



EuroHPC
Joint Undertaking

Work Plan 2022

R&I Actions – Quantum Computing Perspective

Prof. Dr. – Ing. Morris Riedel (EuroHPC JU GB Member Iceland)

(selected slides courtesy by Daniel Opalka, Programme Officer R&I, EuroHPC JU)

EuroHPC – Old & New Regulations

Increasing Relevance of Quantum Computing besides HPC



EuroHPC
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8.10.2018 EN Official Journal of the European Union L 252/1

(note: old regulation – Horizon 2020 timeframe)

II

(Non-legislative acts)

REGULATIONS

COUNCIL REGULATION (EU) 2018/1488

of 28 September 2018

establishing the European High Performance Computing Joint Undertaking

THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 187 and the first paragraph of Article 188 thereof,

Having regard to the proposal from the European Commission,

Having regard to the opinion of the European Parliament,

Having regard to the opinion of the European Economic and Social Committee (°),

(mentioned only once)

- (21) The Joint Undertaking should lay the ground for a longer-term vision and prepare the path towards building the first hybrid High Performance Computing infrastructure in Europe, integrating classical computing architectures with quantum computing devices, e.g. exploiting the quantum computer as an accelerator of High Performance Computing threads. Structured and coordinated financial support at European level is necessary to help research teams and European industries remain at the leading edge in a highly competitive international context by producing world-class results to ensure the fast and broad industrial exploitation of European research and technology across the Union generating important spill-overs for society, to share risk-taking and joining of forces by aligning strategies and investments towards a common European interest.

19.7.2021 EN Official Journal of the European Union L 256/3

(note: new regulation – Horizon/Digital Europe timeframe)
REGULATIONS

COUNCIL REGULATION (EU) 2021/1173

of 13 July 2021

on establishing the European High Performance Computing Joint Undertaking and repealing Regulation (EU) 2018/1488

THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty on the Functioning of the European Union, and in particular Article 187 and the first paragraph of Article 188 thereof,

Having regard to the proposal from the European Commission,

Having regard to the opinion of the European Parliament (°),

Having regard to the opinion of the European Economic and Social Committee (°),

**(mentioned
very often)**

- (35) In order to achieve its objectives to increase the innovation potential of industry, and in particular of SMEs, to contribute to reducing the specific skills gap, to support the increase of knowledge and human capital and to upraise High Performance Computing and quantum computing capabilities, the Joint Undertaking should support the creation, and in particular the networking and coordination, of national High Performance Computing

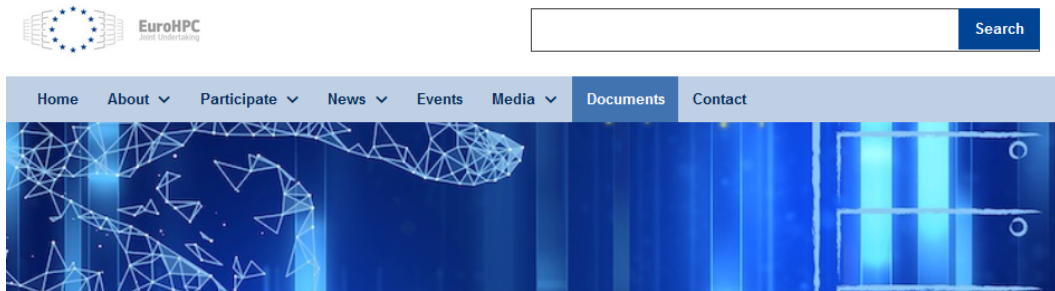
- (36) The Joint Undertaking should provide a demand-oriented and user-driven framework and enable a co-design approach for the acquisition of an integrated, world-class federated, secure and hyper-connected supercomputing and quantum computing service and data infrastructure in the Union, in order to equip users with the strategic computation resource they need to develop new, innovative solutions and to solve societal, environmental, economic and security challenges. For that purpose, the Joint Undertaking should contribute to the acquisition of world-class supercomputers. The supercomputers of the Joint Undertaking, including quantum computers, should be installed in a Participating State that is a Member State.

