

Ion cyclotron frequency range (ICRF) power on the way to DEMO

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Some characteristics of the heating and control systems will become increasingly important as machines move from present experiments to DEMO type machines:

- only a limited number of plasma heating and control systems will be acceptable, favouring systems that can perform more than one function;
- compatibility with neutronics shielding and tritium breeding will be paramount, favouring systems with small openings in blanket and shields;
- reliability and short down time in case of fault will be vital, leading to a preference for systems where components that need maintenance/replacement are easily accessible (far from the machine) with some redundancy;
- small recirculating power will be essential, emphasising the need for systems with high plug-to-power efficiency.

An ICRF system scores well on those attributes and is therefore a strong candidate as one of the heating and control systems in DEMO type machines.

It does however have matters of concern that need to be addressed in present and future machines.

The paper gives an overview of the ICRF system for ITER and highlights where extrapolations with respect to present systems are required. These need to be addressed with high priority in existing machines and on test stands. Critical aspects are the voltage standoff in the antenna and absolutely reliable arc detection methods. Impurity production in a high-Z metallic wall environment may become an issue in a later stage of ITER, but proposals for mitigation can be investigated in ASDEX Upgrade and Alcator C-mod.

The paper proceeds to illuminating the role of ICRF on DEMO. Experiments on present-day machines and on ITER could further strengthen the case for ICRF on DEMO.

ICRF in helical machines such as LHD already prove the long pulse capability of ICRF systems and thus reinforce its suitability for the long pulse/steady state machines of the DEMO type. Experiments on fast ions confinement with ICRF in present helical systems can also contribute significantly to qualify the helical concept for ITER/DEMO type machines.