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## Online monitoring tool for nuclear process

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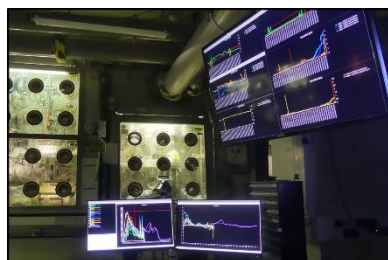
### Abstract

In the back-end spent nuclear fuel cycle, the French Alternative Energies and Atomic Energy Commission (CEA) integrates new complex liquid-liquid extraction processes into low, medium, and high-level activity platforms in the ATALANTE facility. These innovative flowsheets are very sensitive to many parameters, and each action must be done knowingly. Therefore, output data must be regularly and faithfully reported in order to be able to act quickly and fairly on the process.

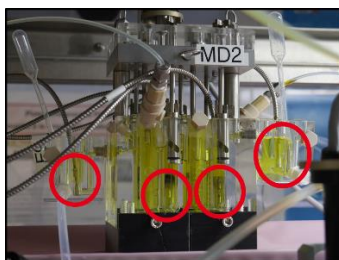
The demonstration platforms are equipped with controllers connected to standard sensors and actuators such as flowmeters, temperature probes, mixer speed feedback and controlled by a Human-Machine Interface. These physical measurements must be completed by chemical data such as uranium/plutonium and nitric acid concentrations that are necessary for modeling the process and acting on the pumps, heaters and mixers.

To check out the process, samples are taken and sent to laboratories for analysis. In the way to reduce the response time and the volume of waste, CEA also develops online monitoring tools. Among these, a UV-Vis-NIR absorptiometry measurement system composed of an optical measurement chain and a specifically developed software has been developed to monitor the concentration of elements of interest at multiple points on the equipment. To complete and improve this system, evolutions are essential for new needs and to adapt at new analytical techniques. For example, the addition of RAMAN measurement to the current system should make it possible to quantify invisible elements by UV-Vis-NIR and thus increase the number of parameters monitored online such as acidity or solvent concentration. In addition, RAMAN spectroscopy should make it possible to measure chemical parameters in a microfluidic cell.

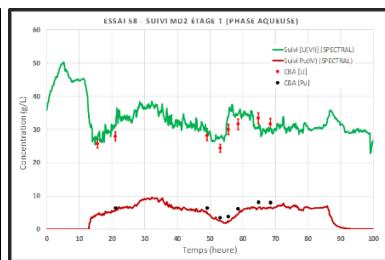
The development of this system, in addition to allowing a significant reduction in waste and effluents and being more reactive in controlling processes, will also contribute to the deployment of new automated control tools, based on the coupling to simulation software PAREX+ and predictions algorithms.



SPECTRAL monitoring system on glove box extraction test



Four stage decanter mixer with submersible measuring probes



Comparison online monitoring VS analysis laboratory

Keywords: ATALANTE ; Uranium-plutonium separation ; liquid-liquid extraction ; online monitoring ; spectrophotometry ; RAMAN ; Microfluidics ; PAREX+ ;