European Quantum Infrastructure Project for Gravimetry



EQUIP-G

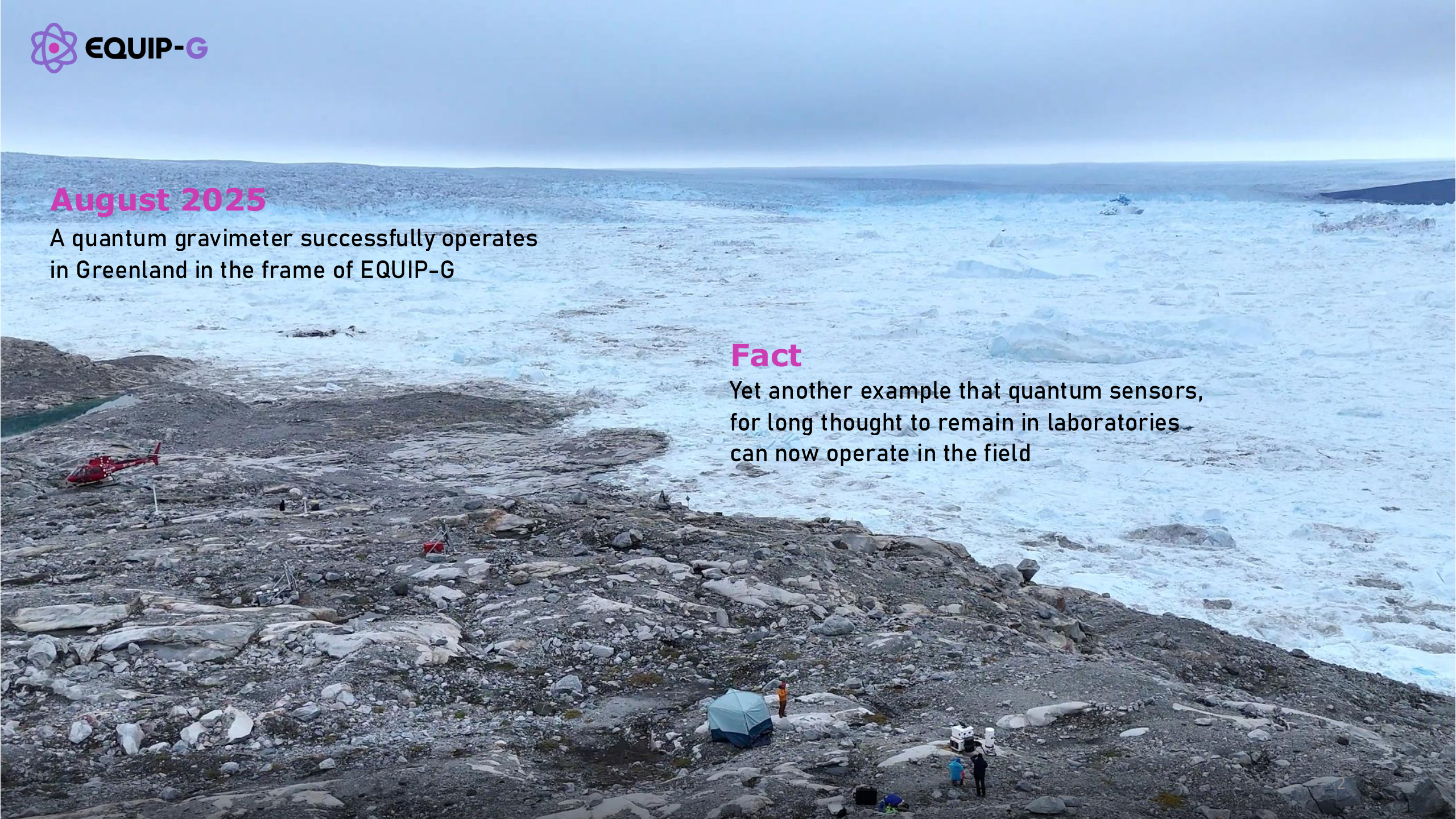
Sébastien Merlet *for EQUIP-G consortium*

Project PI

Funded by the European Union

EQUIP-G has received funding from the EC's Horizon Europe programme, under the HORIZON-CL4-2024-DIGITAL-EMERGING-02 call.

EQUIP-G



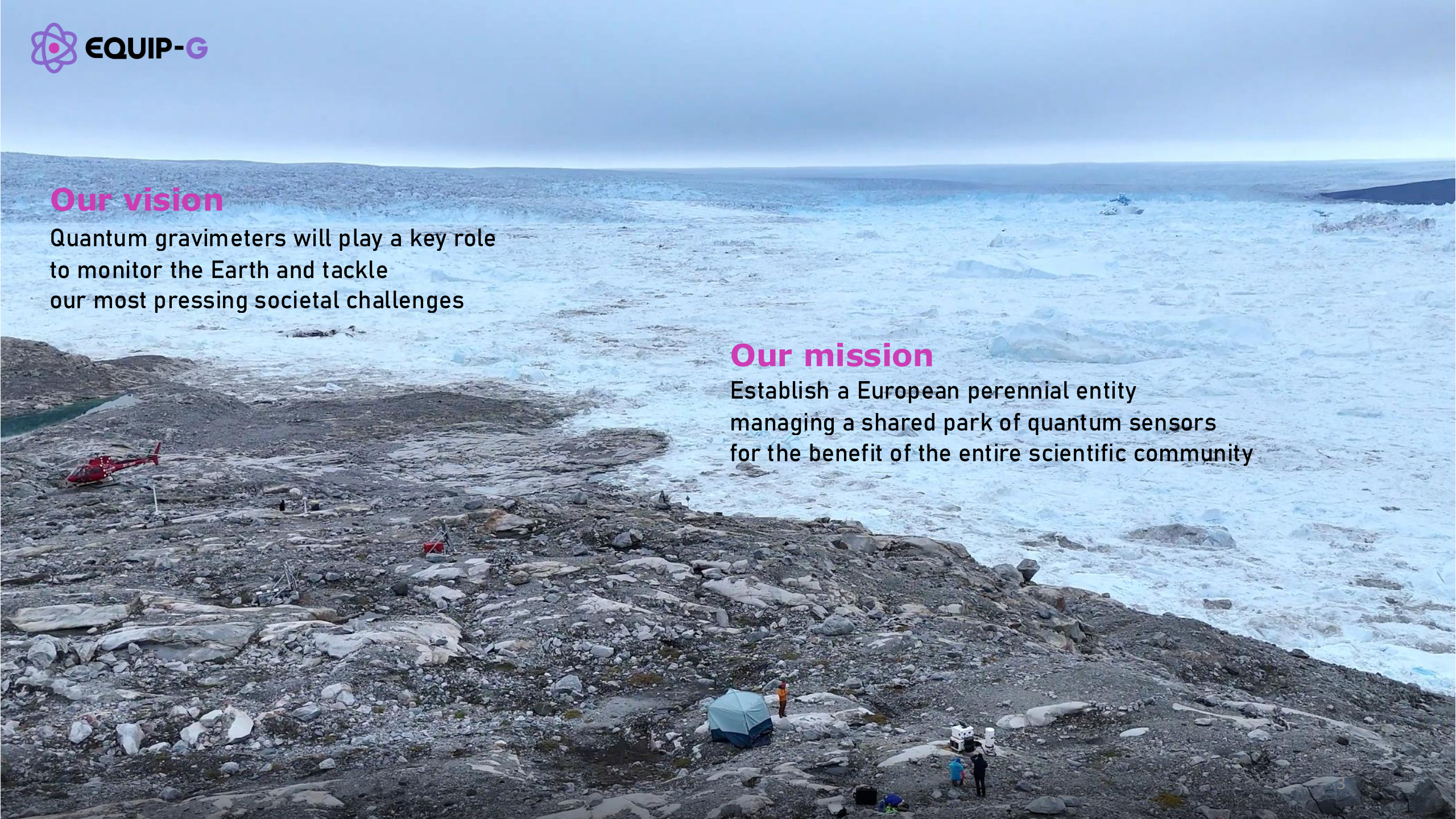
August 2025

A quantum gravimeter successfully operates in Greenland in the frame of EQUIP-G

Fact

Yet another example that quantum sensors, for long thought to remain in laboratories can now operate in the field

EQUIP-G



Our vision

Quantum gravimeters will play a key role
to monitor the Earth and tackle
our most pressing societal challenges

Our mission

Establish a European perennial entity
managing a shared park of quantum sensors
for the benefit of the entire scientific community

