01 / PRODUCT OVERVIEW

MacroPixel LaBr-14x25c-SiPM-T

$LaBr_3$(Ce,Sr) scintillator + SiPM readout in a compact aluminum MacroPixel package.

High-resolution LaBr spectroscopy on the MacroPixel integration platform.

MacroPixel LaBr-14x25c-SiPM-T (also LaBr-14x25c-SiPM-T / LABR-14X25CSIPM-T) is a high-performance, solid-state $LaBr_3$(Ce,Sr) scintillation detector made in the USA. It combines the excellent energy resolution and fast response of co-doped lanthanum bromide with modern SiPM readout. Proprietary hermetic encapsulation protects the hygroscopic crystal, and a built-in TMP451 temperature sensor allows precise monitoring of SiPM/crystal temperature.

The assembly contains a 14 × 14 × 25.4 mm $LaBr_3$(Ce,Sr) crystal coupled to a 2 × 2 MicroFJ SiPM array, with the temperature sensor on the back of the carrier board, hermetically sealed in an aluminum housing with a **0.4 mm** wall.



MacroPixel LaBr-14x25c-SiPM-T

~16 ns DECAY
Fast primary scintillation. Use short shaping and match electronics to the ~16 ns decay.

~3% AT 662 keV
Typical energy resolution for the LaBr MacroPixel assembly; system-dependent.

FULLY POTTED Al
Crystal and SiPM fully potted in a hermetic aluminum canister (0.4 mm wall).

Compact envelope

Body 17 × 17 × 32 mm; about 39 mm overall including pins; mass 35 g. Standard ANODE and FASTOUT outputs.

MacroPixel family

Other MacroPixel scintillators (ScintiClear™, ElpasoLight™, CsI, NaI, EJ-204) are available on the same platform.

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Family flyer download

02 / SPECIFICATIONS & ORDERING

LaBr key specifications

Typical values for MacroPixel LaBr-14x25c-SiPM-T. Performance depends on the complete measurement system.

Parameter	Typical value / note
Ordering models	MacroPixel LaBr-14x25c-SiPM-T · LaBr-14x25c-SiPM-T · LABR-14X25CSIPM-T
Scintillator	$LaBr_3$(Ce) / $LaBr_3$(Ce,Sr); confirm composition with your order
Crystal size	14 × 14 × 25.4 mm cuboid (~5 cm^3)
Readout	2 × 2 array of 6 mm MicroFJ-60035-TSV SiPMs
Typical energy resolution	~3% FWHM at 662 keV (^{137}Cs)
Measured example	2.8% FWHM at 662 keV (^{137}Cs, SN372, ~26.5 °C)
Typical gamma sensitivity[1]	140 cps/(µSv·h^{-1}) (^{137}Cs); geometry dependent
Primary decay time	~16 ns; match electronics / short shaping to this decay
Light output (crystal)	~70,000 photons/MeV
Density / Z_{eff}	~5.1 g/cm^3; high effective atomic number
Energy range	From ~10 keV with suitable readout and settings
Bias / outputs	26–32 V typical; ANODE (standard) and FASTOUT
Temperature sensor	Integrated TMP451; module operating range −40 to +55 °C
Housing	Aluminum, 0.4 mm wall, multi-layer hermetic seal
Body / overall / mass	17 × 17 × 32 mm; ~39 mm including pins; 35 g
Neutron detection	None (gamma spectroscopy module)

[1]Typical ^{137}Cs gamma sensitivity in cps/(µSv·h^{-1}); not a calibrated dosimeter response. Energy resolution and sensitivity are typical values, not guaranteed acceptance limits.

