International Atomic Energy Agency

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INTERNATIONAL NUCLEAR DATA
SCIENTIFIC WORKING GROUP
Vienna, 9-13 November 1964

LIST OF FACILITIES IN THE USSR FOR MEASURING NUCLEAR PHYSICAL CONSTANTS

64-4516

LIST OF FACILITIES IN THE USSR FOR MEASURING NUCLEAR PHYSICAL CONSTANTS

No.	Name of Facility	Institute	Purpose	Basic Characteristics	References in the literature
1	2	3	4	5	6
			I. ACCELERATORS		
1.	Van de Graaff EG-1 electrostatic generator	FEI*	Use of monokinetic neutrons from the reactions D + D, D + T and P + T to study the processes of fission, elastic and inelastic scattering and radiative capture of fast neutrons.	Accelerating voltage: 5 MV. Current in analysed beam: 30 μA. Stabilization of voltage: 0.1%.	1. Fiziko-Energetichesky Institut (Prospectus); Obninsk, 1964 (in Russian). 2. "Electrostatic Generators"; Published by Central Board for the Utilization of Atomic Energy, Moscow, 1959 (in Russian).
2.	Van de Graaff EG-2.5 electrostatic generator	FEI	"	Accelerating voltage: 2.5 MV. Current in analysed beam: 50 μA.	"
3.	KG-1.2 cascade generator	FEI	Study of delayed fission neutrons. Measurement of capture cross-sections by the time-of-flight method.	Accelerating voltage: 1.2 MV. Current at target: max. 200 μA.	Fiziko-Energetichesky Institut (Prospectus); Obninsk, 1964.

* Fiziko-Energetichesky Institut (Physics and Power Institute).

1	2	3	4	5	6
4.	KG-0.2 cascade generator	FEI	Study of elastic and inelastic scattering of fast neutrons by the time-of-flight method.	Accelerating voltage: 0.25 MV. Current in pulse: 500 μA. Pulse length: 3-4 msec. Pulse frequency: 3 Mc/s.	Fiziko-Energetichesky Institut (Prospectus); Obninsk, 1964.
5.	Cyclotron	FEI	Isotope production and nuclear physics research.	Energy of accelerated particles: protons: 18 MeV deutons: 21 MeV α particles: 42 MeV. Intensity of magnetic field: 17 kOe. Diameter of poles of magnet: 1.5 m. Gap between poles: 21 cm.	Fiziko-Energetichesky Institut (Prospectus); Obninsk, 1964.
6.	Electron linear accelerator	IAE*	Neutron spectrometry and neutron thermalization research.	Energy of accelerated electrons: 30 MeV. Average current: 15 μA. Current in pulse: 250-500 ma. Pulse length: 0.05, 0.2 and 0.6 μs. Average neutron yield: 10^{12} n/s.	1. Atomnaya Energiya, 13, 327 (1962) 2. Zhurnal eksperimentalnoi i teoreticheskoi fiziki (ZhETF) 44, 1187 (1963) 3. Atomnaya Energiya, 14, 264 (1963) 4. ZhETF, 45, 1358 (1963) (in Russian)

* Institut Atomnoi Energii (Atomic Energy Institute).

1	2	3	4	5	6
7.	Electrostatic accelerator	IAE	Measurement of fission cross-sections and angular and mass distribution of fission fragments. Study of scattering of neutrons by various nuclei.	Accelerating voltage: 2.5 MV. Current in analysed beam: 100 μA. Stabilization: 0.02%.	1. Doklady Akademii Nauk (DAN), 102, 237 (1955) 2. DAN, 128, 1157 (1959) 3. Atomnaya Energiya, 6, 453 (1950)
8.	Electrostatic accelerator	IAE	"	Accelerating voltage: 3.5 MV. Current in analysed beam: 100 μA. Stabilization: 0.02%.	"
9.	Cyclotron	IAE	Nuclear physics research, neutron spectroscopy, scattering of charged particles, research on polarization of neutrons.	Energy of accelerated particles: protons: 6-17 MeV deutons: 12-20 MeV $(He4)^{++}$: 24-40 MeV $(He3)^{++}$: 18-38 MeV. Intensity of magnetic field: 17 kOe. Energy spread of particles: 0.3-0.4%. Neutron pulse length in neutron-spectrometric investigations by time-of-flight: 2-3 ns.	1. Atomnaya Energiya, 1, 36 (1957) 2. Atomnaya Energiya, 16, 360 (1964) 3. Pribori i Tekhnika Eksperimenta (PTE), 6, 69 (1961) 4. PTE, 5, 37 (1961) 5. Atomnaya Energiya, 15, 62 (1963)

