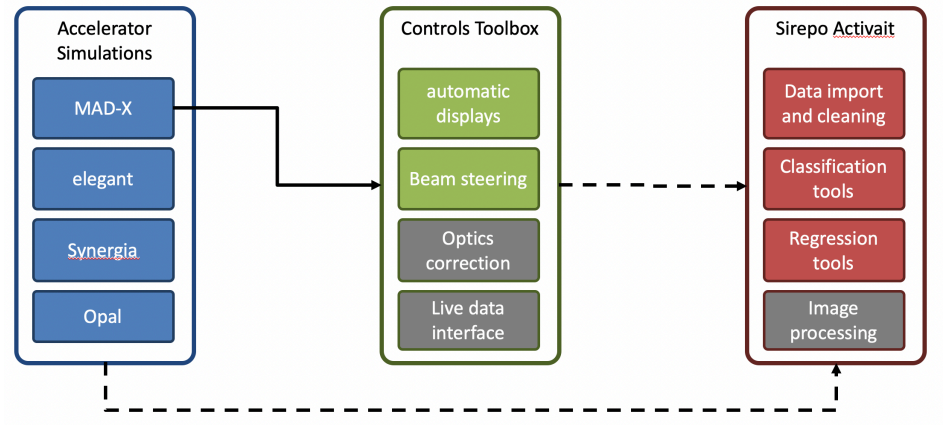
THPV017

A Cloud Based Toolbox for Accelerator Controls Interfaces and Optimization

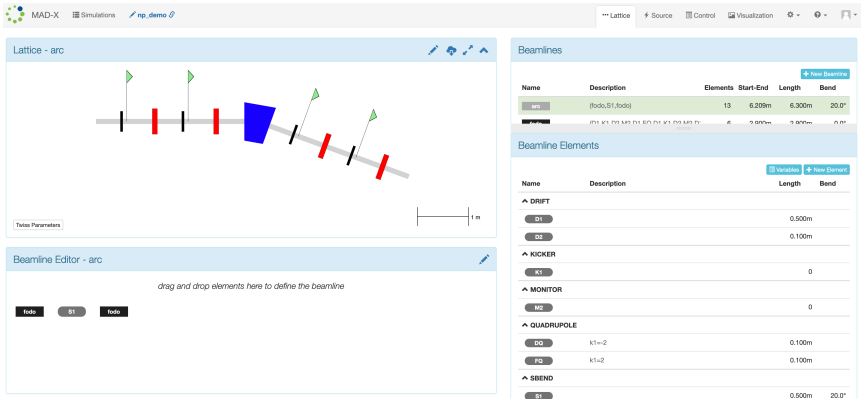
J. P. Edelen, E. Carlin, M. Keilman, P. Moeller, R. Nagler RadiaSoft LLC, Boulder, CO

ICALEPCS 2021

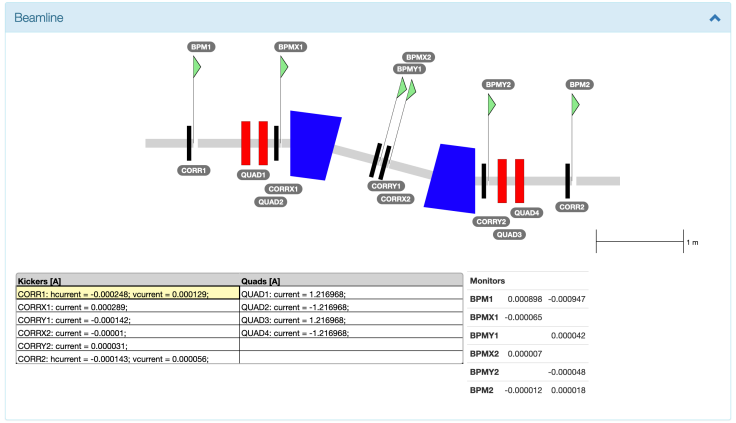
A Browser Based workflow for Accelerator Controls



