

Thermal Neutron Measurement using the Instrumented Test Bundle and Assessment of Maximum Linear Power in HANARO

AECL NRU U₃Si - Al . AECL
 (108kW/m)
 SPND(Self Powered Neutron Detector)가 IR2
 HANAFMS(HANARO Fuel Management System)가
 가 가 , HANAFMS SPND
 11%
 120KW/m 가 .

Abstract

The HANARO fuel, U₃Si - Al, has been developed by AECL and tested in NRU reactor. Due to the lack of the data performed under the high power, the repetitive conduct of the irradiation test was required under the power greater than 108kW/m, which is the estimated maximum linear power in the design stage. Accordingly, the instrumented test bundle with SPND(Self Powered Neutron Detector) was fabricated and its irradiation test was performed in IR2 of HANARO. The measured thermal neutron flux with SPND is compared with calculation results by HANAFMS(HANARO Fuel Management System). The difference in the measured and calculated thermal flux values are below $\pm 11\%$ and the accuracy of the linear power predicted by HANAFMS is consequently accompanied. Therefore, it is believed that the maximum linear power above 120kW/m is achieved during the irradiation test of the test bundle.

1.

AECL (Comminuted Process) NRU

[1]. AECL

가 , 가 80% 24MW
가 [2]. 가 AECL
112.8kW/m 가
SPND(Self Powered Neutron Detector)

121.6kW/m ,
SPND

가 가 [3].
HANAFMS(HANARO Fuel Management System)

SPND SPND HANAFMS

120kW/m

2.

1

36

34 mm, 27 mm, 5 m

36

6

SPND, SPGD(Self Powered Gamma Detector) hollow tube

SPND SPGD

. SPND rhodium , SPGD platinum . SPND SPGD가
instrument tube hollow tube , wire guide
instrument tube 3 가

