

FUTURE OF THE NUCLEAR POWER

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The idea of using accelerator beams for nuclear energy plants was already discussed in 50-ies of the previous century. The concept of the power amplifier assumes forming neutron fluxes in the processes of interaction between the n, p and e⁻ beams extracted from the accelerator. This scheme was accepted to call the electronuclear method of obtaining the energy or ADS (Accelerator Driven System) [1].

This method in the atomic energy was based on the fission of the heavy nuclei ²³⁵U, ²³⁸U, ²³²Th in subcritical systems being controlled by external sources of charged particles p, n, e⁻. The electronuclear method includes obtaining the flux of thermal neutrons being produced while irradiating the n, p, e⁻ prolonged targets made of Pb, Bi or U, placed in the centre of the blanket. The formed flux of thermal neutrons in its turn stimulates deletion of uranium nuclei in them while irradiating “the cooled” thermal elements (twels).

Numerous experiments have been performed at the subcritical system (YALINA – D) by using the proton beam of the Dubna phasotron at the energy of 660MeV. The uranium subcritical polyethylene assembly (maximum multiplication coefficient $K_{\text{eff}} \approx 0.975$) is a cube with the side 120cm long.

The assembly is mounted from polyethylene cubes with the ready-made channels to place the twels located in the rectangular cell with the gap equal to 20mm. In the centre of the assembly there is a neutron producing target, Pb (80 mm × 80 mm × 580 mm). In the active zone of the subcritical system there are specialized experimental channels of Ø20MM to locate the targets (including also the radioactive ones) and the channels for monitoring the neutron flux density.

The article proves the opportunity of constructing the subcritical systems being controlled by the beams of charged particles of the energy from 14 MeV till 1 GeV with the coefficient of using twels from 5% till 50% and higher.

It is necessary to stress the creative potential of the advanced technological approaches to the future of nuclear energy. Subcritical systems are prototypes of a new generation of safe and waste-free mini Nuclear Power Plants.

1. V.S. Butsev, A.N. Sisakian *et al.* Research programme For the 660 MeV Proton accelerator Driven MOX-Plutonium Subcritical assembly. Preprint JINR E1-200-64. 2000.