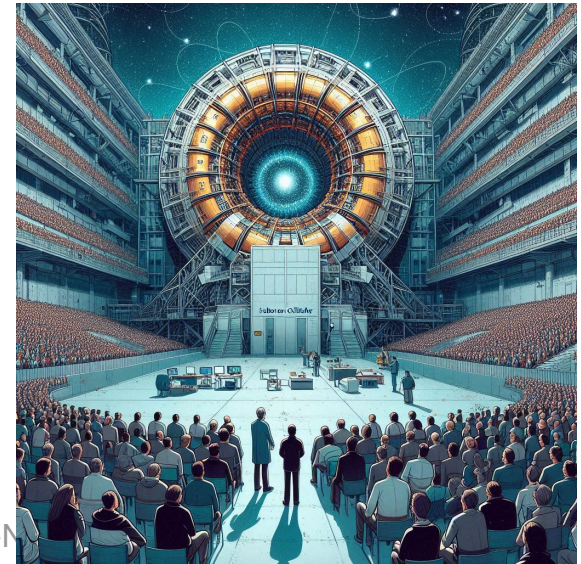
SWIFT-HEP and ExaTEPP Introduction

11 November 2024

Davide Costanzo



Introduction

Welcome to the SWIFT-HEP #8, ExaTEPP #3

- SWIFT-HEP alternating workshops: on our own (Autumn) and with GridPP (Spring)
  Is 9-10 April a good time for our Spring meeting in Manchester?
- ExaTEPP touring Britain, Swansea (Wales), Edinburgh (Scotland), Warwick (England)
- Big thanks to Ben and the Warwick team for organising this event!