2

3 SPND

1

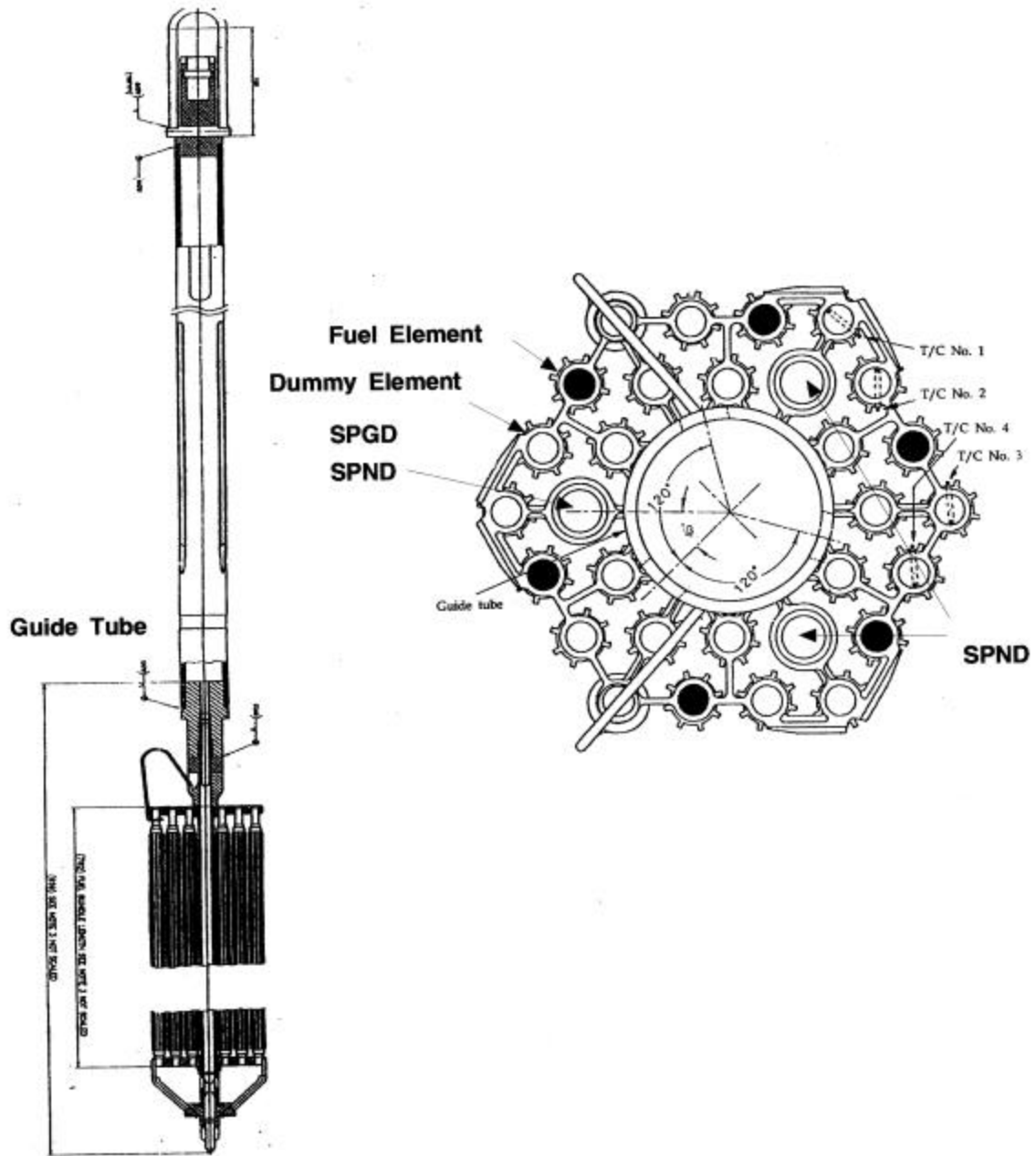
SPND(가) SPGD()가 1

SPND SPGD

, 4

K-Type T/C(Thermo Couple)

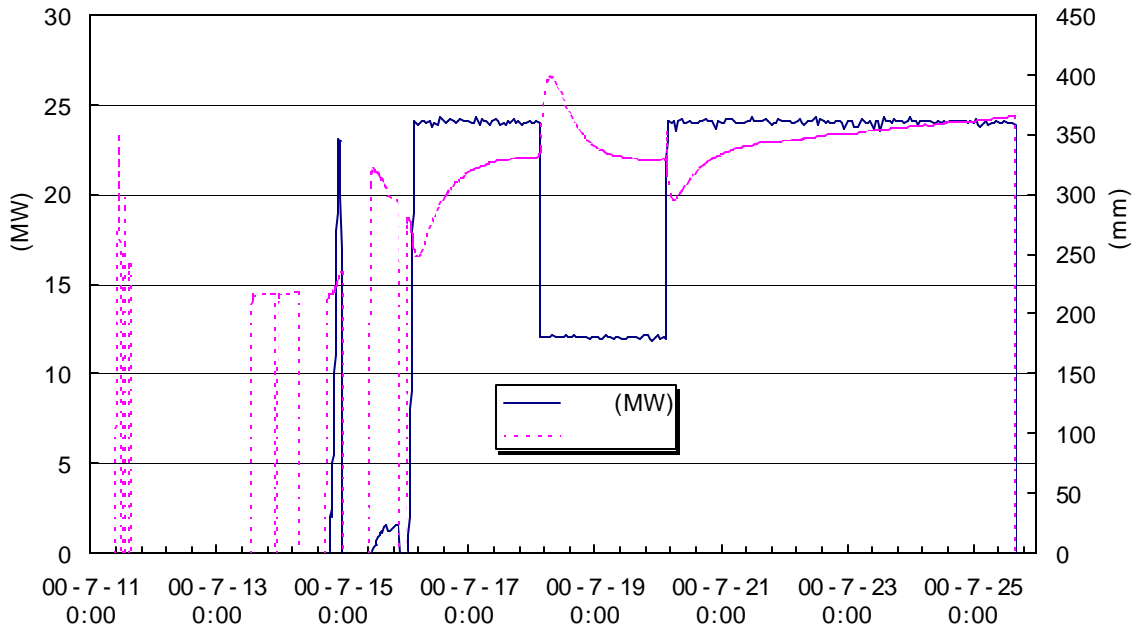
34 mm SS304 tube



3.