EuroHPC – Transparency

Published Documents – Example: Work Plan 2022 Amendments



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Documents

(JU/GB challenge: many non-quantum activities need funding too, e.g. HPC machines, NCCs, CoEs, etc.)

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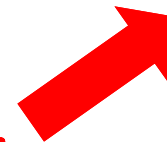
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EuroHPC JOINT UNDERTAKING
DECISION OF THE GOVERNING BOARD OF THE EuroHPC JOINT UNDERTAKING No 06/2022
Amending the Joint Undertaking's Work Plan and Budget for the year 2022

THE GOVERNING BOARD OF THE EuroHPC JOINT UNDERTAKING,

Having regard to Council Regulation (EU) 2021/1173 of 13 July 2021 on establishing the European High Performance Computing Joint Undertaking and repealing Regulation (EU) 2018/1488¹, (hereinafter, "the Regulation"),

Having regard to the Statutes of the European High Performance Computing Joint Undertaking annexed to the Regulation (hereinafter "Statutes") and in particular to Articles 1(o), 7(3)(d), 7(4)(b), 7(5)(b), 7(6)(b), 7(7)(b), 9(4)(b) and (c) and 18 of thereof,

Having regard to Decision of the Governing Board of the EuroHPC Joint Undertaking No 3/2020, approving the Financial Rules of the EuroHPC Joint Undertaking²,

Having regard to Decision of the Governing Board of the EuroHPC Joint Undertaking No 28/2021 of 15 December 2021, adopting the Joint Undertaking's Work Plan for the year 2022

WHEREAS

- (1) Governing Board of the EuroHPC Joint Undertaking No 28/2021 of 15 December 2021, adopted the Joint Undertaking's Work Plan for the year 2022
- (2) The Statutes of the EuroHPC JU confer on the Governing Board the powers to adopt the annual work plan and its annual budget including the staff establishment plan.
- (3) The annual Work Plan and Budget for the year 2022 needs to be amended to:

¹ OJ L 256, 19.7.2021, p. 3–51

² Readopted by Decision of the Governing Board of the EuroHPC Joint Undertaking No 17/2021, approving the re-adoption of Governing Board Decisions adopted under the framework of Regulation (EU) 2018/1488 and its updated Rules of Procedure in the view of Regulation (EU) 2021/1173

EuroHPC – Transparency

Published Documents – Example: Work Plan 2022 Amendments

ANNUAL WORK PLAN YEAR 2022

A) INTRODUCTION

The EuroHPC Joint Undertaking (hereinafter “EuroHPC JU”), will contribute to the ambition of value creation in the Union with the overall mission to **develop, deploy, extend and maintain in the Union an integrated world class supercomputing and quantum computing infrastructure** and to develop and support a highly competitive and innovative High Performance Computing (HPC) ecosystem, extreme scale, power-efficient and highly resilient HPC and data technologies.

➤ Quantum computing

The primary objective of this action is to provide to European HPC users with quantum computers to match a growing demand from European industry and academia for applications with industrial and societal relevance for Europe. **The activities will be centred around European technology such as quantum computing technologies developed within the Quantum Flagship initiative and national research programmes of the EuroHPC Participating States.** It will also foster the emergence of real use case applications, and mature large-scale quantum computing in Europe. This will also contribute to the development of an ecosystem of quantum programming facilities, application libraries and skilled workforce.

These computers will be hosted in EuroHPC supercomputers centres or national supercomputer centres already established in Member States that are Participating States of the Joint Undertaking.

The action will cover the acquisition of the quantum computers, the integration with the HPC supercomputing infrastructure, and the operation of the quantum computers. The aim is to support multiple proposals with diversity in technology to give the European HPC user access to as many different quantum technologies as possible.

Total indicative budget for the topic is EUR 80 million. Indicative EU budget for the topic is EUR 40 million, with an EU funding rate of up to 50%.

A Call may be agreed by the Governing Board in 2022.



