherwise easily identified then the plural can simply add an s, otherwise it is best to rephrase: *e.g.* HPDs, π^0s, pions, rather than HPD's, π^0's, πs.

26. Particle labels, decay descriptors and mathematical functions are not nouns, and need often to be followed by a noun. Thus "background from $B^0 \to \pi^+\pi^-$ decays" instead of "background from $B^0 \to \pi^+\pi^-$", and "the width of the Gaussian function" instead of "the width of the Gaussian".

27. In equations with multidimensional integrations or differentiations, the differential terms should be separated by a thin space. Thus $\int f(x,y)dx\,dy$ instead $\int f(x,y)dxdy$ and $\frac{d^2\Gamma}{dx\,dQ^2}$ instead of $\frac{d^2\Gamma}{dxdQ^2}$. The d's are allowed in either roman or italic font, but should be consistent throughout the paper.

5 Detector and software

The following paragraph can be used for the detector description. Modifications may be required in specific papers to fit within page limits, to enhance particular detector elements or to introduce acronyms used later in the text. Reference to the detector performance papers are marked with a * and should only be included if the analysis described in the paper relies on numbers or methods described in the paper.

The LHCb detector [1] is a single-arm forward spectrometer covering the pseudorapidity range $2 < \eta < 5$, designed for the study of particles containing b or c quarks. The detector includes a high-precision tracking system consisting of a silicon-strip vertex detector surrounding the pp interaction region, a large-area silicon-strip detector located upstream of a dipole magnet with a bending power of about 4 Tm, and three stations of silicon-strip

detectors and straw drift tubes placed downstream. The combined tracking system provides a momentum measurement with relative uncertainty that varies from 0.4% at 5 GeV/c to 0.6% at 100 GeV/c, and impact parameter resolution of 20 μm for tracks with high transverse momentum. Charged hadrons are identified using two ring-imaging Cherenkov detectors [3]∗. Photon, electron and hadron candidates are identified by a calorimeter system consisting of scintillating-pad and preshower detectors, an electromagnetic calorimeter and a hadronic calorimeter. Muons are identified by a system composed of alternating layers of iron and multiwire proportional chambers [4]∗. The trigger [5]∗ consists of a hardware stage, based on information from the calorimeter and muon systems, followed by a software stage, which applies a full event reconstruction.

The trigger description has to be specific for the analysis in question. In general, you should not attempt to describe the full trigger system. Below are a few variations that inspiration can be taken from. First from a hadronic analysis, and second from an analysis with muons in the final state.

- The software trigger requires a two-, three- or four-track secondary vertex with a high sum of the transverse momentum, $p_{\rm T}$, of the tracks and a significant displacement from the primary pp interaction vertices (PVs). At least one track should have $p_{\rm T} > 1.7\,{\rm GeV}/c$ and $\chi^2_{\rm IP}$ with respect to any primary interaction greater than 16, where $\chi^2_{\rm IP}$ is defined as the difference in χ^2 of a given PV reconstructed with and without the considered track. A multivariate algorithm [6] is used for the identification of secondary vertices consistent with the decay of a b hadron.

- Candidate events are first required to pass a hardware trigger, which selects muons with a transverse momentum, $p_{\rm T} > 1.48\,{\rm GeV}/c$. In the subsequent software trigger, at least one of the final state particles is required to have both $p_{\rm T} > 0.8\,{\rm GeV}/c$ and impact parameter $> 100\,\mu{\rm m}$ with respect to all of the primary pp interaction vertices (PVs) in the event. Finally, the tracks of two or more of the final state particles are required to form a vertex that is significantly displaced from the PVs.

The description of our software stack for simulation is often causing trouble. The following paragraph can act as inspiration but with variations according to the level of detail required and if mentioning of *e.g.* PHOTOS is required.

In the simulation, pp collisions are generated using PYTHIA 6.4 [7] with a specific LHCb configuration [8]. Decays of hadronic particles are described by EVTGEN [9], in which final state radiation is generated using PHOTOS [10]. The interaction of the generated particles with the detector and its response are implemented using the GEANT4 toolkit [11] as described in Ref. [12].

Many analyses depend on boosted decision trees. It is inappropriate to use TMVA as the reference as that is merely an implementation of the BDT algorithm. Rather it is suggested to write

In this paper we use a boosted decision tree (BDT) [13] with the AdaBoost algorithm [14] to separate signal from background.

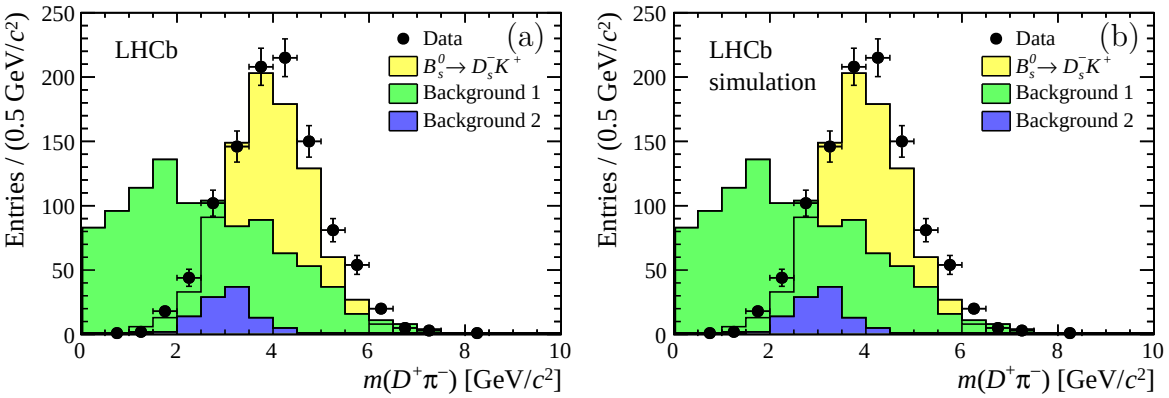

Figure 1: Example plots for (a) data and (b) simulation using the LHCb style from the URANIA package `RootTools/LHCbStyle`. The signal data is shown as points with the signal component as yellow (light shaded), background 1 as green (medium shaded) and background 2 as blue (dark shaded).

