Letter of Intent to join VirgoLab organization from the LUTh-Caen group

To: EGO Director - EGO Council Chair - Virgo Spokesperson

Date: May, 9th 2025

From: LUTh-Caen group, LPC Caen and Observatoire astronomique de Strasbourg, France. Jérôme NOVAK (jerome.novak@astro.unistra.fr)

Subject: Expression of Interest to join VirgoLab

Dear Sir/Madam,

This letter serves as a formal expression of interest by the LUTh-Caen group 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

The part of LUTh-Caen group that intends to join VirgoLab is a research group within CNRS/IN2P3 and University of Normandy specializing in vacuum technology, Faraday isolators and glitches/noise investigations. 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 group has strong backgrounds in several instrumentation and data analysis aspects and particularly:

- Design and production of vacuum chambers for high precision particle experiment, FEA simulations on mechanical structures. Relevant to the Mechanics & Vacuum Technical Team.
- Magnetic field mapping, extraction of magnetization or determination of equivalent surface currents to be used as input in FEA simulations. Magnetic field shielding optimization and post-mapping. Relevant in the Infrastructure Technical Team.
- Electro-static/dynamic detection systems and simulations. Charged particles transport simulations and particle detector design and optimization. Development of ionization devices in low pressure environments. Relevant in the Infrastructure as well as the Mechanics & Vacuum Technical Teams.

- Development of advanced algorithms for the characterization of the detector in terms of noise, spectral features and channel safety extracted from the interferometer's data stream. We have expertise in the development of algorithm for GPU based architectures which can contribute to the Detector Operations and Maintenance project, particularly in the area of detector characterization. Relevant to the Computing & Software Technical Team.
- 3. Description of the Proposed Contribution

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

- Technical Development:
 - Design of the PRM2 and SRM2 vacuum chambers for the stable cavities upgrade.
 - Contributing to the design and the development of the magnetic field of Faraday isolators and their shielding optimization. Environmental magnetic noise investigations and characterizations related to activities conducted in the Infrastructure Technical Team.
 - Contributing in the design, development and testing of a neutralization device based on the emission of charged particles for reducing the electrostatic charge of the payloads.
- **Detector characterization:** Participating in the development and implementation of safety auxiliary channels classification algorithm, high-resolution spectral lines extraction algorithm for the Detector Operations and Maintenance project, contributing to data quality characterization and support to the Detector Commissiong for noise and glitch studies.

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 : 2 researchers and one engineer, for an expected **total commitment of 2.3 FTE**s, and is shown in the following table:

Name	Contribution (FTE)	Status
Damien GOUPILLIERE	0.4	Engineer
Gilles QUEMENER	0.9	Full time researcher
Samuel SALVADOR	1.0	Full time researcher

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 commits to support that effort as much as reasonably possible.

We anticipate the need for funding in order to regularly travel to EGO, rest of needs should be covered by the O5 upgrade program at IN2P3.

We understand that Member Labs are in charge of maintaining and operating the equipment they provide.

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 CNRS/IN2P3 and University of Normandy.

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,

Jérôme NOVAK, LUTh-Caen group leader, On behalf of the LUTh-Caen group.

May, 9th 2025