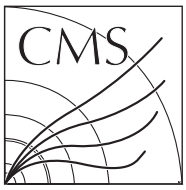

The Compact Muon Solenoid Experiment

CMS Draft Note

Mailing address: CMS CERN, CH-1211 GENEVA 23, Switzerland

2022/01/17
Archive Hash: 2547646-D
Archive Date: 2022/01/12

TDR: the Technical Document Repository System
for the storage, concurrent access, and building of CMS reports, notes, and other LaTeX-based documents

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Abstract

This note describes the TDR documentation system for 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' 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

Contents

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 version controlled repository, https://gitlab.cern.ch/tdr. 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 to only keep files under development in their private areas.

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, Detector 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 `git` (recent versions only), `perl`, and a standard installation of LaTeX. These are already part of the standard CERN Linux environments through the cvmfs file system. 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 group of GitLab repositories. As long as you are a member of the CMS e-group, you can use a web browser to see the repository: https://gitlab.cern.ch/tdr. On any machine with the CMS environment (e.g., lxplus.cern.ch) you can check out any of these repos if you are a member of the cms-members e-group. Only individuals included as Developers for individual projects are able to submit changes to a specific repository.

2.1 Creating a new note or analysis summary

To start you will need to request a note directory in the GitLab repository from the TDR manager (currently George Alverson). 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 GitLab 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."

Check out your note directory from git 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 directory with only your note and not include the other notes. If you have a note, use "note" as the type and "notes" in the path to the project [tag].git. For a paper, use "paper" and "papers." [Notes: (1) when running with Kerberos authentication, use https://:@gitlab.cern.ch:8443/tdr/[papers|notes]/[tag].git; (2) for ssh, ssh://git@gitlab.cern.ch:7999/tdr/[papers|notes]/[tag].git; (3) for http (not recommended), https://gitlab.cern.ch/tdr/[papers|notes]/[tag].git. Instructions for setting up ssh key authentication are located at https://gitlab.cern.ch/help/ssh/README.md. If your primary account is not a CMS account (group zh), be prepared to use ssh for access.]

```
# an optional mydir directory name can be supplied for the following.
# We recommend just using the default.
# for KRB authentication...
> git clone --recursive https://:@gitlab.cern.ch:8443/tdr/papers/XXX-YY-NNN.git
> cd [tag]
> eval `utils/tdr runtime` # add -csh for csh (or -fish for fish)
# (edit the template, then to build the document)
> tdr  --style=[paper|pas|an|note] b XXX-YY-NNN
# to commit changes back...
git add -a                          # add all files modified
git commit -m "add my new changes"  # to stage your changes
git push                            # to send them back to the repo
```

To update your local copy from the repo, you will need to

```
# gets from the repo and merges automatically
#    with the local copy:
git pull
```

We also recommned working on branches and then merging them back into the master branch. The process might look like:

```
git pull
git checkout -b [branch name]
# make your edits and test
git push origin [branch name]
# check again using continuous integration (CI) tests
# submit merge request. After merge:
git checkout master
git pull # back where we started
```

2.1.1 Working at FNAL: The LPC

The LPC environment has a script, `/uscmst1/prod/sw/cms/[cshrc|shrc]`, which sets up a number of aliased commands for working on CERN resources while at FNAL.

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 `tdr/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. The CDS display will use MathJax to display this. The abstract is taken from the `abstract` LaTeX version. MathJax will not see any TeX macros, however, so those should used with care.

2.1.4 Naming convention for CMS Notes, and Internal Notes

A new directory is created in the `tdr/notes` directory, named according to the convention: `contactAuthor_serialNo`. `contactAuthor` is the CMS username (see the CERN "phonebook" 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 `tdr/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 LoI, EoI, etc.)

For major reports, a new directory is created in the reports directory, e.g., `tdr/reports/p1utp` for the Phase 1 Upgrade Technical Proposal. This directory will contains the following subdirectories:

- `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 git

Please make sure to configure your git client:

```
git config --global user.name "Your preferred name"
git config --global user.email "Your-Email-Address"
# failure to set the next option can lead to the message
# 'Basic: Access denied'
# if you use KRB access (http)
git config --global http.emptyAuth true
```

There are other useful settings as well. For example, to stop `git` from asking to commit backup files and object files, you can globally exclude files using a `/git/ignore` file:

```
*.o
*.bak
*~
```

Note specific excludes can be set in a `.gitignore` file in the top directory. [See `https://git-scm.com/docs/gitignore`.]

Filenames should not contain any of the following characters:

```
/\?%*:|"<>
```

plus space. The dot (.) when used as anything but a filetype extension can also can cause problems. The usual reserved filenames for the varying OSs should also be avoided, e.g., CON, AUX, COMn, LPTn, PRN, NUL, with any extension and any combination of upper/lower case. File paths should not exceed 250 characters.

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.

3.2 Editing the document

Simply edit any of the 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 GitLab repository

Before committing any changes always check your changes are valid 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. LaTeXis 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

```
> git add [modified_files]
> git commit -m''Comment explaining changes made''
> git push
```

The -m option should supply a short descriptive message.

It is not sufficient to just do a `git commit`. New files must be first added, then committed, and finally pushed to get them on the central server.

3.3.1 Checking everything is OK with git

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

```
git diff origin/master
```

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

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

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

This will function on Unix or Windows systems which have recent copies of LaTeX (including $\mathcal{AMS}$-LaTeX) and `perl` installed.

Please see also section 4.8 on formatting for journals.

4 Building a formatted manuscript

The 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 LaTeX file

To create a PDF file from a LaTeX file `myPaper.tex`, simply type:

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

Assuming the 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 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,
- `dn` for Detector 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 LaTeX files should (not) contain

The `tdr` script makes a copy of your simple LaTeX file and automatically inserts all the required LaTeX boilerplate commands to produce a fully consistent LaTeX 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 PdfLaTeX 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 LaTeX 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 LaTeX 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`. APS does not accept sub-directories nor included TEXfiles, 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` 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 dimensional gravity...`"

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 $\star$ 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 LaTeX file, 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. When the supplemental material is submitted to a journal, we are required to provide a very short description of the content (not just 'supplemental material') so that the material can be properly labelled on the journal web site.

