Introducing the
HEP Software Foundation

SHiP Collaboration Week, CERN, 27th March 2026

Eduardo Rodrigues (University of Liverpool), on behalf of the HSF

The HSF & its goals, in a few words

The HEP Software Foundation facilitates cooperation and common efforts in High Energy Physics software and computing internationally

- **Bottom-up *community* organisation**, started back in 2014
- We welcome your contributions! Join the Forum and other topical lists!

- Fairly comprehensive set of **HSF goals**:

- Share expertise on software development
- Raise awareness of existing software and solutions
- Help discussions to catalyse new common projects
- Promote commonality and collaboration in new developments to make the most of limited resources
- Aid developers and users in creating, discovering, using and sustaining common software
- Support training and career development for software and computing specialists
- Help the community to set priorities and goals for development
- Facilitate wider connections; while the HSF is a HEP community effort, it is very open to collaboration with other sciences

HSF organisation
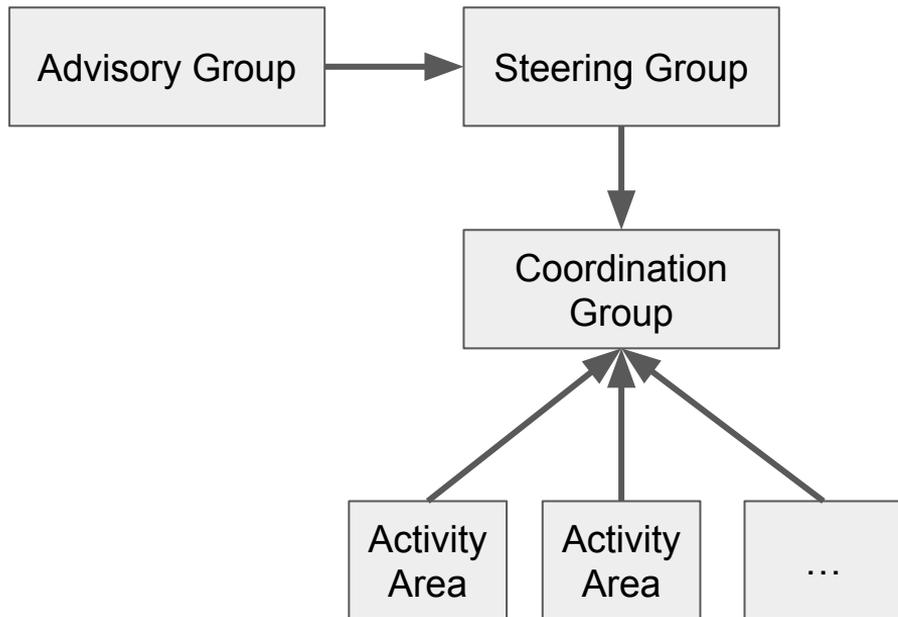
Activity Areas

- ***Where the work is done, relying on the commitment and given time of the conveners** - super appreciated!*
- Data Analysis
- Detector Simulation
- Physics Generators
- Google Summer of Code
- JuliaHEP
- PyHEP
- Reconstruction and Software Triggers
- Software Developer Tools and Packaging
- Training

Community Meetings

- HSF Seminars
- Compute & Accelerator Forum (w/ CERN's Openlab)

HSF organisation: Advisory Group

- **Discuss general HSF strategy and receive input from key communities**:
  ALICE, ATLAS, Belle-II, CMS, DUNE, LHCb, MCNet, SHiP, WLCG (at present)

- **Mandate** and composition detailed in a public document:

  SHiP part of the AG since 2026 !

  ## Mandate

  The purpose of the Advisory Group (AG) is to represent HSF Engaged Communities (ECs) that contribute to HSF activities, in order to provide strategic input to the HSF on their long-term strategies and needs. The AG *is an advisory group* and *not* a decision-making entity; decisions on HSF strategy are taken by the HSF Steering Group (SG). Engaged Communities are envisaged to cover major HEP experiments (including the LHC experiments) and WLCG.

- Meetings held annually (nominally), discuss e.g.
  - What to focus on
  - How to even better promote HSF activities
  - HSF affiliated projects

HSF organisation: Steering Group

- The **decision-making body responsible for the HSF strategy**
- Drives main directions, ensures key activities result in deliverables in due time
  - E.g., input documents to the EPPSU

- **Also delivers strategic inputs**, e.g. via ECFA/ICFA/... and other invited talks, representation in IRIS-HEP Steering Board, etc.