3.1

8-1-1 BOC 36 IR2 20, 18 가 12 가
 26%U-235 24MW
 Xe 12MW 2 24MW
 24 MW 8.71
 2 가
 SPND 5
 HANAFMS Xe Xe 가
 가
 Xe 가

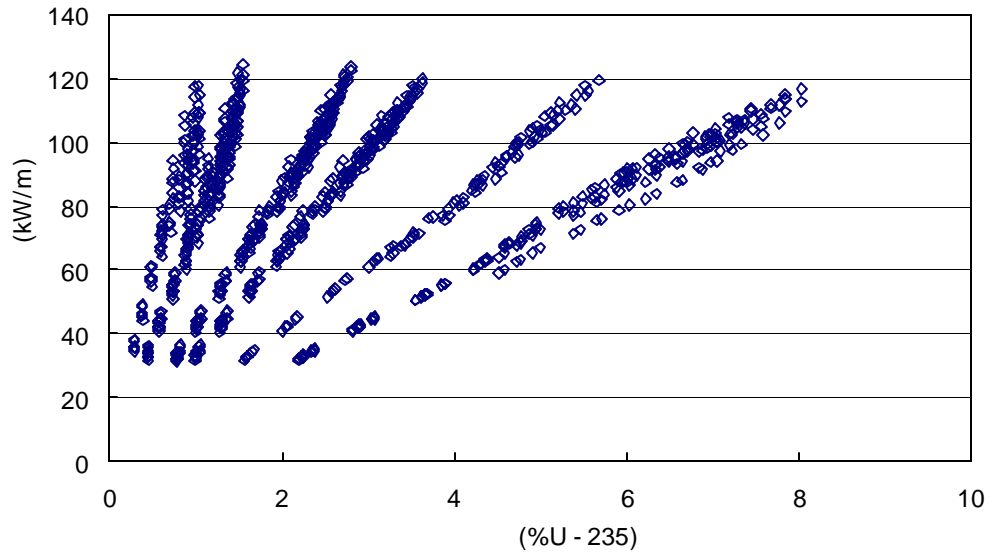


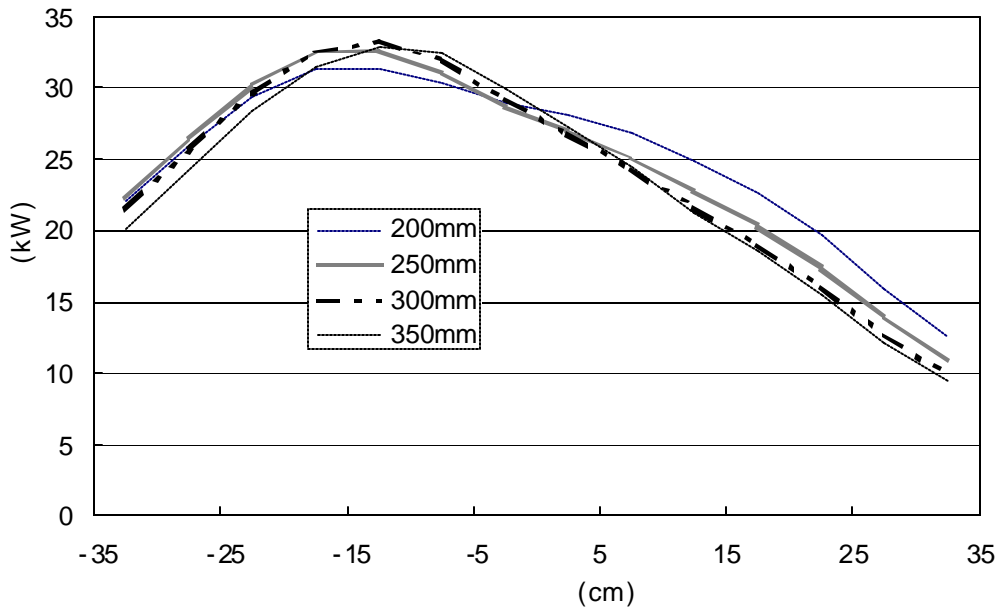
2 8 - 1 - 1

3.2

5cm
 3
 HANAFMS
 가
 가

4 Xe HANAFMS
 5cm
 가 300mm 300mm 300mm
 10cm 가 300mm
 가 250mm Xe 가
 350mm 가
 366mm
 HANAFMS 1 24MW 2.16
 가 250mm 350mm 가 120kW/m 가





4

1 HANAFMS

FPD (24MW Full Power Day)	(mm)	(kW/m)	
0.0	250	117.7	2, -10cm ~ -15cm
0.65 (No-Xe)	300	119.6	2, -10cm ~ -15cm
0.65 (Eq-Xe)		124.4	2, -10cm ~ -15cm
2.16	300	123.7	2, -10cm ~ -15cm
	350	122.6	2, -10cm ~ -15cm
3.17	300	119.8	2, -10cm ~ -15cm
	350	118.7	2, -10cm ~ -15cm
5.74	350	119.4	2, -10cm ~ -15cm
8.71	350	116.6	2, -10cm ~ -15cm
	400	113.8	2, -5cm ~ -10cm