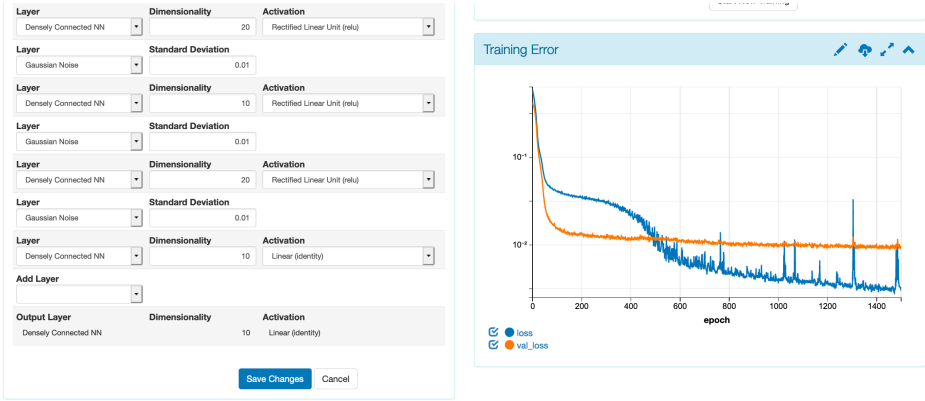
Lattice Construction



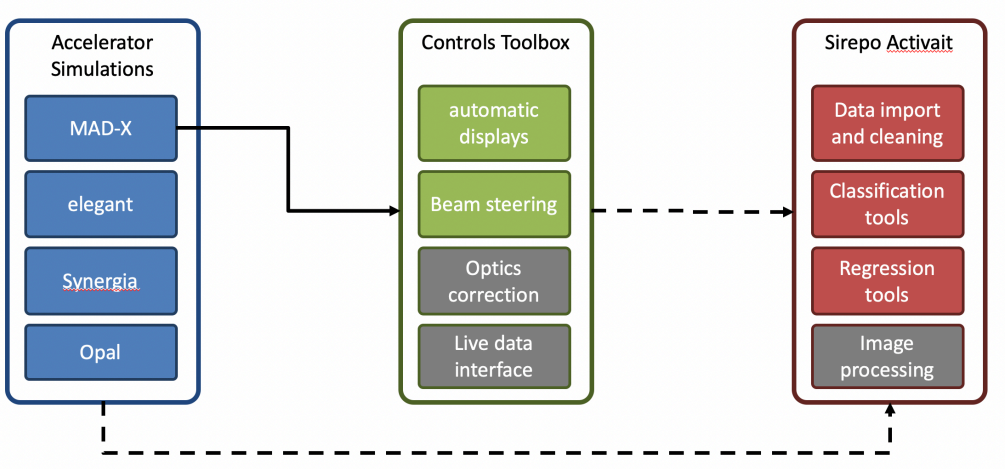
Sample controls interface



Machine learning with Sirepo Activait

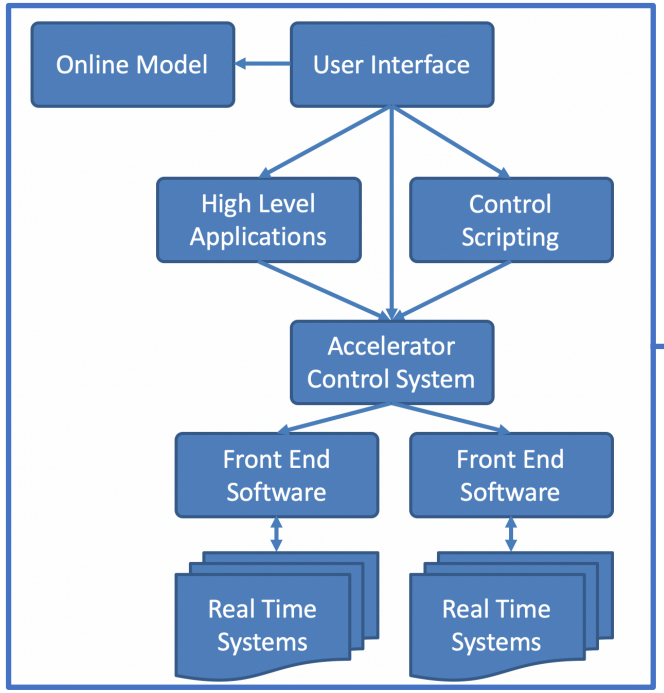


A Browser Based workflow for Accelerator Controls

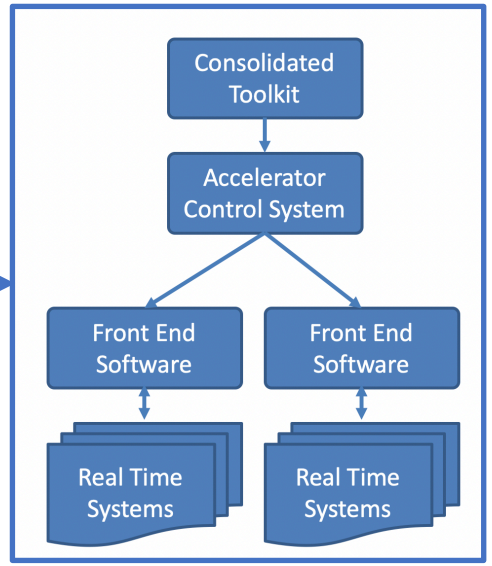


- User interface to control systems
  - Synoptic displays
  - Custom interfaces
  - Communicate directly with front ends or with high level applications
