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Measurements of the reactor neutron power in absolute units

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Taking measurements of neutron power in absolute units is a complicated procedure, and the corresponding measurements are not carried out, if possible, being replaced with results of measuring the neutron power in relative units. A need for measuring continuously the reactor neutron power *W* in absolute units within a range from values measured in watts to the nominal values has arisen in the process of designing the Yenisei space nuclear power unit (SNPU) dur-ing a ground-based tests of its prototypes. For measuring W of the Yenisei SNP reactor, statisti-cal methods were chosen for studying fluctuations of the amount of neutrons in the reactor, namely, the correlation analysis method (CAM). The power tests of the Yenisei SNPU ground prototypes were conducted in vacuum chambers. At this time, the ventilation of the unit, the liquid metal pumps, and other aggregates creating interference were in operation. The interference that is inevitably present in measurements remains at a constant level, while the current level *I(t)* grows as the reactor power increases. Under these conditions, it is expedient to measure W at the maximum possible currents of the experimental ionization chamber in the critical state of the reactor. A result of measuring the fluctuations of the amount of neutrons in the reactor at any instant can be presented as $I(t)=Iav + i(t)$, where *Iav* is average value of the ionization chamber current and *i(t)* is the fluctuating value of the ionization chamber current. The informative component is recorded using statistical methods at the level of the background component. As the reactor power value at which the experiment is conducted grows, the mean value of the ionization chamber current Iav increases proportionally to the reactor power, while the amplitude of the current *i(t)* increases proportionally to the square root of the reactor power. In this connection, even at a value of the reactor power of ~1 vatt, technical difficulties arise in measuring the fluctuations of *I(t)* with acceptable quality against the background of the mean current. The complications are aggravated also by the fact that the transmission band must be sufficient to ensure measurement of the fluctuations of the amount of neutrons in the reactor without distortions. These technical difficulties are overcome by means of separate measurements of the average value of the fluctuating amount of neutrons and the fluctuations proper at the level of the average value. The value *Iav* is measured by an electrometer, while the fluctuating values of the ionization chamber current *i(t)* are measured using a U7-6 serial broad band amplifier. With this arrangement of measuring the fluctuating amount of neutrons in the reactor, the neutron power is determined at the maximum acceptable level of ~500 vatt. In the vacuum chamber of the ground prototype Yenisei SNPU measured values are *W*~50vatt levels, ~100vatt, ~500vatt. Positive result measurements *W* reactor was confirmed by measurements of *W* at a nominal level of reactor power heat balance.

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