**Status of the Development and Testing of Port-Plug and ECH-Protection Components for the ITER Low-Field Side Reflectometer**

C.M. Muscatello1, J.P. Anderson1, R.L. Boivin1, F. Cometa1, R. Fair3, D.K. Finkenthal2, A. Forsman1, D. Fox1, R. Gar1, A. Gattuso1, G.J. Kramer3, M. LeSher1, F. Martinez1, W.A. Peebles4, T.L. Rhodes4, A. Sirinelli5, D. Su1, H. Torreblanca6, L. Zeng4, A. Zolfaghari3

*1General Atomics, 3550 General Atomics Court, San Diego, CA 92121-1122*

*2Palomar Scientific Instruments, San Marcos, CA 92069*

*3Princeton Plasma Physics Laboratory, P.O. Box 451, Princeton, NJ 08543-0451*

*4University of California, Los Angeles, 475 Portola Plaza, Los Angeles, CA 90095-1547*

*5ITER Organization, Route de Vinon sur Verdon, 13115, St Paul Lez Durance, France*

*6CompX, P.O. Box 2672, Del Mar, CA 92014-5672 USA*

We report the status of various microwave components of the vacuum and ECH-protection sub-systems of the ITER Low-Field Side Reflectometer (LFSR). These components consist of:

1. Antenna array: The array consists of 6 antennas for simultaneous profile, fluctuation, and Doppler measurements. High accuracy of the aiming of the profile antennas is required for sufficient monostatic coupling of the reflection. The coupling versus aiming, as measured in the laboratory and with full-wave modeling with an ITER plasma, is used to specify the pointing direction and associated error of the LFSR antennas.

2. Vacuum windows: Windows produce unwanted reflections that can cause noise and clutter in the reflectometer signals, as well as frequency-dependent loss. Dual, redundant windows are used at the vacuum boundary for safety-protection that further exacerbate these issues. Broadband transmission improvement can be achieved with an anti-reflective layer, corroborated by modeling and measurements.

3. Phase calibration mirror: For absolute phase calibration of the LFSR profile reflectometer, an embossed mirror is incorporated into an in-vessel miter bend. Demonstration of real-time phase measurements using the in-situ calibration technique is performed with the DIII-D profile reflectometer. The field tests successfully demonstrate the feasibility of the calibration technique for LFSR; real-time calculations of the phase profiles agree well with the standard DIII-D post-processing analysis.

4. ECH protection mirror and monitor: The stray-ECH protection system for LFSR consists of both passive and active components. Passive diffraction gratings are the system’s first line of defense, rejecting 20 dB of power at 170 GHz. Another layer of defense is a waveguide-integrated power monitor that shutters the back-end electronics in the case of a high-power event.

The current design and initial measurements of these components will be described.