

# QT Calls 2021



Call	Description	Main Coordinator / Backup Coordinator	Open Date	Close Date
HORIZON-CL4-DIGITAL-EMERGING-2021-01-21	<b>Next generation quantum sensing technologies (RIA)</b>	Dagmar Floeck Philippe Raynal	22/06/2021	21/10/2021
HORIZON-CL4-DIGITAL-EMERGING-2021-01-30	<b>Investing in new emerging quantum computing technologies (RIA)</b>	Philippe Raynal Doru Tanasa	22/06/2021	21/10/2021
HORIZON-CL4-DIGITAL-EMERGING-2021-01-32	<b>Support and coordination of the Quantum Technologies Flagship Initiative (CSA)</b>	Dagmar Floeck Oscar Diez	22/06/2021	21/10/2021
HORIZON-CL4-DIGITAL-EMERGING-2021-01-23	<b>International cooperation with Canada (RIA)</b>	Christian Trefzger Dagmar Floeck	22/06/2021	21/10/2021
HORIZON-CL4-DIGITAL-EMERGING-2021-02-16	<b>Basic Science for Quantum Technologies (RIA)</b>	Dagmar Floeck Christian Trefzger	28/10/2021	27/01/2022
HORIZON-CL4-DIGITAL-EMERGING-2021-02-20	<b>Quantum sensing technologies for market uptake (IA) *</b>	Doru Tanasa Dagmar Floeck	28/10/2021	27/01/2022
HORIZON-CL4-2021-DIGITAL-EMERGING-02-10	<b>Strengthening the quantum software ecosystem for quantum computing platforms (RIA)</b>	Philippe Raynal Doru Tanasa	28/10/2021	27/01/2022
HORIZON-CL4-DIGITAL-EMERGING-2021-02-15	<b>Framework Partnership Agreement for developing the first large-scale quantum computers (FPA) *</b>	Oscar Diez Christian Trefzger	28/10/2021	27/01/2022
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\* Art 22.5 Special restrictions apply





# QT Calls 2021

## What are you looking for?

### -High TRL (including FPAs):

- Build on the Quantum platforms supported during the Quantum Flagship ramp up phase.
- Move QT to industry and Commercialization
- Federation of Competencies/Facilities for Pilot Lines/Open testing

- **Coordination & Support Action (CSA):** Coordinating the relevant stakeholders, notably academia, RTOs and industry participating in the Flagship initiative.

### -Low TRL (e.g. emerging technologies):

- Proposals should clearly move the technology up the TRL scale.
- Basic Science: R&D of basic theories and components, addressing foundational challenges relevant for the development of QT in at least one of areas a)-d).
- Leading to long-term economic, scientific and societal benefits, move QT from the laboratory to industry





