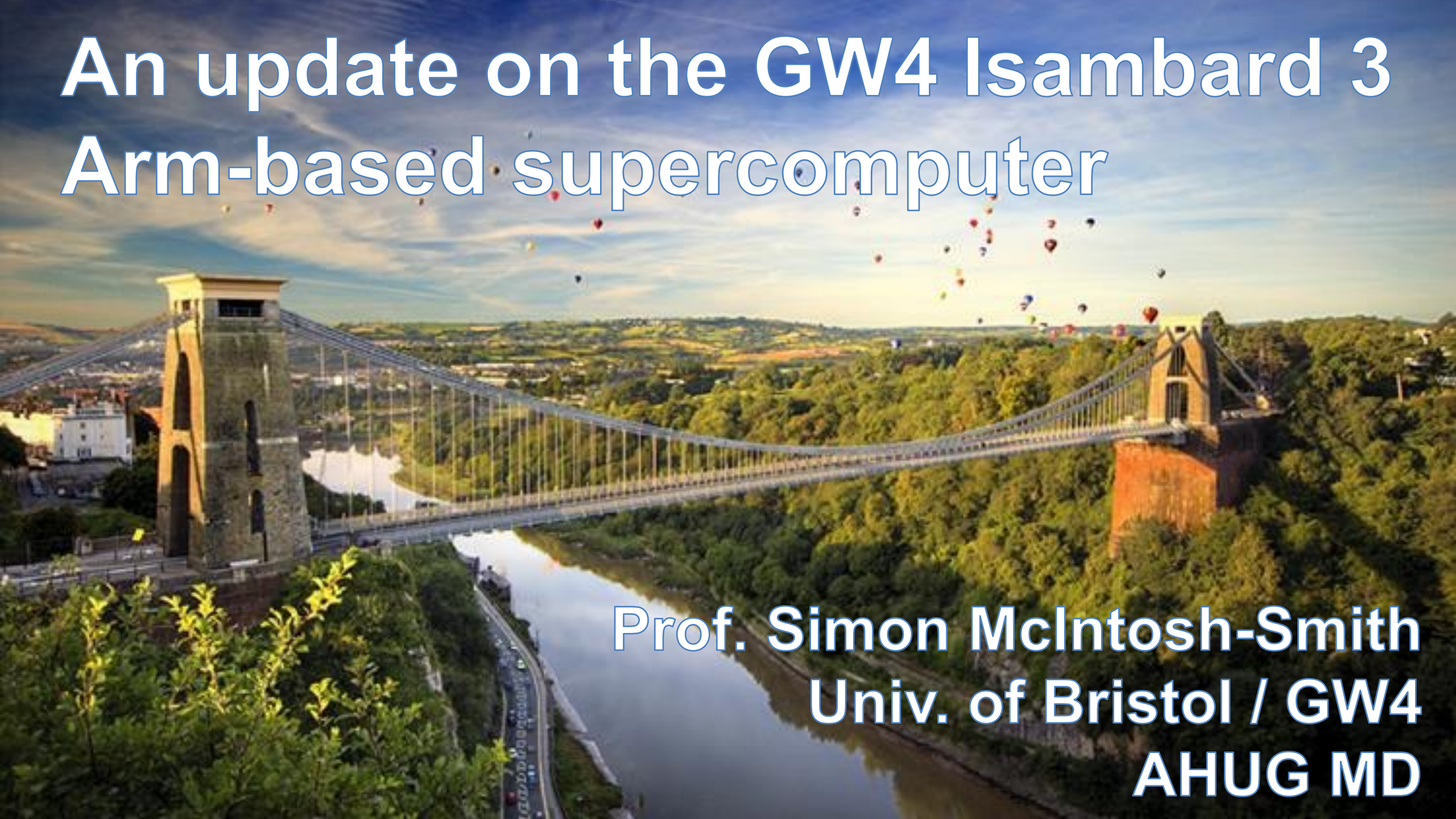


# An update on the GW4 Isambard 3 Arm-based supercomputer

Prof. Simon McIntosh-Smith  
Univ. of Bristol / GW4  
AHUG MD



# GW4 Isambard HPC service

- Isambard 1 was the 1st production Arm-based HPC service in the world
  - **Went live Spring 2018**
- Isambard 2 expanded in 2020 to offer one of the **largest** Arm systems in the world at that time
- **>800 registered users, >400 GW4**
- **£7.7M EPSRC funding to date**
- Hosted by the Met Office in Exeter, UK
- **Multiple awards, best papers,...**

