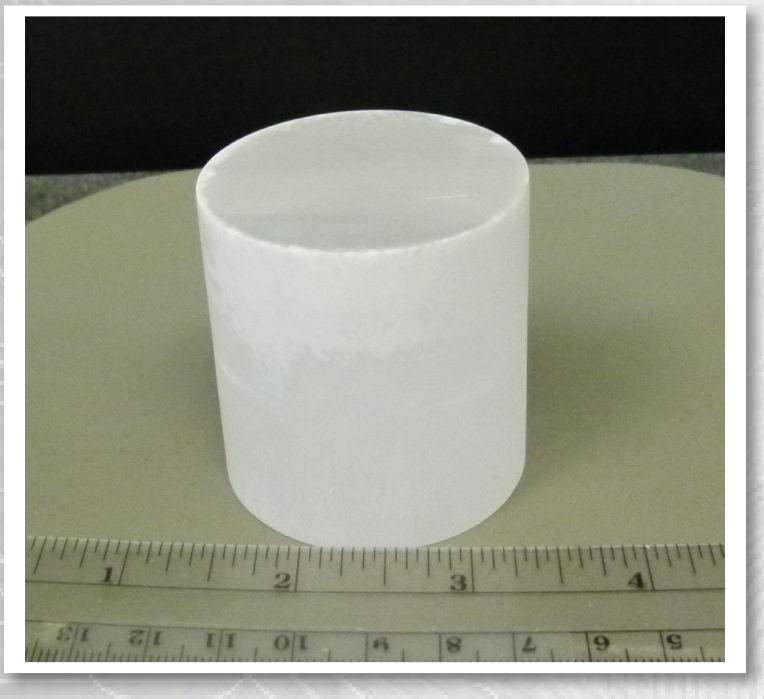
Gamma-Neutron Scintillator Properties

CLLBC

Dual Mode Detection

Room Temperature Operation

Single Scintillation Material



2.0” x 2.0” CLLBC Scintillator

The Science Behind the Technology

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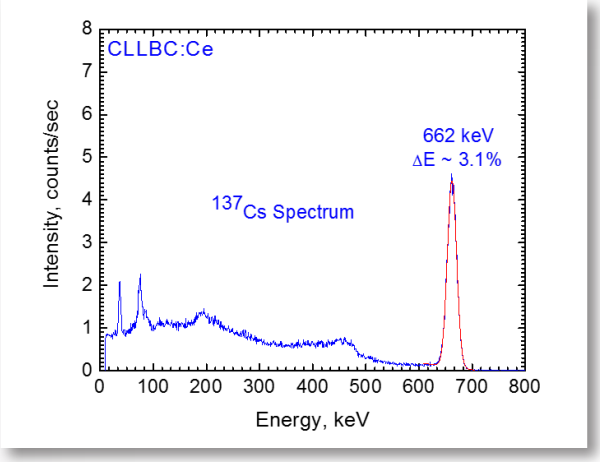
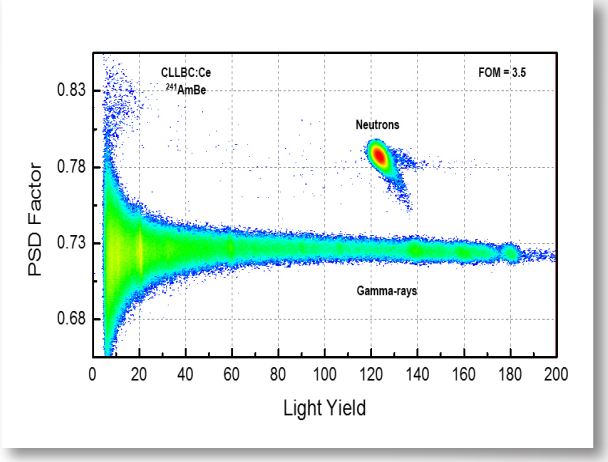
Gamma-Neutron Scintillation Detector



2.0" CLLBC - Pulse Height Analysis



2.0" CLLBC - Pulse Shape Discrimination

CLLBC

The new scintillator $Cs_2LiLa(Br,Cl)_6$:Ce (CLLBC) is a practical gamma-neutron detector for use as a replacement for both high energy resolution gamma-ray detectors and high pressure Helium-3 tubes for neutron detection. The ease of using pulse height as well as pulse shape discrimination for neutron detection, combined with gamma-ray energy resolution better than NaI:Tl or CsI:Tl and in the working range of $LaBr_3$:Ce, make the CLLBC detector an ideal solution for several classes of handheld instruments, including spectroscopic personal radiation detectors (SPRDs) and radionuclide identification devices (RIDs). Other applications requiring gamma-neutron detection can also benefit from using CLLBC.

Instrument manufacturers will also find the simplicity and compactness of implementing a dual-mode detector to be advantageous. The neutron cross-section of 95% ^{6}Li-enriched CLLBC is 2.5 times that of ^{3}He (10 atmospheres), compared on a volume basis. Due to its highly proportional response, energy resolution for 662 keV gamma rays is typically better than 3.5% using CLLBC (a factor of two improvement over NaI:Tl), depending on the configuration of the detector and photosensor.

CLLBC can be packaged with a termperature sensor and a SiPM array. The resulting CLLBC-SiPM sensor offers a compact package, low voltage requirements, and a reliable signal for neutron detection and gamma-ray spectroscopy.

Material	$Cs_2LiLa(Br,Cl)_6$:Ce
Melting Point	540°C
Density	4 g/cm^3
Crystal Structure	Cubic
Cleavage Planes	None
Water Solubility	Hygroscopic
Emission Spectral Range	350 – 450 nm
Peak Scintillation Wavelength	410 nm
Decay Constants (Ce3+, Ce-STE)	115 ns, 500 ns,1500 ns
Scintillation Light Yield	45,000 ph/MeV
GEE for Thermal Neutrons	3.1 MeV
X-ray Absorption Coef. at 100 KeV	5.49 cm^{-1}
X-ray Absorption Coef. at 662 KeV	0.298 cm^{-1}
Radiation Length	2.45 cm

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