



Institute for Research and Innovation in Software for High Energy Physics (IRIS-HEP)

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(Morgridge Institute), Gordon Watts (U.Washington) with
UC-Berkeley, University of Chicago, University of Cincinnati,
Cornell University, Indiana University, MIT, U.Michigan-Ann
Arbor, U.Nebraska-Lincoln, New York University, Stanford
University, UC-Santa Cruz, UC-San Diego, U.Illinois at
Urbana-Champaign, U.Puerto Rico-Mayaguez and
U.Wisconsin-Madison



OAC-1836650

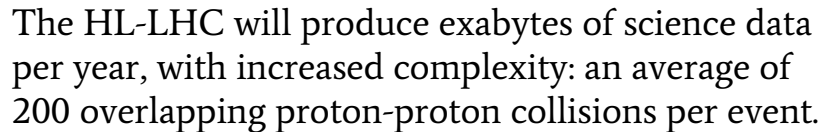
<http://iris-hep.org>

*IRIS-HEP was funded as of 1 September,
2018, and is currently ramping up activities*

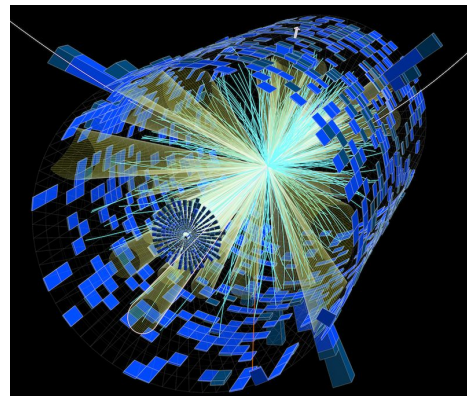




- 1) Use the Higgs boson as a new tool for discovery
- 2) Pursue the physics associated with neutrino mass
- 3) Identify the new physics of dark matter
- 4) Understand cosmic acceleration: dark matter and inflation
- 5) Explore the unknown: new particles, interactions, and physical principles



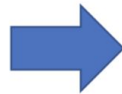
During the HL-LHC era, the ATLAS and CMS experiments will record ~ 10 times as much data from ~ 100 times as many collisions as were used to discover the Higgs boson (and at twice the energy).



The Community White Paper Process (2016-2017)

Involved A Diverse

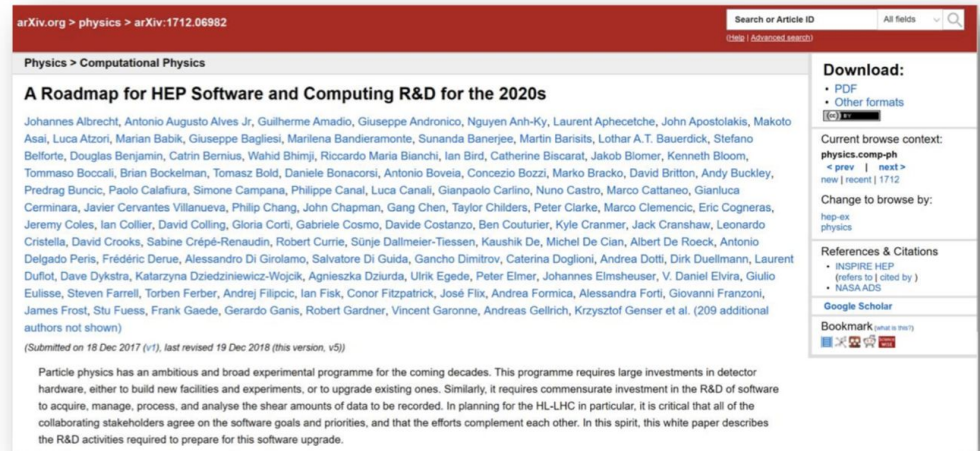
- Computing Management from the Experiments and Labs
- Individuals interested in the problems
- Members of other compute intensive scientific endeavors
- Members of Industry



Individual Papers on the arXiv:

Careers & Training, Conditions Data, DOMA, Data Analysis & Interpretation, Data and Software Preservation, Detector Simulation, Event/Data Processing Frameworks, Facilities and Distributed Computing, Machine Learning, Physics Generators, Security, Software Development, Deployment, Validation, Software Trigger and Event Reconstruction, Visualization