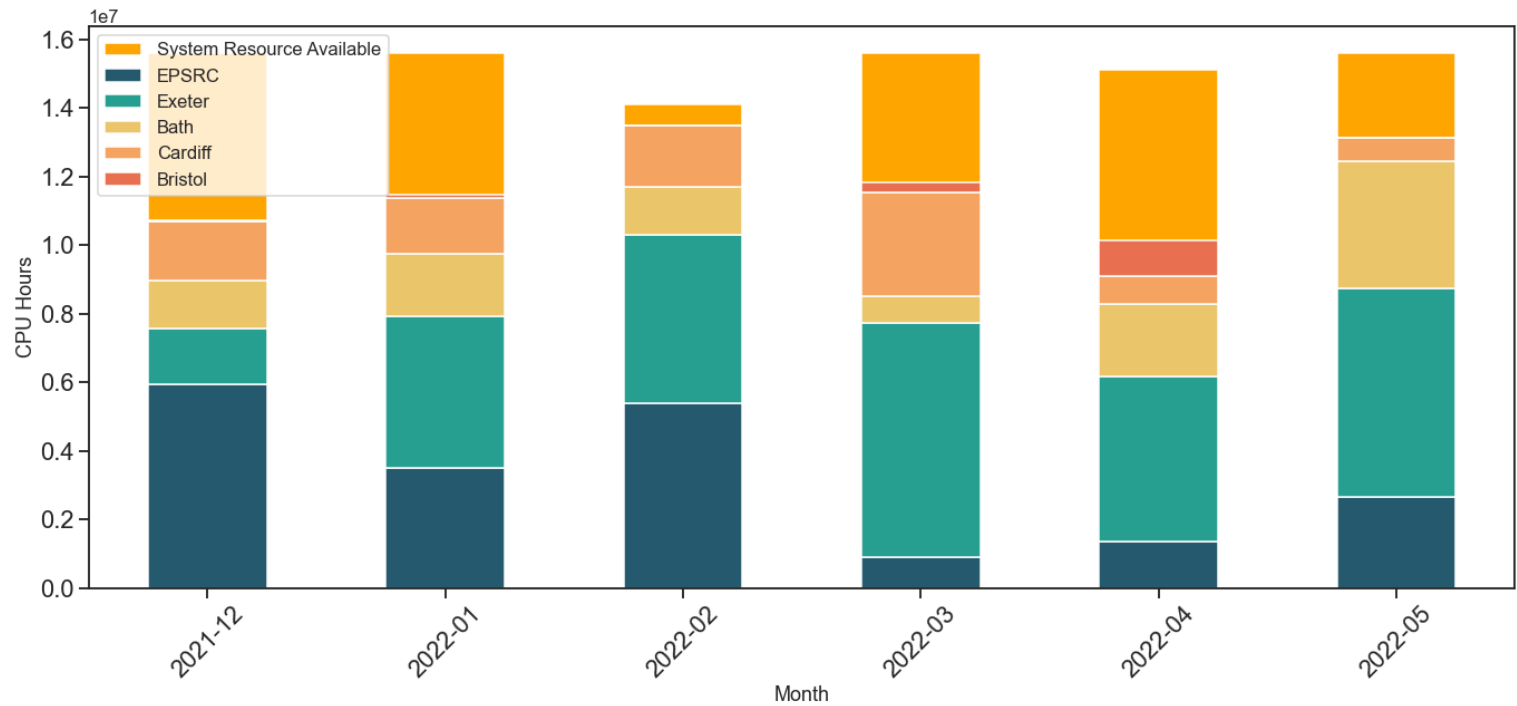