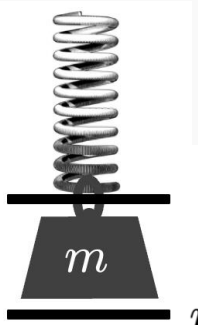
EQUIP-G - Gravimeters

From pendulum to free fall corner cube

Relatives

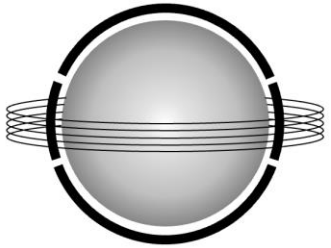


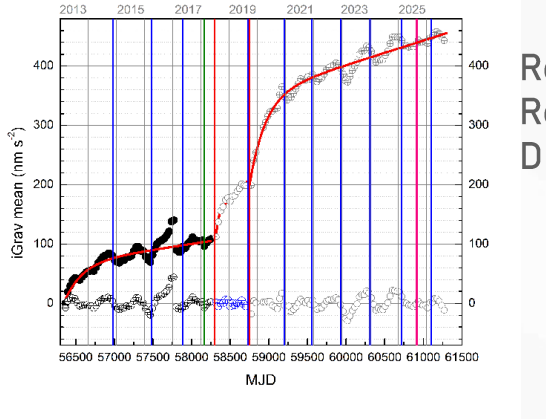


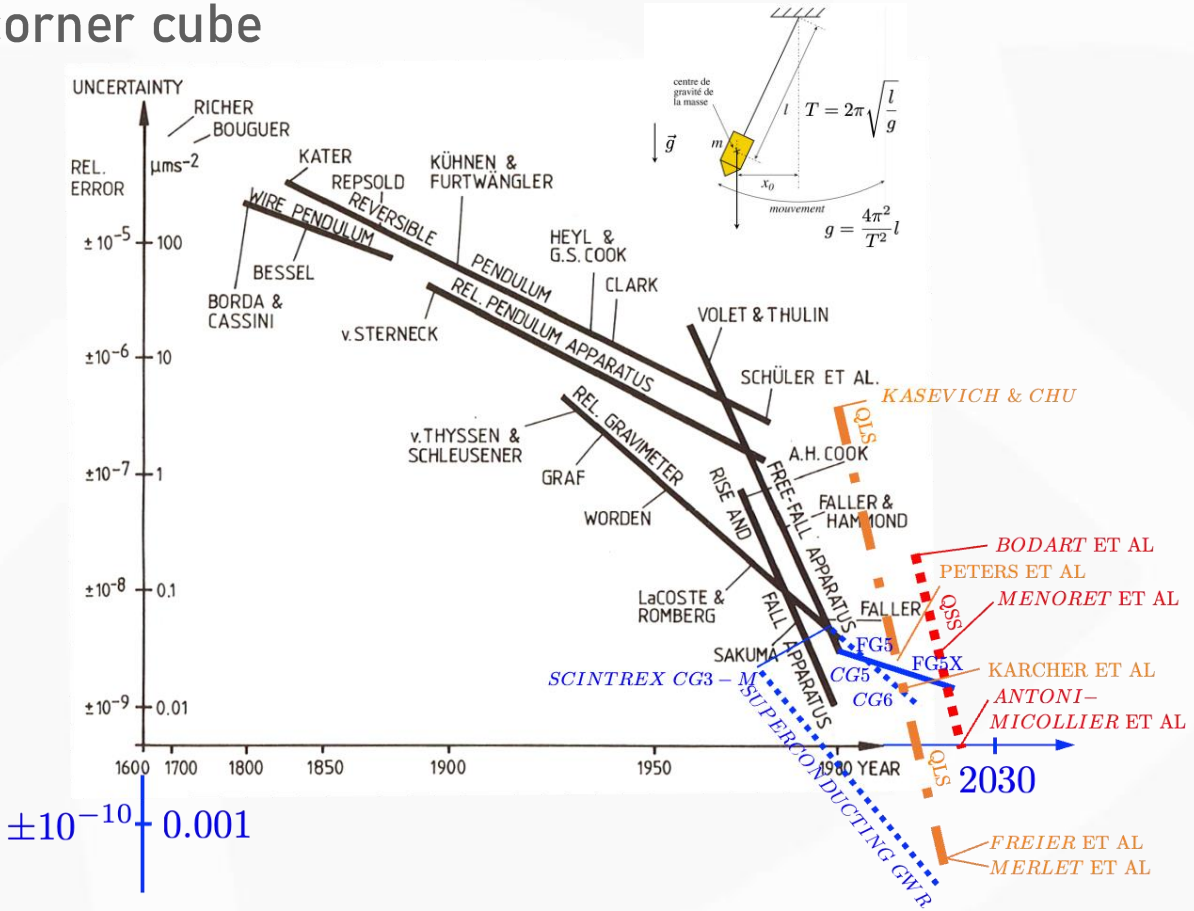


kl

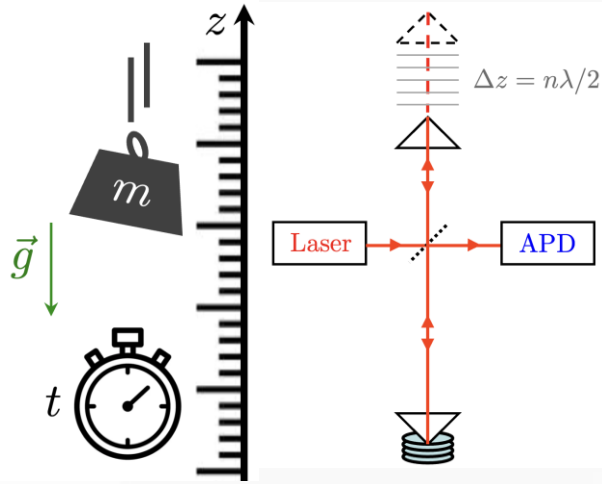
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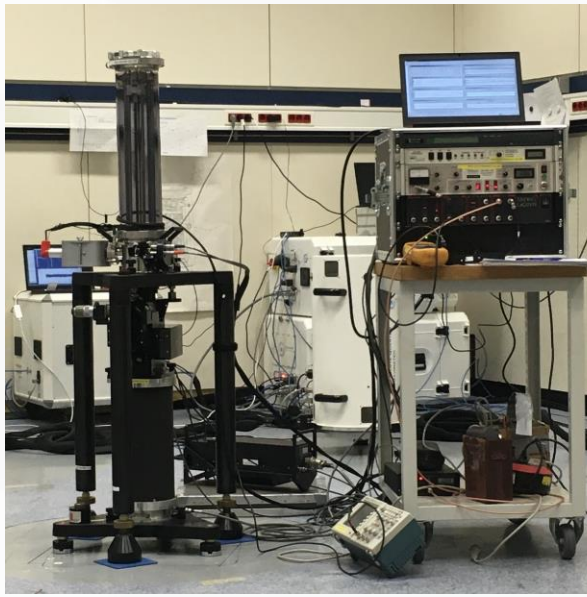






Absolute





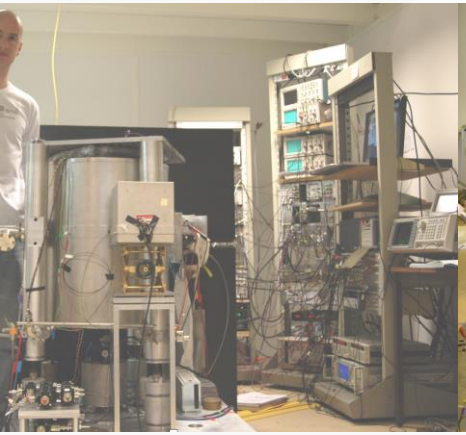
Relatives spring gravimeters: network or continous surveys
Relatives superconducting gravimeters: continous (permanent)
Drift, time consuming, need to be calibrated and drift evaluated periodicaly

Absolute free fall corner cube gravimeter: absolute measurement
Wearing, laboratory conditions

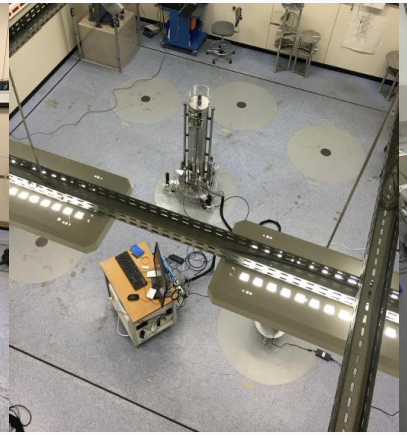
Manufactured and maintained in North America compagnies

EQUIP-G - Atom Gravimeters

From laboratory, principles of demonstration to industrial transfer and robustness improvement





