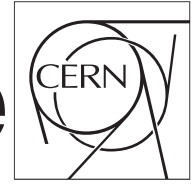


The Compact Muon Solenoid Experiment

# CMS Draft Note

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## TDR: the Technical Document Repository System for the storage, concurrent access, and building of CMS reports, notes, and other $\text{\LaTeX}$ -based documents

George Alverson<sup>1</sup> and Lucas Taylor<sup>2</sup>

<sup>1</sup> Northeastern University

<sup>2</sup> Fermilab

### Abstract

This note describes the TDR documentation system for  $\text{\LaTeX}$ -based documents including CMS Technical Design Reports (TDRs), Expressions of Interest (EoIs), Letters of Intent (LoIs), CMS Notes, Internal Notes, and Analysis Notes. It describes the TDR svn repository for the storage and concurrent multi-user access of documents and the use of the `tdr` build tool for compiling complete or partial documents from users'  $\text{\LaTeX}$  source and graphics files. This system has been successfully used by hundreds of authors of the CMS Computing TDR, the Physics TDR, and a number of other documents. (See also: <http://cmsdoc.cern.ch/cms/cpt/tdr/>)

This box is only visible in draft mode. Please make sure the values below make sense.

PDFAuthor: George Alverson, Lucas Taylor  
PDFTitle: CMS TDR: Technical Document Repository  
PDFSubject: CMS  
PDFKeywords: CMS, physics, software, computing

Please also verify that the abstract does not use any user defined symbols



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## 1 Overview

The CMS Technical Document Repository (TDR) system provides a straightforward environment for the preparation of reports and notes by large numbers of authors working concurrently. It comprises the following components:

### 1.1 TDR Document Repository

All files that are required for the assembly of completed documents are stored in a central CMS svn repository (called `tdr2`). The repository contains the common style files and build tools as well as all the user-generated text ( $\LaTeX$ ) files and figures. This system facilitates the sharing of documents, concurrent working, and means that users do not need to keep any files in their private area.

### 1.2 Document style files

Common  $\LaTeX$  style files have been pre-defined for CMS Technical Design Reports (also used for EoIs, LoIs, and other large documents), CMS Notes, Internal Notes, and Analysis Notes. Template examples are provided enabling the user to get started with minimal overhead.

### 1.3 Document build system

The philosophy of the TDR system is to keep the  $\LaTeX$  document style commands distinct from the user-content. A `tdr` perl script is then provided that assembles on the fly a complete  $\LaTeX$  document using pre-existing standard fragments and the users'  $\LaTeX$  files. It then proceeds to build the document by processing the  $\LaTeX$ , resolving cross-references and citations (using BibTeX), and creating a PDF (portable document format) file. The user selects the style of the document (CMS Note, Analysis Note, etc.) by specifying an option to the `tdr` command. It is therefore totally trivial to switch from one style to another.

### 1.4 External software

The system is designed to be independent of the CMS environment. All that is required is `svn`, `perl`, and a standard installation of  $\LaTeX$ . These are already part of the standard CERN Linux environment. It is also relatively easy to install on non-CERN Linux systems, Mac OSX, and Windows.

### 1.5 Getting started

To **create a new document** in the repository, for example a CMS Note, see section 2.

To **edit the document** once the template has been created, see section 3.

To **build a formatted manuscript** (PDF) for your document see section 4.

For **advice on using  $\LaTeX$** , for example to include figures, see section 5.

## 2 Creating a new document

All files reside in a standard CMS svn repository (called `tdr2`). As long as you are a member of the CMS e-group, you can use a web browser to see the repository: . On any machine with the CMS environment (e.g., `lxplus.cern.ch`) you can check out either the *entire* repository or selected portions with the svn repository address `svn+ssh://svn.cern.ch/repos/tdr2`

### 2.1 Creating a new note or analysis summary

To start you will need to request a note directory in the svn repository from the TDR manager (currently George Alverson or Lucas Taylor). It is best to supply a list of the lxplus usernames of the co-authors who are to have write access to the repository at the time of the request.

To generate output, check out your note directory from svn following the example below. The tag below is the identifier for your paper, typically of the form XXX-YY-NNN. Following the sequence below will populate your local copy of the repository with only your note and not include the other notes. If you have a note, use “notes”. For a paper, use “papers.” [Note: when running without Kerberos authentication, use `svn+ssh://username@svn.cern.ch...` Additional information on accessing svn is available at the <http://svn.web.cern.ch/svn/howto.php#accessing-clients> ]

```
> svn co -N svn+ssh://svn.cern.ch/repos/tdr2 myDir
> cd myDir
> svn update utils
> svn update -N [papers|notes]
> svn update [papers|notes]/XXX-YY-NNN
> # use the following line for tcsh. use -sh for bash.
> eval `[papers|notes]/tdr runtime -csh`
> cd [papers|notes]/XXX-YY-NNN/trunk
# (edit the template, then to build the document)
> tdr --style=paper b XXX-YY-NNN
```

#### 2.1.1 Working at FNAL: The LPC

The LPC environment has a script, `/uscms1/prod/sw/cms/[cshrc|shrc]`, which sets up a number of aliased commands for working on CERN resources while at FNAL. The `svn` command is missing, so you'll need to fix it yourself: `alias svn 'env KRB5CCNAME=/tmp/krb_cern_`id -u` svn' for tcsh,`

```
alias svn='KRB5CCNAME=/tmp/krb_cern_`id -u` svn' for bash.
```

The `kserver_init` command will initialize the KRB5CCNAME file and allow for seamless communication without further intervention.

#### 2.1.2 Naming convention for Analysis Notes and Physics Analysis Summaries

A new directory is created in the `tdr2/notes` directory, named according to the convention chosen by the analysis group, e.g. TOP-07-005. Once created, this directory will contain a template note named according to the analysis name, e.g. TOP-07-005.tex. The `tdr` script will automatically generate the `cmsNoteHeader` from the directory name.

### 2.1.3 Special Note on Physics Analysis Summaries

PAS documents are loaded into the CDS archives after approval. At this point, the title *as stored in the `hypersetup pdftitle` field* is passed to CDS as the document title. This allows for a fully formatted  $\text{\LaTeX}$  title on the document and a natural language title for easy searching. The abstract, on the other hand, is taken from the `abstract`  $\text{\LaTeX}$  version. Both are run through a simple-minded pre-processor for display. The preprocessor will not see any  $\text{\TeX}$  macros, however, so those should not be used.

### 2.1.4 Naming convention for CMS Notes, and Internal Notes

A new directory is created in the `tdr2/notes` directory, named according to the convention: `contactAuthor_serialNo`. `contactAuthor` is the CMS username (see the CERN “phone-book” command) which is used for subsequent access control. `serialNo` is a simple serial number (001, 002,...) for the note generated at the time of the request; it is *not* anything to do with the final CMS note number which will be assigned independently during the review process. For example the first note requested by Paris Sphicas resides in the directory `tdr2/notes/sphicas_001`. Once created, this directory will contain a template note called `contactAuthor_noteNo.tex` and a sub-directory called `fig` in which figures (PDF files) may be stored.

## 2.2 Creating a new Technical Design Report (or Lol, Eol, etc.)

For major reports, a new directory is created in the reports directory, e.g., `tdr2/reports/plutp` for the Phase 1 Upgrade Technical Proposal. This directory will contain the following sub-directories:

- `tex` - latex files and subdirectories (e.g., for different chapters);
- `fig` - figure files and subdirectories;
- `bib` - bibtex file(s) for references.

