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Recent experiments with the European 1MW, 170GHz industrial CW and short-pulse gyrotrons for ITER

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The European Gyrotron Consortium (EGYC) is developing the EU 1 MW, 170 GHz CW industrial prototype gyrotron for ITER in cooperation with the industrial partner Thales Electron Devices (TED) and under the coordination of Fusion for Energy (F4E). This hollow cylindrical cavity gyrotron is based on the 1 MW, 170 GHz short-pulse (SP) modular gyrotron that has been designed and manufactured by KIT in collaboration with TED. The experiments with the CW industrial gyrotron are organized in two phases. The first phase was completed successfully at KIT in 2016. In the SP regime (<10 ms pulses), stable excitation of the nominal cavity mode TE32,9 at 170.22 GHz was achieved for a wide range of operating parameters. The maximum RF output power of the tube is higher than 0.9 MW with a total efficiency of 26% in non-depressed collector operation. The Gaussian mode content of the RF output beam is higher than 97%. In long-pulse operation, pulses with duration of 180 s (limited by the high-voltage power supply at KIT) delivered power higher than 0.8 MW with 38% efficiency (in depressed collector operation). The second phase of the experiments is ongoing at SPC, Lausanne, with the goal to further optimize the output power and extend the pulse duration. In parallel, the experiments with the SP prototype are continued at KIT. The SP tube, which in multiple experimental campaigns delivered power higher than 1 MW with 42% efficiency (in depressed collector operation), is further upgraded. Various depressed collector operation schemes are tested with the goal to achieve an efficiency higher than 50%. Moreover, different beam tunnels will be tested in order to have the possibility to go to higher operating beam currents without exciting parasitic oscillations. In this work, the latest results with the CW and SP prototype gyrotrons will be presented.

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