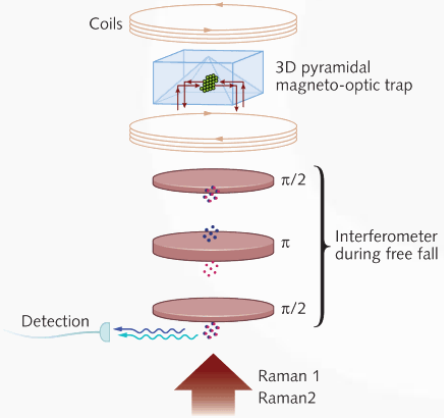




APPLIED PHYSICS LETTERS **96**, 134101 (2010)

A cold atom pyramidal gravimeter with a single laser beam

Q. Bodart,[1] S. Merlet,[1] N. Malossi,[1] F. Pereira Dos Santos,[1] P. Bouyer,[2] and A. Landragin[1,a)]
[1]*LNE-SYRTE, Observatoire de Paris, CNRS, UPMC, 61 avenue de l'Observatoire, 75014 Paris, France*
[2]*Laboratoire Charles Fabry de l'Institut d'Optique, CNRS et Univ Paris Sud, Campus Polytechnique, RD 128, 91127 Palaiseau Cedex, France*

(Received 17 December 2009; accepted 5 March 2010; published online 29 March 2010)



Eur. Phys. J. D **53**, 353–357 (2009)
DOI: 10.1140/epjd/e2009-00150-5
THE EUROPEAN PHYSICAL JOURNAL D
Regular Article

Light-pulse atom interferometry in microgravity

G. Stern[1,2], B. Battelier[1], R. Geiger[1], G. Varoquaux[1], A. Villing[1], F. Moron[1], O. Carraz[3], N. Zahzam[3], Y. Bidel[3], W. Chaibi[2], F. Pereira Dos Santos[2], A. Bresson[3], A. Landragin[2], and P. Bouyer[1,a]
[1] Laboratoire Charles Fabry de l'Institut d'Optique, Centre National de la Recherche Scientifique et Université Paris Sud 11, Institut d'Optique Graduate School, RD 128, 91127 Palaiseau Cedex, France
[2] LNE-SYRTE, CNRS UMR 8630, UPMC, Observatoire de Paris, 61 avenue de l'Observatoire, 75014 Paris, France
[3] Office National d'Étude et de Recherches Aérospatiales, Chemin de la Hunière, 91761 Palaiseau, France

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Published online 16 May 2009 – © EDP Sciences, Società Italiana di Fisica, Springer-Verlag 2009

Appl Phys B (2009) 97: 405–411
DOI 10.1007/s00340-009-3675-9
Applied Physics B
Lasers and Optics

Compact and robust laser system for onboard atom interferometry

O. Carraz · F. Lienhart · R. Charrière · M. Cadoret · N. Zahzam · Y. Bidel · A. Bresson

From

- 16 to single fiber
- Free space optical bench to fibered systems
- Use of isolation platform to strapdown configuration

APPLIED PHYSICS LETTERS **105**, 144102 (2014)

Hybridizing matter-wave and classical accelerometers

J. Lautier, L. Volodimer, T. Hardin, S. Merlet, M. Lours, F. Pereira Dos Santos, and A. Landragin[a)]
LNE-SYRTE, Observatoire de Paris, CNRS, UPMC, 61 avenue de l'Observatoire, 75014 Paris, France

(Received 29 August 2014; accepted 24 September 2014; published online 6 October 2014)

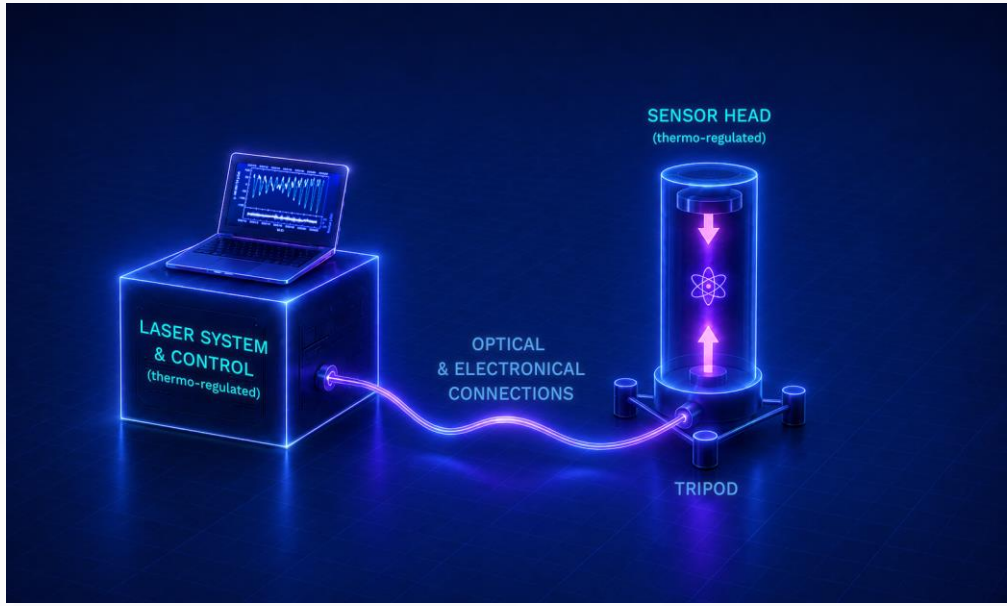
EQUIP-G - Atom Gravimeters

Quantum gravimeters, an attractive technology for Earth monitoring and geodesy

A quantum gravimeter

A sensor implementing Newton's apple experiment *with a cloud of laser-cooled atoms* and the quantum *principle of superposition*. The watter-wave duality of atoms is exploited to perform interferometry with free falling atoms.

The high-precision measurement technique is called light-pulse atom interferometry. The matter-wave packets are manipulated by laser driven Raman transitions.



Want to know more ?

Check out a nice review by IAG GGOS (Global Geodetic Observing System)

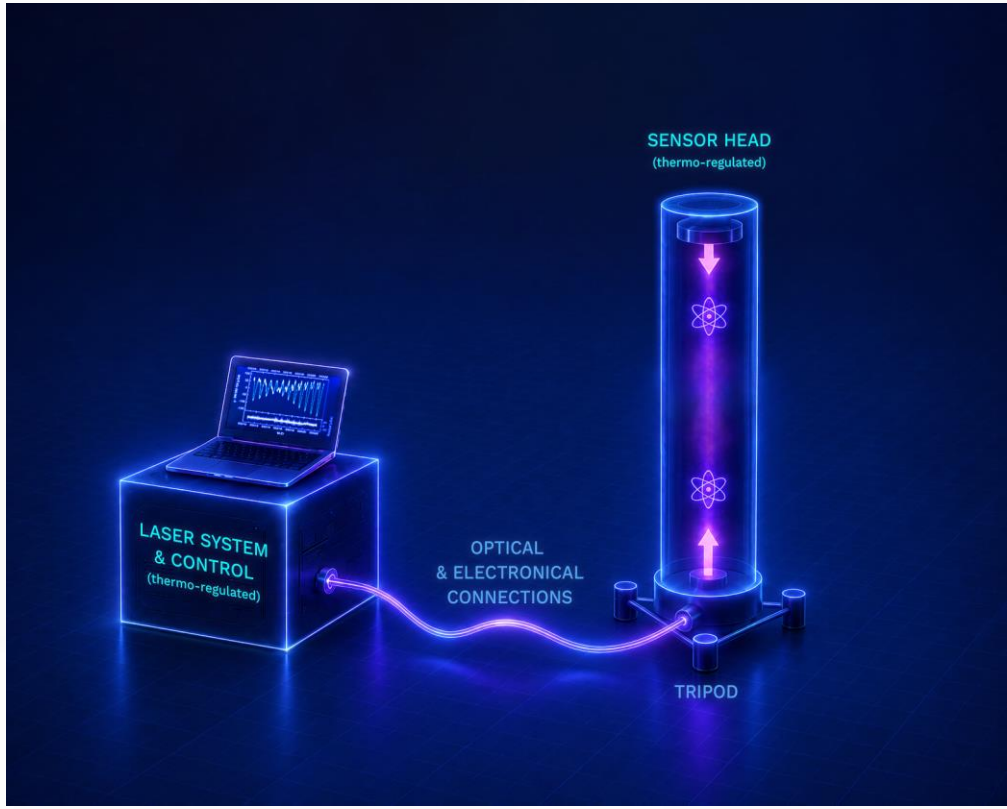
and an IEEE special issue on gravimetry

EQUIP-G - Atom Gravi-Gradio-meters

Quantum gravimeters, an attractive technology for Earth monitoring and geodesy

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and an IEEE special issue on gravimetry

EQUIP-G - EU strategy

https://digital-strategy.ec.europa.eu/en/library/quantum-europe-strategy

European Commission

EN Search

Shaping Europe's digital future

Home | Policies | Activities | News | Library | Funding | Calendar | Consultations | AI Office

Home > Library > Quantum Europe Strategy

POLICY AND LEGISLATION | Publication 02 July 2025

Quantum Europe Strategy

The European Commission has adopted a Quantum Strategy to position Europe as a global leader in quantum by 2030.

