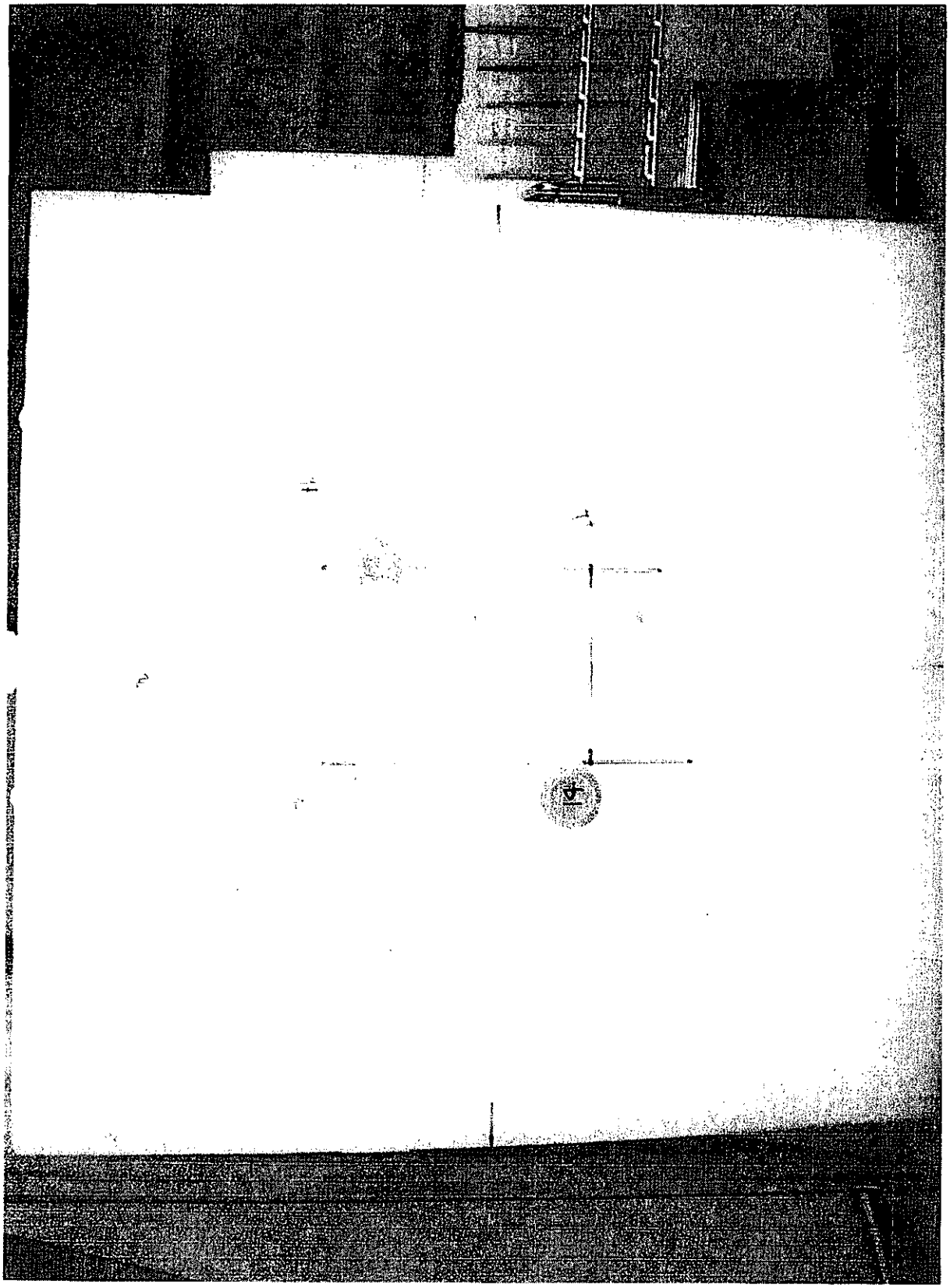
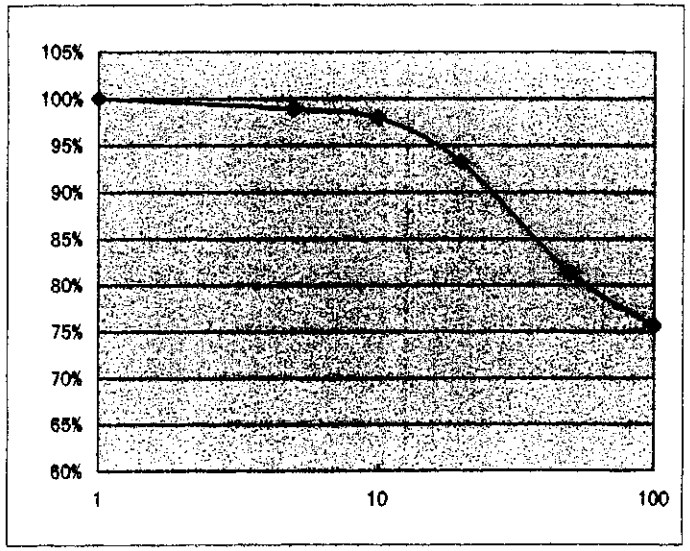
No.	Sample	Measuremen	Note	Stone type	GR(m)
1	Motoyasu Brige. Railing	Eu, Cl		granite	146
2	Shirakami Shrince Fence	Eu, Cl		granite	496
3	Kyodenji Temple	Eu, Cl		granite	548
4	Myochoji Temple 7	Eu, Cl		granite	654
5	Old Prefectural office	Eu, Cl		granite	881
6	Enryuuji Temple 5-1	Eu, Cl		granite	912
7	Shingyoji Temple 1	Eu, Cl		granite	927
8	City Office pavement	Eu, Cl		granite	1016
9	Kozenji Temple 6-1	Eu, Cl		granite	1163
10	Senngyoji temple	Eu, Cl	Iyo stone	granite	
11	Kannonji Temple	Eu, Cl		granite	
12	Senzoubo	Cl	iyo or Oshima stone	granite	8790
13	Senzoubo	Cl	local stone	granite	8790
14	Senzoubo	Eu, Cl	local stone	granite	8790
15	Myokenji Temple	Eu, Cl	local stone	granite	7610
16	Myokenji Temple	Cl	local stone	granite	7610
17	Kikkawa Ryokan	Eu, Cl		granite	1411
18	Surface core of Old Faculty of Hiroshima University (E-building)	Eu, Cl	0cm-5cm depth	granite	1374
	Deeper core of Old Faculty of Hiroshima University (E-building)	Eu, Cl	5cm-15cm depth	granite	1374

