IAEA FEC 2014

Contribution ID: **416** Type: **Poster**

ICRF System on Tokamak T-15

Thursday 16 October 2014 08:30 (4 hours)

This system of ICRH/CD should provide RF heating and current drive in plasma of tokamak T- 15. A total of 6 MW RF power in the plasma should be initially available from the IC system. ICRH and CD system consists of three in-port antennas, corresponding transmission lines, delivering RF energy from sources, matching system , and ancillary subsystems.
Functional requirements in physics • Main heating schemes ICH system should be working on the second hydrogen harmonic at nominal Bo = 2.0 T (frequency of 60 MHz) . Hydrogen minority ions scenario at fundamental harmonic near of 30 MHz is also forseen This circuit also includes a scenario minority helium-3 in order to heat bulk ions. • The system must be capable of generating a current near the plasma axis. • Minority current due to He-3 addition should be created on the outer magnetic surface q = 1 for the control of sawtooth period at nominal field Bo = 2.0 T (frequency ~40 MHz for the 2nd harmonic of He-3) • The system conditions the chamber wall.
Functional technology requirements • Components RF sources should use the technologies available today. That's reliability will be determined at the design stage . • RF sources should be able to be effective, a quasi-continuous under high VSWR change to a maximum value equal to 2 , for any phase of the reflection coefficient.
Functional Requirements treatment needed • Sources of RF power should match modes of operation: *for plasma heating and current; * conditioning of the chamber wall; * Antennas conditioning; * Testing of RF antennas.
ICH Antennae on T-15. ICRF complex has three antennas placed in adjacent horizontal ports. Each antenna consists of 2 poloidal current-carrying conductors, grounded in the center, transparent FS. The poloidal limiters are installed on both sides of the antenna to protect it. They are made of blocks CFC tiles. For option 30 sec pulses antenna has water cooling, including Faraday screen and the vacuum chamber wall of the transmission line. FS is made from 625 inconel (or stainless steel SS316 L) tube coated C4B (back up is CTi). We are also considering advanced option of low impedance surface multi loop broad antenna with wave impedance near of 5 Ohm, fed by strip lines in horizontal ports.

Paper Number

FIP/P5-4

Country or International Organisation

Russian Federation

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Session Classification: Poster 5