Running PElegant on iDataPlex

Peter Williams 15th January 2013
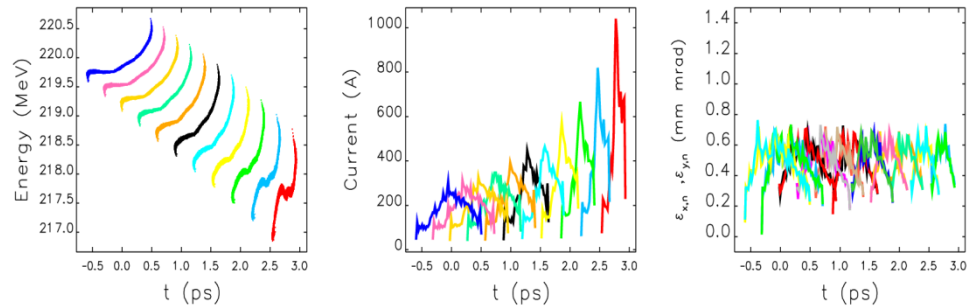
Scan of Linac 1 phase in CLARA
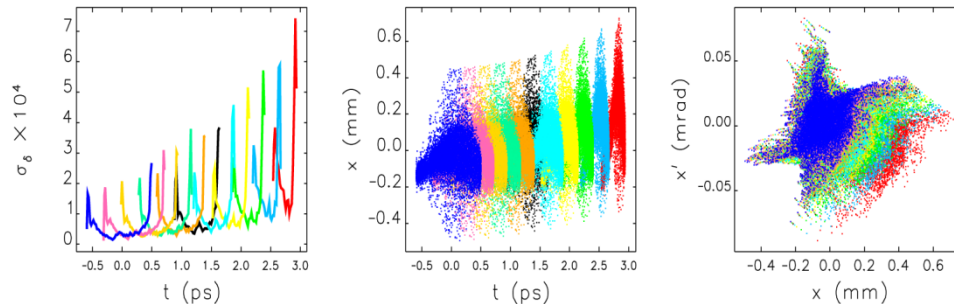
Parallel Elegant

- **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.

- **elegant** was developed by Michael Borland of the APS, Argonne and is a standard tool for the design, optimisation, simulation and verification of many accelerator facilities worldwide
  - **Storage Rings:** APS, NSLS, Petra-III, SLS, Diamond etc
  - **Linacs:** LCLS, XFEL, FERMI, SwissFEL, NLS
  - **Energy Recovery Linacs:** 4GLS, NLS recirculator, ALICE, Jlab FEL, LHeC

- Space charge is included (if you ask for it) as a 1-d approx only – suitable from ~10's MeV for electrons

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Parallel Elegant

- **elegant** has been parallelised – **Pelegant**

- Not every task in accelerator design is suitable for intensive computing – e.g. optics, layouts

- Tasks that are suitable include:

  – Multi-parameter optimisation (trivially parallel)
  – Scanning of parameters
  – Tracking of bunches with large macroparticle number to assess collective effects