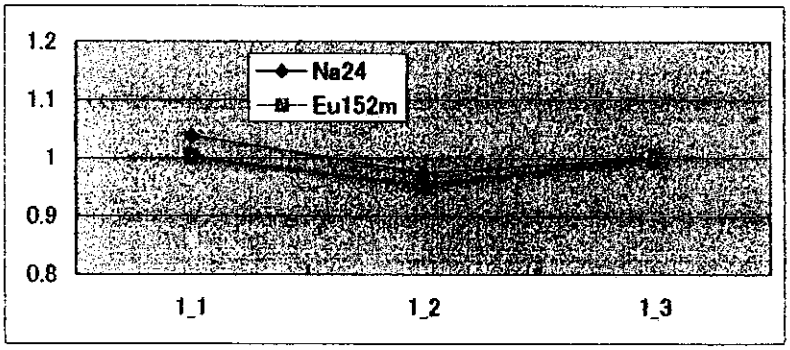


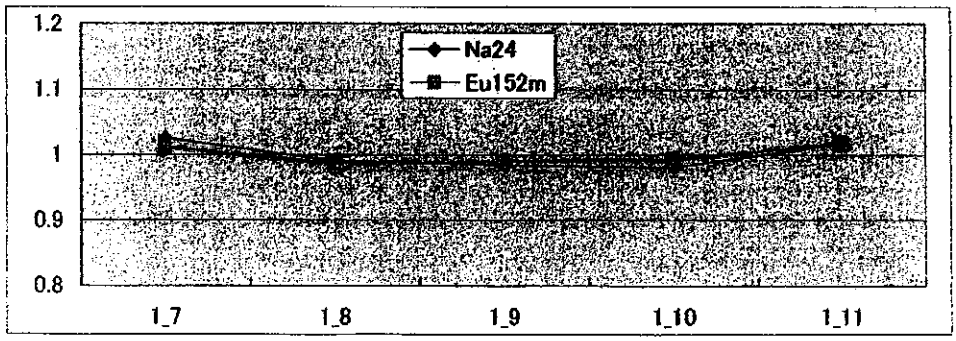
自己遮蔽係数評価実験

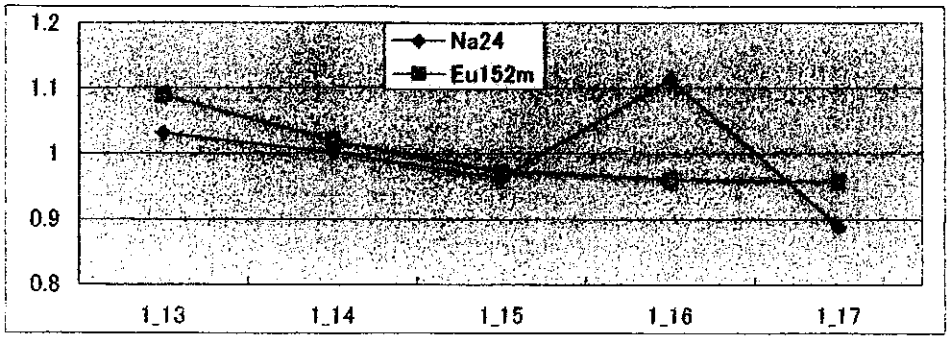
厚さ	質量(mg)	Irr. start	irr time	Mes time	CPS	Net	±	放射能 Activity	飽和放射能 [Bq/g]	[n/cm2/s]	Fluence [n/cm2]	
1	0.46	2002/7/2 18:53	48,000	10000	2.5	25323	192	1.83E+01	3.07E+05	1.02E+06	4.88E+10	100%
5	2.65	2002/7/2 18:53	48,000	1600	14.7	23509	166	1.05E+02	3.03E+05	1.01E+06	4.83E+10	99%
10	6.51	2002/7/2 18:53	48,000	1110	35.9	39851	215	2.56E+02	3.00E+05	9.96E+05	4.78E+10	98%
20	9.58	2002/7/2 18:53	48,000	400	50.4	20172	157	3.59E+02	2.86E+05	9.49E+05	4.55E+10	93%
50	24.42	2002/7/2 18:53	48,000	200	112.2	22448	164	7.99E+02	2.49E+05	8.27E+05	3.97E+10	81%
100	50.58	2002/7/2 18:53	48,000	100	216.3	21627	157	1.54E+03	2.32E+05	7.69E+05	3.69E+10	76%

