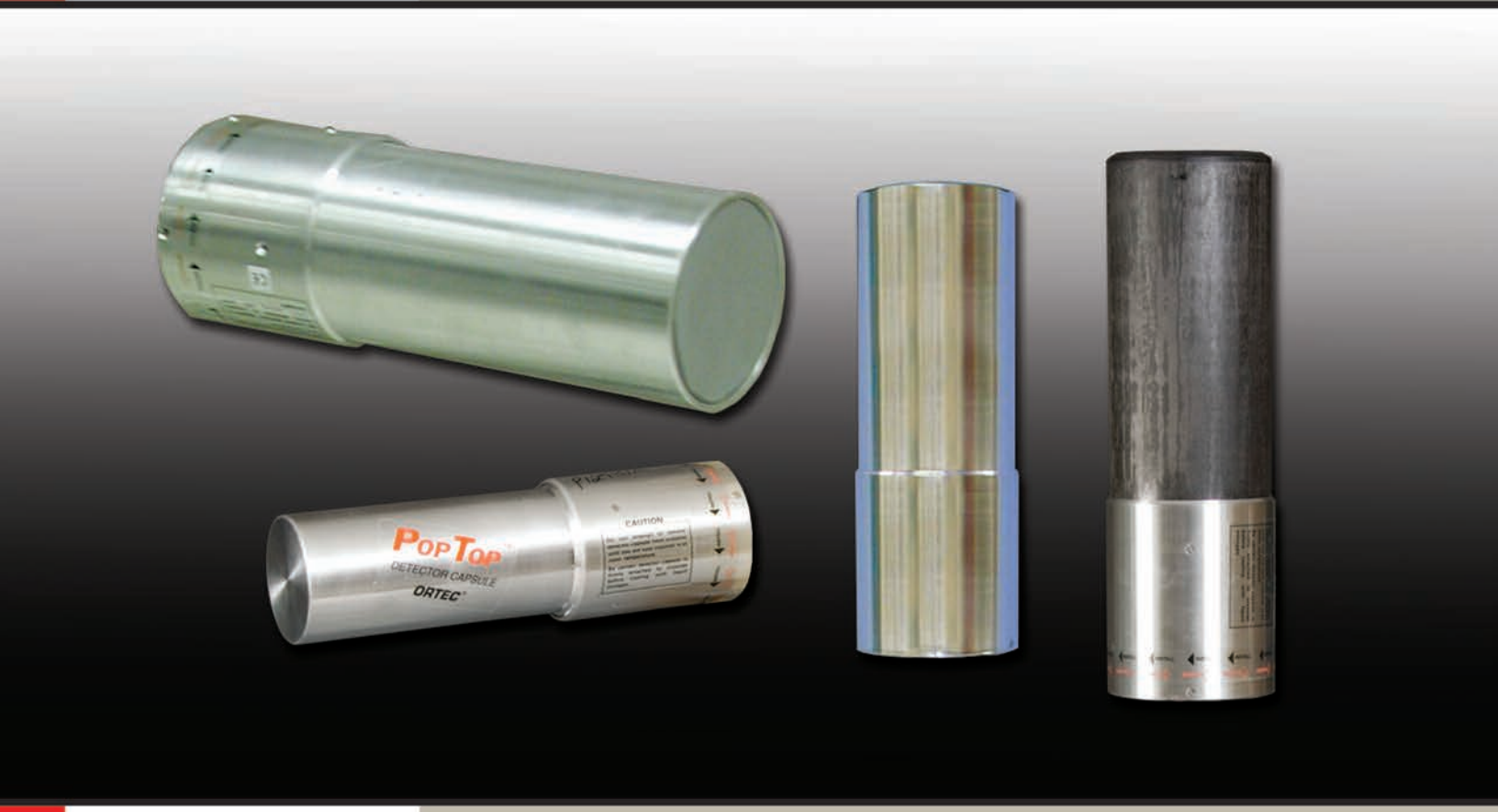
ORTEC®

PROFILE "S" and "C" Series

P-type Semi-planar and Coaxial HPGe Detectors



Exceptional Resolution and Stable, Low-Energy Efficiency
Comprehensive Solutions to Demanding Applications

AMETEK®
ADVANCED MEASUREMENT TECHNOLOGY

PROFILE “S” and “C” Series

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 High Purity Germanium (HPGe) detectors offer both.

The ORTEC PROFILE Series of P-type 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 penetrate into the germanium crystal at room temperature which ensures stable detector efficiency, even when stored warm.