3.3

SPND

SPND가

HANAFMS

HANAFMS

가

SPND가

SPND Rh

0.07cm Rh (depression)

(0.0253 eV 146.6 barn)

HANAFMS

SPND Rh
HANAFMS

7 SPND

3 SPND

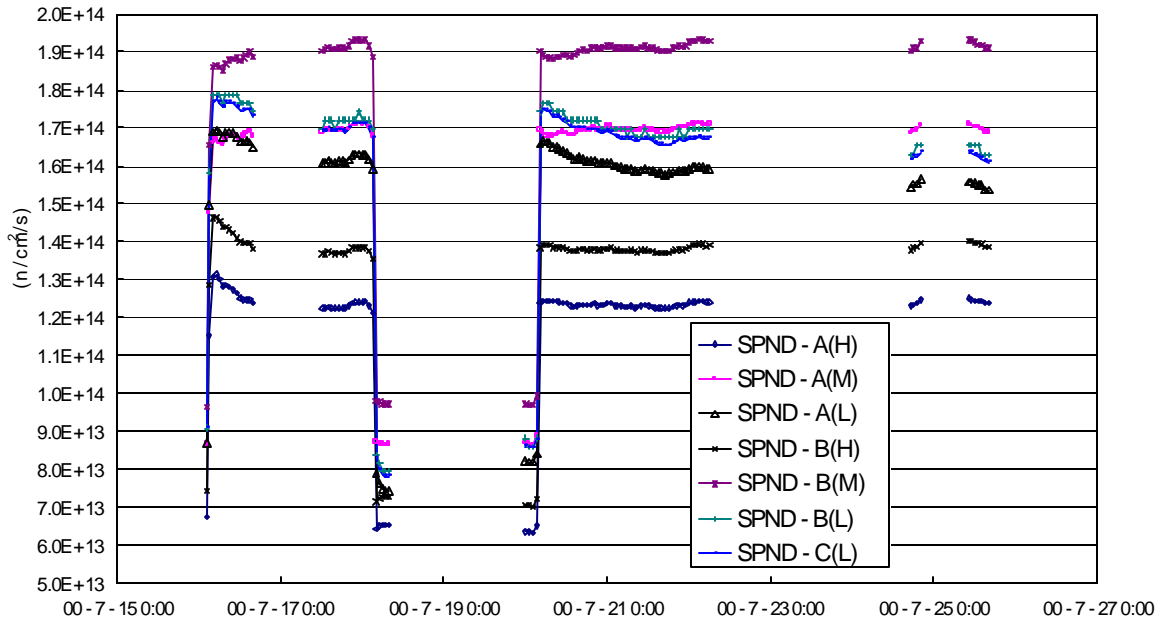
11%

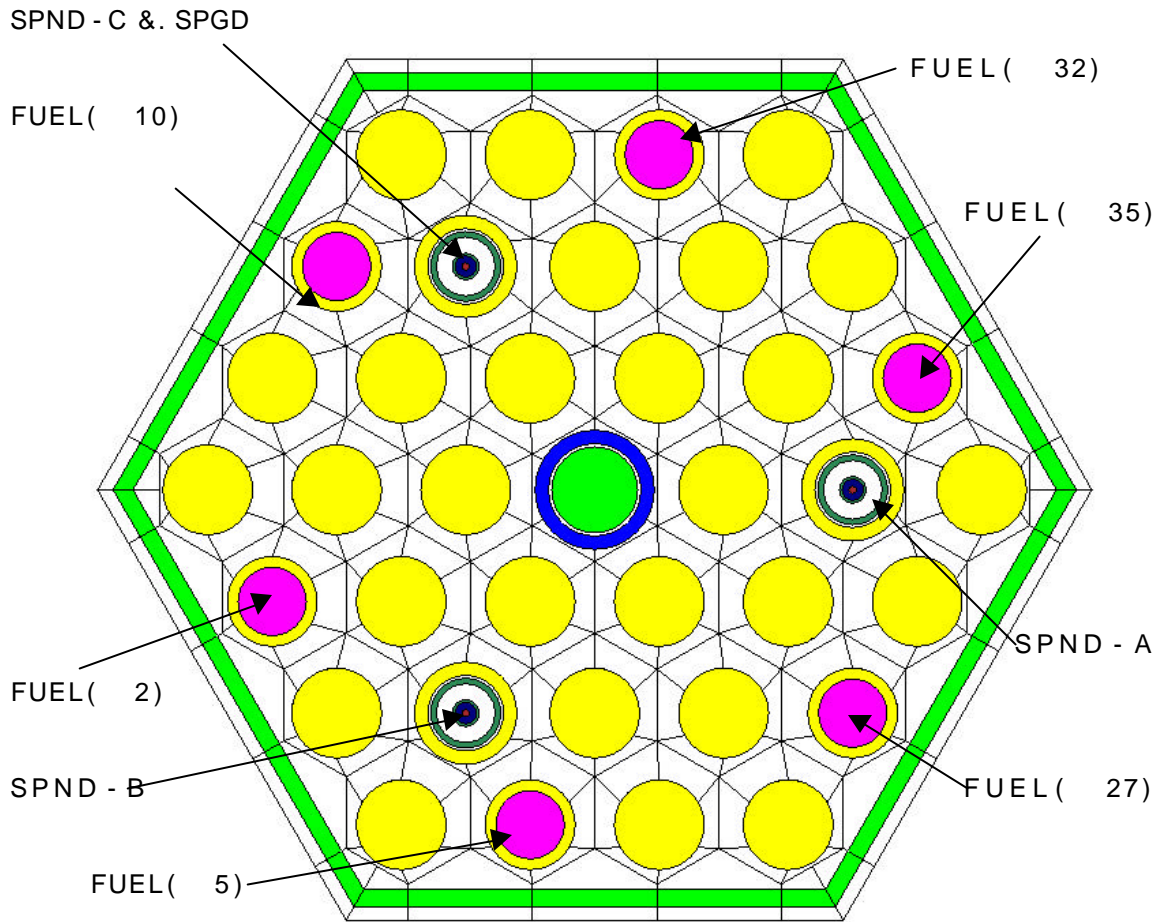
SPND - B

SPND