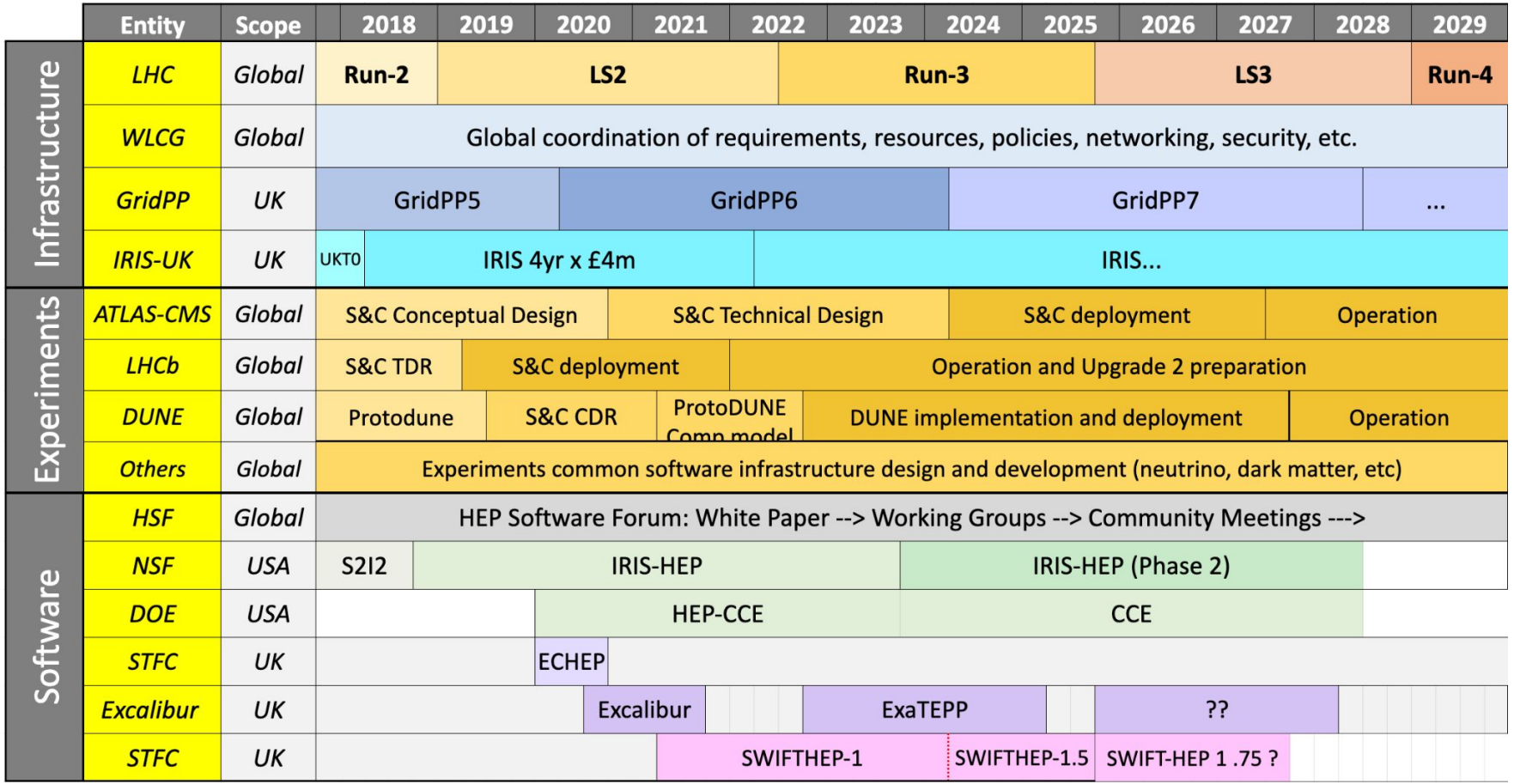
Meeting etiquette

- “Usual” code of conduct applies
- There may be several people you haven’t met before. Please introduce yourselves during break, discussions, etc

Overall projects timeline:

- ExaTEPP at the end (Nov 2024). Some no cost extension in place
  + institute top-ups (Sep 25). Future unclear
- SWIFT-HEP 1.5 funded till Sep 25,

Timeline (incomplete)



SWIFT-HEP 2

Dear Professor Costanzo,

The Statement of Interest (SOI) for the proposal “SWIFT-HEP 2” was considered by Science Board at its meeting on 12 June 2024.

This SoI requested support for SWIFT-HEP2 which is aimed to deliver software infrastructure for high energy physics at a range from £2.3M - £8M spread over four years beginning in October 2025. This would be a further phase on from the current project SWIFT-HEP which is currently funded at a level of £2.07M from April 2021 to 30 September 2025.

Science Board noted that SWIFT-HEP is part of an international programme of software development addressing key challenges around volume of data, need for increased computational efficiency, evolution of hardware, facilitating the exploitation of HEP experiments.

Science Board recognised the strength of the science case, value of the work, the efficiency that has been demonstrated with the software engineering efforts and how the project aims to deliver substantial improvements for current and future high luminosity experiments. However, the project funding requested is not currently affordable at the level requested within the PPAN programme, and so a proposal cannot be invited to PPRP at this time. Science Board also highlighted that there are emerging opportunities and funding calls published by UKRI Digital Research Infrastructure that could be accessed to support the software development and AI workstreams.

Science Board is working to develop the PPAN Roadmap, which will define a balanced programme of excellent science across PPAN research areas over a 10-year timeframe. This will also include a discussion on computing programmes which underpin the particle physics community. Please could you provide an update to the SoI for the minimum level of effort and key deliverables from October 2025 to 30 September 2027. This will help inform the discussion and enable the Board to make a recommendation on future funding. The deadline is 02 September 2024.