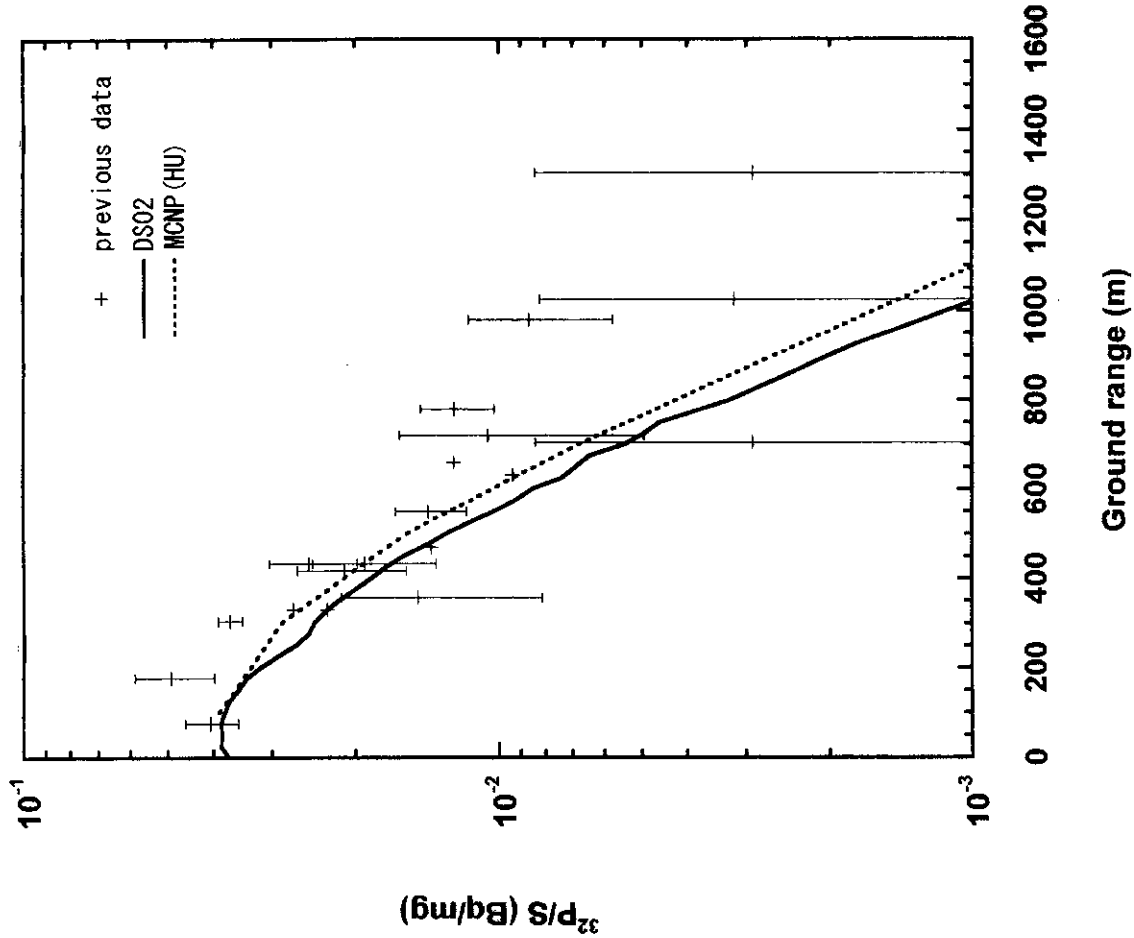


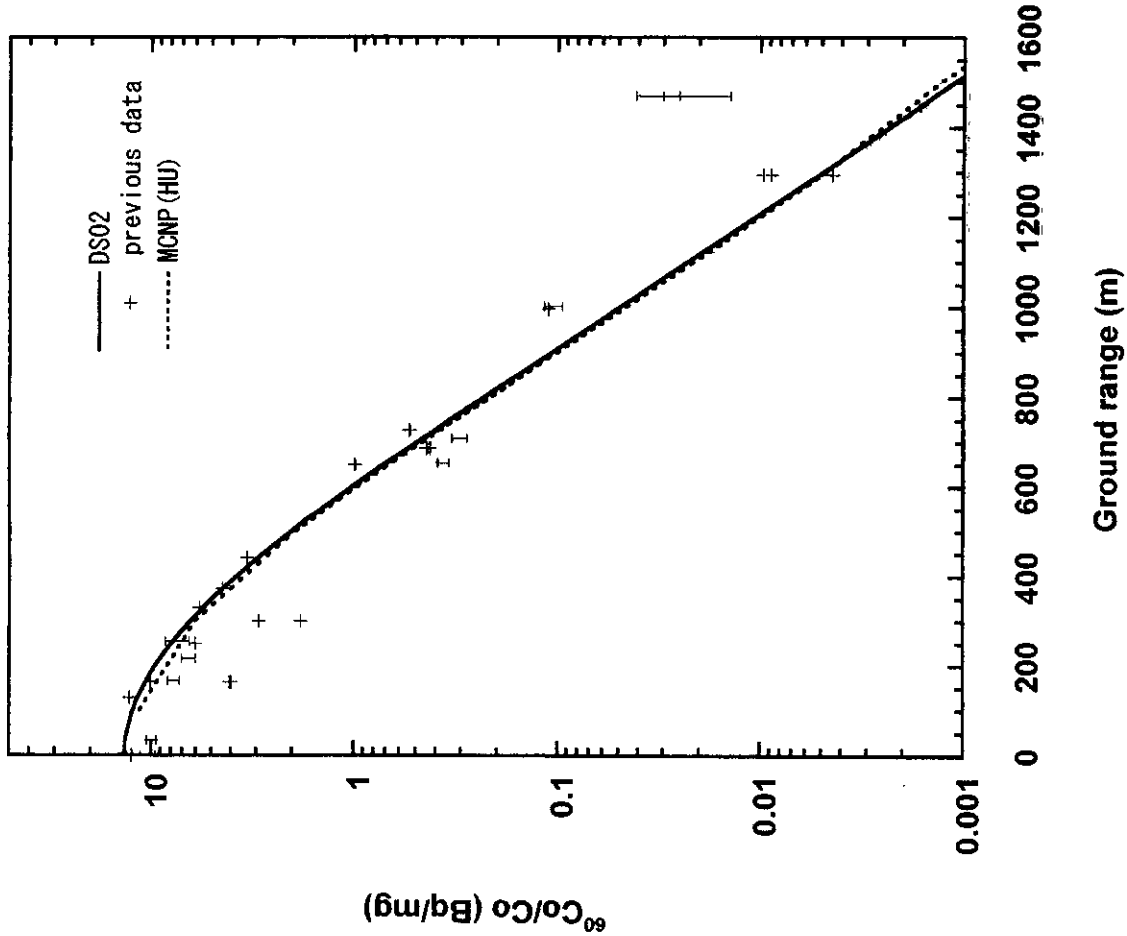
No.	Activity						Fluence (Au-Equivalent)		R_{Cd}
	^{152m}Eu	% err	Ratio	^{24}Na	% err	Ratio	Φ_{th}	Φ_{epi}	
①－1	3043	0.29	1.02	46.3	1.40	1.03	3.27E+11	6.73E+10	5.86
①－2	2896	0.16	0.97	43.4	0.70	0.97			
①－3	3039	0.56	1.02	44.6	2.03	1.00			
①－4	-	-	-	-	-	-			
①－5	-	-	-	-	-	-			
①－7	3119	0.33	1.01	46.7	1.63	1.03	3.44E+11	7.07E+10	5.86
①－8	3043	0.35	0.99	45.2	1.67	0.99			
①－9	3049	0.38	0.99	44.8	1.73	0.98			