Note that for TDRs this sub-structure is assumed to exist by the `tdr` script (described below); if you change it things may fail.

### 3 Modifying a document and working with svn

svn is similar in many ways to cvs. Once a repository has been checked out, the workflow is almost identical except for tagging. In svn, tagging is done by creating a new directory branch using the `svn copy` command. Please see the `svn` manual for details, particularly the chapter on branching and tagging and `svn` for cvs users. Please do not change the depth of the directory structure to the top-level  $\text{\LaTeX}$  file for your document. The template is created in the `trunk` subdirectory, and this is what is used by default. You should also note that `svn`, as opposed to `cvs`, does allow for easily moving and copying directory trees.

*Please make sure to configure your svn client: edit `/.subversion/config` so that it appropriately tags pdf files.*

```
[auto-props]
*.pdf = svn:mime-type=application/pdf
*.png = svn:mime-type=image/png
*.jpg = svn:mime-type=image/jpeg
*.tex = svn:eol-style=native
*.eps = svn:mime-type=application/postscript
```

There are other useful settings as well. For example, to stop `svn` from asking to commit backup files and object files, you can set the `global-ignores` flag:

```
[miscellany]
global-ignores = *.o *.bak
```

#### 3.1 Checking out desired files

Checkout the directory which contains the source files of the document you wish to work on. In addition to your specific note directory, you will see the following general files/directories:

- `tdr` - a script for building documents (described below);
- `utils/general` - a R/O directory containing the style files.
- `tmp` - a temporary directory used for output PDF, etc.

#### 3.2 Editing the document

Simply edit any of the  $\text{\LaTeX}$  files with your favourite text editor. For example, for a new note, start with the file `contactAuthor_noteNo.tex`.

#### 3.3 Committing your changes into the svn repository

*Before committing any changes always check your changes are valid  $\text{\LaTeX}$ , otherwise you will break the document for all other authors.*

Firstly, check the local file, e.g., `myfile.tex` by doing `tdr build myfile`.

If `myfile.tex` is included in a bigger document, e.g., `ctdr.tex`, then you must also check that this builds: `tdr build ctdr`. In both cases you should check that a valid PDF file is produced that looks as expected.  $\text{\LaTeX}$  is rather verbose with its warnings, however it is imperative to look and verify that there are no **error** messages, and no **unresolved** references.

Changes to files are committed to (i.e. stored into) the repository using

```
173 > svn commit -m''Comment explaining changes made''
```

174 The `-m` option should always be used to add a short informative message.

175 Finally: do not forget to `svn add` any new files to the repository. It is not sufficient to just do a  
176 `svn commit`. New files must be first added and then committed.

### 177 3.3.1 Checking everything is OK with svn

178 If you want to see the status of your local files compared to the repository type:

```
179 svn status
```

180 Run this command using the `-u` switch (`--show-updates`) to see any changes relative to the  
181 repository.

182 The first character of each line tells you the status of the file:

183 **A** means the file has been scheduled for addition to the repository.

184 **M** means you have modified your local copy.

185 **D** means it is scheduled for deletion.

186 **C** means there is a conflict between your version and changes downloaded from the server.  
187 Try to avoid doing this (messy) step by committing frequently.

188 **?** means you have a file locally that `svn` knows nothing about. Maybe it's meant to be local  
189 (e.g., is temporary). If you want it to be in the repository then you must use `svn add`  
190 and the `svn commit`.

191 **\*** (if run with `-u` or `--show-updates`) shows a file which has changed on the server. This is in a  
192 second column.

### 193 3.4 Creating a standalone paper, e.g., for submission to a journal

194 If you wish to export your paper (for publication, local work or for security), you can produce  
195 a tarball with all the necessary files with

```
196 > tdr --style=note --export b mynote.
```

197 This will function on Unix or Windows systems which have recent copies of  $\LaTeX$  (including  
198  $\mathcal{A}\mathcal{M}\mathcal{S}\text{-}\mathcal{L}\mathcal{A}\mathcal{T}\mathcal{E}\mathcal{X}$ ) and `perl` installed.

199 Please see also section 4.8 on formatting for journals.



## 4 Building a formatted manuscript

The  $\text{\LaTeX}$  file(s) must be processed to produce a fully typeset and formatted manuscript in PDF (Portable Document Format). A `tdr` perl script is provided for building the whole or parts of your document, as described below. There is no need use any of the following commands yourself: `latex`, `pdflatex`, `pdftex`, `bibtex`, `dvips`, or `dvi2pdf`. They are all replaced by the `tdr` script.

### 4.1 Initializing your environment

Set up the runtime environment by typing:

```
> eval `./tdr runtime -sh`      // if you use Bourne-shell or Korn shell
> eval `./tdr runtime -csh`    // if you use c-shell or tc-shell
```

This must be done from the top-level directory of the checked out area, i.e. the location of the `tdr` script. Note also that the syntax uses single *back* quotation marks.

The `tdr` command has a simple *scram*-like syntax with `runtime`, `build`, `clean`, and `veryclean` commands, support for one-letter abbreviations and so on. For details on `tdr` options type:

```
> tdr help
```

### 4.2 Building a PDF file from a $\text{\LaTeX}$ file

To create a PDF file from a  $\text{\LaTeX}$  file `myPaper.tex`, simply type:

```
> tdr build myPaper          (or simply:  tdr b myPaper)
```

Assuming the  $\text{\LaTeX}$  files have no errors in them, the last line of the screen output will tell you the location of the output PDF file. It is stored in the top-level `tmp` directory together with various log files.

If the build fails, check the printout on the screen for  $\text{\LaTeX}$  errors and resolve them; typically these are trivial syntax errors. Then run the build again.

### 4.3 Choosing the document style

You can choose to format the paper according to various pre-defined styles using the `style` option, for example:

```
> tdr --style=note build myPaper
```

will format the paper as a CMS Note. Valid styles are

- `tdr` for large reports (the default),
- `paper` for a paper to be submitted to a journal,
- `note` for CMS Notes,
- `an` for Analysis Notes,
- `pas` for Physics Analysis Summaries,
- `in` for Internal Notes.

Note that PAS documents can be in either draft mode (the default), or non-draft, as set by the `--nodraft` switch.

## 4.4 What your L<sup>A</sup>T<sub>E</sub>X files should (not) contain

The `tdr` script makes a copy of your simple L<sup>A</sup>T<sub>E</sub>X file and automatically inserts all the required L<sup>A</sup>T<sub>E</sub>X boilerplate commands to produce a fully consistent L<sup>A</sup>T<sub>E</sub>X document in the `tmp` directory, in accordance with the CMS document style requested in the command line options (see above). It then processes the document using PdfL<sup>A</sup>T<sub>E</sub>X with several passes to resolve cross references; citations are handled using BibTeX.

Therefore, it should be stressed that the file `myPaper.tex` should *not* contain any document definition commands (e.g., `\documentclass`, `\begin{document}` and so on).