So for GEN-12-001.tex,

```
...
\bibliography{auto_generated}
\ifthenelse{\boolean{cms@external}}{}{
\clearpage
\numberwithin{table}{section}
\numberwithin{figure}{section}
\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---\\[Your short description]}
{: Supplemental Material, [your short description]}}
\author[cern]{The CMS Collaboration}
\date{\today}
\abstract{}
\hypersetup{%
...}
\maketitle
\null\cleardoublepage
\input{supplemental_material}
```

To generate all three types of files, arXiv (same as CMS format), PRL, and PRL supplement, the commands would be (for PRL, as an example)

```
tdr --style paper --aps - b GEN-12-001
tdr --style paper  b GEN-12-001
tdr --style paper --aps - --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,
  [short description]~\cite{suppMatBib}}}
{\providecommand{\suppMaterial}{Appendix~\ref{app:suppMat}\nocite{\suppMatBib}}}
```

The APS citation should look like

```
  @misc{suppMatBib,
    title = "Supplemental material: [description here]",
    note = "[URL will be inserted by publisher at publication]"
  }
```

where the description of the material should be subsituted in the note above.

Non-APS journals will just use `\ref` and a URL rather than a citation.

The URL will need to be added to our copy once it is available, i.e., after publication but before the final posting to the arXiv.

Please note that referencing individual plots/tables in the supplemental material will require some care as the labels will not be available in standalone mode. It is recommended that you look at existing papers with supplements for examples.

5 Advice on using LaTeX

5.1 LaTeX 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 `tdr/utils/general/ptdr-definitions.sty` 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 `tdr/reports/ptdr1/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.sty` simply (re-)define it (using `\newcomand` or `\renewcommand`) in the local `definitions.tex`. But please consult with the appropriate TDR editor first.

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.

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

$$\mathrm{\Phi} = \text{a mistake} \tag{2}$$

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

It is also advisable to use the `\textrm{Some text}` form rather than `{\rm Some text}`. The same is true for the other short-form holdovers from plain TeX, `\tt` and `\it`, particularly if you would like to submit your paper to a journal with minimal re-editing. For inclusion of text within an equation, `\text` should be used.

5.3 Editorial macros

In addition to the extensive measurement and physics symbols, some editorial macros are defined in `tdr/utils/general/definitions.tex` as well. For example, the following 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}[!htb]
   \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.

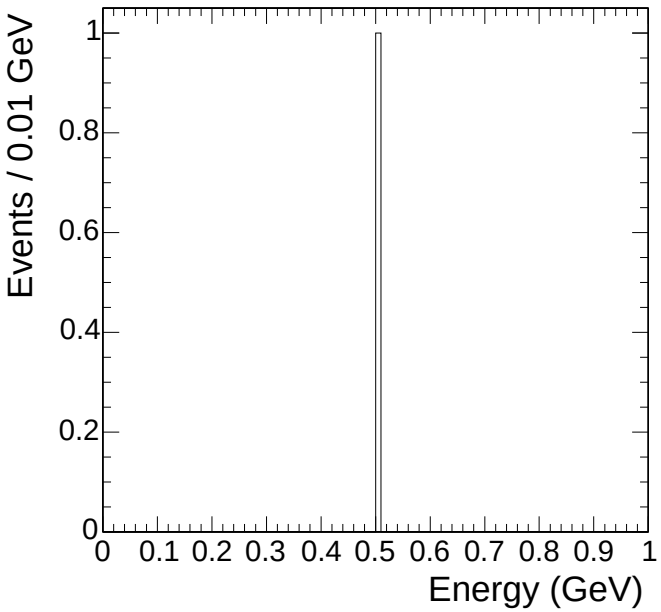

Figure 1: Test of graphics inclusion.

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

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. If paper output is not required or the authors are satisfied with dual-purpose figures, the rest of this section can be ignored.

Colour versions of figures can by 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}[!htb]
   \centering
   \combinedfigure{width=0.4\textwidth}{c1_BlackAndWhite}{c1_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 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`. 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.

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., `tdr/reports/ptdr1/fig/` or `tdr/reports/ctdr/fig/`. 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: `tdr/utils/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.}
    \label{tab:mytab}
    \begin{tabular}{lcc} \hline
```

```
      Parameter & Value 1 & Value 2 \\ \hline
      $s$ & 10.0 & 20.0 \\
      $t$ & 20.0 & 30.0 \\
      $u$ & 30.0 & 40.0 \\ \hline
    \end{tabular}
  \end{center}
\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

5.6 Chapters, sections and other sectioning commands

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

The PDF bookmarks produced from PdfLaTeX will choke on TeXsymbols, e.g., "2.6 This is a "026E30Fsection" for "2.6 This is a \section" since TeX uses 026E30F to represent the backslash. Use the `\texorpdfstring` macro:

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

And this is what it should look like:

5.7 This is a `\subsection`

This is some text.

5.7.1 This is a `\subsubsection`

This is some text.

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

5.8 Cross-references and bibliographic citations

5.8.1 Referring to Sections, Figures, Tables, etc.

LaTeX provides powerful, robust, and scalable facilities for cross-referencing based on symbolic labels. Please use them!

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

```
\chapter{Mass Storage Systems\label{ch:mss}}
\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 BibTeX labels when such an article can be found there, because a unique label is created and LaTeX 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",
     SLACcitation  = "%%CITATION = NUIMA,A506,250;%%",
```

```
      DOI         = "10.1016/S0168-9002(03)01368-8"
}
```

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

In addition, we recommend setting the "DOI" field that was added to the Article BibTeX format in the TDR framework (and is illustrated above). This field represents the Digital Object Identifier for your reference.[1] When you prepend this number with `http://dx.doi.org/`, your browser is automatically directed to the electronic version of the article (provided your institution has paid for this access). Currently you need to manually determine and enter this field after examining the publication.

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

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

This will result in output something like:

> Either: the CMS detector is described elsewhere [34]; or: the CMS detector is described in reference 34.

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

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

5.8.3 Web References

Please use the `\href` and `\url` commands to embed links into your document (these are not allowed in journal submissions).