Benefits	Features
• Greater counting efficiency – lower counting time and lower Minimum Detectable Activity	• Thin front contact • Maximized crystal diameter within the endcap
• Improved X-ray nuclide identification – extended lower energy range operation down to 3 keV	• Thin front contact
• Improved multi-peak nuclide identification – enhanced resolution	• P-type detectors with multiple crystal geometries
• Simplified handling and lower storage costs without loss of detector efficiency – warm storage capability	• Stable contact (no “dead layer” growth at room temperature).

PROFILE C-Series detectors employ coaxial P-type crystal structures with STFC. 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 the same size 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 (lowers) 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

PROFILE S-Series are now available in commercially UNMATCHED diameters of 94 and 105 mm maximizing the absolute efficiency for energies between 3 keV and 1 MeV.

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.

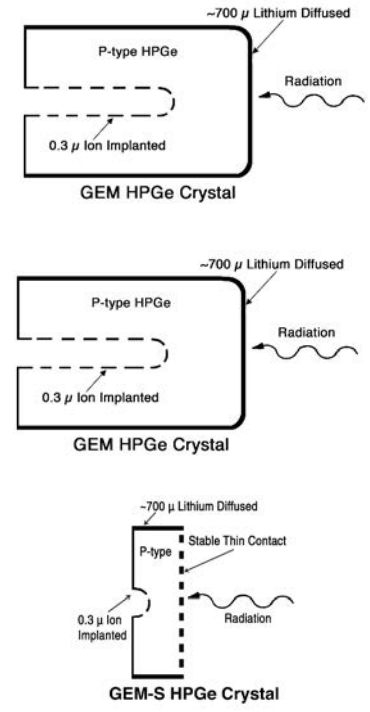


Figure 1. P-type HPGe crystal geometries.

PROFILE “S” and “C” Series

Figure 2 shows the extensive improvement in efficiency at lower energies for a PROFILE “S” detector when measuring a point source. Calculated (color) curves show absolute efficiency versus energy for a point source poistioned 25 cm from the detector endcap. The S8530 (light green) S-Series detector’s absolute efficiency is significantly higher between 10 keV and 600 keV when compared to the same 50% relative efficiency coaxial P- and N-type detectors. At 59 keV, the 85 mm crystal diameter S-Series detector is nearly 6X more efficient than a P-type coaxial detector (GEM50) (red) and 2X more efficient than a coaxial N-type (GMX50) (blue) low-energy detector due to its greater front surface area. As expected, curves converge at 1332 keV, where relative efficiency is measured. The S9430 (green) and S10530 (dark green) unique detectors with 94 mm and 105 mm crystal diameter repsectively, further improve absolute efficiencies below 1 MeV due to a larger surface area.

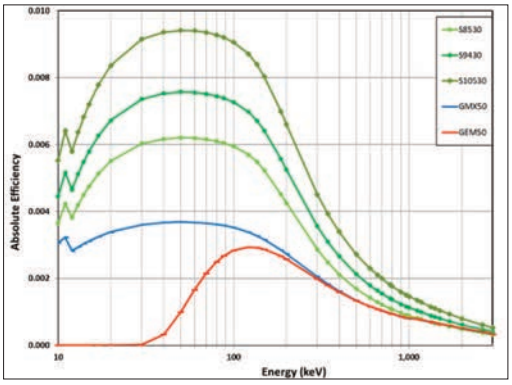


Figure 2. Absolute Efficiency vs. Energy for S10530, S9430, S8530, GEM50 and GMX50 detectors for a point source positioned 25 cm away from the front of the endcap.

Figure 3 reinforces the marked improvement in efficiency for the PROFILE “S” detectors when measuring a filter paper on-endcap source. Calculated (color) curves show absolute efficiency versus energy for a 100 mm diameter filter paper source poistioned on the detector endcap. The S8530 (light green) 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 1.9X more efficient than a P-type coaxial (red) and nearly 1.4X more efficient than an N-type (blue) low-energy detector. The S9430 (green) and S10530 (dark green) unique detectors with 94 mm and 105 mm crystal diameter respectively, further improve absolute efficiencies below 1 MeV due to a larger surface area.

