LHCb-ANA-20XX-YYY
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A template for writing LHCb documents

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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.

Contents

1 Introduction

The weak phase γ is the least well known angle of the CKM unitary triangle. A key channel to measure γ is the time-dependent analysis of $B_s^0 \to D_s K$ decays [REF HERE]. The measurement of γ presented in this note uses $B_s^0 \to D_s K\pi\pi$ decays, where the $K\pi\pi$ is dominated by excited kaon states, such as $K_1(1270)$ and $K_1(1400)$. It is complementary to the above mentioned analysis of $B_s^0 D_s K$, making use of a fully charged final state, where every track is detected in the vertex locator. To account for the non-constant strong phase across the Dalitz plot, one can either bin the phase space and develop a Dalitz model for each bin, or introduce a coherence factor as additional hadronic parameter to the fit.
This analysis is based on the first observation of the $B_s^0 \to D_s K\pi\pi$ decay presented in [REF ANA NOTE HERE] and [REF PAPER HERE], where its branching ratio is measured relative to $B_s^0 \to D_s\pi\pi\pi$. The branching ratio measurement is updated and a measurement of γ using the WHAT EVER approach is presented, exploiting the full Run 1 data sample, corresponding to 3 fb^{-1} of integrated luminosity.

2 Data samples

We use the full Run 1 sample from Stripping 21, consisting of 3 fb^{-1} of data, collected in the years 2011 and 2012 at a center of mass energies of 7 TeV and 8 TeV, respectively. The selected B_s^0-candidates are required to pass the L0 XXX trigger. Events that pass the L0 stage are further required to pass the HLT1 XXX trigger. All remaining candidates have to pass either the 2, 3 or 4-body topological trigger (TOS).
For the presented analysis the B02DKPiPiD2HHHPIDBeauty2CharmLine is used to preselect signal $B_s^0 \to D_s K\pi\pi$ candidates. A summary of the cuts employed by this stripping line can be found in Table 1.

3 Simulated samples

Some bla bla on the MC samples ...

4 Selection

A twofold approach is used to isolate the $B_s^0 \to D_s K\pi\pi$ from data passing the stripping line. First, further one-dimensional cuts are applied to reduce the level of combinatorial background and to veto some specific physical background. After that, a multivariate analysis selection is performed, combining multiple variables to train a neural network and create a powerfull discriminator between signal and background.

Variable	Stripping Cut
Track χ^2/nDoF	< 3
Track p	> 1000 MeV/c
Track p_{T}	> 100 MeV/c
Track IP χ^2	> 4
D_s Daughter p_{T}	$\Sigma_{i=1}^{3} p_i > 1800\,\mathrm{MeV}/c$
D_s Daughter DOCA	0.5 mm
D_s mass m_{D_s}	within $\pm$ 50 MeV/c^2 of PDG value
D_s Vertex chi^2/nDoF	< 10
D_s min FD chi^2	> 36
X_s Daughter DOCA	0.4 mm
X_s Daughter p_{T}	$\Sigma_{i=1}^{3} p_{t,i} > 1250\,\mathrm{MeV}/c$
X_s Vertex chi^2/nDoF	< 8
X_s min FD chi^2/nDoF	> 16
X_s DIRA	> 0.98
X_s $\Delta\rho$	> 0.1 mm
X_s ΔZ	> 2.0 mm
B_s^0 DIRA	> 0.98
B_s^0 min IP χ^2	> 25
B_s^0 Vertex chi^2/nDoF	< 10
B_s^0 $\tau_{B_s^0}$	> 0.2 ps
K DLL$_{K\pi}$	$>$ -5
π DLL$_{K\pi}$	< 10

Table 1: Summary of the stripping selections for $B_s^0 \to D_s K\pi\pi$ decays.

4.1 Cut-based selection

In order to minimize the contribution of combinatorial background to our samples, we apply the following cuts to the b-hadron:

(i) DIRA > 0.99994

(ii) min IP $\chi^2 < 20$ to any PV

(iii) FD $\chi^2 > 100$ to any PV

(iv) Vertex χ^2/nDoF < 8

Additionaly, we veto various physical beackgrounds, which have either the same final state as our signal decay, or can contribute via a single miss-identification of $K \to \pi$ or $K \to p$:

- $B_s^0 \to D_s^+ D_s^-$: $|M(K\pi\pi) - m_{D_s}| > 20\,\mathrm{MeV}/c^2$

- $B_s^0 \to D_s K K \pi$: π^- $\mathrm{DLL}_{K\pi} < 5$
- $B^0 \to D^+(\to K^+\pi^-\pi^+)K\pi\pi$: possible with single miss-ID of $K^+ \to \pi^+$, vetoed by changing mass hypothesis and recompute $|M(K^+\pi^-\pi^+) - m_{Dp}| > 20\ \mathrm{MeV}/c^2$, or the K^+ has to fulfill $\mathrm{DLL}_{K\pi} > 10$
- $\Lambda_b^0 \to \Lambda_c^+(\to pK^-\pi^+)K\pi\pi$: possible with single miss-ID of $K^+ \to p$, vetoed by changing mass hypothesis and recompute $M(pK^-\pi^+) - m_{\Lambda_c^+} > 15\ \mathrm{MeV}/c^2$, or the K^+ has to fulfill $\mathrm{DLL}_{Kp} > 0$