Despite its remarkable progress in quantum technology, the EU is currently lagging behind in translating its innovation capabilities and future potential into real market opportunities, while also struggling with fragmentation of strategies and roadmaps across Member States.

While highlighting Europe's strengths, the Quantum Europe Strategy aims to turn Europe into a quantum powerhouse by fostering a resilient, sovereign quantum ecosystem, that fuels startup growth and transforms breakthrough science into market-ready applications, while maintaining its scientific leadership.



GettyImages © AliseFox

EQUIP-G - EU strategy

https://digital-strategy.ec.europa.eu/en/library/quantum-europe-strategy

EUROPEAN
COMMISSION

Brussels, 2.7.2025
COM(2025) 363 final

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL

Quantum Europe Strategy: Quantum Europe in a Changing World

- Deploy the first EU-interconnected experimental quantum terrestrial and space secure communication network [by 2030]
- Publish a Quantum Communication Roadmap [2026]
- Launch a pilot facility for the European Quantum Internet [2026]

2.2.3 Quantum Sensing

Quantum sensing leverages quantum properties to measure physical features with unprecedented sensitivity and precision, significantly surpassing classical sensor capabilities[50]. It has an enormous potential across many diverse fields, from healthcare, climate change or groundwater resource monitoring to security, defence and space or navigation.

The EU Quantum Flagship has played a leading role in advancing quantum sensing technologies from basic science to application-driven research. Functional prototypes are already being tested in real-world environments, showcasing Europe's leadership in both sensor innovation and in preparing the ground for industrial deployment and adoption in applications with dual-use potential.

Quantum gravimeters

The EU is now developing a ***network of mobile and stationary quantum gravimeters***[51], which allow for the detection of subsurface features located up to several tens of kilometres underground, including water reservoirs, gas deposits, mineral resources, magma chambers, or buried infrastructure. They are particularly valuable for monitoring underground changes over time, supporting applications in earth science and geophysics (including subsurface mapping and earthquake early warning), climate science (e.g. tracking glacier loss and groundwater depletion), natural hazard prevention, civil engineering, and strategic applications in defence and civil protection, such as the detection of underground man-made structures and the monitoring of critical infrastructure.

Under the Quantum Flagship, in the next 3-5 years, a network of ground-based gravimeters will be deployed across Europe, complemented by gravimeters embarked on high-altitude platforms. In parallel, the EU is planning to launch a first quantum space **gravimetry Pathfinder Flight**[52] after 2030. The integration of quantum gravimetry under IRIS[2] follow-up missions will equally be explored. These efforts could pave the way for a full-scale network of ground, airborne and space-based gravimeters for Earth observation purposes, supporting both scientific research and strategic applications, including those with dual-use potential.

EU vision >2030 : A pan-European quantum gravimetry infrastructure

- Array of quantum gravimeters (fixed terrestrial and mounted on carriers) at strategic sites
- Networked quantum sensing infrastructure covering all Europe, both land and sea
- Quantum space gravimetry pathfinder mission (complementing terrestrial network, allowing continuous monitoring of Earth's surface)

Developing and deploying a network of quantum gravimeters in Europe

HORIZON-CL4-2024-DIGITAL-EMERGING-02-01

Programme
Horizon Europe Framework Programme (HORIZON)

Budget overview

Call
Digital and emerging technologies for competitiveness and fit for the Green Deal (HORIZON-CL4-2024-DIGITAL-EMERGING-02)

Type of action	Type of MGA	
HORIZON-IA HORIZON Innovation Actions	HORIZON Action Grant Budget-Based [HORIZON-AG]	Open For Submission

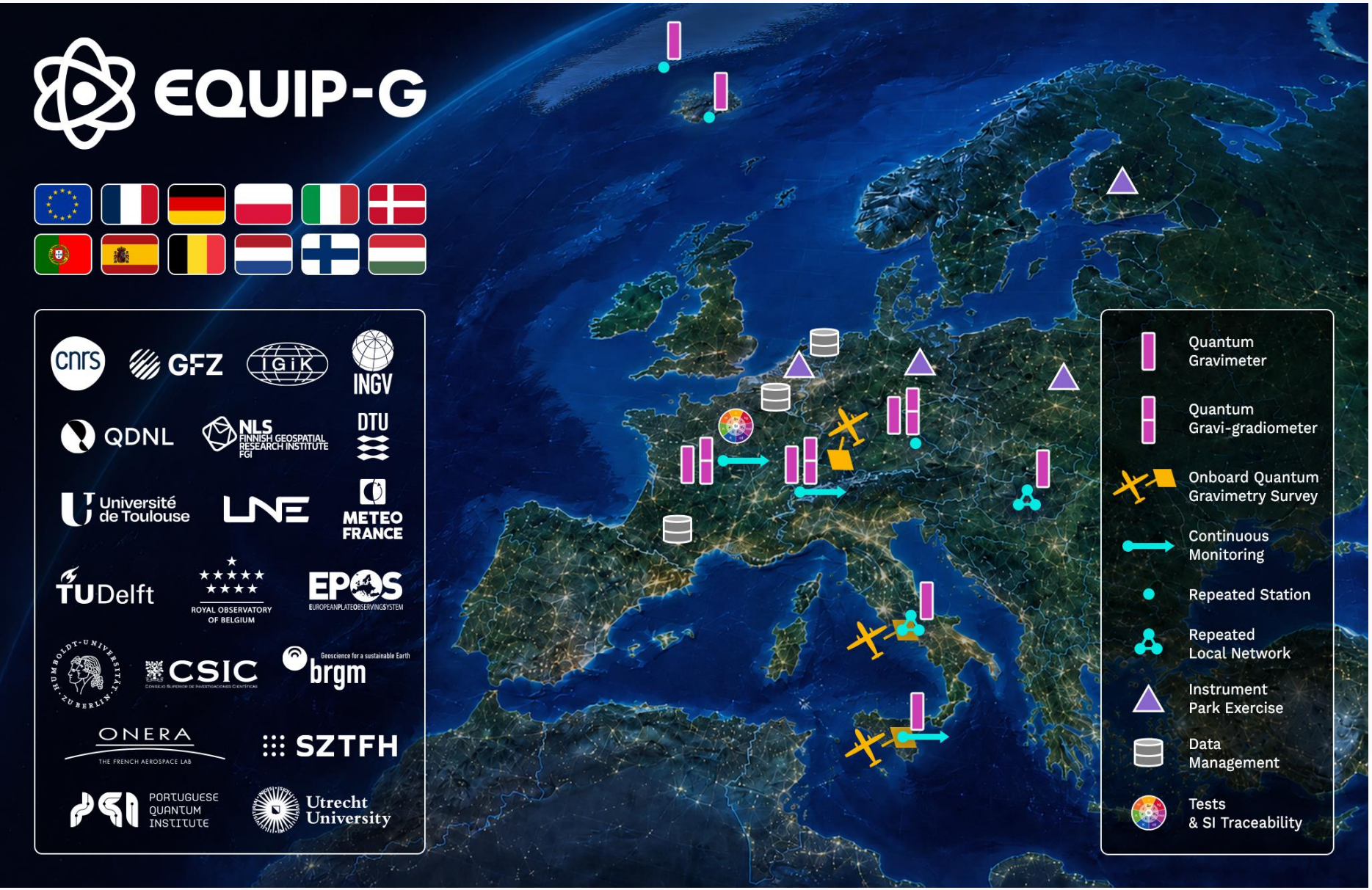
Deadline model	Opening date	Deadline date
single-stage	23 April 2024	18 September 2024 17:00:00 Brussels time

ExpectedOutcome:
Projects are expected to contribute to the following outcomes:

- Demonstration of the advantage of quantum gravimeters in innovative operational settings, delivering results beyond the state-of-the-art for real-world use cases. These operational settings should include a) an onboard gravimeter and b) terrestrial networks of gravimeters, consisting of at least eight gravimeters in total.
- Identification of new use cases and provision of innovative quantum gravimeter services for these use cases.
- The network of quantum gravimeters developed and optimised as part of the project should be ready for integration into a multi-country initiative such as a European Digital Infrastructure Consortium.

