

Letter of Intent

To: EGO Director - EGO Council Chair - Virgo Spokesperson

Date: May 9th, 2025

From: Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT),
Avda. Complutense 40, 28040, Madrid; Carlos Delgado (carlos.delgado@ciemat.es)

Subject: Expression of Interest to join VirgoLab

Dear Sir/Madam,

This letter serves as a formal expression of interest by the Gravitational Waves group of the Basic Research Department of the Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (hereinafter referred to as CIEMAT) to join the VirgoLab, as described in VIR-1025B-24. We understand that VirgoLab operates, commissions, and upgrades the Virgo interferometer, and we are willing to contribute to its mission and to the achievement of its goals.

1. Introduction

CIEMAT is a group belonging to a Spanish Public Research body specializing in development and exploitation of instrumentation for particle and astroparticle physics, specialized in design and production of mechanics and electronics for high precision instrumentation in hostile environments, computing, and development of analysis software. Our expertise and ongoing research activities are highly relevant to the operation, commissioning, and potential upgrades of gravitational wave interferometers.

We believe that our participation in VirgoLab would be mutually beneficial, allowing us to contribute our knowledge and resources to the advancement of gravitational wave science in Europe and beyond, while also providing our members with valuable experience and opportunities within a leading international collaboration.

This letter outlines our main areas of interest and potential contributions to VirgoLab.

2. Scientific / Technological Case or Context of Opportunity

Our department has a strong background in mechanical systems engineering and production for precision instrumentation in astroparticle physics, computing, software development and analysis. Within the Virgo framework, we are contributing to the mechanics of the O5 IMC, particularly in its modification to integrate a ring heater for focal length control of the mirror. We are also in charge of the development of a modular baffles system aimed at reducing stray light in several of the injection and detection suspended benches for O5. These activities align with VirgoLab's Detector Commissioning project and are relevant to the Mechanics & Vacuum Technical Team.

We also provide a computing infrastructure and support, specifically maintaining and operating an offsite computing cluster for low-latency data processing. This computing activity is aligned with the Computing & Software Technical Team, particularly in support of low-latency pipelines and data quality assessment.

We are also developing expertise in detector characterisation with O4, with a focus on glitch detection and classification.

3. Description of the Proposed Contribution

Our proposed involvement in VirgoLab would encompass the following potential contributions:

Instrumentation:

- Continued support for the IMC payload mechanics, including post-installation maintenance, technical assistance to other groups, and assessment of potential upgrades to this or related systems.
- Maintenance and support on any activity related to the baffles of suspended benches, as well as participation in possible upgrades on that or similar system.
- Noise characterisation using standard tools and AI-based methods.

Computing:

- Provision and maintenance of the low-latency computing cluster, used for data processing and online analysis. This includes technical assistance for software deployment and performance monitoring.
- Evaluation and possible implementation of additional tasks within this cluster.

We are also open to contributing to other areas based on the evolving needs of VirgoLab and the expertise within our group. We are keen to engage with the existing VirgoLab Technical Teams and Projects to identify areas where our skills and resources can be most effectively utilized.

4. Costs, Calendar and Resources

Initially, our contribution would primarily involve the effort of our existing personnel, consisting of three researchers (~2 FTE), two mechanical engineers (~1 FTE), together with additional computing and technical personnel available as needed.

We understand that the successful accomplishment of VirgoLab tasks, particularly the timely installation and commissioning of the O5 upgrade, will demand strong and continual presence at EGO site. Our group is prepared to support that effort within available resources.

We anticipate the need for travel to EGO to access the IMC end mirror support mechanics as well as the suspended benches for baffles installation.

We understand that Member Labs are in charge of maintaining and operating the equipment they provide, and we are prepared to discuss the provision of any potential equipment, computing or personnel resources the group might offer as part of a Memorandum of Agreement (MoA).

We are aware that financial resources are allocated by EGO Council, national funding agencies, or research organizations. We will explore potential funding opportunities through our institution and national agencies to support our involvement in VirgoLab.

We are prepared to work towards the establishment of a MoA with EGO should our application be successful.

5. Stakeholders and Requirements

Our primary stakeholders are the Centro de Investigaciones Energéticas Medioambientales and Tecnológicas, the Spanish Ministry of Science, Innovation and Universities, and the Spanish State Research Agency (AEI).

We understand that as a contributing group, our main requirements would be to have effective communication channels within VirgoLab, opportunities for our members to actively participate in relevant projects and technical teams, and recognition for our contributions to the scientific and technical advancements of Virgo.

We are committed to adhering to the policies and procedures of VirgoLab, including those related to resource allocation and publications.

We are ready to discuss our potential participation further and provide any additional information that may be required. We look forward to the possibility of joining the VirgoLab and contributing to its continued success.

Sincerely,

Dr. Carlos Delgado,
Permanent Researcher and
PI of CIEMAT GW group
May 9th, 2025