

# EP R&D Software

Graeme and Jakob



**R&D**  
**on EXPERIMENTAL TECHNOLOGIES**

CERN's Experimental Physics Department has launched a process to define its R&D programme on new Experimental Technologies. The R&D work would span a 5 year period from 2020 onwards with a possible extension for another 2 years and cover detector hardware, electronics and software for new experiments and detector upgrades beyond LHC Phase-II.

**1<sup>st</sup> Workshop**  
16 March 2018 (full day)  
CERN, main auditorium

Please register!  
<http://indico.cern.ch/eP-RD-Workshop1>

**4 working group sessions**  
**Special R&D proposals**

- Silicon detectors
- Gas detectors
- Calorimetry and light based detectors
- Detector Electronics
- IC Technologies
- High Speed Links
- Software
- Detector Magnets

 Experimental Physics Department  
EP-ET (Experimental Technologies)

# European Strategy Update



## 2020 Strategy Statements

### 4. Other essential scientific activities for particle physics

#### Computing and software infrastructure

- There is a need for strong community-wide coordination for computing and software R&D activities, and for the development of common coordinating structures that will promote coherence in these activities, long-term planning and effective means of exploiting synergies with other disciplines and industry
- A significant role for artificial intelligence is emerging in detector design, detector operation, online data processing and data analysis
- Computing and software are profound R&D topics in their own right and are essential to sustain and enhance particle physics research capabilities
- More experts need to be trained to address the essential needs, especially with the increased data volume and complexity in the upcoming HL-LHC era, and will also help in experiments in adjacent fields.

d) Large-scale data-intensive software and computing infrastructures are an essential ingredient to particle physics research programmes. The community faces major challenges in this area, notably with a view to the HL-LHC. As a result, the software and computing models used in particle physics research must evolve to meet the future needs of the field.

*The community must vigorously pursue common, coordinated R&D efforts in collaboration with other fields of science and industry to develop software and computing infrastructures that exploit recent advances in information technology and data science. Further development of internal policies on open data and data preservation should be encouraged, and an adequate level of resources invested in their implementation.*

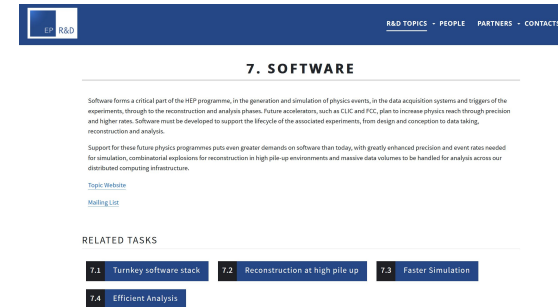
# Personnel News

- Good news on the recruitment front
  - For the Faster Simulation task, Dalila Salamani will start in January 2021
  - For the Efficient Analysis task, Javier Lopez-Gomez will start in September 2020

# EP R&D Website

- The EP R&D website is still (yes, still...) “under development”
  - <https://test-ep-rnd.web.cern.ch/>
- I have made some updates to the content and added a few links
- We should see this website as having two purposes
  - A portal that leads to more substantive information on each task
    - Contact information and other pages (e.g. repositories)
  - A place to collect talks and presentations from the tasks

## WORK PACKAGES



EP R&D R&D TOPICS - PEOPLE PARTNERS - CONTACTS

### 7. SOFTWARE

Software forms a critical part of the HEP programme, in the generation and simulation of physics events, in the data acquisition systems and triggers of the experiments, through to the reconstruction and analysis phases. Future accelerators, such as CLIC and FCC, plan to increase physics reach through precision and higher rates. Software must be developed to support the lifecycle of the associated experiments, from design and conception to data taking, reconstruction and analysis.

Support for these future physics programmes puts even greater demands on software than today, with greatly enhanced precision and event rates needed for simulation, computational pipelines for reconstruction in high pile-up environments and massive data volumes to be handled for analysis across our distributed computing infrastructure.

[Topic Website](#)  
[Mailing List](#)

#### RELATED TASKS

- 7.1 Turnkey software stack
- 7.2 Reconstruction at high pile-up
- 7.3 Faster Simulation
- 7.4 Efficient Analysis



## 7.1. TURNKEY SOFTWARE STACK

Detector studies for future colliders critically rely on well-maintained software stacks to model detector concepts and to understand a detector's limitations and physics reach. These software stacks resemble the offline software of a running experiment, including event generation, detector response simulation, reconstruction algorithms, analysis tools, and distributed computing resource management. In contrast to the software suite of running experiments, detector studies tools must be lightweight and be able to rapidly adapt to detector design changes and varying collider conditions. Moreover, the software must handle a wide range of detail during the detector development lifecycle, from first estimates based on a coarse-grained geometry during the inception phase to detailed physics studies using sophisticated reconstruction algorithms on simulated event data.

The goal of this project is the development of a single turnkey software stack that can be used for the detector studies of both FCC and CLIC communities. A large challenge is in identifying a maximum subset of detector-independent data structures and algorithms, in particular in identifying common parts of the event data model, which is a precondition for applying common reconstruction algorithms. A practical approach is required towards documentation, software dependencies and detector-specific plugin interfaces such that a low maintenance stable software core is readily usable for established and new detector study groups.

### Contact and Collaboration

For more information about the Turnkey Stack task and how to collaborate, please contact [André Sailer and Valentin Volk](#).

### DOCUMENTS



Key4hep GitHub Project



EDM4hep common event data  
model repository

### PRESENTATIONS



Key4hep - Plans for Deployment  
(Valentin Volk, Pre-GDB, 5 May 2020)

# Hardware News

- Hosting
  - We have discussed with colleagues in IT and they have agreed to host the hardware for the R&D project in the data centre
  - There was some concern that these might be misunderstood as a production resource, but we have explained that they are for a relatively small R&D group
  - We will manage the machines, with root access
- Machine for Simulation Task has been ordered
  - Powerful GPU setup, twin NVIDIA RTX8000 GPUs
- Machine for Tracking Task has been quoted for, DAI this week
  - Multi-thread, AMD Ryzen Threadripper 3970X (32 core, 64 threads)
  - With an NVIDIA T4 GPU

# Next Meeting

- We are entering the summer break period
- Propose to resume with next meetings in **September**
  
- Please take a look at the website though and make suggestions for more links and content refresh before the break