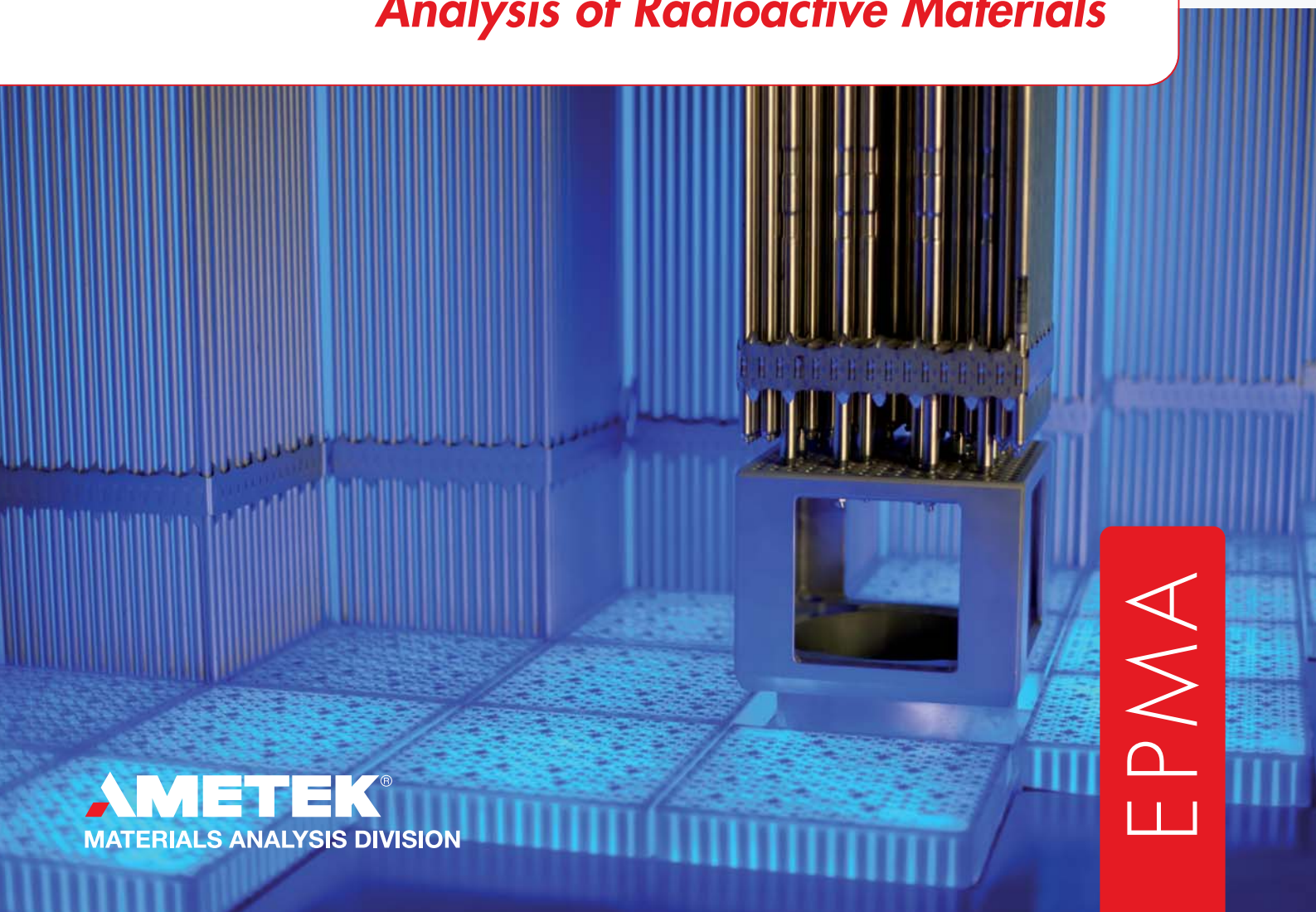
CAMECA®
SCIENCE & METROLOGY SOLUTIONS

# SKAPHIA
SHIELDED ELECTRON PROBE INITIATIVE

## *Analysis of Radioactive Materials*



AMETEK®
MATERIALS ANALYSIS DIVISION

EPMA

**Capitalizing on 50+ years of success in developing and servicing shielded microanalytical instruments for nuclear fuel characterization, irradiated materials behavior investigation and radioactive waste management, CAMECA now launches the SKAPHIA Shielded Electron Probe Initiative, bringing together key players in nuclear research & industry towards the development of the next generation Shielded EPMA.**