When describing the integrated luminosity of the data set, do not use expressions like "1.0 fb^{-1} of data", but instead "data corresponding to an integrated luminosity of 1.0 fb^{-1}".

6 Figures

A standard LHCb style file for use in production of figures in ROOT is in the URANIA package `RootTools/LHCbStyle` or directly in SVN at `svn+ssh://svn.cern.ch/reps/lhcb/Urania/trunk/RootTools/LHCbStyle`. It is not mandatory to use this style, but it makes it easier to follow the recommendations below.

Figure 1 shows an example of how to include an eps or pdf figure with the `\includegraphics` command (eps figures will not work with `pdflatex`). Note that if the graphics sits in `figs/myfig.pdf`, you can just write `\includegraphics{myfig}` as the `figs` subdirectory is searched automatically and the extension `.pdf` (`.eps`) is automatically added for `pdflatex` (`latex`).

1. Figures should be legible at the size they will appear in the publication, with suitable line width. Their axes should be labelled, and have suitable units (e.g. avoid a mass plot with labels in MeV/c^2 if the region of interest covers a few GeV/c^2 and all the numbers then run together). Spurious background shading and boxes around text should be avoided.

2. Fit curves should not obscure the data points, and data points are best (re)drawn over the fit curves.

3. Colour may be used in figures, but the distinction between differently coloured areas or lines should be clear also when the document is printed in black and white,

for example through differently dashed lines. The LHCb style mentioned above implements a colour scheme that works well but individual adjustments might be required.

4. Figures with more than one part should have the parts labelled (a), (b) *etc.*, with a corresponding description in the caption; alternatively they should be clearly referred to by their position, e.g. Fig. 1 (left). In the caption, the labels (a), (b) *etc.* should precede their description.

5. All figures containing LHCb data should have LHCb written on them. For preliminary results, that should be replaced by "LHCb preliminary". Figures that only have simulated data should display "LHCb simulation". Figures that do not depend on LHCb-specific software (*e.g.* only on PYTHIA) should not have any label.

7 References

References should be made using BibTEX [15]. A special style `LHCb.bst` has been created to achieve a uniform style. Independent of the journal the paper is submitted to, the preprint should be created using this style. Where arXiv numbers exist, these should be added even for published articles. In the PDF file, hyperlinks will be created to both the arXiv and the published version.

1. Citations are marked using square brackets, and the corresponding references should be typeset using BibTEX and the official LHCb BibTEX style. An example is in Ref. [7].

2. For references with four or less authors all of the authors' names are listed [16], otherwise the first author is given, followed by *et al.*. The LHCb BibTEX style will take care of this.

3. The order of references should be sequential when reading the document. This is automatic when using BibTEX.

4. The titles of papers should in general be included. To remove them, change `\setboolean{articletitles}{false}` to `true` at the top of this template.

5. Whenever possible, use references from the supplied files `main.bib`, `LHCb-PAPER.bib`, `LHCb-CONF.bib`, and `LHCB-DP.bib`. These are kept up-to-date by the EB. If you see a mistake, do not edit these files, but let the EB know. This way, for every update of the paper, you save yourself the work of updating the references. Instead, you can just copy or check in the latest versions of the `.bib` files from the repository.

6. For those references not provided by the EB, the best is to copy the BibTEX entry directly from `Inspire`. Often these need to be edited to get the correct title, author names and formatting. Also, make sure to eliminate unnecessary capitalisation.

Check that both the arXiv and the journal index are clickable and point to the right article.

7. The `mciteplus` [17] package is used to enable multiple references to show up as a single item in the reference list. As an example `\cite{Mohapatra:1979ia,*Pascoli:2007qh}` where the `*` indicates that the reference should be merged with the previous one. The result of this can be seen in Ref. [18]. Be aware that the `mciteplus` package should be included as the very last item before the `\begin{document}` to work correctly.

8. It should be avoided to make references to public notes and conference reports in public documents. Exceptions can be discussed on a case-by-case basis with the review committee for the analysis. In internal reports they are of course welcome and can be referenced as seen in Ref. [19] using the `lhcbreport` category. For conference reports, omit the author field completely in the BibTEX record.

9. To get the typesetting and hyperlinks correct for LHCb reports, the category `lhcbreport` should be used in the BibTEX file. See Ref. [20] for some examples. It can be used for LHCb documents in the series `CONF`, `PAPER`, `PROC`, `THESIS`, and internal LHCb reports. Papers sent for publication, but not published yet, should be referred with their `arXiv` number, so the `PAPER` category should only be used in the rare case of a forward reference to a paper.

10. Proceedings can be used for references to items such as the LHCb simulation [12], where we do not yet have a published paper.

There is a set of standard references to be used in LHCb that are listed in Appendix A.

8 Inclusion of supplementary material

In some cases it is desirable to approve material that is supplementary to that which is included in the main body of the paper. For example, sometimes a short Letter is written, but additional figures that cannot be contained within the page limit should be approved to be available to be shown in talks. As a reminder, only approved material can be shown in public. Another use case is to provide data tables. Any supplementary material should be made available in the circulation to the collaboration in a clearly marked appendix to the main document. Before the paper is submitted this appendix must be removed, and the supplementary material is added separately to the CDS entry.