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EuroHPC JOINT UNDERTAKING
DECISION OF THE GOVERNING BOARD OF THE EuroHPC JOINT
UNDERTAKING No 06/2022
Amending the Joint Undertaking's Work Plan and Budget for the year
2022

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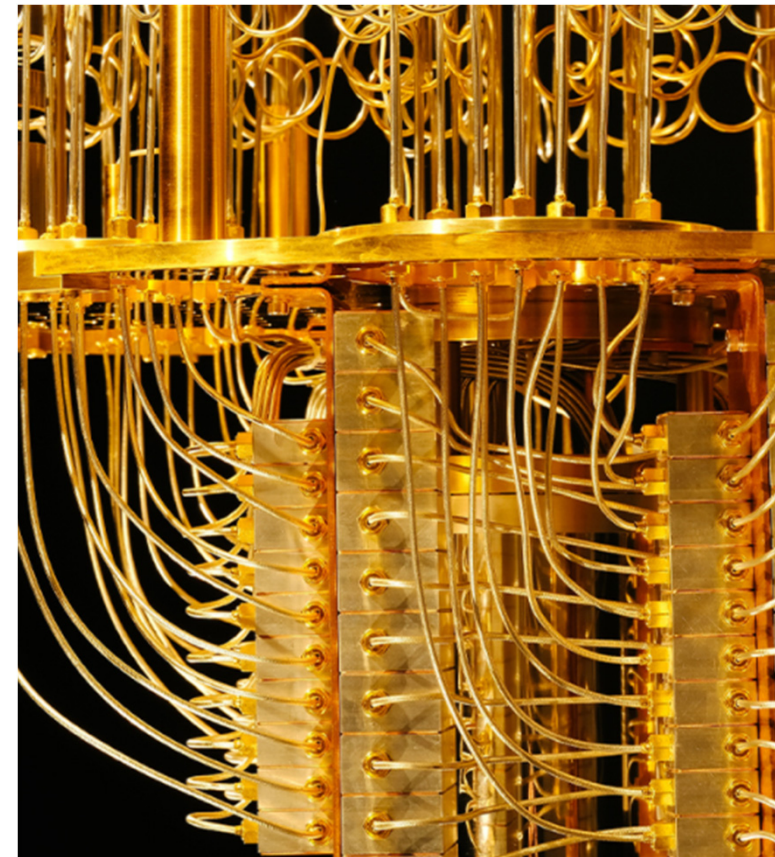
Quantum Computing & HPC Summary



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Towards a EuroHPC and quantum computing infrastructure

- To expand the EuroHPC **world-class supercomputing infrastructure** & increase the **available computing power** in Europe, with the acquisition of:
 - the first European exascale supercomputers,
 - **the first quantum computers,**
 - additional mid-range systems.
- **The selection of the hosting entities to host and operate these new supercomputers is already ongoing,**
- These systems will serve a great variety of users, wherever they are in Europe to improve the **quality of life of European citizens**, boost **industrial competitiveness** and advancing **science**.



Quantum Computing Technologies

HPCQS – Revisited

13:45 – 14:00 Sven Karlsson (DTU)

*Integration of quantum computing devices into the HPC ecosystem
-- Key challenges and approaches*

14:00 – 14:30 Venkatesh Kannan (ICHEC), Kristel Michielsens (FZJ)

HPCQS - "High-Performance Computing and Quantum Simulation": integrating quantum simulators into and making them available within HPC environments

14:30 – 14:45 Mikael Johansson (CSC)

Three different ways of connecting HPC and QC

- The project HPCQS aims to integrate two quantum simulators, each controlling ~100+ qubits in :
 - the GENCI supercomputer Joliot Curie (France);
 - the JSC supercomputer JUWELS (Germany).
- **Incubator for quantum-HPC hybrid computing, unique in the world**
- Enabling research entities & industries to exploit new quantum technologies and find solutions to complex challenges in many areas,
- First step towards a European quantum computing infrastructure.
- More to come...



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HORIZON
2020

High Performance Computer and Quantum Simulator hybrid

Fact Sheet

Results

Project description



Integrating quantum simulators with classical supercomputers

The integration of quantum simulators in existing European supercomputers is the aim of the HPCQS project, funded by the European High Performance Computing Joint Undertaking (EuroHPC JU). Using an innovative approach to prepare Europe for the post-exascale era, the project will integrate two quantum simulators (each controlling about 100+ quantum bits) in two supercomputers. The first is the Joliot Curie of GENCI, the French national High Performance Computing organisation. The second is the JUWELS of Germany's Jülich Supercomputing Centre. By integrating quantum hardware with classical computing resources, research entities and industries will be able to solve complex challenges in areas such as materials and drug design, logistics and transportation.

