

SATIF-12

Contribution ID: 7

Type: not specified

Energy Production Demonstrator Model for the GeV-range Megawatt proton beams_____

Monday, 28 April 2014 18:21 (9 minutes)

A preliminary study of the Energy Production Demonstrator (EPD) concept, a heavy metal target irradiated by GeV-range intense proton beams and producing more energy than consuming, is carried out. Neutron production and fission are simulated using the MARS15 code for tungsten, natural uranium, lead and thorium target options, along with energy deposition and gain, peak DPA rate, materials testing volume and helium production in the proton energy range of 0.5 to 120 GeV.

Study indicates that the proton energy range of 2 to 4 GeV seems to be the most practical for both the natural uranium EPD and the tungsten testing station that would be the most suitable for proton accelerator facilities. Based on the simulations, conservative estimates not including breeding and fission of plutonium suggest that the proton beam power of 6 MW is appropriate in the first case which can produce more energy than use for accelerator needs. Simulation results reveal that the thorium target is not efficient for the energy production purpose. The ANSYS thermal analysis of the target has also been carried out. An existing prototype of the uranium-based EPD target residing at JINR, Dubna is discussed as a possible candidate for benchmark experiments.

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Session Classification: Poster Session and Reception