NEUTRON FLUXES IN EXPERIMENTAL CHANNELS OF WWR-M REACTOR

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There are 13 vertical (VEC) and 17 horizontal (HEC) experimental channels in a berillium reflector of the WWR-M reactor. The central experimental channel (CEC) is equipped with cold and ultracold neutron source (CUS) [1] placed in the center of the core.

500 mm high core is shaped as a hexahedron with diameter of inscribe circle being 570 mm. Fuel assemblies, ampoule devices, experimental channels, lead and beryllium rods, control rods and other devices are placed in 271 cells with triangular pitch of 35 mm.

Neutron fluxes in experimental channels are greatly influenced by the characteristics of core loading. Measurements results of thermal and fast neutron flux density in the VEC and HEC for 807 and 808 digital printout are presented in this paper. Neutron flux densities have been measured by activation of Au, Co and Ni foils [2]. 141 fuel assemblies, CEC with 61 cells in size and irradiation hole (VIC) with 7 cells in size with absorbing screen are installed according to the 807 digital printout. According to 808 digital printout 143 fuel assemblies were loaded and VIC was unloaded. The digital printout and the disposition of experimental channels are presented in Figs.1,2 and 3.

The measured neutron flux densities in VEC and HEC are given in Tables 1 and 2. Errors of measurement of thermal and fast neutron flux density is 5% and 10% respectively. Exit neutron fluxes of neutron guides or collimated beams have an additional unknown error as a result of inaccurate installing foils in the beam; this error may amount to 100% as neutron flux distribution in beam is rather like Gaussian one.

Table 1

Results of measurements in VEC (February 1994)

No. channel	Z cm	807 digital printout			808 digital printout			$\frac{n_{th}v_o(808)}{n_{th}v_o(807)}$
		$n_{th}v_o$	r_{Cd}^{Au}	Φ_1	$n_{th}v_o$	r_{Cd}^{Au}	Φ_1	
V-1	0	3.1	11		8.0	11	7.2	2.6
V-2	0	3.8	7		7.7	6	8.4	2
V-4	10	6.7	10		4.8	8	3.9	0.72
V-5	10	4.5	6		2.9	5	3.9	0.64
V-6	10	4.1	8		3.3	8	2.3	0.8
V-7	10	2.9	8	2.6	3.1	7	2.6	1.07
V-8	10	6.4	9		7.2	9	5.6	1.12
V-9	10	8.0	7	9.1	8.5	6	8.5	1.06
V-12	0	2.5	9		4.2	5		1.7
29-TC	0	0.12	9		0.35	6		2.9
CUS	10	8.7	8		7.4	13		0.86

Z — distance from medial plane of core
$n_{th}v_o$ — thermal neutron flux density
($\times 10^{12}$ n/(cm^2·s· MW))
Φ_1 — fast neutron flux density with energy above 1 MeV
($\times 10^{11}$ n/(cm^2·s·MW))
r_{Cd}^{Au} — cadmium ratio by *Au* foils
$\frac{n_{th}v_o(808)}{n_{th}v_o(807)}$ — thermal neutron flux densities ratio for two digitals printout.

Table 2

Results of measurements in HEC (February 1994)

No. HEC	Place of measurements	$n_{th}v_o$		$\frac{n_{th}v_o(808)}{n_{th}v_o(807)}$
		with VIC (d/p 807)	without VIC (d/p 808)	
3	HEC exit	$1.54 \cdot 10^4$	$6.6 \cdot 10^3$	0.42
4	HEC exit	$8.65 \cdot 10^5$	$6.2 \cdot 10^5$	0.72
4	in sample	$4.7 \cdot 10^3$	$3.6 \cdot 10^3$	0.76
5	HEC exit	$8.7 \cdot 10^6$	$6.7 \cdot 10^6$	0.77
6	neutron guide exit (4.6 m)	$6.6 \cdot 10^6$	$5.6 \cdot 10^6$	0.85
7	HEC exit	$4.7 \cdot 10^7$ $r_{Cd}^{Au} = 3.4$	$4.4 \cdot 10^7$ $r_{Cd}^{Au} = 3.7$	0.94
8	neutron guide exit	$2.9 \cdot 10^6$	$2.5 \cdot 10^6$	0.86
12	in sample	$1.5 \cdot 10^3$	$1.94 \cdot 10^3$	1.3
14	in sample	$2.7 \cdot 10^3$	$4.5 \cdot 10^3$	1.7

where: $n_{th}v_o$ - thermal neutron flux density (n/(cm^2·s· MW))