# QT Calls 2021

## 2. What do we do NOT want?

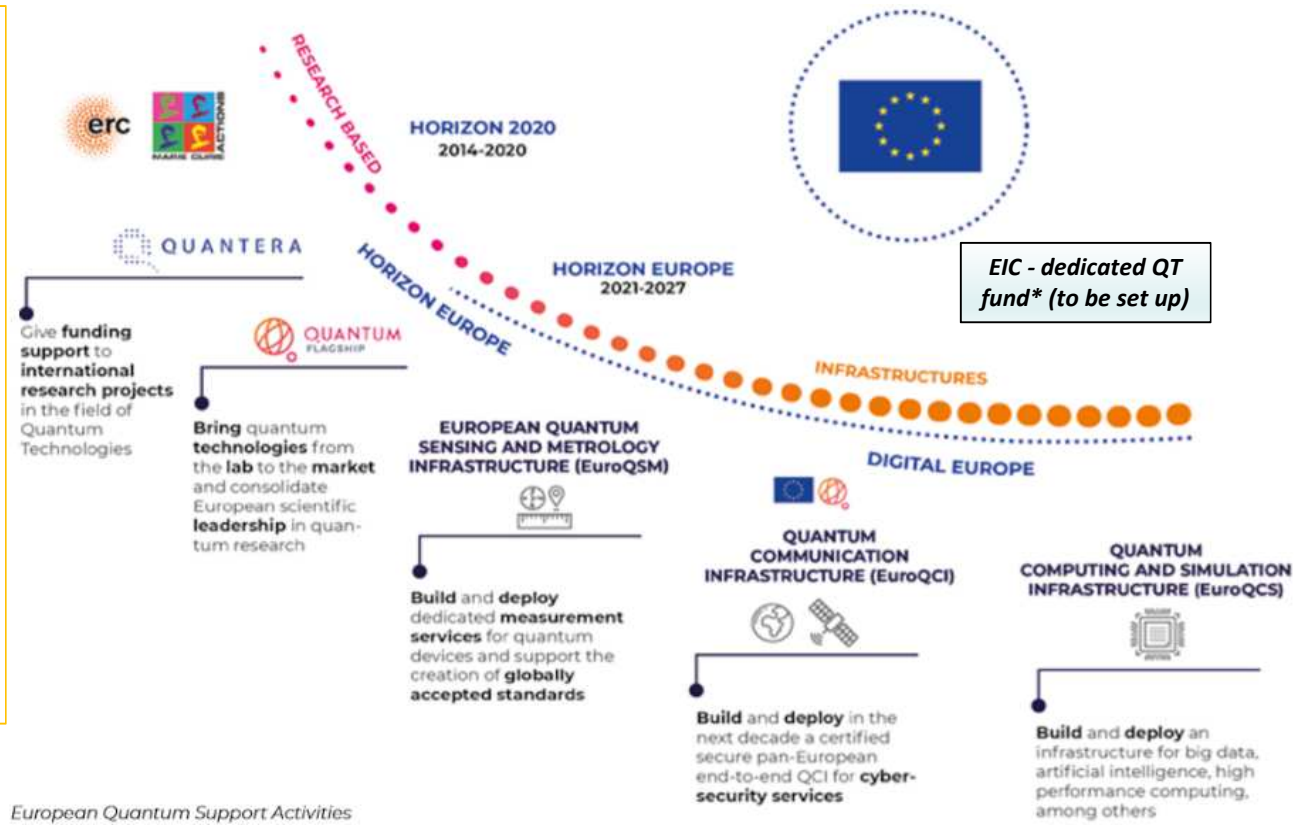
- Pure academic consortia
- Splitting of competences, separation of Splitting of facilities for Pilot Lines/Open testing, incoherent approaches



# QT Calls – topic evolution

3. Is this new or has it been called before?

- High TRLs: Follow up of Quantum Flagship calls
- Basic Science like Quantum Flagship calls