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

5.9 Glossary

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

[1] `http://www.doi.org/`

6 PTDR Symbol Definitions

etal:	et al.
ie:	i.e.
eg:	e.g.
etc:	etc.
vs:	*vs.*
mdash:	—
NA:	—
Lone:	Level-1
Ltwo:	Level-2
Lthree:	Level-3
ACERMC:	ACERMC
ALPGEN:	ALPGEN
BLACKHAT:	BLACKHAT
CALCHEP:	CALCHEP
CHARYBDIS:	CHARYBDIS
CMKIN:	CMKIN
CMSIM:	CMSIM
CMSSW:	CMSSW
COBRA:	COBRA
COCOA:	COCOA
COMPHEP:	COMPHEP
EVTGEN:	EVTGEN
FAMOS:	FAMOS
FASTJET:	FASTJET
FEWZ:	FEWZ
GARCON:	GARCON
GARFIELD:	GARFIELD
GEANE:	GEANE
GEANTfour:	GEANT4
GEANTthree:	GEANT3
GEANT:	GEANT
HDECAY:	HDECAY
HERWIG:	HERWIG
HERWIGpp:	HERWIG++
POWHEG:	POWHEG
HIGLU:	HIGLU
HIJING:	HIJING
HYDJET:	HYDJET
IGUANA:	IGUANA
ISAJET:	ISAJET
ISAPYTHIA:	ISAPYTHIA
ISASUGRA:	ISASUGRA
ISASUSY:	ISASUSY
ISAWIG:	ISAWIG
MADGRAPH:	MADGRAPH
MCATNLO:	MC@NLO
MCFM:	MCFM
MILLEPEDE:	MILLEPEDE
ORCA:	ORCA
OSCAR:	OSCAR
PHOTOS:	PHOTOS
PROSPINO:	PROSPINO
PYTHIA:	PYTHIA
SHERPA:	SHERPA
TAUOLA:	TAUOLA
TOPREX:	TOPREX
XDAQ:	XDAQ
MGvATNLO:	MADGRAPH5_aMC@NLO
DZERO:	D0
de:	$^\circ$
ten{x}:	$\times 10^{\mathrm{x}}$
unit{x}:	x
mum:	μm[Most units include leading thinspace]
micron:	μm
cm:	cm
mm:	mm
mus:	μs
keV:	keV
MeV:	MeV
MeVns:	MeV [*no* leading thinspace with *ns* suffix]
GeV:	GeV
GeVns:	GeV
gev:	GeV
TeV:	TeV
TeVns:	TeV
PeV:	PeV
keVc:	keV/c
MeVc:	MeV/c
GeVc:	GeV/c
GeVcns:	GeV/c
TeVc:	TeV/c
keVcc:	keV/c^2
MeVcc:	MeV/c^2
GeVcc:	GeV/c^2
GeVccns:	GeV/c^2
TeVcc:	TeV/c^2
pbinv:	pb^{-1}
fbinv:	fb^{-1}
nbinv:	nb^{-1}
mubinv:	μb^{-1}
mbinv:	mb^{-1}
percms:	cm^{-2} s^{-1}
lumi:	$\mathcal{L}$
Lumi:	$\mathcal{L}$
LvLow:	$\mathcal{L} = 10^{32}$ cm^{-2} s^{-1}
LLow:	$\mathcal{L} = 10^{33}$ cm^{-2} s^{-1}
lowlumi:	$\mathcal{L} = 2 \times 10^{33}$ cm^{-2} s^{-1}
LMed:	$\mathcal{L} = 2 \times 10^{33}$ cm^{-2} s^{-1}
LHigh:	$\mathcal{L} = 10^{34}$ cm^{-2} s^{-1}
hilumi:	$\mathcal{L} = 10^{34}$ cm^{-2} s^{-1}

PT:	p_{T}
pt:	p_{T}
ET:	E_{T}
HT:	H_{T}
mT:	m_{T}
mTii:	m_{T2}
et:	E_{T}
Em:	$\not{E}$
Pm:	$\not{p}$
PTm:	$\not{p}_{\mathrm{T}}$
PTslash:	$\not{p}_{\mathrm{T}}$
ETm:	$E_{\mathrm{T}}^{\mathrm{miss}}$
MET:	$E_{\mathrm{T}}^{\mathrm{miss}}$
ETmiss:	$E_{\mathrm{T}}^{\mathrm{miss}}$
ptmiss:	$p_{\mathrm{T}}^{\mathrm{miss}}$
ETslash:	$\not{E}_{\mathrm{T}}$
VEtmiss:	$\vec{E}_{\mathrm{T}}^{\mathrm{miss}}$
ptvec:	$\vec{p}_{\mathrm{T}}$
ptvecmiss:	$\vec{p}_{\mathrm{T}}^{\mathrm{miss}}$
tauh:	τ_{h}
sqrtsNN:	$\sqrt{s_{\mathrm{NN}}}$
mht:	$H_{\mathrm{T}}^{\mathrm{miss}}$
htvecmiss:	$\vec{H}_{\mathrm{T}}^{\mathrm{miss}}$
dd{y}{x}:	$\frac{\mathrm{d}y}{\mathrm{d}x}$
ddinline{y}{x}:	$\mathrm{d}y/\mathrm{d}x$
rd:	d
re:	e
abs{x}:	$\lvert x \rvert$
CL:	CL
CLs:	$\mathrm{CL_s}$
CLsb:	$\mathrm{CL_{s+b}}$
zp:	Z'
JPsi:	J/ψ
Z:	Z
ttbar:	$\mathrm{t\bar{t}}$

Other		
AFB:	A_{FB}	
wangle:	$\sin^2\theta_{\mathrm{eff}}^{\mathrm{lept}}(M_{\mathrm{Z}}^2)$	
stat:	(stat)	[Includes leading thinspace]
syst:	(syst)	[Includes leading thinspace]
thy:	(theo)	[Includes leading thinspace]
lum:	(lumi)	[Includes leading thinspace]
kt:	k_{T}	
BC:	$\mathrm{B_c}$	
bbarc:	$\mathrm{\overline{b}c}$	
bbbar:	$\mathrm{b\overline{b}}$	
ccbar:	$\mathrm{c\overline{c}}$	
qqbar:	$\mathrm{q\overline{q}}$	
MD:	M_{D}	
Mpl:	M_{Pl}	
Rinv:	R^{-1}	

