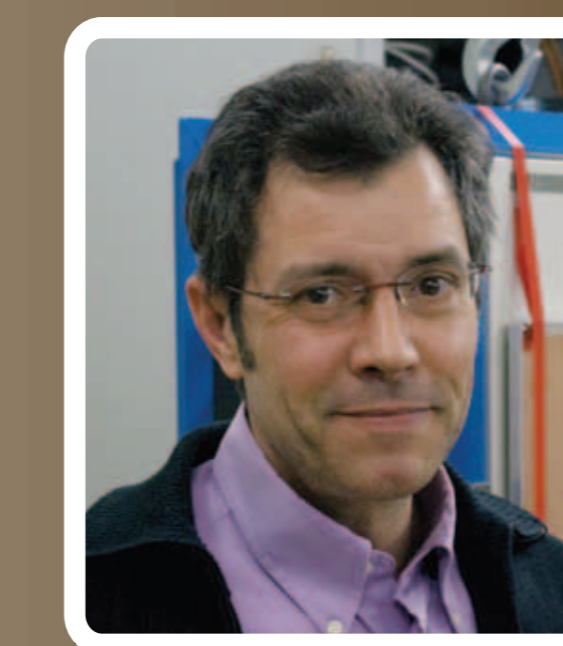




Collaborations

DEN/DMN: Département des Matériaux pour le Nucléaire, CEA - Saclay
 DEN/DPC: Département de Physico-Chimie, CEA - Saclay
 DAM/DRMN: Département de Recherche sur les Matériaux Nucléaires, CEA - Valduc
 DEN/DRCP: Département RadioChimie et Procédés, CEA - Marcoule
 DEN/DEC: Département d'Etude du Combustible, CEA - Cadarache