1	2	3	4	5	6
10.	Cyclotron	IF AN Ukr. SSR *	Isotope production and nuclear physics research.	Energy of accelcrated particles: protons: 6.8 MeV deutons: 13.6 MeV. Intensity of magnetic field: 14.5 kOe. Diameter of poles: 1.2 m. Gap between poles: 15 cm.	Atomnaya Energiya, 14, 159 (1963)
11.	Compressed gas electrostatic accelerator	IF AN Ukr. SSR	Monoenergetic neutron research.	Accelerating voltage: 2.5 MV.	Ukrainsky Fizichesky Zhurnal (UFZh), 1, 303 (1956)
12.	Electrostatic generator	IF AN Ukr. SSR	Production of accelerated monoenergetic protons and deutons.	Acclerating voltage: 5 MV.	"
13.	Neutron generator	IF AN Ukr. SSR	Production of neutrons with energies of 2.5 and 14 MeV.	Acclerating voltage: 0.12 MV.	M.V. Pasechnik, "Problems of Moderate-Energy Neutron Physics", Kiev, 1961 (in Russian)

* Institut Fiziki Akademii Nauk Ukrainskoi SSR (Ukrainian SSR Academy of Sciences, Physics Institute).

1	2	3	4	5	6
14.	Proton linear accelerator	UFTI*	Investigations in nuclear physics.	Energy of accelerated protons: 20.5 MeV. Ion current in pulse: 10 μA. Pulse length: 500 μs. Wavelength: 2.15 m. Injection energy: 1.7 MeV.	Transactions of the Session of the Ukrainian SSR Academy of Sciences on the Peaceful Uses of Atomic Energy, Ukr. Acad. Sci., Kiev, 1958 (in Russian)
15.	Electrostatic accelerator	UFTI	Nuclear physics research.	Energy of accelerated protons: 4 MeV. Current of beam: 10 μA. Energy stability: ± 0.05%.	PTE, 4, 3 (1957)
16.	Electron linear accelerator	UFTI	Measurement of nuclear physical constants.	Energy of accelerated electrons: 90 MeV. Average current: 1 μA. System of operation: pulsed. Pulse frequency: 50 c/s. Pulse length: 1–2 μs.	CERN Symposium, 1959, paper by K.D. Sinelnikov et al., "The Electron Linear Accelerator at the Ukrainian SSR Academy of Sciences' Technophysical Institute"

* Ukrainsky Nauchno-issledovatelsky Fiziko-tekhnichesky Institut (Ukrainian Technophysical Research Institute).

1	2	3	4	5	6
17.	EG-2 electrostatic generator	FIAN*	Nuclear physics research.	Energy of accelerated particles: max. 2.5 MeV. Current: 20 μA.	Yu.G. Balashchko et al., paper presented at International Conference on Nuclear Physics, Paris, 1964
18.	EG-2.5 electrostatic generator	FIAN	Nuclear physics research.	Energy of accelerated particles: max. 2.5 MeV. Current: 25 μA.	V.A. Bukarev and V.I. Popov, paper presented at XIV Annual Congress on Nuclear Spectroscopy, Tbilisi, 1964
19.	EG-5 electrostatic generator	FIAN	Nuclear physics research.	Energy of accelerated particles: max. 4 MeV. Current: 25 μA.	"Electrostatic Generators", Atomizdat, 1954 (in Russian)
20.	Spectrometer for slowing-down time of neutrons in lead	FIAN	Interaction of neutrons with nuclei. Nuclear physics research.	Range of neutron energies measured: thermal to 30-40 keV.	A.V. Antonov, A.I. Isakov, et al., paper presented at I Geneva Conference, 1955. S.A. Romanov, Yu.I. Fenin, et al., paper presented at the International Conference on Nuclear Physics, Paris, 1964

* Fizichesky Institut Akademii Nauk SSSR (USSR Academy of Sciences' Physics Institute).

1	2	3	4	5	6
21.	Fast neutron generator	FIAN	Interaction of neutrons with nuclei. Study of the mechanism of nuclear reactions.	Neutron energy: 2.4, 14.1 MeV. Neutron yield: max. 10^9 n/sec.	B.A. Benetsky and I.M. Frank, paper presented at the International Conference on Direct Interaction and Nuclear Reaction Mechanisms, Padua, 1962 B.A. Benetsky and I.M. Frank, paper presented at the International Conference on Nuclear Physics, Paris, 1964

1	2	3	4	5	6
			II. NUCLEAR REACTORS		
1.	First Atomic Power Station Reactor.	FEI	Measurement of total cross-sections and capture-gamma spectra of neutrons at different resonances using two choppers.	Thermal capacity: 30 MW. Maximum thermal neutron flux: 5×10^{13} n/cm^2/s. Number of irradiation channels: 4. Choppers (a) 1-rotor: path length: max. 132 m; resolution: 13 ns/m; transmission: 5×10^{-5}. (b) 3-rotor: path length: 9 m; resolution: 500 ns/m; transmission: 5×10^{-5}.	1. Fiziko-Energetichesky Institut (Prospectus); Obninsk, 1964 2. Atomnaya Energiya, 1, 10 (1956)
2.	BR-1 fast neutron research reactor.	FEI	Macroscopic experiments for testing systems of multi-group constants.	Thermal capacity: max. 100 W; removable shielding.	1. Fiziko-Energetichesky Institut (Prospectus); Obninsk, 1964 2. II Geneva Conference, paper P/2129 3. III Geneva Conference, paper P/368