①－10	3062	0.39	0.99	44.7	1.75	0.98			
①－11	3136	0.21	1.02	46.4	0.86	1.02			
①－13	326.8	1.13	1.09	4.17	5.34	1.03	4.17E+10	1.57E+11	1.27
①－14	305.8	1.20	1.02	4.05	5.28	1.00			
①－15	291.6	1.37	0.97	3.89	5.76	0.96			
①－16	288.3	1.60	0.96	4.51	6.77	1.11			
①－17	277.8	0.88	0.96	3.14	3.04	0.89			

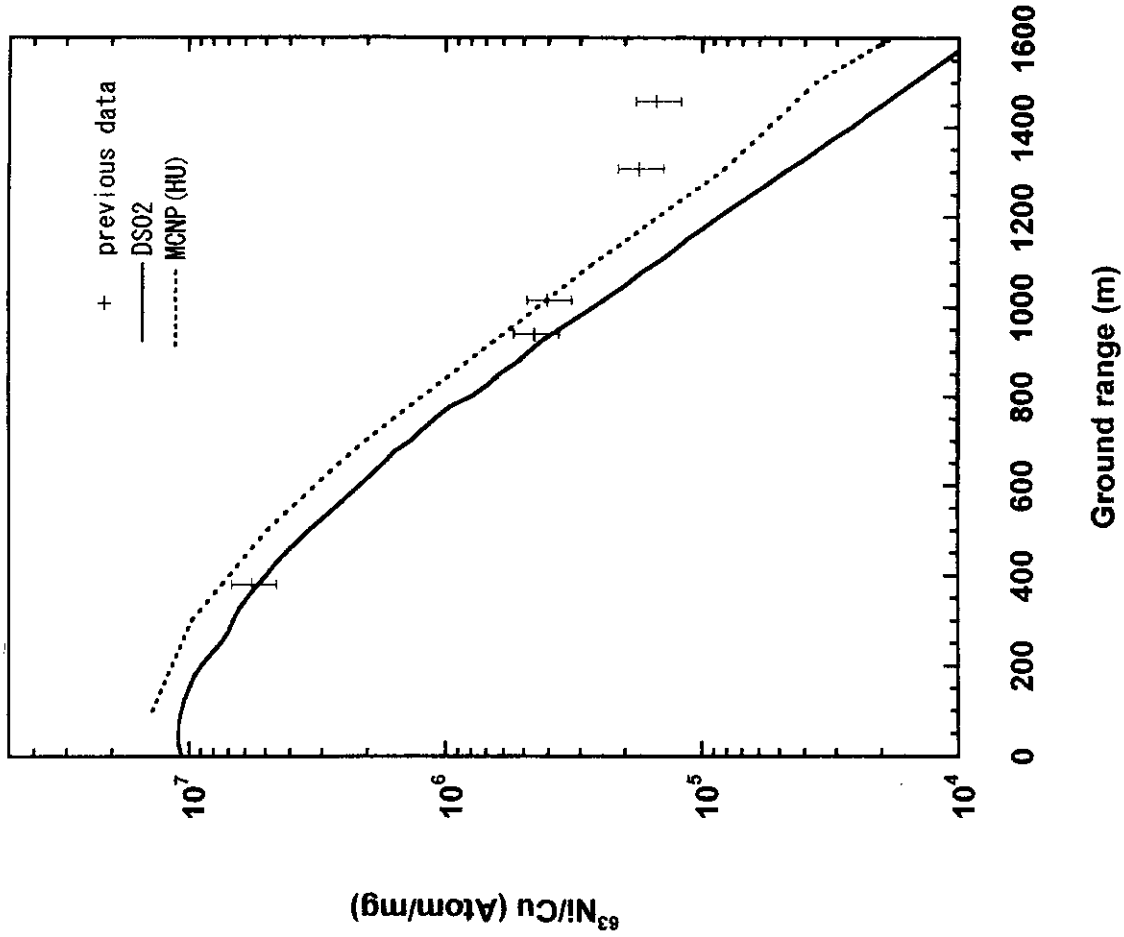







+ previous data
DSO2
MCNP (HU)
$^{32}P/S$ (Bq/mg)
10^{-1}
10^{-2}
10^{-3}
0
200
400
600
800
1000
1200
1400
1600
Ground range (m)


