

Exceptional resolution and stable, low energy efficiency are critical requirements to optimize sample counting which improves your results accuracy and throughput. PROFILE "S" and "C" Series HPGe detectors offer both.

The ORTEC PROFILE Series of P-type High Purity Germanium (HPGe) detectors match the crystal dimensions to your application for optimal counting geometry and results. Both "S" and "C" Series crystals incorporate a Stable, Thin Front Contact (STFC) which provides excellent gamma transmission for energies as low as 3 keV. This advanced contact design does not diffuse into the germanium crystal at room temperature which ensures stable detector efficiency, even when stored warm.



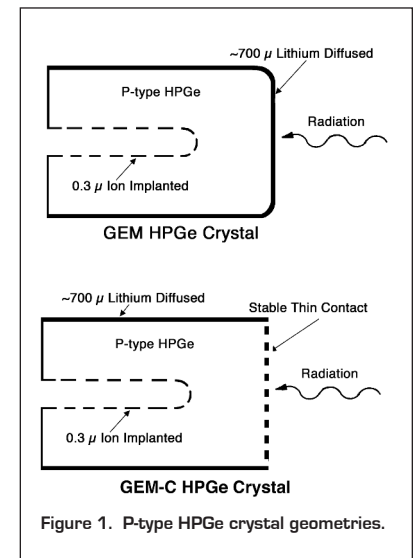
Benefits	Features
<ul style="list-style-type: none"> <li>• Greater counting efficiency – lower counting time and lower Minimum Detectable Activity</li> </ul>	<ul style="list-style-type: none"> <li>• Thin front contact</li> <li>• Maximized crystal diameter within the endcap</li> </ul>
<ul style="list-style-type: none"> <li>• Improved X-ray nuclide identification – extended lower energy range operation down to 3 keV</li> </ul>	<ul style="list-style-type: none"> <li>• Thin front contact</li> </ul>
<ul style="list-style-type: none"> <li>• Improved multi-peak nuclide identification – enhanced resolution</li> </ul>	<ul style="list-style-type: none"> <li>• P-type detectors with multiple crystal geometries</li> </ul>
<ul style="list-style-type: none"> <li>• Simplified handling and lower storage costs without loss of detector efficiency – warm storage capability</li> </ul>	<ul style="list-style-type: none"> <li>• Stable contact (no "dead layer" growth at room temperature).</li> </ul>

PROFILE C-Series detectors employ "nearly square" (diameter < length) coaxial crystal structures. This provides the same resolution, but better absolute efficiency than conventional P-type coaxial (GEM) detectors below 50 keV. The C-Series detectors offer better resolution than N-type (GMX) detectors for a given front window efficiency. For energies above 1 MeV, C-Series detectors offer excellent resolution and efficiency performance, similar to conventional P-type coaxial detectors (GEM).

PROFILE S-Series detectors employ "over-square" (diameter > length) semi-planar crystal structures. This over-square geometry improves low to medium energy resolution, compared to coaxial crystal geometry, by reducing the back-contact capacitance. The detector's larger surface area improves low to medium energy efficiency when used for samples such as:

- Point sources on-endcap
- Filter paper samples on-endcap
- Samples presented in bottles and pots on-endcap
- Bio-assay applications (e.g., lung monitoring)
- Waste drum monitoring

For a given relative (IEEE) efficiency, PROFILE Series detectors represent the "best use" of germanium material producing the maximum absolute counting efficiency for all geometries.



# PROFILE "S" and "C" Series P-type Semi-planar and Coaxial HPGe Detectors

Figure 2 shows the extensive improvement in efficiency at lower energies for a PROFILE "S" detector when measuring a point source. The S8530 S-Series detector's absolute efficiency is significantly higher between 600 keV and 20 keV when compared to the same 50% relative efficiency coaxial P- and N-type detectors. At 59 keV, the S-Series detector area is nearly 6X more efficient than a P-type coaxial detector (GEM50) and almost 2X more efficient than a coaxial N-type (GMX50) low-energy detector due to its greater front surface area. As expected, curves converge at 1332 keV, where relative efficiency is measured.

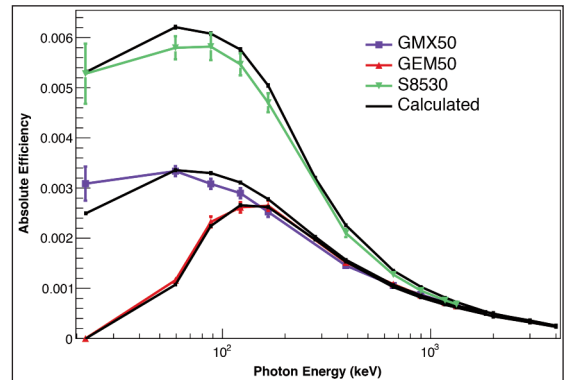


Figure 2. Efficiency vs. Energy for S8530, GEM50 and GMX50 detectors having 50% relative efficiency and a Point Source positioned 25 cm away from the front of the endcap.