All signal candidates for the branching ratio measurement are reconstructed via the $D_s \to K^+K^-\pi^+$ channel. This decay can either proceed via the narrow ϕ resonance, the broader K^{*0} resonance, or non-resonant. Depending on the process being resonant or not, we apply additional PID requirements:

1. resonant case, no additional PID requirements:
   (a) $D_s^+ \to \phi\pi^+$, with $|M(K^+K^-) - m_\phi| < 20\ \mathrm{MeV}/c^2$
   (b) $D_s^+ \to \overline{K}^{*0}K^+$, with $|M(K^-\pi^+) - m_{K^{*0}} < 75\ \mathrm{MeV}/c^2$
2. non-resonant case: $\mathrm{DLL}_{K\pi} > 5$ for kaons

4.2 Multivariate stage

We use TMVA [1] to train a multivariate descriminator, which is used to further improve the signal to background ratio. The 17 variables used for the training are:

- max(ghostProb) over all tracks
- cone(p_T) asymmetrie of every track
- min(IPχ^2) over the X_s daughters
- max(DOCA) over all pairs of X_s daughters
- min(IPχ^2) over the D_s daughters
- D_s DIRA
- D_s FD significance
- max(cos($D_s h_i$)), where cos($D_s h_i$) is the cosine of the angle between the D_s and another track i in the plane transverse to the beam
- B_s^0 IPχ^2, FDχ^2 and Vertex χ^2

Various classifiers were investigated in order to select the most efficient discriminator. As the result a boosted decision tree with gradient boost (BDTG) is chosen as nominal classifier. We use truth-matched Monte Carlo (MC), taken from the mass region $\pm 60\,\mathrm{MeV}/c^2$ around the nominal B_s^0 mass, as signal input. Those simulated signal candidates are required to pass the same trigger and stripping requirements, that were used to select the data samples. For the background we use events from the high mass sideband ($m_{B_s^0 candidate} > 5600\ \mathrm{MeV}/c^2$) of our data samples.
The distributions of the input variables for signal and background are shown in Fig. 1.

The relative importance of the input variables for the BDTG training is summarized in Table 2.

Variable	relative importance [%]
max_ghostProb	14.93
log_Bs_IPCHI2_OWNPV	10.91
log_DsDaughters_min_IPCHI2	10.67
K_plus_ptasy_1.00	9.60
Bs_ENDVERTEX_CHI2	9.38
K_minus_fromDs_ptasy_1.00	8.99
log_Ds_FDCHI2_ORIVX	8.78
log_XsDaughters_min_IPCHI2	7.23
K_plus_fromDs_ptasy_1.00	6.62
Xs_max_DOCA	4.13
log_Bs_DIRA	3.36
pi_minus_ptasy_1.00	1.63
pi_minus_fromDs_ptasy_1.00	1.46
cos(Ds h)	0.93
log_Bs_FDCHI2_OWNPV	0.69
pi_plus_ptasy_1.00	0.43
log_Ds_DIRA	0.27

Table 2: Summary of the relative importance of each variable in the training of the BDTG.

The BDTG output distribution for test and training samples is shown in Fig 2. No sign of overtraining is observed.

The efficiency curves as a function of the cut value are shown in Fig. 3.

Something about how we determine the optimal cut IS MISSING HERE.

