



HERMES PROJECT

**HAUTES ENERGIES POUR L'IRRADIATION DES MATERIAUX SOUS
ELÉCTRONS ET PROTONS**

A 3MEV PROTONS ACCELERATOR AND ITS BEAMLINE

SUMMARIZED TECHNICAL SPECIFICATIONS

The scope of the HERMES project is linked to space applications. The Physics, Instrumentation, Environment, and Space Department (DPHY) of ONERA in Toulouse investigates the space environment surrounding satellites orbiting our planet - as well as other planets - and its impact on these satellites. Satellites are exposed to the harsh space environment, receiving irradiations, while also enduring extreme temperatures, ultraviolet radiation, all within a vacuum. In support of this goal, DPHY carries out experimental approaches based on several radiation facilities which are partially updated within the frame of the HERMES project.

In this context, ONERA intends to renew them as part of the HERMES project, prioritizing the 2 MeV proton accelerator, which will be replaced by a 3 MeV proton accelerator and its beamline. To accomplish this first phase, an extension of the bunker will be necessary. In Phase 2, the 2 MeV electron accelerator will be replaced by a new-generation equivalent with the same energy output, and to gain flexibility and expertise, a 250 KeV proton accelerator and a 400 KeV electron accelerator dedicated to SEMIRAMIS activities will be procured (Figure 1).

Finally, in Phase 3, a new 5 MeV electron accelerator will complete the set. It will be entirely dedicated to GEODUR activities.

It is important to note that the Phase 2 and Phase 3 shall get each a dedicated invitation to tender in the future.

The required equipment consists of an irradiation means capable of providing a continuous proton beam with an intensity ranging from 10 nA to 50 μ A, accelerated at an energy between 50 KeV and 3 MeV. The new 3 MeV proton accelerator will be located in the extended AXEL bunker on ONERA's Toulouse site, in close proximity to existing buildings. Access to the interior of the bunker for accelerator delivery will be through a 6m x 3.5m hatch. The final placement of the access hatch has not yet been determined in order to take into account the dimensions of the procured equipment. The HERMES project's end-state configuration will be studied in the scope of a preliminary analysis (Figure 1).

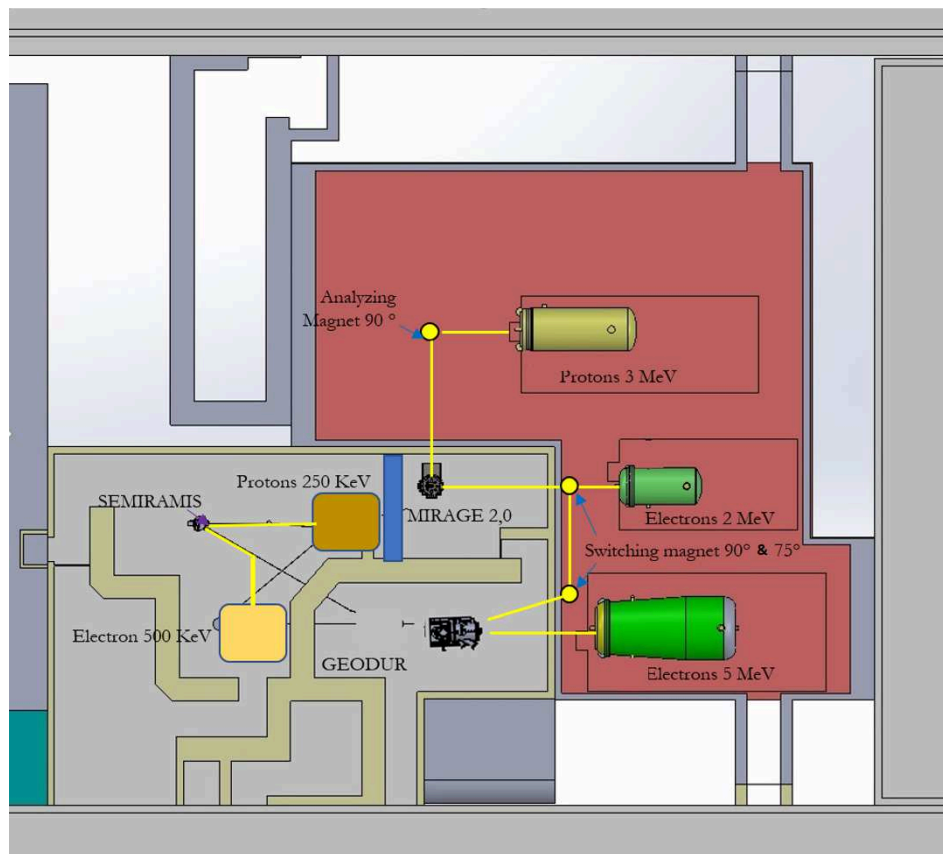


Figure 1 : HERMES project's end-state configuration after the preliminary analysis

The following breakdown is proposed for this project:

Firm Part:

- **Task N°1** : Overall analysis of scientific equipment and their building interfaces

In this first task, the Contractor shall conduct a preliminary study needed for the Phase 1 of the project but also the project in its entirety and anticipate the positioning and dimensional constraints of the equipment (accelerators) that will be procured and set up in subsequent phases. The Contractor shall conduct risk study and the general functional analysis of the 3MeV protons accelerator and its beamline.

- **Task N°2** : Definition of the proton accelerator and its beamline

In this task the Contractor shall propose and provide the 3MeV proton accelerator (SF6 or alternative insulating gas can be considered) and its beamline; The particle accelerator is intended to be installed in the bunker extension. It will accelerate a beam of ions extracted from an accelerated hydrogen gas plasma. A tank of the accelerator containing pressurized dielectric gas will prevent electrical discharges. A beam line will be set up to transport and shape the particle beam, with the goal of achieving the desired beam properties. An analysis magnet will separate the protons from the ion beam based on energy. A switching magnet will distribute the beam to the existing MIRAGE or SEMIRAMIS beamline. After validation by ONERA, the Contractor shall build the equipment (accelerator, beamline and its control system)

- **Task N°3** : Factory acceptance test and validation

In this task, the entire equipment set must be assembled and tested in the factory before on-site installation at ONERA center, Toulouse, France. People from ONERA shall be present at the factory for the acceptance tests.

- **Task N°4** : Delivery and installation

In this task, the validated equipment shall be delivered and installed on the ONERA Site in Toulouse, France.

- **Task N°5** : On-site testing and validation

In this task, the Contractor shall test and validate the equipment in the bunker HERMES on ONERA center, Toulouse, France.

- **Task N°6** : Documentation

The Contractor shall provide to ONERA all documentation related the installed and validated equipment.

- **Task N°7** : Training

The Contractor shall train ONERA people on the operation, maintenance on the equipment

- **Task N°8** : Project quality management plan

Three optional parts are expected for this 1 phase of the project

- Complementary equipment dedicated to the manufacturing and delivery of a dedicated instrumentation cabinet to monitor the operational parameter services (cooled water, pressure, temperatures) of the equipment (Proton accelerator and its beamline)
- **Task N°9** : Tooling, equipment, and spare parts of the equipment
- Storage of the equipment after its factory accepted test and validation and before delivery on the ONERA site.