- In a way, the pot of energy for Sustainability
- Currently, 15 (senior) staff at labs and universities
  - Links to Activity Areas and community meetings

- **Mailing list for the SG**: hsf-steering@googlegroups.com
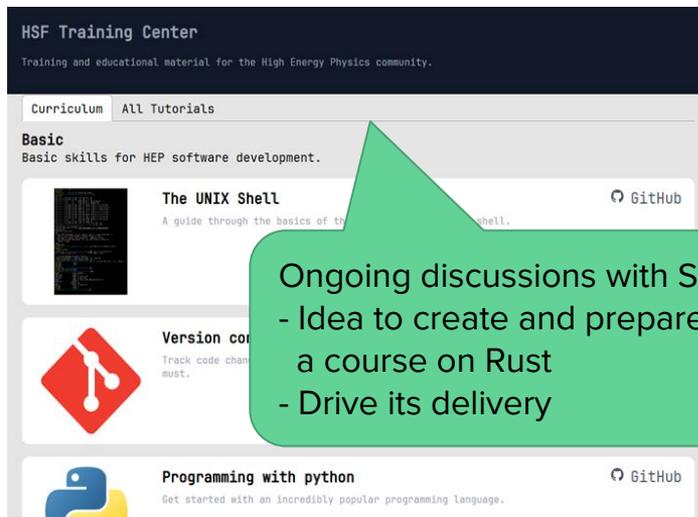
HSF Activities: Activity Areas (AAs)

- **Where the work is done, relying on the commitment and given time of the conveners** - super appreciated!
- *SHiP colleagues encouraged to engage … !*

- Different AAs have different "working modes" as per their needs
  - Some organise sporadic meetings or mini-events
  - Others mainly organise yearly workshops
- Training is special in that regular training events on various topics are organised throughout the year
- PyHEP and JuliaHEP help catalyse activities / focus efforts around their respective languages

- We also act as umbrella for HEP participation in the GSoC programme

- Further information at https://hepsoftwarefoundation.org/what_are_activities.html

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- Data Analysis
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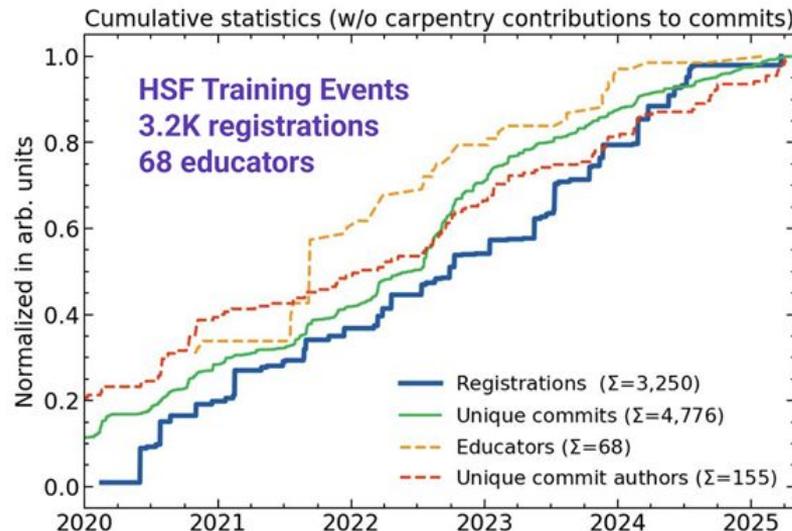- Software Developer Tools and Packaging
- Training

HSF Activities: example of [Training](#)

- Check the [HSF Training Center](#), currently listing some 20 modules!

HSF Training Center

Training and educational material for the High Energy Physics community.

Curriculum | All Tutorials

Basic
Basic skills for HEP software development.

The UNIX Shell
A guide through the basics of th... shell.   ○ GitHub

Version con...
Track code chan...
must.

Programming with python
Get started with an incredibly popular programming language.   ○ GitHub

Ongoing discussions with SHiP:
- Idea to create and prepare
  a course on Rust
- Drive its delivery

Cumulative statistics (w/o carpentry contributions to commits)

**HSF Training Events
3.2K registrations
68 educators**

Normalized in arb. units

— Registrations (Σ=3,250)
— Unique commits (Σ=4,776)
--- Educators (Σ=68)
--- Unique commit authors (Σ=155)

- We are always looking for instructors, contributors, etc. Do get in touch / check [Meetings](#)!
  - Oliver Lantwin has mentored C++ trainings on occasion - super appreciated :). Join the fun …

HSF Activities: workshops, seminars
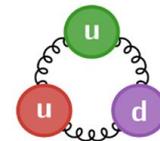
The HSF organises or co-organises several **workshops**:

- Yearly workshops jointly with WLCG
- PyHEP (Users), PyHEP.dev (Developers) and JuliaHEP workshops
- Etc.

