EUROQHPC-I

European prospects for HPC-QCS integration

THE EUROHPC QUANTUM COMPUTING INITIATIVE

Two pilot systems acquired for the HPCQS project

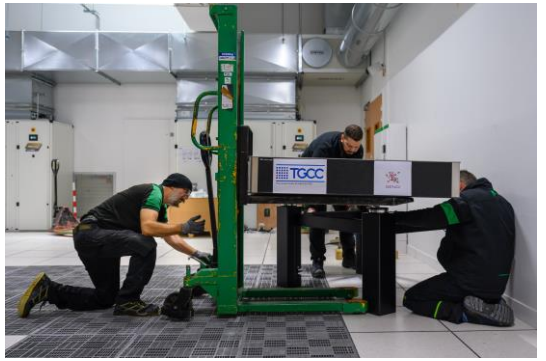
2 100+-qubit quantum simulators acquired in the context of ⟨HPC|QS⟩

GENCI/CEA

FZJ

15 partners in total

6 countries involved



THE EUROHPC QUANTUM COMPUTING INITIATIVE

Six additional quantum computers acquired

6 **10+-qubit quantum computers** acquired through a call for expression of interest (CEI)

30 **partners** in total

17 **countries** involved

EuroQCS-France
GENCI/CEA

Euro-Q-Exa
LRZ

EuroQCS-Italy
CINECA

Lumi-Q
IT4I @ VSB

EuroQCS-Poland
PSNC

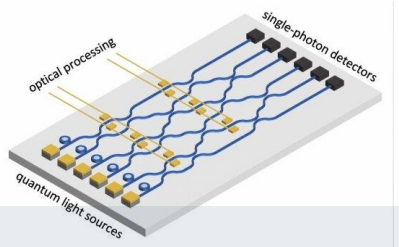
EuroQCS-Spain
BSC-CNS

THE EUROHPC QUANTUM COMPUTING INITIATIVE

Six different flavors of quantum computers acquired

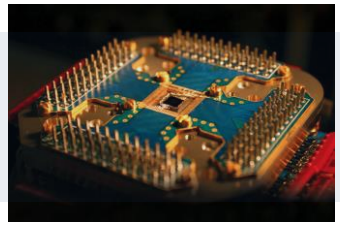
EuroQCS-France
GENCI/CEA

Photonic quantum computer



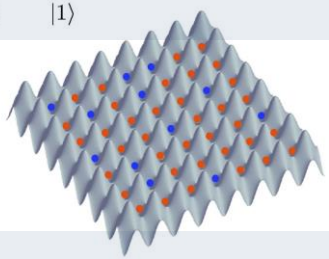
Euro-Q-Exa
LRZ

Superconducting qubits



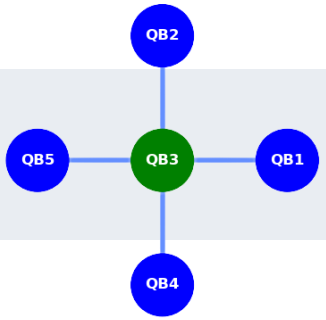
EuroQCS-Italy
CINECA

Neutral atoms



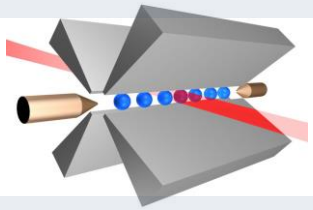
Lumi-Q
IT4I @ VSB

Superconducting qubits with a star-shaped topology



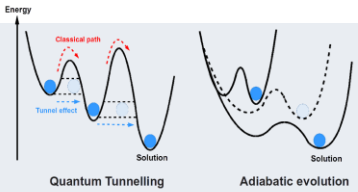
EuroQCS-Poland
PSNC

Trapped ions



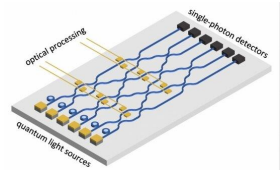
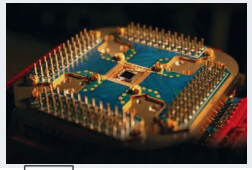
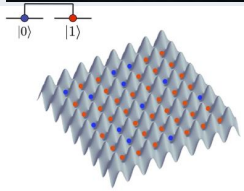
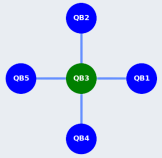
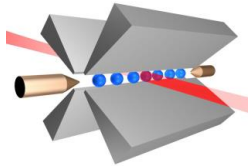