Community White Paper & the Strategic Plan



IRIS-HEP



Sustainable Software R&D objectives

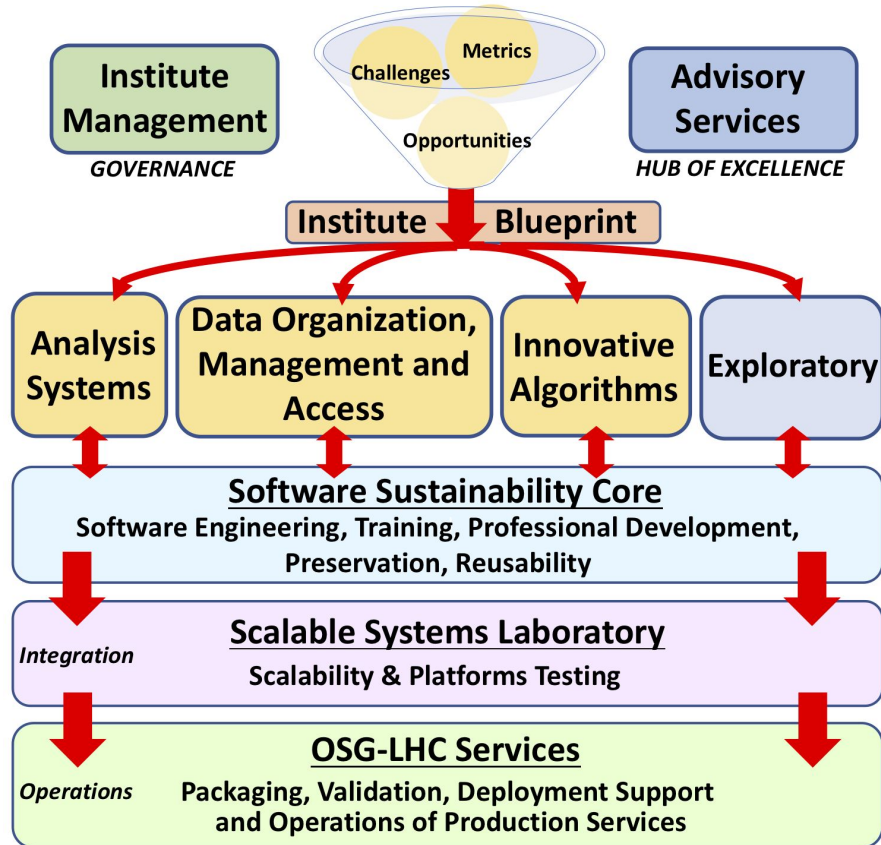
- 1) Development of **innovative algorithms** for data reconstruction and triggering;
- 2) Development of highly performant **analysis systems** that reduce “time-to-insight” and maximize the HL-LHC physics potential; and
- 3) Development of **data organization, management and access systems** for the community’s upcoming Exabyte era.
- 4) Integration of software and scalability for use by **the LHC community on the Open Science Grid**, the Distributed High Throughput Computing infrastructure in the U.S.

Intellectual Hub for the HEP Community













The plan for IRIS-HEP reflects a community vision developed by an international community process organized by the HEP Software Foundation (<https://hepsoftwarefoundation.org>). The S2I2-HEP conceptualization project (<http://s2i2-hep.org>) derived a Strategic Plan from the community roadmap which would leverage the strengths of, and could be executed by, the U.S. university community. This became a proposal to the National Science Foundation, which funded a 5 year project as of 1 September, 2018.

IRIS-HEP Structure and Executive Board



Executive Board































The IRIS-HEP Executive Board manages the day to day activities of the Institute.





