EQUIP-G - Consortium

A large and committed community towards a future European Research Infrastructure



- 20 partners, 11 countries

Expertise in:

- Geophysics, field & onboard
- Metrology
- Data management
- Operation of quantum sensors

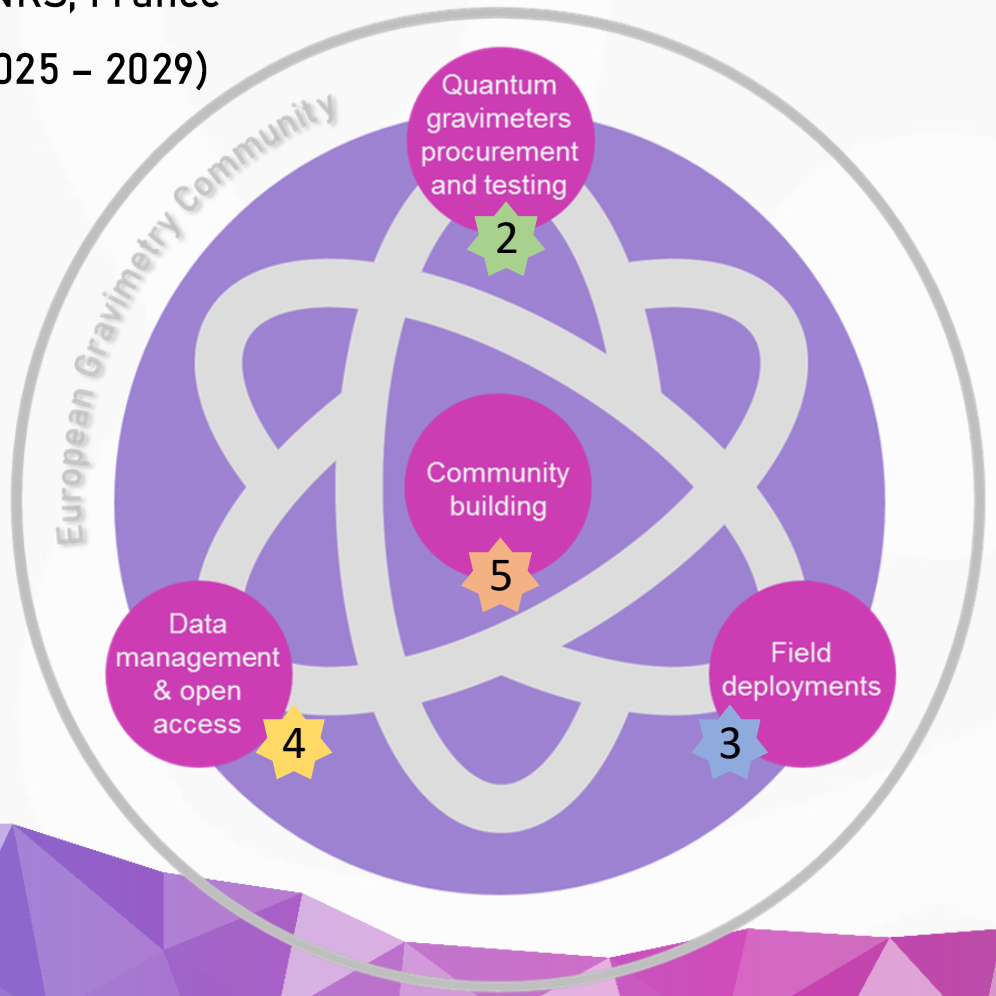
Providing key assets:

- Very first field quantum gravimeters (4)
- Reference laboratory quantum gravimeters (2)
- Gravity reference sites (4)

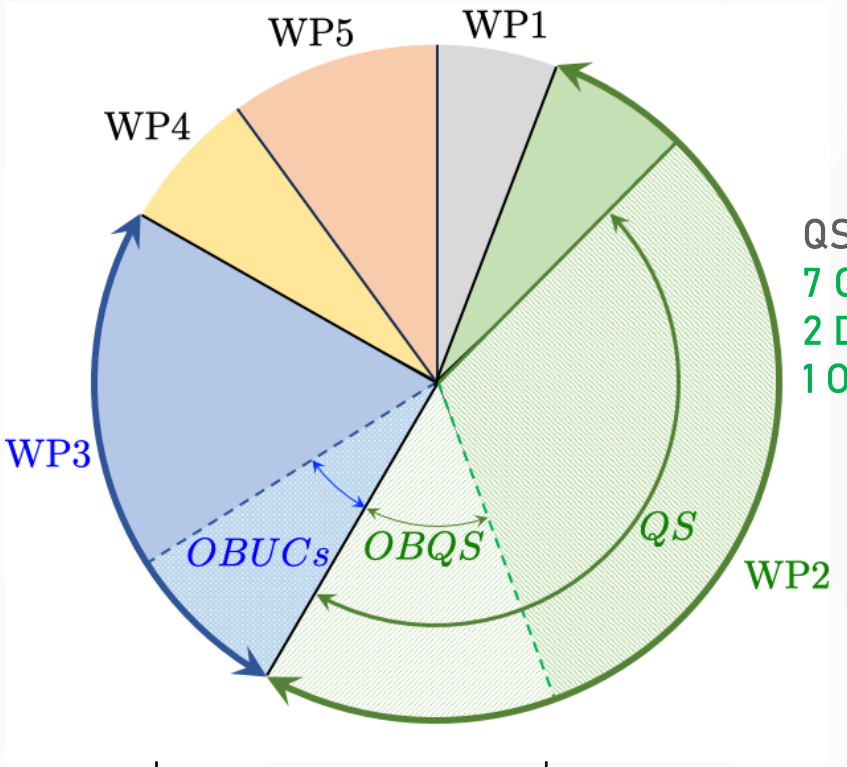
EQUIP-G - Activities

A Horizon Europe project towards a future European Research Infrastructure

- 20 partners, 11 countries
- Lead by CNRS, France
- 4 years (2025 – 2029)
- 4 pillars:



- Budget: 25 M€



QS Quantum Sensors:
7 Q Gravimeters
2 Dual Q Gravimeters
1 OB Q Gravimeter

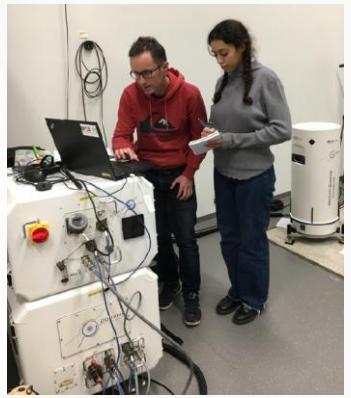
OBQS
in 2 OB Use Cases

- 10 QS
- 8 TUCs
- 2 OBUCs



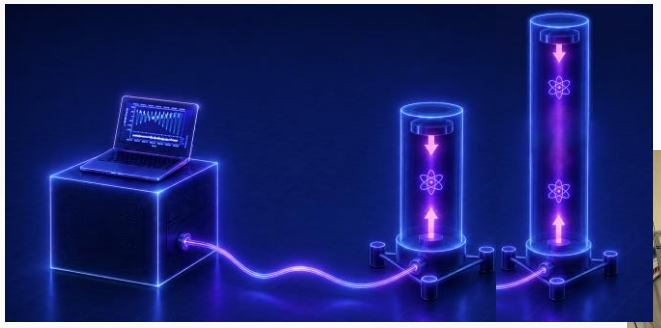
EQUIP-G - Instruments

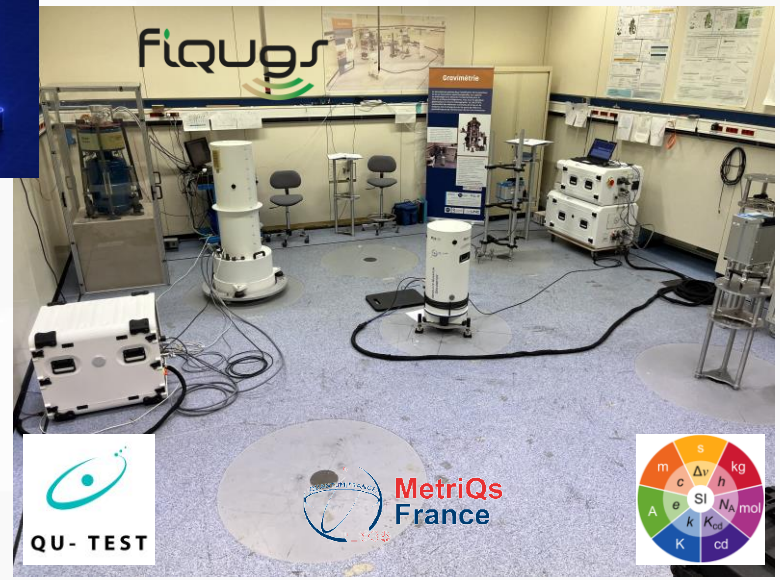
Procuring quantum gravimeters as products, testing and deploying them in the field



