

# Setting up ELEGANT lattice for S2E simulations

Dmitrii Samoilenco  
Hamburg, 17.12.2021



# Getting ready

- > ELEGANT is one of the appropriate tools for studying such effects as CSR and LSC;
- > Install ELEGANT on JUWELS (Jülich Wizard for European Leadership Science);
- > Get files with design optics from Johann. Stay close to design optics to have solid reference for optics;
- > To get familiar with the lattice → sirepo - web-based GUI for simulation codes.



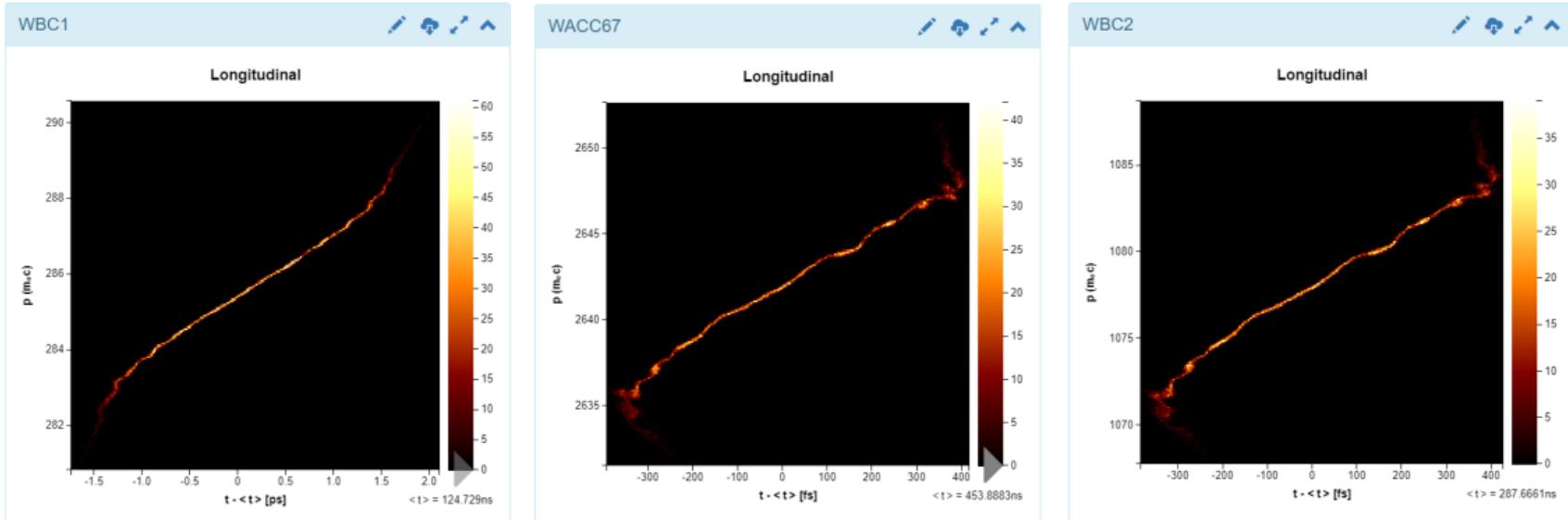
# Getting ready: sirepo

The screenshot shows the sirepo interface for setting up ELEGANT lattice simulations. It includes:

- Lattice - MAD2ELEGANTLATT:** A graphical representation of a particle beamline with various components like guns, lenses, and beamline elements. A scale bar indicates 10 m. A "Twiss Parameters" button is visible.
- Beamlines:** A table for managing beamlines, with columns for Name, Description, Elements, Start-End, Length, and Bend. A "New Beamline" button is present.
- Beamline Elements:** A detailed list of elements with variables and descriptions. It includes:
  - CHARGE:** Q, total=100e-12
  - CSRCSBEND:** D1FL0CBC1.D, D1FL0CBC1.U, D1FL0CBC2.D, D1FL0CBC2.U, D1FL0LAHE.D
- Beamline Editor - MAD2ELEGANTLATT:** A panel for defining beamlines by dragging and dropping elements. It lists components such as Q, L000000, STARTGUN, L000001, H1GUN, L000002, V1GUN, L000003, H2GUN, L000004, V2GUN, and L000005.