- High level applications / control scripting
  - Programs to monitor and adjust subsystems
  - Python / machine language scripts / ocelot / others
- Online models
  - Acquire machine parameters directly or through UI
- Real Time Systems
  - Often FPGA driven or other embedded system

Common current workflow for accelerator controls



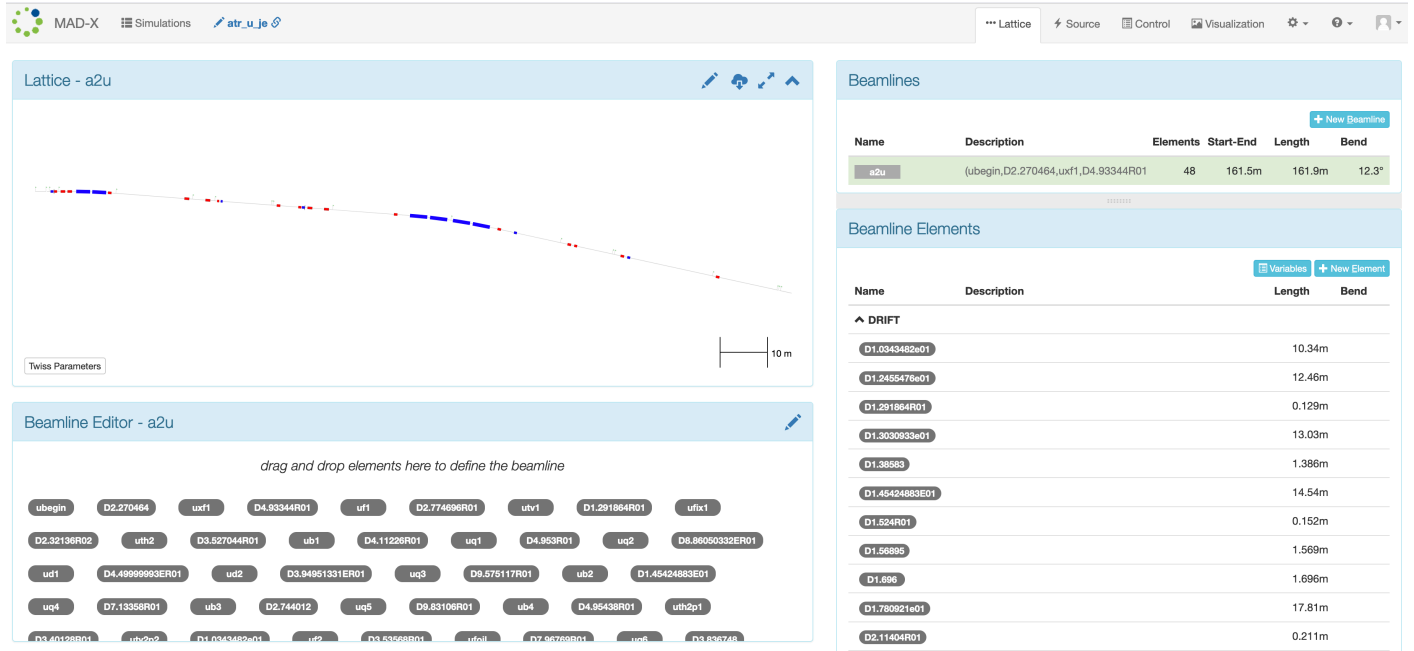
Proposed workflow by integrating and consolidating into a single application

