ABSTRACT

Two rf schemes are being studied on the MST reversed field pinch for possible use in current profile control experiments. MHD modeling has shown that externally driven off-axis parallel current can improve stability of the dominant core tearing modes. Coupling experiments at the 10 MW level with lower hybrid (LH) and electron Bernstein waves (EBW) both show soft x-ray emission consistent with rf heating of electrons, and a small driven current in the LH case. Computational work in both cases suggests that, for sufficiently low energetic electron diffusivity, between 2 and 5 MW should drive enough current for mode stabilization. A 1 MW EBW system is under construction, with a compact antenna allowing variable polarization. A decision on higher power LH development will follow tests of a repaired antenna. Status and results of power and coupling tests will be presented.

Motivation

Transport driven by magnetic, stochastic (LH) fields confirm the triangular MST current profile.

Non-linear MHD simulation of parallel current profile and Polarese surfaces

Non-linear MHD simulations show that fluctuations in a triangular MST current profile are suppressed by internal field components:

Magnetic energy spectra of \( r = 1 \) tearing mode

EBW Results and Plans

Conversion efficiency \( v = \frac{\Delta T}{\Delta t} \) of 2.5 to 3.0 x 10^6 T in MST

3.6 GHz system

3rd generation magnetron line running wave with two crystals to produce 1 MW power. For MST

Superthermal electrons observed localized around antenna.

Fokker-Planck modeling indicates that several MW are required to stabilize the fluctuations in MST.

EBW Computation and Modeling

EBW access limited to \( r = 1 \), good enough for stability to limit core access which would improve detectability.

Diffusivity dependence

Current drive efficiency

Increased diffusivity without the current profile. Non-destructive eccentric plasma can better target for stabilization.

Expected current drive for 1 MW

Expected x-ray flux for 1 MW

Background density increases from entering antenna.

40 kW PCCD RF power required for stabilization.

SXR emission from target measured in 3.6 GHz system.

GH results and plans

Conditioning underway, attempting to restore full power operation and resume LH driven fast electron measurements.

Transmitter development proceeding, antenna design nearing completion, low power coupling tests underway.