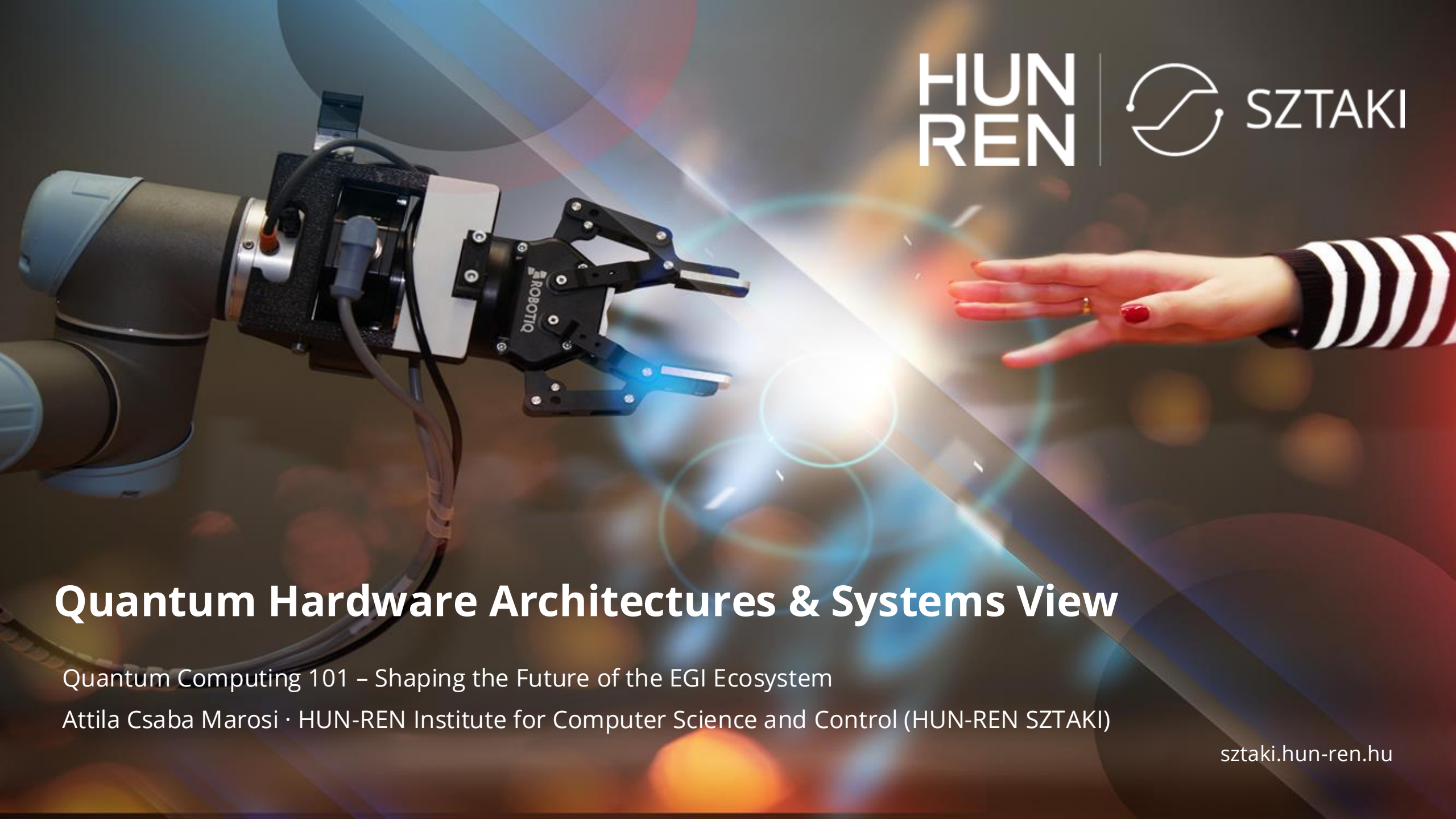


Quantum Hardware Architectures & Systems View

Quantum Computing 101 – Shaping the Future of the EGI Ecosystem

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Overview: hardware, access and workflow

What can a researcher run, and how do they get access?

1 Hardware

Which machines exist, and how do they differ?

2 Entitlement

Who can get time on them, and how?

3 Hybrid workflow

What classical software, data and identity surround a quantum call?

Goal: help researchers take the next step with quantum computing, whether just starting or further along

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Quantum hardware: five technologies

Technology	How the qubits are made	What stands out	Uses described	European example
Superconducting gate-based	Superconducting circuits	Layout matters: square lattice (Euro-Q-Exa); star around a central resonator to cut swap operations (VLQ)	Gate circuits; new algorithms and quantum machine learning (VLQ)	Euro-Q-Exa, LRZ: 54 qubits VLQ, IT4I: 24 qubits
Trapped ion gate-based	Ions held by electromagnetic fields, operated with lasers	All-to-all connectivity (Piast-Q); long coherence times	Hybrid optimisation, chemistry, materials science, machine learning (Piast-Q)	Piast-Q, PCSS: 20 qubits
Neutral atom analogue and digital	Neutral atoms held in programmable laser arrays	Room temperature, low power consumption (Pasqal systems)	Many-body physics, optimisation, machine learning (SOL)	Ruby, TGCC: 100+ qubits SOL, CINECA: 140+ qubits (analogue)
Photonic gate-based	Photons as qubits, linear optics	Room temperature; easier to integrate with HPC systems (Lucy)	Gate circuits; planned integration into the Joliot-Curie supercomputer (Lucy)	Lucy, TGCC: up to 12 qubits
Annealing special category	Superconducting flux qubits settle into a low-energy state	Not a gate machine: the problem is mapped to an energy landscape (Ising model)	Optimisation and sampling problems (D-Wave); molecular modelling, finance, logistics (EuroQCS-Spain)	EuroQCS-Spain, BSC: 10 qubits (first generation) JUPSI, Jülich (D-Wave): thousands of qubits

Qubit counts are not comparable across technologies: each row counts different things.

Semiconductor spin qubits are planned for the Netherlands and Luxembourg; those systems are in procurement.

Sources: EuroHPC JU releases for Piast-Q, Euro-Q-Exa, VLQ, Lucy, EuroQCS-Spain, JADE and Ruby, SOL; D-Wave documentation; Jülich JUNIQ (20 Oct 2026).

