

The EMPIR Project 18SIB07 GIQS:
Graphene Impedance Quantum Standard

**Establishing
SI linked quantum traceability
by exploiting
the potential of graphene**

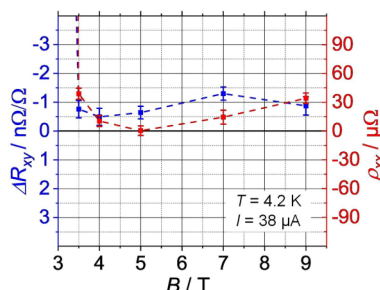
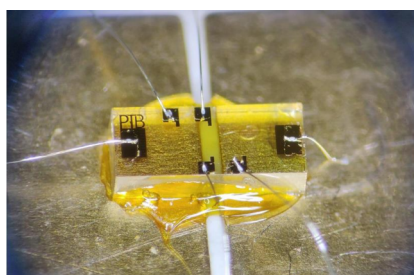
The project

The aim of GIQS is to enable an economically efficient traceability of impedance (resistance, capacitance, inductance) measurements to the defining constants (the Planck constant and the elementary charge) of the International System of Units (SI). New and easier to operate measurement bridges, convenient and easier to use graphene quantum standards, cryogenic systems, and methods to combine them will be developed. The project is now in the middle of its development, and several progresses have been made towards its goals.

Progress

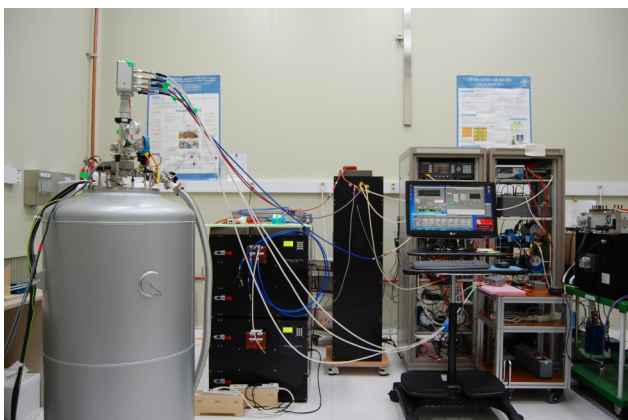
Graphene devices

The development of graphene QHE devices continues: here a device that quantizes at 4 T and 4.2 K is mounted on its double-shielded socket.



AC measurements on QHR graphene devices

The project is now entering the phase where AC QHR measurements are being performed with the digital impedance bridges developed within the project.



KRISS electronic fully-digital bridge measuring a graphene QHE device

Forthcoming events:

- 32th Consultative Committee for Electricity and Magnetism (CCEM), April 2020



- EURAMET Technical Committee for Electricity and Magnetism (TC-EM): meetings of the Subcommittee DC and Quantum Metrology (SC-DC&QM) and Subcommittee Low Frequency (SC-LF) in June 2021

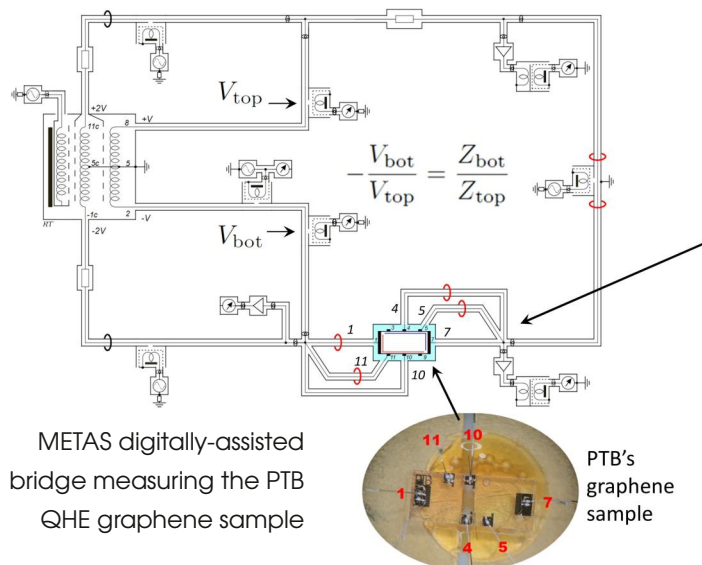


Electricity and Magnetism

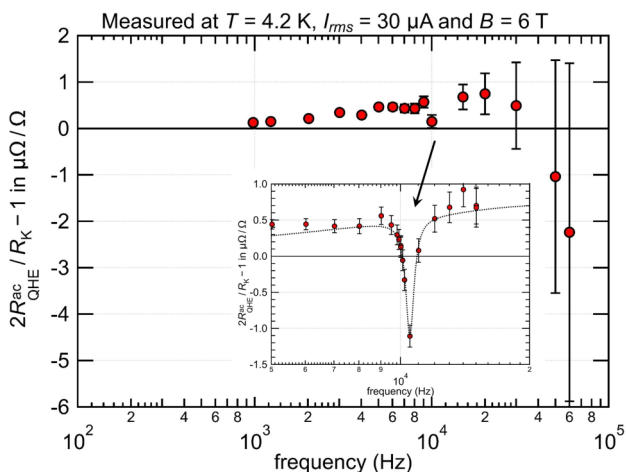
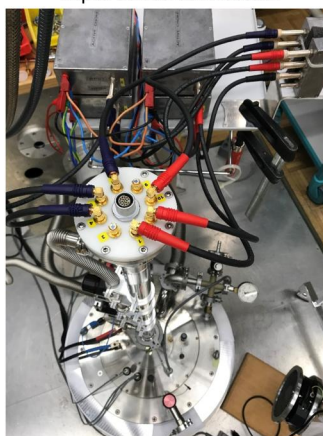
The project stakeholders include metrology organisations, research centers, calibration laboratories, industries which are interested in the project outcome and give input to maximise its impact on the T&M community.

Want to join? Contact us!

AC measurements on QHR graphene devices



Triple-series connection



ACQHR measurements are difficult and can show artifacts that need troubleshooting. This measurement of the QHR resistance versus frequency shows an unexpected resonance above 10 kHz, that deserves further investigations.

Impedance definition

In metrology, the definition of the measurand is the set of rules which identify in a unique way the measurand. The purpose of impedance definition is to define a geometrical surface and a set of electrical boundary conditions that exclude effects of connections, the meter itself, and the electromagnetic properties of the environment, so changes in these have no effect on the measurement outcome.

Several impedance definitions are in use. The most complete one is the four terminal-pair definition. Introduced by Cutkosky in 1964, it allows to perform measurement on impedances of any magnitude by keeping the errors caused by connections to a minimum (often negligible) value. Its achievement requires, however, dedicated circuits in the impedance bridge, which makes those more complex.

Bridges being developed within the GIQS project aim to minimize the complexity added by the 4P definition by making extensive use of digital electronics: hence, the denomination of digital bridges.

The GIQS project on the web:

The project is active on the web!

Now **9 scientific videos** about the project development are available.

Click to view, and subscribe for updates:



The partners

This project has received funding from the EMPIR programme co-financed by the Participating States and from the European Union's Horizon 2020 research and innovation programme.



Research mobility grants (RMG) is an instrument to fund the participation of researchers from other EURAMET members to the GIQS project. If you are interested contact us!