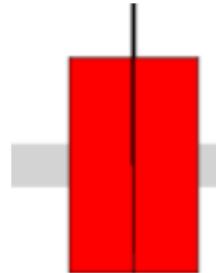


# Getting ready: sirepo



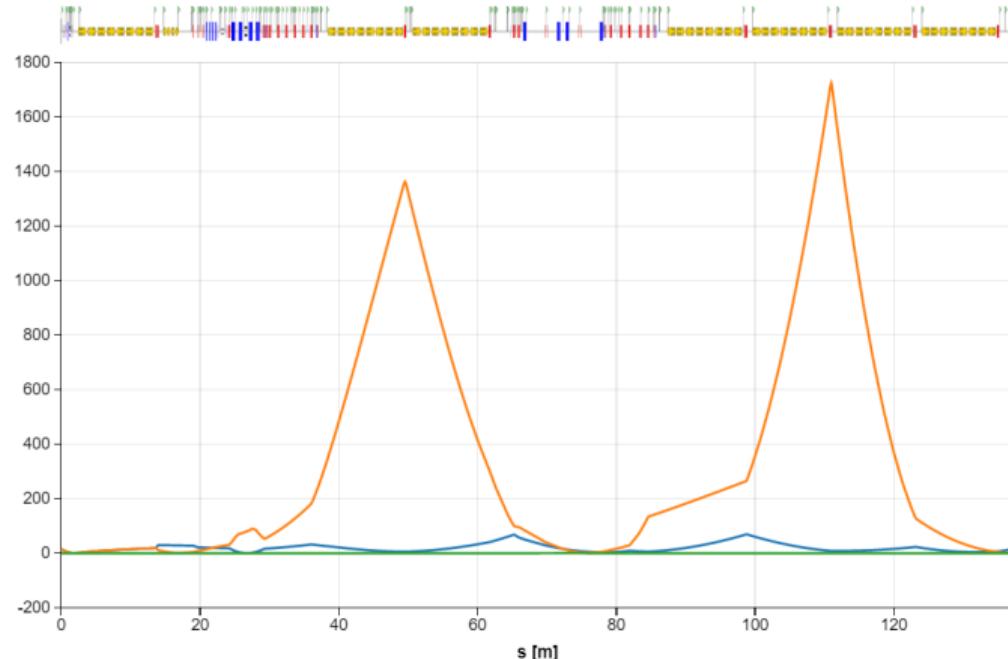
# First experience

- > Error: ACC23ZS defined twice;
- > Warning: N\_KICKS for CSRCSBEND is deprecated, use N\_SLICES;
- > Warning: element has negative length;
- > Each magnet is represented by a doublet, better replaced by a single one;