5 Detector and simulation

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

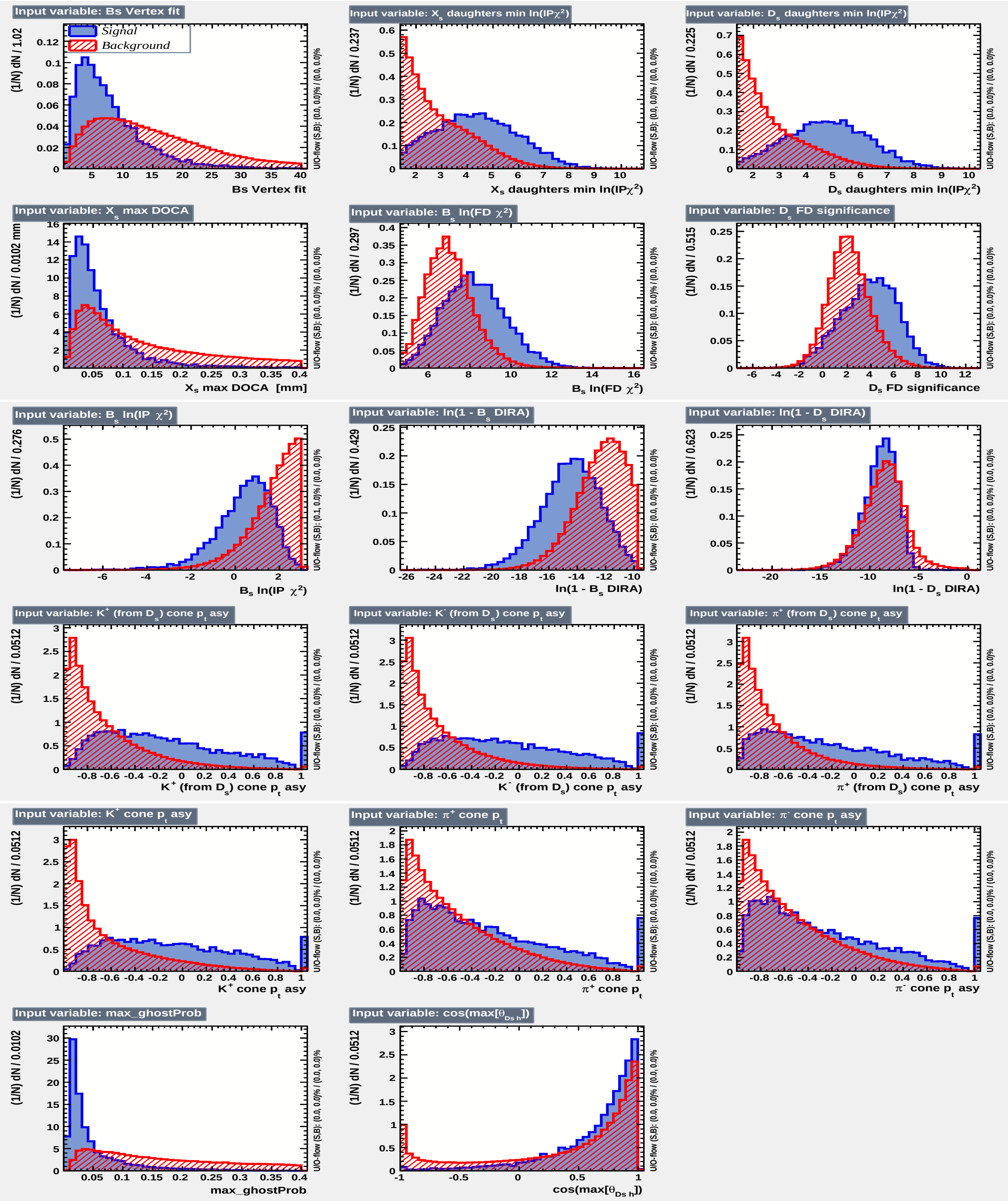

Figure 1: Distributions of the input variables used in the BDTG training. The background is shown as red hatched, while the signal is depicted solid blue.

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 [2, 3] is a single-arm forward spectrometer covering the

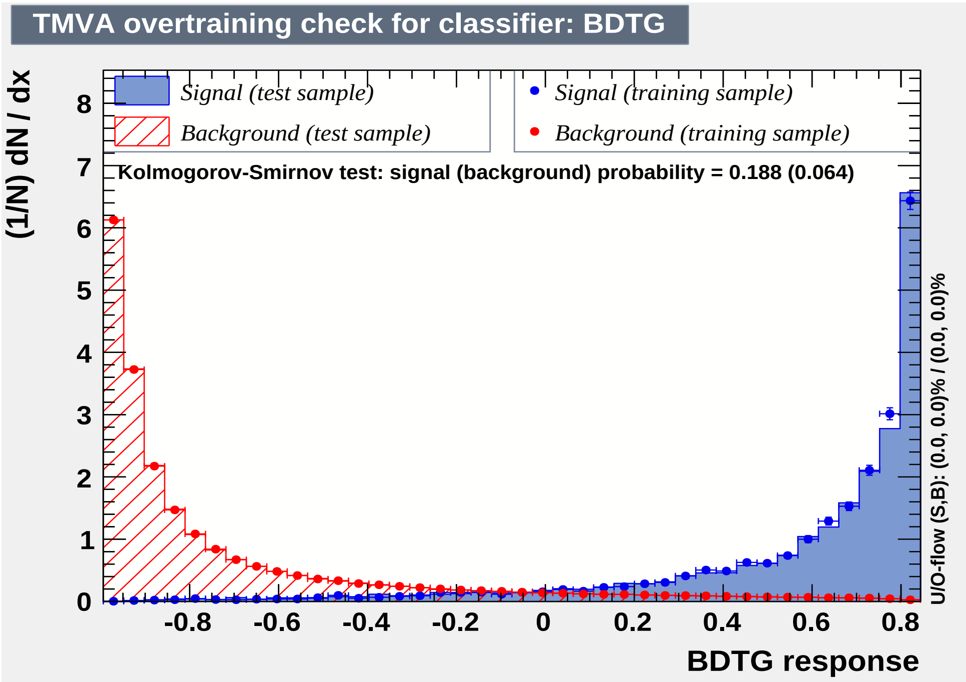

Figure 2: BDTG output classifier distribution for (blue) signal and (red) background. The response of an independent test sample is overlaid.

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 [4]∗, 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 [5]∗ placed downstream of the magnet. The tracking system provides a measurement of momentum, p, of charged particles with a relative uncertainty that varies from 0.5% at low momentum to 1.0% at 200 GeV/c. The minimum distance of a track to a primary vertex, the impact parameter, is measured with a resolution of $(15 + 29/p_{\mathrm{T}})\,\mu\mathrm{m}$, where p_{T} is the component of the momentum transverse to the beam, in GeV/c. Different types of charged hadrons are distinguished using information from two ring-imaging Cherenkov detectors [6]∗. Photons, electrons and hadrons 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 [7]∗. The online event selection is performed by a trigger [8]∗, which 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.