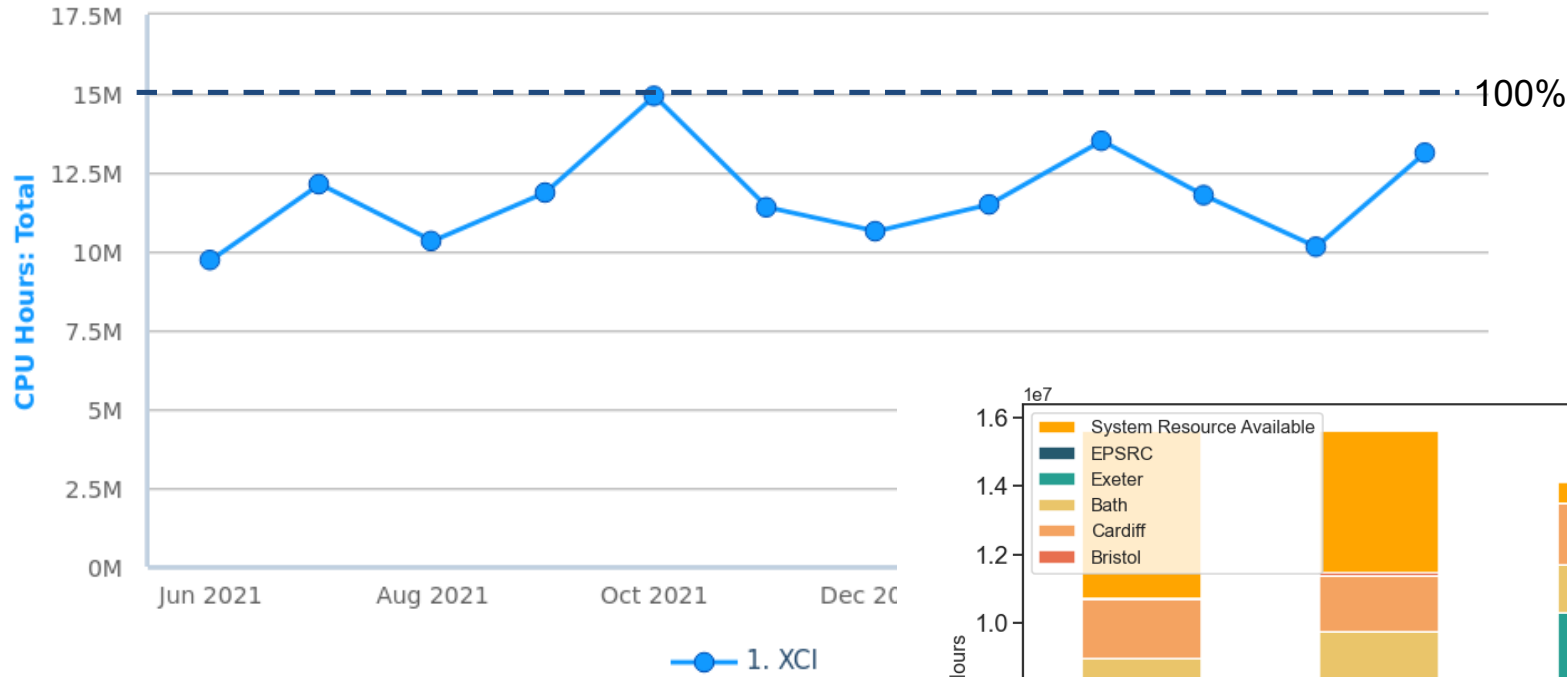


