

Overview of ITPA R&D Activities in Support of ITER Diagnostics

Tuesday, October 23, 2018 8:30 AM (20 minutes)

The International Tokamak Physics Activity (ITPA) Topical Group (TG) on Diagnostics has been conducting R&D activities to support improved ITER diagnostic performance. In this paper, highlights of the Topical Group activity are overviewed: mitigation of first mirror degradation in optical systems, mirror cleaning techniques have been progressed; in-vessel stray-light has been investigated to reduce its impact on diagnostics; diagnostics of escaping particles, feasibility test of the activation probe technique has progressed under a multi machine joint experiment. Diagnostic systems are essential for machine protection, reliable machine operation and comprehensive understanding of burning plasma behavior in ITER [1]. In order to achieve the above aims, more than fifty sub-systems will be developed for measurement of plasma and plasma facing components in the harsh ITER environment, e.g. higher neutron/ -ray irradiation and lower accessibility/maintainability compared to that of existing fusion devices. ITPA Diagnostics TG has addressed common physics issues in diagnostics development [2]. The TG activity is mainly directed to High Priority research areas (HP);

HP-1: Optimization of the life-time of plasma facing mirrors used in optical systems,

HP-2: Assessment of impact of in-vessel wall reflections on diagnostic systems,

HP-3: Develop methods of measuring the energy and density distribution of escaping alphas

HP-4: Plasma control system measurement requirements

HP-5: Develop diagnostic calibration techniques/strategies compatible with the burning plasma environment and Joint Experiments for Diagnostics (JEX-DIAG) under a framework between ITPA and the Implementing Agreement on Co-Operation of Tokamak Programs of the International Energy Agency (IEA);

JEX-DIAG-2: Environmental tests on first mirrors,

JEX-DIAG-5: Field test of an activation probe,

JEX-DIAG-6: Cross comparisons of Charge Exchange Recombination Spectroscopy and X-Ray Imaging Crystal Spectroscopy,

JEX-DIAG-7: Distributed monitoring of microwave power density,

JEX-DIAG-8: Benchmark of Wall reflections,

JEX-DIAG-9: Spectral MSE (MSE-LS) experiments as design driver for ITER

JEX-DIAG-10: Minimizing microwave absorption in vacuum windows

JEX-DIAG-11: Determination of the runaway electron distribution function by spectral Bremsstrahlung measurements in the gamma-ray energy range.

Country or International Organization

United States of America

Paper Number

FIP/P1-15

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Session Classification: P1 Posters

Track Classification: FIP - Fusion Engineering, Integration and Power Plant Design