Benefits

- Excellent ER: ~3% at 662 keV
- High sensitivity: ~5 cm^3 $LaBr_3$(Ce,Sr)
- High light output (~70,000 ph/MeV); ~16 ns decay
- High density (~5.1 g/cm^3) and high Z_{eff}
- Ultra-compact solid-state; magnetically insensitive
- Low bias 26–32 V; usable without a preamp
- Built-in sensor for temperature-compensated MCA
- Intrinsic ^{138}La usable for calibration
- Operating temperature −40 to +55 °C

Scintillation crystal $LaBr_3$(Ce,Sr)

High light output (~70,000 ph/MeV), ~16 ns primary decay, density ~5.1 g/cm^3 and high Z_{eff}. Enhanced resolution from Sandia-patented co-doping plus CapeSym growth in Natick, MA, USA. Hygroscopic crystal hermetically sealed in the MacroPixel housing. Typical ER ~3% at 662 keV.

> **2.8% FWHM at 662 keV — measured example**
> ^{137}Cs only, MacroPixel LaBr-14x25c-SiPM-T SN372 at ~26.5 °C. Spectrum later in this datasheet. System-dependent; not an acceptance limit.

Ordering information

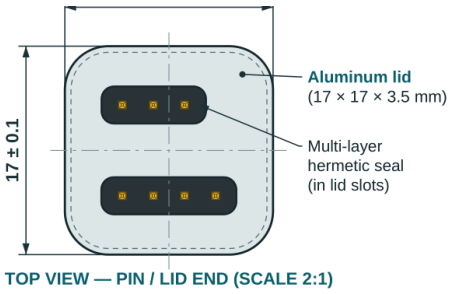
Item	Detail
Part number	MacroPixel LaBr-14x25c-SiPM-T (also LaBr-14x25c-SiPM-T / LABR-14X25CSIPM-T)
Description	14 × 14 × 25.4 mm $LaBr_3$(Ce,Sr) cuboid coupled to a 2 × 2 MicroFJ-60035-TSV SiPM array and TMP451 temperature sensor, hermetically sealed in an aluminum housing (0.4 mm wall)
Contact	sales@capescint.com · +1 (508) 653-7100 · www.capescint.com

CapeScint is a subsidiary of CapeSym, Inc. (Natick, MA, USA). Design and specifications are subject to change without notice.

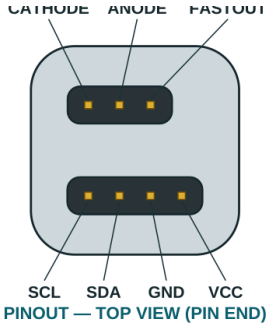
03 / MECHANICAL INTERFACE

2D drawing & mechanical dimensions

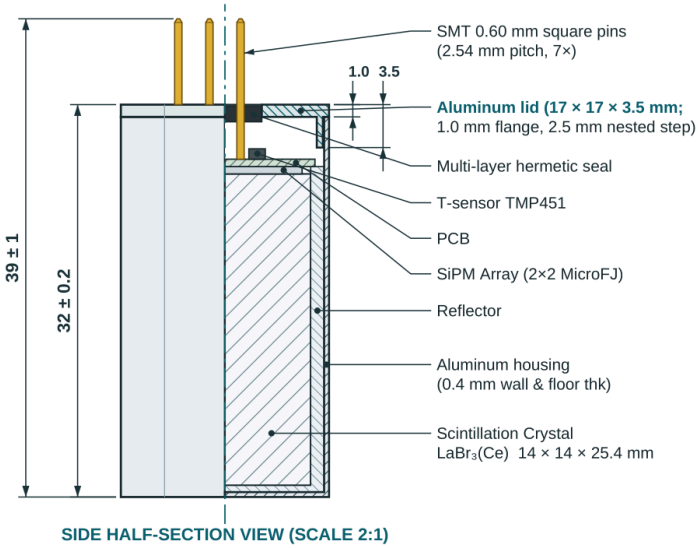
REV 2 MacroPixel LaBr assembly views with nested stepped aluminum lid. Dimensions in mm.



