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Tests and Performances of a Special Identifier of Nuclear Threats and SNM in Realistic Scenarios

Dr. Mangiagalli Giacomo

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POSTER

CAEN SyS
Systems & Spectroscopy Division

Tests and Performances of a Special Identifier of Nuclear Threats and SNM in Realistic Scenarios

Dr. Mangiagalli Giacomo, CAEN SyS

ABSTRACT

Results of the characterization of a SNM backpack identifier that exceeds the ANSI and IEC standards.

Detection and identification of U, Pu, Am/Li, Am/Be, Cf-252 in shielded, moderated or masked condition through a patent pending parallelized algorithm that combines neutron and gamma energy, counting and multiplicity.

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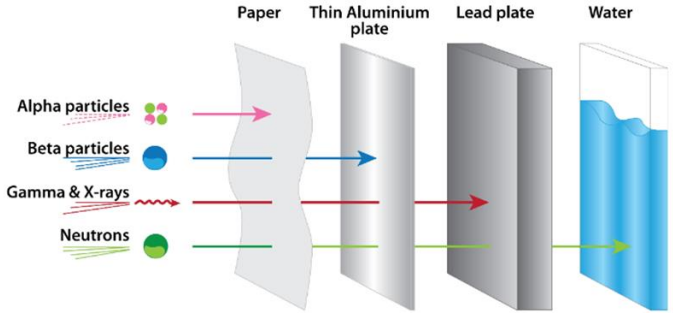
INTRODUCTION

Passive detection systems used by homeland security to intercept smuggled SNM provide:

- Gamma counting alarm
- Gamma spectroscopy identification
- Neutron counting alarm

<u>Neutron identification (through fast neutron measurement) was not available until today</u>



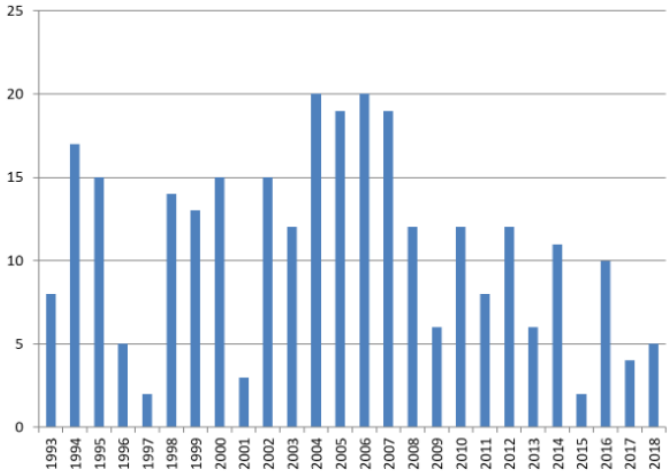


Figure 1 Incidents reported to the ITDB that are confirmed, or likely, to be connected with trafficking or malicious use, 1993–2018.

"ITDB information (International and Trafficking Database – IAEA) demonstrates that unsecured nuclear and other radioactive material continues to be available and individuals and groups are prepared to engage in trafficking this material."

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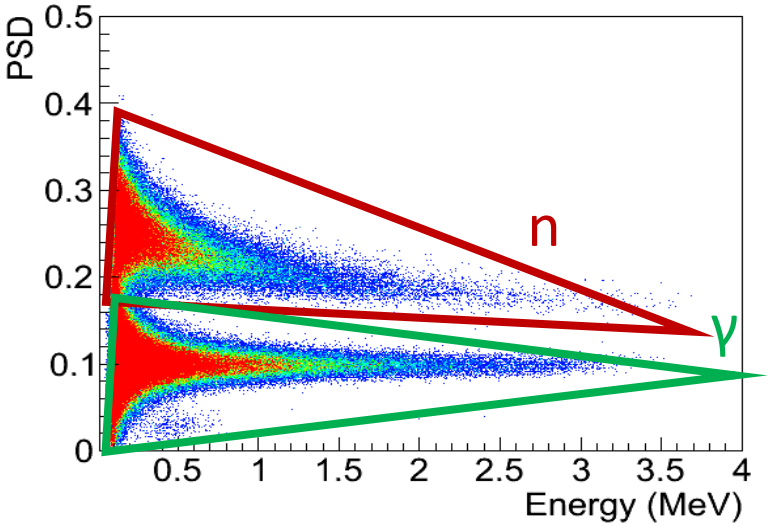
METHODS

