

# Quantum Technologies FET Flagship

## State of Play

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DG CNECT, European Commission

# Agenda

- State of Play on Quantum Technologies (QT)
- Quantum Flagship Status
- Mid-term Review
- KPIs – Future of the Projects
- EuroQCI initiative
- Next Steps

# State of Play – QT

- Calls FETFLAG-05-2020, FETFLAG-06-2020, FETFLAG-07-2020 closed, 16 proposal received, evaluation ongoing
- QuantERA (2016)
  - Transnational initiative (26 countries, 31 partners)
  - 2 Calls – 36 M€ (2017) + 12 M€ (2019) in funding
- Quantum Flagship budget under discussion for the next MFF (2021-2027) – new Strategic Research Agenda under preparation (due on 01/2020)
- Quantum Communication Infrastructure – EuroQCI Initiative
- International activities
  - US workshop on 3-4 September 2019
  - Japan meeting in Kyoto (mid-December 2019)
  - Canada – meeting for next year

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*

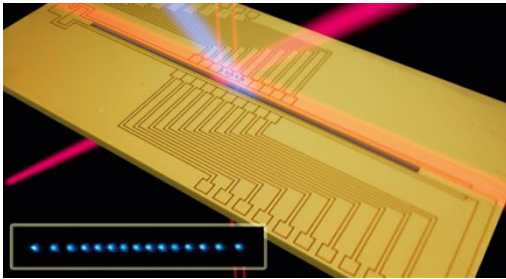
## CYBERSECURITY

- + H2020 LEIT ICT QKD
- Testbed call (2019): 15 m€

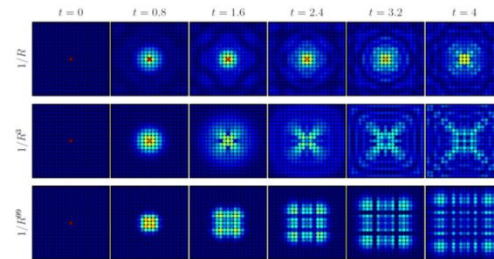
# Quantum Technologies FET Flagship: Coverage