가

5%





6. HANAFMS

HELIOS

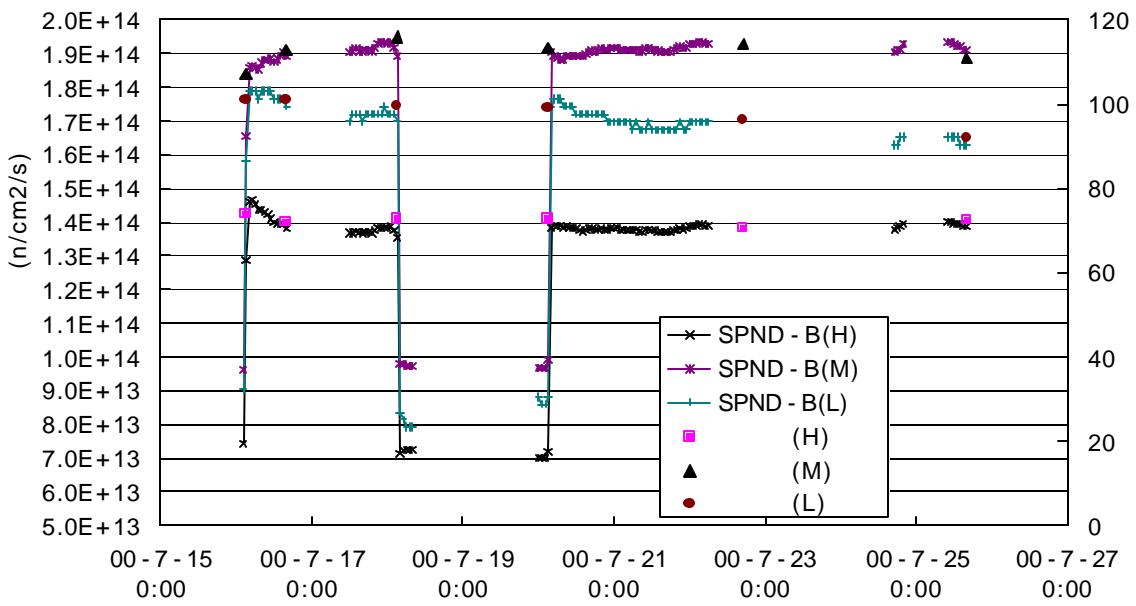
2 HELIOS	SPND Rh	HANAFMS	
(MWD/MTU)			
0(No-Xe)		0.98763	0.71634
0(Eq-Xe)		0.98764	0.71641
50		0.98764	0.71641
150		0.98763	0.71641
250		0.98763	0.71641
350		0.98764	0.71640