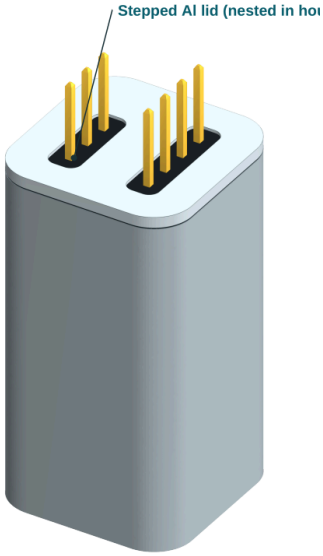
TOP VIEW — PIN / LID END (SCALE 2:1)



PINOUT — TOP VIEW (PIN END)



SIDE HALF-SECTION VIEW (SCALE 2:1)



ISOMETRIC VIEW (CAD ASSEMBLY)

MacroPixel LaBr-14x25c-SiPM-T — REV 2 aluminum-lid assembly drawing, views excerpted for readability. Source drawing: size A, scale 2:1; do not scale this reproduced figure.

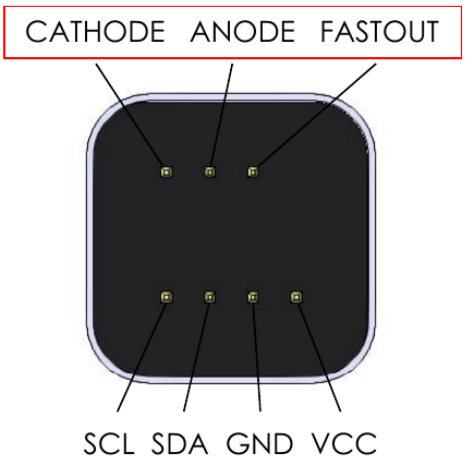
Mechanical item	Nominal value / tolerance
Housing (square)	17 ± 0.1 × 17 ± 0.1 mm
Stepped aluminum lid	17 × 17 × 3.5 mm; 1.0 mm flange + 2.5 mm nested collar
Body height	32 ± 0.2 mm
Overall height (incl. pins)	39 ± 1 mm
Aluminum wall	0.4 mm
SMT pins	0.60 mm square on 2.54 mm pitch
Crystal	14 × 14 × 25.4 mm
Mass	35 g

Support the housing (do not use pins as structural mounts). Leave pin-end access for wiring. Request the current LaBr drawing from CapeScint before production PCB layout.

04 / PINOUT & BLOCK DIAGRAM

Seven-pin interface and internal topology

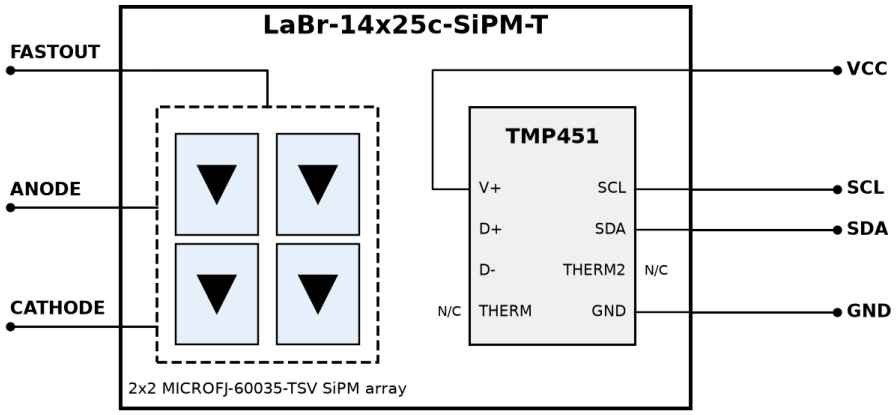
Pin-side view, full function table, and MacroPixel LaBr-14x25c-SiPM-T block diagram (MICROFJ-60035-TSV + TMP451).



Pin-side view of the MacroPixel LaBr module. Confirm orientation against the assembly drawing before PCB layout.

Pin	Function
CATHODE	SiPM array cathode — bias input (+Vbias)
ANODE	SiPM array anode — standard output
FASTOUT	SiPM fast output (capacitively coupled)
VCC	TMP451 supply, 1.7–3.6 V
SDA	SMBus/I²C serial data (open-drain, needs pull-up)
SCL	SMBus/I²C serial clock (needs pull-up)
GND	Ground (TMP451 / signal return)

Separate the SiPM bias supply from the low-voltage TMP451 supply. Never apply SiPM bias to VCC.