Older definitions (may be deprecated)	
bspsiphi:	$\mathrm{B_s} \to \mathrm{J}/\psi\,\phi$
EE:	$\mathrm{e^+e^-}$
MM:	$\mu^+\mu^-$
TT:	$\tau^-\tau^+$
HGG:	$\mathrm{H} \to \gamma\gamma$
GAMJET:	$\gamma + \mathrm{jet}$
PPTOJETS:	$\mathrm{pp} \to \mathrm{jets}$
PPTOGG:	$\mathrm{pp} \to \gamma\gamma$
PPTOGAMJET:	$\mathrm{pp} \to \gamma + \mathrm{jet}$
MH:	M_{H}
RNINE:	R_9
DR:	ΔR
ga:	$\gtrsim$
la:	$\lesssim$
swsq:	$\sin^2\theta_{\mathrm{W}}$
cwsq:	$\cos^2\theta_{\mathrm{W}}$
tanb:	$\tan\beta$
tanbsq:	$\tan^2\beta$
sidb:	$\sin 2\beta$
alpS:	α_{S}
alpt:	$\tilde{\alpha}$
QL:	$\mathrm{Q_L}$
sQ:	$\widetilde{\mathrm{Q}}$
sQL:	$\widetilde{\mathrm{Q}}_{\mathrm{L}}$
ULC:	$\mathrm{U_L^C}$
sUC:	$\widetilde{\mathrm{U}}^{\mathrm{C}}$
sULC:	$\widetilde{\mathrm{U}}_{\mathrm{L}}^{\mathrm{C}}$
DLC:	$\mathrm{D_L^C}$
sDC:	$\widetilde{\mathrm{D}}^{\mathrm{C}}$
sDLC:	$\widetilde{\mathrm{D}}_{\mathrm{L}}^{\mathrm{C}}$
LL:	$\mathrm{L_L}$
sL:	$\widetilde{\mathrm{L}}$
sLL:	$\widetilde{\mathrm{L}}_{\mathrm{L}}$
ELC:	$\mathrm{E_L^C}$
sEC:	$\widetilde{\mathrm{E}}^{\mathrm{C}}$
sELC:	$\widetilde{\mathrm{E}}_{\mathrm{L}}^{\mathrm{C}}$
sEL:	$\widetilde{\mathrm{E}}_{\mathrm{L}}$
sER:	$\widetilde{\mathrm{E}}_{\mathrm{R}}$
sFer:	$\widetilde{\mathrm{f}}$
sQua:	$\widetilde{\mathrm{q}}$
sUp:	$\widetilde{\mathrm{u}}$
suL:	$\widetilde{\mathrm{u}}_{\mathrm{L}}$
suR:	$\widetilde{\mathrm{u}}_{\mathrm{R}}$

sDw:	$\widetilde{d}$
sdL:	$\widetilde{d}_L$
sdR:	$\widetilde{d}_R$
sTop:	$\widetilde{t}$
stL:	$\widetilde{t}_L$
stR:	$\widetilde{t}_R$
stone:	$\widetilde{t}_1$
sttwo:	$\widetilde{t}_2$
sBot:	$\widetilde{b}$
sbL:	$\widetilde{b}_L$
sbR:	$\widetilde{b}_R$
sbone:	$\widetilde{b}_1$
sbtwo:	$\widetilde{b}_2$
sLep:	$\widetilde{l}$
sLepC:	$\widetilde{l}^C$
sEl:	$\widetilde{e}$
sElC:	$\widetilde{e}^C$
seL:	$\widetilde{e}_L$
seR:	$\widetilde{e}_R$
snL:	$\widetilde{\nu}_L$
sMu:	$\widetilde{\mu}$
sNu:	$\widetilde{\nu}$
sTau:	$\widetilde{\tau}$
Glu:	g
sGlu:	$\widetilde{g}$
Wpm:	$W^{\pm}$
sWpm:	$\widetilde{W}^{\pm}$
Wz:	W^0
sWz:	$\widetilde{W}^0$
sWino:	$\widetilde{W}$
Bz:	B^0
sBz:	$\widetilde{B}^0$
sBino:	$\widetilde{B}$
Zz:	Z^0
sZino:	$\widetilde{Z}^0$
sGam:	$\widetilde{\gamma}$
chiz:	$\widetilde{\chi}^0$
chip:	$\widetilde{\chi}^+$
chim:	$\widetilde{\chi}^-$
chipm:	$\widetilde{\chi}^{\pm}$
Hone:	H_d
sHone:	$\widetilde{H}_d$
Htwo:	H_u
sHtwo:	$\widetilde{H}_u$
sHig:	$\widetilde{H}$
sHa:	$\widetilde{H}_a$
sHb:	$\widetilde{H}_b$
sHpm:	$\widetilde{H}^{\pm}$
hz:	h^0
Hz:	H^0
Az:	A^0
Hpm:	$H^{\pm}$
sGra:	$\widetilde{G}$
mtil:	$\widetilde{m}$
rpv:	$\not{R}$
LLE:	$LL\bar{E}$
LQD:	$LQ\bar{D}$
UDD:	$\overline{UDD}$
Lam:	λ
Lamp:	λ'
Lampp:	λ''

7 Particle symbols: PENNAMES2

——Standard model bosons and Higgs——

Pg:	g
PGg:	γ
PW:	W
PWpm:	$W^{\pm}$
PWmp:	$W^{\mp}$
PWp:	W^{+}
PWm:	W^{-}
PZ:	Z
PZz:	Z^{0}
PH:	H
PHz:	H^{0}
PWDt:	W_2

—W and Z Bosons outside Standard Model—

PWpDt:	W_2^{+}
PWpr:	W'
PWL:	W_L
PWR:	W_R
PZpr:	Z'
PZprpr:	Z''
PZst:	Z^{*}
PZzDt:	Z_2^{0}
PZzDT:	Z_3^{0}
PZL:	Z_L
PZLR:	Z_{LR}
PZR:	Z_R
PZGc:	Z_χ
PZGe:	Z_η
PZGy:	Z_ψ

——————LEPTONS——————

Pl:	l
PlR:	l_R
Plpm:	$l^{\pm}$
Plp:	l^{+}
Plm:	l^{-}
PlmR:	l_R^{-}
PAl:	$\overline{l}$
PGnl:	ν_l
PAGnl:	$\overline{\nu}_l$
Pe:	e
Pepm:	$e^{\pm}$
Pemp:	$e^{\mp}$
Pem:	e^{-}
Pep:	e^{+}
PGb:	β
PGbm:	β^{-}
PGbp:	β^{+}
PGm:	μ
PGmpm:	$\mu^{\pm}$
PGmm:	μ^{-}
PGmp:	μ^{+}
PGt:	τ
PGtpm:	$\tau^{\pm}$
PGtm:	τ^{-}
PGtp:	τ^{+}
PGtpr:	τ'
PGtprm:	τ'^{-}
PGtprp:	τ'^{+}
PGn:	ν
PGne:	ν_e
PGnGm:	ν_μ
PGnGt:	ν_τ
PGnGtpr:	$\nu_{\tau'}$
PAGn:	$\overline{\nu}$
PAGne:	$\overline{\nu}_e$
PAGnGm:	$\overline{\nu}_\mu$
PAGnGt:	$\overline{\nu}_\tau$
PAGnGtpr:	$\overline{\nu}_{\tau'}$
PL:	L
PLm:	L^{-}
PLp:	L^{+}
PLz:	L^{0}
PLpm:	$L^{\pm}$
PAL:	$\overline{L}$

