# Effective excitation of an Alfven Slow Wave with Difference-Frequency between Two Fast Waves in the GAMMA 10/PDX Central Cell

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To enable DEMO divertor experiments the primary goal of Pilot GAMMA PDX-SC (PGX-SC) is to achieve hydrogen plasma densities exceeding $10^{19}$ $m^{-3}$. Additionally, it is crucial to develop an effective method for heating ions in high-density plasma in PGX-SC. In GAMMA 10/PDX, ions in plasma are heated by the ICRF slow wave. It has been shown that under the cold plasma approximation, slow waves are difficult to excite in high-density plasma by using ICRF antennas [1]. A Difference-Frequency (DF) wave can be excited as a slow wave through nonlinear coupling between two ICRF fast waves. In previous study on heating ion in plasma by using DF slow waves, increases in diamagnetism and charge-exchange neutral particles were observed by charge-exchange neutral analyzer [2, 3]. However, the method for efficiently exciting high-power DF waves remains unclear.

In this experiment, two Nagoya Type-III (Type-III) antennas were set to 9.9 MHz, and the current phase between them was varied. These antennas are located in the central cell of GAMMA 10/PDX . The East double-half-turn (DHT) antenna was set to 16.26 MHz, and a fast wave was excited as a standing wave in the central cell due to a cutoff caused by the strong magnetic field. The excited waves are measured by using magnetic probes and microwave reflectometer. A 6.36 MHz DF wave was observed at density of ~$3\times10^{18}$ $m^{-3}$ . In this study to investigate the conditions for exciting DF wave with high intensity, the TASK-WF/3D calculation code was used to analyze the wave structure of 9.9 MHz wave (Fig. 1) and examine its phase dependence on the DF wave.

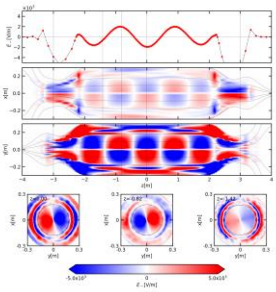

**Fig. 1** 9.9 MHz right handed polarization wave electric field culculated by TASK-WF/3D.

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