Research Results Presentation Meeting of the ICRR Inter-University Research Program FY2023

Tokyo, 21-22 February 2024

Position control system for silicon monolithic suspension in cryogenic gravitational waves detectors

Project Number: 2023i-G-003

M. Bawaj, F. Travasso, H. Vocca

A.D. 1308 unipg
UNIVERSITÀ DEGLI STUDI DI PERUGIA

UNICAM Università di Camerino 1336

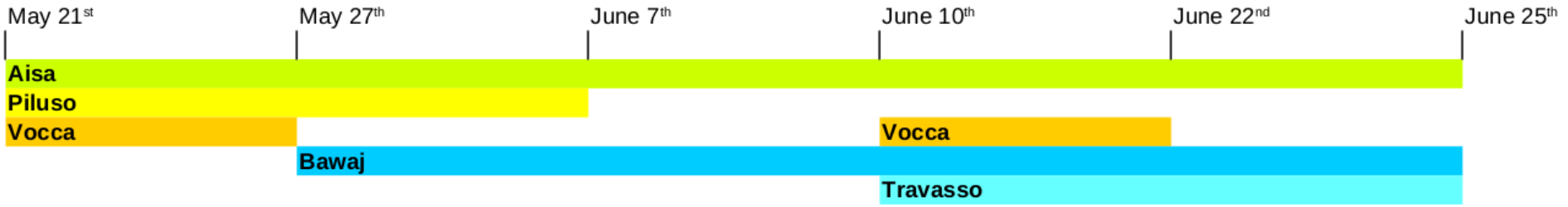
INFN Sez. di Perugia

ICRR Institute for Cosmic Ray Research University of Tokyo

Activities at ICRR during 2023

- stabilisation of the suspended payload
- development of a data acquisition system for the cryostat (pressures and temperatures available on a local web server)
- several cooling and warming up cycles of the cryostat to test the DAQ system

The data acquired during the cooling cycles were used to calibrate the nodal suspension system which was installed inside the cryostat at the time of tests. Preliminary measurements of the substrate angle loss with GENS at the temperature below 45K exhibits values of order 10^{-8}.



Person	Days
• Mateusz Bawaj	35
• Flavio Travasso	14
• Helios Vocca	23
Technical support:	
• Simone Aisa	34
• Antonfranco Piluso	16

Allocated research fund

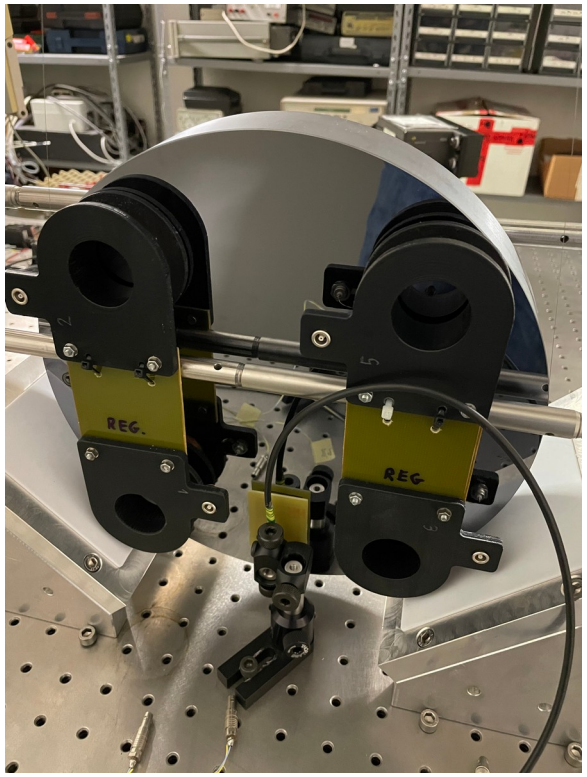
Grand Total: 250,000 JPY

Expenses:

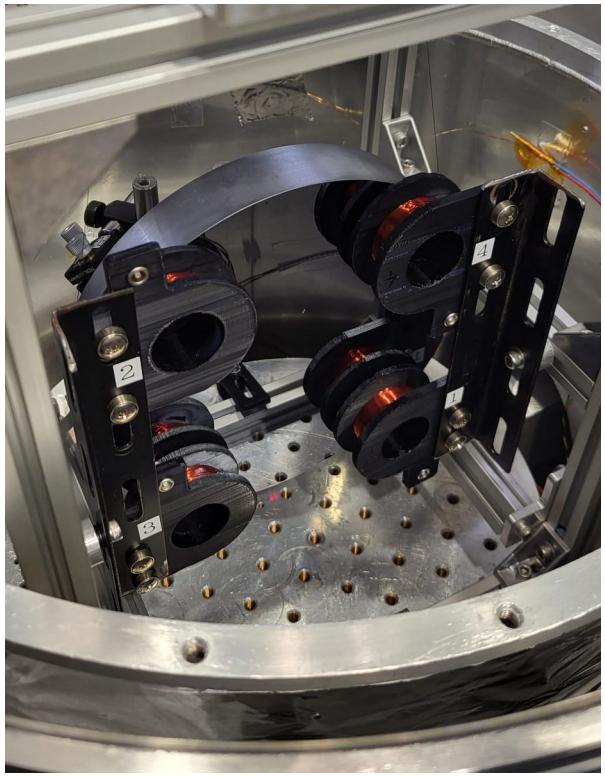
- Moku:Go x2
- MicroPC
- Compact Laser Module

Position control system

- Preliminary tests of the suspension ant actuators were performed in Perugia in 2022
- In 2023 we moved most of the system to ICRR
- In the first phase we worked on the control in air
- Finally we moved the suspension into the vacuum chamber of the cryostat



Suspended substrate in Perugia

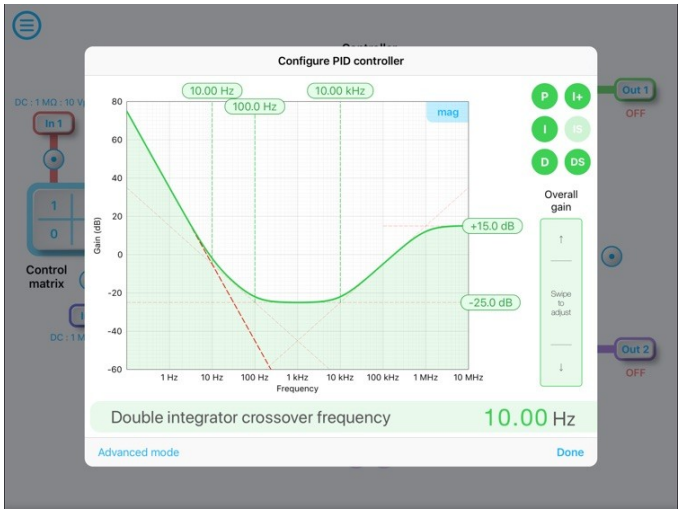


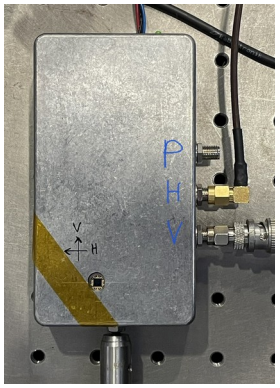
Suspended substrate at ICRR

Position control system

Components:

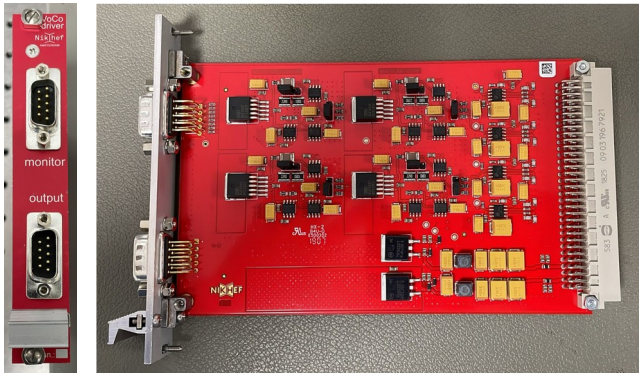
- optical lever:
  - compact laser module
  - position sensor
- filtering box
- coil driver
- coils + magnets





Beam position sensor

Moku:Go

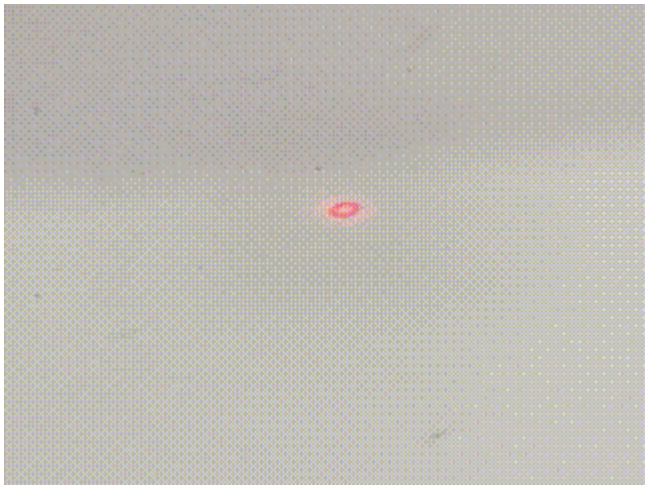


Coil driver

Position control system

Results

Not damped



(moving spots video)