- Today I have provided an example of the last type – tracking a 5M bunch through the NLS two pass recirculating linac
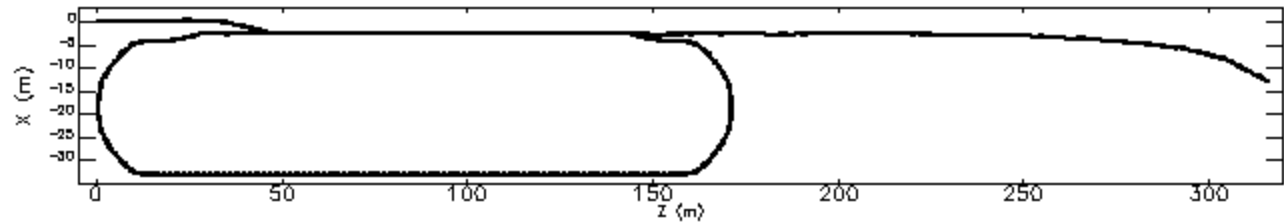
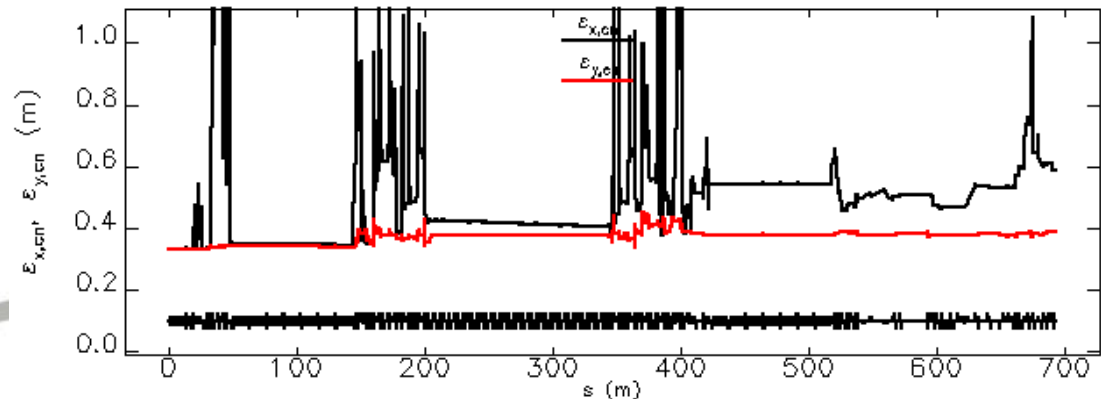**Science & Technology**
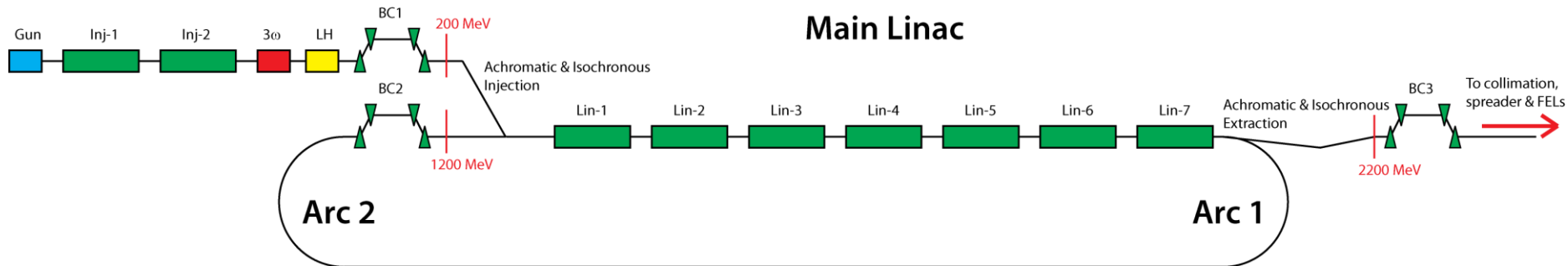Facilities Council