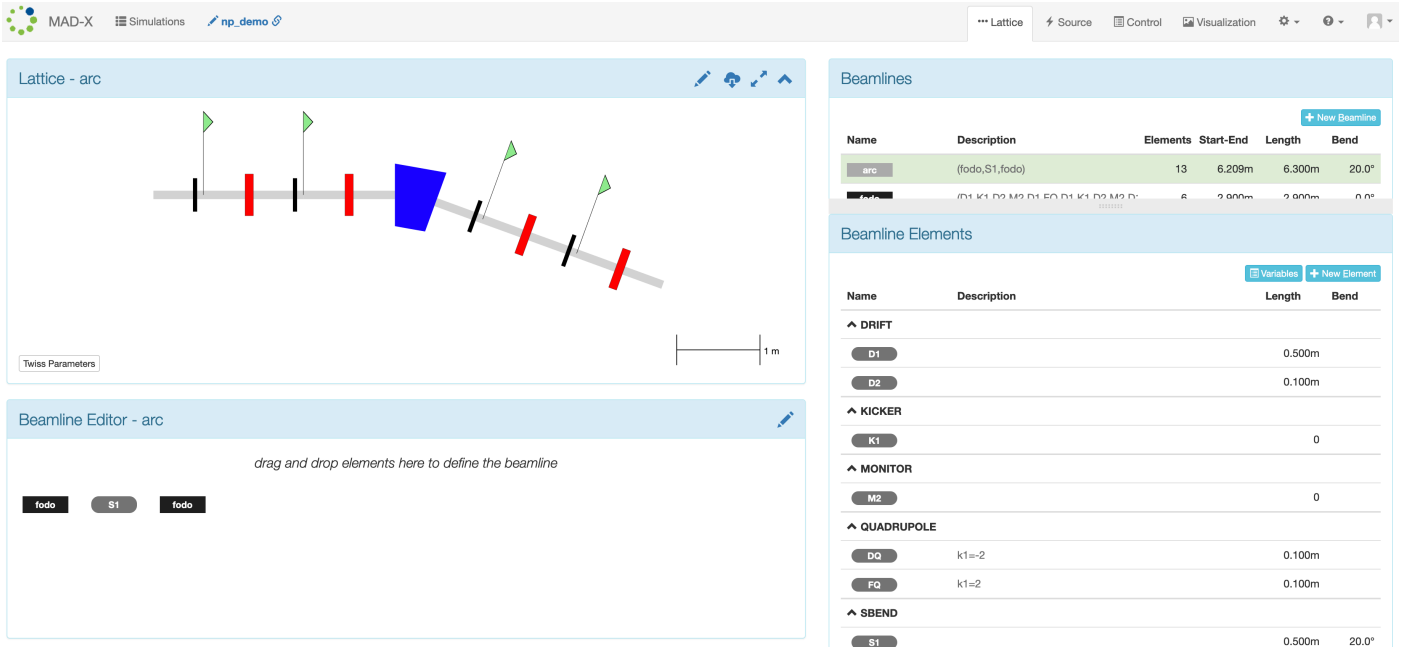


Lattice Construction

The Sirepo GUI for MAD-X supports a wide range of features

- Beamline and lattice component construction
- Layard construction and deconstruction
- Variables and high level parameterization
- TWISS command support
- Matching support
- Templates and implementations for PTC
- Comparison tools for TWISS and PTC results
- Import and export of simulations using sequence files



