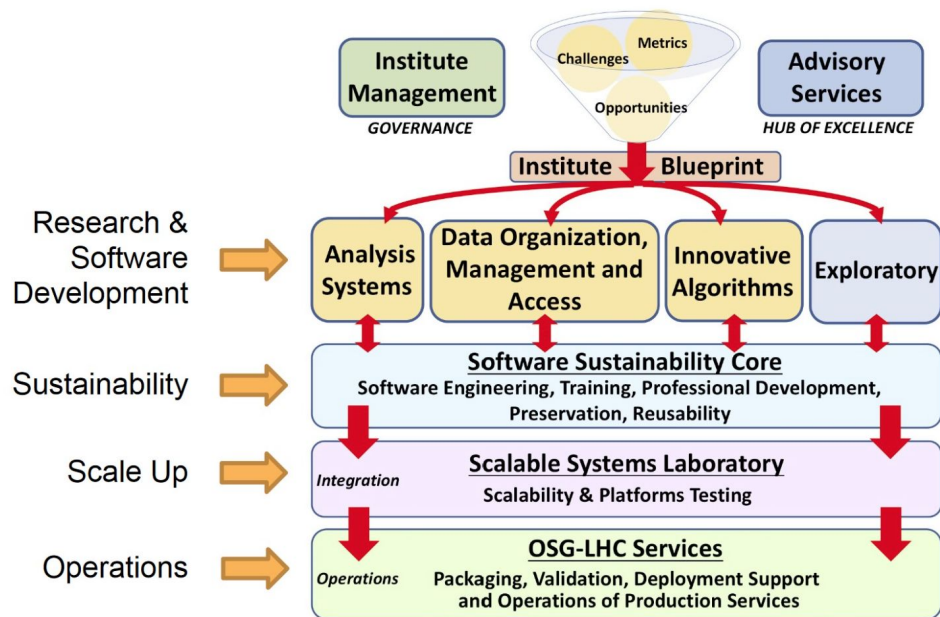


HSF Feedback for IRIS-HEP

Graeme A Stewart, for HSF Coordination and Working Groups

Feedback on the usual areas

- Concentrating on the main areas where the HSF and IRIS-HEP overlap
 - Analysis Systems
 - Innovative Algorithms
 - Training
- Blueprint Meetings
- Grand Challenges





















Training - HSF and IRIS-HEP Joint Activity

- Training found a basic rhythm again in 2021
 - Three Software Carpentry events held, all in virtual format
 - Very good to see **The Carpentries** re-engaged with us, alongside HEP specific training
 - Moving such events back to a hybrid mode will help us to really get to know the new students
 - Want to progress people from students to mentors (a la StarterKit)
- **Sudhir and Killian play a key role** in activating training within the HSF
- New training material for Matplotlib tapped into an enthusiasm that the trainers had
- Development of new material is important
 - Generally, **incentivising training** remains troublesome, especially for development of material
 - Did we progress on ‘pay to teach’?
- Key areas to continue to work in
 - C++ course (has also progressed a lot in the last year)
 - Even if this is moving to a higher level of the pyramid, it remains critical
 - Advanced HEP Python packages
- Links to HSF Software Tools and Packaging could be strengthened

Analysis Systems

- Continuing **support for the evolving Pythonic parts of the ecosystem** is extremely important
 - Impressive list of projects!
 - Allows the community to link to and explore new tooling options
 - **HL-LHC Review input contribution** to the data science area was important
- Common work with HSF Data Analysis working group
 - Analysis benchmarks
 - Declarative analysis languages
 - Metadata/systematics for analysis capture and reuse
- Links to PyHEP are now extremely strong, with two conveners supported by IRIS-HEP
 - Possibility of **joint meetings** should be explored
 - Fosters community development and reduces the overall meeting burden
 - Support for the **PyHEP workshops** is part of this - thank you!
- **Sustainability** is something to consider
 - Projects are well beyond R&D
 - People are the real treasure!

 <p>ADL Benchmarks Functionality benchmarks for analysis description languages More information</p>	 <p>AmpGen Generation and fitting for multibody hadron decays More information</p>	 <p>awesome-hep A curated list of awesome high energy and particle physics software More information</p>	 <p>Awkward Array Manipulate arrays of complex data structures More information</p>
 <p>Cabinetry Building complex template fits More information</p>	 <p>Decay Language Describe and convert particle decays More information</p>	 <p>exploratory-ml Analysis Reinterpretation More information</p>	 <p>Functional ADL Functional Analysis Description Language More information</p>
 <p>HEP Tables Heterogeneous Distributed Array Programming Environment More information</p>	 <p>Boost histogram Histogramming projects More information</p>	 <p>MadMiner Likelihood-free inference More information</p>	 <p>Particle Pythonic particle information More information</p>
 <p>ppx Cross-platform Probabilistic Programming eXecution protocol More information</p>	 <p>pyhf Differentiable likelihoods More information</p>	 <p>recast Analysis Reinterpretation More information</p>	 <p>ROOT on Conda-Forge Use ROOT in Conda through Conda-Forge More information</p>
 <p>Scikit-HEP Pythonic analysis tools More information</p>	 <p>uproot Read and write ROOT files in Python More information</p>		

