Software and Computing Training at Jefferson Lab

Ole Hansen

Jefferson Lab

HOW 2019 March 21, 2019

The Software & Computing Landscape at Jefferson Lab

ullet 4 halls o 3 different simulation & reconstruction packages

Hall	Simulation	Reconstruction	Analysis
A & C	SIMC (Fortran)	Podd (ROOT/C++)	ROOT/C++
В	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)

The Software & Computing Landscape at Jefferson Lab

ullet 4 halls o 3 different simulation & reconstruction packages

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

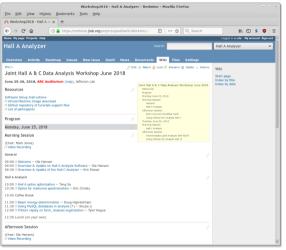
- Computing
 - Batch farm w/in-house workflow tools (SWIF)
 - ► Some OSG, NERSC (experimental)

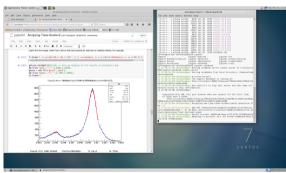
What to teach? C++, ROOT, maybe PyROOT, SWIF

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 A/C Workshop 2018





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