

Neutron emission spectroscopy diagnostics at the EAST tokamak

Tieshuan Fan¹, Yimo Zhang¹, Jiaqi Sun¹, Danke Yang¹, Longyong Liao¹, Lijian Ge¹, Zhimeng Hu^{1,3}, Xingyu Peng¹, Zhongjing Chen¹, Xiangqing Li¹, Chijie Xiao¹, Jixiang Chen¹, Guoqiang Zhong², Liqun Hu², Shiyao Lin², Baonian Wan², G. Gorini^{3,4}, M. Nocente^{3,4}, M. Tardocchi⁴

¹ *Institute of Heavy Ion Physics, School of Physics, Peking University, Beijing, China*

² *Institute of Plasma Physics, CAS, Hefei, China*

³ *Department of Physics, University of Milano-Bicocca, Italy*

⁴ *Istituto di Fisica del Plasma "P. Caldirola", Milano, Italy*

tsfan@pku.edu.cn

Neutron measurements are important for fusion studies as they provide essential information on neutron production rate and the behaviors of fuel ions in tokamak plasmas. A whole set of neutron diagnostic systems has been installed and operated to perform measurements of fusion neutron emission, fluctuation, emission profile, and energy spectra for EAST deuterium plasma discharges with neutral beam injection, lower hybrid waves, ion cyclotron resonance frequency heating and their combination. The prototype neutron time-of-flight enhanced diagnostics (TOFED) spectrometer has been re-installed at the J port of EAST in order to study the behaviors of energetic ions produced by the injection of external auxiliary power. During the EAST 2019 winter campaign, synergized diagnostics from the TOFED and liquid scintillator spectral measurements were performed. The different components of neutron spectra and the velocity distributions of fast ions are successfully separated at EAST plasmas with NBI heating. In this report, we also discuss the implications of measuring the neutron emission on EAST together with the experimental challenges and diagnostic possibilities in scenarios approaching those to be encountered at steady state plasma operations.