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New Results of Development of Gyrotrons for Plasma Fusion Installations

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Gyrotrons for plasma fusion installations usually operate at frequencies 40-170 GHz. Requested output power of the tubes is about 1 MW and pulse duration is between seconds and thousands seconds. To provide operation with indicated parameters the gyrotrons have very large transverse cavity sizes, output barrier windows made of CVD diamond discs, effective collectors with particle energy recovery.

In ITER installation there will be 24 gyrotron systems with 1 MW power each. Russian contribution consists of 8 gyrotron systems. ITER requirements are: frequency 170 GHz, 1 MW power, 1000 s pulse duration, high efficiency of the gyrotrons over 50%, possibility of power modulation with frequency up to 5 kHz, compatibility of the gyrotron complex with ITER control system. In May, 2015 a Prototype of ITER Gyrotron System was completed and its operation was demonstrated. The system consists of gyrotron oscillator, liquid-free superconducting magnet, supplementary magnets, several electric power supplies, cooling systems control and protection systems, and other auxiliary units. The tests were performed in presents of ITER IO and ITER RF DA representatives. In October, 2015 Final Design Procedure for the gyrotron system was successfully passed.

High-level parameters were also achieved with long-pulse 140 GHz gyrotrons developed for EAST and KSTAR installations. Significant results were shown on the way to 1.5-2MW, CW gyrotrons. The development of higher frequency (230-700 GHz) gyrotrons for future plasma installations and for plasma diagnostics began. Novel ideas were proposed to enhance gyrotron operation

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Primary author: Prof. DENISOV, Grigory (Institute of Applied Physics Russian Academy of Sciences)

Co-author: Prof. LITVAK, Alexander (Institute of Applied Physics Russian Academy of Sciences)

Presenter: Prof. DENISOV, Grigory (Institute of Applied Physics Russian Academy of Sciences)

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