Bruno Sitaud
Scientist in charge



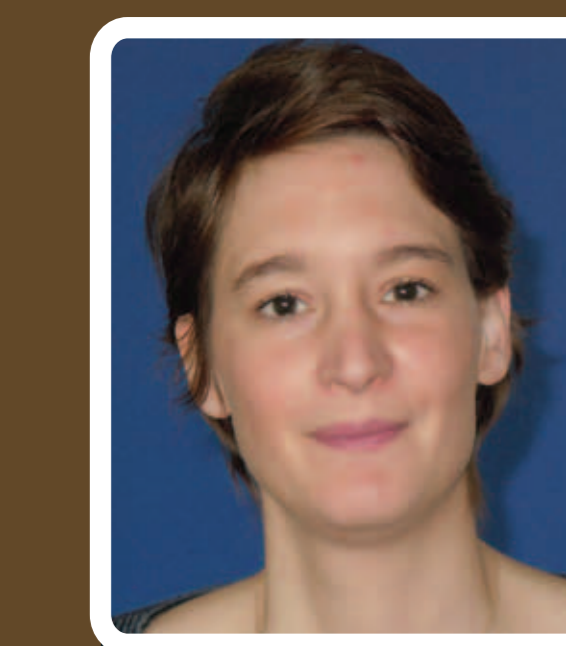
Sandrine Schlutig
Scientist



Pier Lorenzo Solari
Scientist

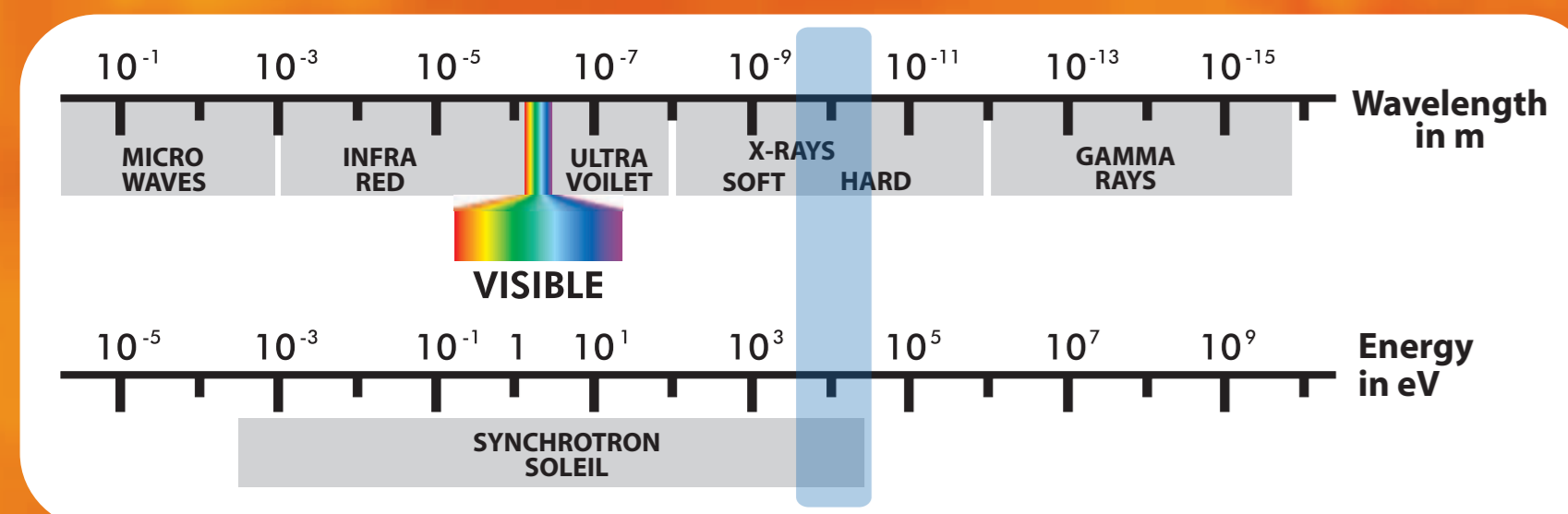


Hervé Hermange
Assistant engineer



Isabelle Llorens
Postdoc

Energy range of MARS: 3.5 to 35 keV



Light source: bending magnet
 Joint project with the CEA

A **unique facility** providing the capability to study more than 70 different elements and 230 isotopes for an activity of 18.5 GBq, as well as several different analysis techniques offered, all in the same place.

Analysis techniques used:

- X-ray diffraction (very high resolution and in transmission)
- X-ray absorption spectroscopy (transmission, fluorescence, and high resolution)
- X-ray fluorescence spectroscopy (microbeam imaging)
- Optics compatible with dispersive EXAFS mode.

Multi Analyses on Radioactive Samples MARS

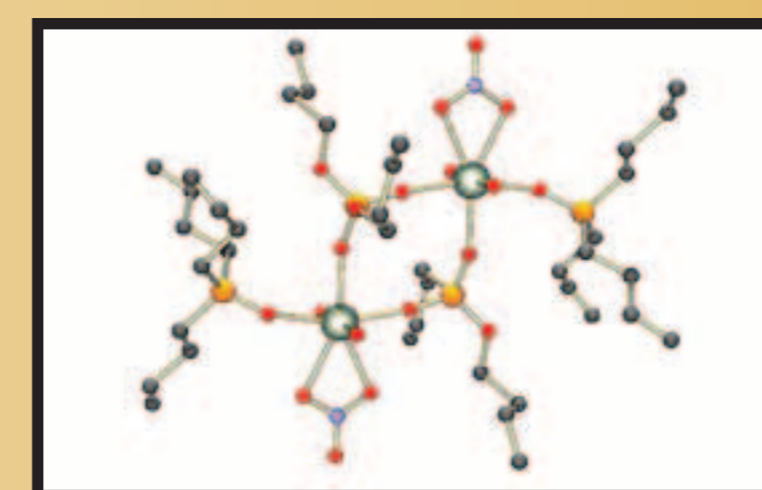
Characterizing radioactive samples for environmental, health and energy applications

Topics and applications

Solution chemistry

- Complexation by inorganic ligands
- Complexation by organic ligands and natural organic matter

Applications: environment, health, waste reprocessing

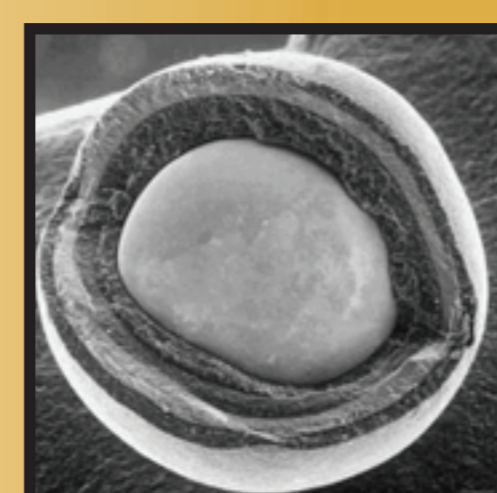


Complexing of uranyl by tributylphosphate

Solid state physics and chemistry

- Structural properties of nuclear fuel
- Matrix for nuclear waste storage
- Stability of actinide alloys
- Study of materials for current and future nuclear facilities

