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MODELING OF HIGH POWER ICRF HEATING EXPERIMENTS ON TFTR*

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INTRODUCTION

Over the past two years, ICRF heating experiments have been performed on TFTR in the hydrogen minority heating regime with power levels reaching 11.2 MW in helium-4 majority plasmas and 8.4 MW in deuterium majority plasmas[1]. For these power levels, the minority hydrogen ions, which comprise typically less than 10% of the total electron density, evolve into a very energetic, anisotropic non-Maxwellian distribution. Indeed, the excess perpendicular stored energy in these plasmas associated with the energetic minority tail ions is often as high as 25% of the total stored energy, as inferred from magnetic measurements. Enhanced losses of 0.5 MeV protons consistent with the presence of an energetic hydrogen component have also been observed [2]. In ICRF heating experiments on JET at comparable and higher power levels and with similar parameters, it has been suggested [3,4] that finite banana width effects have a noticeable effect on the ICRF power deposition. In particular, models indicate that finite orbit width effects lead to a reduction in the total stored energy and of the tail energy in the center of the plasma, relative to that predicted by the zero banana width models. In this paper, detailed comparisons between the calculated ICRF power deposition profiles and experimentally measured quantities will be presented which indicate that significant deviations from the zero banana width models occur even for modest power levels (P_{rf} ~ 6 MW) in the TFTR experiments.

EXPERIMENTAL OBSERVATIONS AND ANALYSIS

ICRF heating experiments on TFTR were performed in the deuterium majority/hydrogen minority regime at power levels up to 8.4 MW with (0-π) phasing. A plasma current of 1.8 MA was used and the toroidal field was set at about 3.2 T to insure on-axis heating for a source frequency of 47 MHz. Central densities ranged from 3.8-5.5 X 10^{13} cm^{-3} with zeff typically about 1.5-1.8 for these discharges. According to spectroscopic measurements, the H/(H+D) ratio at the edge of these plasmas was in the range of 5%-8%, leading to an inferred central hydrogen density of about 6%. At ICRF power lev-

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