A more detailed description of the 'full event reconstruction' could be:

- The trigger [8]∗ consists of a hardware stage, based on information from the calorimeter and muon systems, followed by a software stage, in which all charged particles

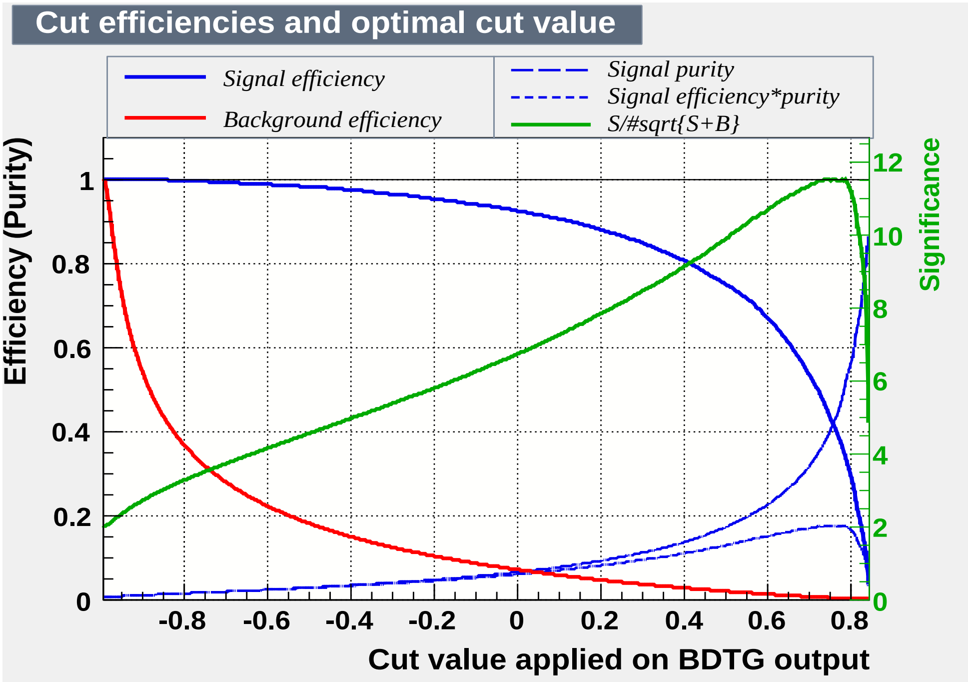

Figure 3: Efficiency and purity curves for (blue) signal, (red) background and the (green) FoM curve, as a function of the chosen cut value.

with $p_{\mathrm{T}} > 500(300)\,\mathrm{MeV}$ are reconstructed for 2011 (2012) data. For triggers that require neutral particles, energy deposits in the electromagnetic calorimeter are analysed to reconstruct π^0 and γ candidates.

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. A detailed description of the trigger conditions for Run 1 is available in Ref. [9].

- At the hardware trigger stage, events are required to have a muon with high p_{T} or a hadron, photon or electron with high transverse energy in the calorimeters. For hadrons, the transverse energy threshold is 3.5 GeV. The software trigger requires a two-, three- or four-track secondary vertex with a significant displacement from the primary pp interaction vertices (PVs). At least one charged particle must have a transverse momentum $p_{\mathrm{T}} > 1.7\,\mathrm{GeV}/c$ and be inconsistent with originating from a PV. A multivariate algorithm [10] is used for the identification of secondary vertices consistent with the decay of a b hadron.

- Candidate events are first required to pass the hardware trigger, which selects muons with a transverse momentum $p_{\mathrm{T}} > 1.48\,\mathrm{GeV}/c$ in the 7 TeV data or $p_{\mathrm{T}} > 1.76\,\mathrm{GeV}/c$ in the 8 TeV data. In the subsequent software trigger, at least one of the final-state particles is required to have both $p_{\mathrm{T}} > 0.8\,\mathrm{GeV}/c$ and impact parameter larger than $100\,\mu\mathrm{m}$ 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.

An example to describe the use of both TOS and TIS events:

- In the offline selection, trigger signals are associated with reconstructed particles. Selection requirements can therefore be made on the trigger selection itself and on whether the decision was due to the signal candidate, other particles produced in the pp collision, or a combination of both.

A good example of a description of long and downstream K^0_S is given in Ref. [11]:

- Decays of $K^0_\mathrm{S} \to \pi^+\pi^-$ are reconstructed in two different categories: the first involving K^0_S mesons that decay early enough for the daughter pions to be reconstructed in the vertex detector; and the second containing K^0_S that decay later such that track segments of the pions cannot be formed in the vertex detector. These categories are referred to as *long* and *downstream*, respectively. The long category has better mass, momentum and vertex resolution than the downstream category.

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 [12] (In case only PYTHIA 6 is used, remove `*Sjostrand:2007gs` from this citation) with a specific LHCb configuration [13]. Decays of hadronic particles are described by EVTGEN [14], in which final-state radiation is generated using PHOTOS [15]. The interaction of the generated particles with the detector, and its response, are implemented using the GEANT4 toolkit [16] as described in Ref. [17].

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) [18, 19] to separate signal from background.

When describing the integrated luminosity of the data set, do not use expressions like "$1.0\,\mathrm{fb}^{-1}$ of data", but *e.g.* "data corresponding to an integrated luminosity of $1.0\,\mathrm{fb}^{-1}$", or "data obtained from $3\,\mathrm{fb}^{-1}$ of integrated luminosity".

For analyses where the periodical reversal of the magnetic field is crucial, *e.g.* in measurements of direct CP violation, the following description can be used as an example phrase: "The polarity of the dipole magnet is reversed periodically throughout data-taking. The configuration with the magnetic field vertically upwards, *MagUp* (downwards, *MagDown*), bends positively (negatively) charged particles in the horizontal plane towards the centre of the LHC." Only use the *MagUp*, *MagDown* symbols if they are used extensively in tables or figures.

