

# A NEW GENERATION OF RADIATION PORTAL MONITOR AND ITS FUTURE EVOLUTION

Radiation Portal Monitors (RPMs) play a key role in Nuclear Security applications for almost two decades. They enable to ensure on-line monitoring and guarantee the safety at borders or in critical infrastructures like big ports. The need for being able to rapidly detect gamma and neutron signatures is crucial for preventing illicit trafficking of radioactive sources or Special Nuclear Material (SNM) as Weapon Grade Plutonium (WGPu), potentially involved in dirty bombs or nuclear devices. Because of the worldwide demand related to Nuclear Security applications, a strong R&D effort was made for finding  $^3\text{He}$  free solutions for neutron detection.

For several years, CEA LIST led an intense R&D activity on the RPM topic, mainly carried out in the frame of different European projects and also with strategic industrial partnerships. The choice was made by the laboratory of focusing on solutions based on large size plastic scintillators. The latter is by definition not initially well adapted to radionuclide identification or to neutron detection, two essential features for Nuclear Security controls. Main reasons are low density, close to 1, low  $Z_{\text{eff}}$  and non-intrinsic ability of standard plastic scintillators for discriminating neutrons and gamma-rays. For overcoming these limitations, an intense work was carried out by our laboratory to develop several configurations able to detect neutrons with a sufficient efficiency for being compliant with the ANSI 42-35 standard and also to develop algorithms able to provide a robust radionuclide identification. These developments were started in the frame of the FP7 SECUR-ED project at the beginning of the 2010's, focusing on configurations combining several pillars working in coincidence mode. RPM developments were pursued through the FP7 SCINTILLA project which was mainly focused on performance benchmark for passive systems compared to reference standards. Finally, the 42 month Horizon 2020 C-BORD project (2015-2018) enabled to move a step forward on this topic, giving a unique opportunity for deploying such systems in different European borders and ports.

In this article, we will first make a review of the key developments carried out by CEA LIST in the frame of previous European projects (SECUR-ED, SCINTILLA, C-BORD). Then, we will make a focus on our most recent RPM developments, developed in close partnership with a Nuclear Industrial company. We will especially insist on our latest results obtained using this system, especially those related to radionuclide identification in complex cases. Finally, we will introduce future developments planned by CEA LIST in the framework of RPM developments.

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