FUSION FOR ENERGY

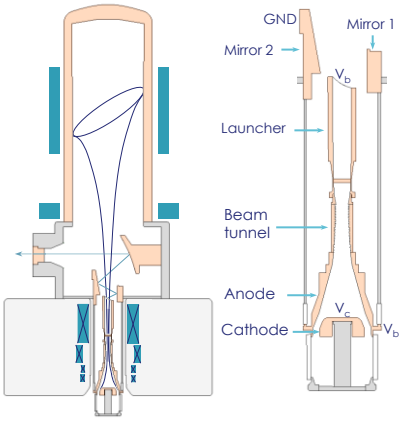
TECHNOLOGY OFFER

Innovative gyrotron device for high-power radiofrequency plasma heating

F4E, EGYC and Thales have developed an innovative gyrotron device able to heat fusion plasma to very high temperatures. This labeled process allows to produce continuous wave (CW) radio frequency (RF) signals at very high-power levels (above 1MW). Numerous applications in the space sector, but also in the industry (welding, heat/surface treatment), or remote energy transfer are possible.

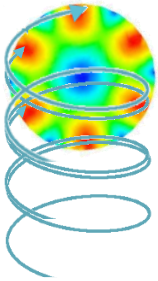
The Technology

ITER operation requires high power to be coupled into the plasma for the fusion condition to be achieved. Thales, EGYC (EU GYrotron Consortium) and F4E have developed a new gyrotron device that is able to provide power levels larger than previous technologies. Specific components have been created for this new kind of gyrotron, like the cavity, that has been designed to transform a DC signal into an RF signal operating at the plasma electron cyclotron resonance frequency (170 GHz).



Efficient plasma heating using DC power supply

The Gyrotron is an electron vacuum tube oscillator which transforms DC high voltage pulses into RF at very high-power levels (above 1 MW) relying on a particular cavity interaction principle, based on resonance at the operating frequency. Traditional electron tubes or solid-state high-power amplifiers cannot achieve those power levels. In addition, the innovative gyrotron device is equipped with depressed collector configuration that allows to reach high efficiencies in the range of 50%. The ITER gyrotron generates 1 MW RF Gaussian beam at 170GHz of continuous wave.



Powerful microwave radiations for numerous applications in the industry

Industrial plasma processes can be performed using the gyrotron, like material heat treatment, steel industry, processing of rubber, ceramics sintering, or the production of composites. Other applications may also be strengthening of surfaces, drying, welding or the removal of organic binders and moisture. The growing of ceramic nanostructures is also achievable. Lastly, the gyrotron may also find new applications in ultra deep geothermal drilling or the space industry, where it can be used for remote energy transfer via microwaves and with AC/DC energy recovery systems for aircrafts or satellites.

Collaboration opportunities

The technology is available for direct use, technical adaptation for new applications and power targets.

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