Streak Camera Systems and Tune Resonance Tools at HZB

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I. INTRODUCTION

The Helmholtz-Zentrum Berlin is a facility that operates two synchrotron light sources: BESSY II and the MLS. One of the long term goals of this center is to continually make bunch lengths as short as possible in storage rings. A way to go about this is through lattice design by changing the momentum compaction factor. An important part of lattice design involves picking a good working point to avoid the tune resonances of the machine. A tune resonance program was therefore developed which can be used to view the current working point and resonance lines given only a few input parameters from the EPICS control systems.

Another way of looking into bunch lengths at HZB is through diagnostic tools. A new streak camera was recently purchased for the MLS, and is currently being setup and tested. The Metrology Light Source (MLS) is an electron storage ring designed as a dedicated UV and VUV source; it has an asymmetric double-bend achromate design as well as six beamlines, two of which are located on a second floor, above the synchrotron. Both the new and the old streak cameras are setup with a UV beamline on the second floor, directly above the machine. Being on the second floor and having the cameras setup far away from the beamline required advanced optical paths in order to get a focused beam into the slit of the cameras.

II. TUNE RESONANCE PROGRAM

A. Developement

The program was written in Python. This provided the opportunity to integrate with EPICS (Experimental Physics and Industrial Control System) through a special python package called PyEpics and build a GUI system using wxPython to make the program simple to use. Much of the program also relies heavily on numpy and matplotlib packages available for Python.

The biggest feature of the program is a 'live mode' option that is able to give the current tune position numerically and graphically. Using the proper epics channels, the program is able to grab the four values it needs to calculate the non integer tune: the RF cavity frequency, the harmonic number, and the horizontal and vertical betatron oscillation frequencies. The program can check and update the tune several times a second, but in order to have the visual display updated, a threading process was used to avoid having the GUI freeze up while in live mode. The threading process is able to do all the processing and updating of the matplotlib graph, continously updating the point on the graph.

B. Customizability

C. Future Improvements

III. REVTEX CLASS OPTIONS SPECIFIC TO AIP

A. Journal Substyle

To access particular features of the AIP substyle, you will specify an additional document class option: the journal substyle, e.g.,

```
\documentclass[aip,jcp]{revtex4-1}
```

in this case, *J. Chem. Phys.*, the default. A complete list of AIP journals with the corresponding journal substyle appears in Table **??**.

B. Options for Citations and Bibliography

The citation style for AIP journals is:

- numerical (default style),

- author-year, and

- numerical author-year,

the latter two styles being only allowed for *Chaos* or *J. Math. Phys.*

The familiar numerical citations and numbered bibliography are the default for most journals: citations are superscript numbers, and the (numbered) bibliographic entries appear in the order cited.

Author-year citations are only allowed for *Chaos* or *J. Math. Phys.*, with citations given in author-and-year format. Bibliographic entries are sorted by alphabetical order of first author's surname, then by year.

Numerical author-year citations (only allowed for *Chaos* or *J. Math. Phys.*) are superscript numbers, just like numerical citations, but the bibliographic entries are sorted like the author-year entries and are numbered. This means that the first citation will not necessarily be 1.

To obtain the numerical style, simply accept the default, or supply a class option of `numerical`:

`\documentclass[aip,numerical]{revtex4-1}`

For author-year citations for *Chaos* or *J. Math. Phys.*, you may specify the `author-year` option:

`\documentclass[aip,author-year]{revtex4-1}`

Each of the above two options are part of standard REVTEX.

To obtain numerical author-year citations for *Chaos* or *J. Math. Phys.*, give the author-numerical option:

`\documentclass[aip,author-numerical]{revtex4-1}`

Note that the `author-numerical` option is not part of standard REVTEX so use of it outside of the AIP substyles may not have any effect.

C. Formatting Options

There are two commonly used formats for an article you may write. One will comply with the manuscript submission formatting requirements of the editorial office of the journal you are submitting to. The other will emulate the format of your article in the published journal itself.

For journal submission, accept the default, or you may specify the `preprint` option:

`\documentclass[aip,preprint]{revtex4-1}`

To emulate the formatting of the journal, specify the `reprint` option:

TABLE I. Other class options

Function	class option
Citation and References	
superscript numbered	numerical[a,b]
author-year	author-year[c]
numbered author-year	author-numerical[c]
Format	
journal submission	preprint[a]
journal emulation	reprint

[a] Default option.
[b] Standard
[c] Only allowed for *Chaos* or *J. Math. Phys.*

`\documentclass[aip,reprint]{revtex4-1}`

Note that emulation is not by any means complete: the fonts used will differ, and therefore the length of the article will not represent an accurate estimate. Other details may also differ.