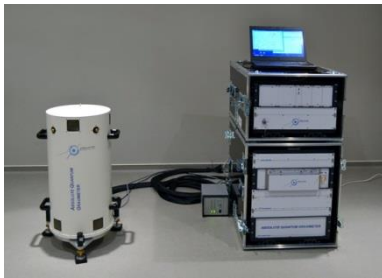
## Computing



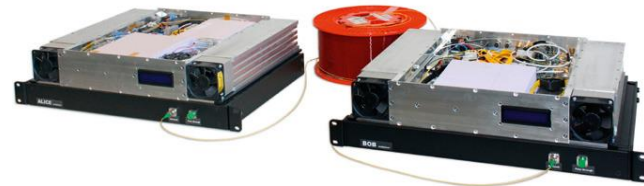
## Simulation



## Metrology & sensing

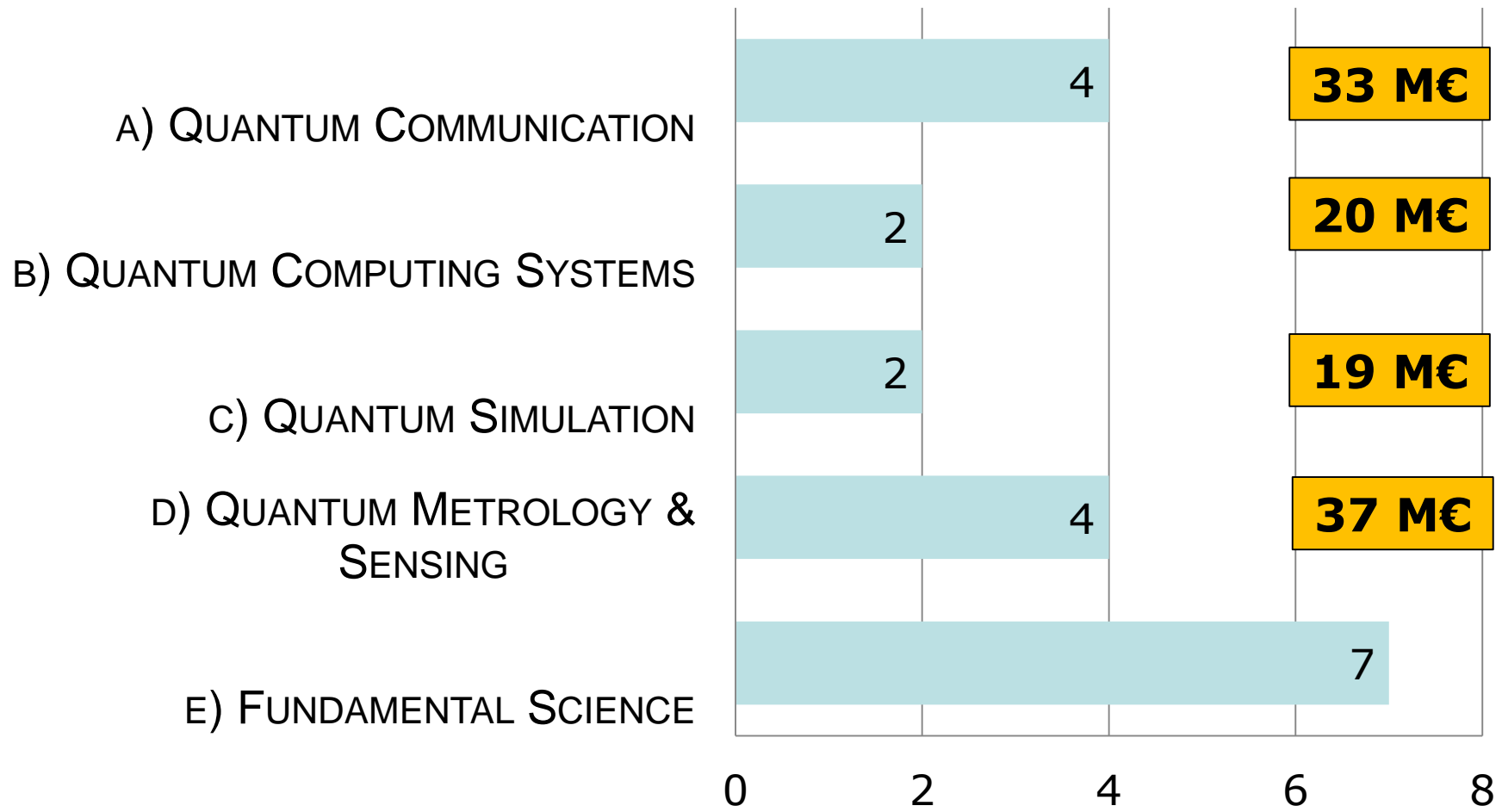


## Communications



**~ 20 M Euro**

**Fundamental Science**



# Mid-Term Review

- Mid-Term for the Q. flagship projects
- Proposed dates: 13.05 - 15.05.2019
- Day 1 and 3 – reviews (4 in parallel)
- Day 2 – Cluster meeting (Agenda TBD)
- SAB Members will attend the Cluster Meeting
- Projects presentations focused on project contributions to the flagship and cross-collaboration