——————QUARKS——————

PQq:	q
PQd:	d
PQu:	u
PQs:	s
PQc:	c
PQb:	b
PQt:	t

PQbpr:	b'
PQtpr:	t'
PAQq:	$\overline{q}$
PAQd:	$\overline{d}$
PAQu:	$\overline{u}$
PAQs:	$\overline{s}$
PAQc:	$\overline{c}$
PAQb:	$\overline{b}$
PAQt:	$\overline{t}$
PAQbpr:	$\overline{b}'$
PAQtpr:	$\overline{t}'$
PQqb:	q_b
PQqbpr:	$q_{b'}$
PQqc:	q_c
PQqd:	q_d
PQqdR:	q_{dR}
PQqs:	q_s
PQqt:	q_t
PQqtpr:	$q_{t'}$
PQqu:	q_u
PQquR:	q_{uR}
PAQqb:	$\overline{q}_b$
PAQqbpr:	$\overline{q}_{b'}$
PAQqc:	$\overline{q}_c$
PAQqd:	$\overline{q}_d$
PAQqs:	$\overline{q}_s$
PAQqt:	$\overline{q}_t$
PAQqtpr:	$\overline{q}_{t'}$
PAQqu:	$\overline{q}_u$

BARYONS

Pp:	p
Pn:	n
PAp:	$\overline{p}$
PAn:	$\overline{n}$
PGa:	α
PN:	N
PNp:	N^+
PNz:	N^0
PNP{x}:	$N(x)$
PNpP{x}:	$N(x)^+$
PNzP{x}:	$N(x)^-$
PGD:	Δ
PGDpp:	Δ^{++}
PGDp:	Δ^+
PGDz:	Δ^0
PGDm:	Δ^-
PGDP{x}:	$\Delta(x)$
PGDppP{x}:	$\Delta(x)^{++}$
PGDpP{x}:	$\Delta(x)^+$
PGDzP{x}:	$\Delta(x)^0$
PGDmP{x}:	$\Delta(x)^-$
PGQpP{x}:	$\Theta(x)^+$
PGFP{x}:	$\Phi(x)$
PGL:	Λ
PAGL:	$\overline{\Lambda}$
PGLP{x}:	$\Lambda(x)$
PGLc:	Λ_c
PGLpc:	Λ_c^+
PGLpcP{x}:	$\Lambda_c(x)^+$
PGLb:	Λ_b
PGLzb:	Λ_b^0
PGS:	Σ
PAGS:	$\overline{\Sigma}$
PGSpm:	$\Sigma^\pm$
PGSm:	Σ^-
PGSp:	Σ^+
PGSz:	Σ^0
PGSstm:	Σ^{*-}
PGSstp:	Σ^{*+}
PGSstz:	Σ^{*0}
PGSP{x}:	$\Sigma(x)$
PGSmP{x}:	$\Sigma(x)^-$
PGSpP{x}:	$\Sigma(x)^+$
PGSzP{x}:	$\Sigma(x)^0$
PGSc:	Σ_c
PGSppc:	Σ_c^{++}
PGSpc:	Σ_c^+
PGSzc:	Σ_c^0
PGScP{x}:	$\Sigma_c(x)$
PGSppcP{x}:	$\Sigma_c(x)^{++}$
PGSpcP{x}:	$\Sigma_c(x)^+$
PGSzcP{x}:	$\Sigma_c(x)^0$
PGSstc:	Σ_c^*
PGSstppc:	Σ_c^{*++}

PGSstpc: Σ_c^{*+}
PGSstzc: Σ_c^{*0}
PGSstcP{x}: $\Sigma_c^*(x)$
PGSstppcP{x}: $\Sigma_c^*(x)^{++}$
PGSstpcP{x}: $\Sigma_c^*(x)^+$
PGSstzcP{x}: $\Sigma_c^*(x)^0$
PGSb: Σ_b
PGSmb: Σ_b^-
PGSpb: Σ_b^+
PGSzb: Σ_b^0
PGSstb: Σ_b^*
PGSstmb: Σ_b^{*-}
PGSstpb: Σ_b^{*+}
PGSstzb: Σ_b^{*0}
PGX: Ξ
PAGX: $\overline{\Xi}$
PGXm: Ξ^-
PGXz: Ξ^0
PGXstm: Ξ^{*-}
PGXstz: Ξ^{*0}
PGXP{x}: $\Xi(x)$
PGXmP{x}: $\Xi(x)^-$
PGXzP{x}: $\Xi(x)^0$
PGXstmP{x}: $\Xi^*(x)^-$
PGXstzP{x}: $\Xi^*(x)^0$
PGXc: Ξ_c
PGXpc: Ξ_c^+
PGXzc: Ξ_c^0
PGXcP{x}: $\Xi_c(x)$
PGXprc: Ξ_c'
PGXprpc: $\Xi_c'^+$
PGXprzc: $\Xi_c'^0$
PGXstc: Ξ_c^*
PGXstpc: Ξ_c^{*+}
PGXstzc: Ξ_c^{*0}
PGXcc: Ξ_{cc}
PGXpcc: Ξ_{cc}^+
PGXppcc: Ξ_{cc}^{++}
PGXstcc: Ξ_{cc}^{*+}
PGXstpcc: Ξ_{cc}^{*+}
PGXstppcc: Ξ_{cc}^{*++}
PGXb: Ξ_b
PGXmb: Ξ_b^-
PGXzb: Ξ_b^0
PGXprb: Ξ_b'
PGXprmb: $\Xi_b'^-$
PGXprzb: $\Xi_b'^0$
PGXstb: Ξ_b^*
PGXstmb: Ξ_b^{*-}
PGXstzb: Ξ_b^{*0}
PGXbc: Ξ_{bc}
PGXpbc: Ξ_{bc}^+
PGXzbc: Ξ_{bc}^0
PGXprbc: Ξ_{bc}'
PGXprpbc: $\Xi_{bc}'^+$
PGXprzbc: $\Xi_{bc}'^0$
PGXstbc: Ξ_{bc}^*
PGXstpbc: Ξ_{bc}^{*+}
PGXstzbc: Ξ_{bc}^{*0}
PGXbb: Ξ_{bb}
PGXmbb: Ξ_{bb}^-
PGXzbb: Ξ_{bb}^0
PGXstbb: Ξ_{bb}^*
PGXstmbb: Ξ_{bb}^{*-}
PGXstzbb: Ξ_{bb}^{*0}
PGO: Ω
PAGO: $\overline{\Omega}$
PGOm: Ω^-
PGOP{x}: $\Omega(x)$
PGOmP{x}: $\Omega(x)^-$
PGOc: Ω_c
PGOzc: Ω_c^0
PGOstc: Ω_c^*
PGOstzc: Ω_c^{*0}
PGOcc: Ω_{cc}
PGOpcc: Ω_{cc}^+
PGOstcc: Ω_{cc}^*
PGOstpcc: Ω_{cc}^{*+}
PGOccc: Ω_{ccc}
PGOppccc: Ω_{ccc}^{++}
PGOb: Ω_b
PGOmb: Ω_b^-

