INSTRUCTIONS FOR PRODUCING A CAMERA-READY COPY (CRC) USING WORLD SCIENTIFIC PUBLISHING STYLE FILES

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This is where the abstract should be placed. It should consist of one paragraph and give a concise summary of the material in the article below. Replace the title, authors, and addresses within the curly brackets with your own title, authors, and addresses; please use capital letters for the title and the authors. You may have as many authors and addresses as you wish. Do not use footnotes in the abstract or the title; the acknowledgments for funding bodies etc. are placed in a separate section at the end of the text.

1. Guidelines

1.1. *Producing the Hard Copy*

The hard copy may be produced using the instructions given in the file *lp2003procs-readme.pdf*, some of the information is repeated in this section but the main purpose of this file is to act as a template file that you can modify. You should have nine files in total.[a]

1. *lp2003procs-readme.txt* – the preliminary guide.
2. *lp2003procs-instructions.txt* – Instructions for producing a proceedings contribution using Latex2e.
3. *ws-procs11x85.cls* – the style file that provides the higher level latex commands for the proceedings. Don't change these parameters.
4. *lp2003ws-procs11x85.tex* – the text template file for Latex2e (this file.) You can delete our sample text and replace it with your own contribution to the volume, however we recommend keeping an initial version of this file for reference.
5. *lp2003-figure1.eps* – first figure file needed by lp2003ws-procs11x85.tex.
6. *lp2003-figure2.eps* – second figure file needed by lp2003ws-procs11x85.tex.
7. *lp2003ws-procs11x85.pdf* – sample typeset pages of the above text file in PDF format.
8. *lp2003ws-procs11x85.ps* – sample typeset pages of the above text file in PostScript format.
9. *lp2003_copyright.pdf* – copyright transfer form, please complete this form, sign and return by mail or FAX.

You can latex the lp2003ws-procs11x85.tex tex file to check your local Latex2e distribution once you have all the appropriate files in your area. The command for latexing is `latex lp2003ws-procs11x85`, do this twice to sort out the cross-referencing. To actually create the PostScript (.ps) file you need to do the following: `dvips lp2003ws-procs11x85`. If you have problems using Latex or with the style file, please first consult your local texpert to check for other conflicting macros that may be unique to your computer system. Page numbers are included in each page for your guidance. Do not worry about the final pagination of the volume which will be done after you submit the paper.

1.2. *Using Other Word-Processing Packages*

If you want to use some other form of word-processor to construct your output please send email as soon as possible to the editors (lp2003_editors@fnal.gov) to get instructions. However we would like everyone to use Latex2e if possible so we can obtain a single file electronic version of the proceedings.

[a] These files can be found at:
http://conferences.fnal.gov/lp2003/proceedings/style_files.html

$$U = D(\delta_1, \delta_2, \delta_3, \delta_4) R_{12}(a, \delta_5) R_{13}(b, \delta_6) R_{14}(c, \delta_7) R_{23}(d, \delta_8) R_{24}(e, \delta_9) R_{34}(f, \delta_{10}) \tag{1}$$

Table 1. This is a Small Table.

Title	ϵ'	λ	γ
3.5687	3.4567	3.8746	2.8934
Trans Process for Decay			
6.8977	8.9087	2.8989	4.2928

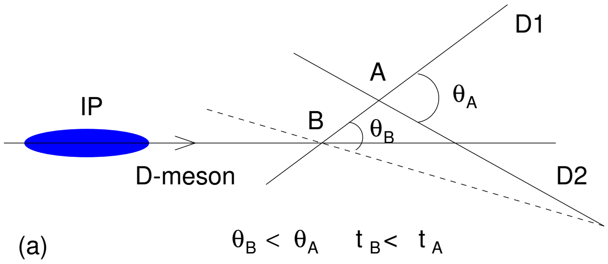

Figure 1. Vertex constraint (example illustration).

1.3. *Headings and Text*

Please preserve the style of the headings, text fonts and line spacing to provide a uniform style for the proceedings volume. In a two column format there are more difficulties when finding suitable line and page breaks. We recommend that you leave such problems until preparing the final draft and after you have checked the placing of the two-column wide tables etc. (See Sec. 1.7 below).

