



Contribution ID: 54

Type: Poster

The development of a diamond detector based Bonner sphere spectrometer for neutron field characterization in the EAST tokamak

Thursday, 4 October 2018 14:30 (1h 30m)

A time-of-flight enhanced diagnostic (TOFED) neutron spectrometer has been developed as a neutron emission spectroscopy for plasma physics study in the Experimental Advanced Superconducting Tokamak (EAST). The TOFED was previously installed in a shield positioned inside the EAST experimental hall, but could not work well because of high γ -ray background. A new neutron diagnostic house was built outside the experimental hall based on 1.5 m thick concrete wall as shielding, and could fulfill the requirements for the TOFED normal operations. However, it is still significant to interpret the source of the γ -ray background in the previous shielding, and estimate the neutron dose level in the new diagnostic house for the normal work of staff during the discharge of EAST. These rely on the neutron spectrum information covering entire energy range in these places. The characterization of the neutron fields outside and inside of the EAST experimental hall can benchmark the Monte Carlo model of EAST for other neutron related research. The Bonner sphere spectrometer (BSS) was chosen to measure the neutron field with energy up to 2.5 MeV for EAST operated in DD plasmas.

A set of ^3He gas counter based BSS, consisting of 10 spheres, has been successfully applied to the neutron field measurement. More central counters are needed to speed up the experiment by carrying out the measurement at different positions at the same time. Considering the high price of ^3He counters and the saturation problems occurring in EAST and the potential application to ITER and CFETR for the BSS based on usual active sensors like ^3He counters, the single crystal diamond detector coated with a ^6LiF converter was chosen because of its simple geometry and high radiation resistance. The BSS based on diamond detectors can characterize the high intense indoor neutron fields when employing NBI. An air gap of several mm between the diamond and converter was designed to improve its applicability in high γ -ray backgrounds. A high speed digitizer was used to record the diamond detector pulses, and a pulse shape analysis was implemented to discriminate signals from backgrounds to further enhance the applicability of the BSS in harsh environment. The response function was established by MCNPX code in the energy up to 20 MeV. The successful derivation of a neutron spectrum at EAST verified the good performance of the new BSS on the measurement of high intense neutron fields when employing NBI.

Summary

Primary author: Dr HU, Zhimeng (Università degli Studi di Milano-Bicocca)

Co-authors: Prof. GORINI, Giuseppe (Università degli Studi di Milano-Bicocca); Prof. ZHANG, Guohui (Peking University); Prof. ZHONG, Guoqiang (Institute of Plasma Physics, Chinese Academy of Sciences); Prof. ZHANG,

Hui (National Institute of Metrology); Ms SUN, Jiaqi (Peking University); Prof. CHEN, Jinxiang (Peking University); Prof. CHEN, Jun (China Institute of Atomic Energy); Mr GE, Lijian (Peking University); Prof. HU, Liqun (Institute of Plasma Physics, Chinese Academy of Sciences); Prof. TARDOCCHI, Marco (Istituto di Fisica del Plasma "P. Caldirola", Associazione EURATOM-ENEA-CNR); Prof. NOCENTE, Massimo (Università degli Studi di Milano-Bicocca); Mr XIAO, Min (Institute of Plasma Physics, Chinese Academy of Sciences); Dr ZHOU, Ruijie (Institute of Plasma Physics, Chinese Academy of Sciences); Dr DU, Tengfei (China Academy of Engineering Physics); Prof. FAN, Tieshuan (Peking University); Prof. YUAN, Xi (China Academy of Engineering Physics); Prof. LI, Xiangqing (Peking University); Dr PENG, Xingyu (China Academy of Engineering Physics); Dr XIE, Xufei (China Academy of Engineering Physics); Mr ZHANG, Yimo (Peking University); Dr CHEN, Zhongjing (China Academy of Engineering Physics)

Presenter: Dr HU, Zhimeng (Università degli Studi di Milano-Bicocca)

Session Classification: POSTER SESSION