PGOstb: Ω_b^*
PGOstmb: Ω_b^{*-}
PGObc: Ω_{bc}
PGOzbc: Ω_{bc}^0
PGOprbc: Ω_{bc}'
PGOprzbc: $\Omega_{bc}'^0$
PGOstbc: Ω_{bc}^*
PGOstzbc: Ω_{bc}^{*0}
PGObcc: Ω_{bcc}
PGOpbcc: Ω_{bcc}^+
PGOstbcc: Ω_{bcc}^*
PGOstpbcc: Ω_{bcc}^{*+}
PGObb: Ω_{bb}
PGOmbb: Ω_{bb}^-
PGOstbb: Ω_{bb}^*
PGOstmbb: Ω_{bb}^{*-}
PGObbc: Ω_{bbc}
PGOzbbc: Ω_{bbc}^0
PGOstbbc: Ω_{bbc}^*
PGOstzbbc: Ω_{bbc}^{*0}
PGObbb: Ω_{bbb}
PGOmbbb: Ω_{bbb}^-

PENTAQUARKS

PGT: Θ
PGTp: Θ^+
PGF: Φ
PGFmm: Φ^{--}

MESONS

PGp: π
PGppm: $\pi^\pm$
PGpmp: $\pi^\mp$
PGpm: π^-
PGpp: π^+
PGpz: π^0
PGpP{x}: $\pi(x)$
PGppP{x}: $\pi^+(x)$
PGpzP{x}: $\pi^0(x)$
PGpDoP{x}: $\pi_1(x)$
PGppDoP{x}: $\pi_1^+(x)$
PGpzDoP{x}: $\pi_1^0(x)$
PGpDtP{x}: $\pi_2(x)$
PGppDtP{x}: $\pi_2^+(x)$
PGpzDtP{x}: $\pi_2^0(x)$
PGh: η
PGhpr: η'
PGhP{x}: $\eta(x)$
PGhprP{x}: $\eta'(x)$
PGhDtP{x}: $\eta_2(x)$
Pf: f
PfDzP{x}: $f_0(x)$
PfDoP{x}: $f_1(x)$
PfDtP{x}: $f_2(x)$
PfprDtP{x}: $f_2'(x)$
PfDfP{x}: $f_4(x)$
PfDsP{x}: $f_6(x)$
PfJP{x}: $f_J(x)$
PGr: ρ
PGrP{x}: $\rho(x)$
PGrpP{x}: $\rho^+(x)$
PGrzP{x}: $\rho^0(x)$
PGrDTP{x}: $\rho_3(x)$
PGrpDTP{x}: $\rho_3^+(x)$
PGrzDTP{x}: $\rho_3^0(x)$
PGrDFP{x}: $\rho_5(x)$
PGrpDFP{x}: $\rho_5^+(x)$
PGrzDFP{x}: $\rho_5^0(x)$
PGo: ω
PGoP{x}: $\omega(x)$
PGoDTP{x}: $\omega_3(x)$
Pa: a
PaDzP{x}: $a_0(x)$
PapDzP{x}: $a_0^+(x)$
PazDzP{x}: $a_0^0(x)$
PaDoP{x}: $a_1(x)$
PapDoP{x}: $a_1^+(x)$
PazDoP{x}: $a_1^0(x)$
PaDtP{x}: $a_2(x)$
PapDtP{x}: $a_2^+(x)$
PazDtP{x}: $a_2^0(x)$
PaDfP{x}: $a_4(x)$
PapDfP{x}: $a_4^+(x)$
PazDfP{x}: $a_4^0(x)$
PaDsP{x}: $a_6(x)$

PapDsP{x}: $a_6^+(x)$
PazDsP{x}: $a_6^0(x)$
PGf: ϕ
PGfP{x}: $\phi(x)$
PGfDTP{x}: $\phi_3(x)$
Ph: h
PhDoP{x}: $h_1(x)$
Pb: b
PbDoP{x}: $b_1(x)$
PbpDoP{x}: $b_1^+(x)$
PbzDoP{x}: $b_1^0(x)$

——————Strange (S=±1,C=B=0) ——————

PK: K
PKpm: $K^\pm$
PKmp: $K^\mp$
PKm: K^-
PKp: K^+
PKL: K_L
PKS: K_S
PKz: K^0
PKzL: K_L^0
PKzS: K_S^0
PKst: K^*
PAK: $\overline{K}$
PAKst: $\overline{K}^*$
PAKz: $\overline{K}^0$
PKP{x}: $K(x)$
PKDzP{x}: $K_0(x)$
PKDoP{x}: $K_1(x)$
PKDtP{x}: $K_2(x)$
PKDTP{x}: $K_3(x)$
PKDfP{x}: $K_4(x)$
PKstP{x}: $K^*(x)$
PKstDzP{x}: $K_0^*(x)$
PKstDoP{x}: $K_1^*(x)$
PKstDtP{x}: $K_2^*(x)$
PKstDTP{x}: $K_3^*(x)$
PKstDfP{x}: $K_4^*(x)$
PKstDFP{x}: $K_5^*(x)$
PKeiii: K_{e3}
PKgmiii: $K_{\mu 3}$
PKzeiii: K_{e3}^0
PKzgmiii: $K_{\mu 3}^0$