High-efficiency gamma/neutron liquid scintillator

- Pulse Shape Discrimination provides real time γ/n discrimination
- based on the same PSD algorithm implemented by CAEN for the IAEA Fast Neutron Collar Monitor (fresh fuel verification)



Mid-high resolution scintillator

- gamma spectroscopy identification
- used also in neutron source identification patented algorithm
- enhances the SNM identification
- Allows enrichment level estimation

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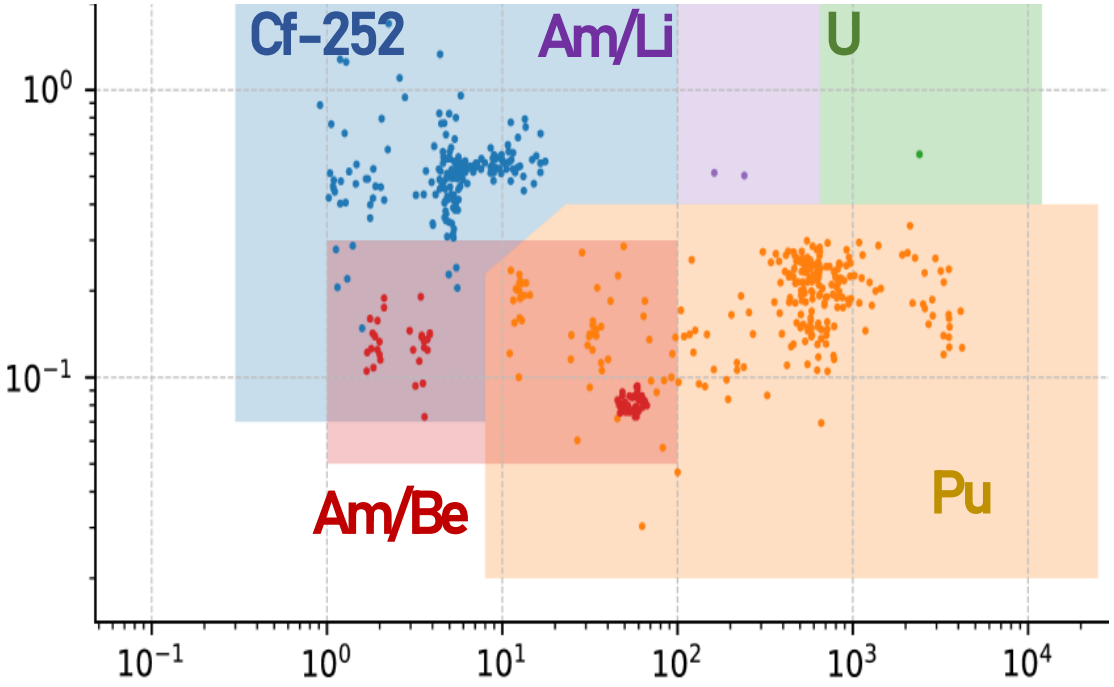
METHODS

NEUTRON source identification patented algorithm results (the quantities on the axes cannot be revealed)

Each point is an identification measurement of a n source. For each source different distances, lead and poly shields and different masking sources were used.

If the color of the point matches with the color of the area, the Identification is correct

This is a 2D projection of a 3D plot, Am/Be (red) area has a 3rd parameter to distinguish it from Cf and Pu.



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METHODS

tests carried out in accordance with the indications of the international standards IEC and ANSI

In these standards no requirements on the NEUTRON SOURCE IDENTIFICATION is provided because this feature was not available until today

IEC 62327 – 2017 (EU)
Hand Held Instruments for the Detection and Identification of Radionuclides

- 1 s for gamma alarm (500 nSv/h above bkg, moving at 0,5 m/s @ 1m)
- 2 s for neutron alarm (252Cf 20.000 n/s @25 cm)
- 1 min or less for identification of isotope

ANSI N42.34 – 2015 (USA)
Hand Held Instruments for the Detection and Identification of Radionuclides

- 1 s for gamma alarm (100 nSv/h above bkg , moving at 0,5 m/s @ 1m)
- 1 s for neutron alarm (252Cf 20.000 n/s @25 cm)
- 2 min or less for identification of isotope