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European landscape: eight EuroHPC systems

Germany

Euro-Q-Exa
in pilot call

LRZ, Munich · Superconducting
Inaugurated Feb 2026

JADE
not in pilot call

Jülich · Neutral atoms, co-funded (HPCQS)
Inaugurated Nov 2025

France

Lucy
in pilot call

TGCC · Photonic
Inaugurated Apr 2026

Ruby
in pilot call

TGCC · Neutral atoms, co-funded (HPCQS)
Inaugurated Nov 2025

Poland

Piast-Q
in pilot call

PCSS, Poznań · Trapped ions
Inaugurated June 2025

Czechia

VLQ
in pilot call

IT4I, Ostrava · Superconducting
Inaugurated 2025

Italy

SOL
not in pilot call

CINECA, Bologna · Neutral atoms
Inaugurated June 2026

Spain

EuroQCS-Spain
in pilot call

BSC, Barcelona · Annealer
Inaugurated May 2026

Pipeline: spin-qubit systems in procurement in the Netherlands (EuroSSQ-HPC, SURF) and Luxembourg (MeluXina-Q, LuxProvide).

In pilot call: open for proposals in the EuroHPC Quantum Access Pilot. Catalogue entry, a place in the call and an award are three different steps.

Sources: EuroHPC JU system directory, Quantum Access Pilot call and inauguration releases (18 Oct 2026).

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European landscape: beyond EuroHPC

Host	System	Funded or operated by	How users get in, or status
Jülich, Germany JUNIQ	JUPSI: D-Wave annealer	Jülich Supercomputing Centre (own purchase)	Own JUNIQ application route (exploratory and research allocations)
Jülich, Germany JUNIQ	JION: trapped ions, gate-based	North Rhine-Westphalia (EPIQ project)	Inaugurated 3 Sep 2026; announced for future users
Bologna, Italy CINECA	NOX: IQM superconducting, 54 qubits	Italian research ministry via ICSC	Inaugurated June 2026
Barcelona, Spain BSC	Quantum Spain: 35-qubit system	Quantum Spain initiative	Open access through the Spanish Supercomputing Network (RES)
Delft, Netherlands QuTech	Quantum Inspire: Tuna-5, 9 and 17, superconducting	QuTech	Open registration; Tuna-17 is free with no usage caps
Espoo, Finland VTT	VTT Q50: IQM superconducting	VTT	Contact VTT; VTT QX cloud service for companies
Ehningen, Germany IBM	ibm_aachen (Heron r3), ibm_berlin (Nighthawk, exploratory)	IBM	IBM Quantum Platform, cloud access
San Sebastián, Spain IBM-Euskadi	IBM Quantum System Two	Basque Government and IBM	Basque Government protocol for Basque companies and public entities; applications by email

A host's participation in EuroHPC does not make all its quantum systems EuroHPC systems.

Sources: Jülich JUNIQ and press releases; CINECA/ICSC; Qilimanjaro and IFAE (BSC); QuTech; VTT; IBM Quantum changelog; Basque Government (20 Oct 2026).

What the EuroHPC pilot systems offer today

System	Technology	Qubits	Inaugurated	Pilot call, QPU h: max (min)
Piast-Q	Trapped ion	20 physical	June 2025	25 (10)
VLQ	Superconducting	24 physical	2025	10 (1)
Euro-Q-Exa	Superconducting	54 physical	Feb 2026	10 (1)
Lucy	Photonic	up to 12 physical	Apr 2026	25 (10)
EuroQCS-Spain	Annealer	10 physical	May 2026	25 (10)
Ruby	Neutral atom	100+	Nov 2025	25 (10)

Request range per project in the EuroHPC Quantum Access Pilot call. Qubits as announced by EuroHPC.

1 to 25
QPU hours per project, depending on the system

3 or 6
months per project

2 weeks
from a cut-off to the start, at most

Planned, not installed: Euro-Q-Exa upgrade to 150 qubits; hybrid analogue/digital mode for SOL (CINECA) in 2027. **Plan around tens of physical qubits and a few QPU hours.**

Sources: EuroHPC JU releases and Quantum Access Pilot Mode call; PCSS; IT4I (18 Oct 2026).

Three ways to start with quantum computing

1 Simulators

Start small

- Run small-scale experiments on simulators.
- The HUN-REN Quantum Reference Architecture provides Qiskit, PennyLane, D-Wave Ocean and more, deployed with simulators, ready to learn and experiment.

2 Open accounts

Open to anyone

- Quantum cloud platforms offer open accounts that anyone can sign up for, for example:
- IBM Quantum Platform: free account, up to 10 minutes of execution time per month.
- Quantum Inspire (QuTech): open registration, Tuna-17 is free.

Then, in parallel:

3a Provider programmes

Apply for access

- Some providers run application programmes, for example D-Wave Leap Quantum LaunchPad (3-month trial, by application). D-Wave systems are annealers, not gate-based: an alternative only if your problem suits annealing.

3b European machines

Direct application routes

- EuroHPC Quantum Access Pilot: proposals with monthly cut-offs; the next are 1 Nov and 1 Dec 2026, 10:00 CET.
- Host routes outside EuroHPC, for example JUPSI at Jülich (JUNIQ application) and VTT Q50 in Finland (contact VTT).

Simulator, then a free account on a quantum platform, then a provider programme or European machines.

Sources: IBM Quantum pricing page; D-Wave Leap Quantum LaunchPad; EuroHPC JU; Jülich JUNIQ; QuTech Quantum Inspire (18 Oct 2026).

How researchers get access in Europe

Route	Who	How	Examples
EuroHPC Quantum Access Pilot	Researchers, public institutions and industry across Europe	Proposal, assessed at monthly cut-offs; projects last 3 or 6 months	Six systems; next cut-offs 1 Nov and 1 Dec 2026
National and consortium programmes	Depends on the programme	VLQ: allocation through EuroHPC, IT4I/e-INFRA CZ, or a LUMI-Q national broker in eight countries. Quantum Spain: RES	VLQ, Quantum Spain
Host programmes	Contact the host	Jülich: JUNIQ application. LRZ: by request to quantum@lrz.de. VTT: contact VTT	JUPSI, Euro-Q-Exa testbed, VTT Q50
Open registration	Anyone	Create an account: Quantum Inspire (Tuna-17 is free), IBM Quantum Platform (up to 10 minutes per month)	Tuna-17, IBM systems
Provider programmes	By application	D-Wave Leap Quantum LaunchPad: 3-month trial; an annealer, not gate-based, so only for suitable problems	D-Wave
Classical resources	Researchers	Node-hours or cloud resources for the classical part of a hybrid project: EuroHPC regular access calls (no QPU hours), EGI, and national providers in each country	EuroHPC supercomputers, EGI, national centres

After an award: site-specific onboarding, for example MyAccessID login, a signed acceptable use policy and an access token (VLQ).

Sources: EuroHPC JU Quantum Access Pilot Mode call; IT4I VLQ documentation; Jülich JUNIQ; LRZ HPCQC documentation; VTT; QuTech; IBM; D-Wave (18 Oct 2026).

