

Multi-nuclide gamma standards are used to establish efficiency curves for gamma spectrometers over a wide energy range and provide the most accurate calibrations available for modern solid-state detectors. The use of multiple gamma-ray emitting radionuclides with simple spectra (single or at most twin gamma-ray emissions) allows the activities of each component to be adjusted to give approximately equal counting statistics across the entire energy range while minimizing spectral interference. The result is that all regions of the energy versus efficiency curve will have equal precision. These mixtures also minimize coincidence summing effects, which is particularly important when counting close to large, high-efficiency detectors.

Standards

Eckert & Ziegler offers multi-nuclide gamma standards customized to match most of your sample counting geometries including:

- Solutions
- Point Sources
- Filter Papers
- Charcoal Filter Cartridges
- Simulated Gases
- Bottles, Beakers, Jars, etc. filled with:
 - Water-equivalent (≈ 1 g/ml) Resin
 - Low Density (< 1 g/ml) Resin
 - High Density (> 1 g/ml) Resin
 - Environmental Matrices (soil, sand, vegetation, etc.)

Calibration

Multi-nuclide gamma standards are prepared gravimetrically from calibrated solutions and then confirmed using a high purity germanium detector. This procedure ensures the highest possible quality with uncertainty values for each component typically in the range of 3 - 4%, 95% relative expanded uncertainty ($k=2$). The standards are calibrated in our accredited measurement laboratories and are traceable to standards held by national metrology institutes world-wide, including the National Institute of Standards and Technology (USA), Physikalisch Technische Bundesanstalt (Germany), National Physical Laboratory (UK), and Laboratoire National Henri Bequerel (France).

Mixtures

Eckert & Ziegler offers a variety of multi-nuclide mixtures made in batches on regular schedules from three production laboratories. The options are summarized on the back. Each production laboratory started independently and developed their own mixtures and, when they joined Eckert & Ziegler, each continued to serve their existing customers with the same mixtures. This has resulted in similar mixtures from all three laboratories containing Cd-109, Co-57, Ce-139, Hg-203, Sn-113, Sr-85, Cs-137, Y-88 and Co-60 covering gamma-ray energies from 88 keV to 1836 keV. Other options include:

- Hg-203 replaced with Cr-51, for those customers who require non-mercury containing standards
- Addition of Am-241 and/ or Pb-210 to extend the calibration curve down to 60 keV and 46 keV.
- Addition of Zn-65 (1115 keV) and Mn-54 (835 keV) to measure coincidence-summing effects.
- A Longer-lived mixture recommended by PTB that includes Ba-133
- True Coincidence Correction (8700) mixture, which is used with special software to correct for coincidence summing effects.

Availability

Our multi-nuclide mixtures are produced several times per year according to the following schedule:

	Eckert & Ziegler Isotope Products (USA)		Eckert & Ziegler Analytics (USA)		Eckert & Ziegler Nuclitec (Germany)	
	7500 / 7600 Series	7900 Series	8300 / 8400 / 8500 / 8600 Series	8700 Series	NG1 / NG2 / NG3 / NG5 / NG6 / NG7	NG4
Production Schedule	Minimum of every 2 months	As Needed	4x per year	1x per year	4x per year	2x per year
Reference Dates	Either the 1st day of the month delivered or the 1st day of the month following delivery	On request	1 January, 1 April, 1 July, 1 October	1 February	NG1 1 January, 1 April, 1 July, 1 October NG2 / NG3 / NG5 / NG6 / NG7 1 March, 1 June, 1 September, 1 December	1 January, 1 July

		Eckert & Ziegler Isotope Products (USA)			Eckert & Ziegler Analytics (USA)					Eckert & Ziegler Nuclitec (Germany)						
Nuclide	γ Energy	7500 Series	7600 Series	7900 Series	8300 Series	8400 Series	8500 Series	8600 Series	8700 Series	NG1	NG2	NG3	NG4	NG5	NG6	NG7
Pb-210	46 keV	+	+	+	+	+	+	+	+		+	+	43%		+	
Am-241	60 keV	+	+	+	+	+	+	+	6%	+		8%	9%		5%	7%
Ba-133	81 keV 356 keV									5%						
Cd-109	88 keV	29%	42%	24%	77%	73%	70%	42%	54%		42%	39%	43%	25%	24%	32%
Co-57	122 keV	1%	2%	2%	2%	2%	2%	1%	1%	5%	2%	2%	5%	1%	1%	1%
Te-123m	159 keV	1%														
Ce-139	166 keV		2%	2%	3%	3%	2%	2%	2%	5%	2%	2%		1%	1%	2%
Hg-203	279 keV		6%			6%	5%		4%		6%	6%				4%
Cr-51	320 keV	36%		52%				42%						44%	42%	
Sn-113	392 keV	5%	7%		5%	4%	4%	3%	3%		7%	7%		4%	4%	6%
Sr-85	514 keV	6%	10%	5%			5%	3%	+	23%	10%	9%		6%	5%	7%
Cs-134	569 keV		+			+	+	+	7%	+				+	+	
Cs-137	662 keV	5%	7%	2%	2%	2%	2%	1%	2%	8%	7%	6%		4%	4%	5%
Mn-54	835 keV			3%	+	+	+	+	4%	8%	+			+	+	6%
Y-88	898 keV 1836 keV	11%	16%	6%	8%	7%	7%	4%	7%	23%	16%	14%		10%	9%	12%
Zn-65	1115 keV				+	+	+	+	10%	23%					+	12%
Co-60	1173 keV 1332 keV	6%	8%	4%	3%	3%	3%	2%		+	8%	7%		5%	5%	6%

+ Nuclide can be added to the batch mixture

Eckert & Ziegler Analytics, Inc. 1380 Seaboard Industrial Blvd. Atlanta, Georgia 30318 USA Tel: +1 404 352 8677 Email: isotrakusa@ezag.com Web: www.ezag.com	Eckert & Ziegler Nuclitec GmbH Gieselweg 1 38110 Braunschweig Germany Tel: +49 5307 932 555 Email: infoisotrak@ezag.com Web: www.ezag.com	Eckert & Ziegler Isotope Products France 91940 Les Ulis France Tel: +33 1 64 86 22 22 Email: contact-fr@ezag.com Web: www.ezag.com	Eckert & Ziegler Brazil Isotope Solutions Rua Miguel Nelson Bechara, 480 Limão, São Paulo, SP, 02712-130 Brasil Tel: +55 11 3526-5757 Email: contato@ezag.com Web: www.ezagbrasil.com.br
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