Parallel Elegant

- NLS lattice
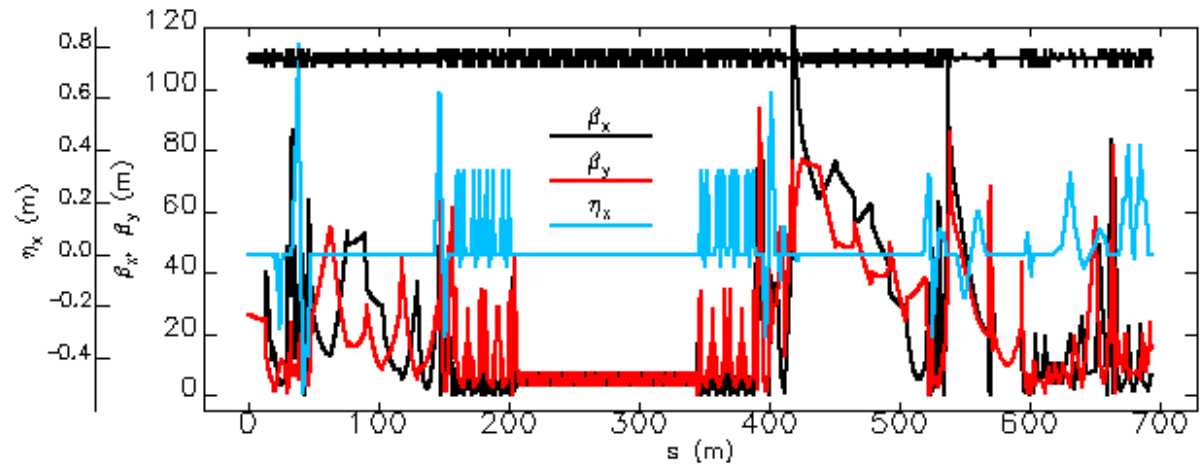
- NLS Layout

- Normalised emittances

New Light Source Recirculating Linac

Parallel Elegant

- On the iDataPlex we have installed **Pelegant** version 25.0.1 (latest) together with SDDSTools 2.11 (latest)

- The **elegant** users manual is at http://www.aps.anl.gov/Accelerator_Systems_Division/Accelerator_Operations_Physics/manuals/elegant_latest/elegant.html

- For those unfamiliar with elegant I recommend following a few of Michael's examples, linked from the download page http://www.aps.anl.gov/Accelerator_Systems_Division/Accelerator_Operations_Physics/software.shtml#elegant

- $ cp ~phw57-jpf03/elegantExamples.tar.gz ~/

- In Michael's scripts insert " –device=cpostscript –output=whatever.ps" after any sddsplot command (no visualisation on cluster and no elegant on desktops!)

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Serial Elegant

- To run my example on iDataPlex
- $ cp ~phw57-jpf03/NLS_TwoPass.tar.gz ~/
- $ tar –zxvf TwoPass.tar.gz
- $ export RPN_DEFNS=~/NLS_TwoPass/defns.rpn
- Take a look at the lattice file (.lte) and elegant command file (.ele) – in particular the &sdds_beam sample_interval switch
- Also included a couple of PDFs about Pelegant
- To run in serial : $ time elegant nls_2pass_track.ele > nls_2pass_out
      (takes about 7 minutes)
- $ sh bunch_analysis_nox.sh
- Get the figures to your desktop (no visualisation on the cluster itself)
- $ scp –r idpxlogin3:~/NLS_Twopass/*.ps .
- On the workstation:

$ export PATH=$PATH:/gpfs/home/training/jpf03/rja87-jpf03/Applications/SDDS/bin

- See the generated postscripts or pngs
- Spot the "gotchas" ☺

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Parallel Elegant

- Edit the nls_2pass_track.ele file, comment out the sample_interval line in the &sdds_beam command – this will now run 5M macroparticles rather than 50,000

- Edit the Pelegant_iDataPlex.sh if you like

- $ bsub < Pelegant_iDataPlex.sh

- Use bjobs to check – during the run you will see output at various points in the machine being generated. (INJector (linac, thirrd harmonic, laser modulator, first compressor, injection achromat), LINac 1st pass, EXTraction1, ARc1, TRAnsport, ARc2, EXTractionReverse 1, Bunch Compressor 2, reInjectionCHicane, LINac2ndpass, EXTraction 2, BunchCompressor3 and SPReader). Each output distribution is ~300M

- I ran on 64 processors and it took 25 minutes

- $ sh bunch_analysis_nox_FEL.sh

- $ scp –r idpxlogin3:~your_login/NLS_TwoPass .

- See the generated postscripts or pngs

- See the coherent radiation induced microbunching increase as the number of particles ☺

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