

UNIVERSITY OF NOTRE DAME
DEPARTMENT OF PHYSICS

NUCLEAR SEMINAR

Monday, August 28

Statistical Signal Processing of Scintillation Detectors in Gamma Ray Spectrometry

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Inorganic scintillation crystals are used to detect ionizing radiation and non-ionizing radiation. For most detector materials the scintillation light output depends strongly on the crystal temperature. Since the light decay time also varies with temperature, a measure of the light decay allows to correct for the temperature dependent light yield. However, the crystal readout with photo multipliers, modern SiPMs or classical PMTs, also changes with temperature. An elegant method to estimate the photo multiplier amplification can be achieved by exploiting the quantum nature of scintillation light pulses [*NIM-A*, 782 (2015) p. 20 - 27]. Combining both methods, light yield correction with PMT gain measurement results in a reliable, comprehensive detector gain stabilization - just by digital signal processing means.

The team at Target Systemelektronik has developed handheld spectrometers for homeland security applications for more than 20 years. These instruments are now branded as the FLIR identiFINDER marking the industry standard Radionuclide Identification Device RID. Target applies its expertise in nuclear signal processing again in the latest development by introducing the F500. It is a novel RID with a single scintillation detector featuring source-less stabilization and high dose-rate capabilities utilizing fast, high resolution digitization. The sampling at 250 Ms/s with 14 bit resolution provides a dynamic range suitable for the measurement of gammas from radio nuclides and even neutron capture gammas as well as fission neutron induced recoils. In the presentation, we will 'open the hood' of the F500 and demonstrate the principles of the statistical gain and light yield measurement for Thallium doped Sodium Iodide (NaI(Tl)) and Cs₂LiYCl₆:Ce (CLYC) detectors. We demonstrate, how peak positions of gamma energy spectra ranging from 10 keV to 10 MeV are held within 0.5% accuracy in an ambient temperature range of -20°C to +55°C.

4 pm – 5 pm
**Nuclear Science
Laboratory**
**124 Nieuwland
Science Hall**

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All interested  
persons are  
cordially invited  
to attend

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Refreshments will be
served prior to the
seminar in room 124