DS02
previous data
MCNP (HU)
10
1
0.1
0.01
0.001
0
200
400
600
800
1000
1200
1400
1600
Ground range (m)
60Co/Co (Bq/mg)


+ previous data
DSO2
MCNP(HU)
^{63}Ni/Cu (Atom/mg)
10^7
10^6
10^5
10^4
0
200
400
600
800
1000
1200
1400
1600
Ground range (m)

Background gamma-rays ··· 330-352 keV

◆ Actinium-series

($^{235}U \rightarrow \cdots {}^{227}Ac \rightarrow {}^{227}Th \rightarrow {}^{223}Ra \rightarrow \cdots {}^{211}Bi \rightarrow {}^{207}Tl \rightarrow {}^{207}Pb$)

21.7y 18d 14d

	Energy(keV)	Intensity(%)
^{227}Th	329.9	2.4
	334.5	0.98
	342.5	0.35
	350.5	0.11
^{223}Ra	323.9	3.7
	328.5	0.2
	338.3	2.5
	342.9	0.2
^{211}Bi	351.0	12.7

◆ Thorium series

($^{232}Th \rightarrow \cdots {}^{228}Ac \rightarrow {}^{228}Th \rightarrow {}^{224}Ra \rightarrow$)

6.1h 1.9y

	Energy(keV)	Intensity(%)
^{228}Ac	328.0	3.66
	338.4	12.0
	340.9	0.42

◆ Uranium-series

	Energy(keV)	Intensity(%)
^{214}Pb	351.9	37.1