Bridging HPC and quantum: the job path

1 Identity and entitlement

- MyAccessID login, a signed acceptable use policy and an access token (VLQ)
- Token types differ by site: bearer token (Euro-Q-Exa), federated token (VLQ), API key (Piast-Q, IBM)

2 Slurm or SDK

- In an HPC centre: a Slurm job with the QPU requested like a resource (LRZ testbed, gres option); QRMI plugins for Slurm (backends: IBM, IQM, Pasqal); Pasqal systems via Slurm (JADE, Ruby)
- Via an SDK, no scheduler: Qiskit with an IBM API key, D-Wave Ocean, the Quantum Inspire SDK, PennyLane plugins

3 Quantum software stack

- Qiskit and PennyLane through the Munich Quantum Software Stack (LRZ)
- Abstract circuits (Euro-Q-Exa) or native gates already mapped to physical qubits (VLQ, Piast-Q)

4 QPU and queue

- The host operates the backend and the queue
- QPU time is accounted per site: equivalent qubit-seconds (Euro-Q-Exa), QPU seconds (VLQ), device time including ion loading (Piast-Q)
- EuroHPC pilot: 1 to 25 QPU hours per project

5 Result back to the classical job

- Classical code reads the result and continues, for example in an optimiser loop
- Record what ran, where, and under whose access

A quantum call here is a call from your code to a quantum backend. Every layer is site-specific: check the host docs.

Sources: IT4I VLQ and LRZ HPCQC documentation; LRZ news (11 Feb 2026); QRMI repository; EuroHPC JU HPCQS release; ENCCS guide (5 Oct 2026, secondary; the only source for the Piast-Q details).

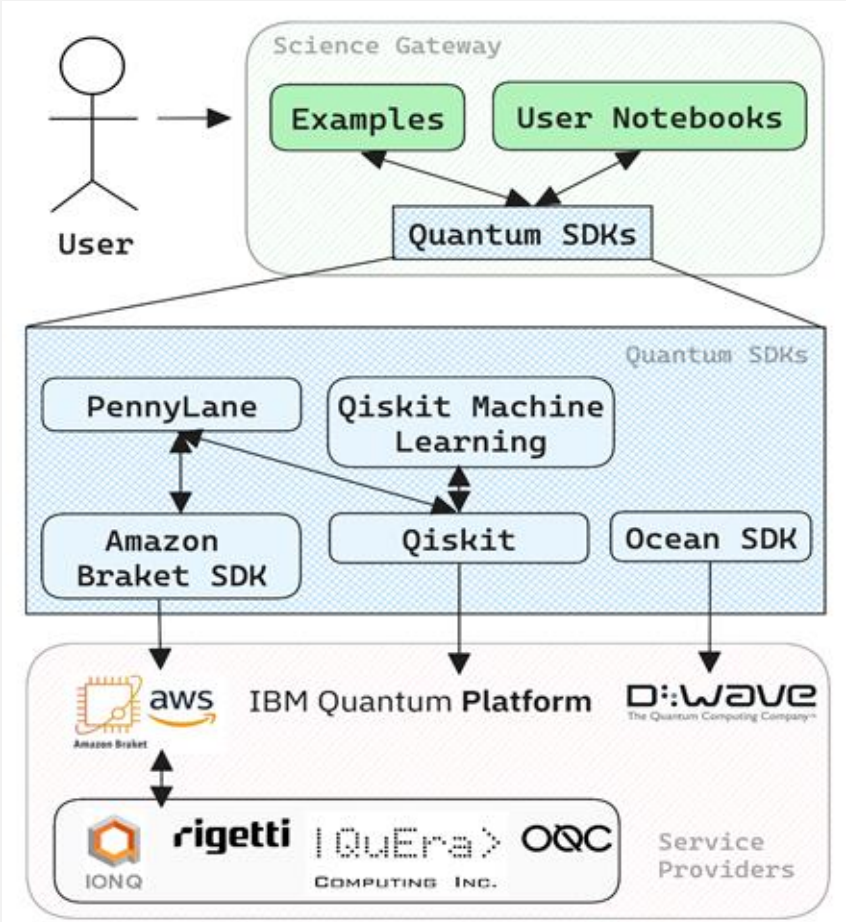
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Quantum Reference Architecture on HUN-REN Cloud

A small-scale HUN-REN Cloud interface for users to explore quantum workflows.

https://science-cloud.hu/en/reference-architectures/quantum

- **JupyterLab / SDK examples** use simulators by default, on whatever resources your own deployment provides. QPU routes (D-Wave Ocean, IBM Qiskit, Amazon Braket) open up with provider access.
- **Notebook-to-REST microservices** are available as an architecture option.
- **A software stack you deploy yourself**: intended for HUN-REN Cloud, it can also run in other cloud environments, on an HPC system or on your own laptop, using the resources of that deployment.



Possible provider paths



Quantum Reference Architecture – Quantum Computing Simulators

Examples of simulator software and backend options. Capacity and scaling depend on the configuration.

Qiskit (Gate-based)	
Qiskit AER	• CPU-based simulator backend (multi-CPU) • GPU-based simulator backend (multi-GPU)
Example Notebooks	• Vertex Cover (CPU) • Vertex Cover (GPU, multi-GPU)
Pennylane (Gate-based)	
Lightning.qubit Qiskit AER	• CPU-based simulator backend • CPU-based simulator backend (multi-CPU) • GPU-based simulator backend (multi-GPU)
Example Notebooks	• **Quantum SVM Car Detection (CPU)** • **Quantum Autoencoder for Sensor Anomaly Detection** • **Quanvolutional Neural Network for Satellite Image Classification (EuroSAT)**

D-Wave (Annealing)	
Classical Samplers (CPU)	• PlanarGraphSolver • RandomSampler • SimulatedAnnealingSampler • PathIntegralAnnealingSampler • RotorModelAnnealingSampler • SteepestDescentSolver • TabuSampler • TreeDecompositionSolver
Example Notebooks	• Cooperative Aerial-Ground 3D Mapping • Traveling Salesman Problem (TSP)