# WIGGLER problem

Twiss Parameters

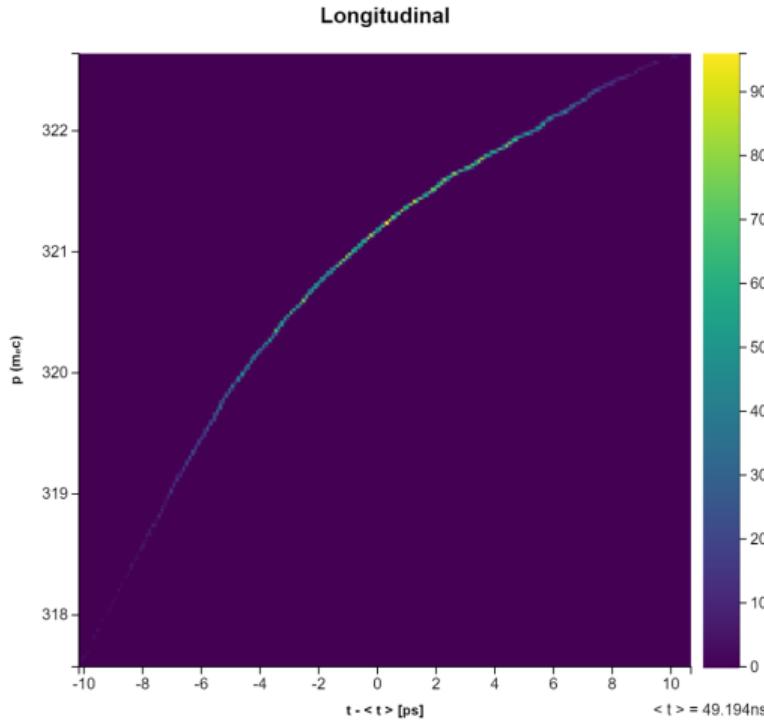


Replacing Wiggler with  
LSRMDLTR helps a bit

# Reaching compression settings

Volt=19907579  
ACC1 Phase=84.5°  
pCentral = 164 MeV

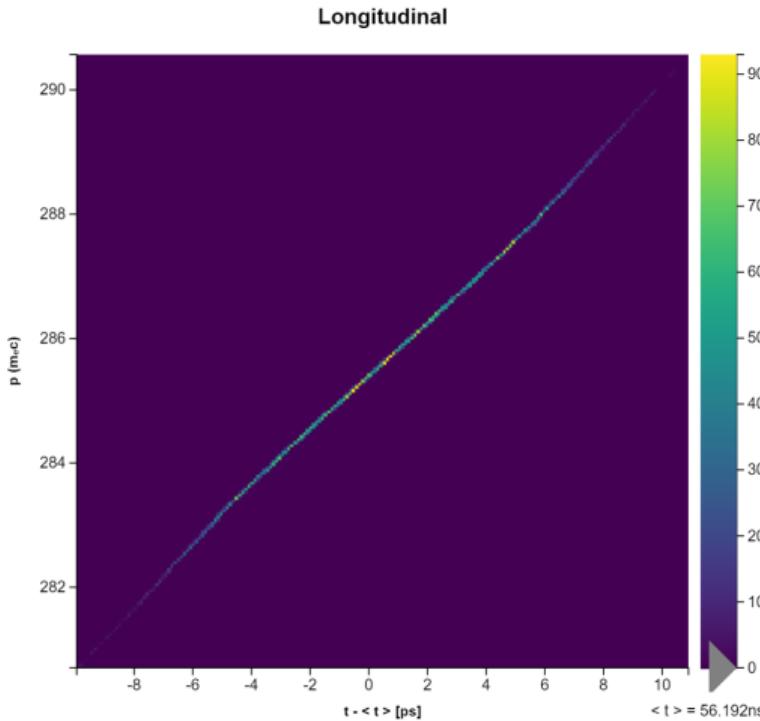
bunchLength = 3.95ps(1.2mm)



# Reaching compression settings

ACC39  
Volt=-4710000  
Phase=105°  
pCentral = 146 MeV

bunchLength = 3.9ps(1.2mm)