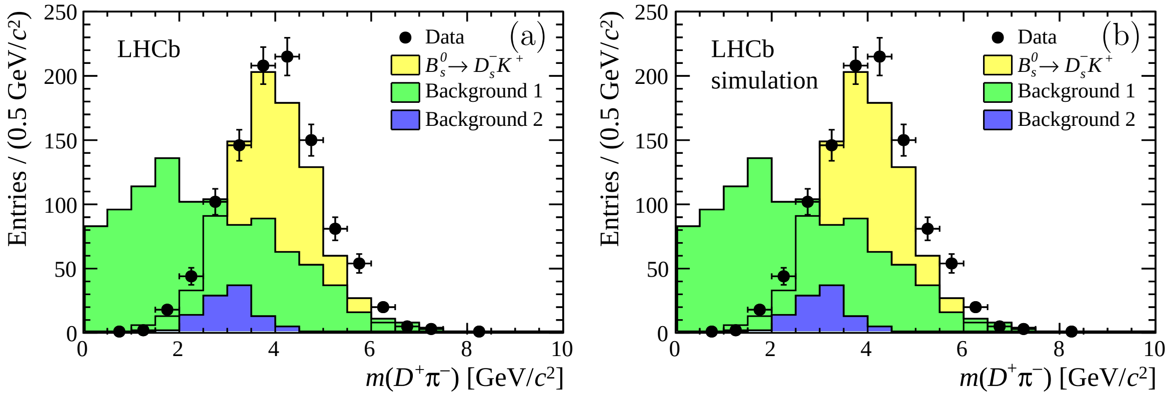

Figure 4: Example plots for (a) data and (b) simulation using the LHCb style from the URANIA package `RootTools/LHCbStyle`. The signal data is shown as points with the signal component as yellow (light shaded), background 1 as green (medium shaded) and background 2 as blue (dark shaded).

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 4 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. For the y-axis, “Entries” or “Candidates” is approriate in case no background subtraction has been applied. Otherwise “Yield” or “Decays” may be more appropriate. If the unit on the y-axis corresponds to the yield per bin, indicate so, for example “Entries / (5 MeV/c^2)” or “Entries per 5 MeV/c^2”.

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

4. 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.

5. Using different hatching styles helps to disinguished filled areas, also in black and white prints. Hatching styles 3001-3025 should be avoided since they behave unpredictably under zooming and scaling. Good styles for “falling hatched” and “rising hatched” are 3345 and 3354.

6. 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. When referencing specific sub-figures, use “see Fig. 1(a)” or “see Figs. 2(b)-(e)”.

7. 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 [20]. 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. [12].

2. For references with four or less authors all of the authors’ names are listed [21], 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. Note that the titles in `LHCb-PAPER.bib` are in plain LaTex, in order to correspond to the actual title on the arXiv record. Some differences in style can thus be noticed with respect to the main text, for example particle names that use capital Greek letters are not slanted in the reference titles (Λ vs $\mathit{\Lambda}$)

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. For authors with multiple initials, add a space between them (change `R.G.C.` to `R. G. C.`), otherwise only the first initial will be taken. Also, make sure to eliminate unnecessary capitalisation. Apart from that, the title should be respected as much as possible (*e.g.* do not change particle names to PDG convention nor introduce/remove factors of c). Check that both the arXiv and the journal index are clickable and point to the right article.

7. The `mciteplus` [22] 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. [23]. 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. [24] 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 Refs. [25] for some examples. It can be used for LHCb documents in the series `CONF`, `PAPER`, `PROC`, `THESIS`, `LHCC`, `TDR` 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 [17], 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

Three types of supplementary material should be distinguised:

- A regular appendix: lengthy equations or long tables are sometimes better put in an appendix in order not to interrupt the main flow of a paper. Appendices will appear in the final paper, on arXiv and on the cds record and should be considered integral part of a paper, and are thus to be reviewed like the rest of the paper. An example of an LHCb paper with an appendix is Ref. [26].

- Supplementary material for cds: plots or tables that would make the paper exceed the page limit or are not appropriate to include in the paper itself, but are desireable to be shown in public should be added to the paper drafts in an appendix, and removed from the paper before submitting to arXiv or the journal. See Appendix D for further instructions. Examples are: comparison plots of the new result with older results, plots that illustrate cross-checks. An example of an LHCb paper with supplementary material for cds is Ref. [27]. Supplementary material for cds cannot be referenced to in the paper.

- Supplementary material for the paper. Most journals allow to submit files along with the paper that will not be part of the text of the article, but will be stored on the journal server. Examples are plain text files with numerical data corresponding to the plots in the paper. The supplementary material should be referenced to in the paper, by including a reference of the type "See supplementary material for [give brief description of material]." The journal will insert a specific link here. For the arXiv record, a specific link to the supplementary material on the arXiv server should be included when the paper gets updated, after it has been published. For the internal reviewing, an appendix should be provided illustrating the format of the file, its purpose and providing a link where the actual files can be found. An example of an LHCb paper with supplementary material is Ref. [28]