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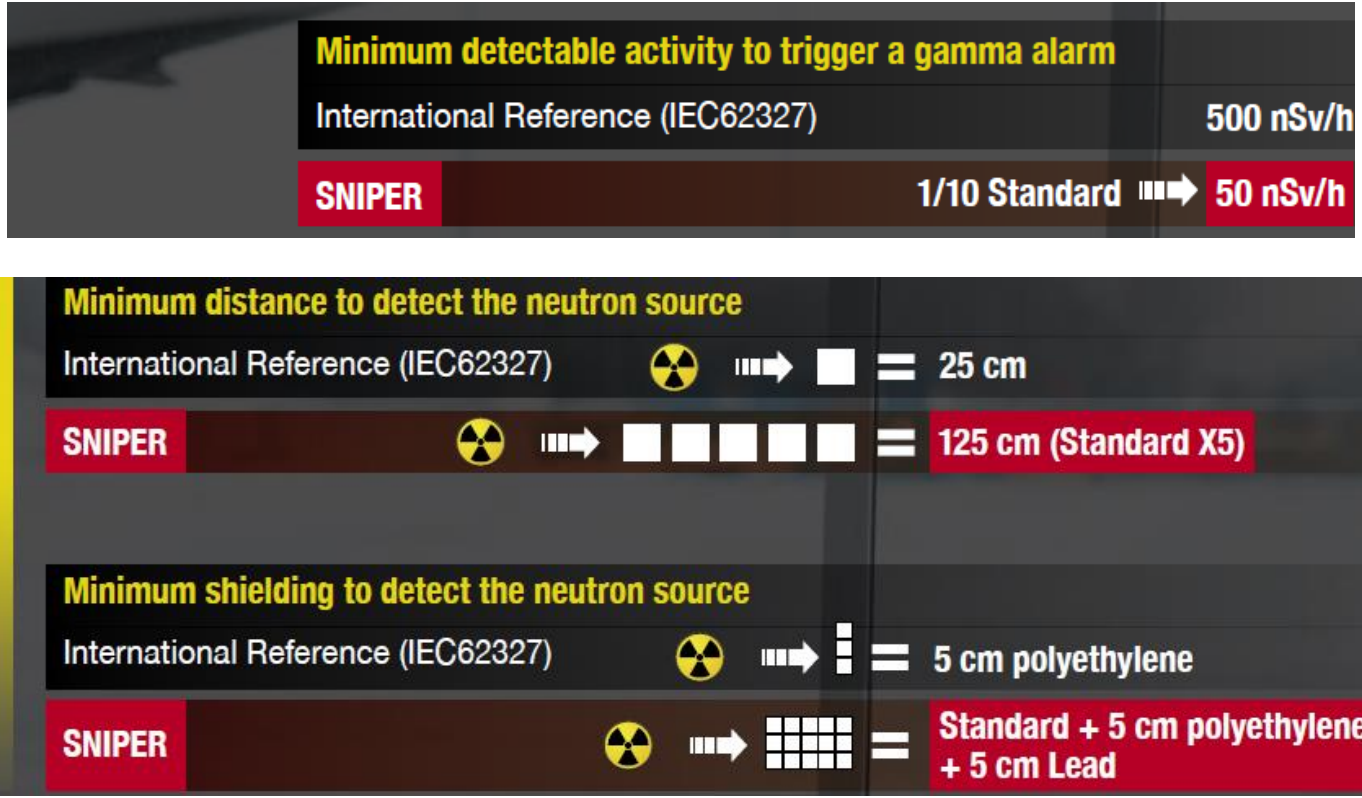
RESULTS