1.4. *Equations*

Equations should be confined to one column wherever possible, as in Eq. (2), and the *eqnarray* environment may be used to split equations into several lines, for example in Eq. (3), or to align several equations. An alternative method is given in Eq. (4) for long sets of equations where only one referencing equation number is wanted.

If it's essential to have a two-column wide equation then use the method of Eq. (1) above. The surrounding environment is important here. In the text file *lp2003ws-procs11x85.tex* make sure that you keep the declarations *begin*{*table*∗} and *end*{*table*∗} and only change the equation and its label within the inner equation environment.

For problems of placement of a wide equation, see Sec. 1.7 below. Please note, do not use square brackets in two-column wide figures, tables and equations. This is a bug due to the declaration *twocolumn*[...] which is hidden in the definition of *table*∗ and *figure*∗. (Solutions would be most welcome!)

1.5. *Tables*

The tables are designed to have a uniform style throughout the proceedings volume. It doesn't matter how you choose to place the inner lines of the table, but we would prefer the border lines to be of the style shown in Tables 1 and 2. For either a single or a double column table, the top and bottom horizontal lines should be single (using *hline*), and there should be single vertical lines on the perimeter, (using *begin*{*tabular*}{|...|}) as in Tables 1 and 2. For the inner lines of the table, it looks better if they are kept to a minimum. We've chosen more complicated examples purely as an illustration of what is possible.

We recommend the use of single column-wide tables wherever possible. For the page wide tables, use the environment given in the example of Table 2. Do not change the latex commands from *begin*{*table*∗} to *begin*{*tabular*}, or from *end*{*tabular*} to *end*{*table*∗}, apart from inserting your own caption heading and table label.

The caption heading for a table should be placed at the top of the table.

1.6. *Figures*

The same arguments apply as are given above for tables, i.e. it is preferable to have figures that fit into one column of the text. If this is not possible, then use the example of Fig. 2 and use the commands *begin*{*figure*∗} and *end*{*figure*∗}.

If you wish to 'embed' a postscript figure in the file, then use the *input psfig* or similar command within the figure description. The *psfig* command is used in this template file, change the filename to an

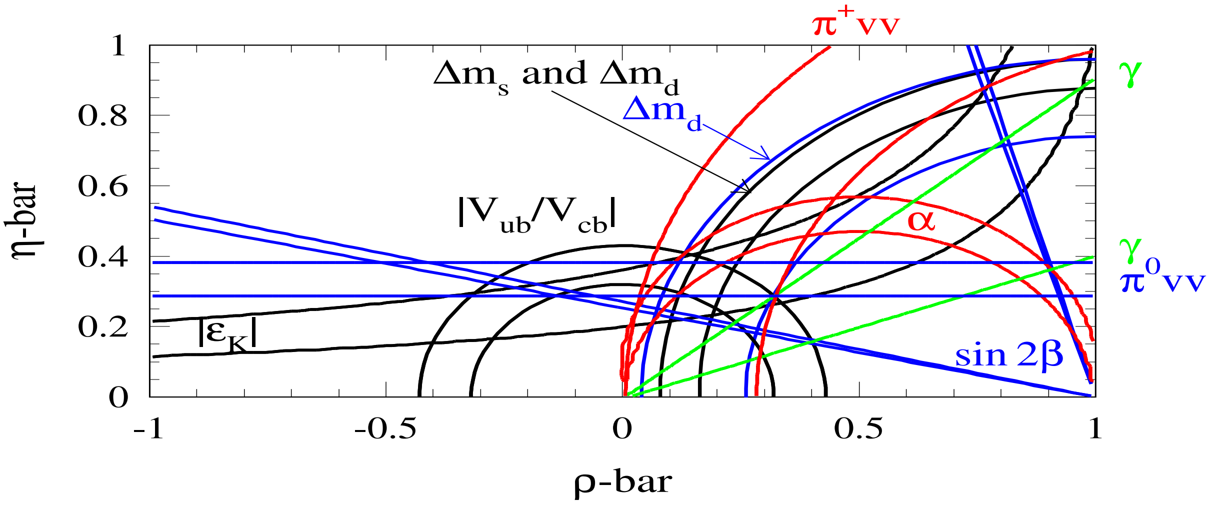

Figure 2. Prophecy for 2010: Confidence levels for the individual constraints in the (rhobar,etabar) plane with full errors (from the CKMfitter www page, `http://ckmfitter.in2p3.fr/`. Note that this sample figures shows what you should not do, *i.e.* using only colors to differentiate lines. Different lines should be differentiated by different line styles and using arrows rather than just by different colors.

appropriate one. Next adjust the scaling of the figure until it's correctly positioned. The caption heading for a figure should be placed below the figure.