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`, `LHCb-DP.bib` `LHCb-TDR.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`	[2]
LHCb simulation	`LHCb-PROC-2011-006`	[17]
PDG 2014	`PDG2014`	[29]
HFAG	`HFAG`	[30]
Pythia	`Sjostrand:2006za, *Sjostrand:2007gs`	[12]
LHCb Pythia tuning	`LHCb-PROC-2010-056`	[13]
Geant4	`Allison:2006ve, *Agostinelli:2002hh`	[16]
EvtGen	`Lange:2001uf`	[14]
Photos	`Golonka:2005pn`	[15]
Dirac	`Tsaregorodtsev:2010zz, *BelleDIRACAmazon`	[31]
Crystal Ball function[1]	`Skwarnicki:1986xj`	[32]
Wilks' theorem	`Wilks:1938dza`	[33]
BDT	`Breiman`	[18]
BDT training	`AdaBoost`	[19]
HLT2 topo	`BBDT`	[10]
DecayTreeFitter	`Hulsbergen:2005pu`	[34]
sPlot	`Pivk:2004ty`	[35]
Punzi's optimization	`Punzi:2003bu`	[36]
f_s/f_d	`fsfd`	[37]

[1] A valid alternative for most papers where the normalisation is not critical is to use the expression"Gaussian function with a low-mass power-law tail" or "Gaussian function with power-law tails". In that case, no citation is needed

LHCb-DP number	Title
LHCb-DP-2014-002 [3]	LHCb detector performance
LHCb-DP-2014-001 [4]	Performance of the LHCb Vertex Locator
LHCb-DP-2013-004 [38]	Performance of the LHCb calorimeters
LHCb-DP-2013-003 [5]	Performance of the LHCb Outer Tracker
LHCb-DP-2013-002 [39]	Measurement of the track reconstruction efficiency at LHCb
LHCb-DP-2013-001 [40]	Performance of the muon identification at LHCb
LHCb-DP-2012-005 [41]	Radiation damage in the LHCb Vertex Locator
LHCb-DP-2012-004 [8]	The LHCb trigger and its performance in 2011
LHCb-DP-2012-003 [6]	Performance of the LHCb RICH detector at the LHC
LHCb-DP-2012-002 [7]	Performance of the LHCb muon system
LHCb-DP-2012-001 [42]	Radiation hardness of the LHCb Outer Tracker
LHCb-DP-2011-002 [43]	Simulation of machine induced background ...
LHCb-DP-2011-001 [44]	Performance of the LHCb muon system with cosmic rays
LHCb-DP-2010-001 [45]	First spatial alignment of the LHCb VELO ...

LHCb-TDR number	Title
LHCb-TDR-016 [46]	Trigger and online upgrade
LHCb-TDR-015 [47]	Tracker upgrade
LHCb-TDR-014 [48]	PID upgrade
LHCb-TDR-013 [49]	VELO upgrade
LHCb-TDR-012 [50]	Framework TDR for the upgrade
LHCb-TDR-011 [51]	Computing
LHCb-TDR-010 [52]	Trigger
LHCb-TDR-009 [53]	Reoptimized detector
LHCb-TDR-008 [54]	Inner Tracker
LHCb-TDR-007 [55]	Online, DAQ, ECS
LHCb-TDR-006 [56]	Outer Tracker
LHCb-TDR-005 [57]	VELO
LHCb-TDR-004 [58]	Muon system
LHCb-TDR-003 [59]	RICH
LHCb-TDR-002 [60]	Calorimeters
LHCb-TDR-001 [61]	Magnet

Table 4: LHCb-PAPERs (which have their identifier as their cite code). Note that LHCb-PAPER-2011-039 does not exist.

LHCb-PAPER-2015-055 [62]	
LHCb-PAPER-2015-054 [63]	LHCb-PAPER-2015-053 [64]
LHCb-PAPER-2015-052 [65]	LHCb-PAPER-2015-051 [66]
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LHCb-PAPER-2011-028 [327]	LHCb-PAPER-2011-027 [328]
LHCb-PAPER-2011-026 [329]	LHCb-PAPER-2011-025 [330]
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Table 5: LHCb-CONFs (which have their identifier as their cite code). Note that LHCb-CONF-2011-032 does not exist.

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[2] If you cite the gamma combination, always also cite the latest gamma paper as `\cite{LHCb-PAPER-2013-020,*LHCb-CONF-2014-004}` (unless you cite LHCb-PAPER-2013-020 separately too).

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Some LHCb papers quoted together will look like [347–351]. The combination of CMS and LHCb results on $B^0_{(s)} \to \mu^+\mu^-$ should be cited like [366].

B Standard symbols

As explained in Sect. **??** 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^0_s, 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 $m_{B^0_s} = 5366.3 \pm 0.6\,\mathrm{MeV}/c^2$. Note that $\mathrm{\mu m}$ is typeset with an upright $\mathrm{\mu}$, 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
`\MagUp`	*MagUp*	`\MagDown`	*MagDown*	`\ode`	ODE
`\daq`	DAQ	`\tfc`	TFC	`\ecs`	ECS
`\lone`	L0	`\hlt`	HLT	`\hltone`	HLT1
`\hlttwo`	HLT2				

C.2 Particles

C.2.1 Leptons

`\electron`	e	`\en`	e^-	`\ep`	e^+
`\epm`	$e^\pm$	`\epem`	e^+e^-	`\muon`	μ
`\mup`	μ^+	`\mun`	μ^-	`\mumu`	$\mu^+\mu^-$
`\tauon`	τ	`\taup`	τ^+	`\taum`	τ^-
`\tautau`	$\tau^+\tau^-$	`\lepton`	ℓ	`\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