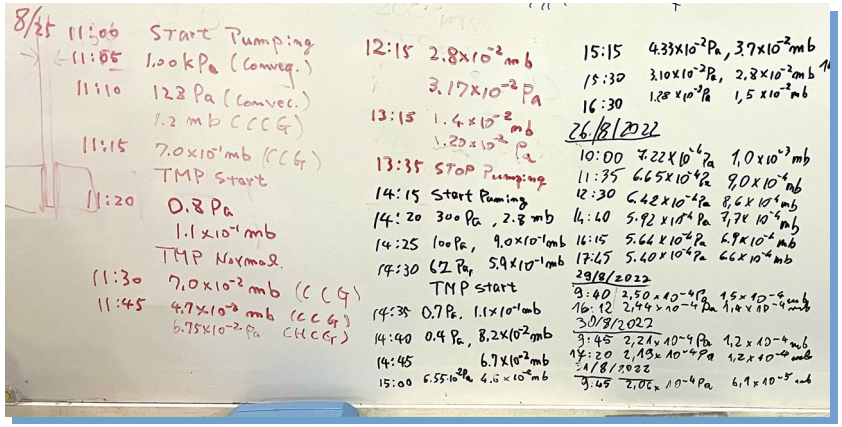
Damped

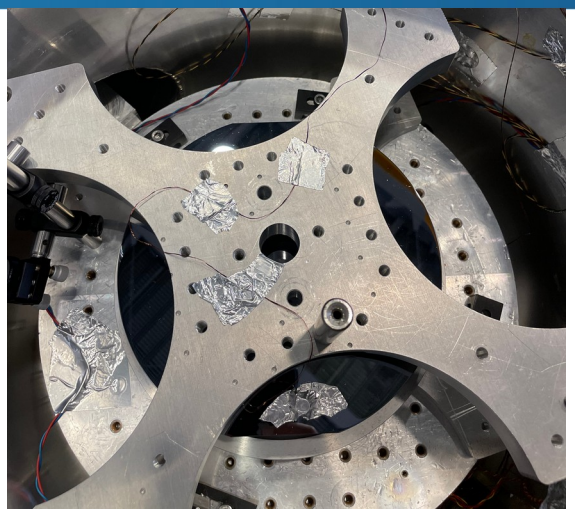
(still spots video)

