

ExaTEPP

Steering group introduction

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ExaTEPP introduction

- Theoretical and Experimental Particle Physics at the Exascale Frontier
- Part of the ExCALIBUR high-priority use cases phase 2
- History:
 - Two use cases in phase 1. Theoretical particle physics (ExaLAT) and experimental particle physics (ExCALIBUR-HEP)
 - Lot of joint work during covid times. A school and a document on RSE knowledge integration
 - Decided on a broader “particle physics” approach for phase 2
- Collaboration:
 - Edinburgh, Hartree, Sheffield, Swansea, Warwick funded. Plus a much larger community behind
 - Covering: Physics, Mathematics and Computer Science
 - Direct collaboration with ECP teams working in particle physics
- Funding:
 - About 3 FTE of mostly RSE effort over 2 years. Plus travel and workshops (Around £700k)

Software and computing in particle physics

- From the European Strategy of Particle Physics (2020):
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](#))
Along with others (energy, neutrino, rare processes, cosmic, theory, accelerators, instrumentation)
- The UK Particle Physics Technology Advisory Panel (PPTAP) ([link](#))
[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 to meet the demand of a software “upgrade”
Along with the [SWIFT-HEP](#) project in the UK

Sustainability and future compute requirements

Increase of demand for compute resources

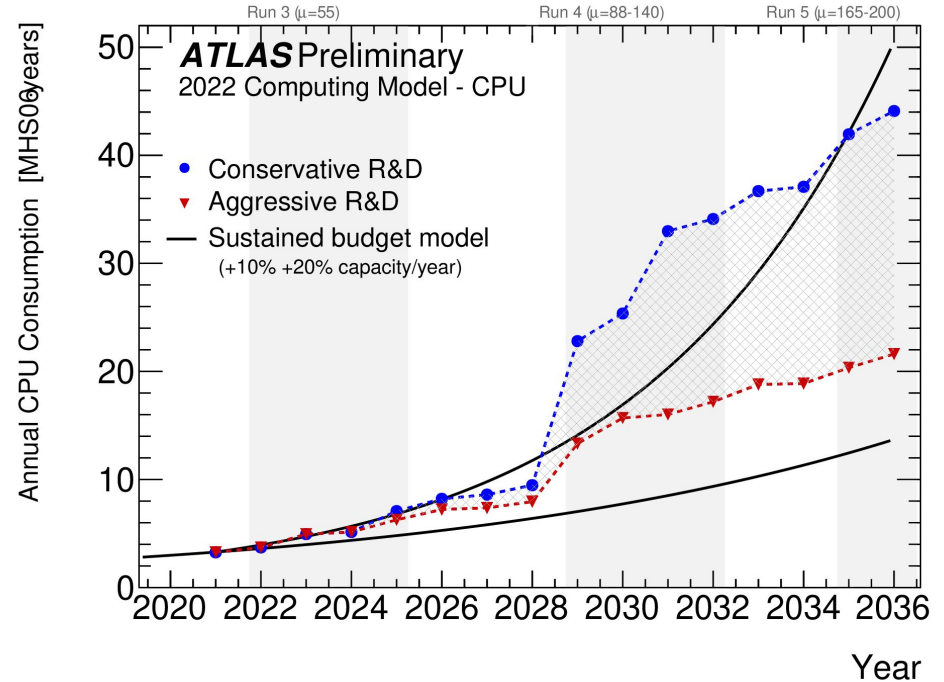
- Driven by advancement in detectors as well as theory calculations
- More **precision** measurements in the next decade
- This is NOT just the LHC

We clearly can not afford business as usual

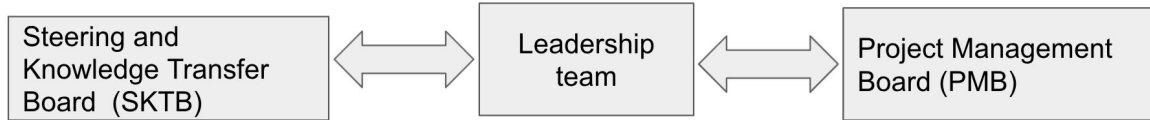
- We can't waste resources and energy
- 10-15% per year expected due to an advances in compute technology (e.g. new chips, more efficient data centres,)

For further improvements we need to look at the software

- Invest in software for new architectures
- Invest in people who write the software
- Co-design new HPC centres



- Management - kept light weight given the size of the project



- **WP1: Knowledge exchange and Training**
 - See Vassil's presentation later. This integrates with the overall ExCALIBUR working group
- **WP2: Simulation**
 - Common team of portable performance to optimise the use of HPCs
 - Lattice QCD. Efficient communication between HPC nodes, optimal usage of complex heterogeneous memories.
 - Simulation of particle transport. Development of a geometry model on GPU, and optimisation of current code
- **WP3: Benchmarking**
 - Development of a continuous benchmark for our codes to test new architectures

Current progress

- Workshop later this week in Swansea
 - Technical progress will be presented and detailed plans discussed
- Progress according to plan
 - Slight delay in recruitment (we started right before XMas!)
 - We should have included some RSE onboarding time

Management

Proj leader

KE coordinator

Recruit RSEs

Workshops

SKTB reports

WP1: Training and KE

In-person training

WP2: Simulation

Optimisation

CUDA development

Portability

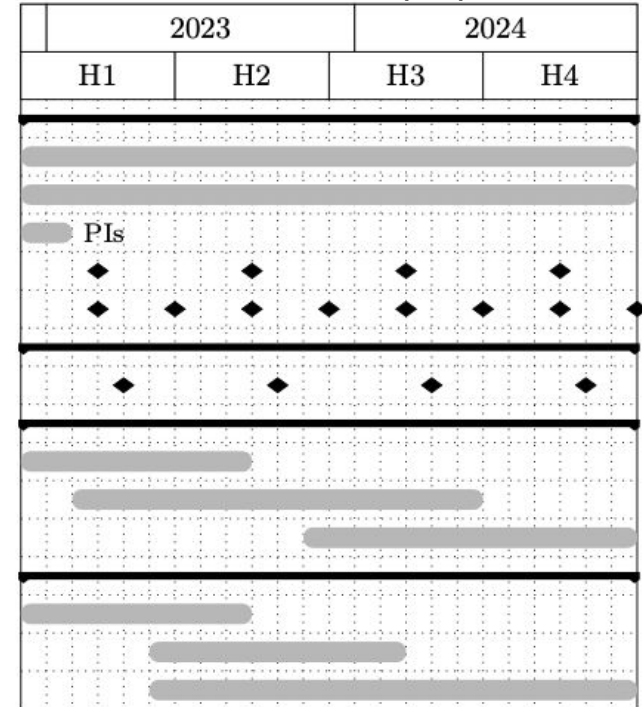
WP3: Benchmarking

NVIDIA Benchmark

Intel Benchmark

WP2 Continuous Bchm

Gantt Chart in the proposal



Conclusions, final comments

- Software work is much needed
 - Funders need to step up the level of software to match future hardware investments
 - Part of a wider ecosystem across multiple countries and multiple disciplines
 - This is work that is very important to enable research. Proper recognition needs to be given to the people in this career profile
- Participation in ExCALIBUR is a good portal to connect to a wider community
 - Hartree connections with other communities (in the UK and abroad) really useful
 - Example the DRI workshop last Spring
- We value input from our steering committee members
 - And thank you for your time!
 - We should have these meetings every 3 to 6 months to discuss progress, ideas and opportunities