3 HANAFMS

(FPD)		($\times 10^{14} \text{nv}$)			(-) / $\times 100$ (%)			
3.36	300mm	SPND-A	H	1.24	1.21	-4.62		
			M	1.68	1.66	-1.20		
			L	1.65	1.60	-2.15		
		SPND-B	H	1.38	1.25	-9.86		
			M	1.88	1.78	-5.43		
			L	1.74	1.74	-0.08		
		SPND-C	L	1.73	1.74	-2.7		
		5.37	350mm	SPND-A	H	1.24	1.20	-3.20
					M	1.71	1.69	-0.94
L	1.60				1.54	-3.47		
SPND-B	H			1.39	1.24	-10.82		
	M			1.93	1.83	-5.26		
	L			1.70	1.68	-0.93		
SPND-C	L			1.67	1.68	0.28		
8.71	366mm			SPND-A	H	1.24	1.22	-0.98
					M	1.69	1.71	3.90
		L	1.54		1.52	2.52		
		SPND-B	H	1.39	1.26	-8.79		
			M	1.91	1.85	-3.24		
			L	1.63	1.66	1.87		
		SPND-C	L	1.61	1.66	-0.37		

3.3

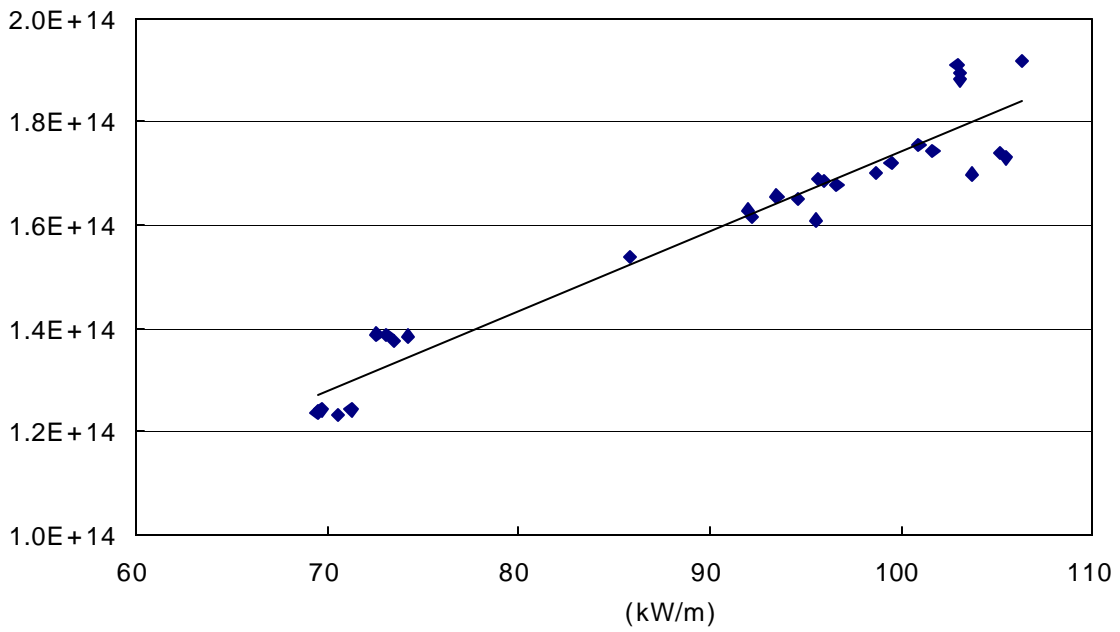
5 SPND (0 m
 -9cm) SPND 가 , (8.5cm 17.5cm)
 (-17.5cm -26.5cm) SPND
 . 7 SPND-B
 HANAFMS 5
 . 7
 . 7 SPND SPND
 8 SPND 가
 . SPND
 HANAFMS



7

SPND-B

5



8 SPND

SPND

HANAFMS

HANAFMS
 가
 , SPND 가
 HANAFMS
 HANAFMS가
 HANAFMS 가
 120kW/m
 γ-flux
 γ-flux

- [1] , “ ”, KAERI/TR-710/96, 5 2 , ,
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- [2] , “ 가 ”, 71231-21, 1995.
- [3] , “ ”, KAERI/TR-1599/2000, ,
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