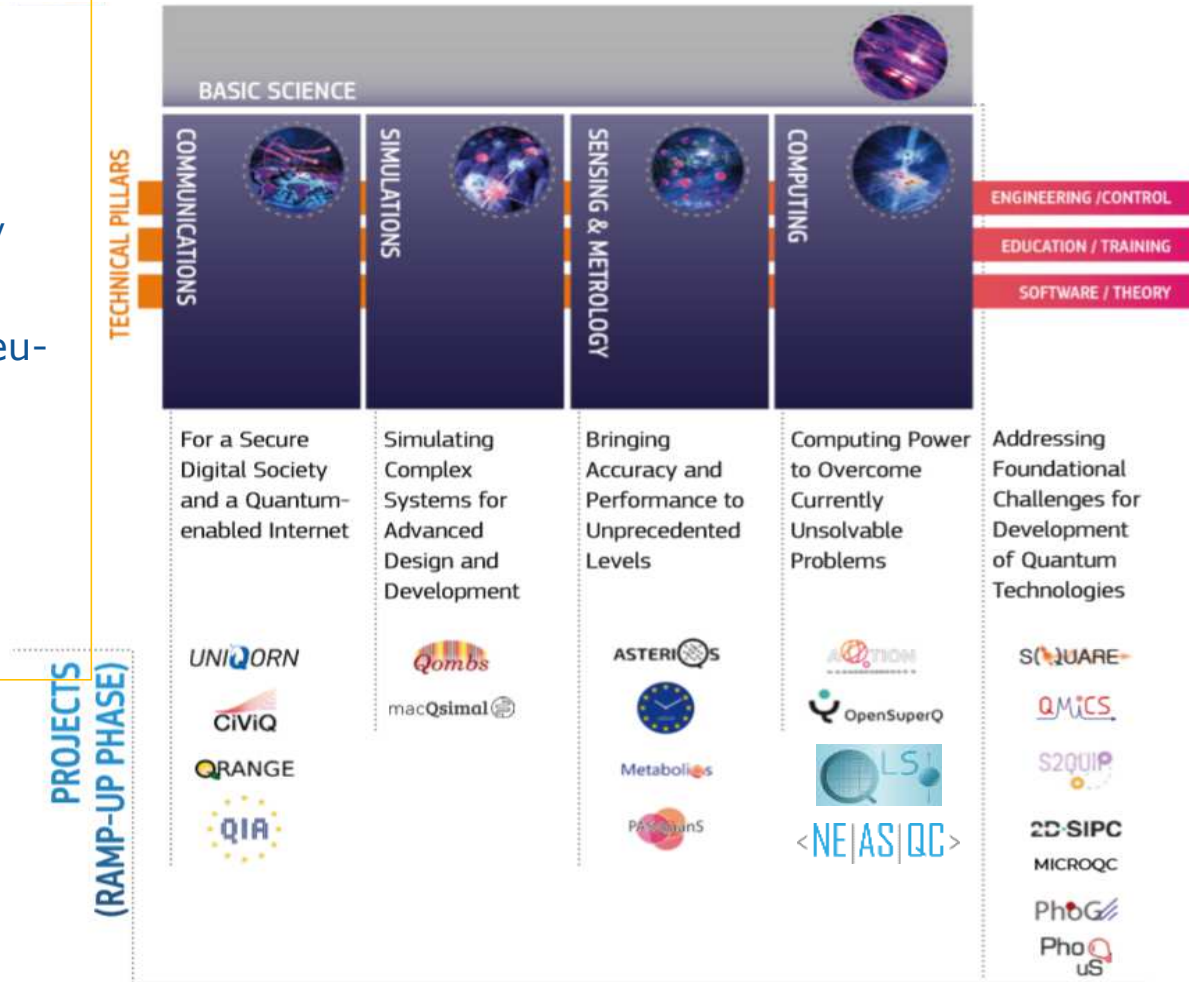


## 4. Current project portfolio *(if relevant)*

-QT Ongoing projects

<https://qt.eu/about-quantum-flagship/projects/>

<https://ec.europa.eu/digital-single-market/en/eu-funded-projects-quantum-technology>





## QT 2021– Key actors

### 5. Who are the types of main stakeholders that are addressed?

- Research institutes, universities, RTOs, foundations, Industry, SMEs and other organizations
- **Academia & industry participation is key;**
- Role of RTOs as facilitators for technology transfer;
- Importance of SMEs and of potential users

### 6. Is there a key group of actors (eg. Partnership or other) driving this?

- **QCN (Quantum Community Network):** <https://qt.eu/about-quantum-flagship/the-quantum-flagship-community/quantum-community-network/>

- **Quantum Industry Consortium – QUIC:** <https://qt.eu/about-quantum-flagship/the-quantum-flagship-community/quic/>

- **QFLag CSA:** <https://qt.eu/about-quantum-flagship/introduction-to-the-quantum-flagship/qflag-quantum-flagship-coordination-and-support-action/>



# QT Calls 2021



## 7. Are there any additional / background documents?

*e.g. call specific background / guidance notes; EC communications and other policy documents;  
work programme consultation workshop reports; strategic research agendas, other research roadmaps;*

**-QT.EU Resources:** <https://qt.eu/about-quantum-flagship/resources/>

**-QT SRA:** [https://qt.eu//app/uploads/2020/04/Strategic\\_Research-\\_Agenda\\_d\\_FINAL.pdf](https://qt.eu//app/uploads/2020/04/Strategic_Research-_Agenda_d_FINAL.pdf)

**-QT Ongoing projects** <https://qt.eu/about-quantum-flagship/projects/> and  
<https://ec.europa.eu/digital-single-market/en/eu-funded-projects-quantum-technology>

**-Horizon Europe Reference Documents** (europa.eu):  
<https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/how-to-participate/reference-documents>



