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Progress on an Ion Cyclotron Range of Frequency System for DEMO

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An Ion Cyclotron Range of Frequency (ICRF) system is one of the options to provide power on DEMO for a number of tasks, which have all been experimentally verified on present machines: breakdown assist, heating the plasma, controlling sawteeth, removing central impurities, current ramp down assist and wall conditioning. ICRF has a number of advantages for a machine like DEMO. The system has a high plug-to-power efficiency and most of the components external to the machine are sturdy, with industrial steady state capability. A critical aspect is the need for the antenna to be in-vessel and close to the plasma. While its low power density (compared to other heating systems) is a bonus in terms of reliability, it requires as conventional in-port antennas too much valuable in-port space. Therefore, travelling wave type antennas have been proposed [1]. They can be integrated in the blanket (several ways of doing this are being considered) and use only a limited number of feeders. Initial calculations for the antenna only, indicated that the effect on the tritium breeding ratio is small. These calculations are being refined and will include the effect of the antenna feeders. The k// spectrum is very peaked and the dominant k// value can be reduced to optimize coupling and bulk absorption. The coupling can be further enhanced with gas puffing near the antenna. Calculations of the antenna resistance show that 50 MW can be coupled with a voltage level of the order of 15 kV. The paper will discuss the proposed concepts, options to integrate the antenna in the blanket and possible remote maintenance schemes.
[1] R.Ragona et al., "The physics of the Traveling Wave Antenna (TWA) an innovative ion-cyclotron resonance heating (ICRH) system for the reactor with proof of principle demonstration on WEST ", this conference

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