

Theoretical and experimental investigation on the optimization of accelerator driven subcritical reactors

T. N. Tran^{1,7,8*}, M. Paraipan^{1,2}, A. Abduvaliev³, A. Balabekyan⁴, O. V. Belov¹, F. H. Ergashev³,
V. M. Javadova¹, S. V. Korneev⁵, L. K. Kostov^{1,6}, J. H. Khushvaktov¹, S. A. Kulikov¹,
A. A. Solnyshkin¹, V. V. Sorokin⁵, S. I. Tyutyunnikov¹

¹ Joint Institute for Nuclear Research, Dubna, Russia

² Institute of Space Science, Magurele, Ilfov, Romania

³ Institute of Nuclear Physics, Tashkent, Uzbekistan

⁴ International Center of Advanced Studies Yerevan State University, Yerevan, Armenia

⁵ Joint Institute for Energy and Nuclear Research-Sosny, Minsk, Belarus

⁶ Institute for Nuclear Research and Nuclear Energy, Sofia, Bulgaria,

⁷ Institute of Physics of the Vietnam Academy of Science and Technology, Hanoi, Vietnam

⁸ Institute for Nuclear Science and Technology, VINATOM, Hanoi, Vietnam

*e-mail: chan@jinr.ru

A new approach for accelerator driven subcritical reactors (ADSR), focused on their use as efficient source of energy was developed [1], [2]. Active zones with larger dimensions offer the possibility to obtain the needed value of the effective multiplication factor k_{eff} with lower enrichment, allowing longer cycle and deeper actinides burning (15–20%) during the cycle. The working value of k_{eff} maintained in the range 0,985–0,988 with the help of control rods ensures a safe exploitation, avoids reaching the criticality during unprotected transients or core damage, and is sufficiently high to realize energy gain above 15. One of the most interesting finding concerns the possibility to use light ion beams as ^7Li or ^9Be with energy 0,25–0,3 GeV/n instead of 1–1,5 GeV protons.

The analysis of possible experiments meant to compare the energy efficiency of different beams showed that the most reliable results are obtained by measuring the fission distribution inside a large target. A suitable lead target LETASUR is presented. The study about the radiation exposure demonstrates that the shielding design of the experimental room SHINE allows safely using beam intensities of 10^9 p/s. Plans for further research activity are presented.

References

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2. M. M. Paraipan, I. A. Kryachko, V. M. Javadova [et al.], Phys. Part. Nucl. Lett. **19**, 129 (2022).