## 4.5 Making partial builds

To speed things up, especially for large documents, the `tdr` command can build single chapters, sections, or indeed any arbitrary L<sup>A</sup>T<sub>E</sub>X files. For example, if your main file is called `myPaper.tex` and looked like:

```
\input{titlepage.tex}
\input{introduction.tex}
\input{data-analysis.tex}
\input{results.tex}
```

then you could use the following commands

```
> tdr build myPaper // build everything as a single PDF paper
> tdr b results      // build just the results section as PDF
```

In general you should be in the directory in which the L<sup>A</sup>T<sub>E</sub>X file resides. The script will search downwards in the directory tree for it, but if more than one version exists, it will not be able to determine which one to build. This situation (multiple copies of the top file) is guaranteed to occur once a tag or branch has been made, so it is important to note this.

## 4.6 Setting the default file to build

To save specifying your preferred build target (e.g., `myPaper.tex`) each time, just set the Unix environmental variable `TDR_TARGET` to `myPaper`. Then you can just type

```
> tdr b
```

If `TDR_TARGET` has not been set, then `tdr` builds this document.

A similar variable, `TDR_STYLE`, controls the default style.

## 4.7 Cleaning up

To clean up temporary files (i.e the locally-created `tmp` directory):

```
> tdr clean
```

To clean up temporary files and emacs and nedit backup files:

```
> tdr veryclean
```

## 4.8 Formatting for Journals

You can produce versions of your document formatted following the standards of several of the journals to which CMS submits physics results. Journal-specific options are passed as strings. To use our defaults, use a single dash as the option:

```
tdr --style paper --aps - b XXX-08-000
```

Please note that the `tdr` script can automatically take the `pdfkeywords` and format them for the equivalent journal field.

**APS** use the normal command for a paper, but add the appropriate APS options with, e.g., `--aps="reprint,prl,linenumbers"`. See the `revtex` documentation for details on APS options. Information on the `revtex` style for use with APS journals can be found at <http://authors.aps.org/revtex4/> and download sites are listed at [https://authors.aps.org/revtex4/revtex4\\_faq.html#download](https://authors.aps.org/revtex4/revtex4_faq.html#download). APS does not accept sub-directories nor included  $\TeX$  files, so the necessary files will either be included or moved to the top level, as appropriate, for submission.

**PLB** use `--plb="3p,twocolumn,times"` or any other set of Elsevier options. See [http://www.elsevier.com/framework\\_authors/misc/elsdoc.pdf](http://www.elsevier.com/framework_authors/misc/elsdoc.pdf) for details on the Elsevier `elsarticle` style. As for the APS, PLB only accepts a flat file structure. The PLB default bib style will convert to lowercase all except the first word in the titles of references, so escape proper names, acronyms, etc., with curly braces, e.g., "Search for {ADD} extra dimensions."

**EPJC** Please provide (using the if-then construction described below) a `\titlerunning` in the text before the `\maketitle`. This is used to create a running head so it cannot be longer than roughly half a page width. When EPJC sets articles, they tend to use the `\sidecaption` macro and have caption plus two small plots run across the full page. This option is not accessible in the CMS style although one can pass it to the EPJC style via an if-then.

**JHEP** JHEP accepts papers in the CMS style.

For instances where the CMS style and the journal style are incompatible, one may use an *if-then* construction to bracket alternatives:

```
\ifthenelse{\boolean{cms@external}}{%
%% journal specific text
}{
%
%CMS specific text
}
```

Note, however, that many formatting changes that are required for the two-column format of many journals can be accommodated in the standard CMS style. Using the `*` format for figures that should extend across two columns does not effect placement for us. If you resize figures, use units of `\columnwidth`, which is the same as the `\textwidth` in single column format.

## 4.9 Supplemental Material for Journals

Supplemental material should be placed in an independent L<sup>A</sup>T<sub>E</sub>X file, e.g., `supplemental_material.tex`. This file will be included via conditional code in the main document (say `GEN-12-001.tex`, representing a GENeric document) when it is formatted for CMS and for the arXiv, and excluded in the journal version. A third file, `GEN-12-001_supp.tex` should have the supplemental material included wrapped in a standard document template, which will provide an independent file for uploading to the journal.

So for `GEN-12-001.tex`,

```
...
\bibliography{auto_generated}
\ifthenelse{\boolean{cms@external}}{}{
\clearpage
\appendix
\section{Supplemental information title\label{app:suppMat}}
\input{supplemental_material}
}
```

while for `GEN-12-001_supp.tex`,

```
\title{GEN-12-001 normal title \texorpdfstring{\[1cm]
---Supplemental Material---}{: Supplemental Material}}
\author[cern]{The CMS Collaboration}
\date{\today}
\abstract{}
\hypersetup{%
...}
\maketitle
\null\cleardoublepage
\input{supplemental_material}
```

The title of `GEN-12-001` should be modified from that of the normal document: `\title{Normal Title\[1cm]—Supplemental Material—}`. To generate all three types of files, arXiv (same as CMS format), PRL, and PRL supplement, the commands would be

```
tldr --style paper --aps - b GEN-12-001
tldr --style paper b GEN-12-001
tldr --style paper --supplement --no-draft --preflight b GEN-12-001_supp
```

You should specifically note how the supplemental material is referenced within the main file: the APS specifies, for instance, that the format for the reference in the text is “See Supplemental Material at [URL will be inserted by publisher] for [give brief description of material],” so we use (for example) “The results are available in tabulated form in `\suppMaterial`”, where we have defined `\suppMaterial` in the `GEN-12-001_supp.tex` file as

```
\ifthenelse{\boolean{cms@external}}{
{\providecommand{\suppMaterial}{the supplemental material
[URL will be inserted by publisher]}}
{\providecommand{\suppMaterial}{Appendix~\ref{app:suppMat}}}
```

351 In the absence of a table of contents we can freely substitute anything we like for “Appendix” in  
352 the string above. If there is a table of contents, the `\appendixname` should be conditionally re-  
353 defined so that in CMS format it would be `\renewcommand{\appendixname}{Supplemental`  
354 `Material}`.

DRAFT

## 5 Advice on using L<sup>A</sup>T<sub>E</sub>X

### 5.1 L<sup>A</sup>T<sub>E</sub>X macros for commonly used constructs

Provisions are made to implement macros across TDR volumes, within a volume, or even locally in a particular section. However, in order to establish a standard look and feel for the text symbols in the TDR volumes (such as for  $E_T$  and  $p_T$ ), we encourage use of the generally defined macros and strongly discourage local use unless you are certain a similar symbol would not be used by another editor.

At the top-most level, definitions defined in `tdr2/Utils/trunk/general/ptdr-definitions.tex` are available to all TDR volumes. An extensive set of macros have been defined there and should be used whenever possible. They include, for example, `\ET`, `\fbinv`, `\sTop`, etc. At the top-level of each TDR (e.g., in `tdr2/reports/ptdr1/trunk/tex/definitions.tex`, there is another file `definitions.tex` for volume-specific definitions. Macros should be suggested and implemented for frequently used constructs or common symbols or names, e.g., `\etc` could be defined to produce “etc.” and so on. The macros in the `definitions.tex` files are usable in tex files at all levels of the particular TDR.

Use `\newcommand` to define a new command that does not exist, `\renewcommand` to re-define a new command that already exists, or `\providecommand` to define a new command but accept the old definition without complaint if it has already been defined.

To override a general definition in `TDR/general/ptdr-definitions.tex` simply (re-)define it in the local `definitions.tex`. But please consult with the appropriate TDR editor.

