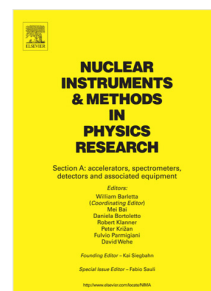


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## IN FIELD APPLICATION OF DIFFERENTIAL DIE-AWAY TIME TECHNIQUE FOR DETECTING GRAM QUANTITIES OF FISSILE MATERIALS

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### Abstract

In the frame of Chemical, Biological, Radiological, and Nuclear defense European activities, the ENEA, the Italian National Agency for New Technologies, Energy and Sustainable Economic Development, is proposing the Neutron Active Interrogation system (NAI), a device designed to find transuranic-based Radioactive Dispersal Devices hidden inside suspected packages. It is based on Differential Die-Away time Analysis, an active neutron technique targeted in revealing the presence of fissile material through detection of induced fission neutrons. Several Monte Carlo simulations, carried out by MCNPX code, and the development of ad-hoc design methods, have led to the realization of a first prototype based on a 14 MeV d-t neutron generator coupled with a tailored moderating structure, and an array of helium-3 neutron detectors. The complete system is characterized by easy transportability, light weight, and real-time response. First results have shown device's capability to detect gram quantities of fissile materials.

### Keywords

**Homeland security; Radioactive Dispersal Device; Neutron techniques; Differential Die Away time Analysis; Neutron Generator; MCNPX.**

### 1. Introduction

Nowadays, Radiological Dispersal Devices (RDD), the so-called dirty bombs, may represent a major concern for homeland security. As countries asked for an improvement in CBRNE [1] defense, many national and international efforts have been put in place to face new risks related to terrorism. In particular, as a major complication, the traditional RDDs based on radioactive isotopes of caesium and cobalt recently evolved towards more sophisticated devices based on transuranics, [2]. As a matter of fact, transuranic RDDs are not so easily detectable as the traditional ones by means of gamma spectrometry, due to complexity of their photon spectra and low photon emission rates.

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