



Fact Sheet 2

With the support of



The FRATHEA project in detail :

Flash RAdiation Therapy Electron Acceleration

Increasing recovery rates and reducing radiation-induced side-effects by combining FLASH radiotherapy with very high energy electrons (VHEE): this is the aim of the FRATHEA project led by Institut Curie, in collaboration with the CEA.

This major project, launched in 2024, is being financed over a four-year period by a €37 million grant (€35 million as part of the Innovation Santé 2030 plan, the healthcare component of France 2030, which will be funded by the ANR on behalf of the French government, and €2 million by the Île-de-France Region as part of its major innovation projects). FRATHEA brings together multidisciplinary teams from Institut Curie and the CEA at Institut Curie site in Orsay. With the support of an industrial partner selected for the project, their goal is to position **France as a leader in the design and deployment of cutting-edge radiotherapy equipment.**

The new and unexplored technological challenges of moving FLASH-VHEE radiotherapy into the clinic require both a radical change in medical irradiator design and new dosimetry methods. The FRATHEA project aims to develop a unique, safe and effective experimental platform for FLASH-VHEE treatment in oncology by 2028.

Institut Curie and CEA teams involved in this groundbreaking project will have to provide innovative tools, instruments and tests to develop optimal treatment protocols and monitoring to ensure controlled clinical use. **Ultimately, this technology will not only cut costs, but above all reduce the duration and number of sessions, an invaluable advantage for patients' quality of life.**

Scientists will also be studying how this new generation of medical devices can be combined with other cancer treatment techniques. Finally, the complex nature of the project will require bringing together the best experts in the field, as well as providing training for the various personnel involved.

Expert multidisciplinary teams

To adapt to this new FLASH-VHEE modality using a dose rate 10,000 times higher than that used in conventional radiotherapy, new methods must be implemented. The FRATHEA project therefore calls on the multidisciplinary expertise of Institut Curie and CEA: physicists developing accelerator components and imaging or dosimetry equipment⁵, medical physicists for treatment planning and simulation, radiobiologists testing systems on tumors and animal models, and clinicians developing new treatment protocols.

⁵ Determining the dose of X-rays or other radiation to be administered in radiotherapy, and its distribution across the tumor zone.

Nine working groups united and connected

Nine groups are working on the FRATHEA project:

- ✓ Selecting a manufacturer, then building and installing the FLASH-VHEE irradiator at the heart of Institut Curie hospital site in Orsay.

In addition to overseeing the innovative procurement process for selecting a manufacturer—set to be announced in summer 2025—one of the working groups is focused on **developing the FLASH-VHEE demonstrator based on the technical specifications outlined in the tender**. The new instrument will have to provide different experimental configurations for beam delivery (FLASH, conventional, mini-beams, etc.), in order to explore different modalities for different therapeutic indications.

Meanwhile, another group is in charge of carrying out all the operations required at the hospital to **adapt the shielded room where the demonstrator will be installed**.

- ✓ Two other groups led by CEA teams are responsible for **the radiation protection and dosimetry studies** that are crucial to meeting current safety requirements. The teams involved here will ensure that the shielding required for radiation protection is in place at the demonstrator. Further **radiation protection** studies will be carried out to ensure that the FLASH-VHEE system and its environment meet radiation criteria for clinical use. In addition, another working group will develop **a complete set of dosimetry instrumentation, essential for controlling the doses delivered during FLASH-VHEE treatments**.

- ✓ Radiobiology and radiophysics studies

The final stage of the FRATHEA project involves validating the FLASH effect - i.e., the anti-tumor efficacy and absence of toxicity for healthy tissue - of the demonstrator through **experiments on different types of *in vitro* and preclinical models**. To prepare for clinical trials, a working group is also carrying out medical physics studies to **provide computational tools for simulating preclinical treatments on the demonstrator**. The scientists involved will identify challenges and opportunities in the initial stages of device development in terms of medical physics and technical specifications for preclinical and clinical applications.

- ✓ The final step involves preparing for clinical trials.

Preliminary clinical trials will be carried out by **simulating different configurations of the demonstrator (layout and number of beams, angles and sizes, type of delivery, etc.) on the basis of clinical cases and a reference system of possible indications** (in particular pancreatic, lung, brain and pediatric cancers, etc.). The aim is to illustrate the potential of FLASH-VHEE treatments in the clinic, before setting up the first patient trials.