Journals published through or by the AIP, such as Phys. Rev. Lett. and Phys. Rev. D, support the use of EPAPS. Their description of relevant supplementary material includes

> *multimedia (e.g., movie files, audio files, animated .gifs, 3D rendering files), color figures, data tables, and text (e.g., appendices) that are too lengthy or of too limited interest for inclusion in the printed journal.*

LHCb publications in those journals can make use of EPAPS as appropriate. However, note that there are some categories of supplementary material, such as additional plots, that are not appropriate for EPAPS.

The appendix containing supplementary material should not be referred to in the main body of the text as it will not appear in the final version. An exception is for material that will be available in EPAPS, where the AIP recommendation is

> *Files are made available to users via links from the journal. Authors should include a reference in the form "See supplementary material at [URL will be inserted by AIP] for [give brief description of material]."*

However, in this template, an example of the formatting for an appendix of supplementary material is given in Appendix D.

Acknowledgements

The text below are the acknowledgements as approved by the collaboration board. Extending the acknowledgements to include individuals from outside the collaboration who have contributed to the analysis should be approved by the EB and, if possible, be included in the draft of first circulation.

We express our gratitude to our colleagues in the CERN accelerator departments for the excellent performance of the LHC. We thank the technical and administrative staff at the LHCb institutes. We acknowledge support from CERN and from the national agencies: CAPES, CNPq, FAPERJ and FINEP (Brazil); NSFC (China); CNRS/IN2P3 and Region Auvergne (France); BMBF, DFG, HGF and MPG (Germany); SFI (Ireland); INFN (Italy); FOM and NWO (The Netherlands); SCSR (Poland); ANCS/IFA (Romania); MinES, Rosatom, RFBR and NRC "Kurchatov Institute" (Russia); MinECo, XuntaGal and GENCAT (Spain); SNSF and SER (Switzerland); NAS Ukraine (Ukraine); STFC (United Kingdom); NSF (USA). We also acknowledge the support received from the ERC under FP7. The Tier1 computing centres are supported by IN2P3 (France), KIT and BMBF (Germany), INFN (Italy), NWO and SURF (The Netherlands), PIC (Spain), GridPP (United Kingdom). We are thankful for the computing resources put at our disposal by Yandex LLC (Russia), as well as to the communities behind the multiple open source software packages that we depend on.

Appendices

A Standard References

Below is a list of common references, as well as a list of all LHCb publications. As they are already in prepared bib files, they can be used as simply as `\cite{Alves:2008zz}` to get the LHCb detector paper. The references are defined in the files `main.bib`, `LHCb-PAPER.bib`, `LHCb-CONF.bib` and `LHCb-DP.bib` files, with obvious contents. Each of these have their `LHCb-ZZZ-20XX-0YY` number as their cite code. If you believe there is a problem with the formatting or content of one of the entries, then get in contact with the Editorial Board rather than just editing it in your local file, since you are likely to need the latest version just before submiting the article.

Description	`cite` code	Reference
LHCb detector	`Alves:2008zz`	[1]
PID performance	`LHCb-PROC-2011-008`	[21]
LHCb simulation	`LHCb-PROC-2011-006`	[12]
PDG 2012	`PDG2012`	[2]
HFAG	`HFAG`	[22]
Pythia 6	`Sjostrand:2006za`	[7]
LHCb Pythia tuning	`LHCb-PROC-2010-056`	[8]
Geant4	`Allison:2006ve, *Agostinelli:2002hh`	[11]
EvtGen	`Lange:2001uf`	[9]
Photos	`Golonka:2005pn`	[10]
Crystal Ball function	`Skwarnicki:1986xj`	[23]
BDT	`Breiman`	[13]
BDT training	`AdaBoost`	[14]
HLT2 topo	`BBDT`	[6]
DecayTreeFitter	`Hulsbergen:2005pu`	[24]
sPlot	`Pivk:2004ty`	[25]

`LHCb-DP` number	Title
`LHCb-DP-2013-001` [26]	Performance of the muon identification at LHCb
`LHCb-DP-2012-005` [27]	Radiation damage in the LHCb Vertex Locator
`LHCb-DP-2012-004` [5]	The LHCb trigger and its performance in 2011
`LHCb-DP-2012-003` [3]	Performance of the LHCb RICH detector at the LHC
`LHCb-DP-2012-002` [4]	Performance of the LHCb muon system
`LHCb-DP-2012-001` [28]	Radiation hardness of the LHCb Outer Tracker
`LHCb-DP-2011-002` [29]	Simulation of machine induced background ...
`LHCb-DP-2011-001` [30]	Performance of the LHCb muon system with cosmic rays
`LHCb-DP-2010-001` [31]	First spatial alignment of the LHCb VELO ...

Table 2: LHCb-PAPERs (which have their identifier as their cite code). Note that LHCb-PAPER-2011-039 does not exist.