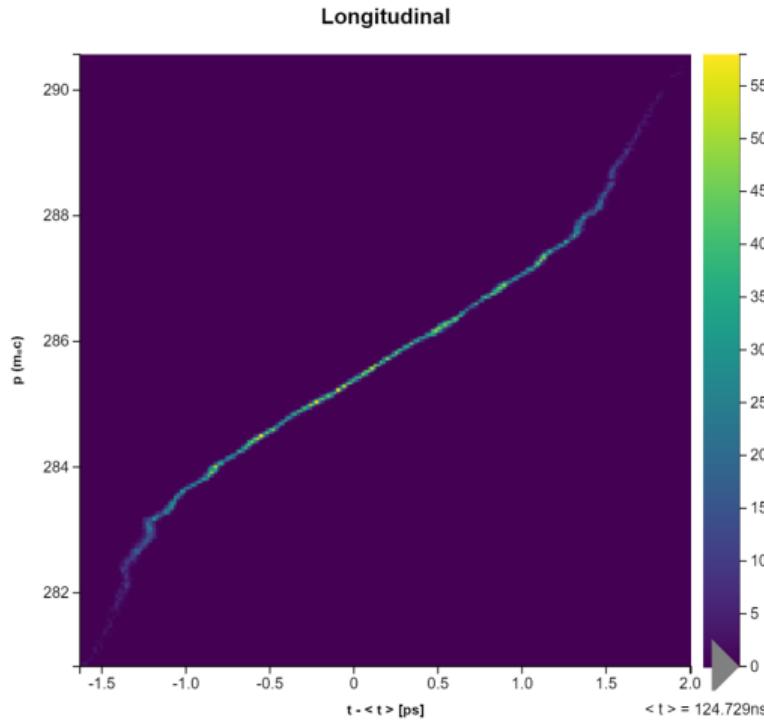
# Reaching compression settings

BC1 R56=147mm

pCentral = 146 MeV

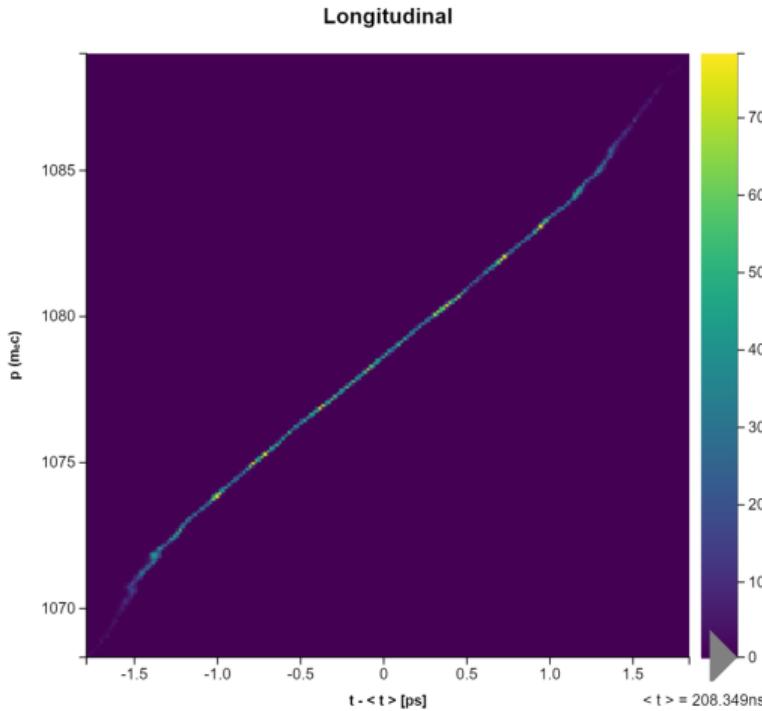
bunchLength = 891fs(267μm)

compressionFactor = 4.44



# Reaching compression settings

Volt=27935044  
ACC23 Phase=65°  
pCentral = 551 MeV  
  
bunchLength = 892fs(267μm)



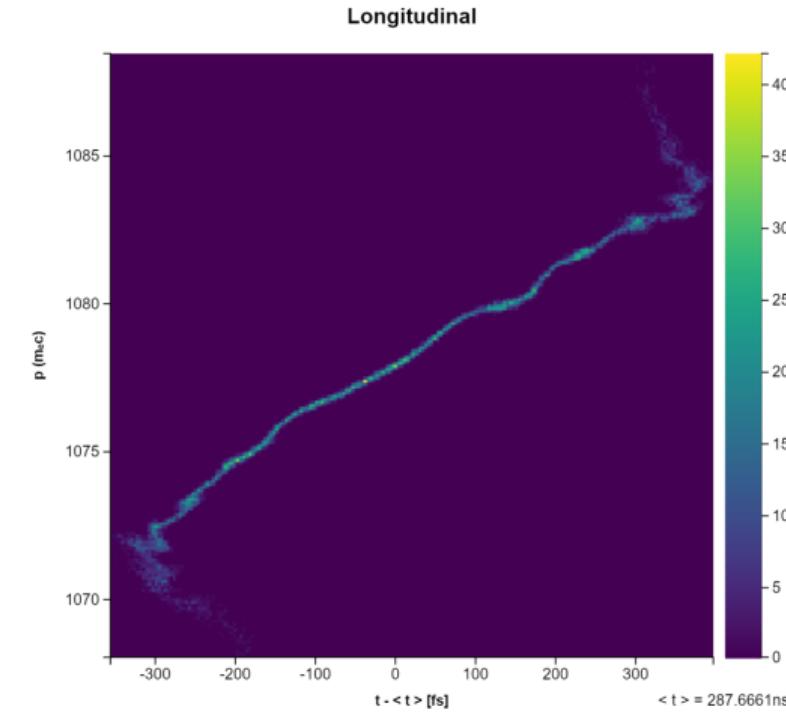
# Reaching compression settings

BC2 R56=48mm

pCentral = 549.4 MeV

bunchLength = 237fs(71μm)