We stress that it is important to use the macros in case a global style change must be made to suit the standards of a particular journal.

### 5.2 Fonts

Do not override the default fonts. They are currently set to be Palatino and Helvetica. The math fonts have also been changed to Palatino so that they do not clash with the body text, particularly in regards to numbers and units. This means the authors should use `\text` commands to put text in subscripts and superscripts, and most importantly *do not use* `\rm` in formulas, otherwise you will end up with formulae looking like the second one below.

$$\phi = \text{a Greek letter} \tag{1}$$

$$\text{CE} = \text{a mistake} \tag{2}$$

Also note that the math fonts include a full set of Greek symbols in Math Italic Bold (produced with `\mathbf`), but only uppercase in Math Bold (`\mathbf`). Use `\boldmath` or `\boldsymbol` to get bold symbols: `\{\boldmath{\alpha \otimes \beta}\}`:  $\alpha \otimes \beta$ . (Note the enclosing braces.) Most journal styles do not have the `\boldmath` command.

It is also advisable to use the `\text{rm}{Some text}` form rather than `\rm Some text`. The same is true for the other short-form holdovers from plain T<sub>E</sub>X, `\tt` and `\it`, particularly if you would like to submit your paper to a journal with minimal re-editing.

### 5.3 Editorial macros

In addition to the extensive measurement and physics symbols, some editorial macros are defined in `tdr2/Utils/trunk/general/definitions.tex` as well. For example, the fol-

lowing tex fragment:

```
\editor{Jane Doe} \\
\contributor{Tom Cobbley} \\
\fixme{check this number!} \\
```

produces the following.

**Editor(s):** Jane Doe

**Contributor(s):** Tom Cobbley

**FIXME:** check this number!

Notes use `author`, `address`, and `abstract` commands.

## 5.4 Inclusion of Figures

Figures should reside in the `fig` directory of the corresponding TDR (volume). A figure may be included as follows:

```
Figure~\ref{fig:test} shows a figure prepared with the TDR
template and illustrates how to include a picture in a document
and refer to it using a symbolic label.
\begin{figure}[!Hhtb]
  \centering
  \includegraphics{width=0.55\textwidth}{c1_BlackAndWhite}
  \caption[Caption for TOC]{Test of graphics inclusion.\label{fig:test}}
\end{figure}
```

Please note that documents intended for journal submission should usually include the `fig` in the path name supplied to `includegraphics` and not rely on the automatic search.

The result of the above is roughly as follows:

Figure 1 shows a figure prepared with the TDR template and illustrates how to include a picture in a document and refer to it using a symbolic label.

Note that the file extension (type) for the filename (e.g., `c1_BlackAndWhite.pdf` above) is not explicitly specified. Also note that authors should use an alternate short caption within the first set of brackets when the complete caption is unduly long for including in the list of figures in the Table of Contents.

Also note that the current recommended size for figures is `0.55\textwidth` for square plots, and `0.7\textwidth` for ones with a standard (i.e., produced using the root template described in Section 5.4.5) rectangular aspect ratio.

Finally, note that correct results for the labeling occur only if you place the `label` command within the caption environment.



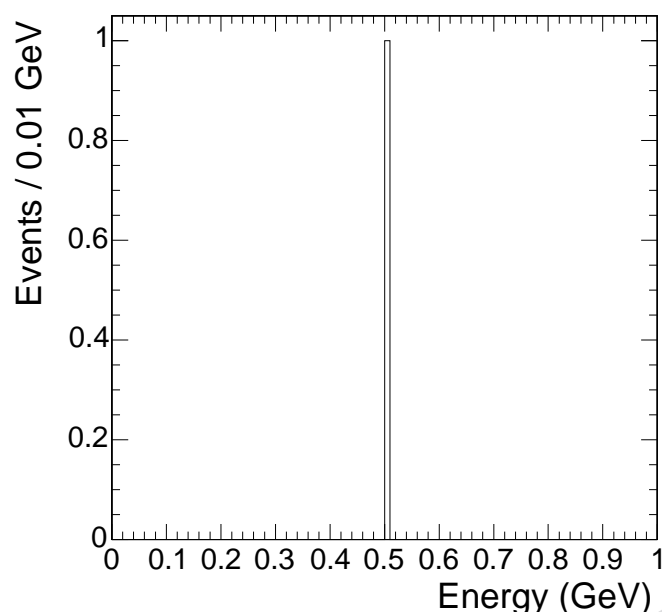


Figure 1: Test of graphics inclusion.

#### 5.4.1 Colour Figures

Figures will generally be printed in black and white for paper versions of the final document. We have found that the automatic conversion of colour figures to black and white often results in a lack of legibility, so we recommend that all authors provide a black and white version for each figure which they have checked for legibility on an actual paper copy.

Colour versions of figures can be provided for PDF output using the `combinedfigure` macro in place of the `\includegraphics` command. This takes two arguments corresponding respectively to the black and white and the coloured versions of the same picture, for example:

```
Figure~\ref{fig:test} shows a figure prepared with the TDR
template and illustrates how to include a picture in a document
and refer to it using a symbolic label.
\begin{figure}[!Hhtb]
  \centering
  \combinedfigure{width=0.4\textwidth}{cl_BlackAndWhite}{cl_Colour}
  \caption[Caption for TOC]{Test of graphics inclusion.\label{fig:test}}
\end{figure}
```

Both figures should have the same size or the pagination may be affected.

#### 5.4.2 How to include multiple figures

If you need to include multiple figures into the figure environment (i.e., you need only one common caption), the recommended procedure is to use multiple instances of the `\includegraphics` command, combined with the `tabular` environment if needed. Please do not use the `subfig` environment just to get “(a)” and “(b)” labels, it is a waste of white space and does not look as nice as putting the labels directly on the plot. Moreover, do not use the `picture` environment to draw the labels, because the coordinate system is absolute on the page and not relative to where the figure will be placed (i.e., this only works for the very final version). In short, to label



multiple figures, it is best to embed the label into the plot.

### 5.4.3 How to handle figures in PDF, jpeg, and PS formats

Files with extensions of `.pdf` (recommended) and `.jpg` are automatically picked up. Direct import of `.eps` files is not supported by the `pdftex` driver which is used to convert  $\text{\LaTeX}$  to PDF. You are advised to convert your `.eps` file to a `.pdf` file using Adobe Acrobat (best results), the `epstopdf` command or `ps2pdf -dEPSCrop`, and commit that to `svn`.<sup>1</sup> Try to avoid converting figures through an intermediate program, such as Powerpoint, and instead convert the natively produced Postscript. If you do convert an EPS file, you are encouraged to also commit the original EPS version as well in case of conversion problems found later. The editors may re-convert if necessary.

Also, keep in mind that some later versions of PDF (e.g., 1.5) will conflict with the  $\text{Pdf\LaTeX}$  machinery on many systems, including `lxplus` so please save figures (e.g., from Distiller) with version 1.3 or 1.4, if possible.

### 5.4.4 Where to store figures

In general the figures should reside in the `fig` directory or one of its subdirectories. A `fig` directory exists for each major document, e.g., `tdr2/reports/ptdr1/trunk/fig/` or `tdr2/reports/ctdr`. Small papers with only a few figures do not require the use of a subdirectory.

Do *not* refer to any figures which reside outside the TDR repository; instead, `svn` add the file in the `fig` directory and check it in.