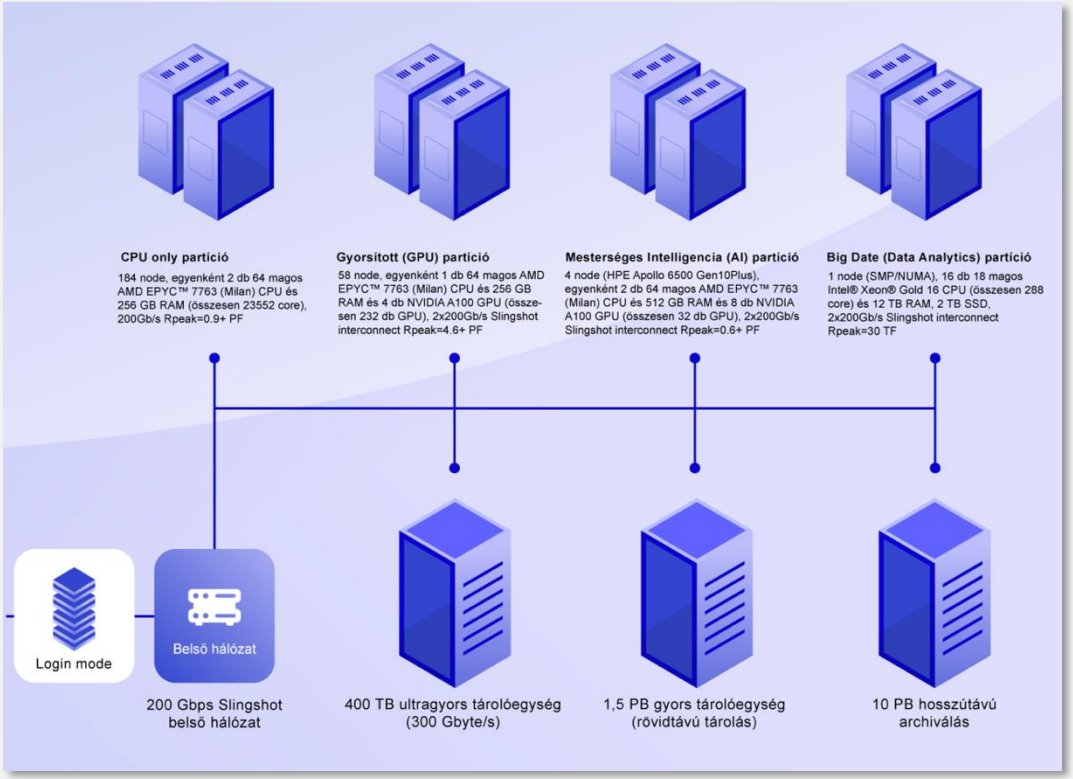
Software options by family. Multi-CPU and multi-GPU entries are options of the software.
EuroSAT saved output: default.qubit CPU simulator.

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Quantum Reference Architecture in HPC Settings

- A containerized software stack you deploy yourself on HUN-REN Cloud; simulators use the resources of that deployment.
- **We ran small-scale experiments** with this architecture on *Komondor*[1], on resources allocated to a pilot project.
- The stack can run in an HPC environment.

Small-scale HPC deployment on the Hungarian national supercomputer.

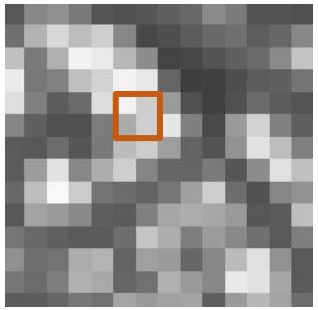


Komondor: Hungarian national supercomputer (KIFÜ)

[1]: https://hpc.kifu.hu/hu/komondor.html

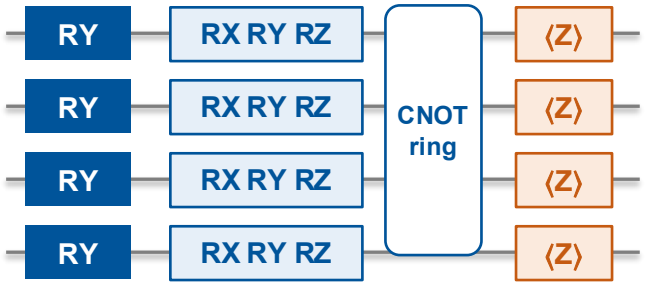
Hands-on: a quantum filter for satellite images

1 Satellite patch



14×14 grayscale; a 2×2 window slides over it

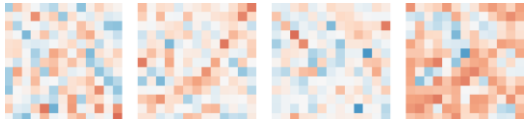
2 Quantum filter



rotations and CNOT ring: ×2 layers

one qubit per pixel; 4 numbers per window

3 Feature maps



4 maps of 13×13, one per qubit: 169 windows per image, so 169 circuit runs per image

4 Classical head

ReLU, pool

144 → 64

64 → 1

PyTorch, trained with the circuit

5 Prediction

Urban

Natural

P(Urban) above 0.5 gives Urban

169
circuit runs per image
13 × 13 window positions

24
quantum parameters
9,369 in total, the rest classical

100 / 50
training / test images
urban vs natural, four of ten EuroSAT classes

CPU
simulator, no hardware
PennyLane default.qubit

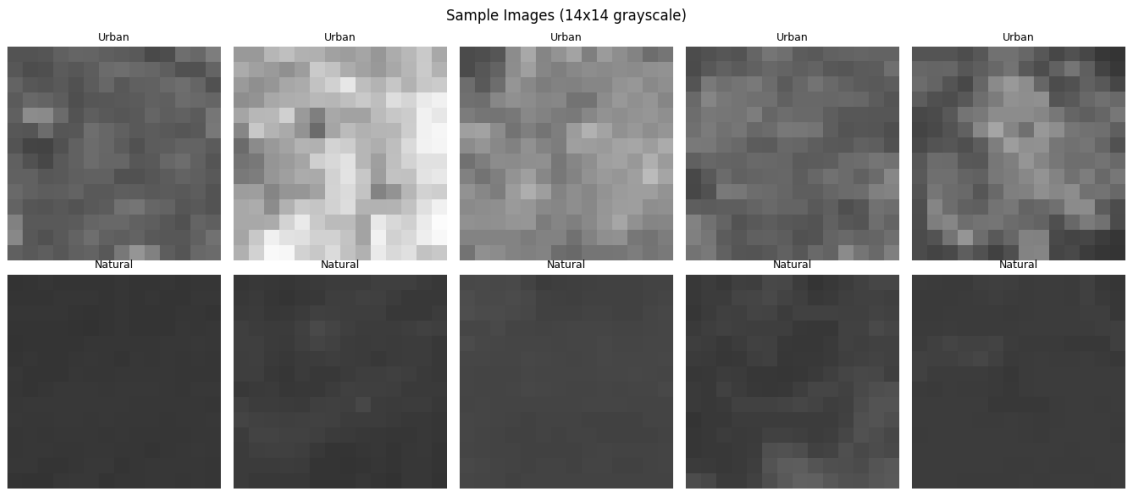
Notebook: 02-Quanvolutional-Neural-Network-EuroSAT in the HUN-REN Quantum Reference Architecture. Next: the code, the switch to hardware, the results.

Notebook saved outputs. EuroSAT images: Helber, Bischke, Dengel, Borth, IEEE JSTARS 2019; MIT license (c) Patrick Helber; based on Copernicus Sentinel-2 data.

