



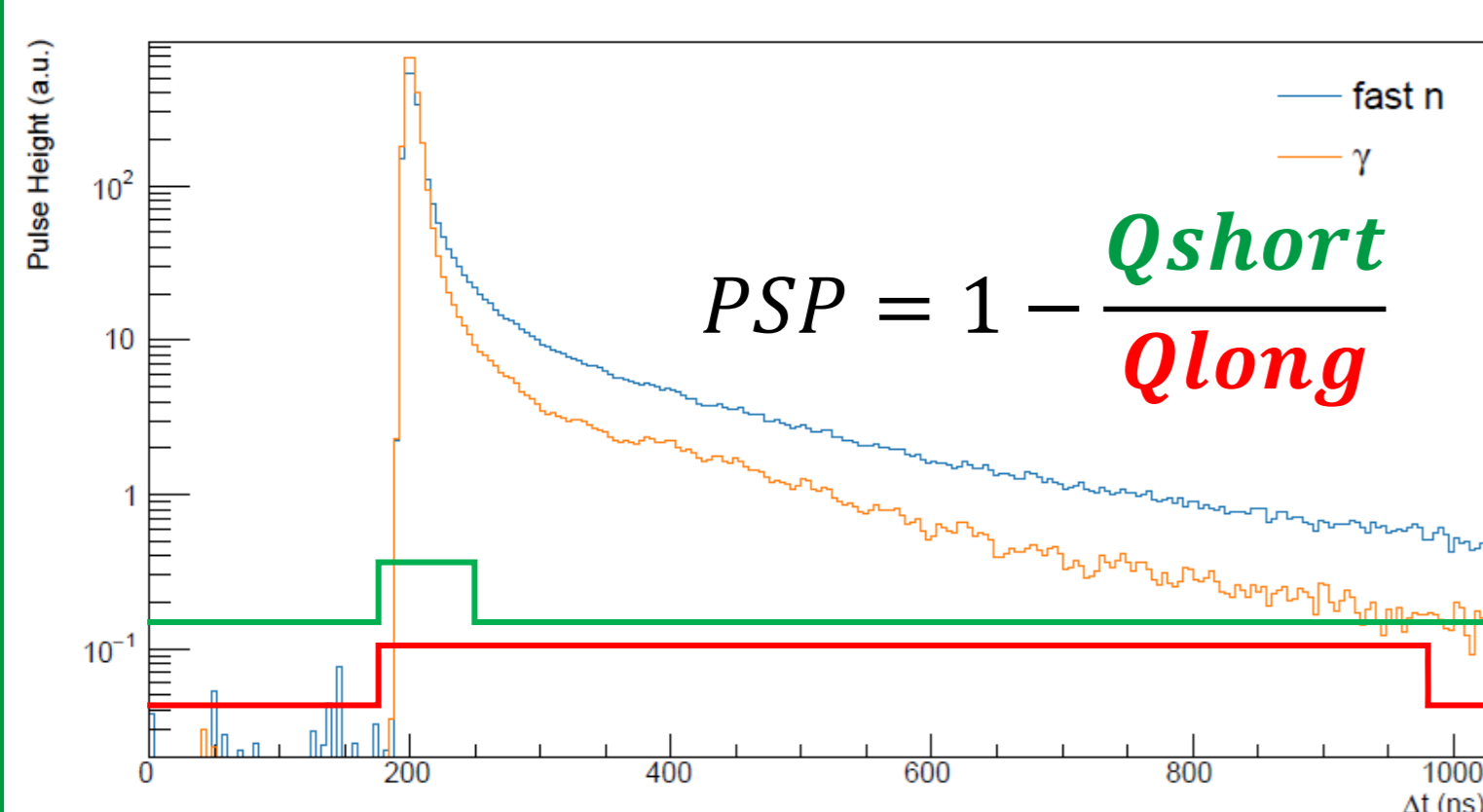
Performances of scintillators applied to Special Nuclear Material (SNM) measurements in the field of Nuclear Safeguards, material verification and Nuclear Security