				
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Kyle Cranmer New York University <i>Analysis Systems Area Lead</i>	Sudhir Malik University of Illinois at Mayaguez <i>Training, Education and Outreach Coordinator</i>	Mark Neubauer University of Illinois at Urbana-Champaign <i>Blueprint Coordinator</i>	Rob Gardner University of Chicago <i>SSL Area Lead</i>	Frank Wuerthwein University of California, San Diego <i>OSG-LHC Area Lead and OSG Executive Director</i>

IRIS-HEP Team

<http://iris-hep.org/about/team>

About 30 FTEs spread over a
larger of people from 18
institutions

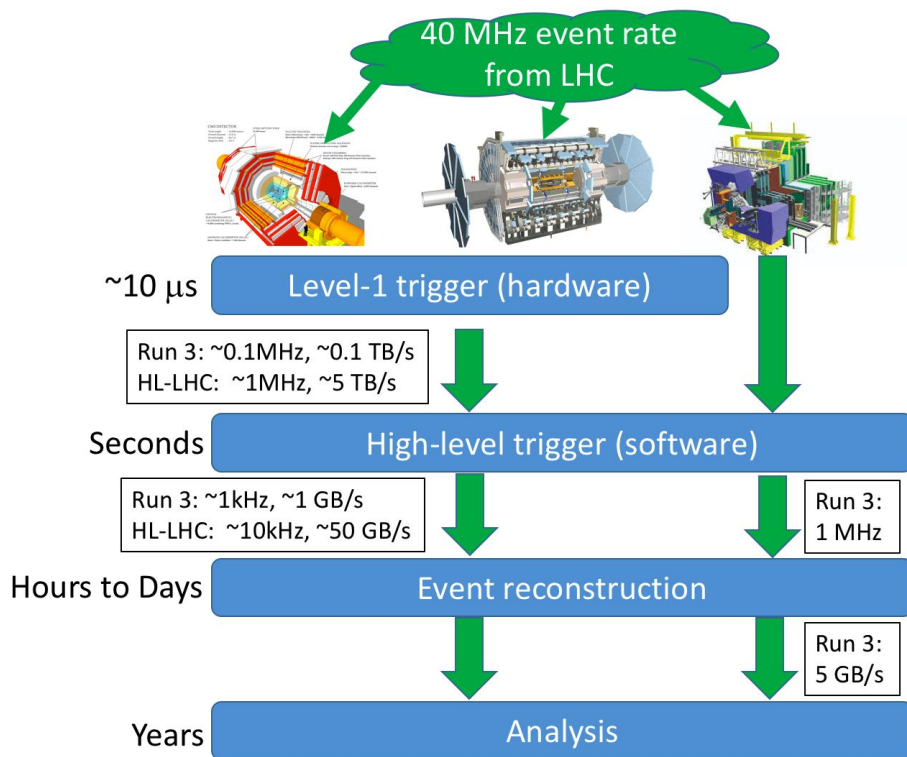
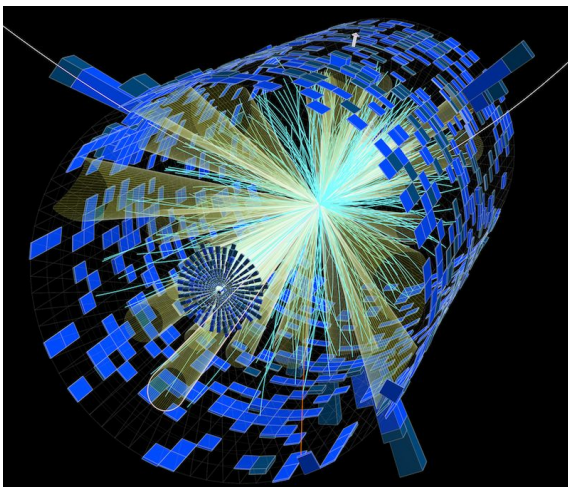
				
Peter Wittich Cornell University	Don Riley Cornell University	Steve Lantz Cornell University Tracking PF Collaborator	Susan Sona Indiana University	Zelak Shah Indiana University Systems Analyst
				
Mike Williams Massachusetts Institute of Technology	Markus Kite Massachusetts Institute of Technology	Daniel Crabb Massachusetts Institute of Technology Postdoctoral Research Associate	Dylan Rankin Massachusetts Institute of Technology	Evan Massaro Massachusetts Institute of Technology
				
Brian Backelman Montclair Institute Institute co-PI and DOH R&D Area Lead	Kyle Cranmer New York University Analysis Systems Area Lead	Peter Elmer Princeton University Institute PI and Executive Director	David Lange Princeton University Innovative Algorithms Area co-Lead	Jim Pivarski Princeton University
				