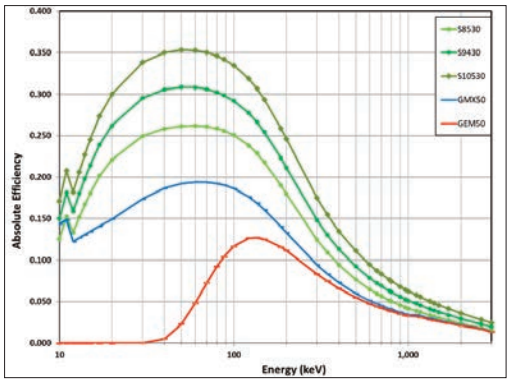


Figure 3. Absolute Efficiency vs. Energy for S10530, S9430, S8530, GEM50 and GMX50 detectors for a 100 mm diameter filter paper source positioned on the endcap.

Figure 4 shows marginal efficiency advantage for the PROFILE “C” detectors when measuring a 1L Marinelli Beaker with 245 cc soil on the endcap source for energies above 200 keV. This advantage of PROFILE C detectors is due to maximizing the crystal diameter within the endcap. The N-type GMX70 (blue) detector has better efficiency than the C70 (light green) and the P-type GEM50 (red) as expected due to a thinner contact on the sides of the detector. However, a C70 offers better resolution performance than an N-type detector. The decision to offer a GMX vs PROFILE C detector for low energies with a Marinelli Beaker source geometry should be based on what is more valuable for a given application — resolution or efficiency.

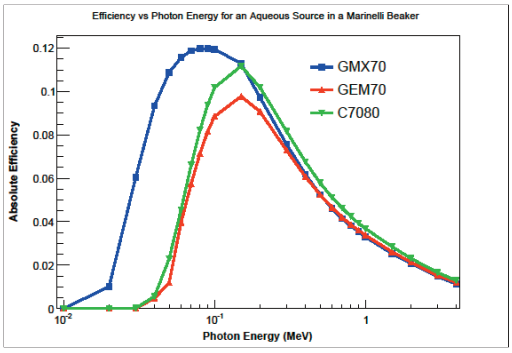


Figure 4. Absolute Efficiency vs. Energy for C70, GEM70, and GMX70 detectors for a 1L Marinelli Beaker filled with 245 cc soil positioned on the endcap.

Figures 5 and 6 highlight the robust peak shape of PROFILE “S” and “C” detectors measuring ^{55}Fe and ^{109}Cd respectively. Low energy peaks at 5.9 keV on the left, and 22 and 88 keV peaks on the right are well defined above the background.

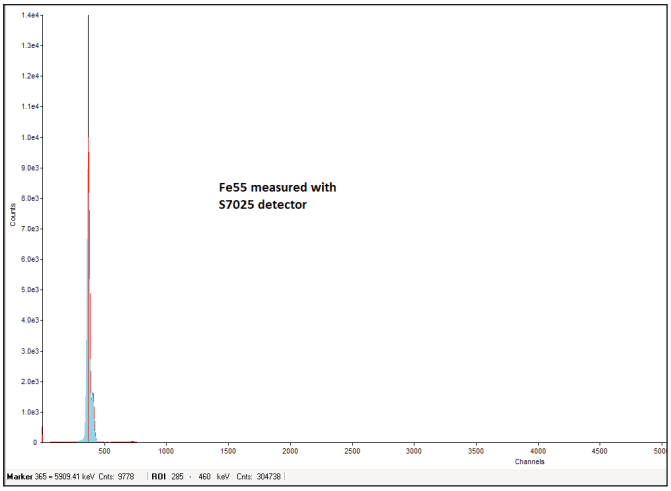


Figure 5. ^{55}Fe spectra measured with a GEM-S7025 detector.

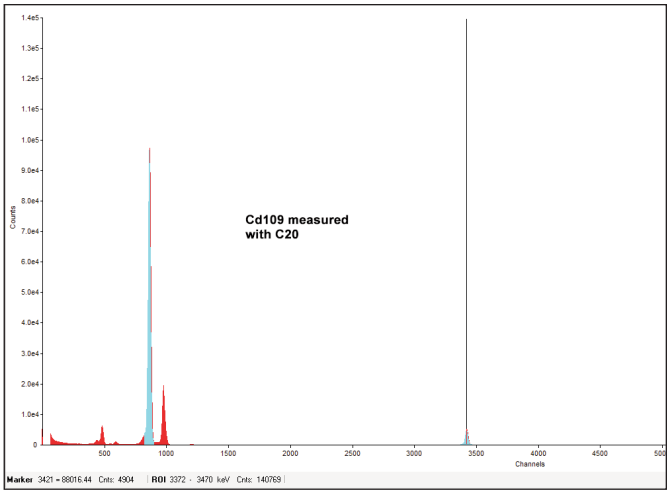


Figure 6. ^{109}Cd spectra measured with a GEM-C20 detector.

