Sirepo: An Open Source Platform for Portable Reproducible Simulations*

Robert Nagler, Paul Moeller & David Bruhwiler

RadiaSoft LLC – nagler@radiasoft.net – rsl.link/cse17

radiasoft
radiasoft.net

sirepo
sirepo.com

Goals

- Reproducible simulations
- Simple sharing across users and systems
- Portable, easy-to-install legacy codes
- Accessible, browser-compatible UI

HPC Application Containers

docker

Executable, portable archive of code and ***all*** dependencies except OS kernel. Docker is most popular container platform for Linux, Windows, and Mac.

Containers run at native speeds on Linus. On Mac OS X and Windows, containers run at native speed for CPU-intensive codes but I/O can be slow (similar to NFS). MPI works well.

Delivering Codes via Docker Images

rsl.link/cse17/1

- Six beam simulation codes available
- UI: Sirepo, Jupyter, and CLI
- Automated build/test/release to Docker/PyPI
- One command to download/install/run:

```
docker run -p 8000:8000 radiasoft/sirepo
```

- Open Source on GitHub
- Try: jupyter.radiasoft.org & beta.sirepo.com

Version Management

- Images identified by chronological version
- Channels: dev (latest), alpha, beta, prod
- `rsmanifest.json` describes image & codes
- Sources for codes stored in image
- Code versions/commits available to simulations
- Future: container commits, full environment sharing, workflows (CWL/DWL?)

Self-Extracting Simulations

Portable archive of simulation configuration and auxiliary files embedded in HTML. Users click to reproduce in Sirepo Cloud or private cluster. Link sharing works for Sirepo Cloud, but scientists like to run their servers, often behind firewalls. Self-Extracting Simulations allow automatic submission to any accessible server with minimal knowledge.

① Rename / Move / Export as Zip / Self-Extracting Simulation / Python Source

② Mods to Tabulated Undulator

Maksim,

I added the new experimental data to the tabulated undulator example. Let me know if it looks good on your server.

Cheers,
Rob

Tabulated Undulator Example.html (2,222K)

Send

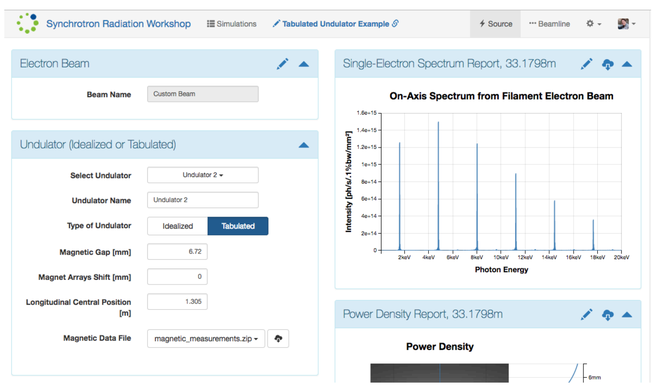
③ Synchrotron Radiation Workshop - Sirepo

Self-Extracting Simulation: Tabulated Undulator Example

https://sirepo.my-company.com

Send to Server

④



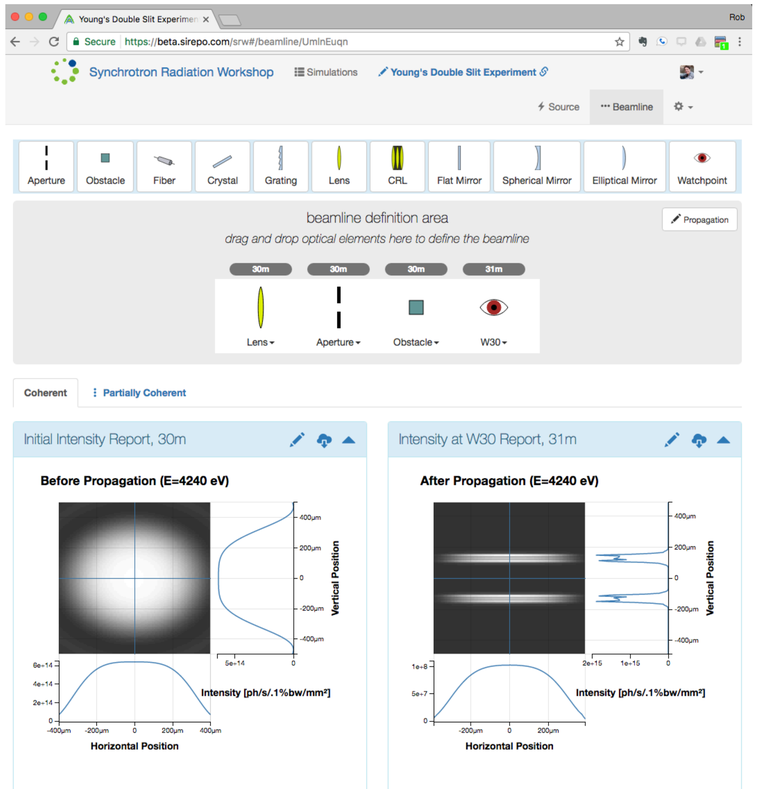
Many Ways to Share

- Zipped archive
- Self-Extracting Simulations
- Python source for CLI
- IPython/Jupyter compatible
- Links for same system copies

The Browser is the Scientific UI

rsl.link/cse17/3

- Easy sharing via links
- Zero install to reproduce simulations
- Responsive to phone, tablet, desktop
- Interactive plots with lineouts, point values
- Modern Javascript: Angular, Bootstrap, D3



Ease of Use Attracts Users

- In use at BNL, Fermilab, SLAC, PSI, European XFEL, Texas A&M, and two commercial clients
- Sirepo: 25+ active users
- Jupyter: 30+ active users

rsl.link/cse17

* This material is based upon work supported by the U.S. Department of Energy, Office of Science under Award Nos. DE-SC0011237 and DE-SC0015209 from the Office of Basic Energy Sciences and Award No. DE-SC0011340 from the Office of High Energy Physics.

U.S. DEPARTMENT OF ENERGY
Office of Science