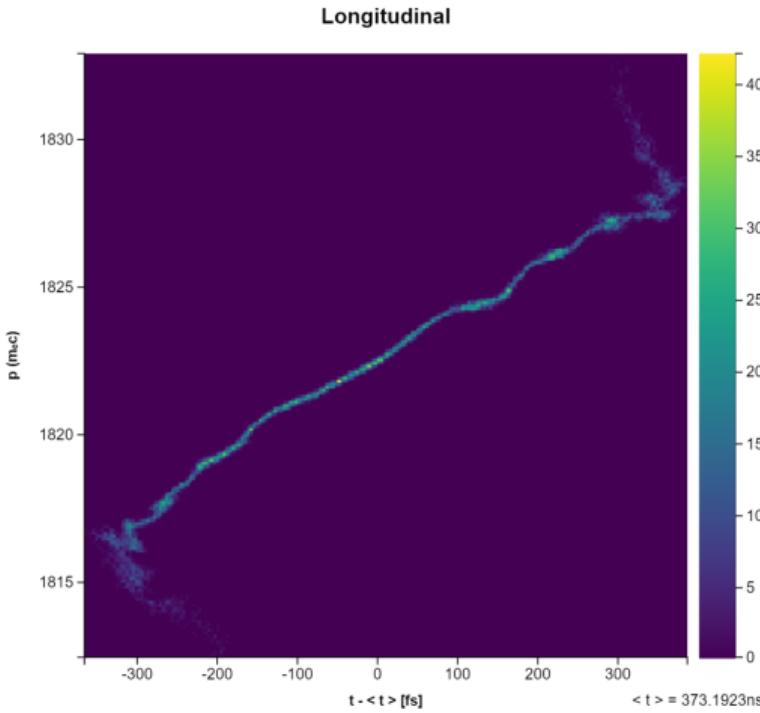
compressionFactor = 3.77



# Reaching compression settings

Volt=23775000  
ACC45 Phase=90°  
pCentral = 931 MeV

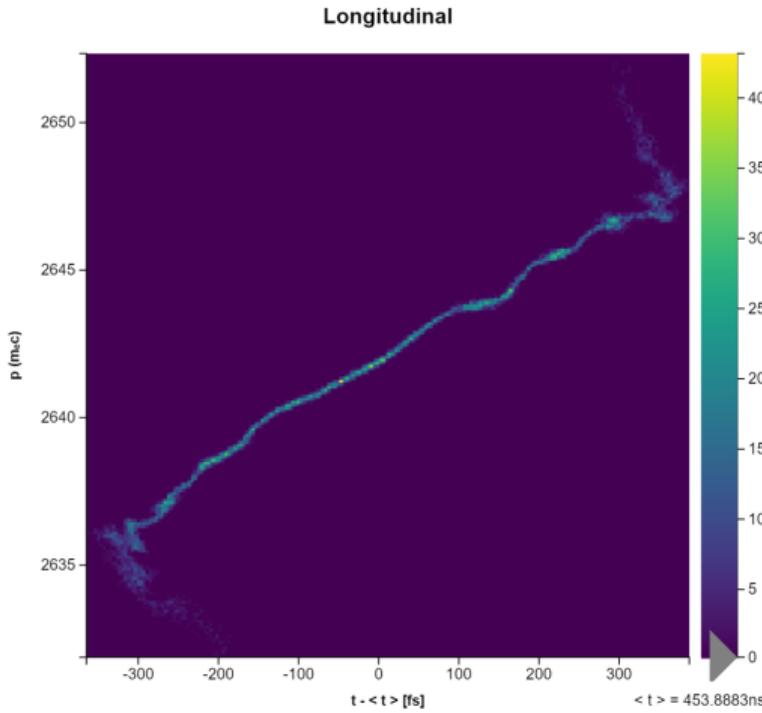
bunchLength = 234fs(70.2μm)



# Reaching compression settings

ACC67  
Volt=26170000  
Phase=90°  
pCentral = 1350 MeV

bunchLength = 234fs(70.3μm)



# Outlook

- > working point for the laser heater;
- > addition of seeding section;
- > interface with GENESIS for FEL simulation (check existing tools);
- > replacing ideal initial bunch with a more realistic one (quasi-3D from SelaV and optics or Impact-Z);



# Thank you!

## Contact

**DESY**, Deutsches  
Elektronen-Synchrotron  
MPY

[www.desy.de](http://www.desy.de)

Dmitrii Samoilenko  
[dmitrii.samoilenko@desy.de](mailto:dmitrii.samoilenko@desy.de)