A summary of class options of interest to AIP authors appears in Table I.

IV. USEFUL LATEX 2ε MARKUP

LATEX 2ε markup is the preferred way to structure your file. In general, the use of low-level commands like TEX primitives or Plain TEX macros is less preferable. Please see the REVTEX User's Guide,[2] the LATEX manual,[3] and the LATEX 2ε book[4] for further details.

A. Title and Front Matter

The REVTEX User's Guide has complete information on using REVTEX's special markup for your article's title, author list, abstract, and other front matter elements. Note that class option `superscriptaddress` is the default for the AIP substyles, as required by all AIP journals.

B. Lead Paragraph

One AIP journal, *Chaos*, requires a paragraph of text to precede the first `\section` of the article; this is known as a lead paragraph and is formatted boldface. To give your article a lead paragraph, include a quotation environment ahead of the first `\section` command:

```
\documentclass[aip]{revtex4-1}
\begin{document}
 \begin{quotation}
  Here is my lead paragraph!
 \end{quotation}
 \section{Introduction}
```

...

The `quotation` environment functions normally after the first `\section` command in the document.

V. BODY

For general information on commands used in the body of the document, see the REVTeX User's Guide. Herein are some features specific to the AIP author.

A. Footnotes

If you are using numbered citations (numerical or numbered author-year), footnotes are by default incorporated into the reference section along with your bibliographic entries. This automated feature is only effective if you use BibTeX to prepare your bibliography.

Author-year style bibliography does not lend itself to such a treatment, so by default footnotes appear in text as is usual. However, be advised that, if your article is accepted for publication, footnotes may be incorporated into text during the production process.

VI. CITATIONS AND REFERENCES

The preparation of your bibliography "by hand" is possible; however, if you do so, you will be entirely responsible for compliance with submission requirements for your bibliographic entries, for incorporating any text footnotes into the references, and for checking bibliographic entries. (In this connection, you may find useful the file `reftest.tex`, distributed with REVTeX.)

There are numerous reasons to use BibTeX, not least because it automates the first and second of the above checks.

A. Using BibTeX

Refer to the REVTeX User's Guide, the LaTeX manual, and the BibTeX manual for full information about using BibTeX.

When using BibTeX keep in mind that changing your bibliography style or citation style (via the document class options described above) will require you to rerun BibTeX. The standard litany (using `aipsamp.tex` as an example) for this is:

```
> latex aipsamp
> bibtex aipsamp
> latex aipsamp
> latex aipsamp
```

Here, the first invocation of `latex` has the effect of rewriting the `aipsamp.aux` file, and the invocation of `bibtex` creates a new `aipsamp.bbl` file. The next two runs of `latex` are then required: the first to update the `aipsamp.aux` file reflecting the new values of your citations and the second to employ those citations correctly. Be sure to check the end of the `aipsamp.log` file for any message advising you to rerun `latex`.

B. Multiple References per Citation

In an article using numerical citations, it is not uncommon to encounter the need for a citation that refers to more than one article or other reference. To accommodate such a case, REVTeX 4.1 implements markup similar to that of the `mcite` package for LaTeX 2_ε.

Let's say that two citation keys `able` and `baker` need to be combined into a single reference. The syntax for the `\cite` command is:

```
word\cite{able,*baker} further text
```

When you run BibTeX the resulting bibliography will contain the two entries, but run together as a single numbered reference. In the `\cite` command argument, any cite key that starts with the * character signifies that its bibliographic entry is to be joined together with the one preceding it; the * may join together any number of entries into a single reference.

[1] For help regarding the installation of this software and its use, please send email to tex@aip.org.

[2] Available with the REVTeX distribution, see http://authors.aps.org/revtex4/.

[3] L. Lamport, *LaTeX a Document Preparation System* (Addison-Wesley, Reading, MA, 1996).

[4] M. Goosens, F. Mittelbach, and A. Samarin, *The LaTeX Companion* (Addison-Wesley, Reading, MA, 1994).

[5] D. E. Knuth, *The TeXbook* (Addison-Wesley, Reading, MA, 1986).

[6] H. Kopka and P. Daly, *A Guide to LaTeX 2_ε* (Addison-Wesley, Reading, MA, 1995).

[7] M. Goossens, S. Rahtz, and F. Mittelbach, *The LaTeX Graphics Companion* (Addison-Wesley, Reading, MA, 1997).

[8] S. Rahtz, M. Goossens *et al.*, *The LaTeX Web Companion* (Addison-Wesley, Reading, MA, 1999).