Vassil Vasilev Princeton University	Flae Fuhs-Wischman Princeton University Project Office (provisional)	Tatiana Medvedeva Princeton University	Henry Schreiner Princeton University	Bei Wang Princeton University HPC Software Engineer
				
Lauren Tompkins Stanford University	Rob Gardner University of Chicago SSL Area Lead	Lincoln Bryant University of Chicago	Andrew Chien University of Chicago	Marc Weinberg University of Chicago
				
Mike Sokoloff University of Cincinnati	Mark Neubauer University of Illinois at Urbana-Champaign Blueprint Coordinator	Daniel S. Katz University of Illinois at Urbana-Champaign	Ben Gehrmeyer National Center for Superconducting Accelerators	Markus Atkinson University of Illinois at Urbana-Champaign

				
Shawn Mullen University of Missouri - Ann Arbor	Ken Bloom University of Nebraska - Lincoln	Derek Weist University of Nebraska - Lincoln	Oksana Shalunova University of Nebraska - Lincoln ZooLUNDP collaborator	Marion Zaida University of Nebraska - Lincoln Systems Integrator
				
Huijun Zhu University of Nebraska - Lincoln	Heather Gray University of California, Berkeley Innovative Algorithms Area co-Lead	Xiaocang Ai UC Berkeley Produce and ACTS	Carlos Matzkin University of California, Santa Cruz	Jeff LeFevre University of California, Santa Cruz
				
Xiaowei(Aaron) Che University of California, Santa Cruz Ph.D. Student	Jul Yagil University of California, San Diego	Frank Wurthwein University of California, San Diego OSS-LHC Area Lead and OSS Executive Director	Mateusz Tadel University of California, San Diego Tracking PF Collaborator	Slava Krut'kov University of California, San Diego Tracking PF Collaborator
				
Mario Masdeu-Sosvilla University of California, San Diego Tracking PF Collaborator	Igor Stifflig University of California, San Diego Lead Scientific Software Developer and Researcher	Sushri Malik University of Washington Training, Education and Outreach Coordinator	Gordon Watts University of Washington Institute co-PI and Deputy Executive Director	Mason Proffitt University of Washington PhD student
				
Emma Torre University of Wisconsin- Madison Post-doc	Tim Cartwright University of Wisconsin- Madison OSS Deputy Executive Director	Brian Lin University of Wisconsin- Madison OSS Software Team Manager	Tim Thiesen University of Wisconsin- Madison OSS Release Manager	Malyis (Mat) Belmont University of Wisconsin- Madison Software Integration Developer
				
Carl Edquist University of Wisconsin- Madison	Aaron Meade University of Wisconsin- Madison Student			



Innovative Algorithms - Trigger/Reconstruction

Algorithms for real-time processing of detector data in the software trigger and offline reconstruction are critical components of HEP's computing challenge.



Innovative Algorithms

These algorithms face a number of new challenges during HL-LHC:

- Upgraded accelerator capabilities, with more collisions per bunch crossing (“pile-up”)
- Detector upgrades, including new detector technologies and capabilities
Increased event rates to be processed
- Emerging computing architectures

Specific R&D investments include collaboration with ACTS, continuation of the parallel Kalman Filter tracking project, work on HLS4ML, etc.

Data Organization, Management and Access (DOMA)

The DOMA focus area performs fundamental R&D related to the central challenges of organizing, managing, and providing access to exabytes of data from processing systems of various kinds.

- **Data Organization:** Improve how HEP data is serialized and stored.
- **Data Access:** Develop capabilities to deliver filtered and transformed event streams to users and analysis systems.
- **Data Management:** Improve and deploy distributed storage infrastructure spanning multiple physical sites. Improve inter-site transfer protocols and authorization