Follow up sent on 2 September

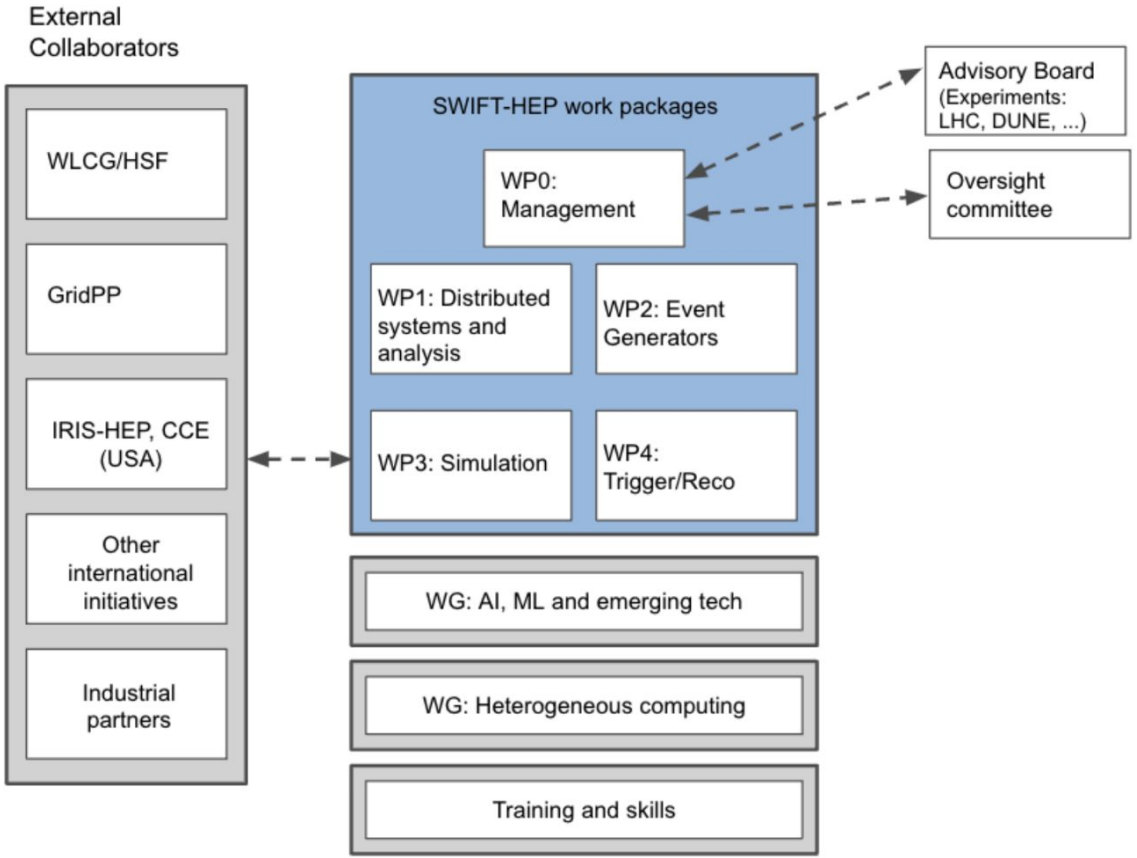
- The minimum scenario requires 5 FTEs of effort, plus some funding for workshops and travel at a cost of £585k/year and a total of £1170k over two years. The funding profile is flat across the two years as the funding is to cover existing staff (although salary increases/inflation needs to be included);

- A list of main deliverables per work package is provided below. Broadly the scope of the next two years is to fully exploit and optimise the prototypes that were developed during the first phase of SWIFT-HEP;

- We will participate in DRI calls as much as possible within the mission of the project. To achieve the best outcomes from these programmes, it is important to have community participation, for which “working groups” are proposed as described below;

- We are in the process of preparing a bid to participate in the CoSeC initiative as a Collaborative Computational Project (CCP). The scope of this initiative is still under discussion.