THERM / THERM2 outputs not connected (N/C). SiPM array: common CATHODE, ANODE (standard output) and FASTOUT.

Block diagram — MacroPixel LaBr-14x25c-SiPM-T (MICROFJ-60035-TSV SiPM array and TMP451 temperature sensor). THERM / THERM2 are not connected (N/C).

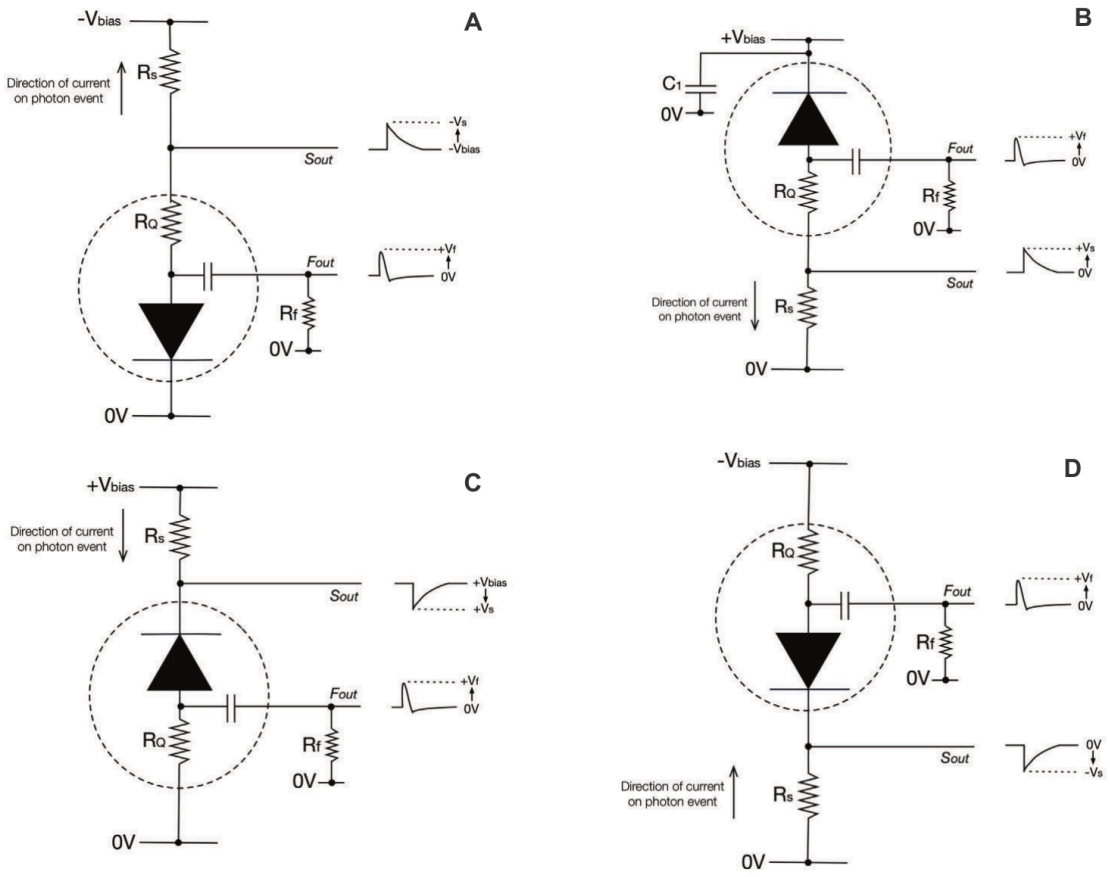
05 / BIASING & SIGNAL POLARITY

Biasing alternatives & signal polarity

J-Series SiPM bias arrangements and standard / fast output polarity for each configuration.

