

# THE CHALLENGES OF CREATING SUBCRITICAL RESEARCH INSTALLATIONS DRIVEN BY EXTERNAL NEUTRON SOURCES

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The world faces today the problem of growing energy demands for the society. Nuclear energy seems to play an important role in developed countries as a reliable energy source.

For a long time, successful development of nuclear power based on the critical reactors using fissile nuclides  $^{235}\text{U}$ ,  $^{233}\text{U}$ ,  $^{239}\text{Pu}$  satisfied the needs of civil nuclear power and nuclear weapon complex.

However, future nuclear power industry must be somewhat different, addressing increased safety consciousness and technological development, for example, by using closed nuclear fuel cycle, decreased volumes of radioactive waste, and other improvements.

Such factors led to extensive investigation and development of fast reactors and subcritical nuclear installations driven by external neutron sources known as GENERATION IV.

In particular, nuclear installations using powerful proton accelerators as external neutron source are called Accelerator Driven Systems (ADS).

The main idea of using high energy accelerators is large-scale application of high energy spallation reactions to produce neutrons in the targets having atomic mass more than 150 (Pb, Bi, W, U, Pb-Bi) with its subsequent multiplication in a subcritical blanket ( $k_{\text{eff}} \sim 0.9 - 0.98$ ).

This paper analyzes the challenges of creating ADS.