By default figures are looked for in the `fig` directory.

If a figure file resides in a subdirectory, e.g., `fig/muon`, of the `fig` directory, then simply prepend the directory name when referring to the figure in the `\includegraphics` command (i.e. `muon/c1` in the above example).

### 5.4.5 Standard macro for figures produced with ROOT

To maintain a standard look and feel for the figures in the Physics TDRs, a Root macro was contributed by Thomas Speer. Figure 1 shows an example plot made using it. In the TDR repository check out: `tdr2/utis/trunk/general/tdrstyle.C`. To use it:

```
.L tdrstyle.C
setTDRStyle()
```

## 5.5 Convention for figure and table captions

Figure captions should be located below each figure, as shown in the example above. Table captions, however, should reside *above* the table and use `topcaption`. For example:

```
\begin{table}[h]
  \begin{center}
    \topcaption{Table captions are above the table whereas figure
    captions are below.}
```

<sup>1</sup>An alternative approach would be to use  $\text{\LaTeX}$  plus `pstopdf`. However, this often fails to produce correct `.ps` and hence `.pdf` output files; nor does it support the inclusion of `.pdf` or `.jpg` pictures which are generally much more compact than the corresponding `.eps` files.

```

493 \label{tab:mytab}
494 \begin{tabular}{lcc} \hline
495   Parameter & Value 1 & Value 2 \\ \hline
496   $s$ & 10.0 & 20.0 \\
497   $t$ & 20.0 & 30.0 \\
498   $u$ & 30.0 & 40.0 \\ \hline
499 \end{tabular}
500 \end{center}
501 \end{table}

```

which produces the following:

Table 1: Table captions are above the table whereas figure captions are below.

Parameter	Value 1	Value 2
$s$	10.0	20.0
$t$	20.0	30.0
$u$	30.0	40.0

502

## 503 5.6 Chapters, Sections and Other Sectioning Commands

504 For all notes use the following section heading commands: `\section`, `\subsection`, `\subsubsection`,  
505 and `\paragraph`. For Technical Design Reports the top-level sectioning command is `\chapter`  
506 followed by all the above sectioning commands.

507 The PDF bookmarks produced from PdfL<sup>A</sup>T<sub>E</sub>X will choke on T<sub>E</sub>X symbols, e.g., “2.6 This is a  
508 “026E30Fsection” for “2.6 This is a `\section`” since T<sub>E</sub>X uses 026E30F to represent the backslash.  
509 Use the `\texorpdfstring` macro:

```
510 \section{Finding the split \texorpdfstring{$A_2$}{A2}}
```

511 And this is what it should look like:

## 512 5.7 This is a `\subsection`

513 This is some text.

### 514 5.7.1 This is a `\subsubsection`

515 This is some text.

#### 516 5.7.1.1 This is a `\paragraph` This is some text.

## 517 5.8 Cross-references and bibliographic citations

### 518 5.8.1 Referring to Sections, Figures, Tables, etc.

519 L<sup>A</sup>T<sub>E</sub>X provides powerful, robust, and scalable facilities for cross-referencing based on symbolic  
520 labels. Please use them!

521 For example, to create symbolic links to a chapter and a section:

```

522 \chapter{Mass Storage Systems\label{ch:mss}}
523 \section{Requirements\label{sec:mss-requirements}}

```

Note that the `label` command is contained *within* the curly braces of the appropriate sectioning command so that the value can be resolved correctly. For figures and tables, the `label` command should be similarly enclosed within the associated `caption` command.

To then refer to the chapter and section:

```
The CMS hierarchical mass storage systems, described in
Chapter~\ref{ch:mss} will be of a size unprecedented in
HEP, as described in Section~\ref{sec:mss-requirements}.
```

This will result in output something like:

```
The CMS hierarchical mass storage systems, described in Chapter 9 will be of a size
unprecedented in HEP, as described in Section 9.1.
```

Note that the numbers (9 and 9.1) are automatically generated according to the placement of the `label` commands in the overall context of the document. The number of digits (levels) is determined automatically from the level of the sectioning command used (chapter, section, subsection, etc.).

Always – *repeat always* – use symbolic labels (e.g., `sec:mss-requirements`) for references and not hardwired numbers (e.g., 9.1) as the latter will invariably become wrong very quickly.

## 5.8.2 Bibliographic References

All bibliographic entries are defined in a BibTeX file (i.e., files with `.bib` extension in the `bib` directory of the TDR (volume) of interest. This enables a standard format to be ensured and helps avoid duplicated entries. Before defining a new bibliographic item, please check in the `.bib` files whether it has already been defined, and if so then use it as it is. When creating new BibTeX entries, the format of the bibliographic entries is mostly self-evident and one can cut-and-paste from an existing entry (well, check that it produces reasonable output) and then change the text.

Keep in mind that for listing authors, the BibTeX implementation uses “Last Name, First Name” (and it automatically abbreviates the first name). Concatenate authors using “and”, and instead of writing “*et al.*” use “and others.” BibTeX will handle the substitution, and our style file will trim the author list automatically after three authors. For complicated names, you can place them in braces, but do this sparingly.

We strongly recommend the use of the inSPIRE<sup>2</sup> BibTeX labels when such an article can be found there, because a unique label is created and L<sup>A</sup>T<sub>E</sub>X can spot multiply-defined references. It also saves you the time of creating the entry yourself. Such an entry looks like:

```
@Article{Agostinelli:2002hh,
  author      = "Agostinelli, S. and others",
  collaboration = "GEANT4",
  title       = "{GEANT4}---a simulation toolkit",
  journal     = nim,
  volume      = "A506",
  year        = "2003",
  pages       = "250-303",
```

---

<sup>2</sup><http://inspirehep.net>

```

564     SLACcitation = "%CITATION = NUIMA,A506,250;%",
565     DOI          = "10.1016/S0168-9002(03)01368-8"
566 }

```

567 However, in the above instance and for many other *commonly* cited references, we will use a  
 568 more conventional name (e.g., GEANT4 instead of Agostinelli:2002hh). So please check the  
 569 other bibliography files to see if yours is already defined. The information should also be  
 570 verified. In the above citation, the title was not quite right on inSPIRE.

571 In addition, we recommend setting the “DOI” field that was added to the Article BibTeX for-  
 572 mat in the TDR framework (and is illustrated above). This field represents the Digital Object  
 573 Identifier for your reference.<sup>3</sup> When you prepend this number with `http://dx.doi.org/`,  
 574 your browser is automatically directed to the electronic version of the article (provided your  
 575 institution has paid for this access). Currently you need to manually determine and enter this  
 576 field after examining the publication.

577 To refer to an item in the bibliography using its symbolic label in your text, use one of the  
 578 following forms:

```

579     Either: the CMS detector is described elsewhere~\cite{CMSTP};
580     or: the CMS detector is described in reference~\citenum{CMSTP}.

```

581 This will result in output something like:

```

582     Either: the CMS detector is described elsewhere [34]; or: the CMS detector is de-
583     scribed in reference 34.

```

584 Note the omission of the square brackets in the second form, where the reference is explicitly  
 585 (rather than parenthetically) referred to.

586 The list of references will be placed at the end of the TDR. It is suggested that each group  
 587 maintain a separate `.bib` file in the `bib` directory for the chapter specific references. Common  
 588 references for the entire TDR will be kept in a common file (e.g., `ptdr1.bib`). Common software  
 589 references will be kept in `software.bib`.