Within EQUIP-G we are procuring quantum sensors using atom interferometry to measure the acceleration of the Earth gravity *g*. Our park of instrument will comprise:

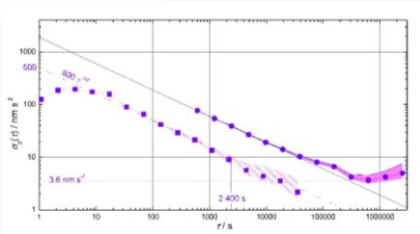
- 11 terrestrial Absolute Quantum Gravimeters
- 2 terrestrial Differential Quantum Gravimeters
- 1 airborne Quantum Gravimeters





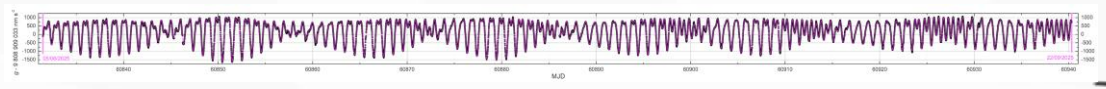
We open public procurement procedures to all EU manufacturers

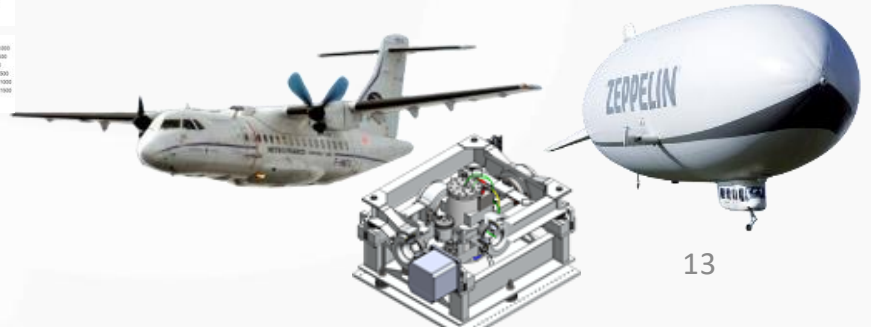
We benefit from a reference infrastructure at French national metrological institute LNE to test and evaluate all the EQUIP-G sensors part of the park



EQUIP-G activities for instruments:

Procurement
Testing
Establishing measurement protocols and good practices
Trainings of new operators
Development of the airborne quantum gravimeter
Comparisons (2026 & 2028)





EQUIP-G - Use Cases

8 use cases to support some of the most pressing European societal challenges

(1) Water storage assessment

(2) Soil pollutant flow monitoring

(3) Nuclear waste underground storage monitoring

(4) Continuous volcano monitoring

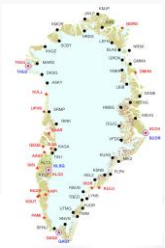
(5) Time-lapse volcano monitoring

(6) Climate change monitoring

(7) Geodesy and national spatial references

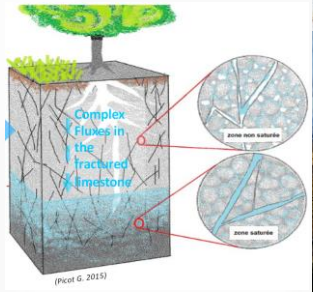
(8) Geothermal energy





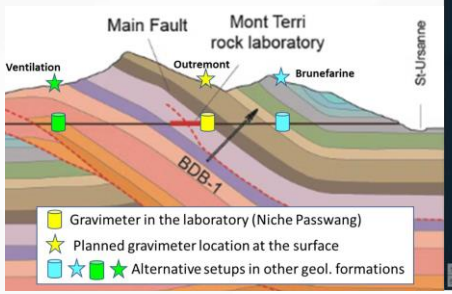




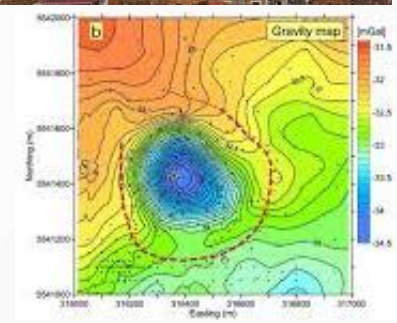












EQUIP-G - Data

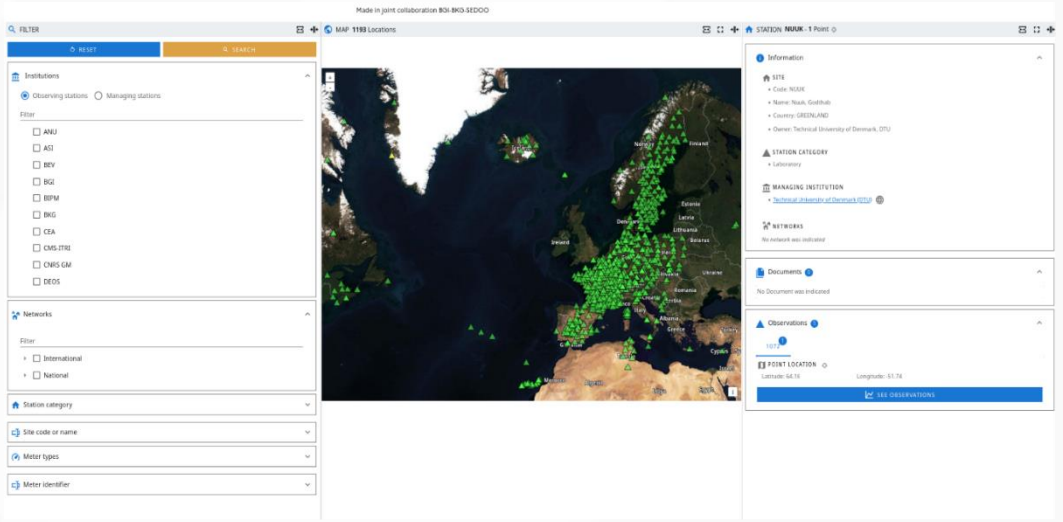
Collecting, storing and providing access to high-quality data to the entire scientific community

All data collected on the field by EQUIP-G sensors will be stored and provided following the FAIR principles:

- Findable
- Accessible in open source
- Interoperable
- Reusable

We leverage the expertise in existing data repository

Heritage from existing gravity data bases and return on experience of GNSS data



EQUIP-G activities for data access:

FAIR assessment and metrics

Recommendations on community standards for FAIR implementation

Implementation in data repository

Initial data integration within EPOS

EPOS EUROPEANPLATEOBSERVINGSYSTEM

EQUIP-G - Community Building

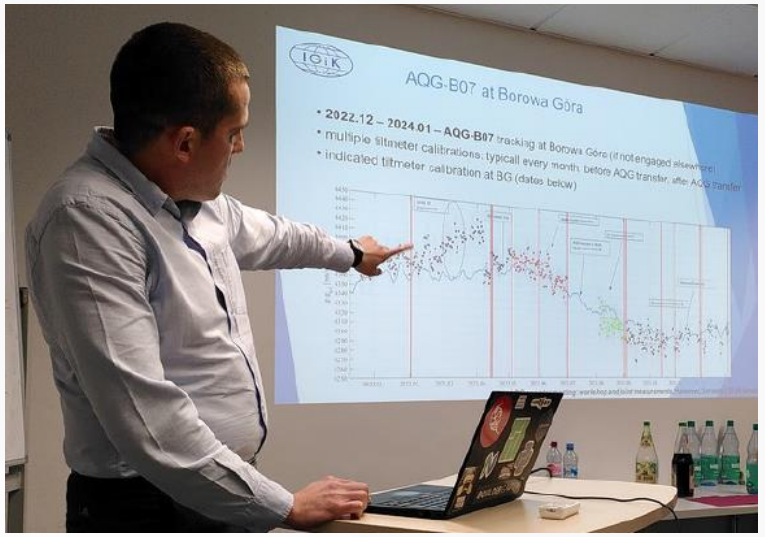
Knowledge transfer and community outreach

Within EQUIP-G we must:

- Raise the awareness of larger community of end users
- Train and educate more technical people
- Bridge the gap with the Industry