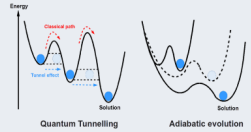
EuroQCS-Spain
BSC-CNS

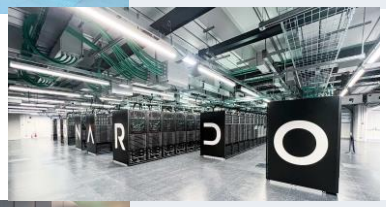
Quantum annealer

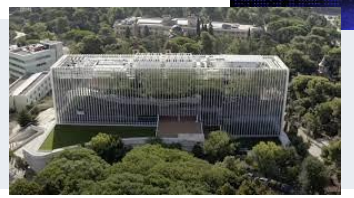


THE EUROHPC QUANTUM COMPUTING INITIATIVE

Seven different flavors of HPC-QC infrastructures

EuroQCS-France GENCI/CEA	Photonic quantum computer	
Euro-Q-Exa LRZ	Superconducting qubits	
EuroQCS-Italy CINECA	Neutral atoms	
Lumi-Q IT4I @ VSB	Superconducting qubits with a star-shaped topology	
EuroQCS-Poland PSNC	Trapped ions	
EuroQCS-Spain BSC-CNS	Quantum annealer	





THE EUROHPC QUANTUM COMPUTING INITIATIVE

Joint HPC-QCS integration efforts from the 7 Hosting Entities and their partners

WP1: Coordination of EuroQHPC-Integration (GENCI)

WP2: Shared integration,development and support activities (LRZ)

WP3: EuroQCS-France specific integration and development activities (GENCI)	WP4: LUMI-Q specific integration and development activities (IT4I@VSB)	WP5: EuroQCS-Spain specific integration and development activities (BCS-CNS)	WP6: EuroQCS-Italy specific integration and development activities (CINECA)	WP7: EuroQCS-Poland specific integration and development activities (PSNC)	WP8: Euro-Q-Exa specific integration and development activities (LRZ)

GENCI | cea | VŠB TECHNICKÁ UNIVERZITA OSTRAVA | IT4INNOVATIONS NÁRODNÍ SUPERPOČÍTAČOVÉ CENTRUM | Barcelona Supercomputing Center Centro Nacional de Supercomputación | CINECA | PSNC | lrz Leibniz-Rechenzentrum der Bayerischen Akademie der Wissenschaften