## A long success story in supporting nuclear science & industry

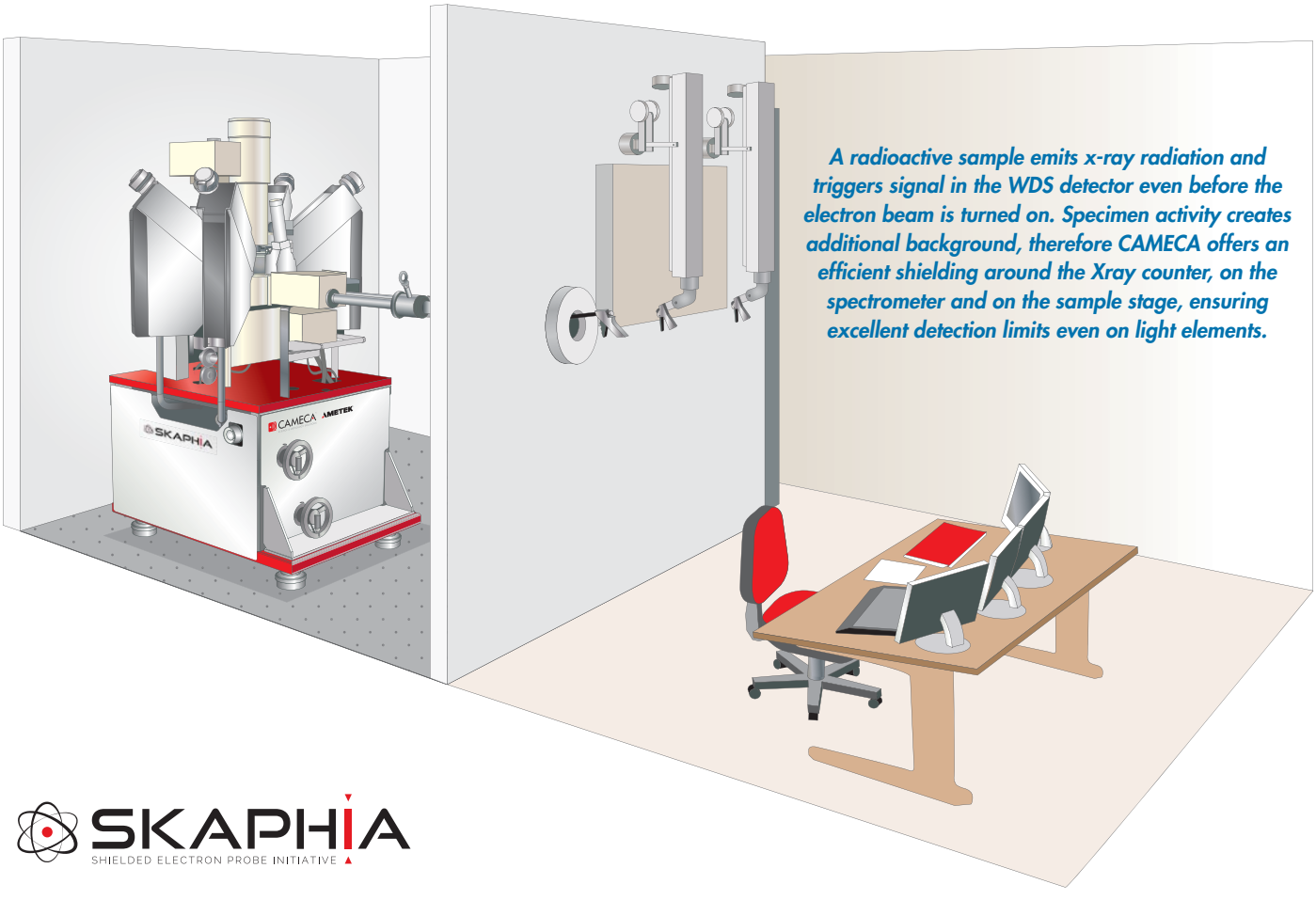
Since the installation of the first shielded Electron Probe Microanalyzer in 1978, CAMECA has developed customized microprobes for major post-irradiation examination facilities such as Idaho National Lab (USA), Korea Atomic Energy Research Institute, SCK-CEN (Belgium), Institute for Transuraniam Elements (Germany), EDF and several CEA research centers in France (cf. iaea.org).