Analysis Ecosystem Workshop II

- After the lull of 2021 (Zoom fatigue!) important to **get back to workshops**
- **IRIS-HEP - HSF co-organisation** was extremely useful
 - Event would not have happened in the same way without this
- Hope that conclusions from this workshop are as prescient as in AE1
 - Should **guide the community in developments for the next 5 years**
- Workshop stressed the need for cooperation between **Data Science and ROOT** components
 - Also an LHCC outcome

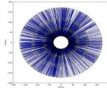
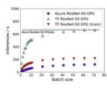



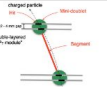
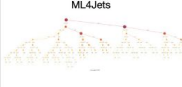

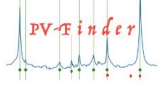


Analysis Facilities Forum and Analysis Grand Challenge

- Analysis Facilities became a hot topic in the last few years
 - Motivated by the challenges of HL-LHC
 - Helped a lot by the developments promoted by IRIS-HEP
- Initiative to broaden this to an HSF Analysis Facilities Forum was broadly welcomed
 - Provides a meeting point for all those involved and interested in providing the facilities and in using them
 - Significant potential, but relationship to other parts of WLCG not yet clear
- Grand Challenge will be a key part of proving they justify the effort to establish them
 - Would be keen to see others involved (e.g. SWAN at CERN; SWIFT-HEP) - broaden the base of the tests
 - Drive by concrete metrics - a key ones are scaling out the number of concurrent users and the breadth of workflows

Innovative Algorithms

- Impressive list of projects that have support from IRIS-HEP
 - Many key pieces of software for HL-LHC and other upgrades
- Focusing on use of Machine Learning and Accelerators
 - **ACTS** on GPUs very notable contribution
 - **Allen** and **mkFit** address immediate Run-3 needs
 - Strong ML themes match needs and opportunities
- David Lange did a great job for many years in this area (HSF Coordinator) - thank you!
 - Ensure that the links to the new coordinators are kept up (Andi, Dorothea, Jin)
- One area to explore is **cross-experiment possibilities**
 - By design in ACTS
 - Are there opportunities in other projects?

 <p>Accelerated GNN Tracking accel-gnn-tracking More information Exploratory</p>	 <p>Accelerators and ML for reconstruction Accelerated calorimeter reconstruction using Machine Learning as a Service More information Archived</p>	 <p>ACTS Development of experiment-independent, thread-safe track reconstruction. More information Development</p>
 <p>exploratory-ml Analysis Reinterpretation More information Development</p>	 <p>GPU Trigger Project Allen: a GPU trigger for LHCb More information Testing</p>	 <p>Line-Segment tracking Segment linking tracking for CMS More information Development</p>
 <p>ML4Jets Machine Learning for jets Machine learning for jets More information Development</p>	 <p>mkFit Modernizing Kalman filter tracking for CMS More information Deployed</p>	 <p>PV-Finder CNNs to find primary vertices More information Testing</p>

Other Areas

- Sustainable Software
 - Have the outcomes of the blueprint meeting made into best practice?
 - Could be a topic to link to HSF Tools group
- Blueprint Meetings
 - Not so many in the last 12 months
 - This is probably fine, given the stage that IRIS-HEP is at in its funding cycle
- EP R&D Project
 - Should still follow-up on topics of mutual interest (as much our fault as anyone else's)
 - PODIO for self-describing data models with backend code generation
 - CLUE as a novel algorithm for high granularity calorimeter reconstruction at high pile-up

Final General Remarks

- Generally we think IRIS-HEP is making a very positive contribution
 - And this is helping attract further support to the field
 - Working as a partner in projects is a good strategy - don't (and shouldn't!) own everything
- HSF and IRIS-HEP communities have a significant overlap
 - This is natural and a good thing, we both benefit
 - Two-way street, so of course we also welcome your feedback and input ([HSF Planning](#))
- Acknowledgement for individuals' areas of cooperation will help projects and people's career development
 - People are one area we need to sustain, as well as software products
- Actively explore additional opportunities to widen discussion and involvement
 - HSF Working Group Meetings and mini-workshops
 - PyHEP, Data Analysis, Reconstruction in particular
 - Compute Accelerator Forum series and Software and Computing Roundtable
 - *Sharing meeting slots also helps overcome meeting overload and Zoom-fatigue*