If you wish to use a cut-and-paste method, then it's most important to leave the right amount of vertical space in the figure declaration to accomodate your figure (i.e. remove the lines and change the space in the example). Send the hard copy figure on a separate page, clearly identifying where it should be placed on the final hard copy. The hard copy figure you send should be correctly scaled as this ensures that the details will be visible in the final version.

To create a totally electronic version, we will have to scan in your figure to embed it into your file. However a good quality hard copy of the figure is needed for the scan and the camera-ready copy.

1.7. *Limitations on the Placement of Equations, Tables and Figures*

In the final stages of preparing the document, try to declare the two-column wide figures, tables or equations at a point in *lp2003ws-procs11x85.tex* that is prior to the top of the column of hard-copy text where you would like the item to appear.[b] Very large figures and tables should be placed on a page by themselves. One can use the instruction *begin*{*figure*∗}[*p*] or *begin*{*table*∗}[*p*] to position these, and they will appear on a separate page at the end of the paper devoted to figures and tables. Again, we would recommend making any necessary adjustments to the layout of the figures and tables only in the final draft. It is also simplest to sort out line and page breaks in the last stages.

1.8. *Footnotes, the Bibliography, Appendices and Acknowledgments*

Acknowledgments to funding bodies etc. may be placed in a separate section at the end of the text, before the Appendices. This should not be numbered so use *section*∗{*Acknowledgements*}.

It's preferable to have no appendices in a brief article, but if more than one is necessary then simply copy the *section*∗{*Appendix*} heading and type in Appendix A, Appendix B etc. between the brackets.

Footnotes are denoted by a letter superscript in

[b] By 'declaring' we refer to placing the chunk of material describing the table or whatever at a particular point in the text file.

Table 2. Experimental Data bearing on $\Gamma(K \to \pi\pi\gamma)$ for the K_S^0, K_L^0 and K^- mesons.

Meson	$\Gamma(\pi^+\pi^-)\ s^{-1}$	$\Gamma(\pi^+\pi^-\gamma)\ s^{-1}$	
K_S^0	0.769×10^{10}	5.46×10^7	No DE observed, not even (IB)-E1 interference, despite large statistics, for $E_\gamma^* > 20$ MeV.
K_L^0	3.93×10^4	0.90×10^3 ($\mathrm{DE} = 0.62 \times 10^3$)	DE prominent, exceeding IB over the range of measurement $20 < E_\gamma^* < 160$ MeV.
	$\Gamma(\pi^-\pi^0)\ s^{-1}$	$\Gamma(\pi^-\pi^0\gamma)\ s^{-1}$	
K^-	1.711×10^7	2.22×10^4 ($\mathrm{DE} = 1.46 \times 10^3$)	No (IB)-E1 interference seen but data shows excess events relative to IB over $E_\gamma^* = 80$ to 100 MeV

the text, and references are denoted by a number superscript. We have used *bibitem* to produce the bibliography. Citations in the text use the labels defined in the bibitem declaration, for example, the first paper by Jarlskog[1] is cited using the command *cite*{*ja*}.

If you more commonly use the method of square brackets in the line of text for citation than the superscript method, please note that you need to adjust the punctuation so that the citation command appears after the punctuation mark.

Please make sure references are numbered in the order they appear, are correct and you do not have extra references that are not cited.

1.9. *Question and Answer Section*

The questions and answers that came up after your talk should be placed after the end of the paper starting on a new page. The section should be titled "DISCUSSION" using the command *section*∗{*DISCUSSION*}. The questions and answers should be inside a *description* environment. See the sample text for formatting details.

1.10. *Final Manuscript*

The final hard copy that will be sent to the publisher will be printed by the editors. The manuscript will not be reduced or enlarged when filmed so please ensure that indices and other small pieces of text are legible. Even though the final hard copy can be printed from a single PDF or PS file, we ask that you send all your source files including all figure files to the editors. The preferred format is via a single tar file or zip file.

