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

Computational and data science research to enable discoveries in fundamental physics

IRIS-HEP is a software institute funded by the National Science Foundation. It aims to develop the state-of-the-art software cyberinfrastructure required for the challenges of data intensive scientific research at the High Luminosity Large Hadron Collider (HL-LHC) at CERN, and other planned HEP experiments of the 2020's. These facilities are discovery machines which aim to understand the fundamental building blocks of nature and their interactions. Full Overview

The IRIS-HEP project was funded on 1 September, 2018, and is ramping up its activities.
The IRIS-HEP Steering Board represents the Institute’s stakeholders to provide, to the Executive Board, the stakeholder’s input on the priorities, execution, and strategy of the Institute.
Thank You

Tommaso Boccali (INFN-Pisa)  Oliver Gutsche (FNAL)  Margaret Votava (FNAL)
CMS  US CMS Ops Program

Paolo Calafiura (LBNL)  Gerhard Raven (VU/NIKHEF)
US ATLAS Ops Program  LHCb

Simone Campana (CERN)  Graeme Stewart (CERN)
WLCG  HSF

David Costanzo (Sheffield)  Ken Bloom (U. Nebraska-Lincoln)
ATLAS (James Catmore(Oslo) filling in)  The OSG Council

We will ask the stake-holders to reconfirm their appointments to the Steering Board once a year.
Welcome

steering-board@iris-hep.org
(you)

exec-board@iris-hep.org
(us)
Next Meeting Dates

Please let me know if any of these dates are problematic

- May 26, 2020
- August 25, 2020
- November 24, 2020
- Feb 16, 2021

(September is booked solid)
Today

- Introduction
  - Short updates on Analysis Systems and Innovative Algorithms
- Experiment Feedback
  - HSF
  - LHCb
- Progress from Focus Areas
  - DOMA
  - OSG-LHC - Canceled
- Feedback
Today

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G. Watts, IRIS-HEP Steering Board Meeting #3

Please add your comments/minutes to our live minutes!
Some Important Future IRIS-HEP Dates

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<tr>
<th>Date</th>
<th>What Is Going On</th>
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<td>Feb 27, 28</td>
<td>NSF 18-Month Review</td>
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<td>May June</td>
<td>IRIS-HEP Retreat and Y3 Planning</td>
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<td>Sept 1, 2020</td>
<td>Start of Y3 of IRIS-HEP</td>
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The NSF Director’s Review

Some comments relevant to the Steering Board from the NSF Program Director’s Review:

- Better defined interface between ATLAS/CMS/LHCb/WLCG and IRIS-HEP
  - More clarity on how IRIS-HEP fits into the bigger picture
- Better identify the process by which IRIS-HEP evolves.
- Metrics.
- As well as a number of framing issues

We also had an Advisory Panel meeting shortly after SB#4
A Coordinated Ecosystem for HL-LHC Computing R&D

The research and development efforts required to address the HEP challenges for the HL-LHC are daunting. The current LHC physics program is enabled by an elaborate software and computing ecosystem. The planned major hardware upgrades for the HL-LHC, and its planned physics program, will require significant evolution of this ecosystem. Major advances in software performance, adaptability, sustainability, workforce development and training that take full advantage of future data & compute platforms and leverage developments from outside of HEP will be required to succeed. A coherent R&D effort in software and computing is required to achieve the physics goals of that era.

https://indico.cern.ch/event/834880/

Presentations from many US players
- US ATLAS/US CMS
- CCE
- Exascale Computing Project
- ESNET
- SLAC, LBNL, Jlab, ANL
1. How does the ensemble of US Software R&D efforts fit together to implement the HL-LHC Software/Computing roadmap described in the Community White Paper and meet the challenges of the HL-LHC? Which areas are not covered by US R&D efforts?

2. How do the US Software R&D efforts collaborate with each other and with international efforts? How do these efforts align with and leverage national exascale, national NSF OAC priorities and trends in the broader community?