***CNECT C2 Evaluations email***

***High Performance Computing & Quantum Technologies***

***[cnect-c2-evaluations@ec.europa.eu](mailto:cnect-c2-evaluations@ec.europa.eu)***



## Future Outlook

8. Do you have information about future trends, emerging initiatives, roadmaps, type of stakeholders in this area?

-In the **QT Strategic Research Agenda** (3 and 6 years vision per pillar):

[https://qt.eu//app/uploads/2020/04/Strategic\\_Research- Agenda\\_d\\_FINAL.pdf](https://qt.eu//app/uploads/2020/04/Strategic_Research- Agenda_d_FINAL.pdf)







## Info Sessions

9. Please list upcoming information days and other events of relevance to this area

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HE Info Day Session 30<sup>th</sup> June afternoon

**Canada Workshop**

<https://qt.eu/about-quantum-flagship/newsroom/eu-canada-workshops/>

HE QT FPAs Session  
2<sup>nd</sup> July 10:00 WebEx

# HORIZON-CL4-DIGITAL-EMERGING-2021-01-21

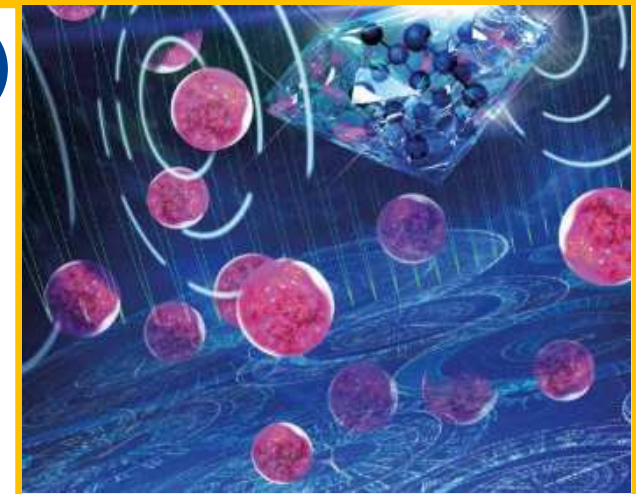
## Next generation quantum sensing technologies (RIA)



### Outcomes



- Demonstrate the feasibility of **next generation quantum sensing technologies and devices**
- disruptive progress in the **performance, reliability and efficiency** (enhancing the TRL of all essential components)



### Scope

starts with TRL 2-3 and ends with TRL 4-5



- Provide **extreme precision** and **accuracy** measurements in many fields
- **beyond the performance of consumer devices and services**
- Examples: **medical diagnostics and imaging, high-precision navigation**, and monitoring, to **future applications in the Internet of Things** and for enhanced measurement and metrology.

Opening: 22 June 2021  
Closing: 21 Oct 2021



Duration: 3 years



Budget EUR 13.5 million  
EUR 6.75 million/project



Topic Coordinator  
Dagmar FLOECK



# HORIZON-CL4-DIGITAL-EMERGING-2021-01-30 (RIA) Investing in new emerging quantum computing technologies



## Outcomes



- **new emerging** and **potentially promising quantum technology platforms** besides the ones supported in the ramp-up phase of the Quantum Technologies Flagship (superconducting, trapped ion, and silicon spin qubits)
- **Examples:** Rydberg atom qubits, photonic qubits, and spin qubits
- prospect for **high scalability** and **fault tolerance**



## Scope

Starts with **TRL 2-3** and ends with **TRL 4-5**



- Integrate **quantum processors (>10 qubits)**, control electronics, software stack, algorithms, applications,...
- Address **scalability towards large systems (>100 qubits)**, **verification** and **validation** of the quantum computation, **fault-tolerance** and **solving a concrete computational problem** to demonstrate **quantum advantage**.