LHCb-PAPER-2013-036 [32]	LHCb-PAPER-2013-035 [33]
LHCb-PAPER-2013-034 [34]	LHCb-PAPER-2013-033 [35]
LHCb-PAPER-2013-032 [36]	LHCb-PAPER-2013-031 [37]
LHCb-PAPER-2013-030 [38]	LHCb-PAPER-2013-029 [39]
LHCb-PAPER-2013-028 [40]	LHCb-PAPER-2013-027 [41]
LHCb-PAPER-2013-026 [42]	LHCb-PAPER-2013-025 [43]
LHCb-PAPER-2013-024 [44]	LHCb-PAPER-2013-023 [45]
LHCb-PAPER-2013-022 [46]	LHCb-PAPER-2013-021 [47]
LHCb-PAPER-2013-020 [48]	LHCb-PAPER-2013-019 [49]
LHCb-PAPER-2013-018 [50]	LHCb-PAPER-2013-017 [51]
LHCb-PAPER-2013-016 [52]	LHCb-PAPER-2013-015 [53]
LHCb-PAPER-2013-014 [54]	LHCb-PAPER-2013-013 [55]
LHCb-PAPER-2013-012 [56]	LHCb-PAPER-2013-011 [57]
LHCb-PAPER-2013-010 [58]	LHCb-PAPER-2013-009 [59]
LHCb-PAPER-2013-008 [60]	LHCb-PAPER-2013-007 [61]
LHCb-PAPER-2013-006 [62]	LHCb-PAPER-2013-005 [63]
LHCb-PAPER-2013-004 [64]	LHCb-PAPER-2013-003 [65]
LHCb-PAPER-2013-002 [66]	LHCb-PAPER-2013-001 [67]
LHCb-PAPER-2012-057 [68]	
LHCb-PAPER-2012-056 [69]	LHCb-PAPER-2012-055 [70]
LHCb-PAPER-2012-054 [71]	LHCb-PAPER-2012-053 [72]
LHCb-PAPER-2012-052 [73]	LHCb-PAPER-2012-051 [74]
LHCb-PAPER-2012-050 [75]	LHCb-PAPER-2012-049 [76]
LHCb-PAPER-2012-048 [77]	LHCb-PAPER-2012-047 [78]
LHCb-PAPER-2012-046 [79]	LHCb-PAPER-2012-045 [80]
LHCb-PAPER-2012-044 [81]	LHCb-PAPER-2012-043 [82]
LHCb-PAPER-2012-042 [83]	LHCb-PAPER-2012-041 [84]
LHCb-PAPER-2012-040 [85]	LHCb-PAPER-2012-039 [86]
LHCb-PAPER-2012-038 [87]	LHCb-PAPER-2012-037 [88]
LHCb-PAPER-2012-036 [89]	LHCb-PAPER-2012-035 [90]
LHCb-PAPER-2012-034 [91]	LHCb-PAPER-2012-033 [92]
LHCb-PAPER-2012-032 [93]	LHCb-PAPER-2012-031 [94]
LHCb-PAPER-2012-030 [95]	LHCb-PAPER-2012-029 [96]
LHCb-PAPER-2012-028 [97]	LHCb-PAPER-2012-027 [98]
LHCb-PAPER-2012-026 [99]	LHCb-PAPER-2012-025 [100]
LHCb-PAPER-2012-024 [101]	LHCb-PAPER-2012-023 [102]
LHCb-PAPER-2012-022 [103]	LHCb-PAPER-2012-021 [104]
LHCb-PAPER-2012-020 [105]	LHCb-PAPER-2012-019 [106]
LHCb-PAPER-2012-018 [107]	LHCb-PAPER-2012-017 [108]
LHCb-PAPER-2012-016 [109]	LHCb-PAPER-2012-015 [110]

– continued from previous page.

LHCb-PAPER-2012-014 [111]	LHCb-PAPER-2012-013 [112]
LHCb-PAPER-2012-012 [113]	LHCb-PAPER-2012-011 [114]
LHCb-PAPER-2012-010 [115]	LHCb-PAPER-2012-009 [116]
LHCb-PAPER-2012-008 [117]	LHCb-PAPER-2012-007 [118]
LHCb-PAPER-2012-006 [119]	LHCb-PAPER-2012-005 [120]
LHCb-PAPER-2012-004 [121]	LHCb-PAPER-2012-003 [122]
LHCb-PAPER-2012-002 [123]	LHCb-PAPER-2012-001 [124]
LHCb-PAPER-2011-045 [125]	LHCb-PAPER-2011-044 [126]
LHCb-PAPER-2011-043 [127]	LHCb-PAPER-2011-042 [128]
LHCb-PAPER-2011-041 [129]	LHCb-PAPER-2011-040 [130]
LHCb-PAPER-2011-038 [131]	LHCb-PAPER-2011-037 [132]
LHCb-PAPER-2011-036 [133]	LHCb-PAPER-2011-035 [134]
LHCb-PAPER-2011-034 [135]	LHCb-PAPER-2011-033 [136]
LHCb-PAPER-2011-032 [137]	LHCb-PAPER-2011-031 [138]
LHCb-PAPER-2011-031 [139]	LHCb-PAPER-2011-029 [140]
LHCb-PAPER-2011-028 [141]	LHCb-PAPER-2011-027 [142]
LHCb-PAPER-2011-026 [143]	LHCb-PAPER-2011-025 [144]
LHCb-PAPER-2011-024 [145]	LHCb-PAPER-2011-023 [146]
LHCb-PAPER-2011-023 [147]	LHCb-PAPER-2011-021 [148]
LHCb-PAPER-2011-020 [149]	LHCb-PAPER-2011-019 [150]
LHCb-PAPER-2011-018 [151]	LHCb-PAPER-2011-017 [152]
LHCb-PAPER-2011-016 [153]	LHCb-PAPER-2011-015 [154]
LHCb-PAPER-2011-014 [155]	LHCb-PAPER-2011-013 [156]
LHCb-PAPER-2011-012 [157]	LHCb-PAPER-2011-011 [158]
LHCb-PAPER-2011-010 [159]	LHCb-PAPER-2011-009 [160]
LHCb-PAPER-2011-008 [161]	LHCb-PAPER-2011-007 [162]
LHCb-PAPER-2011-006 [163]	LHCb-PAPER-2011-005 [164]
LHCb-PAPER-2011-004 [165]	LHCb-PAPER-2011-003 [166]
LHCb-PAPER-2011-002 [167]	LHCb-PAPER-2011-001 [168]
LHCb-PAPER-2010-002 [169]	LHCb-PAPER-2010-001 [170]

Some LHCb papers quoted together will look like [162–166].

B Standard symbols

As explained in Sect. 4 this appendix contains standard typesetting of symbols, particle names, units etc. in LHCb documents.

