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Application of local Monte Carlo calculation method in EAST radial neutron camera

Liangsheng Huang [1,2], Liqun Hu [1], Guoqiang Zhong [1*], Mengjie Zhou [3], Luying Niu [1]
1) Institute of Plasma Physics, Hefei Institutes of Physical Science, Chinese Academy of Sciences, Hefei 230031, China
*E-mail: liangsheng.huang@ipp.ac.cn; *E-mail of Corresponding author: gqzhong@ipp.ac.cn;*
2) University of Science and Technology of China, Hefei 230026, China
3) Sichuan Provincial Engineering Laboratory of Nuclear Facility Decommissioning and Radwaste Management, Nuclear Power Institute of China, Chengdu 610005, China

The Radial Neutron Camera (RNC) on EAST device is mainly used to measure the uncollided neutrons in the upper polar cross section plasma region to obtain the spatial distribution of plasma neutrons. The camera consists of six liquid scintillation detectors, a two-stage shielding collimator, six sight holes and a support frame, and is mounted in the K window. Because the RNC's line of sight hole is small and the distance from the plasma center is far, the global variance reduction method is used to calculate the flux and energy spectrum of the detector, but the accuracy cannot meet the requirements, and large computing resources are needed to support. In order to improve the computational efficiency, this paper uses the local Monte Carlo method to calculate the neutron flux and energy spectrum in each channel of the RNC detector by using SSW/SSR surface source files, aiming at the deep penetration problem of the radial neutron camera diagnostic system on EAST on 56 CPU calculation clusters. The main components on the RNC and K Windows were modeled in detail and integrated into the 45 ° EAST neutronic model for the first step transport calculation SSW surface source write files. The second step uses only the RNC neutronic model, and the SSR surface source reads the file as input. The analysis shows that the local Monte Carlo calculation method is used to solve the deep penetration problem of RNC transport calculation, and it is verified that this method is a fast calculation method that can be used to optimize the nuclear shield design of a single Tokamak diagnostic system.

Keywords: Local monte carlo calculation; SSW/SSR; Radial neutron camera; EAST;