



# *HSF*

## *The HEP Software Foundation*

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EVERSE Community Engagement Event, CERN, 5<sup>th</sup> February 2026

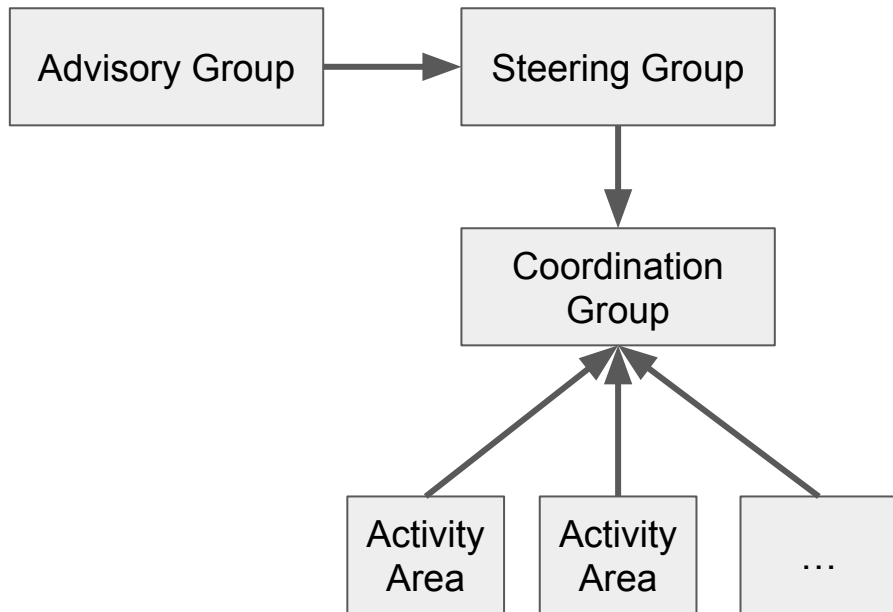
Eduardo Rodrigues (University of Liverpool), on behalf of the HSF

# 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 [more!](#)
- 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

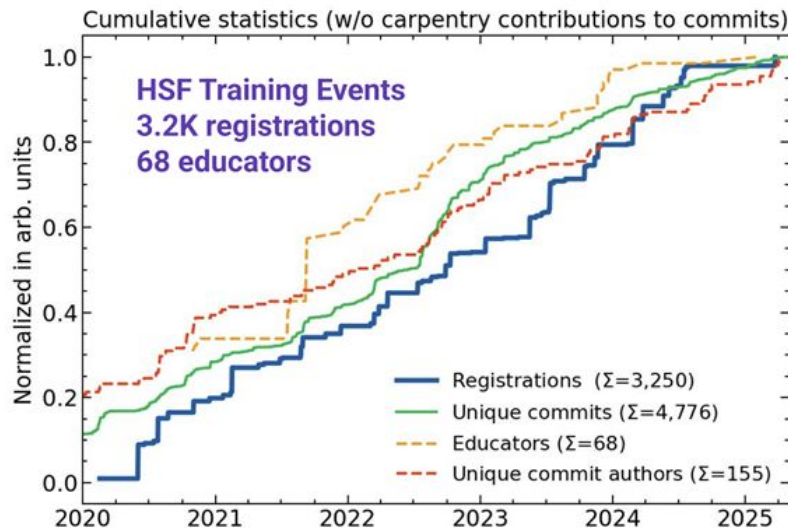
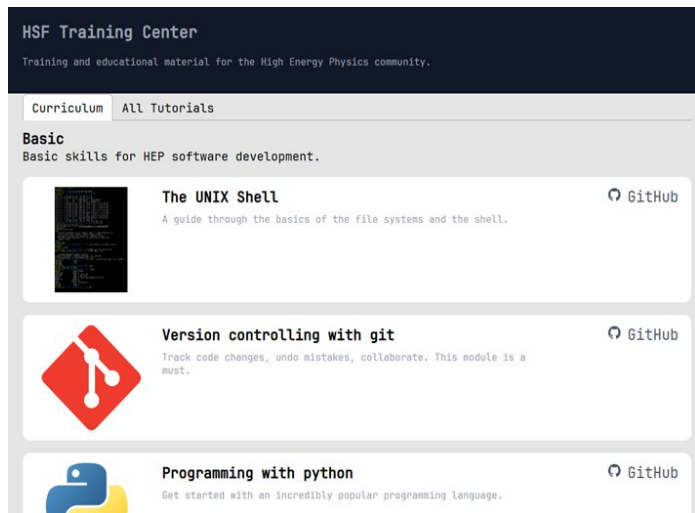
## Community Meetings

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

# HSF Activities: example of Training

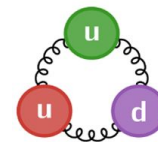
HSF training materials and events are featured in the [EVERSE training catalogue](#) !