Opening: 22 June 2021  
Closing: 21 Oct 2021



Duration: 3 years



Budget EUR 10 million  
EUR 5 million/project



Topic Coordinator  
Philippe RAYNAL



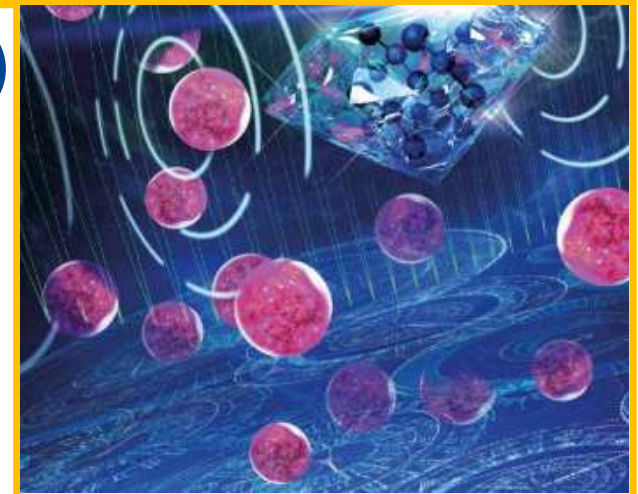
HORIZON-CL4-2021-DIGITAL-EMERGING-01-32:

## Support and coordination of the Quantum Technologies Flagship Initiative (CSA)



### Outcome

- support the efficient functioning of the **QT Flagship** and the efficient implementation of the broader **EU quantum strategy**
- promote the Flagship's activities to a wide public
- enable Flagship projects to find synergies in their work
- contribute to the development of international standards
- Implement innovative research-based curricula and trainings in quantum technologies.



### Scope

- ensure the smooth running and further development of the **Flagship**
- raise the profile of the Flagship's activities and of quantum technologies in general
- undertake wide dissemination of the **Quantum Flagship results**
- foster a **European quantum community** and provide a forum for productive discussions on Research and Innovation strategies
- identify relevant training, education and infrastructure needs.



Opening: 22 June 2021  
Closing: 21 Oct 2021



1 Project - 3 years



Budget EUR 6.4 million



Topic Coordinator  
Dagmar FLOECK



## HORIZON-CL4-2021-DIGITAL-EMERGING-01-23: International cooperation with Canada (RIA)

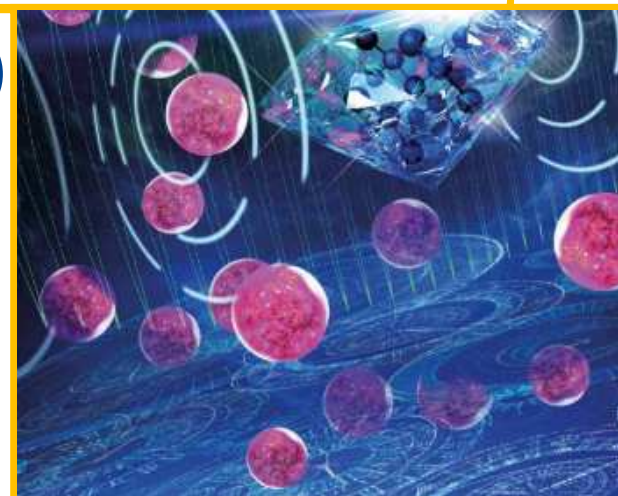


Expected (EU+Canada) contribution per project EUR 2.5 million (possible submission and selection of different amounts)



Indicative EU budget: EUR 4.00 million (CAD 6.00 million)  
Support EU beneficiaries

Indicative Canada budget EUR 4.00 million (CAD 6.00 million )  
Support Canada beneficiaries



### Scope

Address a mix of QT challenge(s) in the areas of EU – Canada interest



Identify the **added value and/or mutual benefit** for both EU and Canadian beneficiaries