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Notebook: data and the quantum filter

Notebook cell · sample images



Urban patches show structure; **natural** patches are dark and smooth, even at 14×14.

A 2×2 window moves with stride 1 over 14×14 pixels: 13 × 13 = 169 windows, so 169 circuit runs per image.

1 angle embedding: one pixel per qubit

2 RX, RY, RZ and a CNOT ring, twice

3 ⟨Z⟩ on each qubit: 4 numbers

Notebook cell · the quantum filter (PennyLane)

```
N_LAYERS = 2

@qml.qnode(dev, interface='torch', diff_method='backprop')
def quanv_circuit(inputs, weights):
    # Angle embedding: RY(pi * pixel_value) per qubit
    for i in range(N_QUBITS):
        qml.RY(np.pi * inputs[i], wires=i)
    # Variational ansatz layers
    for layer in range(N_LAYERS):
        for i in range(N_QUBITS):
            qml.RX(weights[layer, i, 0], wires=i)
            qml.RY(weights[layer, i, 1], wires=i)
            qml.RZ(weights[layer, i, 2], wires=i)
        for i in range(N_QUBITS):
            qml.CNOT(wires=[i, (i + 1) % N_QUBITS])
    return [qml.expval(qml.PauliZ(i)) for i in range(N_QUBITS)]
```

Notebook output · qml.draw of the circuit

```
0: ──RY(0.00)──RX(0.00)──RY(0.00)──RZ(0.00)─╭●─────╭X──RX(0.00)──RY(0.00)──RZ(0.00)─╭●──── ···
1: ──RY(0.00)──RX(0.00)──RY(0.00)──RZ(0.00)─╰X─╭●──│──RX(0.00)──RY(0.00)──RZ(0.00)─╰X─╭●─ ···
2: ──RY(0.00)──RX(0.00)──RY(0.00)──RZ(0.00)───╰X─╭●─│──RX(0.00)──RY(0.00)──RZ(0.00)───╰X─╭● ···
3: ──RY(0.00)──RX(0.00)──RY(0.00)──RZ(0.00)─────╰X─╰●──RX(0.00)──RY(0.00)──RZ(0.00)─────╰X ···

0: ··· ─╭X─┤  <Z>
1: ··· ─├──┤  <Z>
2: ··· ─├──┤  <Z>
3: ··· ─╰●─┤  <Z>
```


Notebook 02-Quanvolutional-Neural-Network-EuroSAT, saved outputs. EuroSAT images: Helber, Bischke, Dengel, Borth, IEEE JSTARS 2019; MIT license; Copernicus Sentinel-2 data.

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Notebook: from simulator to hardware

Notebook cell · choose the quantum device (hardware branch for the current plugin)

```
PENNYLANE_TOKEN = ''  # IBM Quantum token for real hardware

USE_SIMULATOR = True
N_QUBITS = 4
```

```
if USE_SIMULATOR:
    dev = qml.device('default.qubit', wires=N_QUBITS)
```

simulator

```
else:
    # Requires pennylane-qiskit and qiskit-ibm-runtime
    from qiskit_ibm_runtime import QiskitRuntimeService
    QiskitRuntimeService.save_account(token=PENNYLANE_TOKEN)
    service = QiskitRuntimeService()
    backend = service.least_busy(operational=True,
                                 simulator=False,
                                 min_num_qubits=N_QUBITS)
    dev = qml.device('qiskit.remote',
                     wires=backend.num_qubits,
                     backend=backend)
```

IBM hardware

```
print(f'Using device: {dev.name}')
```

```
Using device: default.qubit
```

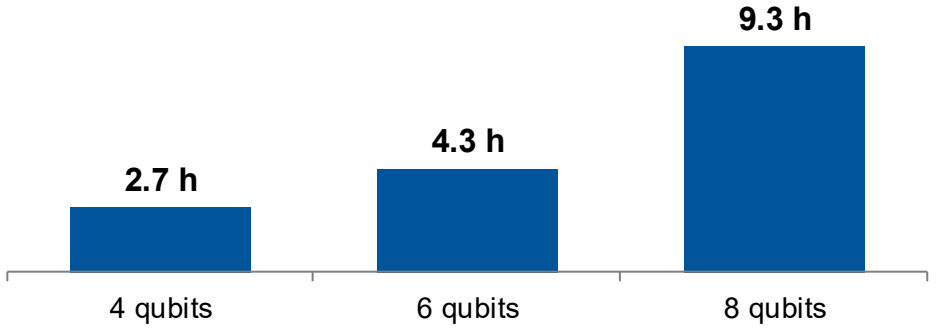
Unchanged: the circuit, the PyTorch model and the training loop.

Two settings change

Device: default.qubit becomes qiskit.remote, with an IBM backend and a saved IBM Quantum token.

Gradients: backprop becomes parameter-shift, with 2 shifted runs per parameter: 48 extra circuit runs per window.

What it costs: one 15-epoch training run on the simulator



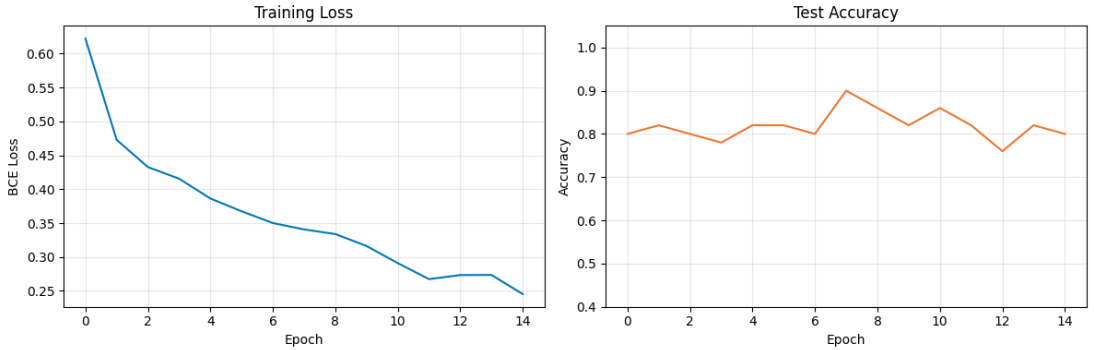
Forward passes alone: 169 windows × 100 images × 15 epochs = 253,500 circuit runs.

On hardware every run is repeated for shots, and each QPU hour has to cover all of them.