SWIFT-HEP organisation - Bridging and next phase



Since September…

A bid to CoSeC was submitted (Leads: Ed Bennett and Ben Morgan
- 1 FTE*year in Warwick/Swansea + 1 FTE*year from CoSeC
- Part of the plan is to write a “roadmap for particle physics software in the UK”

Chris Gütschow received a CoSeC fellowship
- Some money for workshops, etc

A proposal for training and skills from DiRAC was successful

A proposal for “accelerated computing” submitted to the first stage
(Led by Durham, with a wide participation across various UKRI themes)

No news on the SWIFT-HEP continuation (phase 1 ¾)
-Are things trickling down after the spending review?
No news on a possible ExCALIBUR new phase

While it is useful to work with colleagues across domains.
We need to retain some **dedicated particle physics funding**

Rebooting SWIFT-HEP

The project started in 2020, we passed our 4th year anniversary! A lot has changed since then

- We found ourselves a role within the international community. Strong support in the UK
- Some people moved on
- The organisation has changed

What we need to do (in my opinion) - And after we know where we are going(!)

- Refresh the Advisory Board. But also update the HEP community (eg via hi-phy)
- Refresh the conveners' role and replace people who left
- We never had a project manager from PPD (despite funding for it…) And to be fair we always applied a light-touch project management
- We need a fraction of a project administrator

Some work can start, and we don't want to do this in a rush!
(But we also don't want to waste time)

A personal note…

The recurring theme of RSE career development

Working with the RSE community over the past few years was a great experience!

Digital research infrastructure is not useful without the people who operate it!

Development of skills and giving career opportunities to people in this area is critical
- Academia vs industry
- Long term funding for RSEs and a clear career progression path

We should do this together across research communities
- Working with the RSE society and other organisations

Discussion on European Strategy, Funding, etc

A bit of history…

Journal of Scientific Instruments (Journal of Physics E) 1969 Series 2 Volume 2

The use of computers in high energy physics experiments

(link)

D Lord and G R Macleod
Data Handling Division, CERN, Geneva, Switzerland

1.3 *Areas of computer use*

Computers are used in the planning, data acquisition and data analysis phases of high energy physics experiments, as well as in control functions for accelerators (Howard 1967a, beam switchyards (Howry 1967) and bubble chambers (Simpson 1967). In planning an experiment simulation calculations can be made by using Monte-Carlo techniques (James 1968) for estimating event rates to be expected, counting rates due to background, optimum disposition of detectors and so on. Much beam optics design (Whiteside and Gardner 1963)

CERN: “Where the web was born” (1989)

… new in 2024

- From the physics Nobel prize information (2024)

During the 1990s, ANNs became a standard data analysis tool within particle physics experiments of ever-increasing complexity. [...]

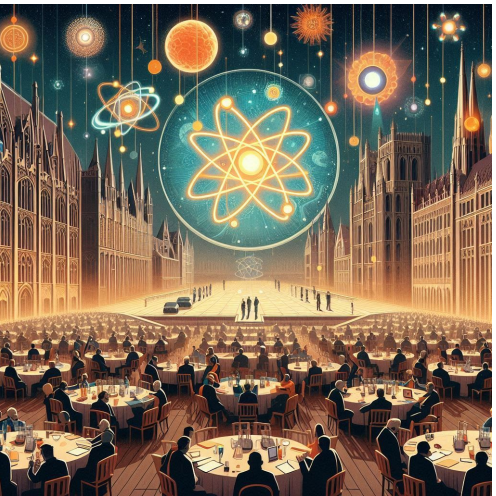
ANNs improved the sensitivity of searches for the Higgs boson at the CERN Large ElectronPositron (LEP) collider during the 1990s [44], and were used in the analysis of data that led to its discovery at the CERN Large Hadron Collider in 2012 [45]. ANNs were also used in studies of the top quark at Fermilab [46].