\hadron	h	\pion	π	\piz	π^0
\pizs	$\pi^0\mathrm{s}$	\pip	π^+	\pim	π^-
\pipm	$\pi^\pm$	\pimp	$\pi^\mp$	\rhomeson	ρ
\rhoz	ρ^0	\rhop	ρ^+	\rhom	ρ^-
\rhopm	$\rho^\pm$	\rhomp	$\rho^\mp$	\kaon	K
\Kb	$\overline{K}$	\KorKbar	$\overset{(-)}{K}$	\Kz	K^0
\Kzb	$\overline{K}^0$	\Kp	K^+	\Km	K^-
\Kpm	$K^\pm$	\Kmp	$K^\mp$	\KS	K^0_{S}
\KL	K^0_{L}	\Kstarz	K^{*0}	\Kstarzb	$\overline{K}^{*0}$
\Kstar	K^*	\Kstarb	$\overline{K}^*$	\Kstarp	K^{*+}
\Kstarm	K^{*-}	\Kstarpm	$K^{*\pm}$	\Kstarmp	$K^{*\mp}$
\etaz	η	\etapr	η'	\phiz	ϕ
\omegaz	ω				

C.2.5 Heavy mesons

\D	D	\Db	$\overline{D}$	\DorDbar	$\overset{(-)}{D}$
\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	$\overline{B}$
\BorBbar	$\overset{(-)}{B}$	\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`	$\mathit{\Delta}$	`\Deltaresbar`	$\overline{\mathit{\Delta}}$
`\Xires`	$\mathit{\Xi}$	`\Xiresbar`	$\overline{\mathit{\Xi}}$	`\Lz`	$\mathit{\Lambda}$
`\Lbar`	$\overline{\mathit{\Lambda}}$	`\LorLbar`	$\overset{(-)}{\mathit{\Lambda}}$	`\Lambdares`	$\mathit{\Lambda}$
`\Lambdaresbar`	$\overline{\mathit{\Lambda}}$	`\Sigmares`	$\mathit{\Sigma}$	`\Sigmaresbar`	$\overline{\mathit{\Sigma}}$
`\Omegares`	$\mathit{\Omega}$	`\Omegaresbar`	$\overline{\mathit{\Omega}}$	`\Lb`	$\mathit{\Lambda}_b^0$
`\Lbbar`	$\overline{\mathit{\Lambda}}_b^0$	`\Lc`	$\mathit{\Lambda}_c^+$	`\Lcbar`	$\overline{\mathit{\Lambda}}_c^-$
`\Xib`	$\mathit{\Xi}_b$	`\Xibz`	$\mathit{\Xi}_b^0$	`\Xibm`	$\mathit{\Xi}_b^-$
`\Xibbar`	$\overline{\mathit{\Xi}}_b$	`\Xibbarz`	$\overline{\mathit{\Xi}}_b^0$	`\Xibbarp`	$\overline{\mathit{\Xi}}_b^+$
`\Xic`	$\mathit{\Xi}_c$	`\Xicz`	$\mathit{\Xi}_c^0$	`\Xicp`	$\mathit{\Xi}_c^+$
`\Xicbar`	$\overline{\mathit{\Xi}}_c$	`\Xicbarz`	$\overline{\mathit{\Xi}}_c^0$	`\Xicbarm`	$\overline{\mathit{\Xi}}_c^-$
`\Omegac`	$\mathit{\Omega}_c^0$	`\Omegacbar`	$\overline{\mathit{\Omega}}_c^0$	`\Omegab`	$\mathit{\Omega}_b^-$
`\Omegabbar`	$\overline{\mathit{\Omega}}_b^+$				

C.3 Physics symbols

C.3.1 Decays

`\BF`	$\mathcal{B}$	`\BRvis`	$\mathcal{B}_{\text{vis}}$	`\BR`	$\mathcal{B}$
`\decay[2] \decay{`a `}{`b c `}`	$a \to bc$	`\ra`	$\rightarrow$	`\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`	τ_{L}	`\tauH`	τ_{H}		

C.3.3 Masses

`\mBd`	m_{B^0}	`\mBp`	m_{B^+}	`\mBs`	$m_{B_s^0}$
`\mBc`	$m_{B_c^+}$	`\mLb`	$m_{\mathit{\Lambda}_b^0}$		

353 ### C.3.4 EW theory, groups

354

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

355 ### C.3.5 QCD parameters

356

\as	α_s	\MSb	$\overline{\mathrm{MS}}$	\lqcd	Λ_{QCD}
\qsq	q^2				

357 ### C.3.6 CKM, CP violation

358

\eps	ε	\epsK	ε_K	\epsB	ε_B
\epsp	ε'_K	\CP	CP	\CPT	CPT
\rhobar	$\overline{\rho}$	\etabar	$\overline{\eta}$	\Vud	V_{ud}
\Vcd	V_{cd}	\Vtd	V_{td}	\Vus	V_{us}
\Vcs	V_{cs}	\Vts	V_{ts}	\Vub	V_{ub}
\Vcb	V_{cb}	\Vtb	V_{tb}	\Vuds	V_{ud}^*
\Vcds	V_{cd}^*	\Vtds	V_{td}^*	\Vuss	V_{us}^*
\Vcss	V_{cs}^*	\Vtss	V_{ts}^*	\Vubs	V_{ub}^*
\Vcbs	V_{cb}^*	\Vtbs	V_{tb}^*		