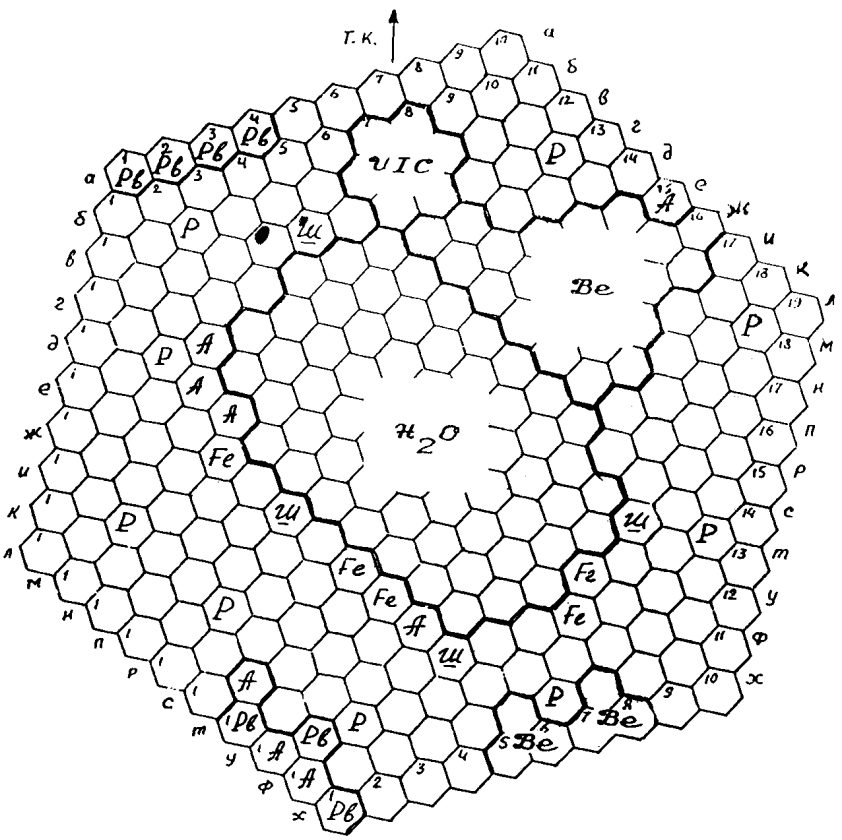

Fig.1. 807 digital printout

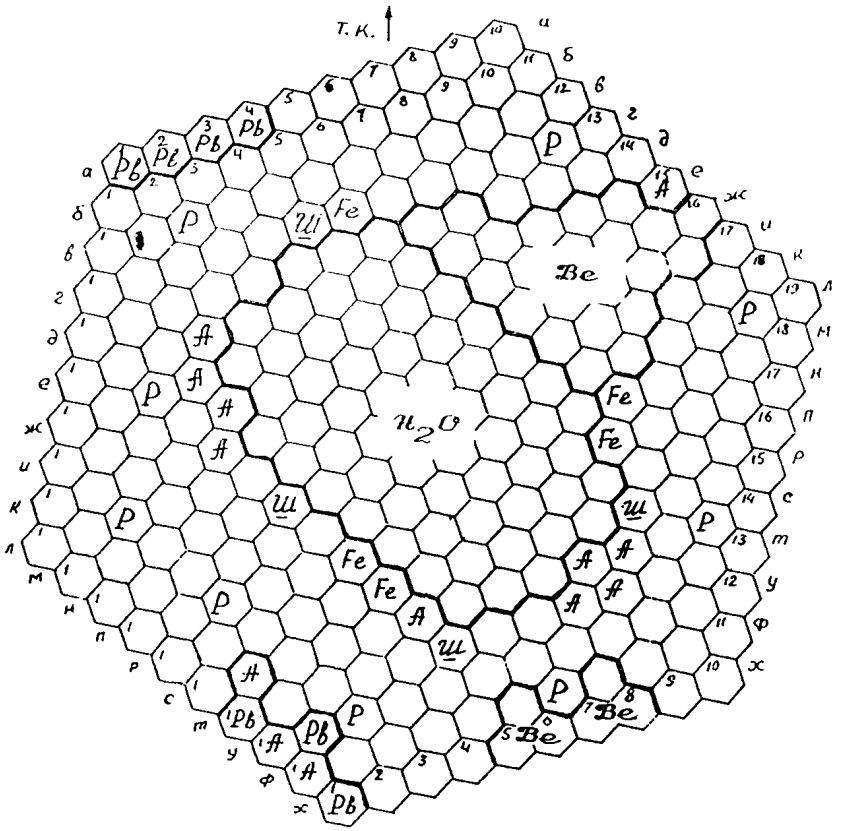

Fig.2. 808 digital printout

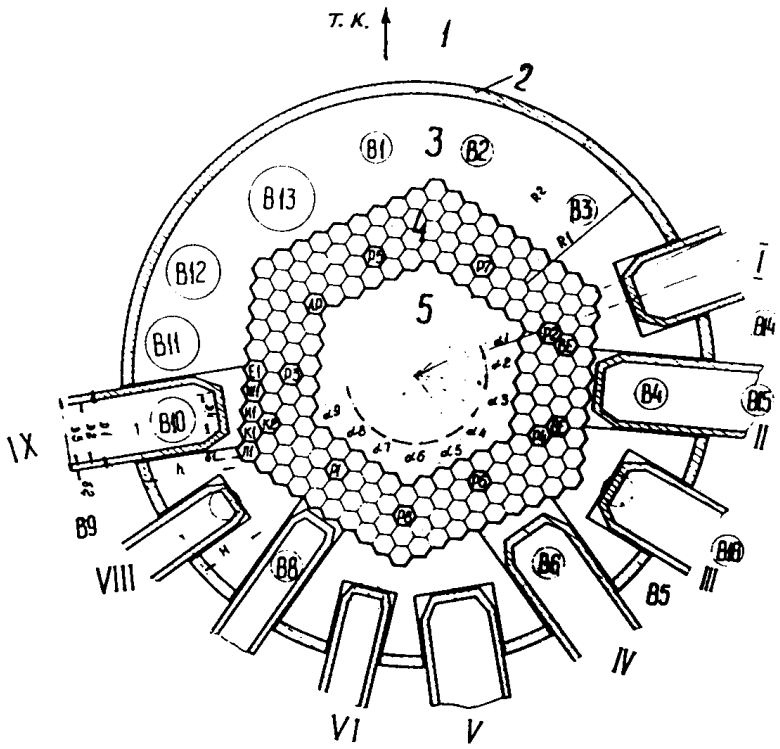

Fig.3. Disposition of experimental channels

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2. *Vasiliev G.Ja. et.al.* // VANT, ser.Atomnoe materialovedenie, 1988. Vip.6(13). P.8.