## Some of Isambard's achievements to date

- Delivered **nearly 1B Arm core hours to date**, 20M per month
- Hundreds of scientists and engineers **trained on Arm in HPC**
- Dozens of **hands-on tutorials and hackathons** (SC, ISC, AHUG...)
- **Dozens of HPC codes ported to Arm** for the first time on Isambard
- **Best paper award** at CUG 2019
- World's first hands-on Arm tutorial on production system (SC18)
- **World's first open SVE tutorial on real hardware** (SC20)
- Made significant contributions to the quality and robustness of the main **Arm software toolchains**: LLVM, GNU, Cray, Fujitsu

# Graphs from recent annual report.

CPU Hours: Total: by Resource  
Resource = XCI



System utilisation typically >90%.  
98.9% uptime.

Learn about it

Success for GW4

scientific-computing.com | Cray to Develop ARM-based Isambard Supercomputer

ARM Benchmarks Show HPC Ripe for Processor Shakeup | top500.org

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**Isambard 2 at UK Met Office to be largest Arm supercomputer in Europe**

February 17, 2020 by staff

The UK [Met Office](#) been awarded £4.1m by [EPSRC](#) to build Isambard 2, the largest Arm-based supercomputer in Europe. The powerful new £6.5m facility, to be hosted by the Met Office in Exeter and utilized by the universities of Bath, Bristol, Cardiff and Exeter, will double the size of GW4 Isambard, to 21,504 high performance cores and 336 nodes.

**Faster, cooler, scalable, sustainable**

Winterstock 2022 Jan 24-27

**Faster, cooler, scalable, sustainable**

Winterstock 2022 Jan 24-27

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GW4

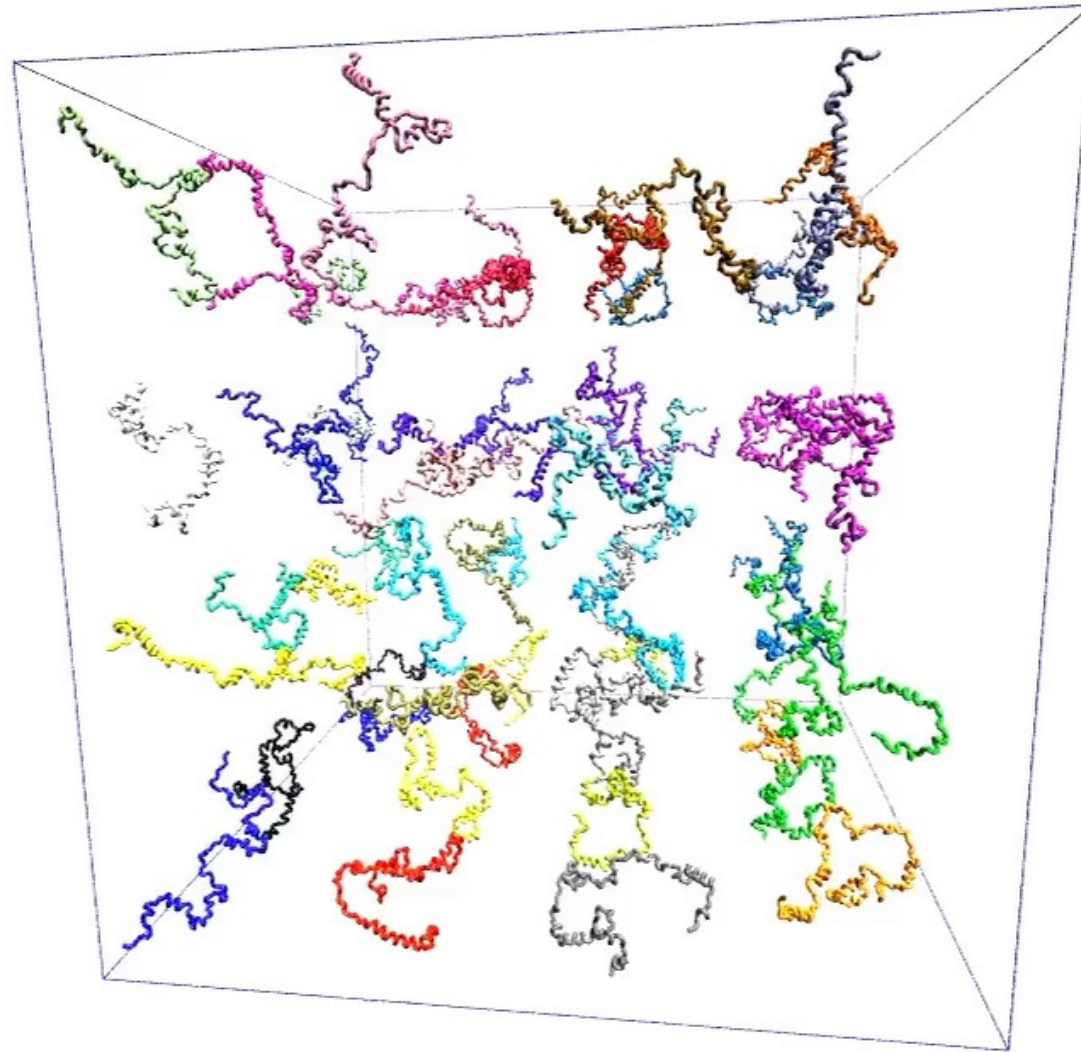
# Isambard Arm-based training, hackathons, workshops etc.