New cryostat monitoring & GENS measurements

Previous DAQ version

July 2022

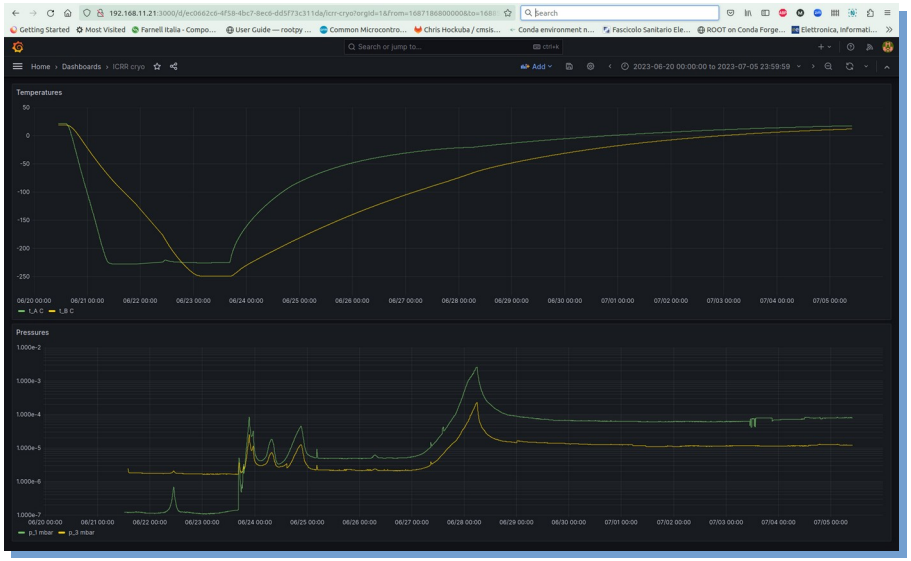




- **Q-factor as a function of temperature**
- **Cryostat and GENS calibration**

New DAQ version

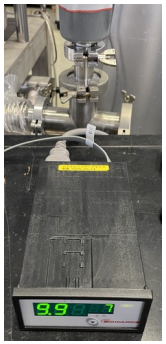
June 2023

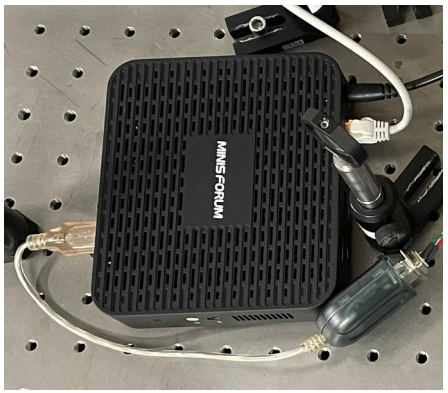


September 2023

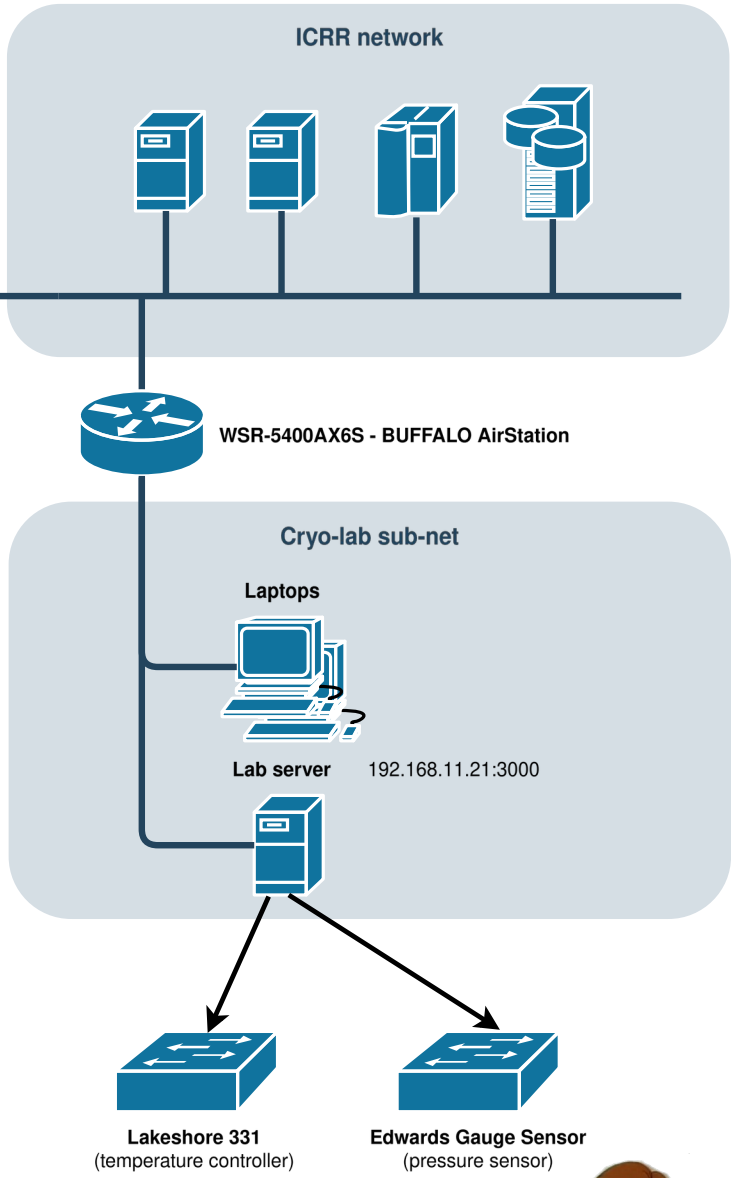
New cryostat monitoring

Sensors





MicroPC



Grafana

Ubuntu

* https://en.wikipedia.org/wiki/Grafana

Acknowledgments

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- Co-funded by the European Union

  PROBES of new physics and technological advancements from particle and gravitational wave physics experiments. A cooperative Europe - United States - Asia effort. H2020 – MSCA – RISE – 2020 (G.A. 101003460)

  NEWS: NEw WindowS on the Universe and technological advancements from trilateral EU-US-Japan collaboration. H2020 – MSCA – RISE – 2020 (G.A. 734303)

European Commission