### 590 5.8.3 Web References

591 Please use the `\href` and `\url` commands to embed links into your document.

592 Example:

```

593 \url{http://cms.cern.ch/iCMS/} gives http://cms.cern.ch/iCMS/,
594 \href{http://cms.cern.ch/iCMS/}{The CMS web site} gives The CMS web site.

```

## 595 5.9 Glossary

596 Please add a short entry to `glossary.tex` whenever introducing any new acronym or ab-  
 597 breviation. Even plain English terms with specific technical meaning should be included (e.g.,  
 598 Python).

---

<sup>3</sup><http://www.doi.org/>

## 6 PTDR Symbol Definitions

600	etal:	et al.	652	unit{x}:	x
601	ie:	i.e.	653	mum:	$\mu\text{m}$
602	eg:	e.g.	654	micron:	$\mu\text{m}$
603	etc:	etc.	655	cm:	cm
604	vs:	vs.	656	mm:	mm
605	mdash:	—	657	mus:	$\mu\text{s}$
606	Lone:	Level-1	658	keV:	keV
607	Ltwo:	Level-2	659	MeV:	MeV
608	Lthree:	Level-3	660	GeV:	GeV
609	ACERMC:	ACERMC	661	TeV:	TeV
610	ALPGEN:	ALPGEN	662	PeV:	PeV
611	CHARYBDIS:	CHARYBDIS	663	keVc:	$\text{keV}/c$
612	CMKIN:	CMKIN	664	MeVc:	$\text{MeV}/c$
613	CMSIM:	CMSIM	665	GeVc:	$\text{GeV}/c$
614	CMSSW:	CMSSW	666	TeVc:	$\text{TeV}/c$
615	COBRA:	COBRA	667	keVcc:	$\text{keV}/c^2$
616	COCOA:	COCOA	668	MeVcc:	$\text{MeV}/c^2$
617	COMPHEP:	COMPHEP	669	GeVcc:	$\text{GeV}/c^2$
618	EVTGEN:	EVTGEN	670	TeVcc:	$\text{TeV}/c^2$
619	FAMOS:	FAMOS	671	pbinv:	$\text{pb}^{-1}$
620	GARCON:	GARCON	672	fbinv:	$\text{fb}^{-1}$
621	GARFIELD:	GARFIELD	673	nbinv:	$\text{nb}^{-1}$
622	GEANE:	GEANE	674	percms:	$\text{cm}^{-2} \text{s}^{-1}$
623	GEANTfour:	GEANT4	675	lumi:	$\mathcal{L}$
624	GEANTthree:	GEANT3	676	Lumi:	$\mathcal{L}$
625	GEANT:	GEANT	677	LvLow:	$\mathcal{L} = 10^{32} \text{cm}^{-2} \text{s}^{-1}$
626	HDECAY:	HDECAY	678	LLow:	$\mathcal{L} = 10^{33} \text{cm}^{-2} \text{s}^{-1}$
627	HERWIG:	HERWIG	679	lowlumi:	$\mathcal{L} = 2 \times 10^{33} \text{cm}^{-2} \text{s}^{-1}$
628	HIGLU:	HIGLU	680	LMed:	$\mathcal{L} = 2 \times 10^{33} \text{cm}^{-2} \text{s}^{-1}$
629	HIJING:	HIJING	681	LHigh:	$\mathcal{L} = 10^{34} \text{cm}^{-2} \text{s}^{-1}$
630	IGUANA:	IGUANA	682	hilumi:	$\mathcal{L} = 10^{34} \text{cm}^{-2} \text{s}^{-1}$
631	ISAJET:	ISAJET	683	zp:	$Z'$
632	ISAPYTHIA:	ISAPYTHIA	684	kt:	$k_T$
633	ISASUGRA:	ISASUGRA	685	BC:	$B_c$
634	ISASUSY:	ISASUSY	686	bbarc:	$\bar{b}c$
635	ISAWIG:	ISAWIG	687	bbbar:	$b\bar{b}$
636	MADGRAPH:	MADGRAPH	688	ccbar:	$c\bar{c}$
637	MCATNLO:	MC@NLO	689	Jpsi:	$J/\psi$
638	MCFM:	MCFM	690	bspsiphi:	$B_s \rightarrow J/\psi \phi$
639	MILLEPEDE:	MILLEPEDE	691	AFB:	$A_{\text{FB}}$
640	ORCA:	ORCA	692	EE:	$e^+e^-$
641	OSCAR:	OSCAR	693	MM:	$\mu^+\mu^-$
642	PHOTOS:	PHOTOS	694	TT:	$\tau^-\tau^+$
643	PROSPINO:	PROSPINO	695	wangle:	$\sin^2 \theta_{\text{eff}}^{\text{lept}}(M_Z^2)$
644	PYTHIA:	PYTHIA	696	ttbar:	$t\bar{t}$
645	SHERPA:	SHERPA	697	stat:	(stat.)
646	TAUOLA:	TAUOLA			
647	TOPREX:	TOPREX			
648	XDAQ:	XDAQ			
649	DZERO:	D0			
650	de:	°			
651	ten{x}:	$\times 10^x$			