In the file `lhcb-symbols-def.tex`, which is included, a large number of symbols is defined. While they can lead to quicker typing, the main reason is to ensure a uniform notation within a document and between different LHCb documents. If a symbol like

\CP to typeset *CP* violation is available for a unit, particle name, process or whatever, it should be used. If you do not agree with the notation you should ask to get the definition in `lhcb-symbols-def.tex` changed rather than just ignoring it.

All the main particles have been given symbols. The B mesons are thus named B^+, B^0, B_s^0, and B_c^+. There is no need to go into math mode to use particle names, thus saving the typing of many \$ signs. By default particle names are typeset in italic type to agree with the PDG preference. To get roman particle names you can just change `\setboolean{uprightparticles}{false}` to `true` at the top of this template.

There is a large number of units typeset that ensures the correct use of fonts, capitals and spacing. As an example we have $m_{B_s^0} = 5366.3 \pm 0.6\,\mathrm{MeV}/c^2$. Note that \mum is typeset with an upright \mu, even if the particle names have slanted greek letters.

A set of useful symbols are defined for working groups. More of these symbols can be included later. As an example in the Rare Decay group we have several different analyses looking for a measurement of $\mathcal{C}_7^{\prime(\mathrm{eff})}$ and $\mathcal{O}_{7.}^{\prime}$

C List of all symbols

C.1 Experiments

\lhcb	LHCb	\atlas	ATLAS	\cms	CMS
\alice	ALICE	\babar	BaBar	\belle	Belle
\cleo	CLEO	\cdf	CDF	\dzero	D0
\aleph	ALEPH	\delphi	DELPHI	\opal	OPAL
\lthree	L3	\sld	SLD	\cern	CERN
\lhc	LHC	\lep	LEP	\tevatron	Tevatron

C.1.1 LHCb sub-detectors and sub-systems

\velo	VELO	\rich	RICH	\richone	RICH1
\richtwo	RICH2	\ttracker	TT	\intr	IT
\st	ST	\ot	OT	\spd	SPD
\presh	PS	\ecal	ECAL	\hcal	HCAL

C.2 Particles

C.2.1 Leptons

\electron	e	\en	e^-	\ep	e^+
\epm	$e^\pm$	\epem	e^+e^-	\mmu	μ
\mup	μ^+	\mun	μ^-	\mumu	$\mu^+\mu^-$
\mtau	τ	\taup	τ^+	\taum	τ^-
\tautau	$\tau^+\tau^-$	\ellm	ℓ^-	\ellp	ℓ^+
\neu	ν	\neub	$\overline{\nu}$	\neue	ν_e
\neueb	$\overline{\nu}_e$	\neum	ν_μ	\neumb	$\overline{\nu}_\mu$
\neut	ν_τ	\neutb	$\overline{\nu}_\tau$	\neul	ν_ℓ
\neulb	$\overline{\nu}_\ell$				

C.2.2 Gauge bosons and scalars

\g	γ	\H	H^0	\Hp	H^+
\Hm	H^-	\Hpm	$H^\pm$	\W	W
\Wp	W^+	\Wm	W^-	\Wpm	$W^\pm$
\Z	Z				

C.2.3 Quarks

\quark	q	\quarkbar	$\overline{q}$	\qqbar	$q\overline{q}$
\uquark	u	\uquarkbar	$\overline{u}$	\uubar	$u\overline{u}$
\dquark	d	\dquarkbar	$\overline{d}$	\ddbar	$d\overline{d}$
\squark	s	\squarkbar	$\overline{s}$	\ssbar	$s\overline{s}$
\cquark	c	\cquarkbar	$\overline{c}$	\ccbar	$c\overline{c}$
\bquark	b	\bquarkbar	$\overline{b}$	\bbbar	$b\overline{b}$
\tquark	t	\tquarkbar	$\overline{t}$	\ttbar	$t\overline{t}$

C.2.4 Light mesons

\pion	π	\piz	π^0	\pizs	$\pi^0{}_{\rm S}$
\pip	π^+	\pim	π^-	\pipm	$\pi^\pm$
\pimp	$\pi^\mp$	\kaon	K	\Kb	$\overline{K}$
\Kz	K^0	\Kzb	$\overline{K}^0$	\Kp	K^+
\Km	K^-	\Kpm	$K^\pm$	\Kmp	$K^\mp$
\KS	$K^0_{\rm S}$	\KL	$K^0_{\rm L}$	\Kstarz	K^{*0}
\Kstarzb	$\overline{K}^{*0}$	\Kstar	K^*	\Kstarb	$\overline{K}^*$
\Kstarp	K^{*+}	\Kstarm	K^{*-}	\Kstarpm	$K^{*\pm}$
\Kstarmp	$K^{*\mp}$	\etapr	η'		

C.2.5 Heavy mesons

\D	D	\Db	$\overline{D}$	\Dz	D^0
\Dzb	$\overline{D}^0$	\Dp	D^+	\Dm	D^-
\Dpm	$D^\pm$	\Dmp	$D^\mp$	\Dstar	D^*
\Dstarb	$\overline{D}^*$	\Dstarz	D^{*0}	\Dstarzb	$\overline{D}^{*0}$
\Dstarp	D^{*+}	\Dstarm	D^{*-}	\Dstarpm	$D^{*\pm}$
\Dstarmp	$D^{*\mp}$	\Ds	D_s^+	\Dsp	D_s^+
\Dsm	D_s^-	\Dspm	$D_s^\pm$	\Dsmp	$D_s^\mp$
\Dss	D_s^{*+}	\Dssp	D_s^{*+}	\Dssm	D_s^{*-}
\Dsspm	$D_s^{*\pm}$	\Dssmp	$D_s^{*\mp}$	\B	B
\Bbar	$\overline{B}$	\Bb	$\overline{B}$	\Bz	B^0
\Bzb	$\overline{B}^0$	\Bu	B^+	\Bub	B^-
\Bp	B^+	\Bm	B^-	\Bpm	$B^\pm$
\Bmp	$B^\mp$	\Bd	B^0	\Bs	B_s^0
\Bsb	$\overline{B}_s^0$	\Bdb	$\overline{B}^0$	\Bc	B_c^+
\Bcp	B_c^+	\Bcm	B_c^-	\Bcpm	$B_c^\pm$