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SCENARIO

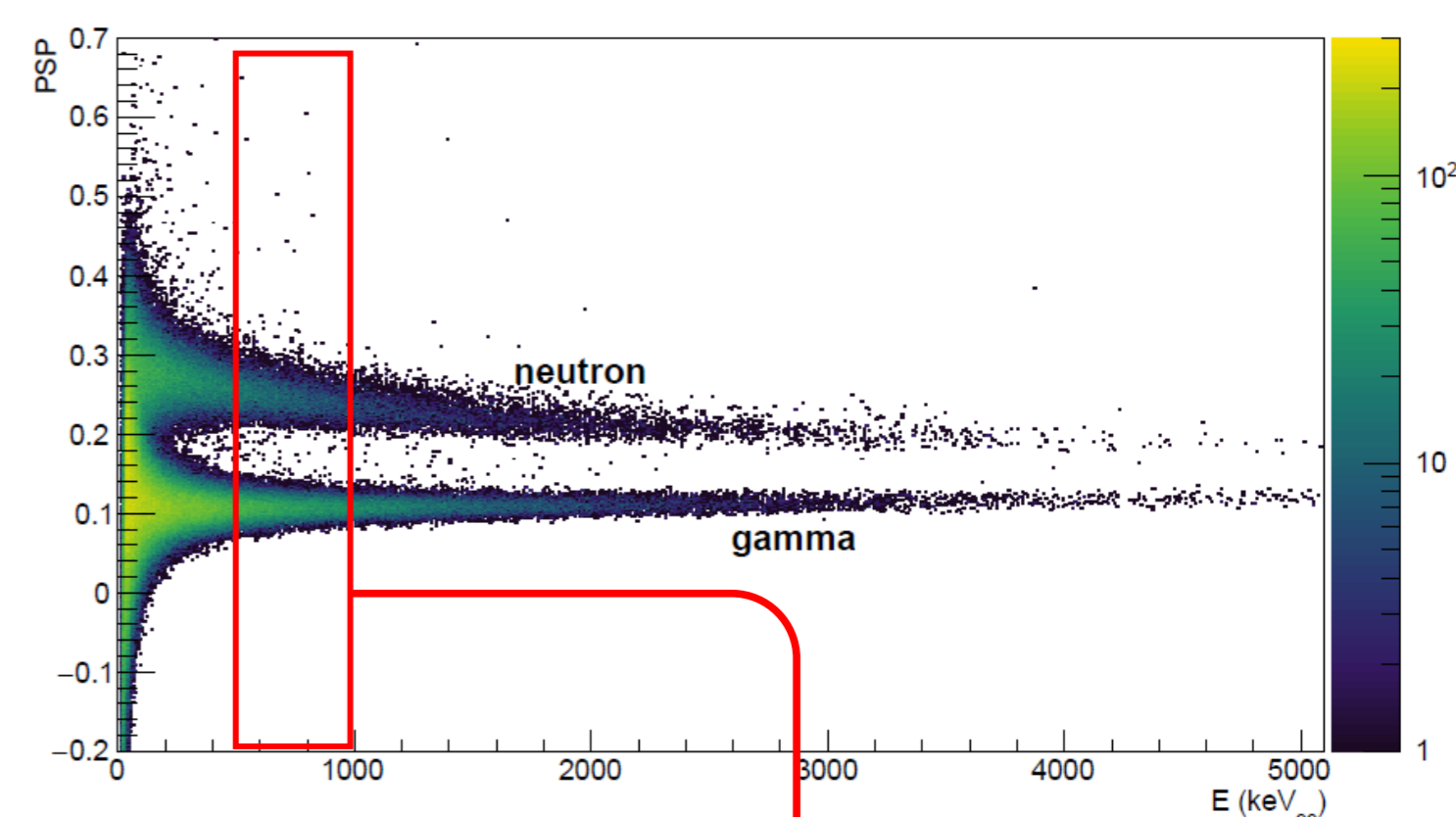
- Nowadays **nuclear threats** are still an actual problem as evidenced by several organization such as the International Atomic Energy Agency (IAEA), INTERPOL and the World Customs Organization. From 1993 to 2018 the IAEA Incident and Trafficking Database (ITDB) reported a total of **3497 incidents**, sometimes highlighting the attempt to sell or traffic Special Nuclear Material (SNM) across international borders.
- If **SNM falls out of regulatory control**, there is the potential of it **being used in criminal or intentional unauthorized acts**. Both **gamma and neutron** emissions are essential for the detection and identification of a smuggled source due to their specificities in terms of energy and multiplicity. These emissions are the detectable signature of a specific radioactive nuclide. Properties of nuclear or other radioactive materials and their usage are essential to understand how their illicit trafficking takes place and what prevention and detection measures should be adopted.