- Over 60 tutorials, hackathons and workshops have been run on Isambard since the service's inception, with many at top-tier international conferences, including IEEE/ACM SuperComputing and International Super Computing (ISC)
- To date, over 1,000 international scientists, researchers and developers have attended tutorials, workshops and hackathons run using Isambard



# Bristol Isambard case study: molecular simulations of factors behind Parkinson's and osteoporosis

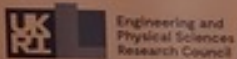
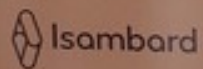
- Bristol researchers have been running molecular level simulations on Isambard to understand the mechanisms behind Parkinson's disease, and to find ways to treat osteoporosis
- Their simulations on Isambard have shown how the alpha-synuclein protein can start to clump together in the human brain, a key feature of Parkinson's disease



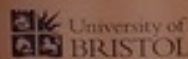


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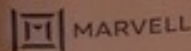


UNIVERSITY OF EXETER



Met Office

arm



THE GREAT BRITAIN  
AT BATHON 1839  
The first iron-hulled steamship  
built in England, she was the  
first to be built in the  
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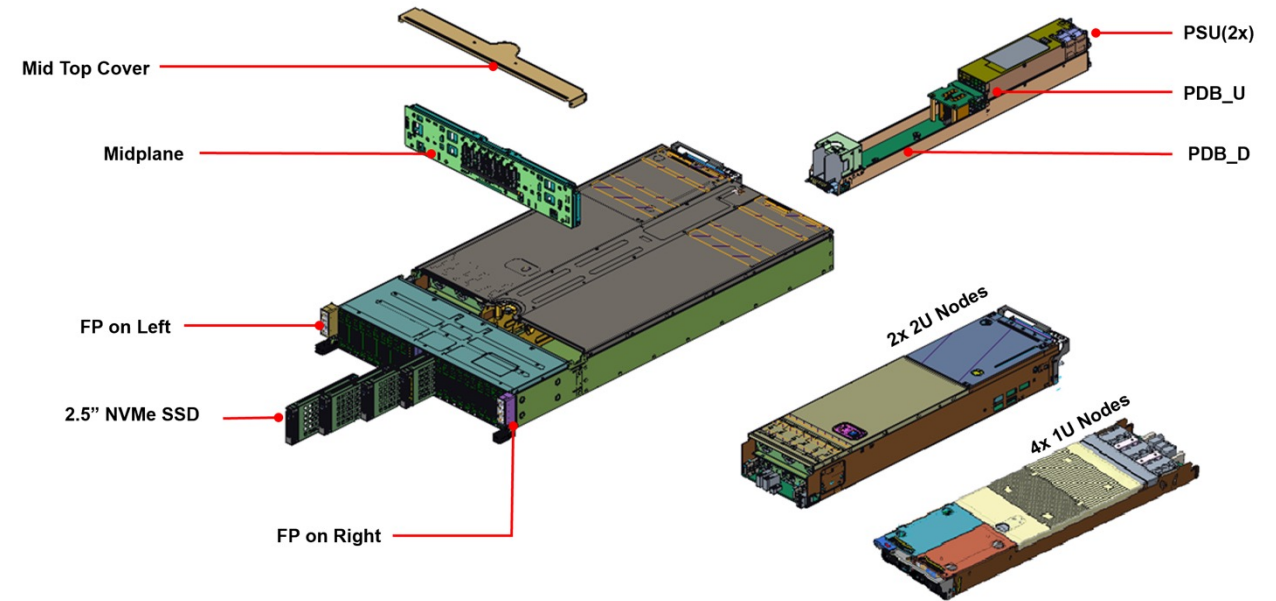
- A64fx system of 72 nodes added in Sep 2020
- Enabled porting and optimization for SVE
- Supported world's first open SVE hackathon at SC20

# Isambard 3 coming this year



- **£9.2M** CAPEX funding, +£6.1M OPEX for 4 years of operation
  - **Significantly expanded support team of 6 RSEs, 2 full-time sys admins**
- Isambard 3 will be one of the first supercomputers based on NVIDIA's new **'Grace'** Arm CPUs
- **55,000+** cores, 2-3 PetaFLOP/s, 6X faster and more energy efficient than Isambard 2
- **Liquid cooling where possible for a low PUE, waste heat reuse potential**
- Each node has 144 cores at 3.5GHz and ~1Tbyte/s memory bandwidth to 256GB of DRAM
- Comes with a complete set of optimized NVIDIA libraries, **including for AI/ML**
- Will also have some **Grace+Hopper GPU nodes**
- On target for installation around the end of 2023

# Isambard 3 NVIDIA 'Grace' CPU superchip



Competitive with best in class CPUs in 2023  
in both performance and energy efficiency.

Using NVIDIA's whitebox air-cooled  
servers with water cooled doors.

**This is the first time that Isambard's Arm processors will come  
from a mainstream HPC chip vendor.**



- NVIDIA Grace-Grace 144 core board for Isambard 3
- Approx. A3 in size and 500W
- 384 of these in Isambard 3
- System delivered by HPE

