

§30. Production and Steady State Operation of Non-inductive Current Driven Plasmas by ECRH

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**1. Objective**

In the experiments of superconducting high-field tokamak TRIAM-1M (R=0.8m, a/b=0.12/0.18m), the purely non-inductive, steady-state current drive plasma has been produced by the combination of electron cyclotron heating (ECH : 170GHz, 200kW, 5sec) and lower hybrid current drive (LHCD : 8.2GHz, 200kW, CW). The objectives of this collaboration are to compare the operation of non-inductive steady-state plasma on TRIAM-1M with the steady state operation of LHD machine using RF or NBI heating and moreover the R and D for both operations. The main programs of 2001 fiscal year are following:

- 1) Experiments of non-inductive current drive, steady-state operation using RF waves only.
- 2) Design and construction of the miter bend polarizer with high-speed rotating mirror for power adjuster.

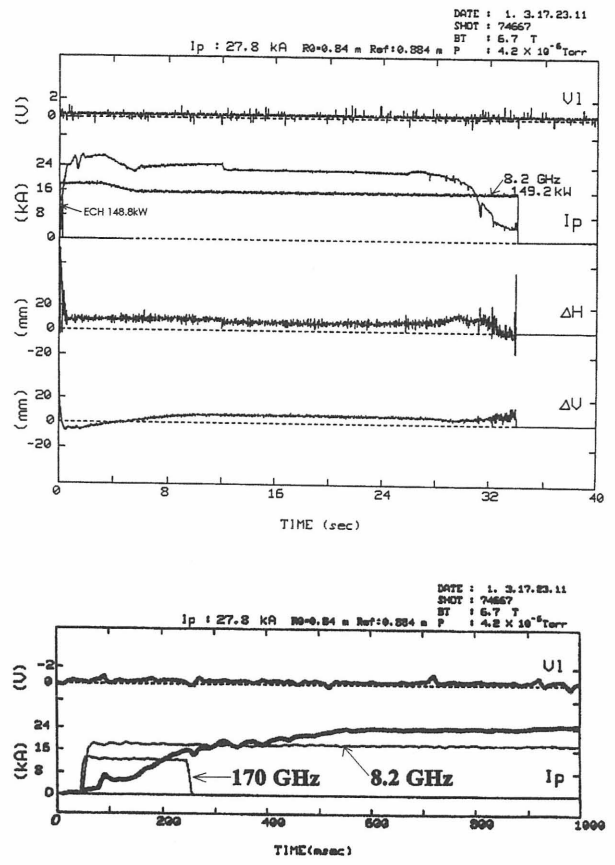
**2. Results in 2001 fiscal year**

On TRIAM-1M current drive experiments, taking over the previous year's 30 second discharge without a center solenoid coil, the high-performance and long-time plasma was demonstrated in successfully. The typical waveforms of a long discharge without CS coils, which obtained March, 2001, are shown in Fig. 1. The current ramped up by ECW and sustained by LHH for longer than 30 seconds.

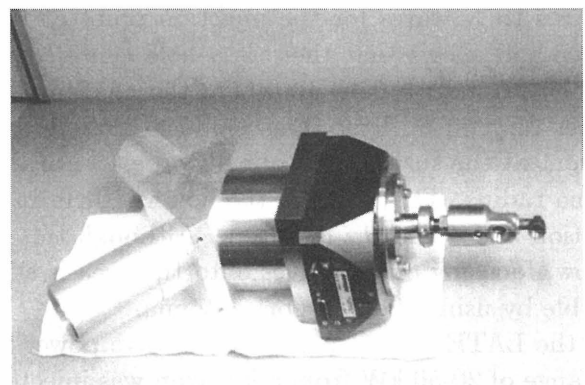
Using this collaboration budget, the miter bend polarizer with high-speed rotating mirror for power adjuster (Fig.2) has been designed and constructed at General Atomics. And also the antenna was designed and constructed. In TRIAM-1M machine the colligate wave-guide of 31.75mm made of stainless steel was used as the antenna. After some accepting test, the antenna will be set up at TRIAM-1M.

Moreover, the pre-test of mesh-shield of leakage microwave has been carried out using 140GHz EIO (20W, CW). Thus the copper mesh filter (visible light transmission factor : 95%) was used for the ports where the leakage is anticipated and the good result

were obtained. The measurement of leakage microwave from TRIAM-1M was demonstrated at the high power injection experiments.



**Fig. 1** The typical waveforms of the discharge without assistance of the ohmic heating are shown. The upper figures show loop voltage, plasma current and RF power, horizontal plasma displacement, vertical one from the top. The lower ones show the details of loop voltage and plasma current at the beginning of the same discharge. The discharge was made by electron cyclotron wave (170GHz, 0-0.3sec) and sustained by lower hybrid current drive (8.2GHz).



**Fig. 2** Photograph of the miter bend polarizer with high-speed rotating mirror.