1	2	3	4	5	6
3.	BR-5 experimental fast neutron reactor.	FEI	Study of fission processes. Research on low angle scattering of neutrons.	Thermal capacity: 5 MW. Fast neutron flux: 8×10^{-14} n/cm^2/s. Number of channels for neutron extraction: 5. Several sample irradiation channels and a thermal column.	1. Fiziko-Energetichesky Institut (Prospectus); Obninsk, 1964 2. II Geneva Conference, paper P/2129 3. III Geneva Conference, paper P/312
4.	IRT Research *Reactor*	IAE	Neutron-physics research, including work with polarized neutrons, inelastic scattering of cold neutrons, and study of fission process and radiation spectrum from neutron capture.	Thermal capacity: 2000 kW. Thermal neutron flux: 3.2×10^{13} n/cm^2/s. No. of horizontal channels: 10. No. of vertical channels: 7. Thermal column Mechanical chopper.	II Geneva Conference, paper P/2181
5.	WWR-M Reactor	IF AN Ukr. SSR	Neutron-physics and biological research, materials testing	Thermal capacity: 10 MW. Neutron fluxes: at centre of core - 3.2×10^{14} n/cm^2/s; on leaving horizontal channel - 3.7×10^{9} n/cm^2/s. No. of research channels: 7.	1. II Geneva Conference, paper P/2185 2. II Geneva Conference, paper P/2042 3. II Geneva Conference, paper P/2041 4. Atomnaya Energiya, 12, 251 (1962)

1	2	3	4	5	6
				Experimental equipment: (a) Neutron chopper rotor diameter: 500 mm; speed of rotation: 10^4 rpm; path length: 175 m. (b) Neutron chopper rotor diameter: 208 mm; speed of rotation: 1.2×10^4 rpm; path length: 20 m. (c) Slow neutron monochromator diameter of discs: 582 mm; No. of slits: 48; width of slits: 3 mm; speed of rotation: 6000 rpm. (d) Pulsed monochromator with parabolic slits: rotor diameter: 300 mm; number of slits: 37; speed of rotation: 7200 rpm; energy resolution: 20%.	

1	2	3	4	5	6
6	IRT-2000 Research Reactor	IF AN Lat. SSR*	Neutron-physics research	Thermal capacity: 2000 kW; Thermal neutron flux: 3×10^{13} n/cm^2/s No. of horizontal channels: 10.	Izv. AN SSSR, Ser. Fiz., XXVIII, No. 2, 262.

* Institut Fiziki Akademii Nauk Latviiskoi SSR (Latvian SSR Academy of Sciences' Physics Institute).

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No.	Name of Facility	Institute	Purpose	Basic Characteristics			References in the literature
1	2	3	4	5			6
1	U-300 cyclotron	OIYaI*	Nuclear physics research with heavy ions	Ions	Energy, MeV	Intens., μA	1. G.N. Flerov, V.A. Karnaukhov, "Mechanisms and products of reactions with heavy ions" review paper (in Russian) presented at International Conference on Nuclear Physics, Paris, 2-8 July 1964.
				B^{+2}_{10}	70	100	
				O^{+3}_{16}	112	80	
				$Ne^{+4}_{20,22}$	140	50	
				Si^{+5}_{28}	200	10	
				Ar^{+7}_{40}	300	5	
				Ar^{+8}_{40}	300	2	
				$C^{+3}_{12,13}$	110	100	
				$N^{+3}_{14,15}$	130	100	
				O^{+4}_{18}	170	50	
				Ne^{+5}_{22}	230	5	
				Intensity of magnetic field: 17 kOe. Diameter of poles: 310 cm. Gap between poles: 42 cm.			2. Yu.Ts. Oganessyan, "Proceedings of a working symposium on exchange of experience and scientific research with cyclotrons", Krakow, 1961.

* Obedinennyy Institut Yadernykh Issledovaniy (Joint Institute for Nuclear Research - Dubna).