C.2.6 Onia

\jpsi	J/ψ	\psitwos	$\psi(2S)$	\psiprpr	$\psi(3770)$
\etac	η_c	\chiczero	χ_{c0}	\chicone	χ_{c1}
\chictwo	χ_{c2}	\OneS	$\Upsilon(1S)$	\TwoS	$\Upsilon(2S)$
\ThreeS	$\Upsilon(3S)$	\FourS	$\Upsilon(4S)$	\FiveS	$\Upsilon(5S)$
\chic	χ_c				

C.2.7 Baryons

\proton	p	\antiproton	$\overline{p}$	\neutron	n
\antineutron	$\overline{n}$	\Deltares	Δ	\Deltaresbar	$\overline{\Delta}$
\Xires	Ξ	\Xiresbar	$\overline{\Xi}$	\Lz	Λ
\Lbar	$\overline{\Lambda}$	\Lambdares	Λ	\Lambdaresbar	$\overline{\Lambda}$
\Sigmares	Σ	\Sigmaresbar	$\overline{\Sigma}$	\Omegares	Ω^-
\Omegaresbar	$\overline{\Omega}^+$	\Lb	Λ_b^0	\Lbbar	$\overline{\Lambda}_b^0$
\Lc	Λ_c^+	\Lcbar	$\overline{\Lambda}_c^-$		

C.3 Physics symbols

C.3.1 Decays

\BF		$\mathcal{B}$	\BRvis	$\mathcal{B}_{\rm vis}$	\BR	$\mathcal{B}$
\decay[2]	\decay{a }{b c }	$a \to bc$	\ra	$\to$	\to	$\to$

C.3.2 Lifetimes

\tauBs	$\tau_{B_s^0}$	\tauBd	τ_{B^0}	\tauBz	τ_{B^0}
\tauBu	τ_{B^+}	\tauDp	τ_{D^+}	\tauDz	τ_{D^0}
\tauL	$\tau_{\rm L}$	\tauH	$\tau_{\rm H}$		

C.3.3 Masses

\mBd	m_{B^0}	\mBp	m_{B^+}	\mBs	$m_{B_s^0}$
\mBc	$m_{B_c^+}$	\mLb	$m_{\Lambda_b^0}$		

C.3.4 EW theory, groups

\grpsuthree	SU(3)	\grpsutw	SU(2)	\grpuone	U(1)
\ssqtw	$\sin^2\theta_{\rm W}$	\csqtw	$\cos^2\theta_{\rm W}$	\stw	$\sin\theta_{\rm W}$
\ctw	$\cos\theta_{\rm W}$	\ssqtwef	$\sin^2\theta_{\rm W}^{\rm eff}$	\csqtwef	$\cos^2\theta_{\rm W}^{\rm eff}$
\stwef	$\sin\theta_{\rm W}^{\rm eff}$	\ctwef	$\cos\theta_{\rm W}^{\rm eff}$	\gv	$g_{\rm V}$
\ga	$g_{\rm A}$	\order	$\mathcal{O}$	\ordalph	$\mathcal{O}(\alpha)$
\ordalsq	$\mathcal{O}(\alpha^2)$	\ordalcb	$\mathcal{O}(\alpha^3)$		

C.3.5 QCD parameters

\as	α_s	\MSb	$\overline{\rm MS}$	\lqcd	$\Lambda_{\rm QCD}$
\qsq	q^2				

C.3.6 CKM, CP violation

\eps	ε	\epsK	ε_K	\epsB	ε_B
\epsp	ε'_K	\CP	CP	\CPT	CPT
\rhobar	$\overline{\rho}$	\etabar	$\overline{\eta}$	\Vud	$\lvert V_{ud}\rvert$
\Vcd	$\lvert V_{cd}\rvert$	\Vtd	$\lvert V_{td}\rvert$	\Vus	$\lvert V_{us}\rvert$
\Vcs	$\lvert V_{cs}\rvert$	\Vts	$\lvert V_{ts}\rvert$	\Vub	$\lvert V_{ub}\rvert$
\Vcb	$\lvert V_{cb}\rvert$	\Vtb	$\lvert V_{tb}\rvert$		

C.3.7 Oscillations

\dm	Δm	\dms	Δm_s	\dmd	Δm_d
\DG	$\Delta\Gamma$	\DGs	$\Delta\Gamma_s$	\DGd	$\Delta\Gamma_d$
\Gs	Γ_s	\Gd	Γ_d	\MBq	M_{B_q}
\DGq	$\Delta\Gamma_q$	\Gq	Γ_q	\dmq	Δm_q
\GL	$\Gamma_{\rm L}$	\GH	$\Gamma_{\rm H}$	\DGsGs	$\Delta\Gamma_s/\Gamma_s$
\Delm	Δm	\ACP	$\mathcal{A}^{CP}$	\Adir	$\mathcal{A}^{\rm dir}$
\Amix	$\mathcal{A}^{\rm mix}$	\ADelta	$\mathcal{A}^{\Delta}$	\phid	ϕ_d
\sinphid	$\sin\phi_d$	\phis	ϕ_s	\betas	β_s
\sbetas	$\sigma(\beta_s)$	\stbetas	$\sigma(2\beta_s)$	\stphis	$\sigma(\phi_s)$
\sinphis	$\sin\phi_s$				