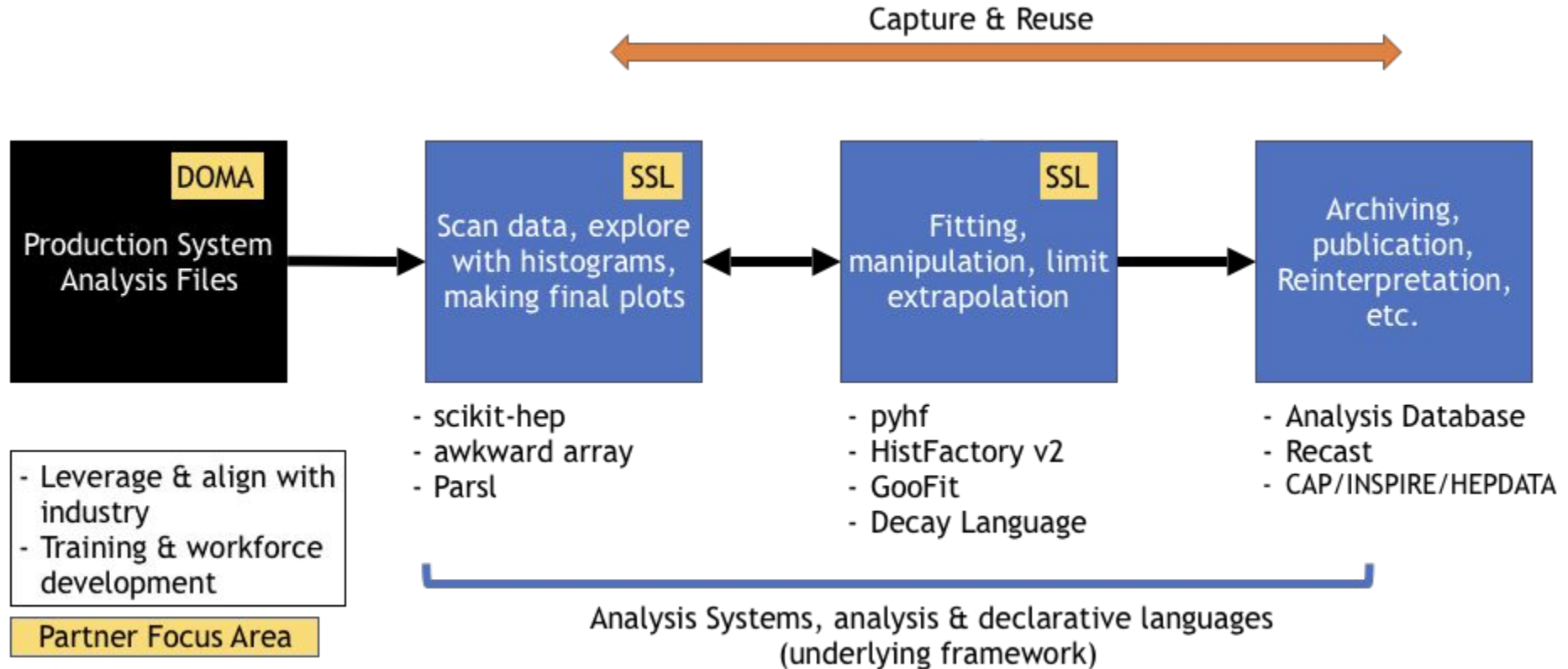
Analysis Systems R&D Goals

Develop sustainable analysis tools to extend the physics reach of the HL-LHC experiments by creating greater functionality, reducing time-to-insight, lowering the barriers for smaller teams, and streamlining analysis preservation, reproducibility, and reuse.

Compared to DOMA and Innovative Algorithms (which has more targeted reco/trigger goals), the Analysis Systems group is dealing with more “greenfield” area where there is a very heterogeneous set of use cases and relevant components.

The nature of IRIS-HEP Analysis Systems tasks is more exploratory and “big R” (R&d)

