Abstract

A 2.5 MW system designed to heat electrons and drive current via the electron Bernstein wave is in its early stages of operation on the MST reversed field pinch. The antenna is a grill of four half-height S-band waveguides with each arm powered by a separate, phase- controlled traveling wave tube amplifier. Coupling to the plasma (as measured by the ratio of reflected power) is very dependent on the relative phasing between adjacent waveguides. The total reflected power can be maintained at or below 15%, better than that measured for a two-waveguide full height SBW (X-mode). The antenna face is cut-off with a pair of triple-length quarter-wave section waveguides which propagates a circular polarized wave to the upper hybrid resonance and converts to \( B \). The total reflected power is in its early stages of operation on the MST reversed field pinch. The antenna is a grill of four half-height S-band waveguides with each arm powered by a separate, phase- controlled traveling wave tube amplifier. Coupling to the plasma (as measured by the ratio of reflected power) is very dependent on the relative phasing between adjacent waveguides. The total reflected power can be maintained at or below 15%, better than that measured for a two-waveguide full height SBW (X-mode). The antenna face is cut-off with a pair of triple-length quarter-wave section waveguides which propagates a circular polarized wave to the upper hybrid resonance and converts to \( B \).

Motivation

In addition to the benefits of an auxiliary heating source, the EBW scheme promises localized heating and current drive. This feedback is vital to measurements of heat and current drive feedback by measuring the change of the current or temperature profile in time. Localized current drive can also be used to investigate stability in the RFP by matching the phase \( \phi \) in the EBW to the resonance of magnetic modes. If successful in controlling the magnetic modes, the confinement in the RFP can be improved. The heating experiment can be altered to study the behavior of local pressure gradients approaching the Suydam limit.

Coupling to the EBW

Electro-cyclotron resonance heating is not accessible in the MST plasma, as the electromagnetic waves are cut-off due to high density, \( \omega_{ce} > \omega \). Electron cyclotron heating is still be done with the cyclotron resonance by coupling edge-electromagnetic waves to the electron Bernstein mode, which propagates in the over-dense plasma to the cyclotron resonance.

Improved coupling to plasma with 4 guide grill

Experimental Status

4 guide grill operational, coupling improved from 2 guide grill.

Manufacturing imperfections of antenna impeded performance; repairs made.

Antenna conditioned to about 1/2 of full transmitter power (~250 kW available)

No observable heating effects at ~100 kW injected.