2. Sample Text

The following may be (and has been) described as 'dangerously irrelevant' physics. The Lorentz-invariant phase space integral for a general n-body decay from a particle with momentum P and mass M is given by:

$$I((P-k_i)^2, m_i^2, M) = \frac{1}{(2\pi)^5}\int \frac{d^3k_i}{2\omega_i}\delta^4(P-k_i). \quad (2)$$

The only experiment on $K^\pm \to \pi^\pm\pi^0\gamma$ since 1976 is that of Bolotov *et al.*[2] The photon spectrum observed certainly exceeds the IB spectrum for $E_\gamma^* \geq 70 MeV$. These authors report definite evidence for DE, however they "conclude that [IB-DE] interference is not observed" in their experiment but such interference is expected to be seen.

Although PDG has recorded the Serphukov experiment as K^+ decay, it is in fact a K^- experiment. This is not a trivial difference. Assuming CPT invariance to be satisfied, CP violation is equivalent with T violation. The latter has to do with phases in the DE processes. Part of the calculated phase will arise from the final-state interactions, but there will also be a non-zero phase in the initial Lagrangian which may feed through to the phases in the final amplitudes. These Lagrangian phases will be different for the K^+ and K^- processes, and can give rise to differences between spectra and rates for K^+ and K^- mesons.

2.1. *Parametrizations of the CKM Matrix*

It is emphasised that there are two necessary conditions required for any acceptable parametrization of the quark mixing matrix. The first is that the matrix must be unitary, and the second is that it should contain a CP violating phase δ.

In Sec. 2.2 the connection between invariants (of form similar to J) and unitarity relations will be examined further for the more general $n \times n$ case. For the present, it's sufficient to note that J is equal to just twice the area of any one of these triangles.

This does not mean that a non-zero J follows from unitarity alone; if J equalled zero, the unitarity constraint would still hold, but the triangle would collapse to a straight line and the measurement of J would be of no use in determining the existence of CP violation if the quark mixing matrix was in fact represented by such a matrix. The reason is that such a matrix is not a faithful representation of the group, i.e. it does not cover all of the parameter space available

$$\begin{aligned} T &= \Im[V_{11}V_{12}{}^*V_{21}{}^*V_{22}] \\ &\quad + \Im[V_{12}V_{13}{}^*V_{22}{}^*V_{23}] \\ &\quad - \Im[V_{12}V_{13}{}^*V_{22}{}^*V_{23}] \\ &\quad - \Im[V_{33}V_{31}{}^*V_{13}{}^*V_{11}]. \end{aligned} \tag{3}$$

There are only 162 quark mixing matrices using these parameters which are to first order in the phase variable $e^{i\delta}$ as is the case for the Jarlskog parametrizations, and for which J is not identically zero.[c] It should be emphasised that these are physically identical and form just one true parametrization.

2.2. *Four and N-Generation Mixing Matrix*

Murnaghan[3] provides us with a general representation of a 4×4 unitary matrix given in Eq. (1). We have calculated the possible combinations and have found that there are eight distinct parametrizations.

[c] An example of a matrix which has elements containing the phase variable $e^{i\delta}$ to second order, i.e. elements with a phase variable $e^{2i\delta}$ is given at the end of this section.

The unitary nature of the matrix imposes eight conditions on the connections between adjacent rows and columns, analagous to the six unitarity triangles for the three family case, but for four generations the unitarity condition forms a quadrilateral in the imaginary plane. We have found only one set of invariants that are independent of their positions in the matrix, i.e. for which one can choose any element to be the 'starting point' element $V_{j,\alpha}$ in the definitions of **K, L** and **M** given below (where the invariants are the sums or differences of the imaginary parts of four plaquettes).

