

# Software Training and Sustainable HEP

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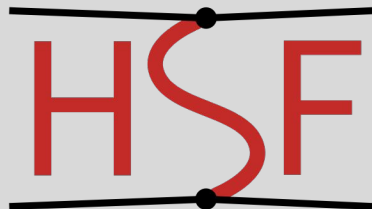
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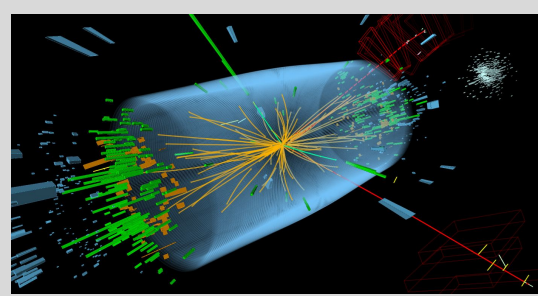
HEP Software Foundation



*Sustainable HEP Workshop, CERN, 28-30 June 2021*

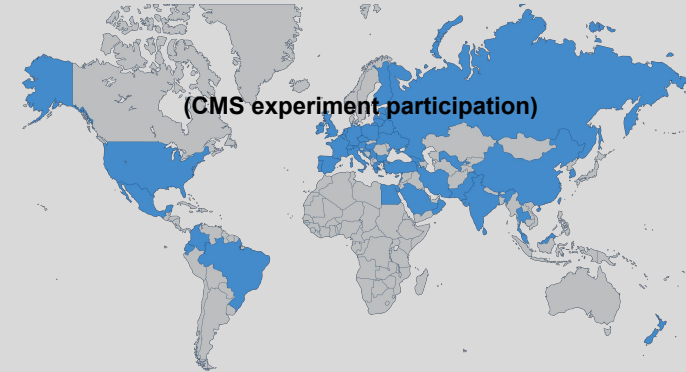
# Software a key to HEP success

- Solving software challenges integral to the success of current and future HEP experiments (DUNE, HL-LHC etc.)
- Software and computing systems are key subsystems of our experiments, involve significant budget
- Maximizing science from the hardware investments increasingly relies critically on software
- Software skills essential for a successful HEP physicist, and for career evolution for people trained inside HEP, seeking career in industry



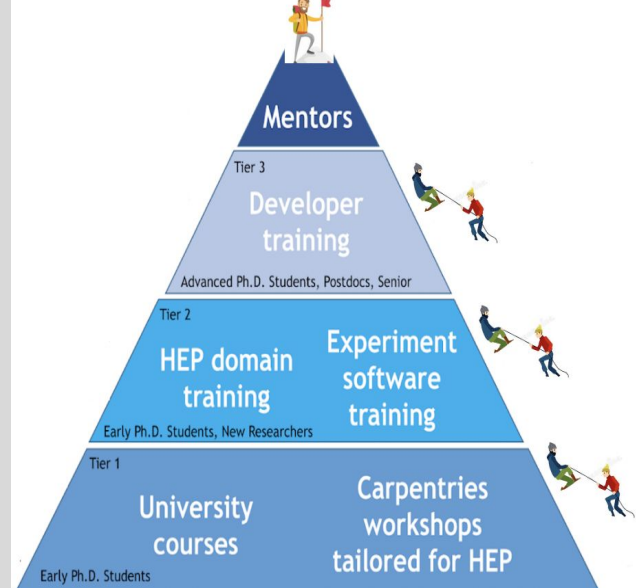
# HEP Paradigm

- **Complex computing and physics analysis tools**
- **Diverse software ecosystem**
  - *Analysis Preservation, Event Generators, Detector Simulation, Trigger, Event Reconstruction, Data Analysis, Interpretation, Simulation, Visualization, Data Processing Frameworks, Machine Learning, Data Management Organisation & Access, Facilities, Distributed Computing, Security*
- **Big collaborations (examples)**
  - **BELLE II** - 1200 collaborators/121 institutes/26 countries
  - **CMS** - 4000 collaborators/200 institutes/50 countries
  - **ATLAS** - 3000 collaborators/174 institutes/38 countries
  - **LHCb** - 1200 collaborators/76 institutes/16 countries
  - **ALICE** - 1000 collaborators/100 institutes/30 countries
  - **DUNE** - 1000 collaborators/180 institutions/30 countries
- **Users resident in different time zones but expected to contribute irrespective and effectively**
- ***You want to have a high impact and advance HEP? - Software Training might be your most effective choice for sustainability !***



