The Quantum Technologies FET Flagship Initiative of the European Union

Fall 2018 INTRIQ meeting, November 13 & 14th

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DG CNECT, European Commission
The Origins

Future and Emerging Technologies

Quantum Information Processing and Communication

Kick-off meeting

Brussels 22-23 September 1999
Quantum World in 2015

~7000 investigators
1.5 B€/y -> 5 B€/y

1 Combined estimated budget of EU countries

SOURCE: Publication search, Mac Kinsey
FET Flagship: Rationale

• Maturing field – no longer "proof-of-principle"
• 550 M€ investment in 20 years – return on investment?
• First QT commercial products & companies emerge – growing steadily
• Accrued industrial interest
  • Big IT companies
  • Non-traditional users
• Other regions invest massively
• No dominant player yet – build an European industry
What is a FET Flagship?

"A research and innovation initiative pursuing grand scientific and technological challenges"

- ambitious
- highly-risky
- long term
- large scale
- Interdisciplinary

- Coordination of national & EU efforts
- Requires close cooperation between Member States & Commission.
- Requires large & long term research investments that cannot be carried out alone by the Commission or any single Member State
- Includes an appropriate governance structure
  - Member States are fully involved in the governance of the Flagships through the Board of Funders
The political mandate

"… unlock the full potential of quantum technologies, accelerate their development and bring commercial products to public and private users …" (ECI 19/4/2016)

"… unlock the full potential of quantum technologies and accelerate their development and take-up in commercial products …" (COMPET 26/5/2016)
Quantum Europe 2016
17-18 May 2016, Amsterdam

• Quantum Manifesto
FET Flagships – Partnering for Excellence
6 November 2017, Brussels

• QT-HLSC Final Report
Quantum Technologies FET Flagship: Objectives

- Translate S&T excellence into industrial success
- Move advanced QT from laboratory to industry with concrete prototype applications and marketable products
- Accelerate transition from science to technology
- Stimulate industrial involvement & innovation
- Focus funding on application areas rather than on fundamental science
- Complemented by fundamental science on emerging topics
- Create value in Europe and retain know-how
**2016**

**PREPARATORY STEPS**
- 04/2016: Announcement in EU Cloud Initiative
- 09/2016: Set-up of the QT Flagship High Level Steering Committee
  - Intermediate report (02/2017)
  - Final report (09/2017)

**2018**

**RAMP UP PHASE**
- Flagship Coordination & Support Actions:
  - 0.5 m€ (2017) + 2 m€ (2018)
- Flagship Research & Innovation Actions: 130 m€ (2018)

**QUANT-ERA**
- QuantERA (01/2018): 26 countries, 36 m€ (1/3 EU)
- QuantERA II (2020 - tbc): FET call: 10 m€

**2019**

**2020**

**FULL IMPLEMENTATION**
- Series of QT calls
- EU Quantum Key Distribution Network

*pending adoption under the next multi-annual framework programme*

**CYBERSECURITY**
- H2020 LEIT ICT QKD
  - Testbed call (2019): 15 m€
Quantum Technologies FET Flagship: Implementation

**FET**

**FETFLAG-03-2018**
- 130M€ RIA, 2M€ CSA
- Closed 20 Feb '18

**LEIT ICT**

**SU-ICT-04-2019**
- 15M€ IA
- Closing 14 Nov '18

**LEIT SPACE**

**SPACE-15-TEC-2018**
- 9M€ RIA
- Closed 6 Mar '18
Quantum Technologies FET Flagship: Coverage

**Computing**

~ 110 M Euro

**Simulation**

**Metrology & sensing**
~ 20 M Euro

**Communications**

**Fundamental Science**
<table>
<thead>
<tr>
<th>Topic Coverage</th>
<th>Retained proposals</th>
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<tbody>
<tr>
<td>A) QUANTUM COMMUNICATION</td>
<td>33 M€</td>
</tr>
<tr>
<td>B) QUANTUM COMPUTING SYSTEMS</td>
<td>20 M€</td>
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<tr>
<td>C) QUANTUM SIMULATION</td>
<td>19 M€</td>
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<tr>
<td>D) QUANTUM METROLOGY &amp; SENSING</td>
<td>37 M€</td>
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<tr>
<td>E) FUNDAMENTAL SCIENCE</td>
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Additional call on Quantum Computing (semicon) in 2020?
Timeline toward a Q-ecosystem

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QKD testbed call

- up to 15 M€ funding

- build an experimental platform
- test and validate the concept of end-to-end security
- providing QKD as a service (economically / security justified)
- with continuous R&D input from QT-Flagship (technologies, architecture, protocols, interoperability, standardization, ... )
QT Flagship Governance

Intelligence gathering
Decision making
Implementation

Advice

Stakeholders (QT community)
- QUANTUM COMMUNITY NETWORK

Board of Funders
European Commission

Strategic Advisory Board

Science and Engineering Board
- QT Flagship Projects
- QuantERA Projects

National activities,...

Coordination and Support Action

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**Decision making by public authorities**

**Board of Funders:**
- Discussion forum
- Alignment of initiatives
- Overall follow-up

**European Commission:**
- Planning of financial support
- Project selection and funding decision
- Project follow-up

**Strategic advice by quantum community**

**Strategic Advisory Board:**
- Monitors the progress of the Flagship towards its goals
- Proposes updates of Strategic Research Agenda
- Works with the EC and reports progress to the BoF
- Gets inputs from networking & coordination level (CSA, SEB)
Towards a EU QT-ecosystem

- QT in space (e.g., Galileo)
- QKD testbed (ground)
- FET Open (early-stages)
- COST Actions
- National/Regional Initiatives
- QUANTERA
- QUANTUM FLAGSHIP
- EURAMET
QT Flagship: next steps

- Identify collaborative activities across Flagship Projects
  - Technology challenges
  - Engineering / manufacturing
  - Benchmarking activities
- Define scope & objectives of post-ramp-up
  - Continuity
  - Spin-offs / feeding other programs
  - Focus?
  - Complementarity / positioning with national initiatives
- Identify common challenges
- Skills, Training & Education
Next Multi-annual Financial Framework

Digital Europe Program:
- Experimental Q.Comp infrastructure
- QT/HPC hybrid
- QKD network

2021 - 2028

Horizon Europe: QT FLAGSHIP
- Technology supply
- Fundamental R&D

Quantum Technologies FET FLAGSHIP
Scope for International Cooperation

- QT Flagship International Cooperation policy in preparation
  - What is the "win-win" with Canada?
  - In which areas is there a mutual benefit to cooperate?
  - What is it that Canada could offer?
  - What could the European Union offer?
  - Instruments of cooperation?

=> Fact-finding EU/CDN workshop under preparation (Q1 2019)
Thank you for your attention

Questions