

Radiofrequency superconducting cavities and high-power proton Linacs



Mol, Belgium



MYRRHA

MULTIPURPOSE HYBRID RESEARCH REACTOR FOR HIGH-TECH APPLICATIONS

Demonstrating the feasibility of particle accelerator driven nuclear reactors (ADS) for nuclear waste reprocessing

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- **Scientific leader:** Luc Perrot (IJCLab) *
- **Laboratories involved:** IJCLab (Orsay), IPHC (Strasbourg), LPSC (Grenoble)
- **Nature:** research infrastructure
- **Status:** project under construction, supported by the Belgian Nuclear Research Centre (SCK CEN)
- **Website:** <https://myrrha.be/>

SCIENTIFIC OBJECTIVES

The MYRRHA project aims to build a hybrid research reactor (or ADS for Accelerator driven system) in Mol, Belgium, to study the incineration of certain highly radiotoxic nuclear waste products. Accelerated protons will be projected onto a target to produce a flow of fast neutrons through the phenomenon of spallation. This will sustain the chain reaction in the subcritical core of the reactor. The maximum power of this hybrid reactor will be 100 MWth.

RESOURCES DEPLOYED

The maintenance of nuclear reactions requires an accelerator with very high power (2.4 MW with a continuous flow of protons accelerated to 600 MeV) and remarkable beam stability (no more than 3 interruptions per quarter). The chosen solution is a superconducting linear accelerator with redundant accelerator cavities to compensate for failures. The accelerator will also have a backup injector in operation to take over immediately in case of failure of the main injector. Phase 1 of the project (called MINERVA) will aim to test these failure compensation methods based on the principle of redundancy.

400 metres length (Linac)

2,4 MW continuous beam power

600 MeV proton energy

2 to 3 billion euros (total estimated cost)

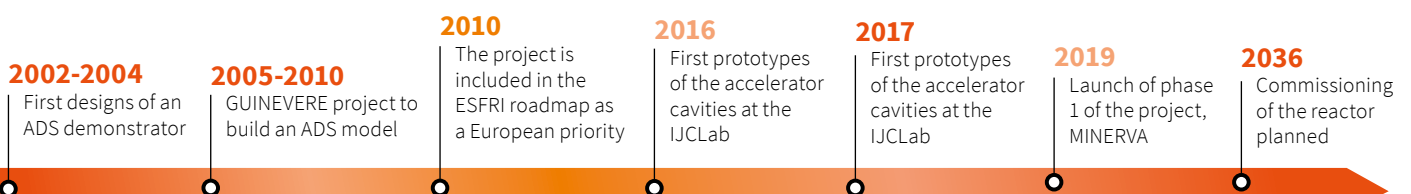
10 beam stops longer than 3 seconds every 3 months tolerated at most

IN2P3 CONTRIBUTIONS

- Main player in the accelerator design studies.
- Development, construction and testing of the spoke cryomodule prototype (30 such cryomodules will make up the first part of Linac).
- Beam dynamics studies.
- Participation in the qualification of the injector.
- Design of magnetic elements.
- Modelling of vacuum systems and development of beam diagnostics (position and profile monitors) essential for accelerator settings.

OTHER FRENCH LABORATORIES INVOLVED

ACS company (Orsay)



* Since 2020