

Production  
Internal  
Radiotherapy  
Astatine  
Generator  
Radon



REPARE (Research and dEveloppements for the Production of innovAtive RadioElements) is a French scientific project supported by the Agence Nationale de la Recherche (ANR). Its goal: to develop the use of astatine, a radioactive isotope discovered in 1940, and still very little known.

Rare and elusive in nature, astatine must be produced by particle accelerators. The physical properties of this radioisotope are very promising for internal radiotherapy, one of the tools of nuclear medicine to fight against cancer. Unfortunately, the half-life (7.2h) and the small number of production sites of this isotope limit the possibilities to study it.

The REPARE project aims to increase the production capacity of astatine and to develop a radon/astatine generator.

Since radon is a parent radioisotope of astatine with a much longer half-life, this transportable generator would allow astatine to be available on demand in different laboratories. In order to get sufficient quantities of radon, the REPARE project plans to design a new production line at GANIL, Grand Accélérateur National d'Ions Lourds, in Caen.

FROM RESEARCH TO  
ASTATINE TECHNOLOGY



How make astatine accessible to a larger number of laboratories to develop research?

How to increase the production capacity of astatine?

How to manufacture a radon/astatine generator?



D<sub>2</sub>

Generator: production system containing a parent radioisotope that decays into the daughter radioisotope of interest, which can be extracted for use in medical imaging or therapy.

Internal radiotherapy: therapy that uses radiation from an isotope injected into the body to kill cancer cells.



[Astatine, an Ally against Cancer, 2016, CNRS News](#)



[Astatine is a chemistry puzzle that shows anticancer promise, 2020, C&EN](#)



[Advances in the Chemistry of Astatine and Implications for the Development of Radiopharmaceuticals, 2021, ACR](#)



[Research and dEveloppements for the Production of innovAtive RadioElements – REPARE, ANR](#)



« REPARE is a synthesis of the very diverse expertise present in my laboratory. All the people I call upon put their skills, their astuteness and their sense of innovation at the service of the project with great pleasure. »

Matthieu

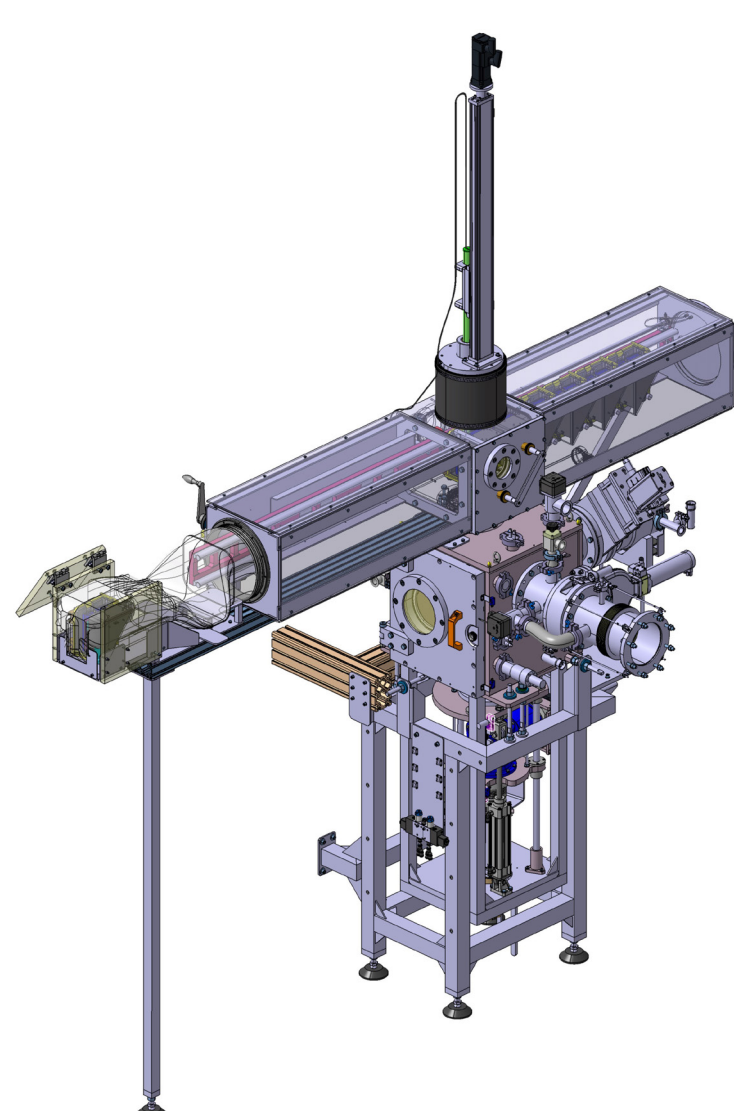
Objectives

To develop innovative production methods of astatine-211, by encapsulated liquid targets or by liquid flow of a bismuth/lead alloy target.

To increase astatine production capabilities by improving the current solid target.

To work out a radon/astatine generator and to understand the radon adsorption mechanisms on the surfaces in order to recover only the astatine produced in the generator.

Rotating solid target for astatine production, CAD view.



A Grant from the French Agence Nationale de la Recherche called "Investissements d'Avenir" has supported this work under the reference ANR-19-CE31-0013.

2020

Project start and allocation of resources

2021

Design of the rotating solid state target

2022

First production of astatine at SPIRAL2. Radon adsorption studies, development of new production methods

2023

Prototype of radon/astatine generator, implementation of the new production methods

2024

Beam availability for radon production, valuation of the radon/astatine generator