It also (co-)organises **seminars**:

- HSF seminars: Indico agenda
- CERN's Compute and Accelerator Forum (CAF): Indico agenda

HSF Affiliated Projects and Software

- **We want to recognise and help promote important software for the whole community**
  - Software of wide and recognised interest and applicability beyond a single collaboration/experiment/...
  - See https://hepsoftwarefoundation.org/projects/affiliated.html

- **Goal of becoming an HSF Affiliated** is to
  - Certify that project/software meets appropriate software quality standards
    and is part of the HEP community software landscape (product recognition & visibility)
  - Raise recognition of developers for research software in HEP (people recognition)
  - Help promoting people committed to C&SW and help promoting relevant "products"

- Projects are evaluated according to a set of "**Affiliated Projects and Software Guidelines**"
  - https://hepsoftwarefoundation.org/projects/guidelines.html
  - Software tiers from EVERSE used to apply appropriate sets of criteria to software projects

HSF Affiliated Projects and Software

Two affiliated projects so far:

- **NNPDF** provides parton distribution function sets (e.g. to LHAPDF)
- **prmon**, monitor resource consumption e.g. relevant for software sustainability

Several in the pipeline:

Do not hesitate to point SHiP relevant projects/libraries to us !

NoPayloadDB + Client
Conditions Database

Pythia
MC event generator

Pepper, GPU accelerated parton level MC event generation

Madgraph5_aMC@NLO
MC event generator

See https://hepsoftwarefoundation.org/projects/projects.html

HSF Strategic inputs & "timely actions"

- We have a strong track record of submitting inputs to strategic deliberations
- We also take "timely actions" when / where relevant

Recent-ish examples:

- Community document ["The Critical Importance of Software for HEP"](#) contributed to the European Particle Physics Strategy Update process, on the critical areas of event generation, simulation, reconstruction, analysis and training and careers
  - Important first for us - document was endorsed by the major HEP experiments (ALICE, ATLAS, Belle II, CMS, DUNE, ePIC, LHCb), the MCnet collaboration and WLCG
- Creation of an Analysis Facilities Forum when AFs were a very hot & debated topic
  - We produced a [White Paper](#)
- Co-chairing by HSF SG member of the recently created [WLCG Sustainability Forum](#)

Inputs often provided in the form of HSF publications or technical documents …

HSF publications

- Reports, recommendations, studies, white papers, etc. are paramount to what we do ! Some examples:

  - See the full list of [Technical Notes](#) and [HSF Documents](#):

Analysis Facilities White Paper

arXiv:2404.02100 [hep-ex]

A Roadmap for HEP Software and Computing R&D for the 2020s

Software Foundation[5] · Johannes Albrecht[69] · Antonio Augusto Alves Jr[81] · Guilherme

Computing and Software for Big Science (2019) 3:7

1 Introduction
2 Software and Computing Challenges
3 Programme of Work
  3.1 Physics Generators
  3.2 Detector Simulation
  3.3 Software Trigger and Event Reconstruction
  3.4 Data Analysis and Interpretation
  3.5 Machine Learning
  3.6 Data Organisation, Management and Access
  3.7 Facilities and Distributed Computing
  3.8 Data-Flow Processing Framework
  3.9 Conditions Data
  3.10 Visualisation
  3.11 Software Development, Deployment, Validation and Verification
  3.12 Data and Software Preservation
  3.13 Security
4 Training and Careers
5 Conclusions
Appendix A - List of Workshops
Appendix B : Glossary
References

Computing and Software for Big Science (2021) 5:22

Software Training in HEP

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Abstract
The long-term sustainability of the high-energy physics (HEP) research software ecosystem is essential to the field new facilities and upgrades coming online throughout the 2020s, this will only become increasingly important. Meet sustainability challenge requires a workforce with a combination of HEP domain knowledge and advanced software The required software skills fall into three broad groups. The first is fundamental and generic software engineering Unix, version control, C++, and continuous integration). The second is knowledge of domain-specific HEP package practices (e.g., the ROOT data format and analysis framework). The third is more advanced knowledge involving speci techniques, including parallel programming, machine learning and data science tools, and techniques to maintain soft projects at all scales. This paper discusses the collective software training program in HEP led by the HEP Software Fou tion (HSF) and the Institute for Research and Innovation in Software in HEP (IRIS-HEP). The program equips particip with an array of software skills that serve as ingredients for the solution of HEP computing challenges. Beyond serving community by ensuring that members are able to pursue research goals, the program serves individuals by providing int lectual capital and transferable skills important to careers in the realm of software and computing, inside or outside HEP

arXiv:2504.01050 [hep-ex]

The Critical Importance of Software for HEP

Prepared by the HEP Software Foundation, with inputs from the HEP community.

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This document has been endorsed by the following experiments and communities:

ALICE, ATLAS, Belle II, CMS, DUNE, ePIC, LHCb, MCnet, WLCG

Summary

- The HSF has been striving for common efforts in Computing and Software, and better and sustained software for a decade !

- It values software work, essential in HEP, and works towards appropriate recognition

- Several actions have seen the light over the years, E.g. the HSF Affiliation programme

- We look forward to engaging with you !
  - Engagement has already started - nice
  - Some pointers given for possible routes forward
  - Do not hesitate to get in touch and share ideas

Thank you for listening

and

looking forward to hearing from you!