

Research Result Report

ICRR Inter-University Research Program 2024

Research Subject:

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

Principal Investigator:

Mateusz Bawaj

Participating Researchers:

Helios Vocca

Flavio Travasso

Nicolo Baldicchi

Francesco Bianchi

Gabriele Capoccia

Summary of Research Result :

Activities organization

Last year, preparatory activities: design, prototype manufacturing were performed in Perugia. Consequently, six researchers and three technical staff members were present at ICRR during two distinct phases of the summer period, spanning from early July to early September 2024. During the initial phase, Prof. H. Vocca was present from early to mid-July, followed closely by Prof. F. Travasso, whose stay lasted from mid-July to early August. This research period was supported by D. Aisa and S. Aisa, who maintained concurrent presences from early July until the end of that month. The second phase began with N. Baldicchi, who stayed from late July to early August, briefly overlapping with Prof. M. Bawaj, whose longer tenure spanned from early August until the end of activities in early September. In the second part of our stay A. Piluso assured technical support. Additionally, Eng. G. Capoccia had a brief visit at the very beginning in early July, and Eng. F. Bianchi's shorter presence occurred towards the conclusion of the second phase. Overall, researchers collectively spent 82 days at ICRR, whereas technical support accounted for a total of 97 days.

Research results

During 2024, significant progress was made in the development of the test monolithic suspension. Utilizing two pre-existing silicon pieces identified in

2023, minor adjustments were made to employ them effectively as a test mass and a marionette. Collaboration with Wielandts UPMT continued, resulting in the completion of the design and feasibility study for the silicon rods (thick fibres) with integrated ears. Additionally, the mechanical suspension system was designed, manufactured from aluminum, delivered to ICRR, and successfully assembled (see Fig. 1). Three primary objectives were achieved: testing of anchoring techniques for silicon rods using aluminum components, verification and refinement of the mechanical system design and the preparation of electronics required to control the suspended elements.

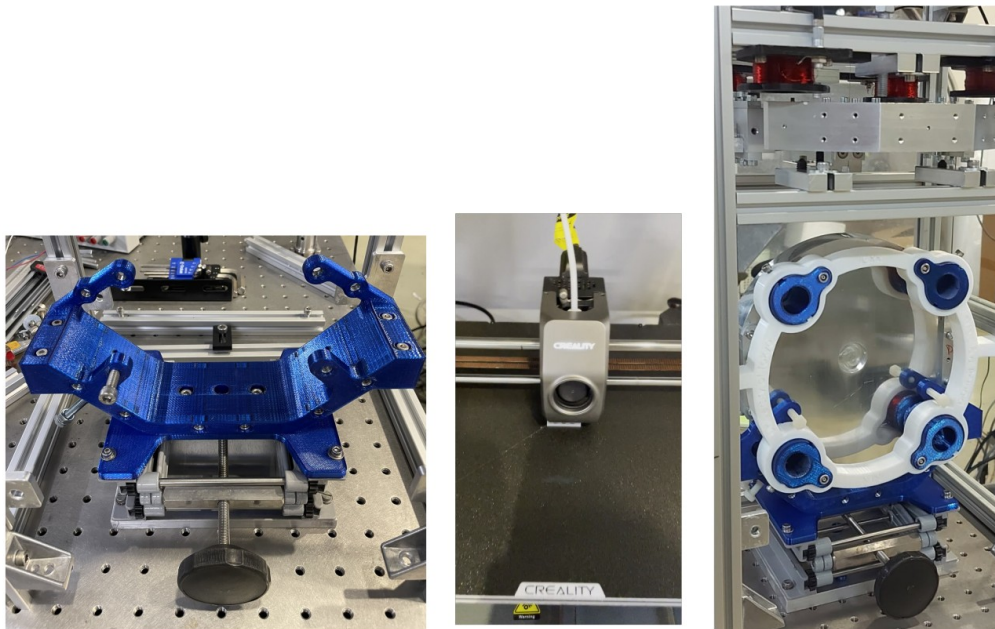


Figure 1: Aluminum dummy suspension with prototyped elements.

A printed circuit board was designed and prototyped. The prototype integrates 4 high-impedance inputs of type 1 and 4 high-impedance inputs of type 2 for experimental validation of the design (see Fig. 2). For driving electromagnetic actuators 4 voltage outputs and 4 current outputs were designed. Finally we started the development of firmware for multichannel digital controller.