This section shows the possible ways to bias a J-Series SiPM and gives the standard and fast signal polarity for each arrangement. Configurations **A** and **B** are recommended. **C** and **D** work but are **not recommended** for use with the fast output. Abbreviations used:

Vbias = bias voltage
Sout = standard output
Fout = fast output
Rs = load resistor for the standard output
Rf = load resistor for the fast output
Vs = standard output voltage
Vf = fast output voltage
RQ = quench resistor (included on the SiPM die)
C1 = decoupling capacitor 10 nF (50 V), low ESR, ceramic



Biasing alternatives and signal polarity for SensL / onsemi J-Series SiPMs. Configurations A and B recommended; C and D not recommended with the fast output.

Ref.: J-Series High PDE and Timing Resolution, TSV Package, Datasheet, SensL / onsemi. Verify polarity and loading before applying power.

06 / TMP451 & APPLICATION NOTE

Temperature sensor and traditional analog readout

TMP451 features, ratings and a practical analog electronics application note for MacroPixel LaBr.

TMP451 temperature sensor

The TMP451 is a high-accuracy, low-power remote temperature sensor monitor with a built-in local temperature sensor.

- ±1 °C diode accuracy
- 1.7 V to 3.6 V supply and logic voltage range
- 27 µA operating current
- Temperature reported as a 12-bit digital code
- Two-wire and SMBus™ serial interface
- Specified temperature range: −40 °C to 125 °C (component; module operating range is −40 to +55 °C)

Absolute maximum ratings

Parameter	MIN	MAX	UNIT
Power supply (VCC)	−0.3	3.6	V
Input voltage (SDA, SCL)	−0.3	3.6	V
Input current	—	10	mA
Operating temperature	−55	127	°C
Junction temperature (T_{Jmax})	—	150	°C
Storage temperature (T_{stg})	−60	150	°C

Recommended operating conditions

Parameter	MIN	NOM	MAX	UNIT
Supply voltage	1.7	3.3	3.6	V
Operating free-air temperature (T_A)	−40	—	125	°C

Ref.: TMP451 / SBOS686A — June 2013 — revised December 2014, Texas Instruments. Stresses above absolute maximum ratings may cause permanent damage. The sensor enables system-level compensation; it does not regulate SiPM gain.

Application note: traditional analog electronics with MacroPixel

Acquiring spectra with a MacroPixel is straightforward, and the same approach applies to all MacroPixel detectors. Only the following standard analog electronics, found in most scintillator and radiation-measurement labs, are needed:

- **Bias supply.** A stable, programmable source providing ripple-free bias up to +30 V, current-limited to 0.5 mA (three 9 V batteries also work). Apply the bias to the MacroPixel cathode. An additional RC filter (e.g., 10 nF to ground) reduces noise from the supply and connection lines.
- **No preamplifier needed.** Take the signal directly from the MacroPixel anode, connected to ground through a 50 Ω (up to 1000 Ω) resistor (configuration B on the biasing page).
- **Shaping spectroscopy amplifier.** Common models include Ortec 671, 672, 673 and Canberra 2025 or 2026. $LaBr_3$(Ce,Sr) has a fast primary decay time of about 16 ns, much shorter than CsI(Tl) or SrI_2(Eu); use short shaping times and match the electronics to the ~16 ns primary decay.
- **Multichannel analyzer (MCA)** with software. Any MCA can be used; CapeScint also offers USB MCA solutions with temperature-compensated gain based on the built-in TMP451 sensor.