——————Charmed (C=±1) ——————

PD: D
PDpm: $D^\pm$
PDmp: $D^\mp$
PDz: D^0
PDm: D^-
PDp: D^+
PDst: D^*
PDstm: D^{*-}
PDstp: D^{*+}
PDstpm: $D^{*\pm}$
PAD: $\overline{D}$
PADz: $\overline{D}^0$
PDstzP{x}: $D^*(x)^0$
PDstpmP{x}: $D^*(x)^\pm$
PDstmP{x}: $D^*(x)^-$
PDstpP{x}: $D^*(x)^+$
PDzDoP{x}: $D_1(x)^0$
PDpmDoP{x}: $D_1(x)^\pm$
PDmDoP{x}: $D_1(x)^-$
PDpDoP{x}: $D_1(x)^+$
PDstzDtP{x}: $D_2^*(x)^0$
PDstpmDtP{x}: $D_2^*(x)^\pm$
PDstmDtP{x}: $D_2^*(x)^-$
PDstpDtP{x}: $D_2^*(x)^+$

———Charmed, generic quarks (B=±1) ———

PDq: D_q
PDzq: D_q^0
PADq: $\overline{D}_q$
PADzq: $\overline{D}_q^0$

————Charmed, strange (C=S=±1) ————

PDs: D_s
PDms: D_s^-
PDps: D_s^+
PDpms: $D_s^\pm$
PDstms: D_s^{*-}
PDstps: D_s^{*+}
PDstpms: $D_s^{*\pm}$
PDstpmsJP{x}: $D_{sJ}^*(x)^\pm$
PDstmsJP{x}: $D_{sJ}^*(x)^-$

PDstpsJP{x}: $D_{sJ}^{*}(x)^{+}$
PDpmsJP{x}: $D_{sJ}(x)^{\pm}$
PDmsJP{x}: $D_{sJ}(x)^{-}$
PDpsJP{x}: $D_{sJ}(x)^{+}$
PDpmsDoP{x}: $D_{s1}(x)^{\pm}$
PDmsDoP{x}: $D_{s1}(x)^{-}$
PDpsDoP{x}: $D_{s1}(x)^{+}$
PDpmsDtP{x}: $D_{s2}(x)^{\pm}$
PDmsDtP{x}: $D_{s2}(x)^{-}$
PDpsDtP{x}: $D_{s2}(x)^{+}$

——————Bottom (B=±1)——————

PB: B
PBpm: $B^{\pm}$
PBp: B^{+}
PBm: B^{-}
PBz: B^{0}
PBst: B^{*}
PBstp: B^{*+}
PBstz: B^{*0}
PBstDz: B_{0}^{*}
PBstpDz: B_{0}^{*+}
PBstzDz: B_{0}^{*0}
PBstDo: B_{1}^{*}
PBstpDo: B_{1}^{*+}
PBstzDo: B_{1}^{*0}
PBstDt: B_{2}^{*}
PBstpDt: B_{2}^{*+}
PBstzDt: B_{2}^{*0}
PAB: $\overline{B}$
PABz: $\overline{B}^{0}$
PBstJP{x}: $B_{J}^{*}(x)$
PBstpJP{x}: $B_{J}^{*}(x)^{+}$
PBstzJP{x}: $B_{J}^{*}(x)^{0}$
PBDoP{x}: $B_{1}(x)$
PBpDoP{x}: $B_{1}(x)^{+}$
PBzDoP{x}: $B_{1}(x)^{0}$

———Bottom, strange (B=±1,S=-+1) ———

PBs: B_{s}
PBzs: B_{s}^{0}
PABs: $\overline{B}_{s}$
PABzs: $\overline{B}_{s}^{0}$
PBsts: B_{s}^{*}
PBstzs: B_{s}^{*0}
PBstsDz: B_{s0}^{*}
PBstzsDz: B_{s0}^{*0}
PBstsDo: B_{s1}^{*}
PBstzsDo: B_{s1}^{*0}
PBstsDt: B_{s2}^{*}
PBstzsDt: B_{s2}^{*0}
PBstsJP{x}: $B_{sJ}^{*}(x)$
PBstzsJP{x}: $B_{sJ}^{*}(x)^{0}$
PBsDoP{x}: $B_{s1}(x)$
PBzsDoP{x}: $B_{s1}(x)^{0}$

———Bottom, generic quarks (B=±1) ———

PBq: B_{q}
PBzq: B_{q}^{0}
PABq: $\overline{B}_{q}$
PABzq: $\overline{B}_{q}^{0}$

————Bottom, down (B=±1,S=0) ————

PBd: B_{d}
PBzd: B_{d}^{0}
PABd: $\overline{B}_{d}$
PABzd: $\overline{B}_{d}^{0}$

————Bottom, up (B=±1,S=0) ————

PBu: B_{u}
PBzu: B_{u}^{0}
PABu: $\overline{B}_{u}$
PABzu: $\overline{B}_{u}^{0}$

————Bottom, charmed (B=C=±1) ————

PBc: B_{c}
PBmc: B_{c}^{-}
PBpc: B_{c}^{+}
PBpmc: $B_{c}^{\pm}$
PBstc: B_{c}^{*}
PBstpc: B_{c}^{*+}
PBstcDz: B_{c0}^{*}
PBstpcDz: B_{c0}^{*+}
PBstcDo: B_{c1}^{*}
PBstpcDo: B_{c1}^{*+}
PBstcDt: B_{c2}^{*}
PBstpcDt: B_{c2}^{*+}
PBcDoP{x}: $B_{c1}(x)$
PBpcDoP{x}: $B_{c1}(x)^{+}$

charm/anticharm

PGhc:	η_c
PGhcP{x}:	$\eta_c(x)$
PJGy:	J/ψ
PJGyP{x}:	$J/\psi(x)$
PGy:	ψ
PGyP{x}:	$\psi(x)$
PGc:	χ
PGcc:	χ_c
PGccDzP{x}:	$\chi_{c0}(x)$
PGccDoP{x}:	$\chi_{c1}(x)$
PGccDtP{x}:	$\chi_{c2}(x)$
Phc:	h_c
PhcP{x}:	$h_c(x)$
PX:	X
PXP{x}:	$X(x)$

bottom/antibottom

PGhb:	η_b
PGhbP{x}:	$\eta_b(x)$
PGU:	Υ
PGUP{x}:	$\Upsilon(x)$
PGUpr:	Υ'
PGUprpr:	Υ''
PGUprprpr:	Υ'''
PGUprprprpr:	Υ''''
PGcb:	χ_b
PGcbDzP{x}:	$\chi_{b0}(x)$
PGcbDoP{x}:	$\chi_{b1}(x)$
PGcbDtP{x}:	$\chi_{b2}(x)$