698	syst:	(syst.)	747	sFer:	$\tilde{f}$
699	HGG:	$H \rightarrow \gamma\gamma$	748	sQua:	$\tilde{q}$
700	gev:	GeV	749	sUp:	$\tilde{u}$
701	GAMJET:	$\gamma + \text{jet}$	750	suL:	$\tilde{u}_L$
702	PPTOJETS:	$pp \rightarrow \text{jets}$	751	suR:	$\tilde{u}_R$
703	PPTOGG:	$pp \rightarrow \gamma\gamma$	752	sDw:	$\tilde{d}$
704	PPTOGAMJET:	$pp \rightarrow \gamma + \text{jet}$	753	sdL:	$\tilde{d}_L$
705	MH:	$M_H$	754	sdR:	$\tilde{d}_R$
706	RNINE:	$R_9$	755	sTop:	$\tilde{t}$
707	DR:	$\Delta R$	756	stL:	$\tilde{t}_L$
708	PT:	$p_T$	757	stR:	$\tilde{t}_R$
709	pt:	$p_T$	758	stone:	$\tilde{t}_1$
710	ET:	$E_T$	759	sttwo:	$\tilde{t}_2$
711	HT:	$H_T$	760	sBot:	$\tilde{b}$
712	et:	$E_T$	761	sbL:	$\tilde{b}_L$
713	Em:	$E$	762	sbR:	$\tilde{b}_R$
714	Pm:	$\not{p}$	763	sbone:	$\tilde{b}_1$
715	PTm:	$\not{p}_T$	764	sbtwo:	$\tilde{b}_2$
716	ETm:	$E_T^{\text{miss}}$	765	sLep:	$\tilde{l}$
717	MET:	$E_T^{\text{miss}}$	766	sLepC:	$\tilde{l}^C$
718	ETmiss:	$E_T^{\text{miss}}$	767	sEl:	$\tilde{e}$
719	VEtmiss:	$\vec{E}_T^{\text{miss}}$	768	sElC:	$\tilde{e}^C$
720	dd{y}{x}:	$\frac{dy}{dx}$	769	seL:	$\tilde{e}_L$
721	ga:	$\gtrsim$	770	seR:	$\tilde{e}_R$
722	la:	$\lesssim$	771	snL:	$\tilde{\nu}_L$
723	swsq:	$\sin^2 \theta_W$	772	sMu:	$\tilde{\mu}$
724	cwsq:	$\cos^2 \theta_W$	773	sNu:	$\tilde{\nu}$
725	tanb:	$\tan \beta$	774	sTau:	$\tilde{\tau}$
726	tanbsq:	$\tan^2 \beta$	775	Glu:	$g$
727	sidb:	$\sin 2\beta$	776	sGlu:	$\tilde{g}$
728	alpS:	$\alpha_s$	777	Wpm:	$W^\pm$
729	alpt:	$\tilde{\alpha}$	778	sWpm:	$\tilde{W}^\pm$
730	QL:	$Q_L$	779	Wz:	$W^0$
731	sQ:	$\tilde{Q}$	780	sWz:	$\tilde{W}^0$
732	sQL:	$\tilde{Q}_L$	781	sWino:	$\tilde{W}$
733	ULC:	$U_L^C$	782	Bz:	$B^0$
734	sUC:	$\tilde{U}^C$	783	sBz:	$\tilde{B}^0$
735	sULC:	$\tilde{U}_L^C$	784	sBino:	$\tilde{B}$
736	DLC:	$D_L^C$	785	Zz:	$Z^0$
737	sDC:	$\tilde{D}^C$	786	sZino:	$\tilde{Z}^0$
738	sDLC:	$\tilde{D}_L^C$	787	sGam:	$\tilde{\gamma}$
739	LL:	$L_L$	788	chiz:	$\tilde{\chi}^0$
740	sL:	$\tilde{L}$	789	chip:	$\tilde{\chi}^+$
741	sLL:	$\tilde{L}_L$	790	chim:	$\tilde{\chi}^-$
742	ELC:	$E_L^C$	791	chipm:	$\tilde{\chi}^\pm$
743	sEC:	$\tilde{E}^C$	792	Hone:	$H_d$
744	sELC:	$\tilde{E}_L^C$			
745	sEL:	$\tilde{E}_L$			
746	sER:	$\tilde{E}_R$			

793	sHone:	$\tilde{H}_d$	804	sGra:	$\tilde{G}$
794	Htwo:	$H_u$	805	mtil:	$\tilde{m}$
795	sHtwo:	$\tilde{H}_u$	806	rpv:	$\cancel{R}$
796	sHig:	$\tilde{H}$	807	LLE:	$LL\bar{E}$
797	sHa:	$\tilde{H}_a$	808	LQD:	$LQ\bar{D}$
798	sHb:	$\tilde{H}_b$	809	UDD:	$\overline{UDD}$
799	sHpm:	$\tilde{H}^\pm$	810	Lam:	$\lambda$
800	hz:	$h^0$	811	Lamp:	$\lambda'$
801	Hz:	$H^0$	812	Lampp:	$\lambda''$
802	Az:	$A^0$	813	MD:	$M_D$
803	Hpm:	$H^\pm$	814	Mpl:	$M_{Pl}$
			815	Rinv:	$R^{-1}$

DRAFT

## 7 Particle Symbols

817	PAz:	$A^0$	863	PNd:	$N(1650) S_{11}$
818	PBm:	$B^-$	864	PNe:	$N(1675) D_{15}$
819	PBpm:	$B^\pm$	865	PNf:	$N(1680) F_{15}$
820	PBp:	$B^+$	866	PNg:	$N(1700) D_{13}$
821	PBz:	$B^0$	867	PNh:	$N(1710) P_{11}$
822	PB:	$B$	868	PNi:	$N(1720) P_{13}$
823	PDiz:	$D_1(2420)^0$	869	PNj:	$N(2190) G_{17}$
824	PDm:	$D^-$	870	PNk:	$N(2220) H_{19}$
825	PDpm:	$D^\pm$	871	PNl:	$N(2250) G_{19}$
826	PDp:	$D^+$	872	PNm:	$N(2600) I_{1,11}$
827	PDstiiz:	$D_2^*(2460)^0$	873	PSHpm:	$H^\pm$
828	PDstpm:	$D^{*\pm}$	874	PSHz:	$H^0$
829	PDstz:	$D^*(2010)^0$	875	PSWpm:	$\tilde{W}^\pm$
830	PDz:	$D^0$	876	PSZz:	$\tilde{Z}^0$
831	PD:	$D$	877	PSe:	$\tilde{e}$
832	PEz:	$E^0$	878	PSgg:	$\tilde{\gamma}$
833	PHpm:	$H^\pm$	879	PSgm:	$\tilde{\mu}$
834	PHz:	$H^0$	880	PSgn:	$\tilde{\nu}$
835	PJgy:	$J/\psi(1S)$	881	PSgt:	$\tilde{\tau}$
836	PKeiii:	$K_{e3}$	882	PSgxpm:	$\tilde{\chi}^\pm$
837	PKgmiii:	$K_{\mu 3}$	883	PSgxz:	$\tilde{\chi}^0$
838	PKia:	$K_1(1400)$	884	PSg:	$\tilde{g}$
839	PKii:	$K_2(1770)$	885	PSq:	$\tilde{q}$
840	PKi:	$K_1(1270)$	886	PWR:	$W_R$
841	PKm:	$K^-$	887	PWm:	$W^-$
842	PKpm:	$K^\pm$	888	PWpr:	$W'$
843	PKp:	$K^+$	889	PWp:	$W^+$
844	PKsta:	$K^*(1370)$	890	PW:	$W$
845	PKstb:	$K^*(1680)$	891	PZLR:	$Z_{LR}$
846	PKstiii:	$K_3^*(1780)$	892	PZgc:	$Z_\chi$
847	PKstii:	$K_2^*(1430)$	893	PZge:	$Z_\eta$
848	PKstiv:	$K_4^*(2045)$	894	PZgy:	$Z_\psi$
849	PKstz:	$K_0^*(1430)$	895	PZi:	$Z_1$
850	PKst:	$K^*$	896	PZz:	$Z^0$
851	PKzL:	$K_L^0$	897	PaBz:	$\bar{B}^0$
852	PKzS:	$K_S^0$	898	PaB:	$\bar{B}$
853	PKzeiii:	$K_{e3}^0$	899	PaDz:	$\bar{D}^0$
854	PKzgmiii:	$K_{\mu 3}^0$	900	PaD:	$\bar{D}$
855	PKz:	$K^0$	901	PaKz:	$\bar{K}^0$
856	PK:	$K$	902	PaSq:	$\bar{q}$
857	PLpm:	$L^\pm$	903	PagL:	$\bar{\Lambda}$
858	PLz:	$L^0$	904	PagOp:	$\bar{\Omega}^+$
859	PN:	$N$	905	PagSm:	$\bar{\Sigma}^-$
860	PNa:	$N(1440) P_{11}$	906	PagSp:	$\bar{\Sigma}^+$
861	PNb:	$N(1520) D_{13}$	907	PagSz:	$\bar{\Sigma}^0$
862	PNc:	$N(1535) S_{11}$	908	PagXp:	$\bar{\Xi}^+$
			909	PagXz:	$\bar{\Xi}^0$