07 / TYPICAL ^{137}Cs SPECTRUM

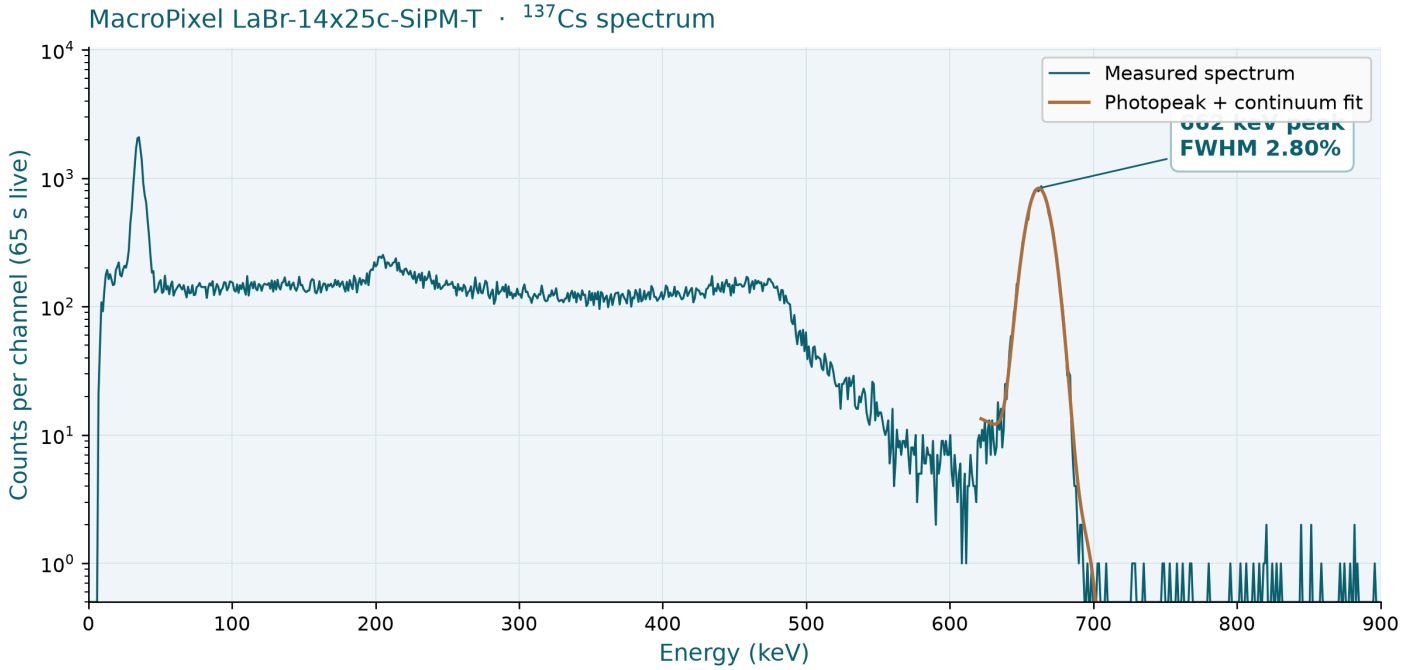
Measured cesium-137 response

Energy-calibrated ^{137}Cs-only spectrum from MacroPixel LaBr-14x25c-SiPM-T SN372. Example, not an acceptance limit.

~3%
Typical product ER · 662 keV

2.8%
Measured example FWHM · 662 keV

~1.6 kcps
input rate · 65 s live · ~26.5 °C



SN372 · module ~26.5 °C · ICR 1559 cps · energy scale linear through 662 keV

Measured ^{137}Cs-only spectrum, MacroPixel LaBr-14x25c-SiPM-T SN372. Energy axis linear through the 662 keV photopeak (0–900 keV). Raw FWHM ~2.8% at 662 keV, module temperature ~26.5 °C.

Energy scale. Horizontal axis is energy (keV), calibrated linearly through the 662 keV photopeak. Quoted ~2.8% is the raw photopeak FWHM (not saturation-corrected). Typical product energy resolution remains ~3% at 662 keV; this is a measured example, not an acceptance limit.

Acquisition: approximately 1.6 kcps input rate; 65 s live; module temperature ~26.5 °C (SN372). Pure ^{137}Cs (no Th companion source). Source geometry and readout settings affect the recorded spectrum.

Measured example, not a production acceptance limit. Energy resolution depends on the detector, readout electronics, calibration and settings.