Analysis Systems Data Flow and Projects

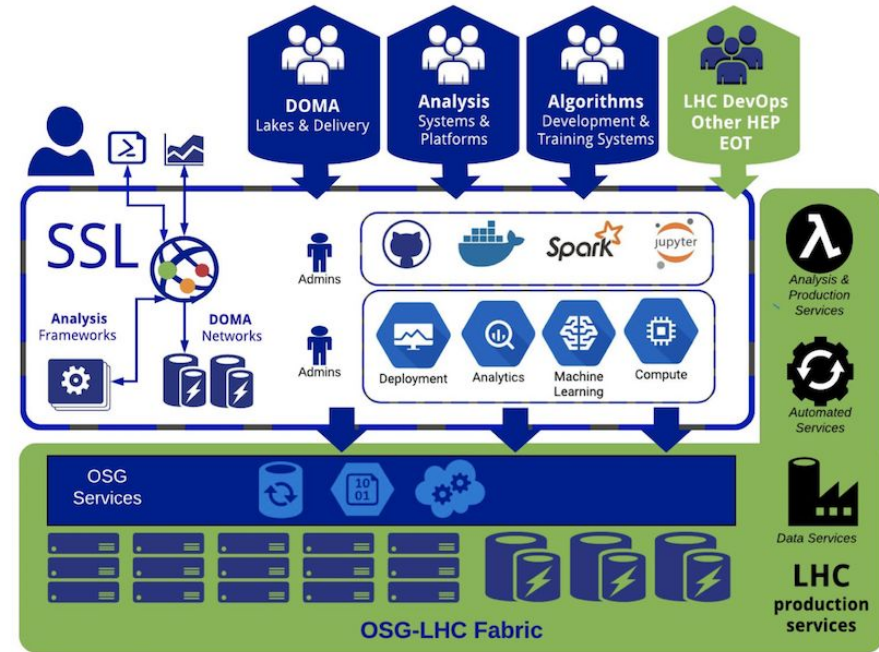


Scalable Systems Laboratory (SSL)



Goal: Provide the Institute and the HL-LHC experiments with scalable platforms needed for development in context

- Provides access to infrastructure and environments
- Organizes software and resources for scalability testing
- Does foundational systems R&D on accelerated services
- Provides the integration path to the OSG-LHC production infrastructure