# QT Flagship Governance



*Intelligence gathering*

*Decision making*

*Implementation*

*Advice*

**Stakeholders  
(QT community)**

**QUANTUM  
COMMUNITY  
NETWORK  
(QCN)**

**BOARD OF  
FUNDERS  
(EC + MS/AC)**

**EUROPEAN  
COMMISSION**

**SCIENCE AND  
ENGINEERING  
BOARD**

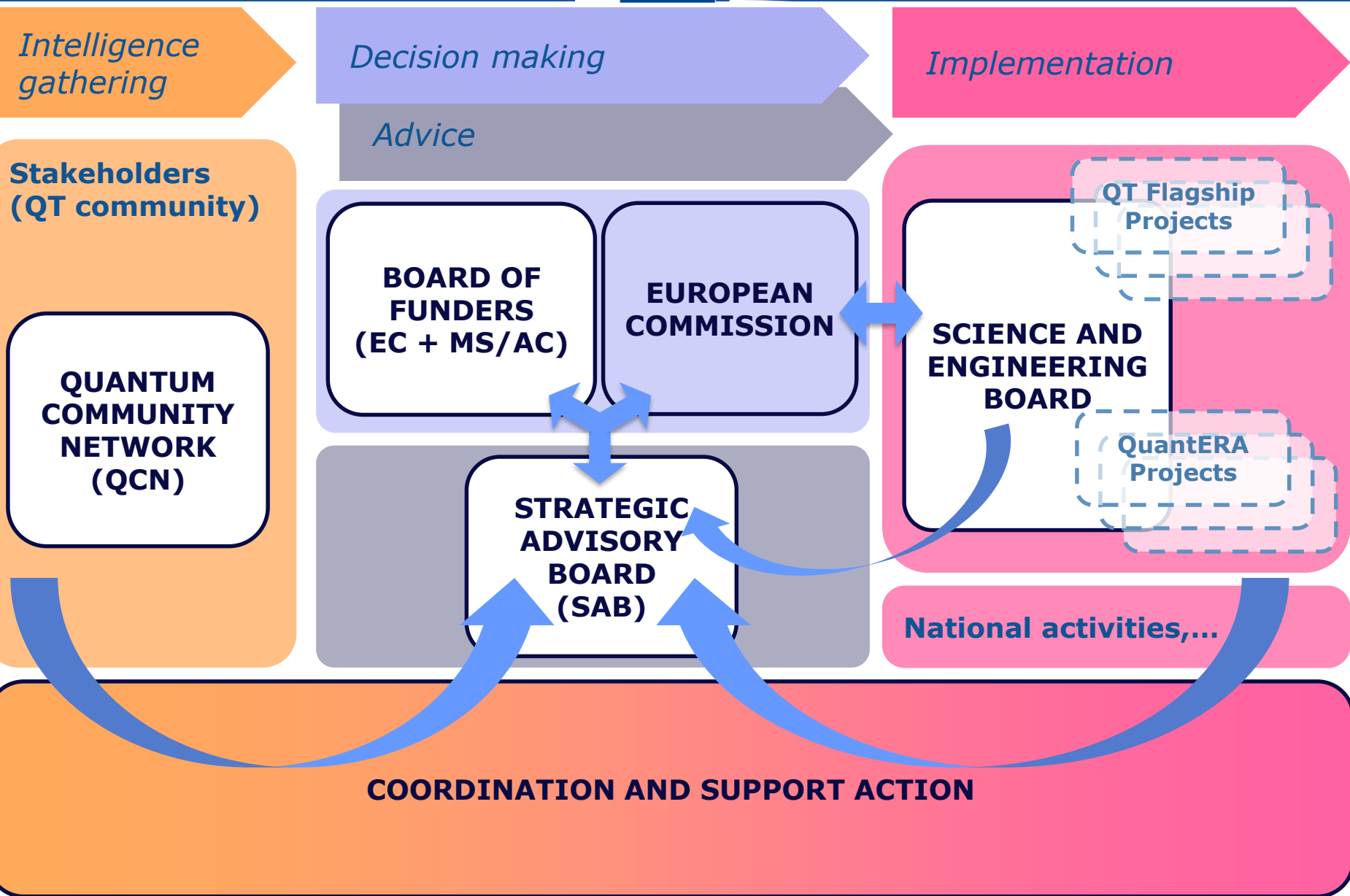
**QT Flagship  
Projects**

**QuantERA  
Projects**

**STRATEGIC  
ADVISORY  
BOARD  
(SAB)**

**National activities,...**

**COORDINATION AND SUPPORT ACTION**





# SAB Composition



Chair: **Jürgen Mlynek** (Academic)

Vice-Chair: **Jaya Baloo** (Industry)

Academic	Industry
<b>Ana Sanpera</b> , Universitat Autònoma de Barcelona	<b>Fabio Cavaliere</b> , Ericsson Italia
<b>Daniel Esteve</b> , CEA	<b>Ulises Arranz</b> , Accenture
<b>Elisabeth Giacobino</b> , CNRS	<b>Grzegorz Kasprowicz</b> , Creotech Instruments S.A.
<b>Marek Kus</b> , Polish Academy of Sciences	<b>Christoph Sandner</b> , Infineon
<b>Maria Rastello</b> , Italian National Metrology Institute	<b>Thierry Botter</b> , Airbus
<b>Peter Loosen</b> , Fraunhofer Institute for Laser Technology	
<b>Radu Ionicioiu</b> , National Institute for R&D in Physics and Nuclear Engineering	
<b>Vladimir Buzek</b> , Comenius University	
<b>Wim van Saarloos</b> , Leiden University	