Show the project objective



Project Information

HPCQS

Grant agreement ID: 101018180

Start date

1 December 2021

End date

30 November 2025

Funded under

INDUSTRIAL LEADERSHIP - Leadership in enabling and industrial technologies - Information and Communication Technologies (ICT)

Total cost

€ 12 000 000

EU contribution

€ 6 000 000

Coordinated by

FORSCHUNGSZENTRUM JÜLICH GMBH

Germany



Quantum Computing Infrastructure

Towards a EuroHPC and quantum computing infrastructure



1. Selection of Hosting Entities by GB

- **Call for expression of interest for ≈ 3 different quantum computers**

2. Acquisition of quantum computers by JU

- Call for tender – JU will own the system and cover 50% of acquisition costs

3. Integration of quantum computers in supercomputers by consortia

- Grant – Research and Innovation Action for hardware and software development and integration

4. Operation of quantum computers by Hosting Entities

- Grant – Operating Grant to cover 50% of operational costs

EUROHPC-2022-CEI-QC-01



Call for Expression of Interest for Hosting Entities for quantum computers

Key Objectives

- » Procurement of at least three different technologies developed in the Union and PS
- » Integration of quantum computers with HPC by a co-design approach with applications
- » Software development and applications supporting different quantum computing technologies as backend

Applications

- » Eligibility: national Supercomputing Centres already established in Member States that are also Participating States of the EuroHPC JU
- » Specifications of the quantum processing unit and other relevant technology
- » Description of integration into the EuroHPC infrastructure according to objectives

Budget

- » **EUR 8-10 millions EU contribution per quantum computer matched by Participating States**

EUROHPC-2022-CEI-QC-01

Call for Expression of Interest for Hosting Entities for quantum computers



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CALL FOR EXPRESSION OF INTEREST for the hosting and operation of European quantum computers integrated in HPC supercomputer

EUROHPC-2022-CEI-QC-01

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Introduction

The overall objective of this call is to select hosting entities for quantum computers, which will be acquired by the EuroHPC JU.

Topics

Topic Identifier: EUROHPC-2022-CEI-QC-01
Publication Date: 31 March 2022
Opening Date: 31 March 2022

Deadline Model: Single
Deadline date: 30 June 2022 17:00
Luxembourg time

01-Call for Expression of Interest EuroHPC Hosting Entities QC 2022

01_Call_Expression_Interest_EuroHPC_Hosting Entities_QC_2022.pdf
English (548.58 KB - PDF)

[Download](#)

1. INTRODUCTION – CONTEXT AND BACKGROUND

The European High Performance Computing Joint Undertaking (hereinafter "EuroHPC JU") was established by Council Regulation (EU) 2021/1173 of 13 July 2021 (hereinafter "Regulation") and entered into force on 8 August 2021¹.

According to Article 3 of the Regulation, the mission of the EuroHPC JU is to develop, deploy, extend and maintain in the Union a federated, secure hyperconnected supercomputing, quantum computing, service and data infrastructure ecosystem; to support the development and uptake of demand-oriented and user-driven innovative and competitive quantum computing systems based on a supply chain that will ensure the availability of components, technologies and knowledge, therefore limiting the risk of disruptions while ensuring the development of a wide range of applications optimised for these systems; and, to widen the use of that quantum computing infrastructure to a large number of public and private users, and to support the transition and the development of key skills for European science and industry.

One of the targets of the EuroHPC JU is to develop and support a highly competitive and innovative quantum computing ecosystem broadly distributed in Europe contributing to the scientific, industrial, and digital leadership of the Union, capable of autonomously producing quantum computing technologies and architectures and their integration on leading HPC computing systems, and advanced applications optimised for these systems. The primary objective of this action is to make available to users European quantum computers integrated with EuroHPC Participating States HPC computers, in a hybrid configuration, in order to address a growing demand from European industry and academia for applications with industrial, scientific and societal relevance for Europe. The activities should leverage European technology, in particular quantum computing technologies developed within the Quantum Flagship, other European initiatives and national Quantum research programmes of the EuroHPC Participating States. The action should foster the emergence of real use case applications, and mature quantum computing in Europe. This will contribute to the development of an ecosystem of quantum programming facilities, application libraries and skilled workforce.