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



- We are always looking for instructors, contributors, etc. Do get in touch / check [Meetings](#)!

# HSF Activities: workshops, seminars



The HSF organises or co-organises several **workshops**:

- Yearly workshops jointly with WLCG (Worldwide LHC Computing Grid)
- 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>

# 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:



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 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<sup>5</sup> · Johannes Allbrecht<sup>69</sup> · Antonio Augusto Alves Jr<sup>81</sup> · 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 of new facilities and upgrades coming online throughout the 2020s, this will only become increasingly important. Meeting this sustainability challenge requires a workforce with a combination of HEP domain knowledge and advanced software engineering skills. The required software skills fall into three broad groups. The first is fundamental and generic software engineering techniques, including parallel programming, machine learning and data science tools, and techniques to maintain software projects at all scales. The second is knowledge of domain-specific HEP packages and the Institute for Research and Innovation in Software in HEP led by the HEP Software Foundation (HSF) and the Institute for Research and Innovation in Software in HEP (IRIS-HEP). The program equips participants with an array of software skills that serve as ingredients for the solution of HEP computing challenges. Beyond serving the community by ensuring that members are able to pursue research goals, the program serves individuals by providing intellectual 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.

#### Edited by:

Christina Agapopoulou<sup>1</sup> · Claire Antel<sup>2</sup> · Saptaparna Bhattacharya<sup>3</sup> · Steven Gardiner<sup>4</sup> · Krzysztof L. Genser<sup>5</sup> · James Andrew Gooding<sup>6</sup> · Alexander Held<sup>7</sup> · Michel Hernandez Villanueva<sup>8</sup> · Michel Jouvin<sup>9</sup> · Tommaso Lari<sup>10</sup> · Valeria Lukashenko<sup>11</sup> · Sudhir Malik<sup>12</sup> · Alexander Moreno Briceño<sup>13</sup> · Stephen Mrenna<sup>14</sup> · Inés Ochoa<sup>15</sup> · Joseph D. Osborn<sup>16</sup> · Jim Pivarski<sup>17</sup> · Alan Price<sup>18</sup> · Eduard Rodrigues<sup>19</sup> · Richa Sharma<sup>20</sup> · Nicholas Smith<sup>21</sup> · Graeme Andrew Stewart<sup>22</sup> · Anna Zaborowska<sup>23</sup> · Dirk Zerwas<sup>24</sup> · Maarten van Veghel<sup>25</sup>

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 strives for appropriate recognition
- Several actions have seen the light over the years, E.g. the HSF Affiliation programme
- For 2026:
  - Engage with less represented countries and regions
  - Look further for relevant (cross-)collaborations
  - ...

Thank you for listening  
and  
looking forward to hearing from you!

# HSF organisation: Advisory Group

- **Discuss general HSF strategy and receive input from key communities:**  
ALICE, ATLAS, Belle-II, CMS, DUNE, LHCb, MCNet, WLCG (at present)
- First (annually, by default) meeting held in January 2025
  - How to even better promote HSF training activities
  - How to best bootstrap the idea of “HSF affiliated projects”
  - Funding, e.g. to maintain a coordination role
- **Mandate** and composition detailed in a [public document on the HSF website](#):

## 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.

# 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](mailto: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!
- 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=AAs 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](https://hepsoftwarefoundation.org/what_are_activities.html)

- Data Analysis
- Detector Simulation
- Physics Generators
- Google Summer of Code
- JuliaHEP
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- Reconstruction and Software Triggers
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# HSF Activities: seminars



- Held monthly, typically (alternating with the CAF meetings)
  - [Indico](#) agenda
  - Recent topics: AI assisted tools, dCache, AdePT and Celeritas for detector simulation on GPUs, 4D reconstruction
  
- The same team jointly organises CERN's Compute and Accelerator Forum (CAF)
  - [Indico](#) agenda
  - Recent topics: A Formal but Pragmatic Foundation for General-Purpose Operating Systems, Error estimation for floating point operations via automatic differentiation, Julia and GPUs