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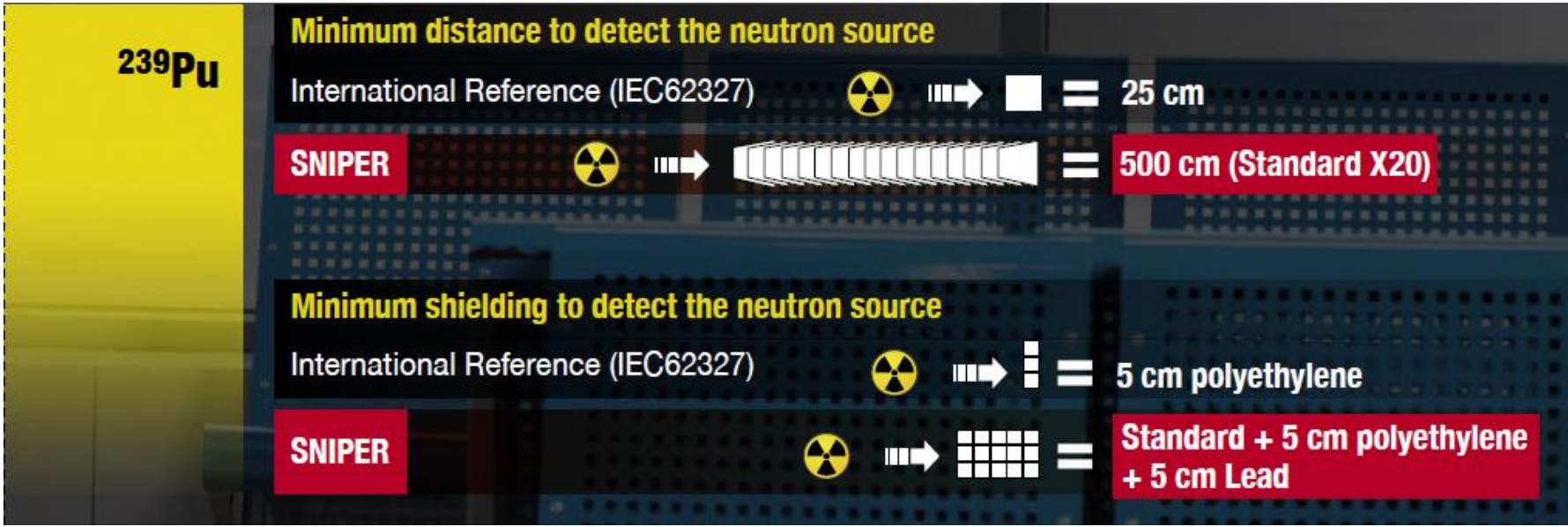
RESULTS



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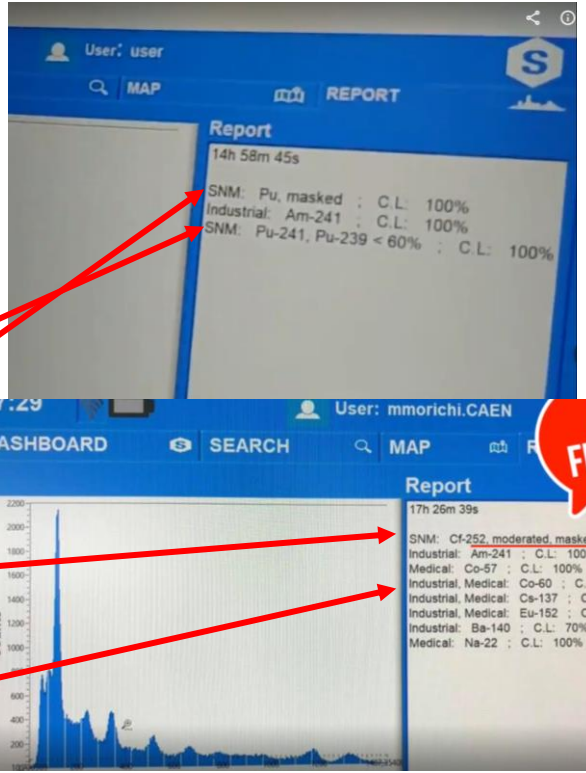
RESULTS

	gamma RIID	Gamma / n RIID	SNIPER-GN
Counting alarm for common gamma sources (Co-60, Cs-137, I-131)	✓	✓	✓
Identification of common gamma sources (Co-60, Cs-137, I-131)	✓	✓	✓
Counting alarm of γ and n emitting SNM (WGPu)	✓ gamma ✗ neutron	✓ gamma ✓ neutron	✓ gamma ✓ neutron
identification of γ and n emitting SNM (WGPu)	✓ gamma ✗ neutron	✓ gamma ✗ neutron	✓ gamma ✓ neutron
Counting alarm of **mainly n** emitting SNM (WGPu in a lead box)	✗ gamma ✗ neutron	✗ gamma ✓ neutron	✗ gamma ✓ neutron
Identification of **mainly n** emitting SNM (WGPu in a lead box)	✗ gamma ✗ neutron	✗ gamma ✗ neutron	✗ gamma ✓ neutron extra info: shielded
Identification of **mainly n** emitting SNM (WGPu in a lead box) + common gamma masking source (I-131)	✓ I-131 ✗ SNM	✓ I-131 ✗ SNM	✓ I-131 ✓ SNM extra info: masked



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CONCLUSIONS

An algorithm able to provide such level of accuracy in the SNM identification, with only 1 minute measurement, can be a step change to the portable instrumentation (BRD or RIID) used in the field of nuclear security.

It can open the possibility to new usage scenarios.

This technology, combined with multi-channel electronics equipped with PSD firmware, can be scaled to different sizes to cover scenarios from personal access control to cargo scanning