Applications: energy, environment, waste reprocessing



Nuclear fuel for high-temperature reactors (Generation IV)
© CEA-Cadarache

Interface chemistry

- Radionuclides retention in the nuclear waste storage context
- Radionuclides migration to the geosphere

Applications: energy, environment

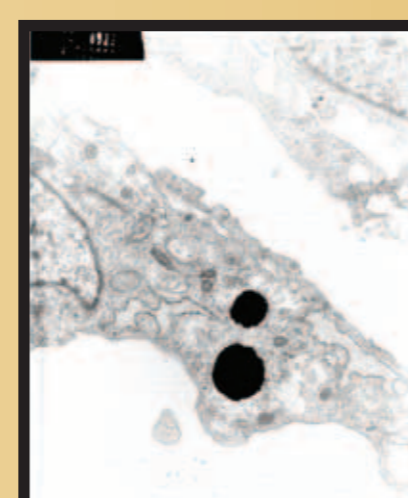


Nuclear waste storage facility in deep geological formations
© ANDRA

Biology

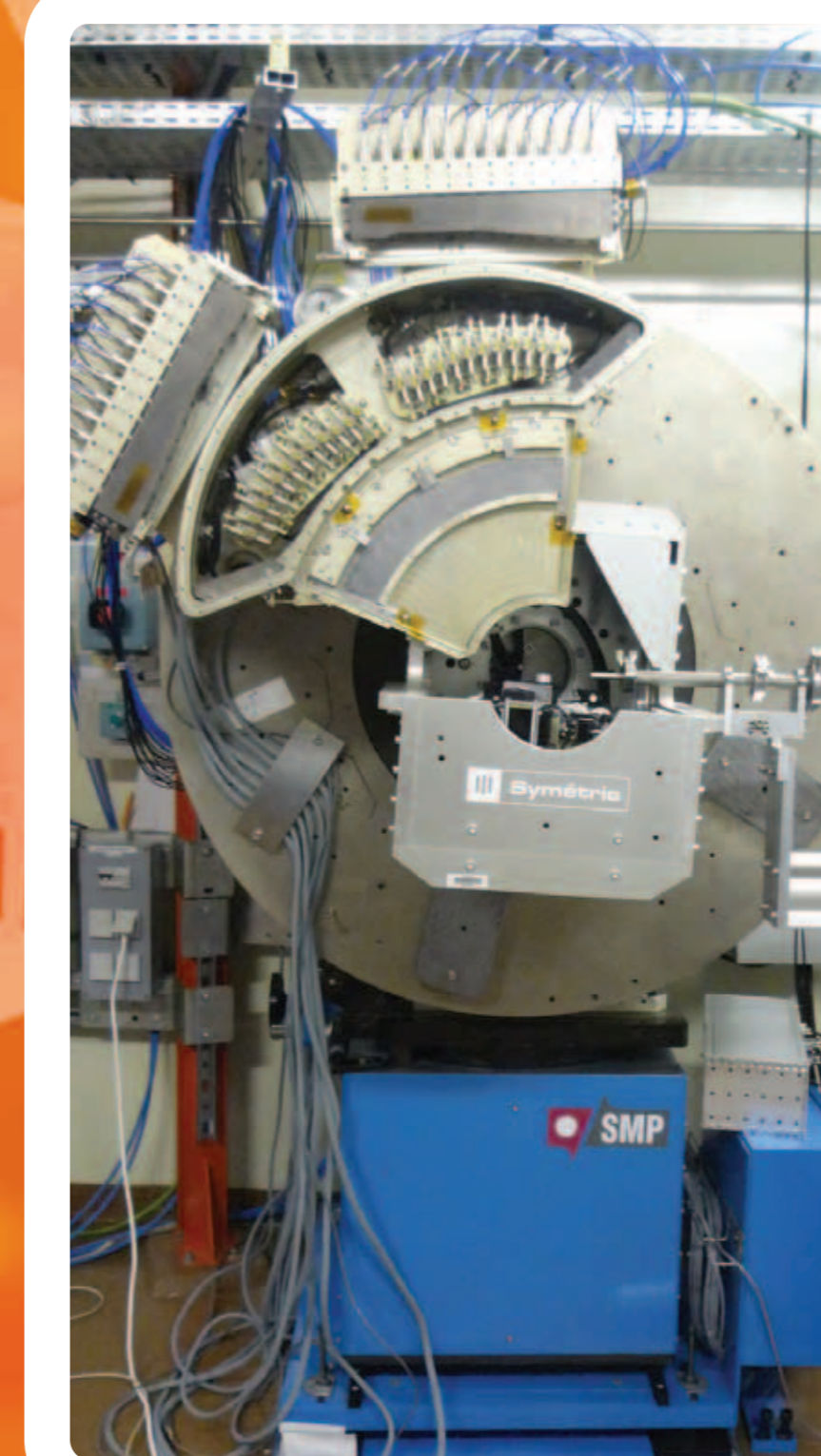
- Retention/migration of radionuclides in nuclear waste storage context
- Study of complexes of medical interest
- Study of biological effects due to radiation
- Nuclear toxicology studies