Measured [color] and calculated [black] curves show absolute efficiency versus energy for a point source positioned 25 cm from the detector endcap. Measured data points are obtained using mixed NIST traceable sources. Calculated data points were generated using MCNP-X. Note, energy range shown is from 20 keV to 4 MeV.

Figure 3 reinforces the marked improvement in efficiency for the PROFILE "S" detectors when measuring a filter paper on-endcap source. S8530 has significantly higher absolute efficiency at all energies below 1 MeV down to 10 keV. Due to a larger diameter crystal, at 122 keV, the S-Series detector is 2.5X more efficient than a P-type coaxial and nearly 2X more efficient than an N-type low-energy detector.

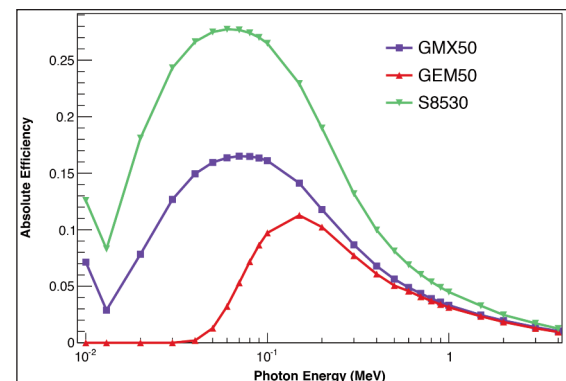


Figure 3. Efficiency vs. Energy for S8530, GEM50 and GMX50 detectors having 50% relative efficiency and a 100 mm diameter Filter Paper Source positioned on the endcap.

Calculated [color] curves show absolute efficiency versus energy for a 100 mm diameter filter paper source positioned on the detector endcap. Note, energy range shown is from 10 keV to 4 MeV.

Figures 4 and 5 highlight the robust peak shape of PROFILE "S" and "C" detectors measuring  $^{55}\text{Fe}$  and  $^{109}\text{Cd}$  spectra respectively. Low energy peak at 5.9 keV on the left, and 22 and 88 keV peaks on the right are well defined above the background.

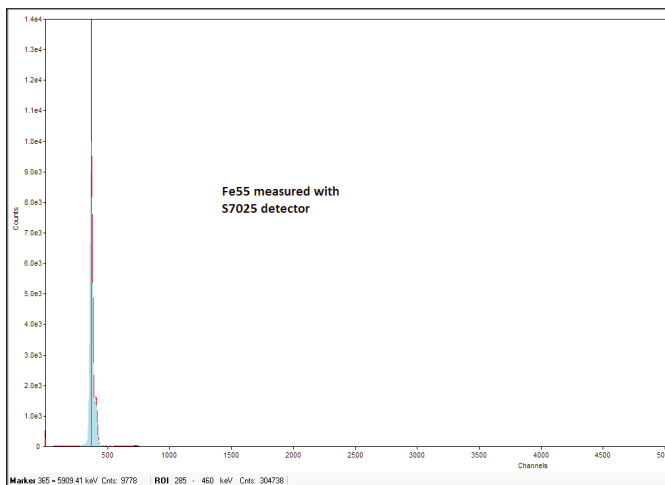


Figure 4.  $^{55}\text{Fe}$  spectra measured with S7025.

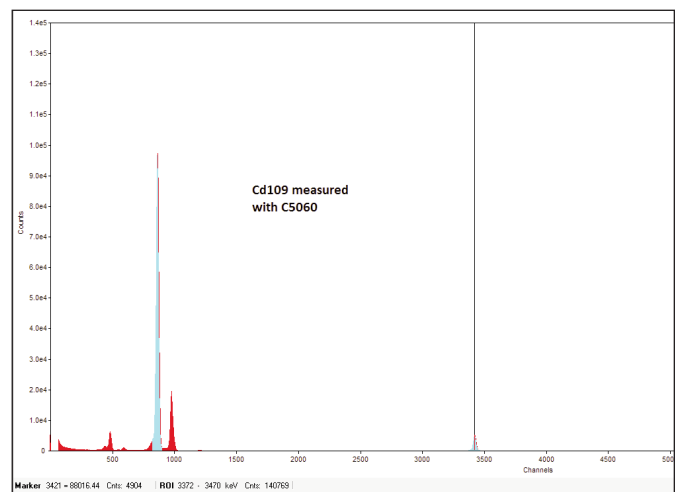


Figure 5.  $^{109}\text{Cd}$  spectra measured with C5060.