Over the years, we have perfected our EPMA instrumentation in order to deliver ever higher spatial resolution and better detection limits, while also developing shielding methods and systems allowing nuclear scientists to efficiently analyze radioactive materials.

## The SKAPHIA Shielded Electron Probe Initiative

Today, after five generations of CAMECA shielded electron microprobe analyzers, among which several SX50-R are still in operation, CAMECA is ready to develop its next generation Shielded EPMA.

While providing a safe environment for manipulating and analyzing nuclear samples, SKAPHIA will provide benchmark analytical performance. It will allow scientists to gain a deeper understanding of fuel performance, to explore irradiated material behavior and radiation damage processes, to develop innovative alloys and structural materials, to optimize the nuclear fuel cycle and to achieve better nuclear waste management, thus contributing to a safer world.

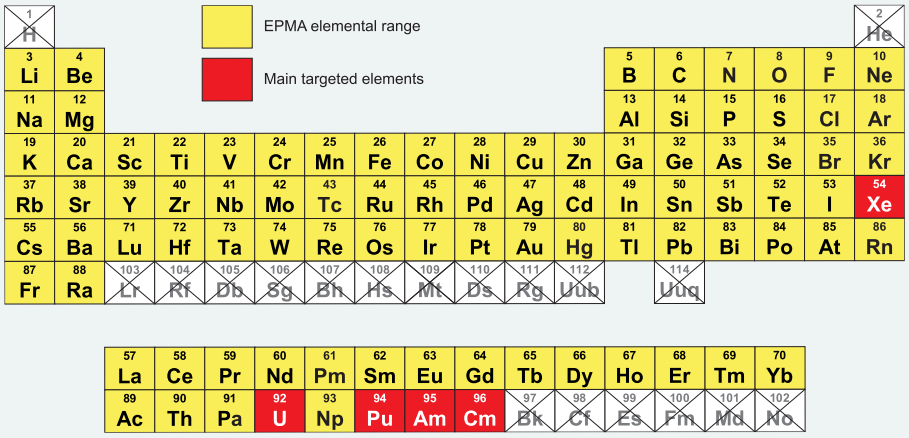



*A radioactive sample emits x-ray radiation and triggers signal in the WDS detector even before the electron beam is turned on. Specimen activity creates additional background, therefore CAMECA offers an efficient shielding around the Xray counter, on the spectrometer and on the sample stage, ensuring excellent detection limits even on light elements.*

SKAPHIA
SHIELDED ELECTRON PROBE INITIATIVE

# SKAPHIA will offer benchmark EPMA analytical performance.

Derived from CAMECA state-of-the-art EPMA instruments, our next generation Shielded EPMA will analyze almost all elements of the periodic table, revealing compositional information for both major and trace elements of radioactive sample. The information will be obtained from sub-micron areas with ultimate precision and accuracy.
The system will be designed to accept samples emitting β and γ radiations with a maximum acceptable γ radiation level of 111 GBq at an energy of 0.75 MeV.




*In irradiated nuclear fuel analysis, the most important elements to take into consideration are U and Pu as well as desintegration elements such as americium (Am), curium (Cm), and to a lesser extent, xenon (Xe) and Rare Earth Elements (REE).*

