Getting Started with Elegant

elegant is an accelerator code that computes beta functions, matrices, orbits, floor coordinates, amplification factors, dynamic aperture, and more. It does 6-D tracking with matrices and/or canonical integrators, and supports a variety of time-dependent elements. It also does optimization (e.g., matching), including optimization of tracking results. It is the principle accelerator code used at APS.

You can go to Fermi-Lab website to download manual or install source:

http://www.aps.anl.gov/Accelerator_Systems_Division/Accelerator_Operations_Physics/software.shtml
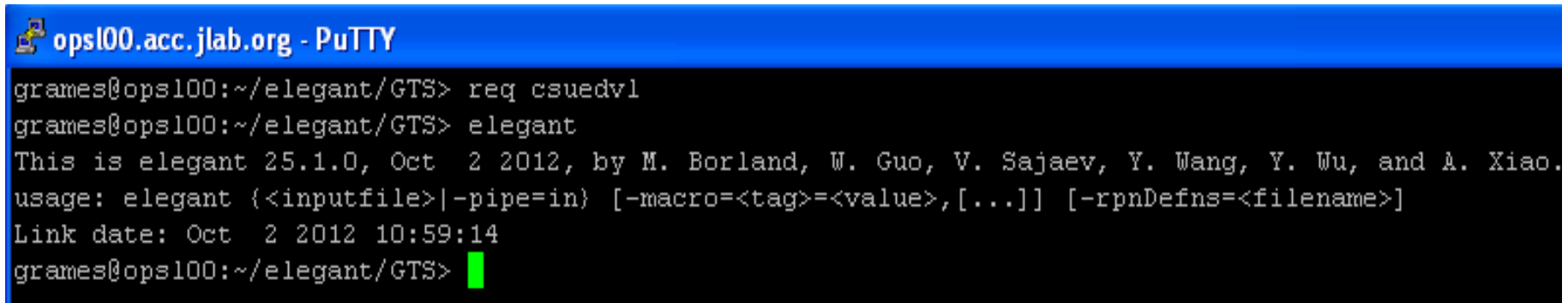
There is also a forum where you can get examples/info and ask questions:

https://www.aps.anl.gov/Accelerator_Systems_Division/Accelerator_Operations_Physics/phpBB3/

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To run the current version:

✓ You need an accelerator account

✓ Use console or PuTTY to *> ssh opsll.acc.jlab.org*

✓ To run the current version during shutdown use *> req csuedvl*


```
opsl00.acc.jlab.org - PuTTY
grames@opsl00:~/elegant/GTS> req csuedvl
grames@opsl00:~/elegant/GTS> elegant
This is elegant 25.1.0, Oct  2 2012, by M. Borland, W. Guo, V. Sajaev, Y. Wang, Y. Wu, and A. Xiao.
usage: elegant {<inputfile>|-pipe=in} [-macro=<tag>=<value>,[...]] [-rpnDefns=<filename>]
Link date: Oct  2 2012 10:59:14
grames@opsl00:~/elegant/GTS>
```

✓ Some type of X-forwarding (console, Exceed, NXClient) for editor or graphics

✓ A linux text editor, e.g., *> nedit* or *> emacs*

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Step 1 – A lattice file (file.lte) is a linear sequence of elements that specifies the Elements and their Sequence.

- Elements

  ➢ Specify an element's description (name, geometry, orientation) and what the element does (bend, focus, measure) => *Name: Type, Parameters*

  ➢ You can specify as many Elements as you like, even if not used.

  ➢ Elements can be externally defined transfer matrices or field maps.

- Sequence

  ➢Specify the order (beam line) of elements => *Name: **Line**=(Element1, …, Element-Last)*

  ➢Lines can reference other lines, e.g., *MyBigLine: Line=(SmallLine1, SmallLine2)*

- Example: */a/itsuser/grames/elegant/GTS/GUN2.lte*

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Step 2 – A command file (file.ele) provides Elegant with <u>Setup</u> and <u>Action</u> commands.

- <u>Setup Commands</u>, e.g.

    ➤ run_setup - Specifies global parameters and the input/output files

    ➤ optimization_setup – specifies parameters and methods

- <u>Action Commands</u>, e.g.

    ➤ twiss_output – compute and output Twiss parameters

    ➤ floor_coordinates – computer floor coordinates for your layout

    ➤ bunched_beam – track particle coordinates for beam distributions

- Example: */a/itsuser/grames/elegant/GTS/GUN2.ele*

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Step 3 – Invoke Elegant from the command line or IEE

- Command Line

  - *> elegant file.ele*

  - Generates SDDS database files
    - *> sddsquery file.type*
    - *> sddsprintout file.type –col=name –col=name*

- Interactive Elegant Explorer (IEE)

  - *> IEE*

  - GUI to open, execute and view results all at once

  - Drop down menus provide details and interactive modification

- Example: Let's try both!

A Little Take-Home Practice...

Elegant

☐ Download a copy of the Elegant manual.
☐ Create your own elegant working directory and copy example files.
☐ Try running elegant from the command line and using IEE.
☐ Use manual to look up definitions of key-words in GUN2.ele and GUN2.lte.
☐ Try the *sddsquery* and *sddsprintout* commands.

Modeling

1. Using GUN2.ele bunch conditions build a beam line using a 45 dipole magnet (L=10cm, normal faces) and FH-type solenoid to focus 100keV beam to 2mm size (assume center spacing is 0.5m everywhere).
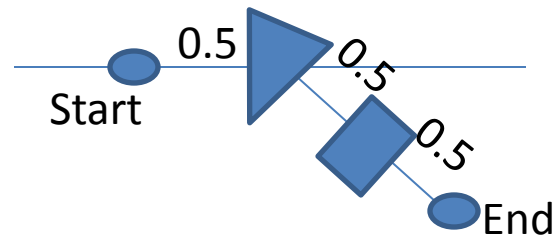
2. Reconcile the Elegant manual SOLENOID parameters (L, KS) and the Excel spreadsheet magnet parameters for the "FH" and "FB" magnets at 100keV?