C.3.8 Tagging

\edet	$\varepsilon_{\rm det}$	\erec	$\varepsilon_{\rm rec/det}$	\esel	$\varepsilon_{\rm sel/rec}$
\etrg	$\varepsilon_{\rm trg/sel}$	\etot	$\varepsilon_{\rm tot}$	\mistag	ω
\wcomb	$\omega^{\rm comb}$	\etag	$\varepsilon_{\rm tag}$	\etagcomb	$\varepsilon_{\rm tag}^{\rm comb}$
\effeff	$\varepsilon_{\rm eff}$	\effeffcomb	$\varepsilon_{\rm eff}^{\rm comb}$	\efftag	$\varepsilon_{\rm tag}(1-2\omega)^2$
\effD	$\varepsilon_{\rm tag}D^2$	\etagprompt	$\varepsilon_{\rm tag}^{\rm Pr}$	\etagLL	$\varepsilon_{\rm tag}^{\rm LL}$

C.3.9 Key decay channels

\BdToKstmm	$B^0\to K^{*0}\mu^+\mu^-$	\BdbToKstmm	$\overline{B}^0\to \overline{K}^{*0}\mu^+\mu^-$	\BsToJPsiPhi	$B_s^0\to J/\psi\,\phi$
\BdToJPsiKst	$B^0\to J/\psi\,K^{*0}$	\BdbToJPsiKst	$\overline{B}^0\to J/\psi\,\overline{K}^{*0}$	\BsPhiGam	$B_s^0\to \phi\gamma$
\BdKstGam	$B^0\to K^{*0}\gamma$	\BTohh	$B\to h^+h'^-$	\BdTopipi	$B^0\to \pi^+\pi^-$
\BdToKpi	$B^0\to K^+\pi^-$	\BsToKK	$B_s^0\to K^+K^-$	\BsTopiK	$B_s^0\to \pi^+K^-$

C.3.10 Rare decays

\BdKstee	$B^0\to K^{*0}e^+e^-$	\BdbKstee	$\overline{B}^0\to \overline{K}^{*0}e^+e^-$	\bsll	$b\to s\ell^+\ell^-$
\AFB	$A_{\rm FB}$	\FL	$F_{\rm L}$	\AT#1 \AT2	$A_{\rm T}^2$
\btosgam	$b\to s\gamma$	\btodgam	$b\to d\gamma$	\Bsmm	$B_s^0\to \mu^+\mu^-$
\Bdmm	$B^0\to \mu^+\mu^-$	\ctl	$\cos\theta_\ell$	\ctk	$\cos\theta_K$

C.3.11 Wilson coefficients and operators

\C#1 \C9	$\mathcal{C}_9$	\Cp#1 \Cp7	$\mathcal{C}_7'$	\Ceff#1 \Ceff9	$\mathcal{C}_9^{\rm (eff)}$
\Cpeff#1 \Cpeff7	$\mathcal{C}_7'^{\rm (eff)}$	\Ope#1 \Ope2	$\mathcal{O}_2$	\Opep#1 \Opep7	$\mathcal{O}_7'$

C.3.12 Charm

\xprime	x'	\yprime	y'	\ycp	y_{CP}
\agamma	A_Γ	\dkpicf	$D^0\to K^-\pi^+$		

C.3.13 QM

\bra[1] \bra{a} $\langle a|$ \ket[1] \ket{b} $|b\rangle$ \braket[2] \braket{a}{b} $\langle a|b\rangle$

C.4 Units

\unit[1] \unit{kg} kg

C.4.1 Energy and momentum

\tev	TeV	\gev	GeV	\mev	MeV
\kev	keV	\ev	eV	\gevc	GeV/c
\mevc	MeV/c	\gevcc	GeV/c^2	\gevgevcccc	GeV^2/c^4
\mevcc	MeV/c^2				

C.4.2 Distance and area

\km	km	\m	m	\cm	cm
\cma	cm^2	\mm	mm	\mma	mm^2
\mum	μm	\muma	$\mu\mathrm{m}^2$	\nm	nm
\fm	fm	\barn	b	\mbarn	mb
\mub	μb	\nb	nb	\invnb	nb^{-1}
\pb	pb	\invpb	pb^{-1}	\fb	fb
\invfb	fb^{-1}				

C.4.3 Time

\sec	s	\ms	ms	\mus	μs
\ns	ns	\ps	ps	\fs	fs
\mhz	MHz	\khz	kHz	\hz	Hz
\invps	ps^{-1}	\yr	yr	\hr	hr

C.4.4 Temperature

\degc	°C	\degk	K

C.4.5 Material lengths, radiation

\Xrad	X_0	\NIL	λ_{int}	\mip	MIP
\neutroneq	$\mathrm{n_{eq}}$	\neqcmcm	$\mathrm{n_{eq}/cm^2}$	\kRad	kRad
\MRad	MRad	\ci	Ci	\mci	mCi

C.4.6 Uncertainties

\sx	σ_x	\sy	σ_y	\sz	σ_z
\stat	(stat)	\syst	(syst)		

C.4.7 Maths

\order	$\mathcal{O}$	\chisq	χ^2	\chisqndf	χ^2/ndf
\chisqip	χ^2_{IP}	\chisqvs	χ^2_{VS}	\chisqvtx	χ^2_{vtx}
\deriv	d	\gsim	$\gtrsim$	\lsim	$\lesssim$
\mean[1] \mean{x}	$\langle x \rangle$	\abs[1] \abs{x}	$\|x\|$	\Real	$\mathcal{R}e$
\Imag	$\mathcal{I}m$	\PDF	PDF	\sPlot	*sPlot*
\sWeight	*sWeight*				

C.5 Kinematics

C.5.1 Energy, Momenta

\Ebeam	$E_{\rm BEAM}$	\sqs	$\sqrt{s}$	\ptot	p
\pt	$p_{\rm T}$	\et	$E_{\rm T}$	\mt	$M_{\rm T}$
\dpp	$\Delta p/p$	\dedx	$\mathrm{d}E/\mathrm{d}x$		