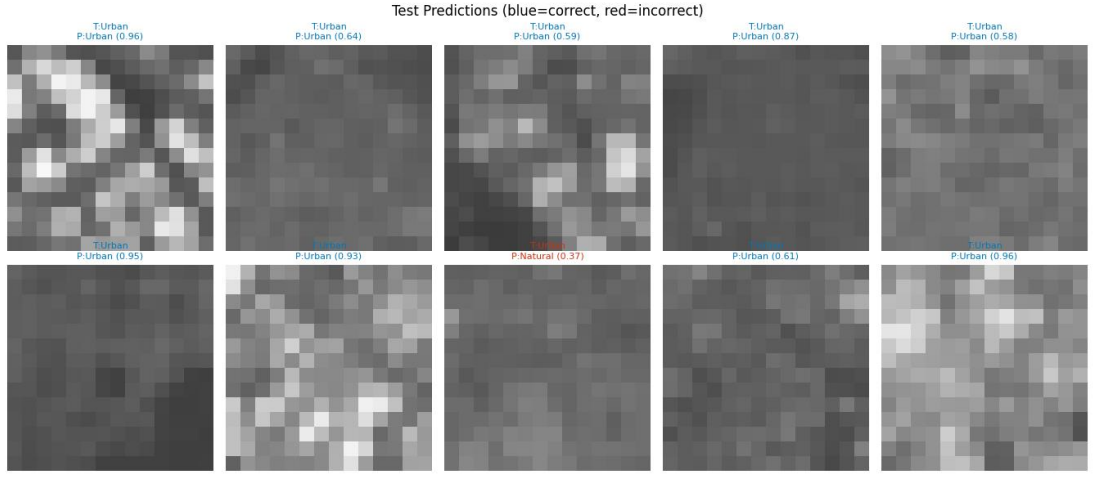
Notebook 02-Quanvolutional-Neural-Network-EuroSAT: configuration and gradient cells, hardware branch adapted from the PennyLane-Qiskit documentation; timings from its CPU benchmark sweep (default.qubit, single run).

Notebook: training, predictions and feature maps

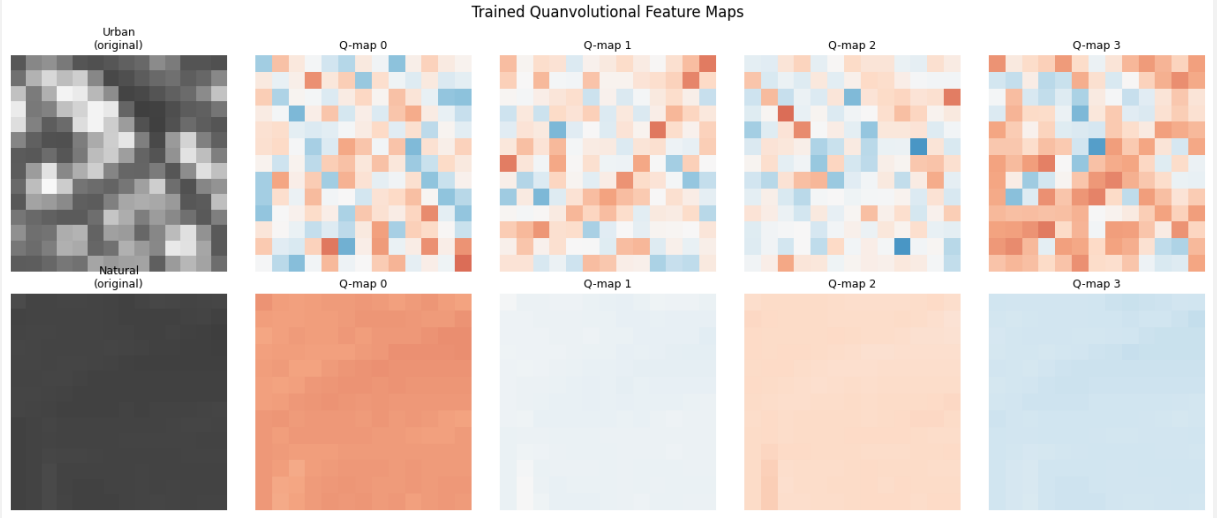
Notebook output · training loss and test accuracy per epoch



Notebook output · first ten test predictions (blue correct, red wrong)



Notebook output · trained quantum feature maps, one urban and one natural patch



Loss (training error, lower is better): about 0.6 falling to about 0.25

Test accuracy (share of test images correct): 0.76 to 0.90, ends at 0.80

Predictions: all ten shown are urban; nine correct, one called natural

Feature maps: patterned for the urban patch, smooth for the dark natural patch

Notebook 02-Quanvolutional-Neural-Network-EuroSAT, saved outputs of a pre-trained model (CPU simulator). EuroSAT images: Helber et al., IEEE JSTARS 2019; MIT license.

Possible next steps

If you are just starting

- Start on a simulator with a small, clearly specified scientific task.
- Compare with a classical baseline.
- Open a free account on a quantum platform, for example IBM Quantum Platform or Quantum Inspire, for first hardware runs.

If you are ready for the next step

- Apply to a provider programme, for example D-Wave Leap Quantum LaunchPad (annealing: suits specific problems only).
- Apply for QPU time on European machines: the EuroHPC pilot or a host's own route.
- Compare each hardware result with your classical baseline.

Next EuroHPC Quantum Access Pilot cut-off: 1 Nov 2026, 10:00 CET. Allocations follow proposal assessment.

Sources: EuroHPC JU Quantum Access Pilot Mode call; IBM Quantum pricing page; D-Wave Leap Quantum LaunchPad (18 Oct 2026).