SUSY particles

PSH:	H
PSHpm:	$H^{\pm}$
PSHp:	H^{+}
PSHm:	H^{-}
PSHpmpm:	$H^{\pm\pm}$
PSHpp:	H^{++}
PSHmm:	H^{--}
PSh:	h
PShz:	h^0
PSA:	A
PSAz:	A^0
PSHzDo:	H_1^0
PSHzDt:	H_2^0
PSHzDT:	H_3^0
PSGg:	$\widetilde{\gamma}$
PSg:	$\widetilde{g}$
PSW:	$\widetilde{W}$
PSWm:	$\widetilde{W}^{-}$
PSWp:	$\widetilde{W}^{+}$
PSWpm:	$\widetilde{W}^{\pm}$
PSZ:	$\widetilde{Z}$
PSZz:	$\widetilde{Z}^0$
PSGc:	$\widetilde{\chi}$
PSGcz:	$\widetilde{\chi}^0$
PSGczDo:	$\widetilde{\chi}_1^0$
PSGczDt:	$\widetilde{\chi}_2^0$
PSGczDT:	$\widetilde{\chi}_3^0$
PSGczDf:	$\widetilde{\chi}_4^0$
PSGcm:	$\widetilde{\chi}^{-}$
PSGcp:	$\widetilde{\chi}^{+}$
PSGcpm:	$\widetilde{\chi}^{\pm}$
PSGcmDo:	$\widetilde{\chi}_1^{-}$
PSGcpDo:	$\widetilde{\chi}_1^{+}$
PSGcpmDo:	$\widetilde{\chi}_1^{\pm}$
PSGcmDt:	$\widetilde{\chi}_2^{-}$
PSGcpDt:	$\widetilde{\chi}_2^{+}$
PSGcpmDt:	$\widetilde{\chi}_2^{\pm}$
PSl:	$\widetilde{l}$
PASl:	$\bar{\widetilde{l}}$
PSlL:	$\widetilde{l}_L$
PSlR:	$\widetilde{l}_R$
PSe:	$\widetilde{e}$
PSemL:	$\widetilde{e}_L^{-}$
PSemR:	$\widetilde{e}_R^{-}$
PSeL:	$\widetilde{e}_L$
PSeR:	$\widetilde{e}_R$
PSGm:	$\widetilde{\mu}$
PSGmmL:	$\widetilde{\mu}_L^{-}$
PSGmmR:	$\widetilde{\mu}_R^{-}$
PSGmL:	$\widetilde{\mu}_L$
PSGmR:	$\widetilde{\mu}_R$
PSGt:	$\widetilde{\tau}$
PSGtmDo:	$\widetilde{\tau}_1^{-}$

PSGtmDt: $\widetilde{\tau}_2^-$
PSGtL: $\widetilde{\tau}_L$
PSGtR: $\widetilde{\tau}_R$
PSGtDo: $\widetilde{\tau}_1$
PSGtDt: $\widetilde{\tau}_2$
PSGn: $\widetilde{\nu}$
PASGn: $\overline{\widetilde{\nu}}$
PSGne: $\widetilde{\nu}_e$
PSGneL: $\widetilde{\nu}_{eL}$
PSGneR: $\widetilde{\nu}_{eR}$
PSGnGm: $\widetilde{\nu}_\mu$
PSGnGmL: $\widetilde{\nu}_{\mu L}$
PSGnGmR: $\widetilde{\nu}_{\mu R}$
PSGnGt: $\widetilde{\nu}_\tau$
PSGnGtDo: $\widetilde{\nu}_{\tau 1}$
PSGnGtDt: $\widetilde{\nu}_{\tau 2}$
PSQ: $\widetilde{q}$
PSQL: $\widetilde{q}_L$
PSQR: $\widetilde{q}_R$
PSQd: $\widetilde{d}$
PSQdL: $\widetilde{d}_L$
PSQdR: $\widetilde{d}_R$
PSQu: $\widetilde{u}$
PSQuL: $\widetilde{u}_L$
PSQuR: $\widetilde{u}_R$
PSQs: $\widetilde{s}$
PSQsL: $\widetilde{s}_L$
PSQsR: $\widetilde{s}_R$
PSQc: $\widetilde{c}$
PSQcL: $\widetilde{c}_L$
PSQcR: $\widetilde{c}_R$
PSQb: $\widetilde{b}$
PSQbL: $\widetilde{b}_L$
PSQbR: $\widetilde{b}_R$
PSQbDo: $\widetilde{b}_1$
PSQbDt: $\widetilde{b}_2$
PSQt: $\widetilde{t}$
PSQtL: $\widetilde{t}_L$
PSQtR: $\widetilde{t}_R$
PSQtDo: $\widetilde{t}_1$
PSQtDt: $\widetilde{t}_2$
PASQ: $\overline{\widetilde{q}}$
PASQL: $\overline{\widetilde{q}}_L$
PASQR: $\overline{\widetilde{q}}_R$
PASQd: $\overline{\widetilde{d}}$
PASQdL: $\overline{\widetilde{d}}_L$
PASQdR: $\overline{\widetilde{d}}_R$
PASQu: $\overline{\widetilde{u}}$
PASQuL: $\overline{\widetilde{u}}_L$
PASQuR: $\overline{\widetilde{u}}_R$
PASQs: $\overline{\widetilde{s}}$
PASQsL: $\overline{\widetilde{s}}_L$
PASQsR: $\overline{\widetilde{s}}_R$
PASQc: $\overline{\widetilde{c}}$
PASQcL: $\overline{\widetilde{c}}_L$
PASQcR: $\overline{\widetilde{c}}_R$
PASQb: $\overline{\widetilde{b}}$
PASQbL: $\overline{\widetilde{b}}_L$
PASQbR: $\overline{\widetilde{b}}_R$
PASQbDo: $\overline{\widetilde{b}}_1$
PASQbDt: $\overline{\widetilde{b}}_2$
PASQt: $\overline{\widetilde{t}}$
PASQtL: $\overline{\widetilde{t}}_L$
PASQtR: $\overline{\widetilde{t}}_R$
PASQtDo: $\overline{\widetilde{t}}_1$
PASQtDt: $\overline{\widetilde{t}}_2$

Random things

PEz: E^0
PgA: g_A^0
PXXA: A
PXXAz: A^0
PXXG: G
PXXSG: $\widetilde{G}$