# PROFILE “S” and “C” Series P-type Semi-planar and Coaxial HPGe Detectors

## General Guidelines for Choosing a Profile S Detector

For a close or on-endcap sample, the detector diameter should exceed the sample diameter by 20% or more. Beyond 30% the gain in efficiency is small. In addition, if the detector diameter exceeds the sample diameter by 20% or more, errors due to irreproducibility of the sample position will be minimal.

If budget constraints must be considered, first select the largest diameter in comparison with the optimum diameter. Selection of a deeper detector will further increase the absolute efficiency, specifically at higher energies.

If the application or situation includes prolonged storage of the detector in an ambient environment, selection of the S- or C-Series PROFILE detector will maintain excellent performance, with no degradation in the low-energy range.

**Table 1. HPGe Detector Selection Guide for Various Counting Geometries Relative to Energies of Interest**

Overall Guidelines on the Choice of High Purity Germanium (HPGe) Detector						
Source Energy [keV]	Marinelli Beaker		Near or Far Point Source		Large Surface Area	
Preference	Efficiency	Resolution	Efficiency	Resolution	Efficiency	Resolution
3 to 2000	GMX	PROFILE C	PROFILE S	PROFILE S	PROFILE S	PROFILE S
3 to 5000	GMX	PROFILE C	PROFILE C	PROFILE C	PROFILE C	PROFILE S
20 to 2000	GMX	PROFILE M	PROFILE F	PROFILE F	PROFILE F	PROFILE F
50 to 5000	GEM	GEM	GEM	GEM or PROFILE F	GEM or PROFILE F	PROFILE F
20 to above 5000	GMX70 or larger	PROFILE C94100	PROFILE C94100	PROFILE C94100	PROFILE C94100	PROFILE C94100
above 5000	GEM70 or larger	GEM70 or larger	GEM70 or larger	GEM70 or larger	GEM70 or larger	GEM70 or larger
Neutron Damage	GMX	GMX	GMX	IGLET	GMX	large IGLET
High Count Rate	small GEM or GMX	small GEM or GMX	small GEM	small PROFILE F or small PROFILE S	small PROFILE F or small PROFILE S	small PROFILE F or small PROFILE S

**Table 2. PROFILE Series GEM Detector Specification Information**

Model No.	Crystal Dimension		Energy Resolution (FWHM)				Peak Shape		P:C Warr.	Nominal Relative Efficiency%	Endcap Dia. (mm)
	Actual Diameter [+0/-2 mm]	Actual Length Minimum	5.9 keV Warr. (eV)	46 keV Typical (eV)	@122 keV Warr. (eV)	@1.33 MeV Warr. (keV)	FW.1M/ FWHM Typical	FW.02M/ FWHM Typical			
GEM-S5020P4	50	20	350	450	650	1.8	1.90	2.55	35	7	70
GEM-S5825P4	58	25	400	500	650	1.8	1.90	2.65	35	15	70
GEM-S7025P4	70	25	450	575	650	1.9	1.95	2.75	40	20	83
GEM-S8530P4	85	30	500	625	700	1.9	2.00	2.90	55	50	108
GEM-C5060P4	50	60	725		850	1.8	1.90	2.55	60	20	70
GEM-C5970P4	59	70	750		900	1.8	1.90	2.65	62	38	70
GEM-C7080P4	70	80	830		950	1.9	2.00	3.10	75	66	83
GEM-C8295P4	82	95	1215		1250	2.1	2.00	3.10	85	115	95
GEM-C94100P4	94	100	1230		1300	2.3	2.00	3.10	90	175	108

## Notes

- 1) FWHM = Full Width at Half Maximum; FW.1M = Full Width at One-Tenth Maximum; FW.02M = Full Width at One-Fiftieth Maximum; total system resolution for a source at 1000 counts/s measured in accordance with ANSI/IEEE Std. 325-1996, using ORTEC standard electronics.
- 2) Measured at 6  $\mu$ sec analog or equivalent digital shaping time using ORTEC electronics.
- 3) PROFILE S and C detectors come with a standard Carbon Fiber window. For improved performance between 3 and 5 keV select the Beryllium window option.
- 4) The proprietary contact employed in the S- and C-Series detectors offer exceptionally high transmission at energies below 40 keV. Warm storage will not degrade the transmission efficiency of the front contact.

# PROFILE Coaxial HPGe Photon Detector Product Configuration Guide

## Detector Options

- Harsh Environment Option [-HE]
- Beryllium Window Options [-B, -RB-B]
- Ultra-High Count-Rate Preamplifier Option [-PL]
- Remote Preamplifier Option [-HJ]
- Low-Background Carbon Fiber Endcap Options [-RB, -LB-C, and -XLB-C]
- SMART-1 Option [-SMP]
- See full PROFILE data sheet for more a detailed detector configuration guide.

Specifications subject to change  
070214

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