Applications: health, environment



Scanning electron microscope image of a cell that has incorporated uranium

Zoom 1: Characterization of strongly radiating materials



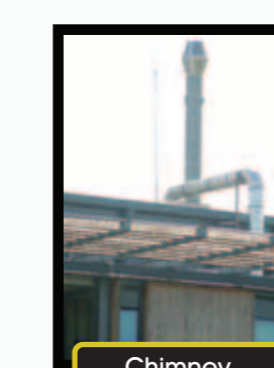
The materials will notably be characterized by very high resolution X-ray diffraction with a diffractometer specifically designed to reduce the noise induced by the radioactivity of the samples:

- 24 crystal analyzers associated with 24 detectors
- Diagram acquisition time 1 hour
angular range: 10° to 150°
- angular resolution reaching 0.001°
- signal-to-noise ratio around 100
- Three circles for precise sample orientation, with a 40 μm diameter for the confusion sphere
- Different characterization possibilities:
 - Determination of complex crystalline structures
 - Measurements at different energies (anomalous diffraction)
 - Determination of residual constraints
 - Characterization of microstructures and defects based on the analysis of diffraction peak shape

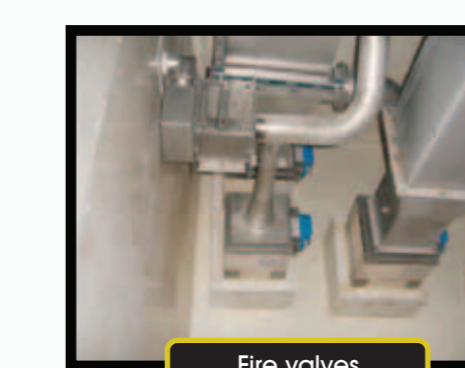
Zoom 2: The infrastructure on MARS

The infrastructure of the beamline was designed according to the requirements of nuclear safety authorities in the context of the handling and analyses on radioactive materials (irradiant and contaminant):

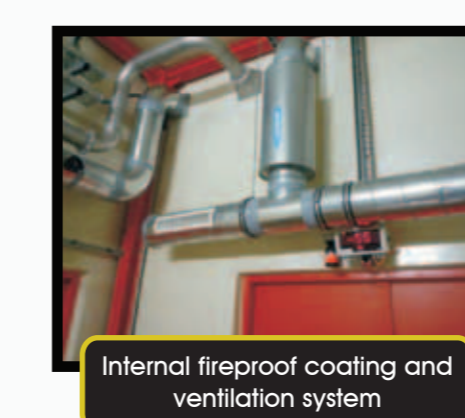
- Internal pressure of hutches -80 Pa / atm
- Fire resistance 2 hours
- Absolute air filtration
- Airtight conduits for electrical and fluid systems
- Nuclear ventilation system with chimney



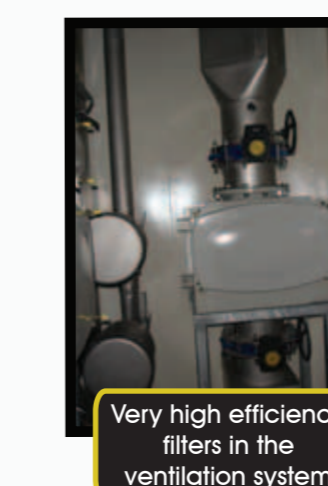
Chimney



Fire valves



Internal freepipe cooling and ventilation system



Very high efficiency filters in the ventilation system