1	2	3	4	5	6
2	U-150 cyclotron	OIYaI	Nuclear physics research with heavy ions	Ions / Energy, MeV / Intens. of int. beam, μA / Intens. of ext. beam, μA C^{+4}_{12} 80 40 10 N^{+5}_{17} 100 30 10 O^{+5}_{16} 110 20 5 Intensity of magnetic field: 17 kOe. Diameter of poles: 150 cm Gap between poles: 18 cm.	1. G.N. Flerov, V.A. Karnaukhov. "Mechanisms and products of reactions with heavy ions" review paper (in Russian) presented at International Conference on Nuclear Physics, Paris, 2-8 July 1964.
3	EG-5 electrostatic generator	OIYaI	Nuclear physics research	Maximum designed energy of accelerated ions: 5 MeV	"Industrially manufactured electrophysical apparatus", (Gosatomizdat handbook, 1963) (in Russian)
4	EG-2-410 electrostatic generator	OIYaI	Nuclear physics research on light nuclei	Maximum energy of accelerated particles: 1800 keV. Stabilisation of generator voltage obtained by back-coupling of slit system with corona triode, and amounts to ≈ 0.1%. Stabilisation of magnetic field of analyser (with two measuring channels) obtained by stabilisation of magnet current, maintained constant to 0.1-0.2%.	1. Supplement to Atomnaya energiya, entitled: "Light nuclear reactions", Atomisdat, 1957 (in Russian). 2. ZhETF, 39, 2(8), 1960, 225.

1	2	3	4	5	6
5	ITEF cyclotron	ITEF*	Nuclear physics research	Energy of accelerated neutrons: 12.5 MeV. Intensity of magnetic field: 14 000 Oe. Diameter of poles: 120 cm. Gap between poles: 30 cm.	PTE, 3, 1961.
6	Neutron spectrometer with pulsed beam of ITEF cyclotron	ITEF	Measurement of neutron cross-sections	2 timeanalysers, each of 1024 channels. Resolution: max. 5ns/m. Path length: 7 and 15 m.	1. PTE, 4, 1959. 2. Nuclear Electronics II, Vienna, 1962.
7	Slow neutron spectrometer on ITEF cyclotron	ITEF	Measurement of slow neutron spectra	(a) 1st spectrometer, 160 channels with resolution: 0.1 μs/m. (b) 2nd spectrometer, 112 channels with resolution: 0.14 μs/m. Path length: 10 m.	1. PTE, 2, 1963. 2. PTE, 6, 1958.
8	Fast neutron spectrometer	ITEF	Measurement of fast neutron spectra, research on fast neutron scattering and polarisation	No. of channels: 160. Channel width: 1 ns. Resolution: 0.3 ns/m. Path length: 10-15 m.	PTE (in press)
9	Twin iron-free beta spectrometer with toroidal magnetic field.	ITEF	Research on internal conversion and beta spectra; study of initial transitions	Resolution: 0.3-0.7%. Transmission: 2-5%. Area of source: 20-200 mm^2.	Izvestiya Akademii Nauk SSSR (Physics series) XXVI, 1470 (1962).

* Institut Teoreticheskoi i eksperimentalnoi fiziki (Theoretical and Experimental Physics Institute).

1	2	3	4	5	6
10	Mechanical neutron spectrometer with rotor suspended in magnetic field	ITEF	Measurement of total cross-sections in neutron energy range from 10-1000 eV	Resolution: 5 ns/m. No. of channels: 1024. Path length: 50 m.	1. PTE, 1963 2. Proceedings of Conference on Nuclear Electronics, Belgrade, 1962.
11	IRT-2000 type research reactor	ITMO* AN BSSR	Neutron physics research; radiation chemistry research; radiobiology research	Thermal capacity: 2000 kW. Thermal neutron flux at centre of core: 1.8×10^{13} n/cm^2.s. No. of irradiation channels: 9 horizontal 11 vertical.	1. V.V. Goncharov et al., II Geneva Conference, paper P/2185. 2. A.K. Krasin, et al., III Geneva Conference, paper P/718.
12	ITEF heavy water physical research reactor	ITEF	Neutron physics and neutron diffraction research	Thermal capacity: 2500 kW. Neutron flux at centre of reactor: 4×10^{13} n/cm^2.s. Flux at outlet of horizontal channels: 4×10^{9} n/cm^2.s. No. of channels: for sample irradiation: 55 horizontal, for beam outlet: 10.	II Geneva Conference material, Vol. 2, p. 266.

* (An institute of the Byelorussian SSR Academy of Sciences)

1	2	3	4	5	6
13	Fast neutron pulsed reactor (IBR)	OIYaI	Neutron physics research	Reactor provides periodic neutron pulses with half-width 36-40 μs and repetition frequency 3.3-83 pulses/s. Mean thermal capacity can attain 3 kW, permitting max. momentary power in pulse of approx. 23 MW. Reactor power between pulses: not over 100 W. Mean over-all neutron intensity: 1.7×10^{14}/s. Over-all neutron intensity at pulse max.: 1.3×10^{18}/s. Reactor has 7 channels, 2 of which have 1000-m and 100-m evacuated path lengths respectively.	Atomnaya Energiya, 10, (1961), 437.