

**Point Detector  
HPGe**

**Calculation of the Absolute Peak Efficiency  
of the HPGe Detector by using Point Detector Concept**

56-1

HPGe

point detector concept

Eu-152

HPGe

Kim

point detector concept

**Abstract**

For the calculation of the absolute peak efficiency of the HPGe detector, the effective interaction depth was derived by applying the point detector concept to the measured count rate data, which are obtained by moving the Eu-152 point source both in the axial and radial direction. And the properties of the point detector concept was examined by the comparison between the calculated absolute peak efficiency from the effective interaction depth and the measured data by Kim et al.

1.

가

point detector concept

2.

$$\frac{\epsilon_{abs}(d)}{\epsilon_{abs}(d_0)} = \frac{\Omega(d)}{\Omega(d_0)} \quad (1)$$

가 ,  $d \approx d_0$  ,  $R_D$  (coincidence summing),  $d \approx d_0$  , 가  $(E_\gamma \geq 400 \text{ keV})$  , 가 (effective solid angle) 가 [1]. ,  $d$  (1)

$$d = d_c + d_s + d_e(E) \quad (2)$$

(volume detector extended detector)가 point detector 가 - point detector concept[1,2] -

$$\Omega(d) = \frac{1}{4\pi d^2} \quad (3)$$

가 point detector concept point detector  $d$  (4)

$$n(d) \propto \frac{1}{d^2}$$

$$n(d)^{-1/2} \propto d = d_s + d_c + d_e(E) \quad (5)$$

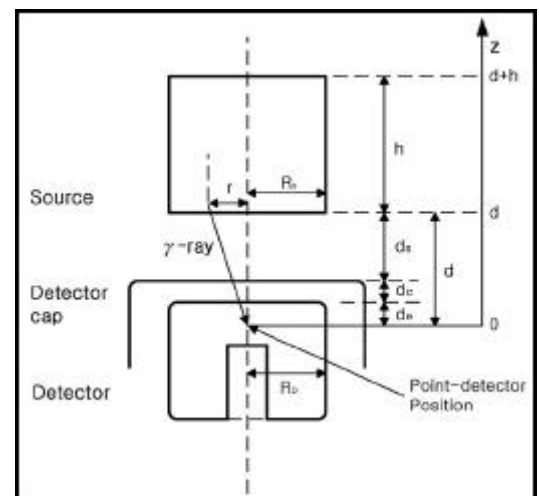


Fig. 1. A sketch of the point detector concept for an extended source.

가 .  $d_s$  - endcap  
,  $d_c$  endcap  
,  $d_0$

$$\epsilon_{abs}(d) = \epsilon_{abs}(d_0) \cdot \frac{d_0^2}{d^2} \quad (6)$$

point detector concept

1

2

(photon

attenuation)

3.

	HPGe	Canberra	closed-
ended coaxial	72cm <sup>3</sup>		15%
	122 keV, 1.33 MeV		0.84
keV	1.73 keV		3
0.8	shaping time 4 μsec	pile up rejection	off
4 k	LLD 40 keV	40 keV	3100 keV

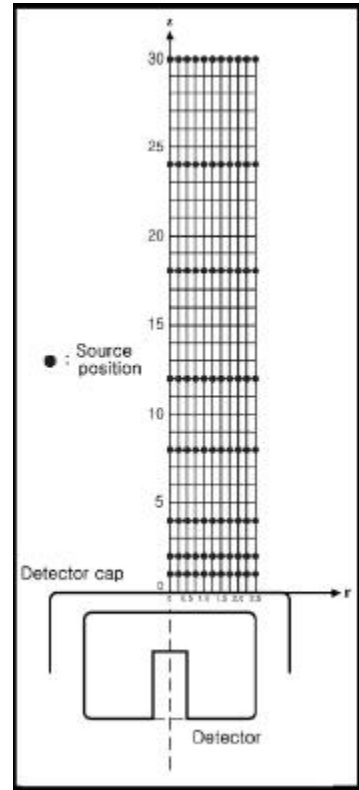


Fig. 2. The source position.

