**Development of the electron cyclotron emission diagnostics on EXL-50 spherical tours**

Yumin Wang1,2,\*, Weiqiang Tan1,2, Qifeng Xie1,2, Renyi Tao1,2, Xiaokun Bo1,2, Xiuchun Lun1,2, Hui Zhang1,2, Lin Chen1,2, Xiaomin Tian1,2, Minsheng Liu1,2 and EXL-50 team

1 Hebei Key Laboratory of Compact Fusion, Langfang 065001, China

2 ENN Science and Technology Development Co., Ltd., Langfang 065001, China

Email: wangyuminb@enn.cn

***Abstract.*** The electron cyclotron emission diagnostic (ECE) system has been developed on ENN Spherical Torus (EXL-50). EXL-50 is a solenoid-free spherical tours with the major and minor radius at 0.58 and 0.39m, and the ECRH at 28 GHz is used to drive plasma current [1]. The ECE system aims to detect radiation from energetic electrons in the frequency range between 4 to 40 GHz. The system is composed of five subsystems with different frequency bands, i.e., C-band (4-8 GHz), X-band (8-12 GHz), Ku-band (12-18 GHz), K-band (18-26.5 GHz) and Kα-band (26.4-40 GHz), and it uses heterodyne detection. K-band and Kα-band subsystems are located horizontally in the EXL-50 equatorial plane while C-band, X-band and Ku-band subsystems are vertically located under EXL-50 tours. A local oscillator (LO) at 28 GHz is used to lower the frequency of the detected microwaves for K- and Kα-band subsystems. The quasi-optical system has been developed to direct the microwaves from plasma to the antennas for horizontal detection subsystems, and the beam width at the magnetic axis during the whole K- and Kα-band is less than 20 cm. The antennas for vertical detection are attached directly to the port beneath the torus at R=700mm, i.e., the magnetic axis of the torus. The system integration, bench test and the initial experimental results will be given in detail.

Reference:

[1] Shi, Y., et al. (2022). Nuclear Fusion **62**(8): 086047.