References and links: European landscape and access

EuroHPC JU: quantum computers	https://www.eurohpc-ju.europa.eu/eurohpc-quantum-computers/our-quantum-computers_en
EuroHPC JU: pilot call	https://www.eurohpc-ju.europa.eu/eurohpc-ju-call-proposals-quantum-access-pilot-mode_en
EuroHPC JU: regular access calls	https://www.eurohpc-ju.europa.eu/access-our-supercomputers/eurohpc-access-calls_en
EuroHPC JU: Piast-Q	https://www.eurohpc-ju.europa.eu/inauguration-piast-q-leap-european-quantum-computing-2025-06-23_en
EuroHPC JU: VLQ	https://www.eurohpc-ju.europa.eu/vlq-europes-next-leap-towards-quantum-powered-research-and-innovation-2025-09-23_en
EuroHPC JU: JADE and Ruby	https://www.eurohpc-ju.europa.eu/inauguration-jade-and-ruby-quantum-processors-milestone-towards-hybrid-high-performance-computing-2025-11-13_en
EuroHPC JU: Euro-Q-Exa	https://www.eurohpc-ju.europa.eu/inauguration-euro-q-exa-expanding-european-quantum-computing-infrastructure-2026-02-12_en
EuroHPC JU: Lucy	https://www.eurohpc-ju.europa.eu/eurohpc-ju-inaugurates-quantum-computer-france-strengthening-europes-sovereignty-2026-04-14_en
EuroHPC JU: EuroQCS-Spain	https://www.eurohpc-ju.europa.eu/eurohpc-ju-inaugurates-euroqcs-spain-barcelona-2026-05-28_en
EuroHPC JU: SOL	https://www.eurohpc-ju.europa.eu/inauguration-sol-new-quantum-computer-together-lisa-upgrade-leonardo-supercomputer-2026-06-11_en
EuroHPC JU: Netherlands procurement	https://www.eurohpc-ju.europa.eu/eurohpc-ju-launches-procurement-quantum-computer-netherlands-2025-09-15_en
EuroHPC JU: Luxembourg procurement	https://www.eurohpc-ju.europa.eu/eurohpc-ju-launches-procurement-quantum-computer-luxembourg-2026-07-23_en
Jülich: JUNIQ access	https://www.fz-juelich.de/en/jsc/systems/quantum-computing/juniq-facility/access-service-and-support
LRZ: HPCQC documentation	https://doku.lrz.de/documentation-hpcqc-system-access-and-hpcqc-job-submission-via-mqss-adapter-2603423874.html
LRZ: Euro-Q-Exa news	https://www.lrz.de/en/news/detail/first-european-quantum-computer-for-germany-euro-q-exa-starts-operation-at-lrz
IT4I: VLQ access	https://docs.it4i.cz/en/docs/clusters/vlq/access
PCSS: Piast-Q	https://www.pcss.pl/system-piast-q-oficjalnie-uruchomiony/
CINECA: NOX	https://w.media/iqm-quantum-computer-goes-live-at-supercomputing-center-cineca-in-italy/
BSC: Quantum Spain (IFAE)	https://www.ifae.es/news/2026/05/28/qilimanjaro-contributes-to-new-quantum-computing-milestone-at-bsc/
Basque Government: IBM-Euskadi	https://www.euskadi.eus/gobierno-vasco/-/noticia/2026/el-gobierno-vasco-abre-ibm-quantum-system-two-industria-y-entidades-publicas-impulsar-nuevos-proyectos-innovacion-y-transferencia/
QuTech: Quantum Inspire	https://qutech.nl/2026/07/07/quantum-inspire-adds-new-open-architecture-quantum-processor-tuna-17/
VTT: quantum computers	https://www.vttresearch.com/en/technology-infrastructures/quantum-computers

Addresses as read in October 2026.

References and links: providers and the notebook

IBM Quantum: pricing and plans	https://www.ibm.com/quantum/pricing
IBM Quantum: changelog	https://quantum.cloud.ibm.com/docs/en/guides/latest-updates
D-Wave: Leap Quantum LaunchPad	https://www.dwavequantum.com/quantum-launchpad/
D-Wave: annealing documentation	https://docs.dwavequantum.com/en/latest/quantum_research/annealing.html
Pasqal: technology	https://www.pasqal.com/technology/
Quandela: technology	https://www.quandela.com/technology/
QRMI repository	https://github.com/qiskit-community/qrmi
ENCCS: EuroHPC quantum access guide	https://enccs.se/2026/10/short-tutorials/eurohpc-ju-quantum-devices-access/
HUN-REN Cloud: Quantum	https://science-cloud.hu/en/reference-architectures/quantum
Komondor HPC (KIFÜ)	https://hpc.kifu.hu/hu/komondor.html
Quantum @ SZTAKI	https://q.sztaki.hun-ren.hu/
Marosi et al., IEEE Access 2023	https://doi.org/10.1109/ACCESS.2023.3342749
Notebook: PennyLane	https://pennylane.ai/
Notebook: PyTorch	https://pytorch.org/
Notebook: PennyLane-Qiskit plugin	https://docs.pennylane.ai/projects/qiskit/en/latest/
EuroSAT paper (Helber et al.)	https://arxiv.org/abs/1709.00029

Notebook: 02-Quanvolutional-Neural-Network-EuroSAT in the HUN-REN Quantum Reference Architecture. Addresses as read in October 2026.

Backup

Backup: the eight systems in the EuroHPC JU catalogue

System	Host, country	Technology (JU directory)	Inaugurated	In pilot call
Piast-Q	PCSS/PSNC, Poland	Trapped ions, digital	June 2025	Yes
VLQ	IT4I, Czechia	Superconducting, digital	2025	Yes
Euro-Q-Exa	LRZ, Germany	Superconducting, digital	Feb 2026	Yes
Lucy	CEA/GENCI (TGCC), France	Photonic, digital	Apr 2026	Yes
EuroQCS-Spain	BSC, Spain	Superconducting annealer (analogue)	May 2026	Yes
SOL	CINECA, Italy	Neutral atoms, analogue	June 2026	No
JADE	JSC Jülich, Germany	Neutral atoms (HPCQS co-funded)	Nov 2025	No
Ruby	CEA/GENCI (TGCC), France	Neutral atoms (HPCQS co-funded)	Nov 2025	Yes

Source: EuroHPC JU system directory, Quantum Access Pilot figure and inauguration releases (18 Oct 2026). Pipeline: Netherlands, Luxembourg.