# KPIs – Future of the Projects

- KPIs for measuring the economic return on investments still under development
- To be presented at the next SAB meeting (3.3.20)
- Combination of Super-KPI + field and time-period specific KPIs
- E.g. of Super-KPI “*Have a full-stack European Quantum Computer by 2030*”

# EuroQCI Declaration: A Quantum Communication Infrastructure for the EU

## *A European Cybersecurity Shield based on a Quantum communication infrastructure (EuroQCI)*

- Addressing *cybersecurity concerns* by integrating quantum cryptography into conventional communication networks
- for secure interconnection and data storage based on quantum technologies, linking critical public communication assets all over the EU
- based on a *terrestrial* and a *space* segment

Deliverables: unbreakable trusted communications based on Quantum Key Distribution, preparing for the Quantum Internet



Secure command & control links with satellites, and ground to ground communications



# Non-paper to implement the QCI

- 9-page document developing:
  - Rationale
  - Implementation proposal for space and ground segment
  - The different phases and their implementation
  - Financial envelopes
- Sent to MS Sherpas on 28 October 2019 for discussion and for agreeing the next steps

# Implementation Approach for QCI



## 2020-2023: 1<sup>st</sup> phase – The preparatory phase (Pathfinder mission)

### Terrestrial Segment

- Mission Identification Study (Comparative Study)
- Analysis and Feasibility Study (System Study)
- OpenQKD Horizon 2020 project
- System and technology development

### Space Segment

- Mission Identification Study (Comparative Study)
- Analysis and Feasibility Study (System Study)
- Preliminary System Definition
- System and technology development

## 2023-2025+: 2<sup>nd</sup> phase - The QCI demo and first deployment phase

### Terrestrial Segment

- Operational Deployment
- Testing of cross-border QCI links
- QCI testing and compliance infrastructure

### Space Segment

- Detailed System Definition, incl. R&D
- Preparation/demonstration of In-orbit mission components

The EU cyber-security competence centre could be the overall QCI project manager of phase 1 & 2, while the development of the Space Segment could be managed by ESA

## 2025+ ...: 3<sup>rd</sup> phase – The full QCI deployment and operational phase

### Terrestrial Segment

- Full deployment
- Operationalisation

### Space Segment

- In-orbit validation and mission deployment
- Operationalisation

# Possible financial envelope



- **Terrestrial Segment: 1.4 B€:** R&D, implementation of national testbeds and first ground nodes and ground links, large scale implementation of the terrestrial segment and of the QCI testbed, deployment and operationalisation costs
- **Space Segment: 500 to 750 M€:** Design of the QCI Space Segment according to Security Requirements; development of LEO / MEO / GEO Satellite systems and their Ground Segment including the central mission operational centre and the required technology developments; Demonstrators and Implementation of the above

## Organisation and next steps:

- In 2019-2020: regular meetings with EU Sherpa's and Experts, cooperation with ESA on the space segment, launch of system studies, of the QCI pilot testbed (under EU's Horizon 2020) and of some critical technology developments (under SAGA)
- From 2021: Funding from Horizon Europe, Digital Europe Programme, SAGA, Regional Funds, National Funds and the Private Sector

Close collaboration of all “partners”  
is essential to define and implement the QCI



# Next Multi-annual Financial Framework

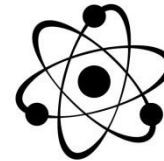


2021 - 2027



## Digital Europe Program €2.7 billion

- Supercomputing, quantum-computing infrastructure
- QT/HPC hybrid



## Horizon Europe QT FLAGSHIP €1 billion

- Technology supply
- Fundamental R&D



## Digital Europe Program €2 billion

- Cybersecurity, QCI

# Thank you for your attention

## Questions