C.5.2 PID

\dllkpi	$\mathrm{DLL}_{K\pi}$	\dllppi	$\mathrm{DLL}_{p\pi}$	\dllepi	$\mathrm{DLL}_{e\pi}$
\dllmupi	$\mathrm{DLL}_{\mu\pi}$				

C.5.3 Geometry

\degrees	$^\circ$	\krad	krad	\mrad	mrad
\rad	rad				

C.5.4 Accelerator

\betastar β^* \lum $\mathcal{L}$ \intlum[1] \intlum{2 fb^{-1} } $\int \mathcal{L} = 2$ fb^{-1}

C.6 Software

C.6.1 Programs

\bcvegpy	BCVEGPY	\boole	BOOLE	\brunel	BRUNEL
\davinci	DAVINCI	\dirac	DIRAC	\evtgen	EVTGEN
\fewz	FEWZ	\fluka	FLUKA	\ganga	GANGA
\gaudi	GAUDI	\gauss	GAUSS	\geant	GEANT4
\hepmc	HEPMC	\herwig	HERWIG	\moore	MOORE
\photos	PHOTOS	\powheg	POWHEG	\pythia	PYTHIA
\resbos	RESBOS	\roofit	ROOFIT	\root	ROOT
\spice	SPICE	\urania	URANIA		

C.6.2 Languages

\cpp	C++	\ruby	RUBY	\fortran	FORTRAN
\svn	SVN				

C.6.3 Data processing

\kbytes	kbytes	\kbsps	kbits/s	\kbits	kbits
\kbsps	kbits/s	\mbsps	Mbytes/s	\mbytes	Mbytes
\mbps	Mbyte/s	\mbsps	Mbytes/s	\gbsps	Gbytes/s
\gbytes	Gbytes	\gbsps	Gbytes/s	\tbytes	Tbytes
\tbpy	Tbytes/yr	\dst	DST		

C.7 Detector related

C.7.1 Detector technologies

\nonn	n^+-on-n	\ponn	p^+-on-n	\nonp	n^+-on-p
\cvd	CVD	\mwpc	MWPC	\gem	GEM

C.7.2 Detector components, electronics

\tell1	TELL1	\ukl1	UKL1	\beetle	Beetle
\otis	OTIS	\croc	CROC	\carioca	CARIOCA
\dialog	DIALOG	\sync	SYNC	\cardiac	CARDIAC
\gol	GOL	\vcsel	VCSEL	\ttc	TTC
\ttcrx	TTCrx	\hpd	HPD	\pmt	PMT
\specs	SPECS	\elmb	ELMB	\fpga	FPGA
\plc	PLC	\rasnik	RASNIK	\elmb	ELMB
\can	CAN	\lvds	LVDS	\ntc	NTC
\adc	ADC	\led	LED	\ccd	CCD
\hv	HV	\lv	LV	\pvss	PVSS
\cmos	CMOS	\fifo	FIFO	\ccpc	CCPC

C.7.3 Chemical symbols

\cfourften	C_4F_{10}	\cffour	CF_4	\cotwo	CO_2
\csixffouteen	C_6F_{14}	\mgftwo	MgF_2	\siotwo	SiO_2

C.8 Special Text

\eg	*e.g.*	\ie	*i.e.*	\etal	*et al.*
\etc	*etc.*	\cf	*cf.*	\ffp	*ff.*
\vs	*vs.*				

D Supplementary material

This appendix includes supplementary material that will be part of the draft during the review phase but will not appear in the final version of the paper. Instead it will be posted as supplementary material alongside the paper on CDS.

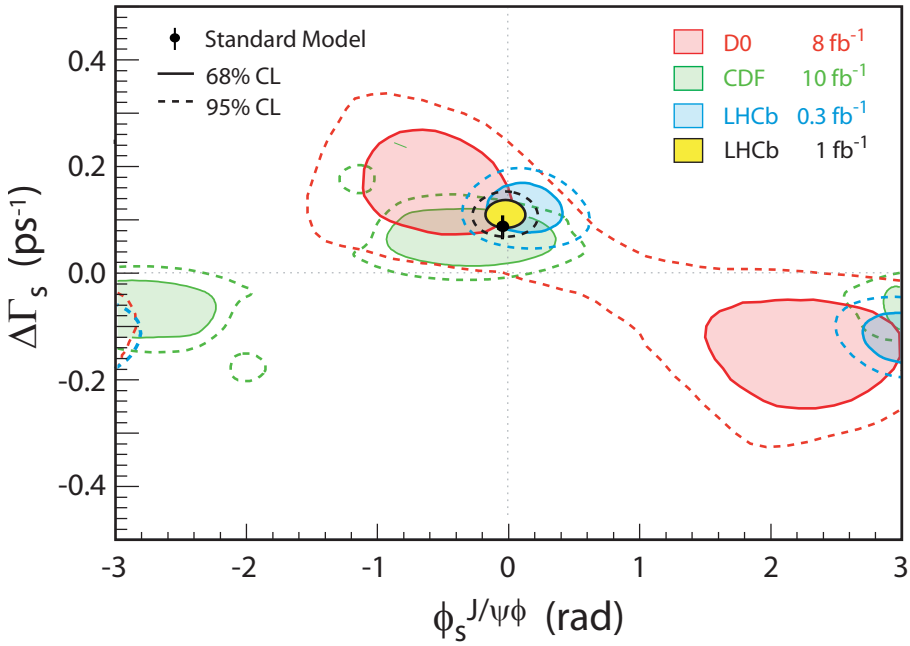

Figure 2: Comparison of our result to those from other experiments. Note that the style of this figure differs slightly from that of Figure 1

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