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High Power mm-wave loss measurements of ITER ex-vessel waveguide component prototypes at the FALCON test facility in Lausanne Switzerland

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Many future Fusion devices will rely heavily, if not solely, on electron cyclotron (EC) heating subsystems to provide bulk heating, instability control (neoclassical tearing mode (NTM) stabilisation), and thermal instability control. Efficient use of the installed heating power (gyrotrons) requires low-loss transmission of the power over 100s of meters since the mm-wave sources need to be installed where the stray magnetic field has a small amplitude. Transmission lines are used to propagate the mm-wave power over this long distance. Quasi-optical techniques (mirrors) are used at W7X and are planned for DTT, for example. Guided components are installed at DIII-D, TCV and elsewhere and are planned at JT60SA and ITER. High power test facilities exist to evaluate the power transmission of assemblies of guided components (transmission lines). The European test facility FALCON was setup by Switzerland and Fusion for Energy (F4E) in Lausanne Switzerland at the Ecole Polytechnique Fédérale de Lausanne (EPFL) in the Swiss Plasma Center (SPC). Operations are funded through a framework contract with F4E. SPC operates the facility. Two ITER-class 170GHz gyrotrons are housed within the facility and used to evaluate the thermal behaviour of components provided by various ITER partners. Loss measurements are presented for miter bends and waveguides of several materials at two different diameters. The results are used to model the expected losses in the ITER ex-vessel waveguides (EW) that are part of the ITER EC launcher (both Upper and Equatorial).
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