THE METHOD



EJ 309

- Liquid scintillator for detection of both neutron and gamma
- Replace ³He based neutron detector (thermal neutrons)
- Detection of fast neutrons (energy information of the neutron)
- Gamma- neutron discrimination with PSP technique



CeBr₃

- gamma source identification through gamma spectroscopy
- Higher resolution than a NaI, easier to use respect a HPGe
- 4% FWHM at 662 keV, intrinsic background < 10 nSv/h

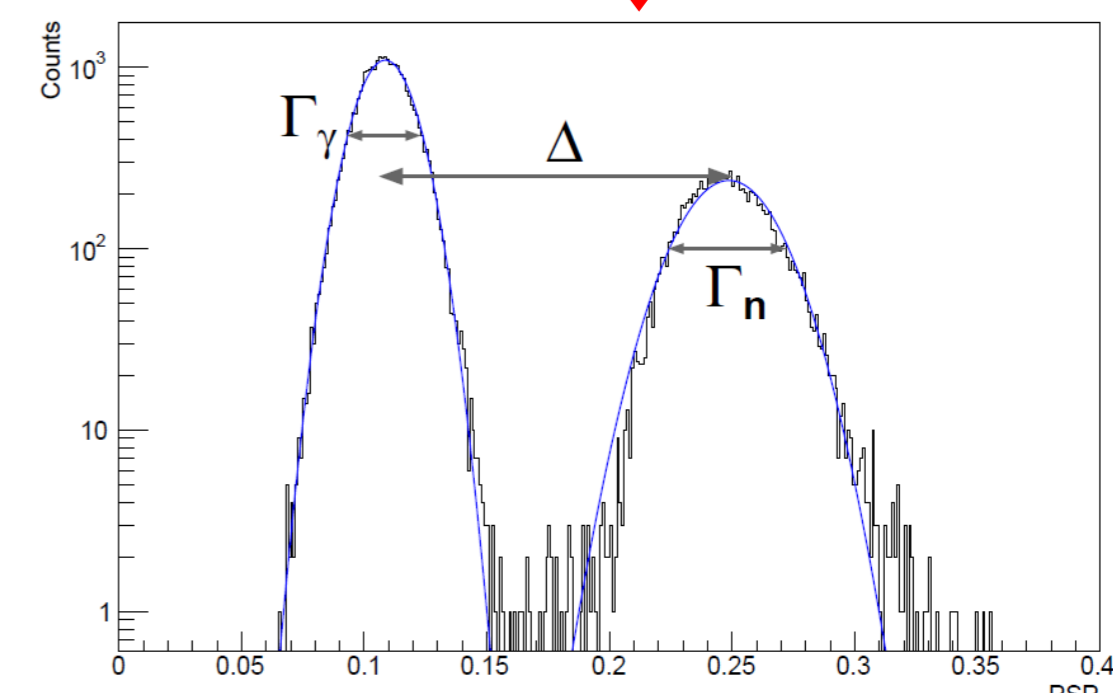
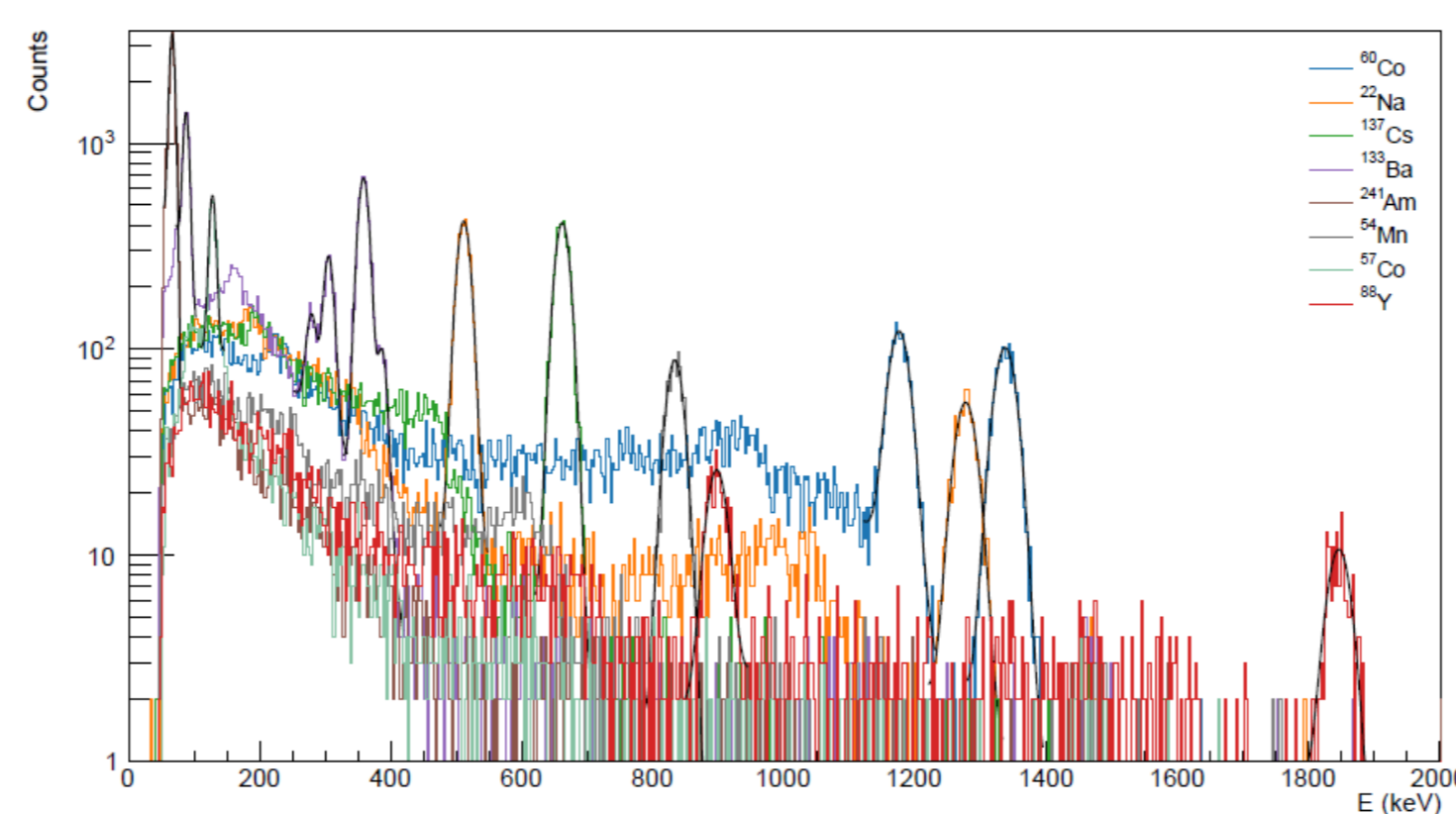


Figure 3.13: FoM parameters (Δ , Γ_γ , Γ_n) for events with energy between 500 and 1000 keV_{ee}. The solid blue line represents the fitting function computed to obtain the FoM.

THE SOLUTION

SNIPER-GN

- **SNIPER-GN** is a backpack radiation device (BRD) equipped with two **different scintillators**: a **EJ309 liquid scintillator** with fast neutron and gamma detection and discrimination performed through PSP and a **CeBr₃ scintillator** for gamma spectroscopy
 - the system has 8 hours of autonomy thanks to rechargeable and hot swappable Li Ion batteries
 - The software is installed on a tablet connected through Wi-Fi to the SNIPER-GN system
 - Compact sizes: (L x W x D) = 470 x 175 x 335 mm³ and easy transportable: weight < 10 kg

PERFORMANCES

- Exceeds the international standards IEC62327, ANSI N42.34, ANSI N42.53
- 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)
- 1 min or less for identification of isotope

UNIQUE FEATURE

SNIPER-GN is the only instrument in the world that is able to identify in less than 1 minute the neutron source through the fast neutron detection discriminating between: Cf-252, Am/Be, Am/Li, U, Pu. Is also able to determine the measurement condition: masked, lead shielded, moderated