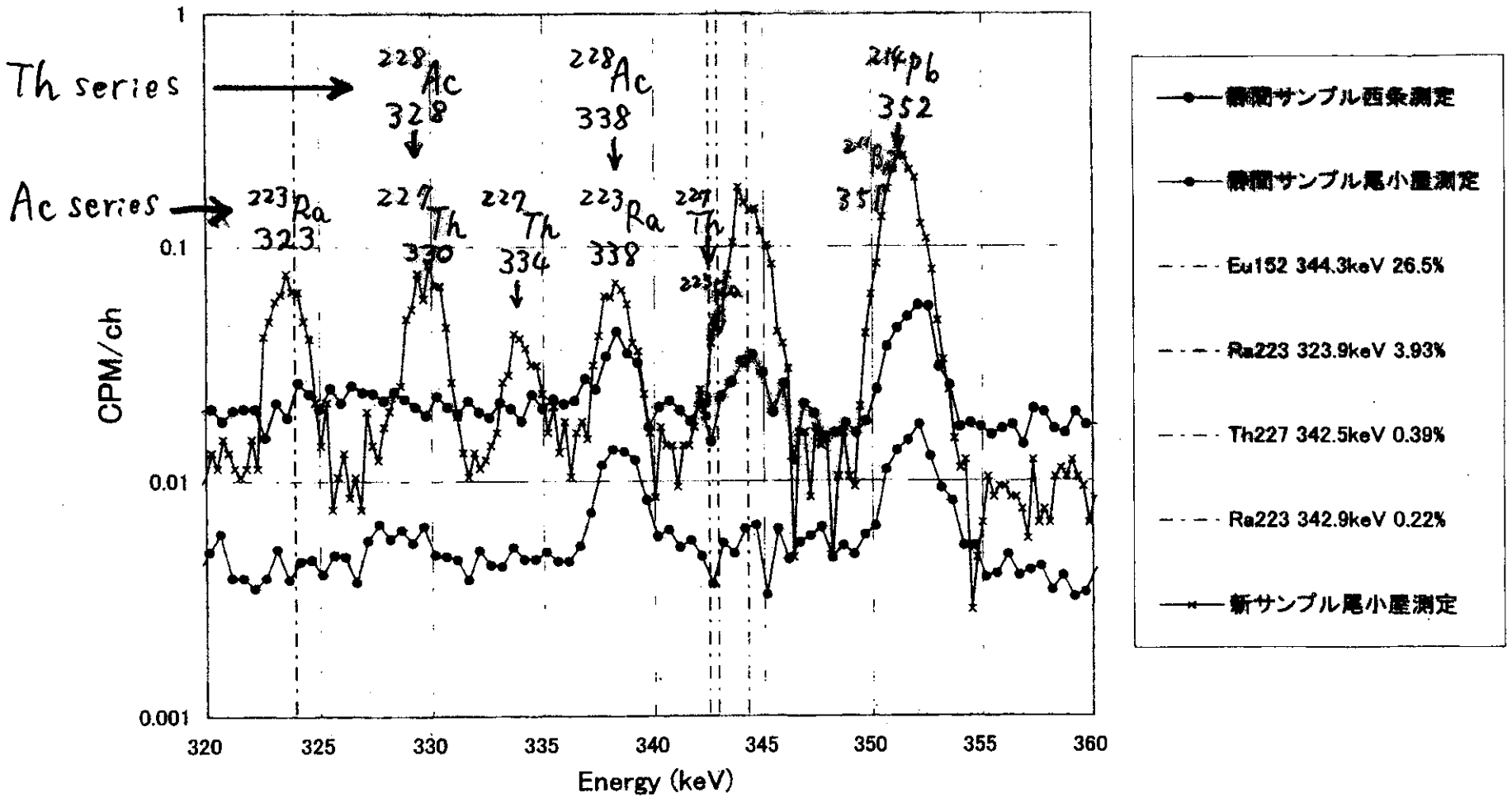


Fig.4 広島Eu： 妙頂寺 GR654m #4

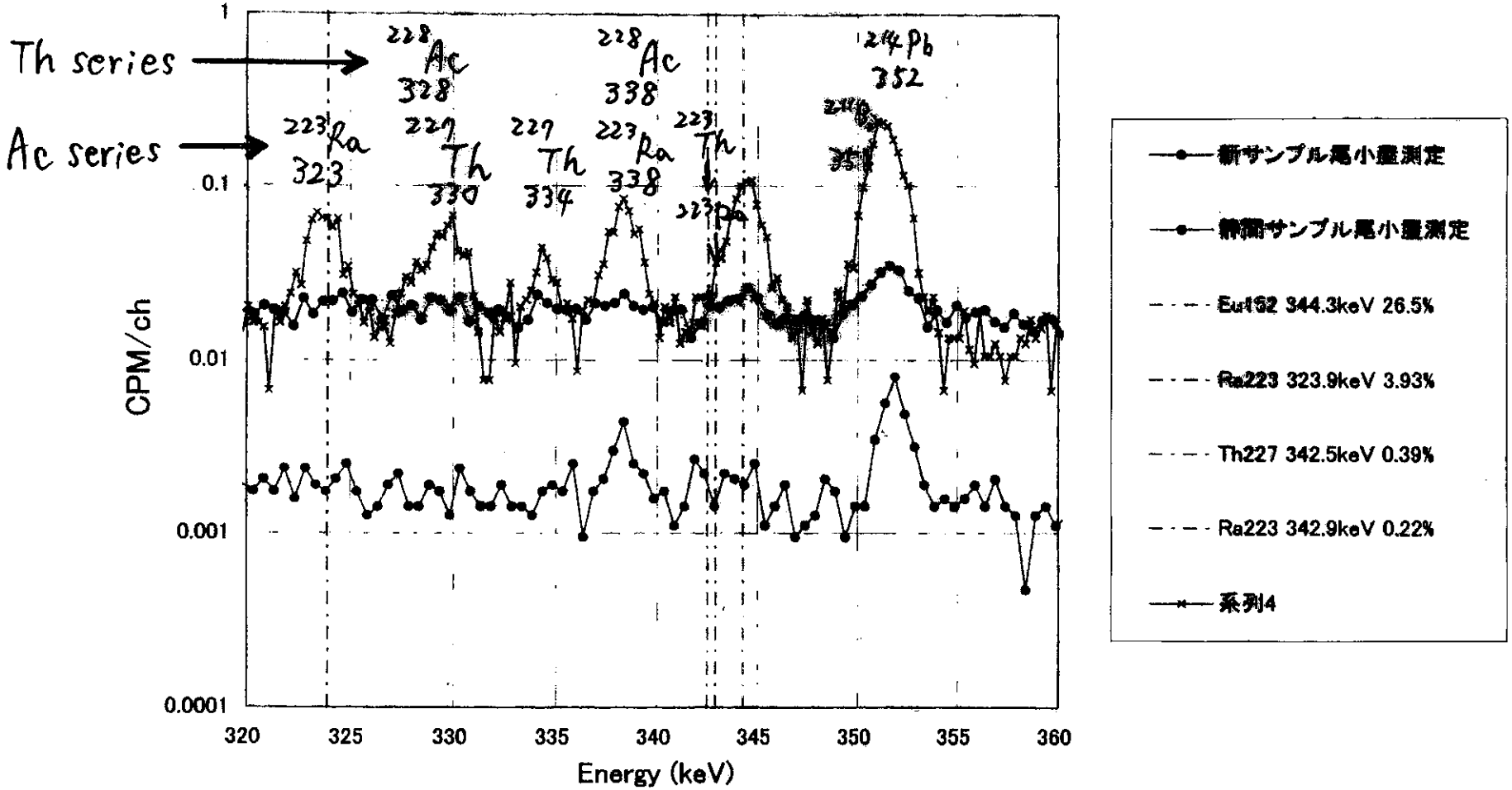


Fig.5 広島Eu：県庁 GR881m

#5

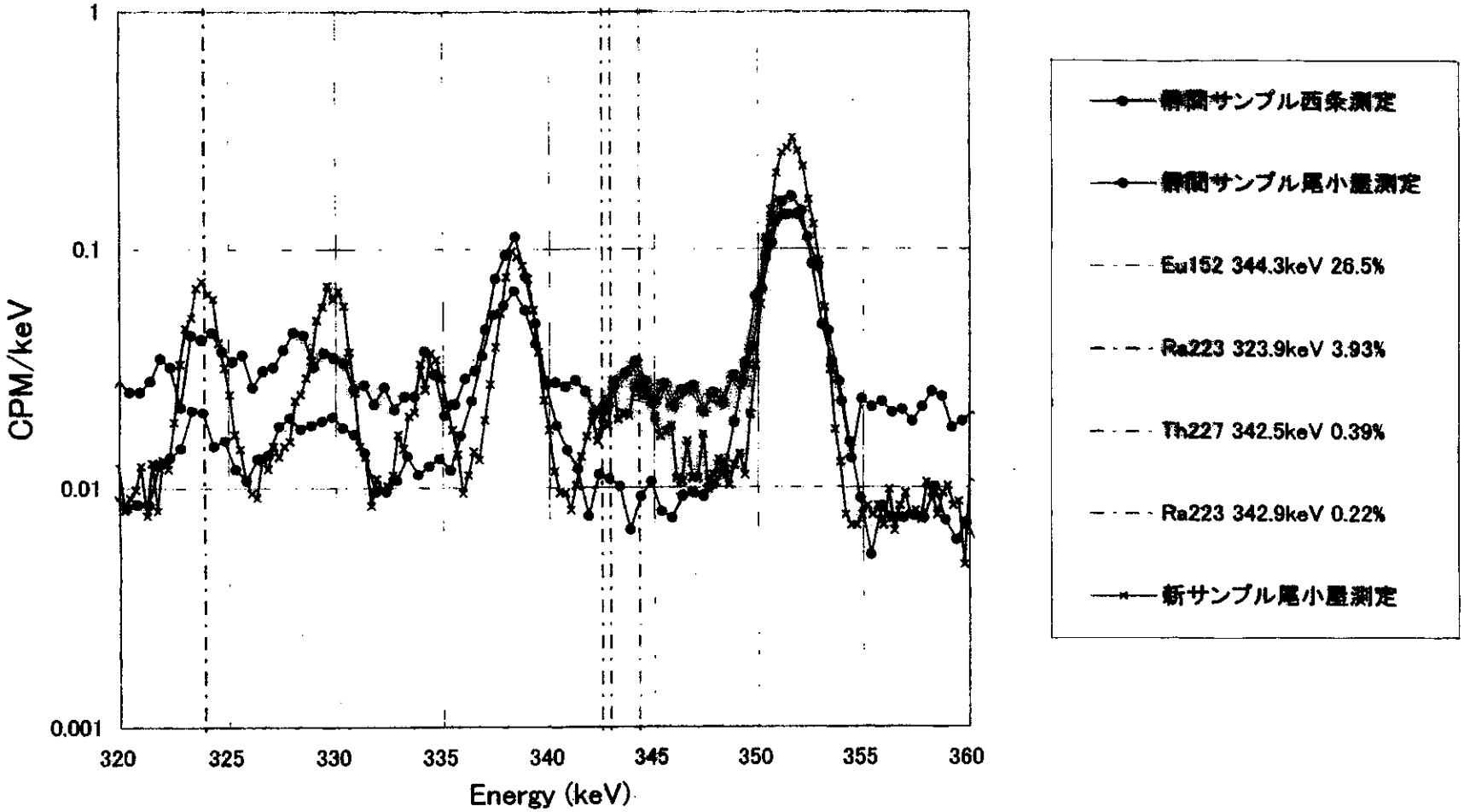


Fig.6 広島Eu：円隆寺 GR912m

#6

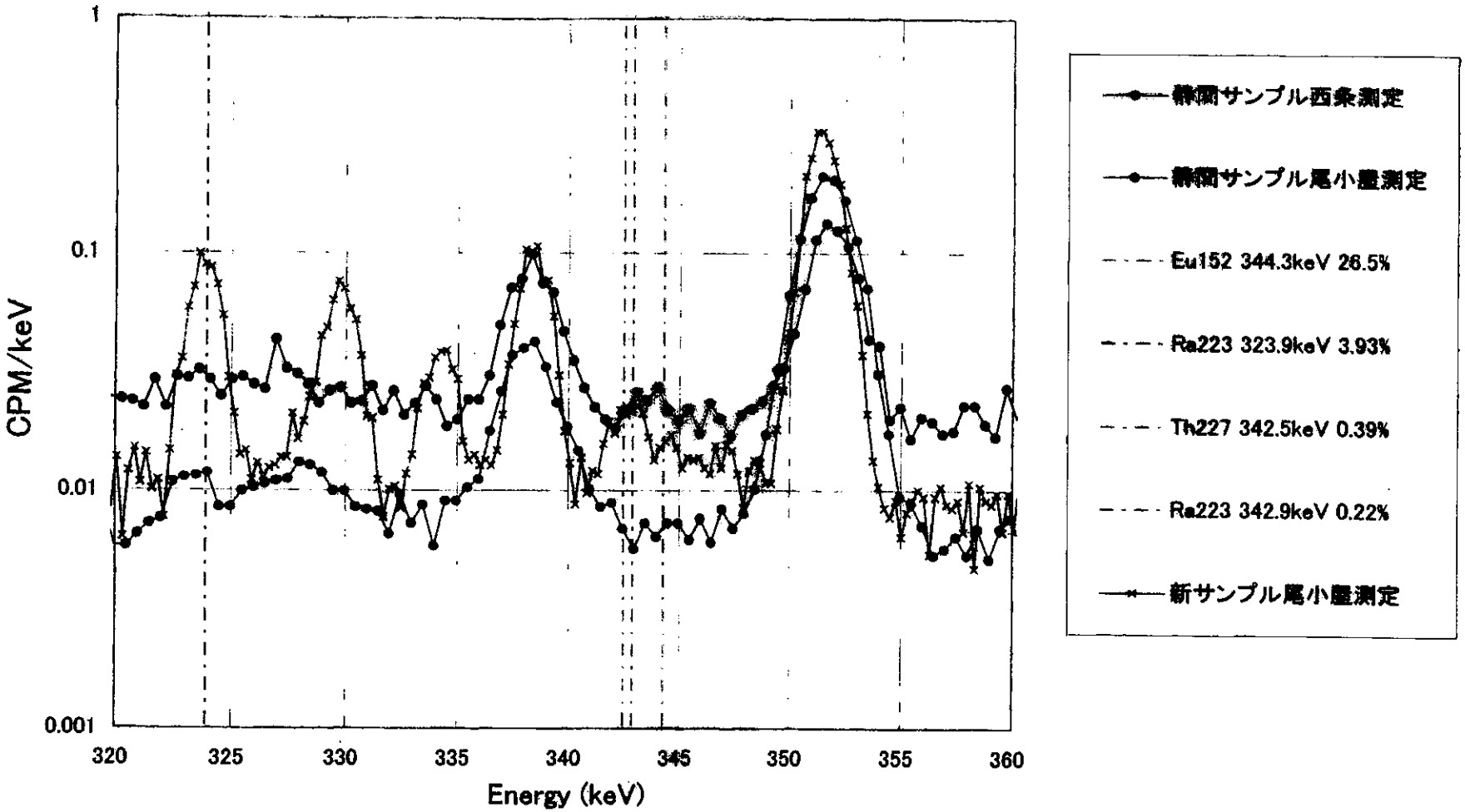


Fig.9 広島Eu：興禅寺 GR1163m #9

◆ Error estimation

N (net) = G (gross) − B (backgrond)

$$\sigma_n = \sqrt{\sigma_g^2 + \sigma_b^2}, \quad \sigma_g = \sqrt{G}, \quad \sigma_b = \sqrt{B}$$

when G ≈ B,

$$\sigma_n = \sqrt{\sigma_g^2 + \sigma_b^2} = \sqrt{G + B} \approx \sqrt{2G}$$

◆ L_c (Critical level)

$$L_c = 1.645\sigma_n = 2.33\sqrt{G}$$

◆ MDC (Minimum Detectable Concentration)

$$\text{MDC} \approx \frac{2L_c}{K \cdot T}$$ (K: Counting Efficiency, T: time)

◆ # 9 spectrum (Dr. Komura's measurement)

[^{152}Eu 344 keV reagion]

- Gross counts : 1122 counts
- Net counts : 111 counts

$\sigma_n \approx \sqrt{2G}$ = 47 (counting error)