3. How should the US R&D efforts be structured and organized in order to impact planned updates (all in ~2021/2022) to the HSF Community White Paper, the software/computing part of the US Snowmass process and HL-LHC experiment-specific software/computing TDRs?

Approval of summary slides and report is under way (and very late)
“The result: a Programme of Work for the field as a whole, a multifaceted approach to addressing growing computing needs on the basis of existing or emerging hardware.” – Eckhard Elsen (CERN Director of Research and Computing), editorial published with Roadmap

49 citations so far!
Topical Meetings

From Indico:

February 2020
- 19 Feb: ACTS tracking NEW
- 12 Feb: HL-LHC tracking
- 03 Feb: Modeling computing resource needs/costs

January 2020
- 29 Jan: Primary vertex finding at LHCb
- 27 Jan: Allen project

Recordings on YouTube

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Innovative Algorithms
Projects

Scope of Innovative Algorithms (IA)

- Algorithms for real-time processing of detector data in the software trigger and offline reconstruction are critical components of HEP’s computing challenge.
- These algorithms face a number of new challenges during HL-LHC:
  1. Upgraded accelerator capabilities, with more collisions per bunch crossing (pileup)
  2. Detector upgrades, including new detector technologies and capabilities
  3. Increased event rates to be processed
  4. Emerging computing architectures

Innovative Algorithms will employ a wide range of strategies to address these challenges and ensure that experiments are ready for HL-LHC physics

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Updates

ACTS Project
• An initial version of the Combinatorial Kalman Filter (CKF) has been implemented within the ACTS project and the first complete pass of the track reconstruction chain has been run to produce track candidates.

MKFit Project
• Milestone to integrate vectorized KF tracking into the CMS software environment is done!
• Work in the HLT environment is proceeding
• Debugging and chasing corner cases for running in CMSSW

ML4Jets Project
• The ML4Jets conference was held at NYU (15-17 January), Nearly 120 people attended 3 days of plenary sessions.
• Work on parton models for use in ML research (portable outside HEP)

FastML Project
• First implementation in the context of the CMS HLT
• Now work on making it more realistic
• Tracking with a GNN is being ported to a FPGA

FastPID Project
• Working prototype for all particle types now in place at LHCb.
• Being checked for physics fidelity.
Analysis Systems

**Overall R&D goal for Analysis Systems**

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.

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Updates

Meetings

- **Machine Learning for Physics Sciences** workshop was held at NeurIPS2019. Organized by members of IRIS-HEP, 100 posters and several hundred attendees.
- **PyHEP 2020** will be at UT Austin, sponsored by IRIS-HEP, and held in conjunction with the large SciPy 2020 conference. Part of our efforts to integrate with the projects in the larger scientific community.

Papers

- Normalizing Flows on Tori and Spheres ([inspire](https://inspirehep.net))

ServiceX

- Multi-TB data set testing (20 minutes for 10 TB, bottleneck is rucio)
- TTree transformer commissioning (needed for CMS)
- Demonstrated at CHEP
- **func_adl** integrated and now being fleshed out as a simple query language.

pyhf

- Now part of the Scikit-HEP collection, along with awkward array and boost-histogram.
- Work ongoing to integrate pyhf fit data into HEPData
Feedback From US CMS and US ATLAS

- How can we better participate in the evolution of the IRIS-HEP program?
  - Retreat planned at the end of May (tentative)
- US CMS: Better promote OSG-LHC, DOMA, SSL, and IA activities inside CMS
- Co-locate more training activities with collaboration meetings
- US ATLAS/ATLAS IDDS efforts and ServiceX need to coordinate
- ML work needs to be grounded in solving real computing problems
- How do we move from current computing architectures to new heterogeneous ones?
- Please allow longer for feedback and discussion!
- LHCb: reach out to new offline computing coordinator (RECAST, etc.)
Conclusions, Comments…

• We are mostly focused on the Review at the moment

• Next: Deep dives into DOMA

• Thanks to US ATLAS and US CMS last time for giving us some feedback, and thanks this time to the HSF and LHCb.