SYSTEM FOR TUNERLESS OPERATION OF A FOUR-ELEMENT PHASED ARRAY ANTENNA FOR FAST WAVE CURRENT DRIVE*

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Recent work at DIII–D [1] has been aimed at the development of fast wave heating and current drive systems that present a matched load to the rf transmitter despite the time-varying load on the antennas. Another strongly desirable property for these systems is to minimize the use of variable high power impedance matching elements in the transmission line, as these bulky, expensive devices are among the least reliable parts of these systems. While a system that easily satisfies these criteria can be constructed with a "combline" antenna [2], the goal of the present work is to optimize our use of the three existing four-element antennas on DIII–D. One line of development is based on the traveling wave antenna concept, as discussed in the paper by D.A. Phelps, *et al.* at this conference. Another method of achieving these goals is based on a simplification of the type of system presently used to power all three antenna arrays on DIII–D. In this approach, a 3 dB 90° hybrid junction is used in conjunction with a two-port decoupler. The resulting system can be used for either co- or counter-current drive phasing (progressive 90° phasing) of the array elements, and presents a matched load to the transmitter *without the use of variable tuning elements,* despite variations in the resistive or self-reactive antenna loading. Only variations in the mutual reactance between the antenna elements result in non-zero reflections to the transmitter; for this reason, a variable tuning stub remains in the decoupler for the version of the system that has been installed on the 60 MHz system at DIII–D. In this paper, details of the practical implementation of this system will be discussed, along with the first results from high power operation.

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[1]R.I. Pinsker, *et al.*, "Fast Wave Antenna Array Feed Circuits . . ." 12th Top. Conf. on Radio Frequency Power in Plasmas, Savannah, GA, 1997.

[2]R.I. Pinsker, C.P. Moeller, C.C. Petty, *et al.*, in *Proc. 19th Symp. on Fusion Technology*, Lisbon, 1996, to be published.

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If possible, please associate this paper with that of D.A. Phelps, *et al.*