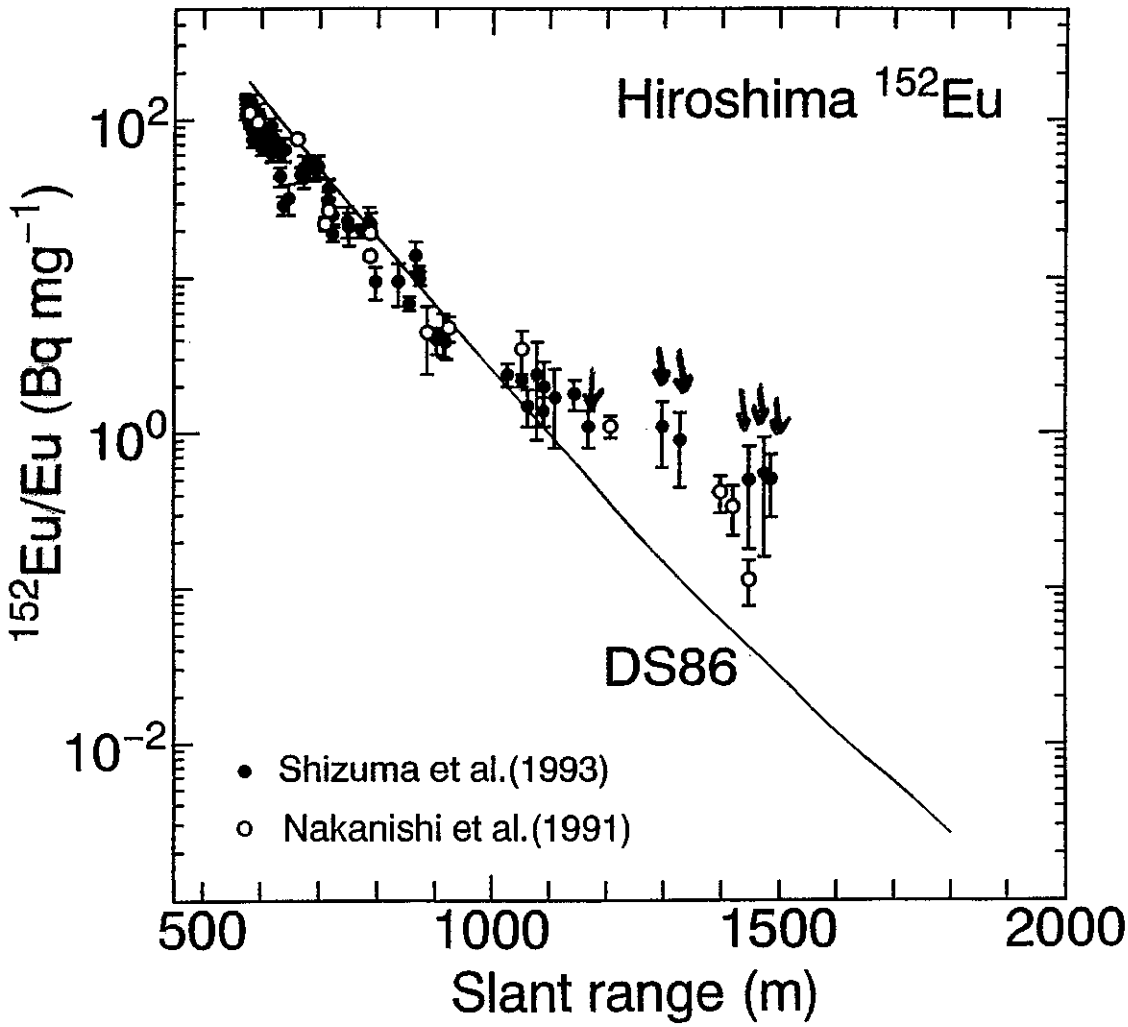
$L_c = 2.33\sqrt{G}$ = 110

Ratio : Net/L_c = 111/110 ≈ 1.01

Detection limit of ^{152}Eu in Nagasaki and Hiroshima

Sample No.	Place	Slant range (m)	Measurement Date	Measurement time(s)	Peak counts (344keV) N_0	Peak counts (344keV) n_0(cps)	Background N_b	Background σ	n^* (cps)	$n_0 : n^*$
Hiroshima										
1	Shima hospital	579	910117	81130	254±20	3.13x10-3	50	7	1.23x10-4	25.4
45	Naka telepfone office	774	901114	139970	263±28	1.87x10-3	250	16	1.60x10-4	11.7
52	myochgoji	873	900926	378200	175±27	4.63x10-4	260	16	6.0x10-5	7.7
60	Enryuji	1081	910227	220400	31±18	9.53x10-5	270	16	4.2x10-5	1.34
62	Shingyoji	1093	910110	308300	37±17	1.20x10-4	150	12	9.06x10-5	1.32
63	Teramachi stone wall	1112	910114	200240	35±19	1.74x10-4	120	11	1.27x10-4	1.37
65	City Hall	1171	910221	218740	26±19	1.18x10-4	150	12	1.27x10-4	0.93
66	Kozenji	1299	910702	550680	31±18	3.40x10-4	300	17	7.19x10-5	0.47
68	Primary school	1450	901119	425730	24±17	5.64x10-5	300	17	5.8x10-5	0.98
70	Communication Hospital	1488	9107222	747820	62±40	8.29x10-5	1100	33	1.03x10-4	0.81
Control	Comercial high school	2928	000713	1270310	-	-	700	27	2.9x10-5	-
Nagsaki										
NM1	Yana bridge	594	990908	515690	465±32	9.02x10-4	325	18	4.94x10-5	18.6
NM2	Ukrakami church	677	940906	670720	127±27	1.89x10-4	380	19	4.11x10-5	4.6
NM4	Gokoku shrineB	815	991026	1178360	285±59	2.42x10-4	725	27	3.23x10-5	7.5
NM6	Nanzan school	850	990922	1717590	119±34	6.93x10-5	985	31	2.58x10-5	2.7
NM10	sakamoto-cho	1142	940314	779480	37±9	4.75x10-4	300	17	3.14x10-5	1.5
NM11	Maruomachi	2889	990601	895430	-	-	664	26	4.06x10-5	-

n* : Detectable minimum counting rate $n^* = 2.33\sigma_b/T$


Hiroshima ^{152}Eu
10^2
10^0
10^{-2}
^{152}Eu/Eu (Bq mg^{-1})
DS86
Shizuma et al.(1993)
Nakanishi et al.(1991)
500
1000
1500
2000
Slant range (m)

^{63}Ni Measurements of Hiroshima Copper Samples

T. Shibata

Joint Meeting of U.S.-Japan Working Group
on Reassessment of A-Bomb Dosimetry
Hiroshima, Japan
September 11-12, 2002

Previous Result

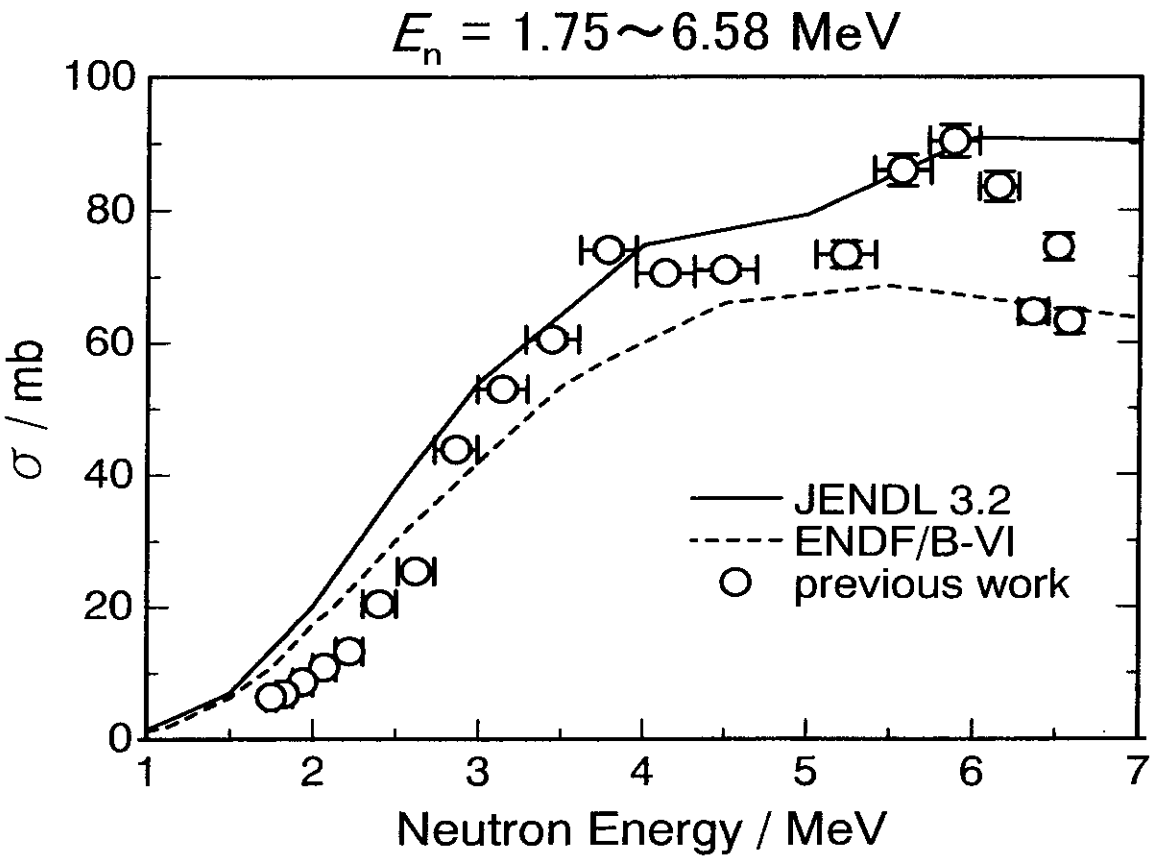


Fig. Excitation function of $^{63}Cu(n,p)^{63}Ni$.