General Guidelines for Choosing a Profile S Detector

For close or on-endcap samples, 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, the detector front contact will maintain excellent performance with no degradation in the low-energy range regardless of any thermal cycling.

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 or GEM M	GEM or PROFILE F	GEM or PROFILE F	PROFILE F
20 to above 5000	GMX70 or larger	PROFILE C70 or larger	PROFILE C70 or larger	PROFILE C70 or larger	PROFILE C70 or larger	PROFILE C70 or larger
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	GMX	GMX	GMX
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

PROFILE “S” and “C” Series

Table 2. PROFILE Series GEM Detector Specification Information

Model No.	Crystal Dimension		Energy Resolution (FWHM)				Peak Shape		P:C	Nominal	Endcap
	Actual Diameter (+0/–2 mm)	Actual Length Minimum	5.9 keV Warranted (eV)	46 keV Typical (eV)	@122 keV Warranted (eV)	@1.33 MeV Warranted (keV)	FW.1M/ FWHM Typical	FW.02M/ FWHM Typical	Warranted	Relative Efficiency %	Diameter (mm)
GEM-S5020	50	20	350	450	650	1.8	1.90	2.55	35	7	70
GEM-S5825	58	25	400	500	650	1.8	1.90	2.65	35	15	70
GEM-S7025	70	25	450	575	650	1.9	1.95	2.75	40	20	83
GEM-S7030	70	30	450	600	700	1.9	2.00	2.90	40	28	83
GEM-S8530	85	30	500	625	700	1.9	2.00	2.90	55	50	108
GEM-S9430	94	30	500	650	700	1.9	2.00	2.90	65	65	108
GEM-S10530	105	30	550	650	700	2.0	2.00	2.90	65	80	121
GEM-S10535	105	35	550	650	700	2.0	2.00	2.90	65	90	121
	Actual Diameter (+2/–2 mm)	Actual Length Minimum	5.9 keV Warranted (eV)	46 keV Typical (eV)	@122 keV Warranted (eV)	@1.33 MeV Warranted (keV)	FW.1M/ FWHM Typical	FW.02M/ FWHM Typical	P:C Warranted	Nominal Relative Efficiency %	Endcap Diameter (mm)
GEM-C10	50	25	600		800	1.8	1.9	2.55	41	10	70
GEM-C15	50	44	635		820	1.8	1.9	2.55	46	15	70
GEM-C20	50	60	650		820	1.8	1.9	2.55	52	20	70
GEM-C25	57	50	690		850	1.8	1.9	2.60	56	25	70
GEM-C30	57	62	715		850	1.8	1.9	2.60	60	30	70
GEM-C35	57	75	730		850	1.8	1.9	2.60	62	35	70
GEM-C40	64*	58	760		870	1.8	1.9	2.60	64	40	76
GEM-C45	64*	68	800		900	1.8	1.9	2.60	64	45	76
GEM-C50	68	62	800		900	1.9	1.9	2.60	66	50	83
GEM-C55	68	70	830		1000	1.9	1.9	2.60	67	55	83
GEM-C60	68	77	830		1000	1.9	1.9	2.80	70	60	83
GEM-C65	68	86	830		1000	1.9	1.9	3.00	73	65	83
GEM-C70	70*	85	900		1000	2.0	1.9	3.00	75	70	83
GEM-C75	80	56	900		1000	2.0	1.9	3.00	73	75	95
GEM-C80	80	61	950		1000	2.0	1.9	3.00	73	80	95
GEM-C90	80	70	950		1100	2.0	1.9	3.00	80	90	95
GEM-C100	80	82	1000		1100	2.1	1.9	3.00	83	100	95
GEM-C110	80	91	1050		1100	2.1	1.9	3.00	85	110	95
GEM-C120	82*	98	1050		1100	2.1	1.9	3.00	86	120	95
GEM-C130	92	67	1100		1200	2.1	2.0	3.10	83	130	108
GEM-C140	92	74	1100		1200	2.2	2.0	3.10	83	140	108
GEM-C150	92	81	1100		1300	2.3	2.0	3.10	90	150	108
GEM-C175	94*	100	1100		1300	2.3	2.0	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 optimum 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.

*) Diameter tolerance +0/–2.

Ordering Information

See the PROFILE Detector Configuration Guide for complete ordering information.

PROFILE “S” and “C” Series

Specifications subject to change
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