359 ### C.3.7 Oscillations

360

\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	Γ_{L}	\GH	Γ_{H}	\DGsGs	$\Delta\Gamma_s/\Gamma_s$
\Delm	Δm	\ACP	$\mathcal{A}^{CP}$	\Adir	$\mathcal{A}^{\mathrm{dir}}$
\Amix	$\mathcal{A}^{\mathrm{mix}}$	\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	$\sin\phi_s$				

361 ### C.3.8 Tagging

362

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

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	$B^0_s \to J/\psi\,\phi$
\BdToJPsiKst	$B^0 \to J/\psi\,K^{*0}$	\BdbToJPsiKst	$\overline{B}^0 \to J/\psi\,\overline{K}^{*0}$	\BsPhiGam	$B^0_s \to \phi\gamma$
\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	$B^0_s \to K^+K^-$	\BsTopiK	$B^0_s \to \pi^+K^-$

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_{FB}	\FL	F_{L}	\AT#1 \AT2	A_{T}^2
\btosgam	$b \to s\gamma$	\btodgam	$b \to d\gamma$	\Bsmm	$B^0_s \to \mu^+\mu^-$
\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	$\mathcal{C}_9^{(\mathrm{eff})}$
\Cpeff#1 \Cpeff7	$\mathcal{C}_7^{\prime(\mathrm{eff})}$	\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	`\ma`	m^2
`\cm`	cm	`\cma`	cm^2	`\mm`	mm
`\mma`	mm^2	`\mum`	µm	`\muma`	$\mathrm{µm}^2$
`\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}	`\ab`	ab
`\invab`	ab^{-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}	`\invns`	ns^{-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`	n_{eq}	`\neqcmcm`	$\mathrm{n}_{\mathrm{eq}}/\mathrm{cm}^2$	`\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}
`\chisqvtxndf`	$\chi^2_{\mathrm{vtx}}/\mathrm{ndf}$	`\deriv`	d	`\gsim`	$\gtrsim$
`\lsim`	$\lesssim$	`\mean[1]` `\mean{x}`	$\langle x \rangle$	`\abs[1]` `\abs{x}`	$\lVert x \rVert$
`\Real`	$\mathcal{R}e$	`\Imag`	$\mathcal{I}m$	`\PDF`	PDF
`\sPlot`	*sPlot*				

C.5 Kinematics

C.5.1 Energy, Momenta

`\Ebeam`	E_{BEAM}	`\sqs`	$\sqrt{s}$	`\ptot`	p
`\pt`	p_{T}	`\et`	E_{T}	`\mt`	M_{T}
`\dpp`	$\Delta p/p$	`\msq`	m^2	`\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`$^{-1}$ `}`	$\int\mathcal{L} = 2\ \mathrm{fb}^{-1}$

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
`\neurobayes`	NeuroBayes	`\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 for LHCb-PAPER-20XX-YYY

This appendix contains supplementary material that will posted on the public cds record but will not appear in the paper.

Please leave the above sentence in your draft for first and second circulation and replace what follows by your actual supplementary material. For more information about other types of supplementary material, see Section 8. Plots and tables that follow should be well described, either with captions or with additional explanatory text.

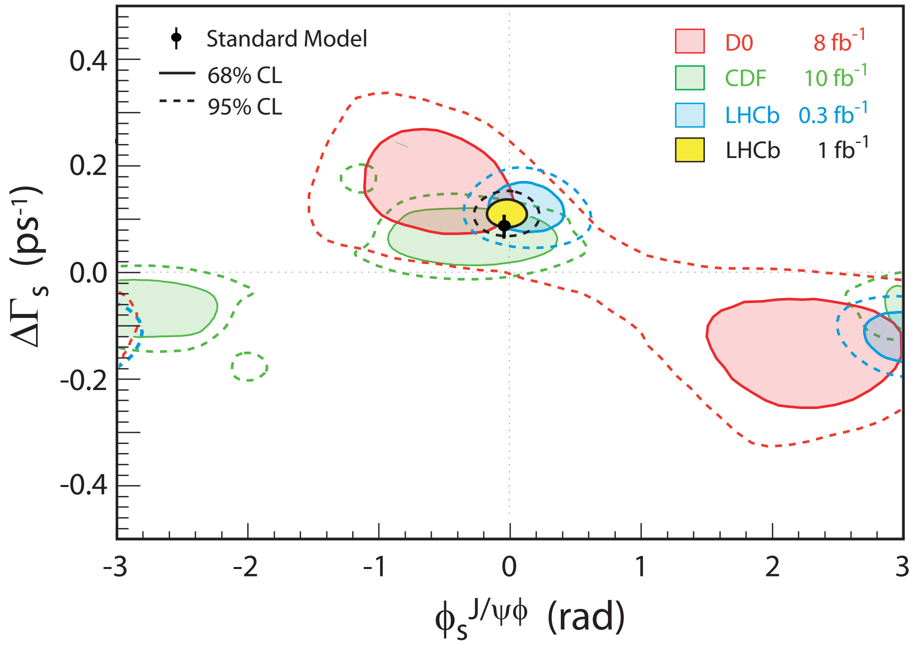

Figure 5: Comparison of our result to those from other experiments. Note that the style of this figure differs slightly from that of Figure 4

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