Previous Results

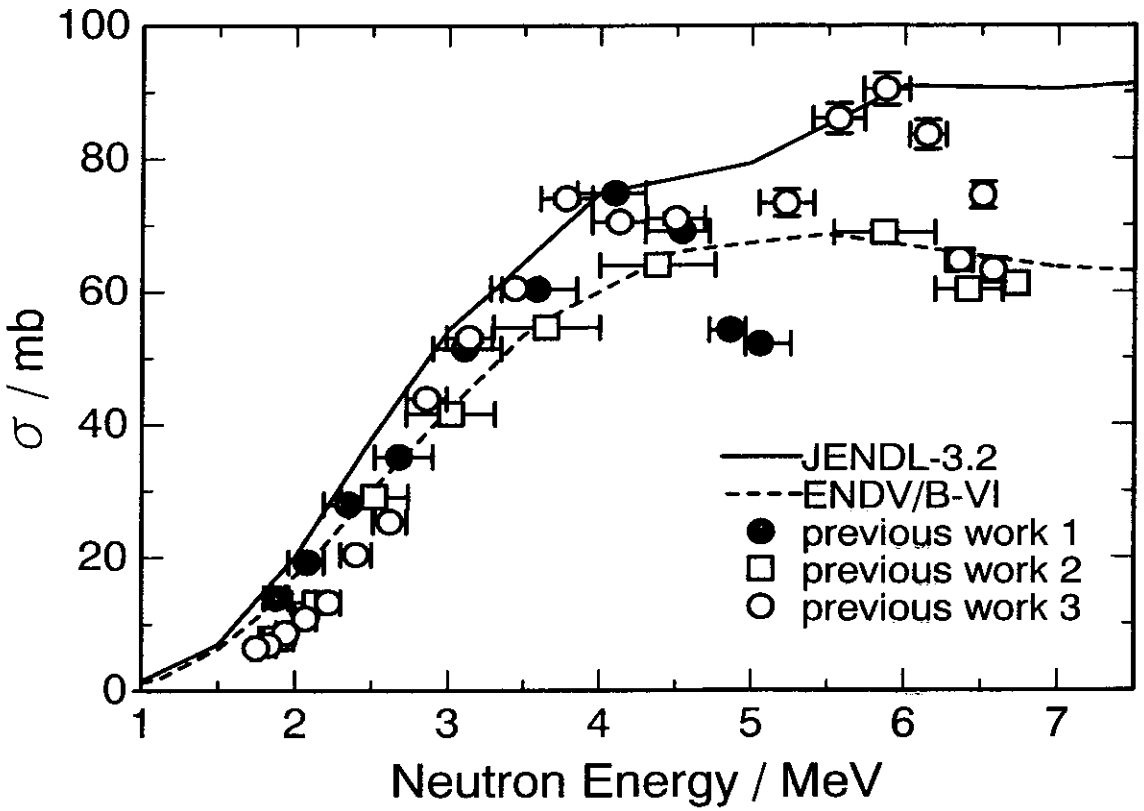
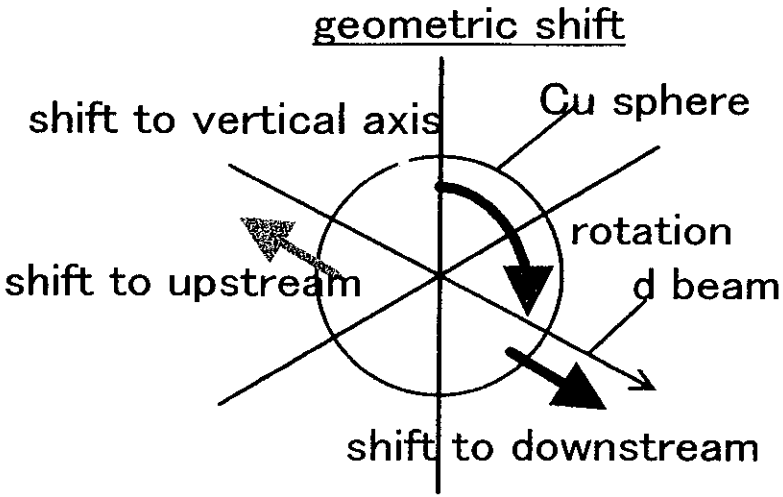
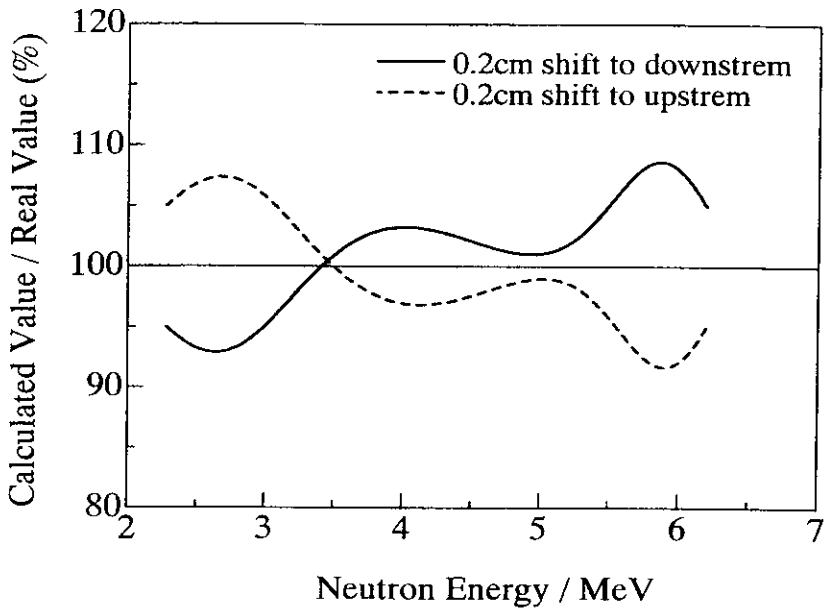


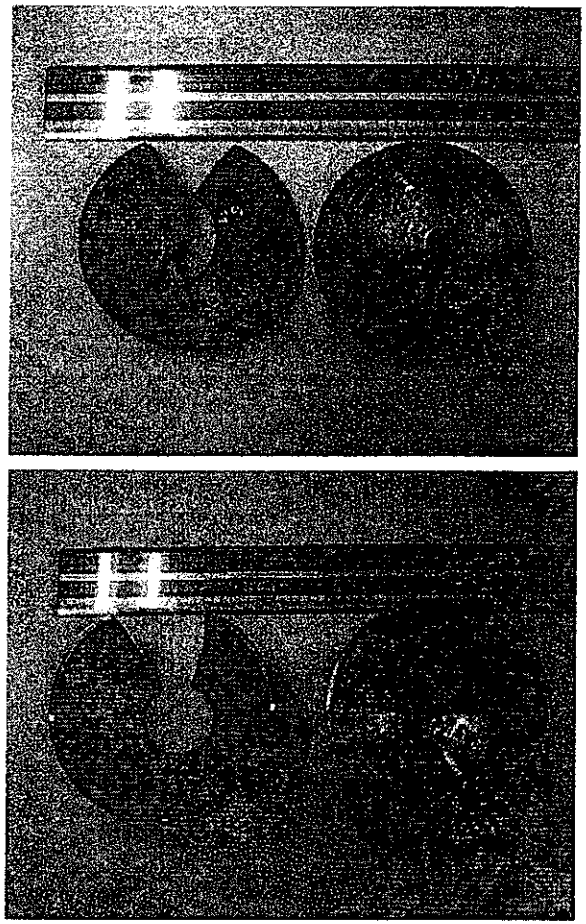
Fig. Excitation function of $^{63}Cu(n,p)^{63}Ni$.

Previous Result





Recent Experiment [Cu target]



◇ Cu hollow sphere target

⇒ external diameter: 11 cm
(before → 8 cm, 5 cm)
⇒ thickness: 0.3 cm
⇒ divided into 21 parts (7.5°)

◇ beam monitor

⇒ 4 Ni foils (both sides)
$^{58}Ni(n,p)^{58}Co$