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Observation of energetic particle transport via passive beam emission spectroscopy diagnostic system on HL 2A tokamak

Rui Ke[1], Guangzhou Hao[1], William W Heidbrink[2], George R McKee[3], Zheng Yan[3], Ting Wu[1], Ping Lu[1], Jianyong Cao[1], Xianming Song[1], Min Xu[1], and HL-2A team[1]

[1] Center for Fusion Science, Southwestern Institute of Physics

[2] Department of Physics and Astronomy, University of California, Irvine

[3]Department of Engineering Physics, University of Wisconsin, Madison

e-mail (speaker): kerui@swip.ac.cn

A newly developed beam emission spectroscopy (BES) diagnostic system has been installed on HL-2A tokamak. Initial 48 channels has been deployed and high spatial ($\Delta r \leq 1$ cm, $\Delta z \leq 1.5$ cm) and temporal ($\Delta t = 0.5$ μs) resolutions have been achieved[1]. The BES diagnostic views the original co-current NBI source (Figure 1, NBI 1#). In last campaign, a new co-current neutral beam line (NBI 2#) has been installed in the opposite port to the original beam on HL-2A tokamak, providing an opportunity to utilize passive BES signals to study the energetic particle transport on edge region during core plasma instabilities[2]. Passive fast-ion D_α (FIDA) signal, which is emitted by charge exchange between fast ions and background neutrals in the plasma periphery instead of beam neutrals, has been detected by BES with the original beam off and the new beam on. FIDASIM prediction confirms that the reliability of BES measurement. The BES response suggests that the energetic particle modes in the core region could induce the transport of fast ions to the edge region. More numerical simulation and comparison between theoretical and experimental results will be carried out.

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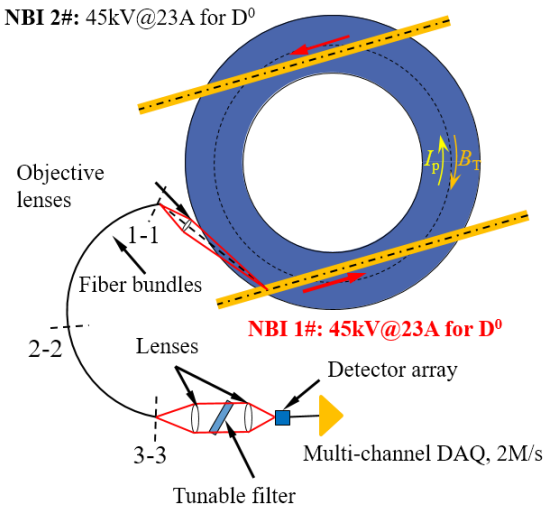

Figure 1 Diagram of BES and neutral beams on HL-2A tokamak. The BES objective lenses is at $Z \approx 18$ cm below the midplane and view downward at the original beam (NBI 1#) , intersecting the beam near the midplane ($Z = 0$), fitting the pitch angle in the edge region roughly.