910	Pagne:	$\bar{\nu}_e$	960	PgDe:	$\Delta(1905) F_{35}$
911	Pagngm:	$\bar{\nu}_\mu$	961	PgDf:	$\Delta(1910) P_{31}$
912	Pagngt:	$\bar{\nu}_\tau$	962	PgDh:	$\Delta(1920) P_{33}$
913	Paii:	$a_2(1320)$	963	PgDi:	$\Delta(1930) D_{35}$
914	Pai:	$a_1(1260)$	964	PgDj:	$\Delta(1950) F_{37}$
915	Pap:	$\bar{P}$	965	PgDk:	$\Delta(2420) H_{3,11}$
916	Paqb:	$\bar{q}_b$	966	PgL:	$\Lambda$
917	Paqc:	$\bar{q}_c$	967	PgLa:	$\Lambda(1405) S_{01}$
918	Paqd:	$\bar{q}_d$	968	PgLb:	$\Lambda(1520) D_{03}$
919	Paqs:	$\bar{q}_s$	969	PgLc:	$\Lambda(1600) P_{01}$
920	Paqt:	$\bar{q}_t$	970	PgLd:	$\Lambda(1670) S_{01}$
921	Paqu:	$\bar{q}_u$	971	PgLe:	$\Lambda(1690) D_{03}$
922	Paq:	$\bar{q}$	972	PgLf:	$\Lambda(1800) S_{01}$
923	Paz:	$a_0(980)$	973	PgLg:	$\Lambda(1810) P_{01}$
924	Pbgcia:	$\chi_{b1}(2P)$	974	PgLh:	$\Lambda(1820) F_{05}$
925	Pbgciia:	$\chi_{b2}(2P)$	975	PgLi:	$\Lambda(1830) D_{05}$
926	Pbgcii:	$\chi_{b2}(1P)$	976	PgLj:	$\Lambda(1890) P_{03}$
927	Pbgci:	$\chi_{b1}(1P)$	977	PgLk:	$\Lambda(2100) G_{07}$
928	Pbgcza:	$\chi_{b0}(2P)$	978	PgLL:	$\Lambda(2110) F_{05}$
929	Pbgcz:	$\chi_{b0}(1P)$	979	PgLm:	$\Lambda(2350) H_{09}$
930	Pbi:	$b_1(1235)$	980	PgO:	$\Omega$
931	PcgLp:	$\Lambda_c^+$	981	PgOm:	$\Omega^-$
932	PcgS:	$\Sigma_c(2455)$	982	PgOma:	$\Omega(2250)^-$
933	PcgXp:	$\Xi_c^+$	983	PgS:	$\Sigma$
934	PcgXz:	$\Xi_c^0$	984	PgSa:	$\Sigma(1385) P_{13}$
935	Pcgcii:	$\chi_{c2}(1P)$	985	PgSb:	$\Sigma(1660) P_{11}$
936	Pcgci:	$\chi_{c1}(1P)$	986	PgSc:	$\Sigma(1670) D_{13}$
937	Pcgcz:	$\chi_{c0}(1S)$	987	PgSd:	$\Sigma(1750) S_{11}$
938	Pcgh:	$\eta_c(1S)$	988	PgSe:	$\Sigma(1775) D_{15}$
939	Pem:	$e^-$	989	PgSf:	$\Sigma(1915) F_{15}$
940	Pep:	$e^+$	990	PgSg:	$\Sigma(1940) D_{13}$
941	Pe:	$e$	991	PgSh:	$\Sigma(2030) F_{17}$
942	Pfia:	$f_1(1390)$	992	PgSi:	$\Sigma(2050)$
943	Pfib:	$f_1(1510)$	993	PgSm:	$\Sigma^-$
944	Pfiaa:	$f_2(1720)$	994	PgSp:	$\Sigma^+$
945	Pfiib:	$f_2(2010)$	995	PgSz:	$\Sigma^0$
946	Pfiic:	$f_2(2300)$	996	PgU:	$Y$
947	Pfiid:	$f_2(2340)$	997	PgUa:	$Y(1S)$
948	Pfiipr:	$f_2'(1525)$	998	PgUb:	$Y(2S)$
949	Pfii:	$f_2(1270)$	999	PgUc:	$Y(3S)$
950	Pfiv:	$f_4(2050)$	1000	PgUd:	$Y(4S)$
951	Pfi:	$f_1(1285)$	1001	PgUe:	$Y(10860)$
952	Pfza:	$f_0(1400)$	1002	PgUf:	$Y(11020)$
953	Pfzb:	$f_0(1590)$	1003	PgX:	$\Xi$
954	Pfz:	$f_0(975)$	1004	PgXa:	$\Xi(1530) P_{13}$
955	PgD:	$\Delta$	1005	PgXb:	$\Xi(1690)$
956	PgDa:	$\Delta(1232) P_{33}$	1006	PgXc:	$\Xi(1820) D_{13}$
957	PgDb:	$\Delta(1620) S_{31}$	1007	PgXd:	$\Xi(1950)$
958	PgDc:	$\Delta(1700) D_{33}$	1008	PgXe:	$\Xi(2030)$
959	PgDd:	$\Delta(1900) S_{31}$	1009	PgXm:	$\Xi^-$

1010	PgXz:	$\Xi^0$	1035	Pgp:	$\pi$
1011	Pgfa:	$\phi(1680)$	1036	Pgra:	$\rho(1450)$
1012	Pgfiii:	$\phi_3(1850)$	1037	Pgrb:	$\rho(1700)$
1013	Pgf:	$\phi(1020)$	1038	Pgriii:	$\rho_3(1690)$
1014	Pgg:	$\gamma$	1039	Pgr:	$\rho(770)$
1015	Pgha:	$\eta(1295)$	1040	Pgt:	$\tau$
1016	Pghb:	$\eta(1440)$	1041	Pgya:	$\psi(3770)$
1017	Pghpr:	$\eta'(958)$	1042	Pgyb:	$\psi(4040)$
1018	Pgh:	$\eta$	1043	Pgyc:	$\psi(4160)$
1019	Pgmm:	$\mu^-$	1044	Pgyd:	$\psi(4415)$
1020	Pgmp:	$\mu^+$	1045	Pgy:	$\psi(2S)$
1021	Pgm:	$\mu$	1046	Phia:	$h_1(1170)$
1022	Pgne:	$\nu_e$	1047	Pn:	$n$
1023	Pngm:	$\nu_\mu$	1048	Pp:	$p$
1024	Pngt:	$\nu_\tau$	1049	Pqb:	$q_b$
1025	Pgoa:	$\omega(1390)$	1050	Pqc:	$q_c$
1026	Pgob:	$\omega(1600)$	1051	Pqd:	$q_d$
1027	Pgoiii:	$\omega_3(1670)$	1052	Pqs:	$q_s$
1028	Pgo:	$\omega(783)$	1053	Pqt:	$q_t$
1029	Pgpa:	$\pi(1300)$	1054	Pqu:	$q_u$
1030	Pgprii:	$\pi_2(1670)$	1055	Pq:	$q$
1031	Pgpm:	$\pi^-$	1056	PsDipm:	$D_{s1}(2536)^\pm$
1032	Pgppm:	$\pi^\pm$	1057	PsDm:	$D_s^-$
1033	Pgpp:	$\pi^+$	1058	PsDp:	$D_s^+$
1034	Pgpz:	$\pi^0$	1059	PsDst:	$D_s^*$