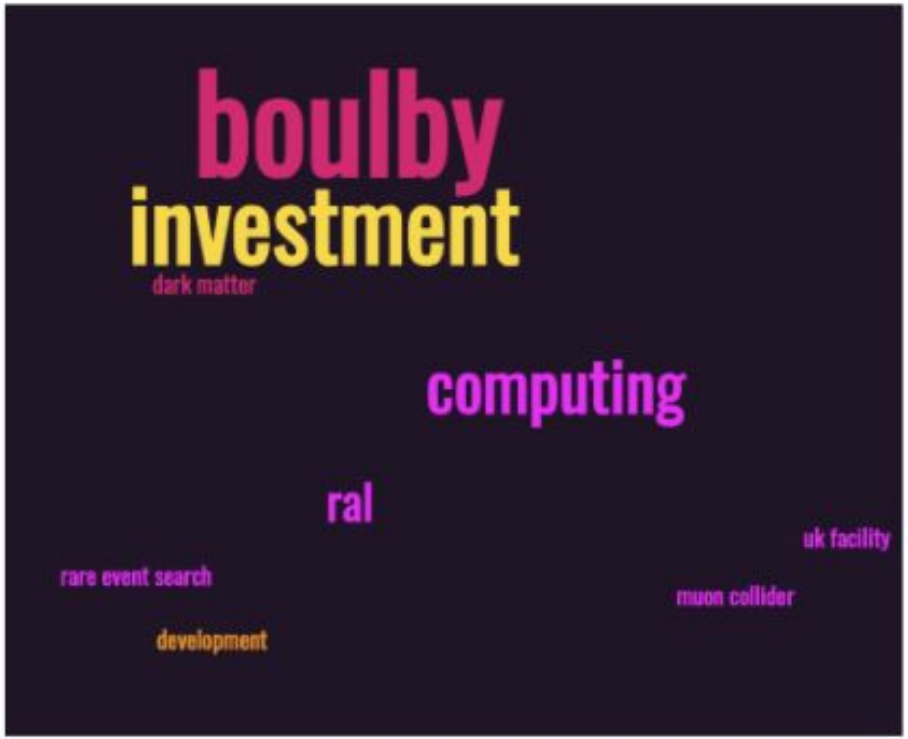
Software and computing in HEP - statements from funders

- From the European Strategy of Particle Physics (2020): (update in 2025)
  Large-scale data-intensive software and computing infrastructures are an essential ingredient to particle physics research programmes [...] **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.** (link)
- In the US, the Snowmass process included a "Computational frontier" (link) (2021-22)
  Along with others (energy, neutrino, rare processes, cosmic, theory, accelerators, instrumentation)
- The UK Particle Physics Technology Advisory Panel (PPTAP) (link) (2022-23)
  [34] Likewise within software and computing the UK has significant leadership in a significant number of important areas, including in exploitation of computing accelerators, exploitation of low power compute units, computing operations, enabling software and computing, reconstruction algorithms, software framework development, development of cross- experiment development tools, use of HPC and development of collision simulation/generation programmes.
- The HEP Software Foundation (HSF) established (2014) to meet the demand of a software "upgrade"
  Along with the **SWIFT-HEP** project in the UK (2020-)

Particle Physics Advisory Panel last summer

Wordle from Particle Physics Advisory Panel (link)
Q: Key infrastructure requirements





European Strategy for PP - Drafting day in Daresbury

To protect R&D in detectors, software, and computing, funding should be safeguarded and ideally ring-fenced. This will ensure the R&D programme is not eroded by current or future large-scale project commitments. This strategy is essential for securing the technical capabilities and advancements that will drive future success of particle physics.

Software and computing are essential for the development and operation of modern particle physics experiments, which generate and process massive datasets (exabytes by the late 2020s). To maximize the physics potential of future colliders, we must leverage modern computing technology for both low-latency (e.g., trigger-level) and high-latency (e.g., offline processing). Advancements in hardware and software will be pivotal for future particle physics research. To stay at the forefront, we must adopt emerging technologies like AI, collaborating with other research and industry sectors.