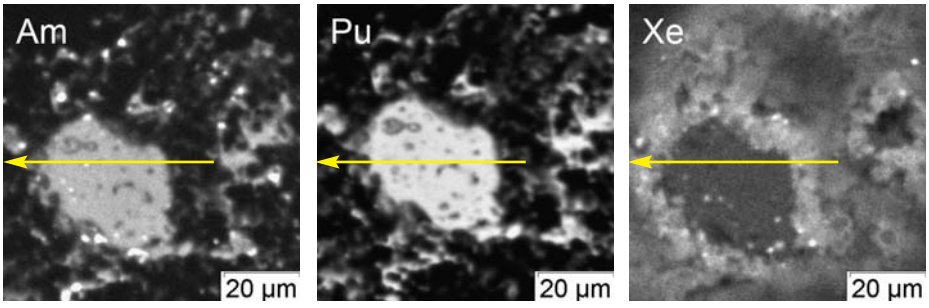
- Column, spectrometers and sample stage will be installed in a hot cell (lead or concrete shielded room).
- Remote-manipulators and/or ball manipulators will be used to insert and mount the radioactive samples.
- The instrument will be fully remote-controlled (stage, column, diaphragms...) with electronics and computer deported outside the "hot" cell environment.
- All WDS analyzers and detectors will be shielded to prevent the background caused by the γ radiations.
- The stage will be made of Denal material.
- The Secondary Electron detector will have a special orientation to avoid γ ray interference.
- Dedicated CAMECA EPMA software will provide all necessary features for quantitative analysis, X ray mapping, line profile acquisition and data processing.

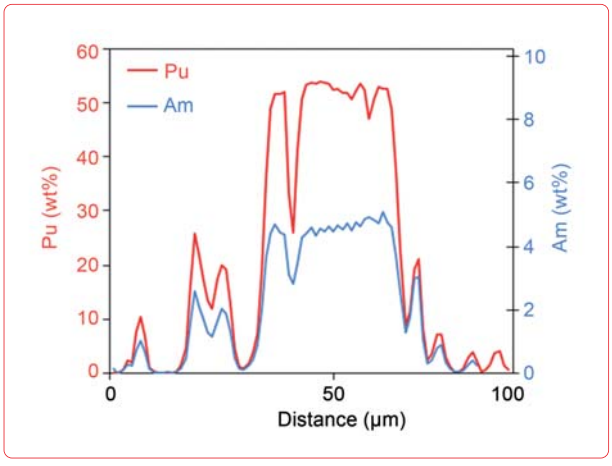
## Applications

CAMECA Shielded EPMAs have been used in a wide range of nuclear applications: study of the radiation damage processes in materials and complex micro-structures, analysis of materials for the nuclear fuel cycle, R&D of advanced alloys and innovative structural materials, nuclear reactor maintenance optimization, nuclear waste management...

*Shown here are results from EPMA analyses of MgO pellet including AmOx particules irradiated up to 318 effective full power days (EFPD) in the Phénix reactor. The results demonstrated the Am transmutation rate reached was close to 95.5%.*

*Courtesy of Karine Hanifi and Jérôme Lamontagne, CEA Cadarache, France.*



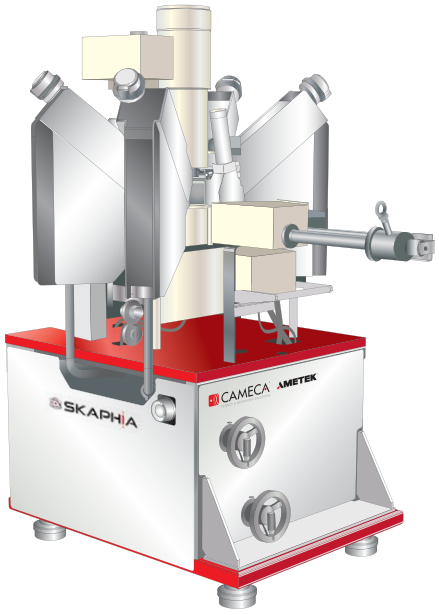




*X-ray maps and related quantitative analysis through a particle located at 400 µm from the pellet periphery demonstrating that AmOx particles are mostly composed of Pu (53 wt%) and Am (~4.6 wt%). The Xe map shows fission gases precipitation into bubbles in the AmOx particles and its recoil in the surrounding matrix.*

# SKAPHIA

SHIELDED ELECTRON PROBE INITIATIVE

***Analysis of radiactive materials***
***Post-irradiation examinations of nuclear fuel***
***Characterization of advanced alloys***
***Nuclear waste management***

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**CAMECA is the world premier provider of microanalytical instrumentation.** We deliver cutting-edge science and metrology solutions, and offer our customers unparalleled support and maintenance service through the comprehensive AMECARE program.

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