Basic science → TRL 1-2 to TRL 2-3

Opening: 22 June 2021  
Closing: 21 Oct 2021



3 Project - 3 years



EU + Canada  
Budget EUR 8 million



Topic Coordinator  
Christian Trefzger

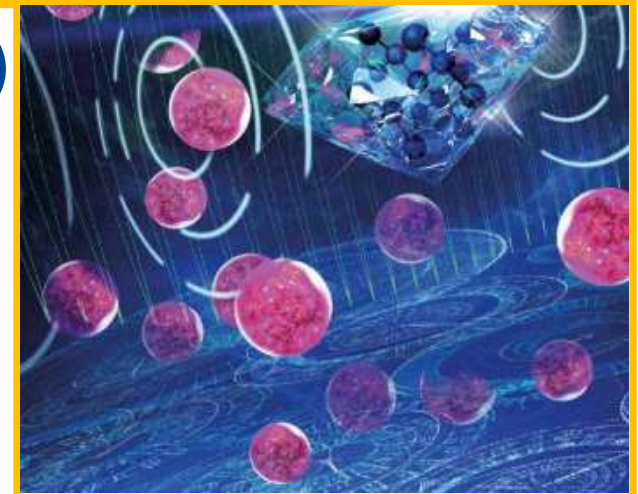


# HORIZON-CL4-2021-DIGITAL-EMERGING-02-16: Basic Science for Quantum Technologies (RIA)



## Outcome

- **Opening up new avenues** for potential growth in the field of quantum technologies
- **Novel concepts**, leading to more advanced technologies
- **inform the Flagship's work in other quantum fields, and/or explores new directions within existing fields**



## Scope

- explore **new quantum effects** and gain **new knowledge that is not limited to the pillar activities**
- Areas of particular interest include **quantum information theory**, the **identification of new laws and limits, understanding the mechanisms behind decoherence**
- Development of **strategic components**



**Opening: 28 Oct 2021**  
**Closing: 27 Jan 2022**



**Duration: 3 years**



**Budget EUR 16 million**  
**EUR 2-3 million/project**



**Topic Coordinator**  
**Dagmar FLOECK**



# HORIZON-CL4-DIGITAL-EMERGING-2021-02-20

## Quantum sensing technologies for market uptake (IA)



### Outcomes



- **mature quantum sensing technologies and devices** (TRL 6-7) in many different application sectors
- **reliable & efficient supply chain(s)** including first standardisation and calibration efforts for rapid market uptake



### Scope

(starts with TRL 4-5 and ends with TRL 6-7)



- development of relatively mature quantum sensing technologies
- development of single / network-operating devices
- applications for these devices in fields such as: **transportation, precise localisation, health, security, telecommunications, energy, electronics industry, construction, mining, prospection**, etc.

**Opening: 28/10/2021**  
**Closing: 27/01/2022**



**Duration: 3 years**



**Budget EUR 23 million**  
**EUR 7.66 million/project**



**Topic Coordinator**  
Doru Tanasa



# HORIZON-CL4-DIGITAL-EMERGING-2021-02-10 (RIA) Strengthening quantum software ecosystem for QC platforms



## Outcomes



- quantum-specific algorithms and methods to solve problems in a wide variety of industrial fields, giving European industry a competitive edge

## Scope

Starts with TRL 2-3 and ends with TRL 4-5



- Develop quantum algorithms and methods for problems like chemical and material simulation, data analysis and optimisation, space data processing and mission planning,... to bring a quantum advantage
- Develop quantum applications and industrial use cases for the QC of the QT Flagship (2 SGAs on large-scale QC, RIA on new emerging QC technologies)
- Develop quantum software stacks, libraries, etc., that facilitate the link from a high-level description of algorithms to a low-level implementation with quantum gates, for applications expected to demonstrate quantum advantage
- Develop applications and software that are platform-independent and test them on as many platforms as possible within the QT Flagship



Opening: 28/10/2021  
Closing: 27/01/2022



Duration: 3-4 years



Budget EUR 12 million  
EUR 5-7 million/project



Topic Coordinator  
Philippe RAYNAL





# HORIZON-CL4-DIGITAL-EMERGING-2021-02-15 FPA/SGA developing first large-scale Quantum Computers



## Scope

2 FPAs - (TRL 4-5 to TRL 6-7)



- **build** on the QC platforms supported **Quantum Flagship ramp up phase**.
- integrating the key building blocks in NISQ regime (>100 qubits) with control electronics, low-level software, verification and validation.
- break-even point of fault tolerance to **increase algorithmic depth** (#operations).
- integrate **full SW stack** (compiler, scheduler), programming tools & algorithms
- open QC experimental systems and work on **reduction of their form factor**.



## Outcomes

- Universally programmable processor at least **100 physical qubits (2025)**
- NISQ domain including firmware and sufficient coherence to perform computations **involving all of its qubits**
- **HW-agnostic test suite**, including **real-world applications**
- Full stack, highly connected, high fidelity **QC 1000 physical qubits (2029)**
- Standards and interface specifications for a **complete SW and HW stack**.