Open Science Grid (OSG) for the LHC



The People in OSG

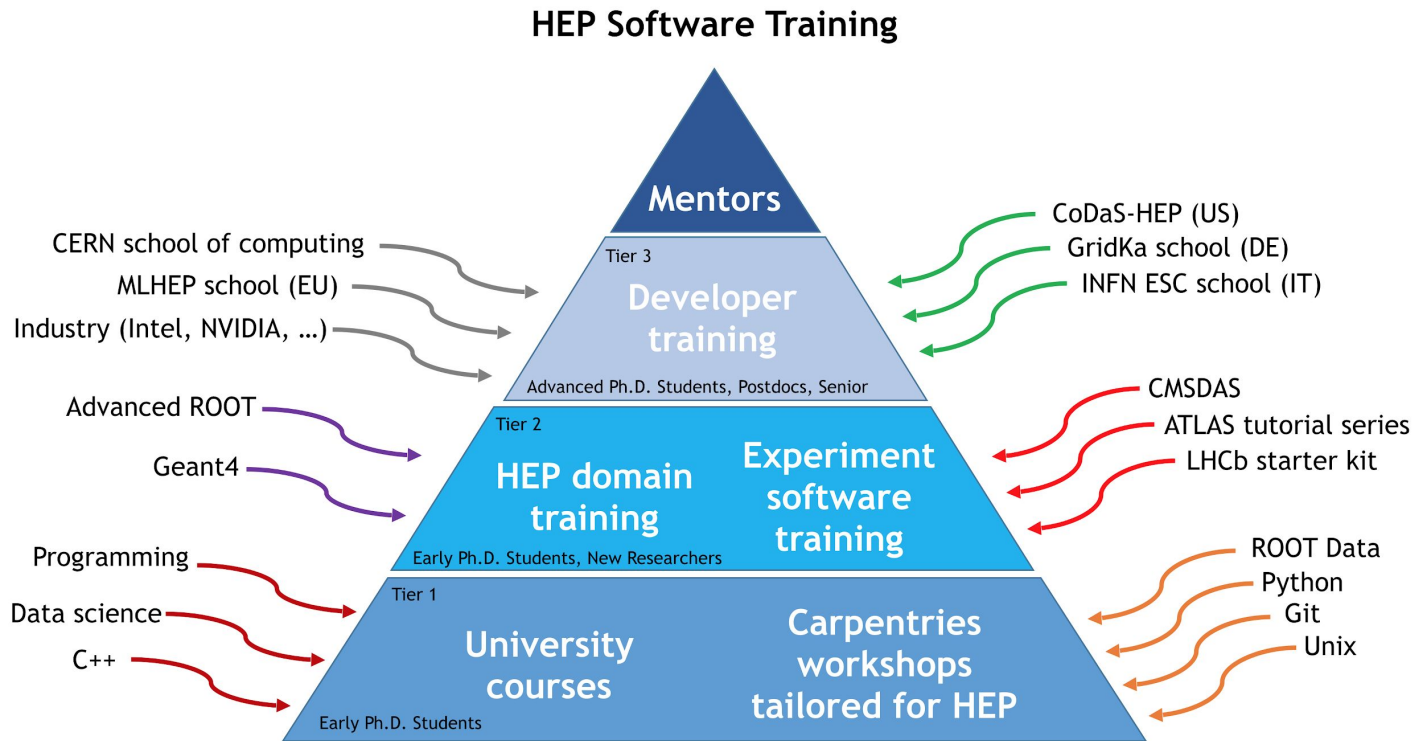


Operations = UNL
Security = Indiana University
Software = U. Wisconsin – Madison
Networking = U. Michigan

A total of 6 FTE across 11 people.
These people have worked together
and with the LHC program years.

(Slide from FKW)

Training and Education - Sustainability/Scalability



This is a general framework for training, but from the NSF we have funds from both IRIS-HEP (OAC-183665) and a separate project FIRST-HEP (OAC-1829707, OAC-1829729, <http://first-hep.org>) which can work towards implementing this model.

Training and Education - Upcoming events

We are organizing a very first introductory level Software Carpentry (git/python/PyRoot/uproot) workshop at Fermilab (1-2 April 2019)

We are organize the CoDaS-HEP School (Princeton) - 22-26 July 2019 - tools, techniques and methods for Computational and Data Science for High Energy Physics (<http://codas-hep.org>)

With US-ATLAS colleagues we will be organizing an introductory “first test run” level Carpentry session for US-ATLAS at LBNL and CMS/ATLAS at CERN, the latter connecting to the international parts of the experiment, build on the experience of the FNAL workshop.

Invite LHCb/ALICE to showcase Starterkit on pre- and first analysis steps

IRIS-HEP Topical Meeting Series



Home » Projects » IRIS-HEP » Topical Meetings

Topical Meetings

Two weekly time slots are available for IRIS-HEP topical meetings:

- Mondays - 17:30-18:30GVA (Vidyo and 40-R-B10 at CERN)
- Wednesdays - 18:00-19:00GVA (Vidyo only)

There is one event in the future. [Hide](#)

April 2019



15 Apr [Development of new Histogram tools](#)

March 2019



25 Mar [Introduction to modern CDN Architectures](#)



04 Mar [The FAST project](#)

February 2019



25 Feb [Analysis Description Languages](#)



18 Feb [Integration of C++ Modules into CMSSW](#)



13 Feb [HLS4ML: Using ML on FPGAs to enhance reconstruction output](#)



04 Feb [Training for Software, Computing, Computational and Data Science in HEP](#)

January 2019



28 Jan [FuncX: High Performance Function as a Service for Science](#)

<https://indico.cern.ch/category/10570/>

Meetings are announced on the announcements@iris-hep.org mailing list

Recorded videos are available in Youtube (see links on the individual agenda pages)

Connecting with IRIS-HEP



Website: <http://iris-hep.org>

Public announcement mailing list: announcements@iris-hep.org [[Subscribe](#)]

Topical meetings: <https://indico.cern.ch/category/10570/>

We will be organizing, co-organizing and hosting various events going forward, see the main webpage above.

Summary

HEP faces major challenges in the 2020s: Data, Compute, Staffing

The HSF executed an important community process that produced the CWP.

It was great to see this collaborative spirit continue here at HOW2019 and bodes well for us as a community to meet those challenges.

IRIS-HEP

We are focusing on 3 R&D areas from the CWP: Innovative Algorithms, Analysis Systems, and DOMA.

Plus training, a dedicated integration activity and continuity for the OSG services for the LHC.

We are just beginning our activities and are looking forward to collaborating with many of you in the coming years!