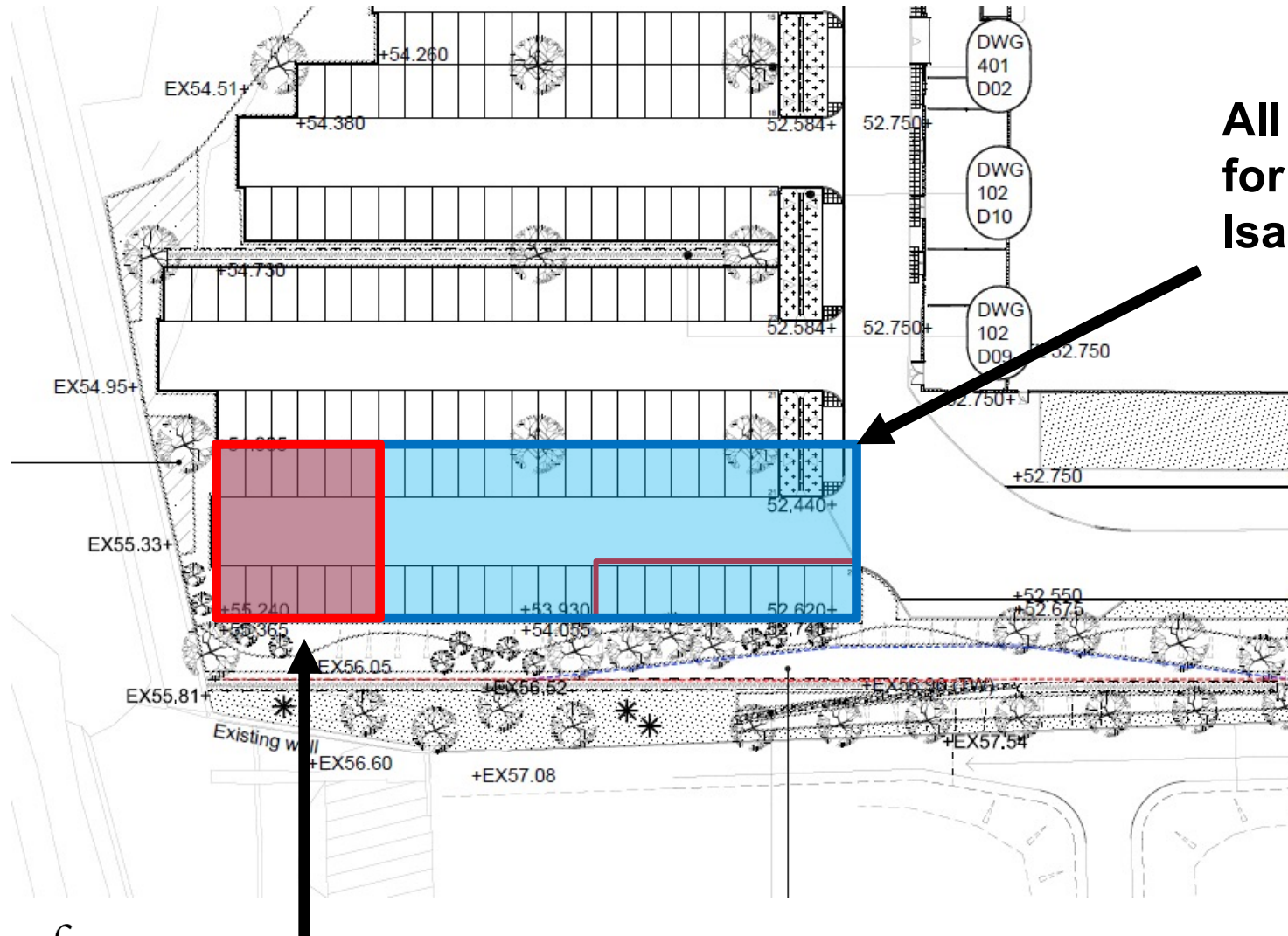
# Isambard 3 site: the National Composites Centre in Bristol



**University composite materials research centre**  
Close to M4 and Parkway Station.  
Significant room for future expansion.