Opening: Oct 2021  
Closing: Jan 2022



Duration: FPA 4 years  
SGAs 3 years



Budget (EUR million)  
0 FPA -> 40 €mill SGA



Topic Coordinator  
Oscar Diez



# HORIZON-CL4-DIGITAL-EMERGING-2022-02-17

## FPA/SGA for developing large scale quantum simulation platform technologies



### Outcome

- Fully programmable open quantum simulators reaching **several hundred individual quantum constituents (by 2025/2026)** and **above 1000 quantum constituents (by 2029)**.
- **Improved levels of control and scalability** and achievement of a **further entropy reduction**
- Demonstrated **full quantum simulation stack and operational stability for various classes of problems**



### Scope

(TRL 4-5 to TRL 6-7)

- simulator should be **based on and reinforce existing physical platforms (such as ultra-cold atoms, trapped ions, Rydberg atoms, photonics or other qubits)**
- The simulator platform should **include user-interfaces and software to allow applications of real world problems** in e.g. material science, quantum chemistry and others
- Applications **in solving practical routing and scheduling problems**



**Opening: 28 Oct 2021**  
**Closing: 27 Jan 2022**



**4 years/3 years**



**Budget (EUR million)**  
**0 FPA -> 16.6 SGA**



**Topic Coordinator**  
**Dagmar FLOECK**



# HORIZON-CL4-DIGITAL-EMERGING-2021-02-19

## FPAs/SGAs in Quantum Communications



### 2 FPAs/SGAs for:

1. Building the Quantum Internet
2. Quantum encryption and future quantum network technologies



### Scope

- Develop quantum communication technologies with improved performance and security to ensure European leadership
- Build on the ongoing projects supported under the Quantum Flagship ramp up phase and on those currently defining the EuroQCI initiative
- Realise a quantum communication/inf. network over very large distances



**Opening: Oct 2021**  
**Closing: Jan 2022**



### Outcomes

- Demonstrate long-distance (i.e., above 500 km) entanglement distribution involving quantum memories
- Demonstrate a fully functional prototype of a quantum repeater operating across multiple network nodes
- Demonstrate future quantum network technologies in support of the EuroQCI initiative



**4 years / 3 years**



**Budget (EUR million)**  
**0 FPAs -> 24 / 25 SGAs**



**Topic Coordinator**  
**Doru Tanasa**

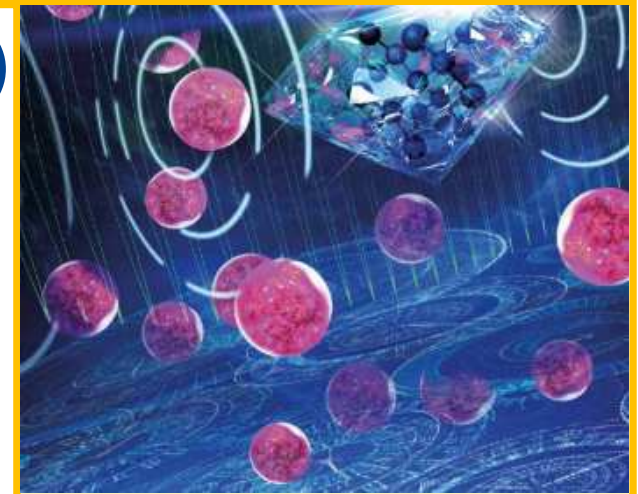


## HORIZON-CL4-2021-DIGITAL-EMERGING-02-22:

Open testing and experimentation, and pilot production capabilities for quantum technologies



- **Create long-term open, supportive and sustainable experimental and testing infrastructures in Europe that are openly accessible by European academia and industry**
- **Develop and provide access to first European fabrication (production) capabilities for QT, building on and linking together existing infrastructures**



## Scope

- Establish well-networked lab facilities that interact and support each other
- Federate key competences in the whole QT innovation value chain
- Provide access and support to European QT innovation actors
- Provide the QT ecosystem with a 'one-stop-shop' to unique facilities, competences and know-how centred at various locations in Europe



**Opening: Jun 2021**  
**Closing: October 2021**



**Duration: FPA 4 years**  
**/ SGA 3 years**



**Budget EUR 38 million**  
**2 FPA/SGA**



**Topic Coordinator**  
**Christian TREFZGER**