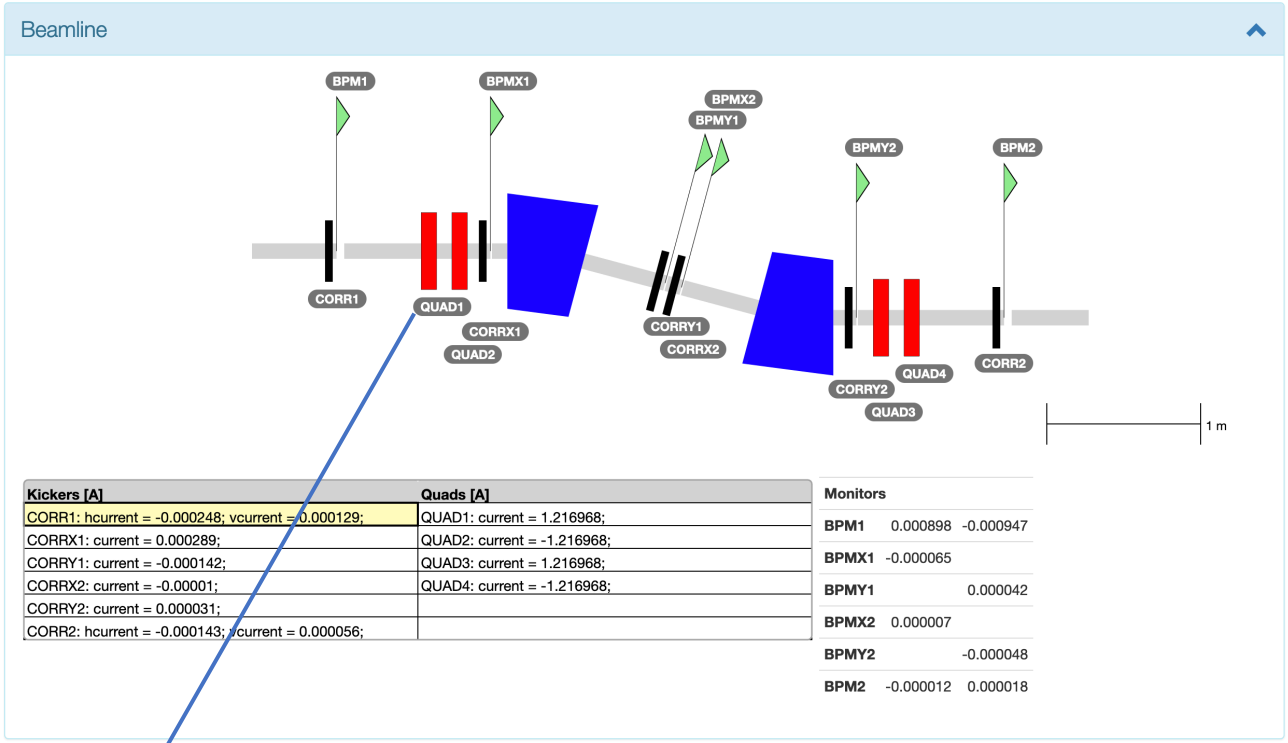


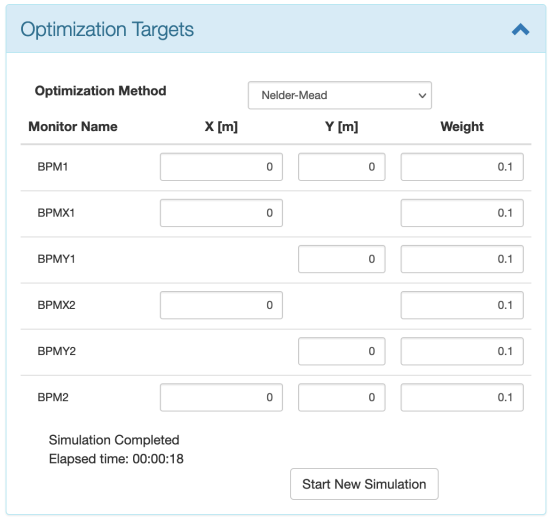
Top: Example lattice construction using MAD-X import. Here a sequence file is loaded for an existing lattice.