Democratize quantum gravimeter use

We benefit from a large and committed community already active in Geosciences
We engage with both public entities and private companies



EQUIP-G activities for community building:
Two EU-wide community workshops
Two Open Calls to borrow and use quantum gravimeters from the EQUIP-G park
Trainings
Identify future Use Cases
Works towards TCS

To establish a roadmap and recommendations for future European perennial entity

EQUIP-G - Next steps

Towards the blueprint of a future European Research Infrastructure

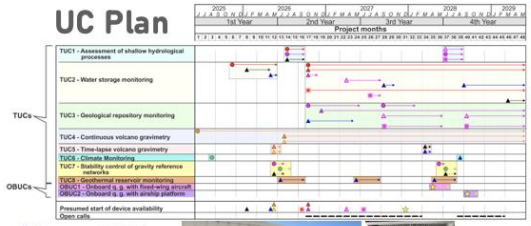
June 2025 KO





1st tender

UC Plan





Deliverable D11
Use Cases Plan

TUC2





1st QS delivery



April
1st Instrument
Comparison

June
First EU
workshop
Potsdam,
Germany

First Open-call:
External European entities
will be able to borrow
quantum gravimeters from
EQUIP-G
Summer 2026

YOU ARE HERE



2nd Comparison
2nd device WS

Roadmap and
recommendations
to the European Commission
for a European entity
managing a shared park of
quantum gravimeters

2nd Open Call

2nd EU-WS

2025 | 2026 | Register | 2027 | 2028 | 2029



August 2025 TUC6

Repository
SEDOO

October EEAB

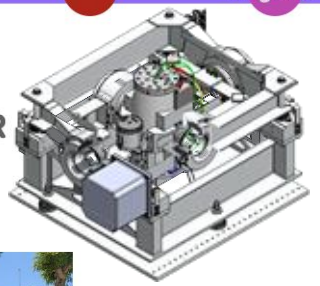


February
Instrument
training



Last tender

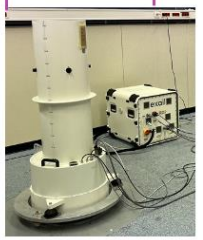
May
OBQS PDR



TUC5



DQS
deliveries



Test data
integration

EPOS
EUROPEAN PLATE OBSERVING SYSTEM

Data
availability

IP
operational

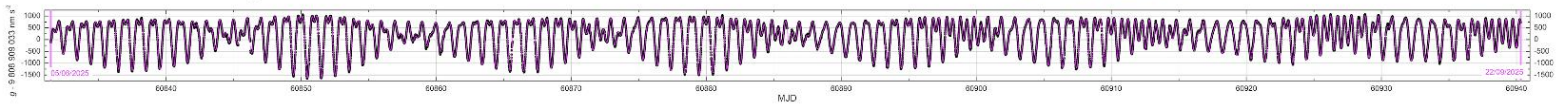
OBUC1

OBUC2



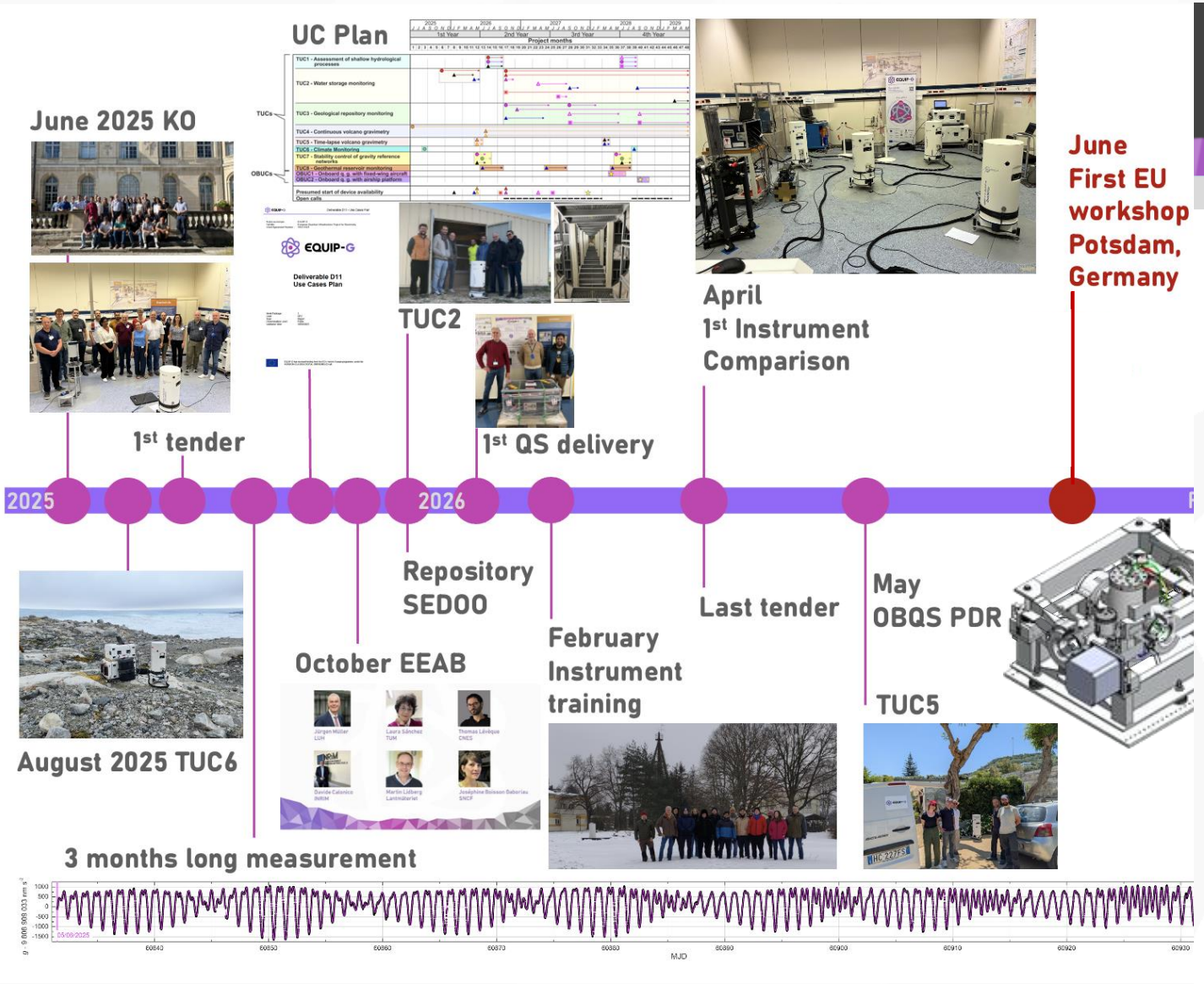


3 months long measurement



EQUIP-G - Next steps

Towards the blueprint of a future European Research Infrastructure



EQUIP-G community workshop 2026

3–5 juin 2026
GFZ Helmholtz Centre for Geosciences - Potsdam, Germany
Fuseau horaire Europe/Berlin

Entrer le texte à rechercher

Workshop materials available!

- Overview
- Programme
- Inscription
- General information
  - Venue
  - Getting there
  - Accommodation
- Conversation starters
- Workshop materials
  - Posters
  - Slides & recordings
- About EQUIP-G

Contact organising team
community@equip-g.eu

Funded by the European Union

Slides & recordings

Below you can download the available presentations (pdf format) and the video recordings of the panel discussions.