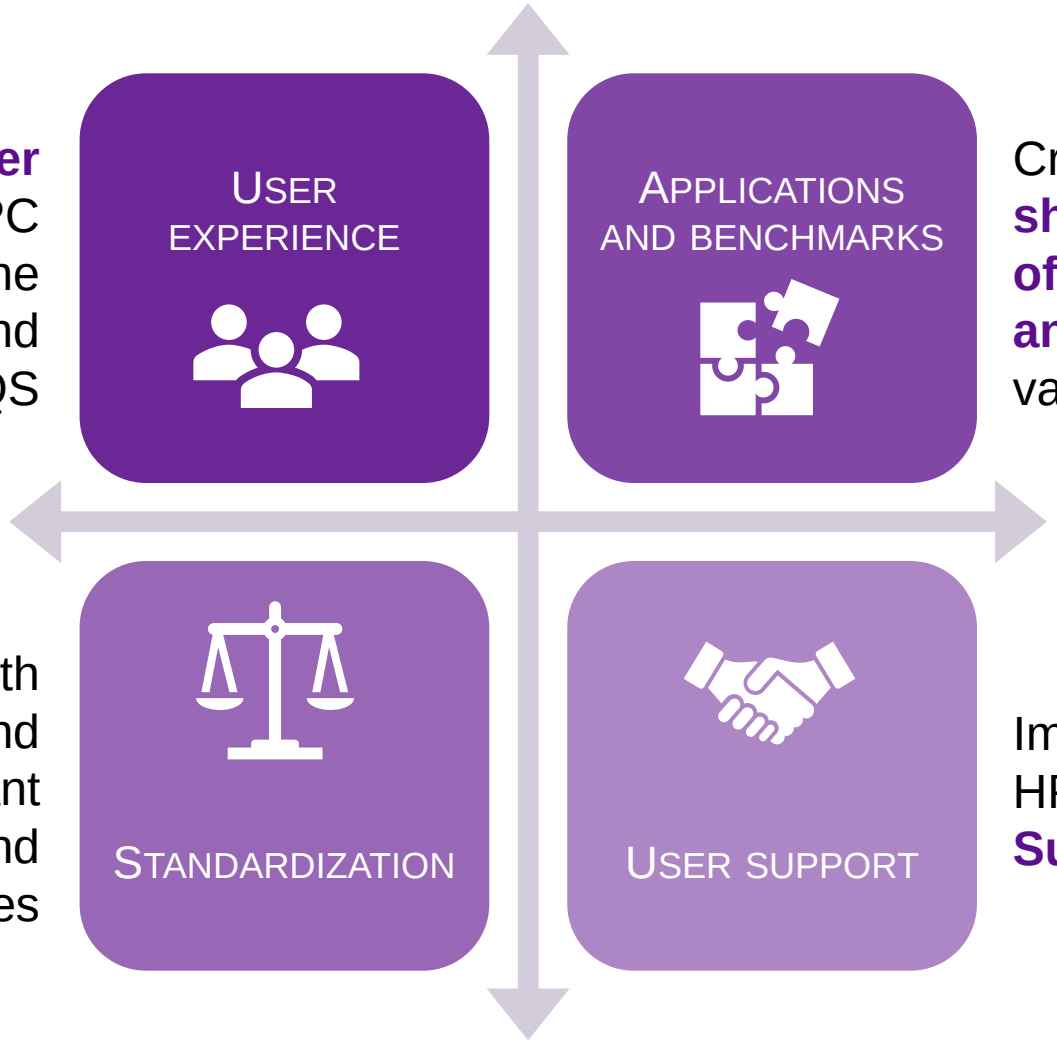
DISCLAIMER – Proposal submitted to EuroHPC JU – under review

THE EUROHPC QUANTUM COMPUTING INITIATIVE

Joint HPC-QCS integration efforts from the 7 Hosting Entities and their partners

Harmonization of the user experience for the EuroHPC quantum systems across the six Hosting Entities and HPCQS

Collaboration with **standardization bodies** and participation in relevant working groups and committees



Creation of a repository of **shared collection of proof-of-concept applications and benchmarks** running on various hybrid systems

Implementation of an HPC-QC **Technical Support Team**

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THE EUROHPC QUANTUM COMPUTING INITIATIVE

Joint HPC-QCS integration efforts from the 7 Hosting Entities and their partners

USER EXPERIENCE

Exchange of **best practices and harmonization of the user experience** on the seven HPC-QCS environments

Link with the **EuroHPC JU Federation of Resources project** for tasks related to Authentication and authorization on its infrastructure (AAI).