# So what are we doing

- While all HEP experiments have their specific and targeted training, a lot of the HEP software stack is the same (So why reinvent the wheel)
- HSF/IRIS-HEP training group is leading the common HEP Software training



- Provide training in the computing skills to produce high quality sustainable software, solve HEP challenges, software-trained workforce
- Train every new HEP entrant in the related software and tools
- Build community for Scalability and Sustainability
- Training style - Hands-on, Student-centric, Experiment Agnostic, Reuseable, Open and Accessible, Inclusive
- Broader impact - reach out to STEM aspirants in high schools via their teachers and involve students early on

# Kicked-off to a great start and in last 2 yrs, we have created...

- **Software modules**

- Basic software curriculum
  - One introductory software training curriculum that serves HEP newcomers
- And many more. Check them out at
  - <https://hepsoftwarefoundation.org/training/curriculum.html> )



## And organised.....

- **Training events**

- 13 software training, 6 in-person, 7 online trainings, 1000 participants

- **Outreach events**

- Training material for outreach, 5 workshops



## And learnt lessons to get better

- Pros and cons of in-person and virtual methods of training
- Covid enforced virtual training expanded our reach
- Feedback mechanism via surveys cycles back to improve the next training

..... But we need your help in sustainable success

# Virtual training vs in-person training experience

- Pivot to remote training due to COVID
  - Adapted quickly
  - 7 online training workshops (last 12 months)
- Attendance increased : few dozens → few ***hundred***
- Positives
  - Broader reach, more participants: >100 registrants
  - No travel costs → critical for some supervisors
  - Easier logistics, easy to reach all timezones
  - Materials are recorded and archived (videos)
  - No specialized rooms with big display screens and sitting space

- **Limitations**

- Active/meaningful interactions
- Mentors in different time zones
- Keep everyone engaged

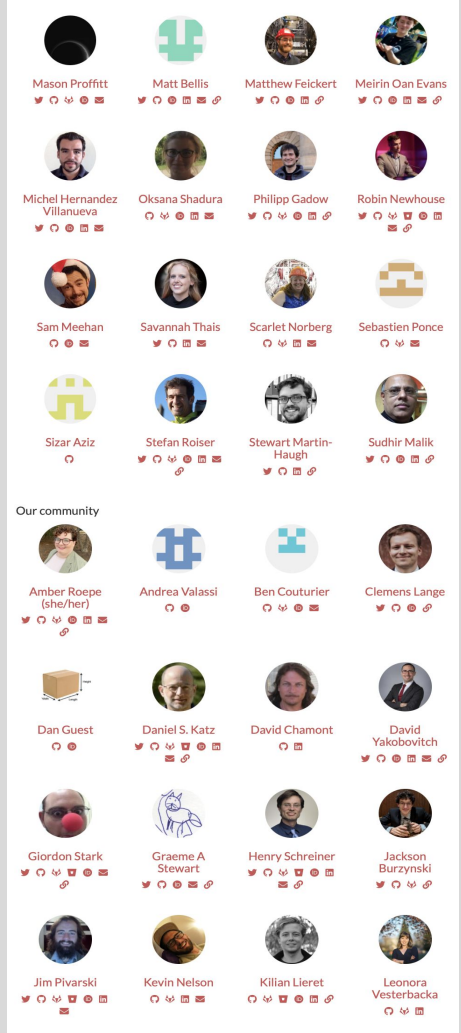
- **Important things**

- Clearly-defined roles for instructors
- Effective chat application is essential
  - mattermost/discord/slack



# Benefits of contributing

- Feeling of community, satisfaction, giving back
- Creativity in designing new lessons,
- Funding to pay for your efforts, travel
- Build network, connections that might help in your projects and perhaps find a job
- Become “famous” (we advertise your photo and links to your work)
  - <https://hepsoftwarefoundation.org/training/community.html>



## Further Information on Software Training

- **Training events:** <https://indico.cern.ch/category/11386/>
- **Material:** All the training modules developed so far resides: <https://hepsoftwarefoundation.org/training/curriculum.html>
- **Community:** Our training community is listed here: <https://hepsoftwarefoundation.org/training/community.html>
- **Procedure:** how to request and organize a training: <https://hepsoftwarefoundation.org/training/howto-event.html>
- **Funding:** Funding for training events is provided by the IRIS-HEP/FIRST-HEP



### Training Partners



<https://iris-hep.org/>  
OAC-1836650



**FIRST-HEP**  
<http://first-hep.org/>  
OAC-1829707  
OAC-1829729

### Training Motivation