	IAEA	IAEA	1983	7	1
99%	415.6(± 1%) kBq			2	
				1, 2, 4, 8, 12, 18, 24,	
30 cm	8			2.5 mm	25mm
	11				
					1mm
	peak				1
	4cm	5%			

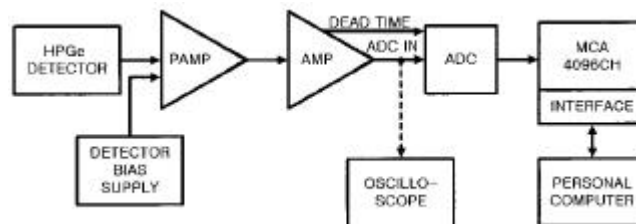
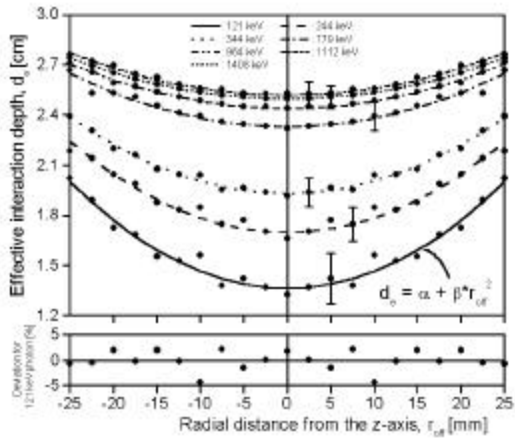


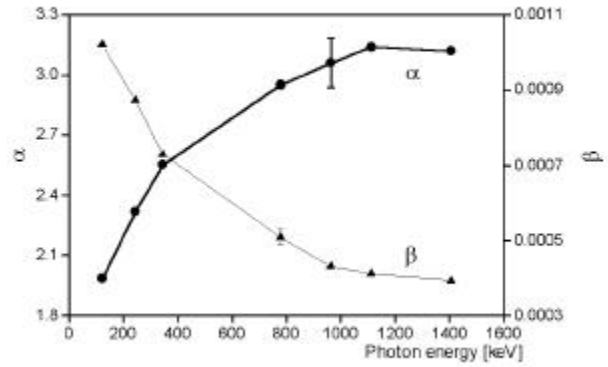
Fig. 3. Block diagram for the gamma-ray spectroscopy.





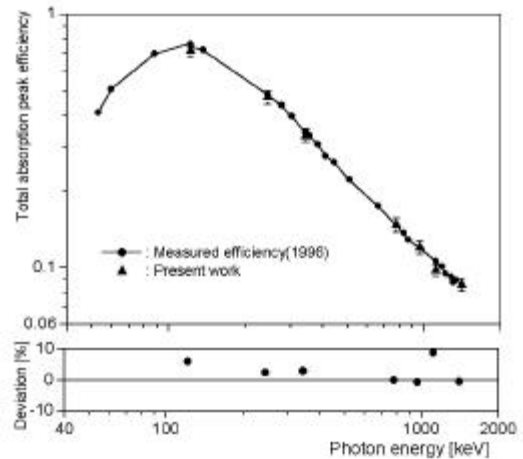
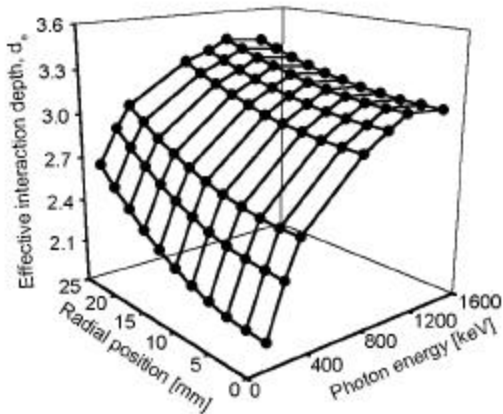
function of the source position in the radial direction. Deviations of the measured effective interaction depths from the fitted for 121 keV are shown.

9  
concept



shown as a function of photon energy. (fitting eq.  $d_e = \alpha + \beta * r_{off}^2$ ).

point detector  
778 keV  
25.6cm  
Kim [5] HPGe  
1112 keV 8.5%



efficiency as a function of the photon energy. Present work are compared with the measured efficiencies at 25.6 cm [5].

5.

	HPGe	Kim	1112
keV	8.5%	5%	
	point detector concept	Point detector concept	

## 6.

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- [2] G. Gilmore, J.D. Hemingway, "Practical gamma-ray spectrometry", pp 139-140, John Willey & Sons, 1995.
- [3] G.W. Phillips and K.W. Marlow, "Program HYPERMET for Automatic Analysis of Gamma-Ray Spectra from Germanium Detectors", NRL Memorandum Report 3198, Naval Research Laboratory, 1976.
- [4] R. Jedlovsky, REPORT OMH 8301 ICRM-S-10.
- [5] C.S. Kim, G.M. Sun, J.Y. Lee, S.H. Byun, M.S. Kim, Y.D. Bae and H.D. Choi, Sae Mulli 37 (1997) 399.