Set up a common framework of **components and services** towards a federated access to HPC-QCS resources

Use of **common tools**

- Co-scheduling
- Hardware-agnostic programming tools
- Reporting the use of resources (time, performance, energy consumption)
- Supporting European HPC-QCS libraries

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THE EUROHPC QUANTUM COMPUTING INITIATIVE

Joint HPC-QCS integration efforts from the 7 Hosting Entities and their partners

Taking benefit of the **complementarity of HPC-QCS hardware architectures** proposed by the six Hosting Entities and FZJ

APPLICATIONS AND BENCHMARKS

collection of benchmarks, use cases and libraries

allowing for developers and end-users the possibility to **assess**

- various **QPUs**
- various **coupling approaches** with traditional HPC resources

FINDING THE RIGHT FIT BETWEEN ALGORITHMS AND HARDWARE

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THE EUROHPC QUANTUM COMPUTING INITIATIVE

Joint HPC-QCS integration efforts from the 7 Hosting Entities and their partners

Creation of a **distributed Technical Support Team (TST)** by pooling existing resources planned in each individual proposal and sharing best practices and experience

USER SUPPORT

Link with other **EuroHPC JU Application Support Teams (AST)**

- Inclusive engagement of European users
- Training and support on all the various hardware

Collaboration with **EuroHPC Peer Review team** during the technical evaluation of projects submitted to regular EuroHPC calls for proposal to access the HPC-QCS resources.

FOSTER THE ENABLEMENT OF END-USERS TOWARDS HYBRID HPC-QCS SOLUTIONS

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THE EUROHPC QUANTUM COMPUTING INITIATIVE

Joint HPC-QCS integration efforts from the 7 Hosting Entities and their partners

STANDARDIZATION

Collaboration with **standardization bodies** and participation in **relevant working groups and committees**

Ensuring that project developments **align with existing standards** and support the establishment of new ones for hybrid Quantum Computing.

Promotion of a **European HPC-QCS benchmark suite.**

CEN CENELEC

IEEE Advancing Technology for Humanity

THE EUROHPC QUANTUM COMPUTING INITIATIVE

EUROQHPC-I: a good example of a strong will to collaborate

All consortia had **planned HPC-QCS integration work** within their own project, taking into account their target HPC and QC platforms

All of them had to review their proposals to **find common grounds** with all 7 HPC-QCS infrastructures

The whole proposal was written in **28 days** !

- Administrative work required to get information from 6 partners (Hosting Entities) and 24 affiliated entities (their consortium members)
- → All of them synchronized properly and provided the information in a timely manner !

THE EUROHPC QUANTUM COMPUTING INITIATIVE

When will the EuroHPC quantum devices be available?

23/05/2023

With Software From EVIDEN and PASQAL, FZJ, GENCI and CEA Prepare European Research Communities for the Quantum Era

Forschungszentrum Jülich (FZJ), GENCI and CEA announce today that they will provide access to hardware-agnostic (EVIDEN QaptivaTM) and hardware-specific (PASQAL Pulser) programming and emulation environments as part of the pan-European hybrid HPC/quantum pilot project HPCQS. These first services will allow European research communities to prepare for the arrival of two twin 100+-qubit PASQAL quantum simulators, one at the Jülich Supercomputing Centre (FZJ/JSC) and one at CEA/TGCC, by the end of this year. In between, FZJ, GENCI and CEA will gradually deploy additional noisy emulators of such type of Fresnel analog quantum computers based on the technology of neutral atoms and will provide remote access to an identical Fresnel system hosted by PASQAL.

〈HPC|QOS〉

- Emulation capabilities **already available**
- 2x100+-qubit simulators available in **H1 2024 !**

PRESS RELEASE | 16 October 2023 | European High-Performance Computing Joint Undertaking

EuroHPC JU Launches Procurement for EuroQCS-Poland

The European High Performance Computing Joint Undertaking (EuroHPC JU) has launched a call for tender for the installation of EuroQCS-Poland, the EuroHPC quantum computer to be located in Poland.

2 additional procurements were launched

Acquisition, delivery, installation and hardware and software maintenance of Euro-Q-Exa quantum computer for EuroHPC Joint Undertaking

The purpose of this call for tenders is to select one vendor for the acquisition, delivery, installation and hardware and software maintenance of Euro-Q-Exa quantum computer for the European High Performance Computing Joint Undertaking.

Stay tuned for more information !

Thank you