# NCC Site for Isambard 3



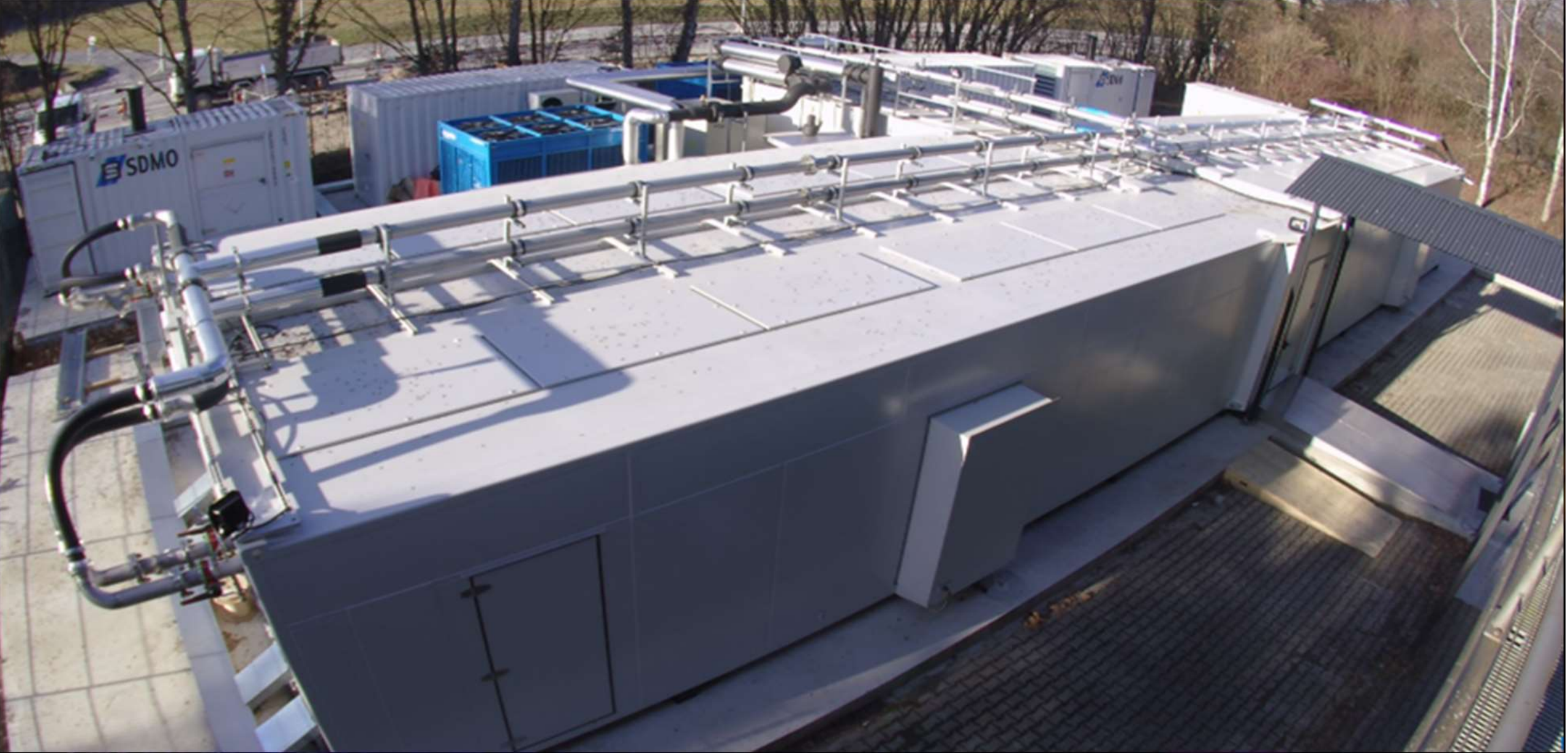
**All of this region available for future expansion of the Isambard service.**

**Area initially used for Isambard 3**



- A** POD
- B** PUMP SKID Secondary Pump
- C** Chiller 1
- D** Heat Recovery Plant
- E** Chiller 2
- F** Decal / Vinyl to POD





University of  
**BRISTOL**

All of Isambard 3 will fit in a single, agile, energy efficient Modular Data Centre (MDC). Easy to scale up in an agile manner.

**GW4**

GW4



UK Research  
and Innovation



NVIDIA.

arm



## Great Western 4 Isambard 3 summary

- The new service will be one of the most **energy efficient CPU-based systems in the world**, 5-6X better than Isambard 2
- We expect Grace to be performance competitive with the best x86 processors in 2023/24
- Energy efficiency-wise, should be class leading
- DRAM-sized memory per node, but HBM-like bandwidth
- Very flat NUMA structure should enable excellent ease of use
- On the floor late 2023, in production early 2024