08 / TYPICAL ^{232}Th SPECTRUM

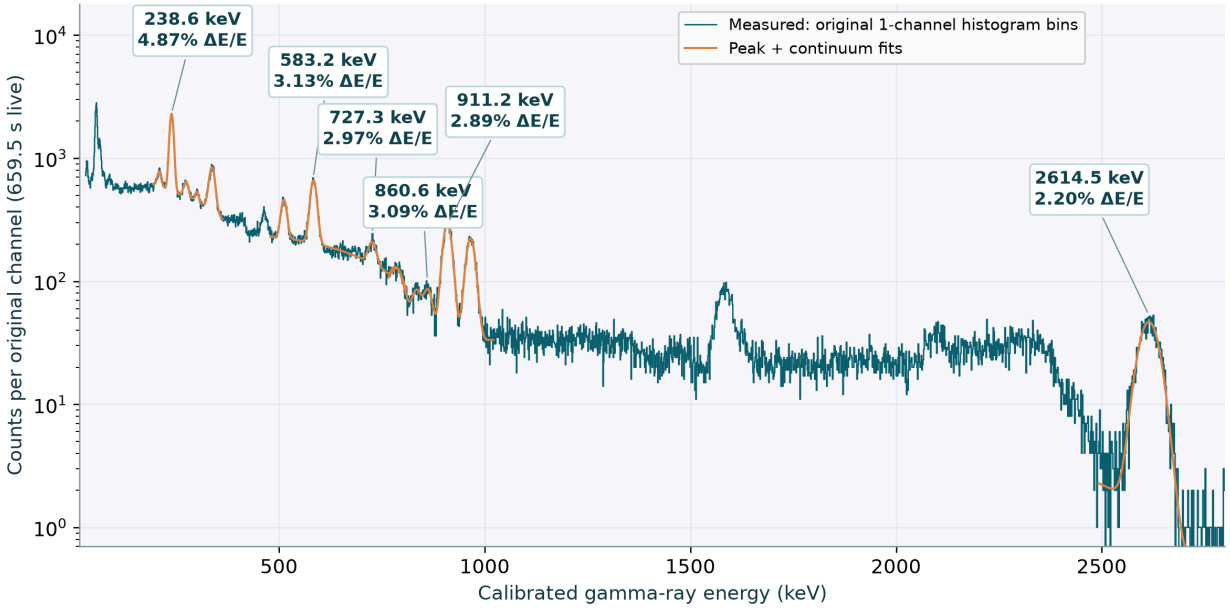
Energy-corrected thorium spectrum & intrinsic ^{138}La

Measured energy resolution with SiPM saturation correction applied, plus intrinsic activity notes.

2.20%
ΔE/E FWHM · 2614.5 keV

3.13%
ΔE/E FWHM · 583.2 keV

659.5 s
live acquisition · 27.5 °C



Thorium spectrum from a MacroPixel LaBr-14x25c-SiPM-T detector. Labels show corrected energy-domain FWHM. Counts are per original acquisition channel, not per keV.

Gamma energy	Nuclide	Measured ΔE/E FWHM
238.6 keV	^{212}Pb	4.87%
583.2 keV	^{208}Tl	3.13%
727.3 keV	^{212}Bi	2.97%
860.6 keV	^{208}Tl	3.09%
911.2 keV	^{228}Ac	2.89%
2614.5 keV	^{208}Tl	2.20%

TIG thorium rods; 659.5 s live / 660 s real; detector temperature 27.5 °C; approximately 710 counts/s input. Energy calibration accounts for nonlinear SiPM response over 238–2615 keV.

Intrinsic activity of $LaBr_3$

Lanthanum contains the naturally occurring radioisotope ^{138}La, so every $LaBr_3$ crystal has a small, constant intrinsic activity. The CapeScint ScintiClear SC-14x25c-SiPM-T datasheet lists the intrinsic activity of $LaBr_3$(Ce) as **A = 1.125 Bq/cm³**. The intrinsic ^{138}La lines form a known background that can be used for in-situ energy calibration and gain stabilization; account for it in low-count-rate measurements. The LaBr crystal is grown with minimal actinide contamination.

Measured example, not a production acceptance limit. Corrected ΔE/E values on this page are not raw-channel Δch/ch widths. Design and specifications are subject to change without notice.