Backup: the six systems in the pilot call



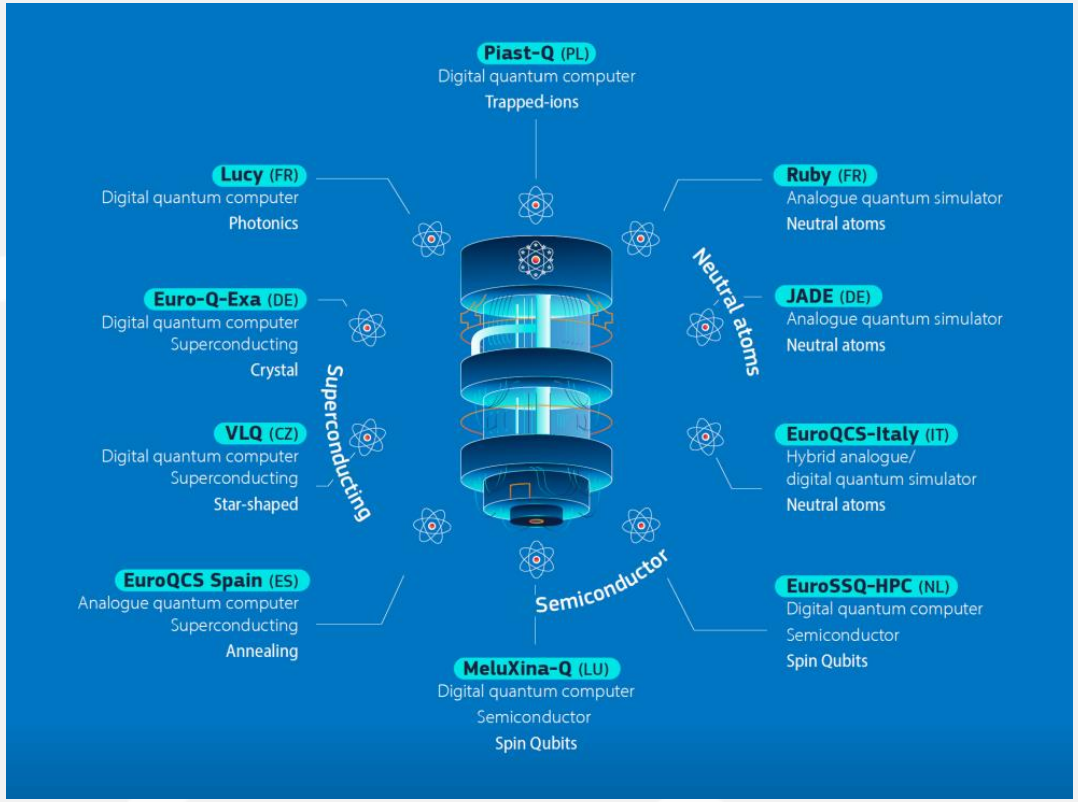
SYSTEM*	SITE (COUNTRY)	TECHNOLOGY	MODALITY	TOPOLOGY	MAX. (MIN.) REQUEST*#
EuroQCS Spain	BSC (ES)	Analogue (annealer)	Superconducting	N/A	25 (Min 10)
Ruby	GENCI/CEA (FR)	Analogue simulator	Neutral atoms	2D Array	25 (Min 10)
EURO-Q-EXA	LRZ (DE)	Digital	Superconducting	Crystal	10 (Min. 1)
Lucy	GENCI/CEA (FR)	Digital	Photonic	All-to-all connectivity	25 (Min. 10)
PIAST-Q	PCSS (PL)	Digital	Trapped-ions	All-to-all connectivity	25 (Min. 10)
VLQ	IT4 INNOVATIONS (CZ)	Digital	Superconducting	Star with central resonator	10 (Min. 1)

System	Site	Technology	Topology	Max. (min.) request, QPU h
EuroQCS-Spain	BSC (ES)	Analogue annealer, superconducting	n/a	25 (10)
Ruby	GENCI/CEA (FR)	Analogue simulator, neutral atoms	2D array	25 (10)
Euro-Q-Exa	LRZ (DE)	Digital, superconducting	Crystal	10 (1)
Lucy	GENCI/CEA (FR)	Digital, photonic	All-to-all	25 (10)
Piast-Q	PCSS (PL)	Digital, trapped ions	All-to-all	25 (10)
VLQ	IT4Innovations (CZ)	Digital, superconducting	Star with central resonator	10 (1)

Next cut-offs: 1 Nov and 1 Dec 2026, 10:00 CET.

Figure: EuroHPC JU, Quantum Access Pilot Mode call, systems available for quantum access (18 Oct 2026).

Backup: EuroHPC plan of 2025 and status in October 2026



EuroHPC figure of planned deployments, 2025: https://www.eurohpc-ju.europa.eu/quantum-technologies/quantum-computing-access_en

Planned 2025	Technology	Status, 18 Oct 2026
Piast-Q (PL)	Trapped ions	Inaugurated June 2025; in pilot call
VLQ (CZ)	Superconducting	Inaugurated 2025; in pilot call
Euro-Q-Exa (DE)	Superconducting	Inaugurated Feb 2026; in pilot call
Lucy (FR)	Photonic	Inaugurated Apr 2026; in pilot call
Ruby (FR)	Neutral atoms	Inaugurated Nov 2025; in pilot call
JADE (DE)	Neutral atoms	Inaugurated Nov 2025; not in pilot call
EuroQCS-Spain (ES)	Annealing	Inaugurated May 2026; in pilot call
EuroQCS-Italy (IT)	Neutral atoms	SOL (EuroQCS-Italy consortium), June 2026; not in pilot call
EuroSSQ-HPC (NL)	Spin qubits	Procurement launched Sep 2025; at least 16 qubits
MeluXina-Q (LU)	Spin qubits	Procurement launched Jul 2026; at least 10 qubits

Figure: EuroHPC JU, https://www.eurohpc-ju.europa.eu/quantum-technologies/quantum-computing-access_en. Status: EuroHPC JU inauguration, procurement and pilot releases (18 Oct 2026; Netherlands 15 Sep 2025, Luxembourg 23 Jul 2026).

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Backup: further sources and dates

EuroHPC JU: access to quantum computers opens	25 Jun 2026	https://www.eurohpc-ju.europa.eu/eurohpc-ju-opens-access-its-quantum-computers-2026-06-25_en
EuroHPC: figure of planned systems (2025)	May 2025	https://www.eurohpc-ju.europa.eu/quantum-technologies/quantum-computing-access_en
EuroHPC JU: pilot call systems figure (image)	published Oct 2026	https://www.eurohpc-ju.europa.eu/sites/default/files/styles/embed_large/public/2026-10/Systems%20available%20for%20Quantum%20access%20v3_0.png?itok=aAdNzXhQ
IT4I: VLQ consumption guide	undated	https://docs.it4i.cz/en/docs/clusters/vlq/vlq-consumption-guide
Jülich: JUPSI system page	modified 4 Oct 2025	https://www.fz-juelich.de/en/jsc/systems/quantum-computing/juniq-facility/juniq/d-wave-advantagetm-system-jupsi
Jülich: JUPSI purchase	13 Feb 2025	https://www.fz-juelich.de/en/news/archive/press-release/2025/forschungszentrum-julich-strengthens-quantum-research-with-purchase-of-d-wavetm
Jülich: JION launch	3 Sep 2026	https://www.fz-juelich.de/en/news/archive/press-release/2026/launch-jion-quantum-computer-juelich
CINECA: NOX funding (DCD, trade report)	read Oct 2026	https://www.datacenterdynamics.com/en/news/italys-cineca-launches-two-quantum-computers-in-bologna/
BSC: news page	read 21 Oct 2026	https://www.bsc.es/news/bsc-news/bsc-expands-its-quantum-computer-capacity-and-consolidates-open-access-infrastructure
QuTech: Quantum Inspire backends	read Oct 2026	https://www.quantum-inspire.com/backends/
Notebook 02-Quanvolutional-Neural-Network-EuroSAT	saved outputs, CPU benchmark timings	https://git.science-cloud.hu/science-cloud/reference-architectures/quantum/-/blob/main/lab/notebook/pennylane/02-Quanvolutional-Neural-Network-EuroSAT.ipynb?ref_type=heads
EuroSAT: dataset repository (MIT license)	read Oct 2026	https://github.com/phelber/EuroSAT

Sources already listed on the main reference slides (20 and 21) are not repeated. Dates are publication dates where the page gives one, otherwise the month the page was read.