

# HISOL: High performance ISOL systems for the production of radioactive ion beams

RL – Valerio Villa

# HISOL

The HISOL project aims to develop a new generation of high-performance ISOL (Isotope Separator On-Line) targets and ion sources.

The project focuses on three main objectives:

- studying and developing innovative recipes and methods for producing ISOL targets,
- developing new methods for operating ion sources, and
- characterizing and simulating these components using advanced techniques.

The ultimate goal is to **leverage cutting-edge technologies available within INFN and its collaboration network to enhance the production and operation of radioactive ion beams.**

For the PV section, associate physicists conducted Monte Carlo simulations for the proposed primary target solutions, while associate engineers handled the propagation of dimensional and geometric errors of the ionization source components.

**HISOL started in 2023 and will end in 2024**

# From HISOL to HISOL\_NEXT

HISOL\_NEXT will differ from HISOL in several key areas:

1. Focus on Development: HISOL\_NEXT will continue and finalize the development of ISOL target-ion source systems initiated by HISOL, aiming for readiness during the SPES facility's online commissioning phase.
2. Enhanced Ion Sources: Improvements will be made to the SPES hot-cavity ion source for surface and laser ionization, alongside finalizing the SPES FEBIAD ion source design.
3. Advanced Components: There will be advancements in insulators for high-temperature targets, neutral atom injectors for ion sources, and improved vacuum chambers.

The PV section in HISOL\_NEXT will focus on completing the design of the SPES FEBIAD ion source and improving the hot-cavity ion source for surface and laser ionization with Monte Carlo simulations

# Informazioni generali

Sezioni Coinvolte:

INFN-LNL

INFN-PD

**INFN-PV**

Durata del progetto:

2025-2027

## Anagrafica di Pavia 2025:

Name	Expertise – Activity in the project	WP	FTE
<b>Valerio Villa</b> (PV local resp.)	Morphologic design of additively manufactured components Tolerance stack analysis of assemblies	2	0.4
<b>Antonietta Donzella</b>	Monte Carlo simulation	3	0.1
<b>Ileana Bodini</b>	Morphologic design Tolerance stack analysis of assemblies	2	0.2
<b>Diego Paderno</b>	Morphologic design Proof-of-concept of proposals for devices	2	0.2
<b>Davide Pagano</b>	Data Analysis and Interpretation	3	0.1
<b>Total INFN-PAVIA FTE</b>			<b>1.0</b>

FTE 2025 sezione PV: 1

# 2025 Activities

## Work Package 1 - LNL: Advanced Development of ISOL Primary Targets

- Microstructure Development and Optimization - Continue the development of TiC and SiC discs with advanced microstructures and manufacturing techniques such as precision 3D printing.
- Prolonged Testing and Thermal Stress - Perform long-term testing and evaluate the strength and durability of ISOL TiC/SiC targets under extreme operating conditions.

## Work Package 2 – PV and PD: Development of Advanced ISOL Ion Sources

- Design and Production of Complex Components - Continue the study and optimization of components for ion sources with materials such as W, Ta, Mo and complex geometries, **improving the control of dimensional and geometric errors through the review of morphologies and manufacturing requirements** .
- Emission Testing and Source Optimization FEBIAD – Perform advanced thermionic emission testing with new Ta cathodes for high electron fluxes and **improve non-contact optical measurement of anode and cathode deformations in service**.

## Work Package 3 – LNL, PD, PV: Characterization and Advanced Simulation of Materials

- Materials Characterization - Perform detailed thermal, electrical, and mechanical characterizations of new target and ion source materials, implementing fatigue and resistance testing to repeated thermal cycling.
- **Advanced Multiphysics Simulation - Develop advanced multiphysics simulation models to accurately predict the behavior of ISOL targets and ion sources under real-world operating conditions, optimizing component design and reducing development time and costs.**

# Richieste 2025

## Budget

- Consumo – 1k€
- Inventariabile - 3k€
- Altri servizi - 0k€
- Missioni – 4k€

## Servizi

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**totale 8k€**