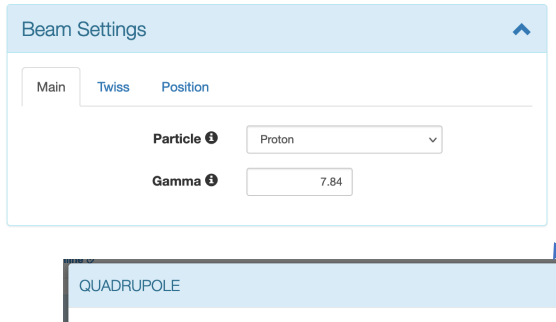
Left: Example lattice construction using MAD-x and component beamlines. Component beamlines are built via drag and drop of individual elements. These component beamlines can then be added to larger beamlines to build a full lattice.

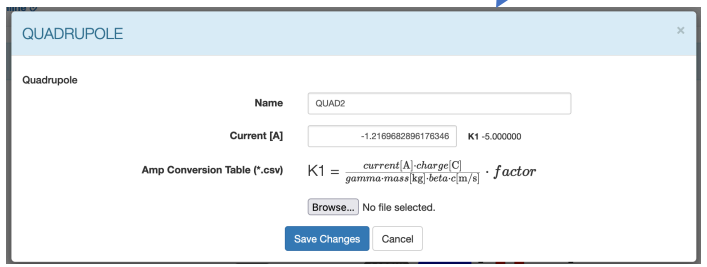
Sample controls interface

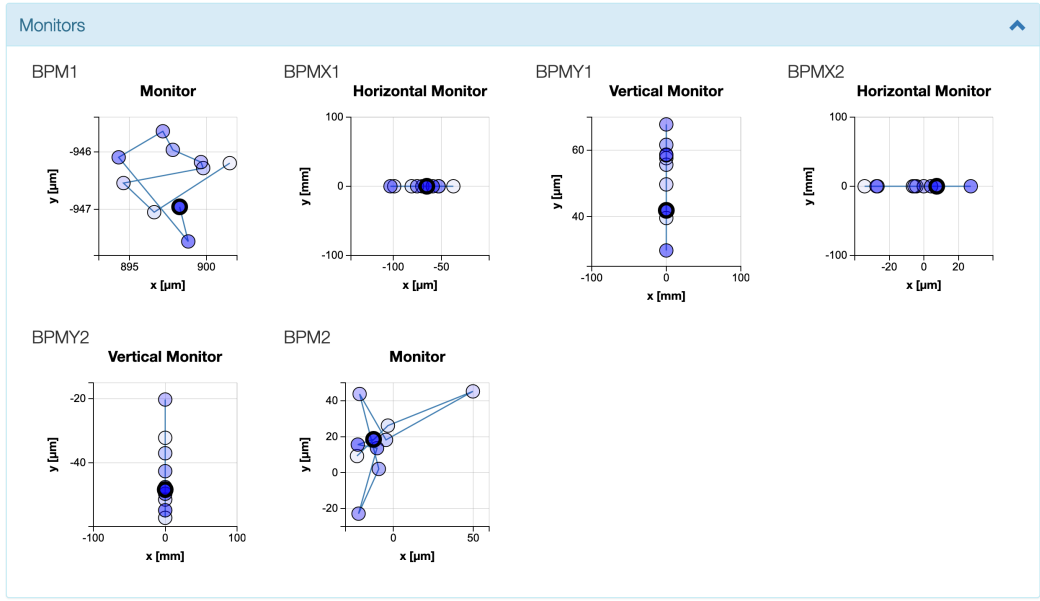
- Build a lattice in MAD-X and use our controls application for optimization
  - Controls display is generated automatically
  - Provides scalar settings and readings
  - Magnet transfer maps can be specified via upload of a CSV file
- Beam steering programs available
  - Optimize the beam trajectory based on weighted desired beam positions
  - python optimization toolboxes and matrix based steering are implemented











Machine learning with Sirepo Activait