

Software and Computing Training at Jefferson Lab

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Jefferson Lab

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The Software & Computing Landscape at Jefferson Lab

- 4 halls → 3 different simulation & reconstruction packages

Hall	Simulation	Reconstruction	Analysis
A & C	SIMC (Fortran)	Podd (ROOT/C++)	ROOT/C++
B	GEMC (Geant4)	CLARA (Java/C++)	Analysis Studio (Java) Clas12Tool (ROOT/C++)
D	HDGeant4 (Geant4)	JANA/DANA (C++)	ROOT/C++

- Computing
 - ▶ Batch farm w/in-house workflow tools (SWIF)
 - ▶ Some OSG, NERSC (experimental)

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What to teach? C++, ROOT, maybe PyROOT, SWIF

JLab Training: General Beginner/Intermediate

- Basic skills: Software Carpentry Workshops 2017/2018
 - ▶ For students/beginners
 - ▶ **Unix shell, Git, Python, ROOT, Jupyter notebooks, OSG/HTCondor**
 - ▶ 2017: <https://swc-osg-workshop.github.io/2017-05-17-JLAB/>
 - ▶ 2018: <https://kevin-vilbig.github.io/2018-05-21-JLAB/>
- Hall A/C
 - ▶ 2-day software workshops, for beginning graduate students, new postdocs
 - ▶ **Hands-on tutorials in Virtual Machine**
 - ▶ Hall A/C simulation & reconstruction software, analysis methods
 - ▶ **Generally useful: ROOT, Python/PyROOT, Git, JLab batch farm use/SWIF**
 - ▶ <https://redmine.jlab.org/projects/podd/wiki/Workshop2018/>

Hall-Specific Intermediate/Advanced

- Hall B

- ▶ 1–3 hour **hands-on tutorials in Docker containers** at collaboration meetings
- ▶ Very specific to Hall B environment
- ▶ Most recent: <https://www.jlab.org/indico/event/303/>

- Hall D

- ▶ 2-day Analysis Workshop 2013:
https://halldweb.jlab.org/wiki/index.php/GlueX_Analysis_Workshop_2013
- ▶ 3-day Physics Workshop 2016:
https://halldweb.jlab.org/wiki/index.php/GlueX_Physics_Workshop_2016
- ▶ **Hands-on tutorials in Virtual Machine**
- ▶ Limited to Hall D collaboration (contents and access)

General Intermediate/Advanced/Expert

- Geant4

- ▶ 5-day hands-on course by Geant4 developers
- ▶ Offered annually at changing locations
- ▶ 2012 workshop at JLab: <https://www.jlab.org/conferences/geant4/>

- Computing Roundtable

- ▶ Advanced presentations on **recent developments**
- ▶ Machine learning, new programming tools, languages, libraries
- ▶ 2018 series: <https://www.jlab.org/indico/event/247/>

- Machine Learning

- ▶ Informal weekly lunch meetings for anyone interested
- ▶ Tracking ML meeting series (<https://github.com/JeffersonLab/trackingML>)

Observations

- Useful Teaching Tools
 - ▶ Fully configured environments (VMs, containers)
 - ▶ Hands-on exercises/tutorials **combined with concepts overview**
 - ▶ Alerts about **common pitfalls**
 - ▶ AV recordings of presentations
- Teaching of **analysis techniques** as important as technical training
- Huge variation in student/postdoc preparedness
- 2–5 day workshops or “schools” are invariably too short
- Preparing workshops can be enormously time-consuming
- **Good written documentation** (*not* the auto-generated kind) often best for in-depth learning

Not Covered—A Very Incomplete List

- Technical
 - ▶ C++ (incl. new standards, STL)
 - ▶ Intermediate/advanced ROOT
 - ▶ In-depth Python, libraries (numpy . . .)
- Logistical
 - ▶ Coordinated effort across the lab
 - ▶ Modern teaching tools (e.g. more Jupyter Notebooks, web-based courses)

Plans

- 5-day workshop, **graduated by skill level**, maybe 2020, hopefully across halls