The action will cover the acquisition of the quantum computers, their integration with the HPC infrastructure including the development of a quantum software stack, and their operations. The aim is to support multiple proposals with diverse qubit technologies to give users access to as many different quantum technologies as possible. The action should seek synergies and cooperation with the relevant projects at European or national level developing or testing the different layers of the software stack, quantum applications, or use cases, notably the projects resulting from the Quantum Flagship call HORIZON-CL4-2021-DIGITAL-EMERGING-02-10: Strengthening the quantum software ecosystem for quantum computing platforms.

In accordance with Article 12 of the Regulation, the EuroHPC JU shall proceed to the acquisition of quantum computers, funded by the Union's budget stemming from the Digital Europe Programme by contributions from the relevant Participating States to the EuroHPC JU. In accordance with Article 12 of the Regulation, the Union's contribution from Digital Europe Programme should cover up to 50 % of the acquisition costs, up to 50% of the costs for the integration of the quantum computer with the existing supercomputer of the hosting entity and up to 50 % of the operating costs of these quantum computers. The EuroHPC JU will be the owner of the quantum computers it has acquired.

Pursuant to Article 9 of the Regulation, the EuroHPC JU shall entrust to a hosting entity the operation of each individual quantum computer it owns in accordance with Article 10 of the Regulation.

The hosting entity shall be selected by the Governing Board of the EuroHPC JU ('Governing Board') following a Call for Expression of Interest evaluated by independent experts.

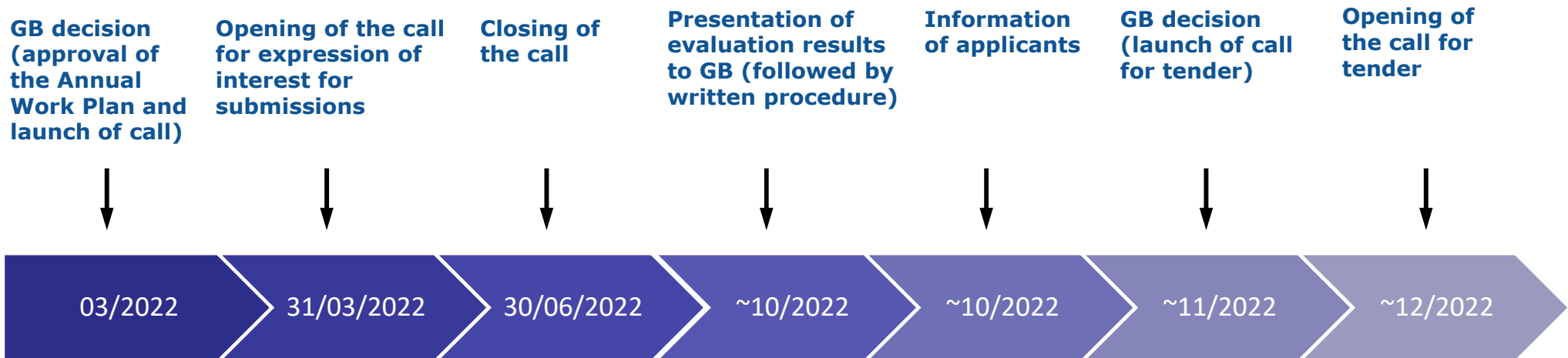
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Call for Expression of Interest for Hosting Entities for quantum computers

(Note: Indicative Dates!)



(Call was opened two months earlier as initially planned by the JU/GB, so changes in subsequent timeline also possible)

- » **Award of contracts by end of 2023**
- » **Delivery of quantum computers in 2024**
- » **JU currently inquires whether an earlier delivery may be possible**



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Thanks for your Attention!

Prof. Dr. – Ing. Morris Riedel (EuroHPC JU GB Member Iceland)

(most slides courtesy by Daniel Opalka, Programme Officer R&I, EuroHPC JU)

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