Wednesday, 3 June 2026

		Session	Title	Speaker	Files
10:00 AM	10:10 AM	Welcome	Welcome by GFZ	Marvin Reich (GFZ)	slides
10:10 AM	10:20 AM	Welcome	Welcome by EQUIP-G	Sebastien Merlet (CNRS)	slides
10:20 AM	10:50 AM	Presentation 1	EQUIP-G in EC's view & EU quantum strategy	Laurent Olislager (Project Officer)	slides
11:30 AM	12:00 PM	Presentation 2	EQUIP-G: project overview	Sebastien Merlet (CNRS)	slides
12:00 PM	12:45 PM	Panel discussion 1	Quantum gravimetry in Europe	Laurent Olislager (PO EU), Bruno Desruelle (Exail), Christian Freier (Nomad Atomics), Matthias Weigelt (DLR)	video
12:45 PM	1:15 PM	Presentation 3	CARIOQA	Celia Pelluet (CNES)	slides
2:30 PM	3:00 PM	Panel discussion 2	Applications of quantum gravimetry to geoscience	Sebastien Merlet (CNRS), Marvin Reich (GFZ), Daniele Carbone (INGV), Przemyslaw Dykowski (iGiK)	video
3:00 PM	3:15 PM	Presentation 4	EQUIP-G: onboard quantum sensor	Tim Jensen (DTU)	slides
3:15 PM	3:45 PM	Panel discussion 3	Onboard quantum gravimetry	Georges Bonheure (DG DEFIS), Mark Dransfield (Excalibur), Alexander Löwer (iMAR), Vincent Menoret (Exail)	n/a
4:45 PM	5:15 PM	Presentation 5	EQUIP-G: the international park of quantum gravimeters for Europe	Marvin Reich (GFZ)	slides
5:15 PM	5:45 PM	Presentation 6	EPOS	Lilli Freda (EPOS ERIC)	slides

Thursday, 4 June 2026

		Session	Title	Speaker	Files
9:10 AM	9:30 AM	Presentation 1	Open-calls: requesting instruments for your own project	Gentle Dash (QDLN)	slides
9:30 AM	10:00 AM	Panel discussion 1	Feedback, questions, interactions (instrumental park and open-calls)	Sebastien Merlet (CRNS), Marvin Reich (GFZ), Gentle Dash (QDLN)	video
10:00 AM	10:30 AM	Presentation 2	Selected use cases within EQUIP-G	Daniele Carbone (INGV)	slides
11:00 AM	11:30 AM	Presentation 3	EQUIP-G: Use case Greenland	Przemyslaw Dykowski (iGiK), Tim Jensen (DTU)	slides

EQUIP-G - Next steps

Towards the blueprint of a future European Research Infrastructure

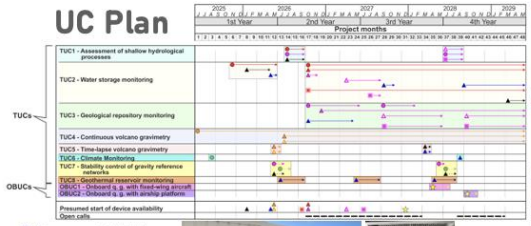
June 2025 KO





1st tender

UC Plan





Deliverable D11
Use Cases Plan

TUC2





1st QS delivery



April
1st Instrument
Comparison

June
First EU
workshop
Potsdam,
Germany

First Open-call:
External European entities
will be able to borrow
quantum gravimeters from
EQUIP-G
Summer 2026

YOU ARE HERE



2nd Comparison
2nd device WS

Roadmap and
recommendations
to the European Commission
for a European entity
managing a shared park of
quantum gravimeters

2nd Open Call

2nd EU-WS

2025 | 2026 | Register | 2027 | 2028 | 2029



August 2025 TUC6

Repository
SEDOO

October EEAB

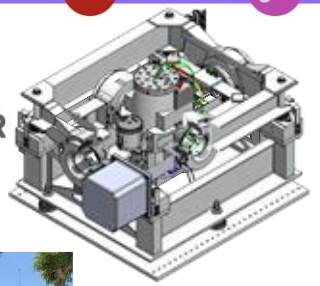


February
Instrument
training



Last tender

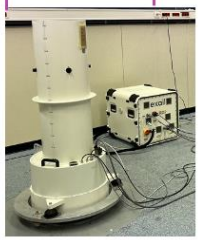
May
OBQS PDR



TUC5



DQS
deliveries



Test data
integration

EPOS
EUROPEAN PLATE OBSERVING SYSTEM

Data
availability

IP
operational

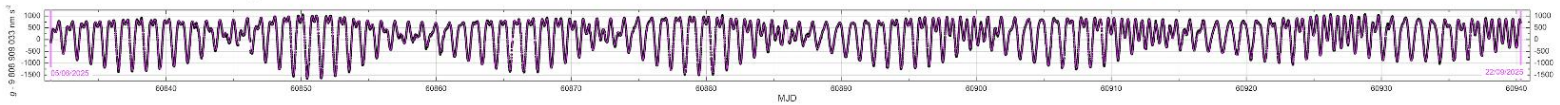
OBUC1

OBUC2





3 months long measurement



EQUIP-G - Open call

19 proposals, committee with external reviewers, select 4 instead of 3 projects

EQUIP-G

European Quantum Infrastructure Project for Gravimetry

2026 Open-Call winners

The Evaluation Comittee of EQUIP-G has selected the following entities to receive and operate a quantum gravimeter, free of charge.
Field works will stretch from November 2026 to January 2028.

Géosciences Montpellier	Landslide processes and hazard assessment
LANTMÄTERIET	Geodesy & Geodynamics
LATVIJAS ĢEOTELPISKĀS INFORMĀCIJAS AĢENTŪRA	Underground gas storage monitoring
ETH zürich	Fluid injection and earthquake physics

Funded by the European Union

Contact for EQUIP-G Instrument Park Exercize: ipe@equip-g.eu

EQUIP-G - EU project

A Horizon Europe project towards a future European Research Infrastructure

Funded by the European Union

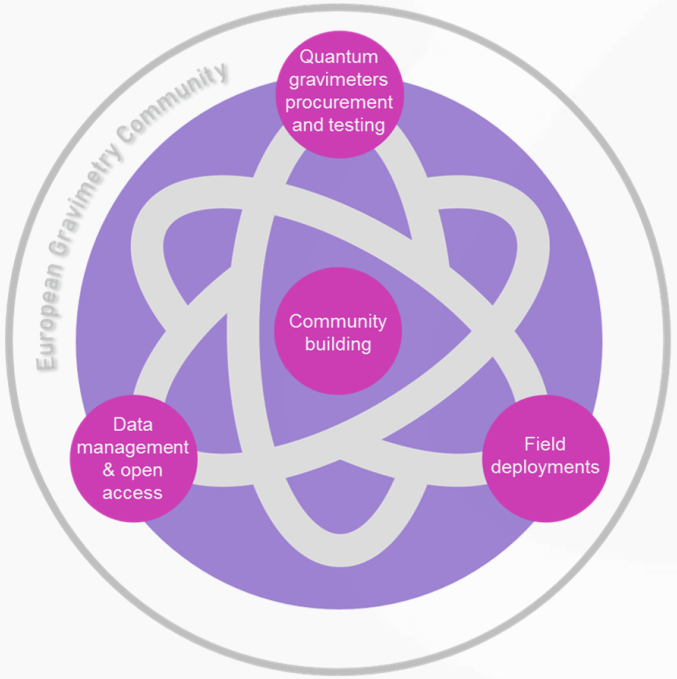
equip-g.eu

Mission

Establish a European perennial research infrastructure managing:

- a shared park of quantum sensors,
- a terrestrial reference gravity network,

for the benefit and the sovereignty of Europe.



EU vision >2030 : A pan-European quantum gravimetry infrastructure



EQUIP-G - EU project

A Horizon Europe project towards a future European Research Infrastructure

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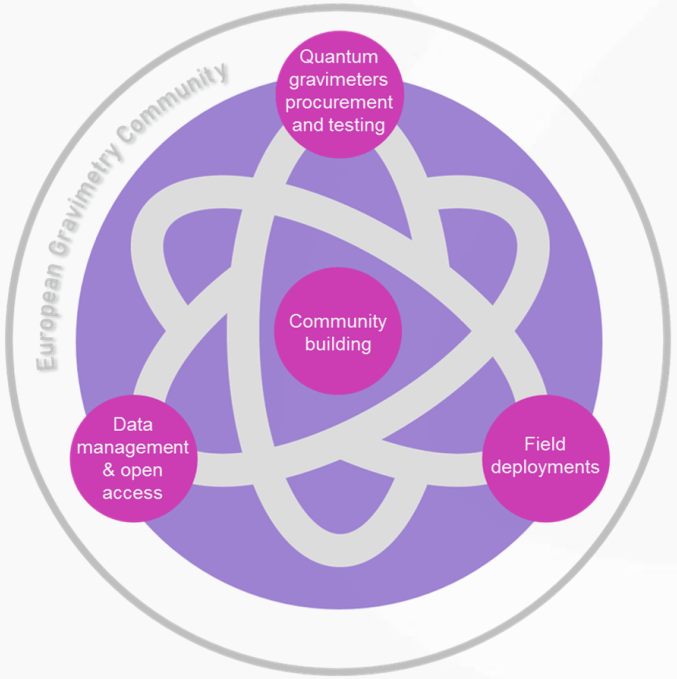
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EU vision >2030 : A pan-European quantum gravimetry infrastructure



EQUIP-G

European Quantum Infrastructure Project for Gravimetry

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Follow us!

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EQUIP-G has received funding from the EC's Horizon Europe programme, under the HORIZON-CL4-2024-DIGITAL-EMERGING-02 call.