$$\begin{aligned} \mathbf{K} = {} & \Im[V_{j,\alpha}V^*_{j,\alpha+1}V^*_{j+1,\alpha}V_{j+1,\alpha+1}] \\ & + \Im[V_{k,\alpha+2}V^*_{k,\alpha+3}V^*_{k+1,\alpha+2}V_{k+1,\alpha+3}] \\ & + \Im[V_{j+2,\beta}V^*_{j+2,\beta+1}V^*_{j+3,\beta}V_{j+3,\beta+1}] \\ & + \Im[V_{k+2,\beta+2}V^*_{k+2,\beta+3}V^*_{k+3,\beta+2}V_{k+3,\beta+3}] \\[1ex] \mathbf{L} = {} & \Im[V_{j+1,\alpha}V^*_{j+1,\alpha+1}V^*_{k,\alpha+2}V_{k,\alpha+3}] \\ & - \Im[V_{j,\alpha}V^*_{j,\alpha+1}V^*_{k+1,\alpha+2}V_{k+1,\alpha+3}] \\ & + \Im[V_{j+3,\beta}V^*_{j+3,\beta+1}V^*_{k+2,\beta+2}V_{k+2,\beta+3}] \\ & - \Im[V_{j+2,\beta}V^*_{j+2,\beta+1}V^*_{k+3,\beta+2}V_{k+3,\beta+3}] \\[1ex] \mathbf{M} = {} & \Im[V_{j,\alpha+1}V^*_{j,\alpha}V^*_{j+1,\alpha+1}V_{j+1,\alpha}] \\ & + \Im[V_{k,\alpha+2}V^*_{k,\alpha+3}V^*_{k+1,\alpha+2}V_{k+1,\alpha+3}] \\ & + \Im[V_{j+2,\beta+1}V^*_{j+2,\beta}V^*_{j+3,\beta+1}V_{j+3,\beta}] \\ & + \Im[V_{k+2,\beta+2}V^*_{k+2,\beta+3}V^*_{k+3,\beta+2}V_{k+3,\beta+3}], \end{aligned} \tag{4}$$

where $k = j$ or $j + 1$ and $\beta = \alpha$ or $\alpha + 1$, but if $k = j + 1$, then $\beta \neq \alpha + 1$ and similarly, if $\beta = \alpha + 1$ then $k \neq j + 1$.

Acknowledgments

This is where one places acknowledgments for funding bodies etc. Note that there are no section numbers for the Acknowledgments, Appendix or References.

Appendix A. First Appendix

Appendices should be used only when absolutely necessary. They should come before the References. If there is more than one appendix, number them alphabetically. Number displayed equations occurring in the Appendix in this way, e.g. (A.1), (A.2), etc.

$$\mu(n,t) = \frac{\sum_{i=1}^{\infty} 1(d_i < t, N(d_i) = n)}{\int_{\sigma=0}^{t} 1(N(\sigma) = n) d\sigma} \, . \qquad \text{(A.1)}$$

References

1. C Jarlskog in *CP Violation*, ed. C Jarlskog (World Scientific, Singapore, 1988).
2. J.D. Bjorken and I. Dunietz, *Phys. Rev.* D **36**, 2109 (1987).
3. L. Maiani, *Phys. Lett.* B **62**, 183 (1976).

DISCUSSION

Bennie Ward (Baylor University & University of Tennessee): From your transparencies, I could not see at what point the funding agencies enter the process that you have presented. Could you please comment?

Maury Tigner: Connections with funding agencies differ greatly in the three regions, Asia, Europe and the US. In Europe they differ from country to country. In general, the agencies are already involved through the need for them to approve expenditures. In July many of the agency representatives met in London to begin discussions of how to govern and finance the LC project internationally.

Hugh Montgomery (Fermilab): I've not understood from today's talks when, with respect to the technology discussion, the global study group would be populated. What is your view of how that will happen?

Maury Tigner: This is a matter very much under discussion at the moment. There is now a Task Force in place to recommend the mandate and organization of this global study group. At a minimum it will be activated immediately upon achieving a technology recommendation.

Tony Liss (University of Illinois): There is also a university-based R&D group, and I was wondering if you could comment on how they fit into this work, if at all.

Maury Tigner: University groups are very much a part of this activity and are already performing important parts of the R&D. That will only grow in the future.

Maria Spiropulu (University of Chicago): You gave us a list of committees and a list of times by which there will be a technology decision. Who will force that this timing is kept?

Maury Tigner: There is no external authority that has the will or competence to do this. It must be generated within our community. Because of the importance of getting this job done I firmly believe that our self discipline will suffice.

Bruce Yabsley (Virginia Tech): This is perhaps an ICFA question. I've heard concern expressed that in this security environment, the U.S. might be less willing to fund a facility outside the U.S., or if it was on U.S. soil, might be unwilling to relinquish control to the extent that would be acceptable to the rest of the community. Is that a concern that is shared by the committee, or is the perspective different from where you are standing?

Maury Tigner: The current Administrations science officials are very keen on this being a truly international enterprise wherever it is located and have repeated that to us many times.