ICRF heating and current drive prospects for W7-X

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The current planning of IC systems in W7-X foresees in a first phase the construction of an IC wall conditioning (ICWC) antenna, composed of two poloidal straps connected in parallel and fed by one generator providing max 1MW at frequencies between 4 and 25 MHz. While this system is expected to be very well suited for ICWC applications, we show that it could also be used for ICRF plasma heating and current drive with simple modifications to the current plans. To this end, each strap could be fed separately using the two (independent) generators available at W7-X, together with a decoupler circuit to minimize cross talk, and a prematching susceptance to reduce the voltages on antenna components and transmission lines allowing thus higher power output and flexible antenna phasing for ICRF heating and/or current drive. This would offer the important capability of validating numerical tools and testing the potential of a dedicated second phase ICRH/ICCD system for heating high density plasmas with $n_e > 2 \times 10^{20} m^{-3}$. Calculations with ANTITER II [1], TOMCAT [2] and CYRANO [3] show for various heating schemes (e.g. at 25 and 19 MHz) increased antenna coupling with increasing density, with absorbed power substantially above 1MW for the highest plasma densities, and about 1-2kA/MW$_{absorbed}$ non inductive current drive.

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