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Performance of PAM launcher in ADITYA-U tokamak

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After the successful integration of passive active multijunction (PAM) launcher in ADITYA-U tokamak, the lower hybrid current drive (LHCD) experiments with PAM launcher is conducted in ADITYA-U tokamak. The PAM launcher, designed to launch up to 250kW of rf power at 3.7 GHz, for one second, was successfully installed on radial port#5 of the tokamak. It was validated for UHV compatibility (10-9 mbar) and baking tests up to ~150oC. Good coupling of PAM launcher with plasma was demonstrated both with, low (~100mW) as well as with high (~120kW) rf power. Reflection co-efficient (RC) below 5% was achieved even when PAM launcher was placed ~15mm behind limiter.

The PAM launcher is designed to launch lower hybrid waves (LHWs) having parallel refractive index (N||) centered at 2.25 when two adjacent modules are relatively phased at 180o. Experiments are carried out by varying the phase difference between the two modules from 30o to 270o. The maximum power launched in to the plasma was around ~120kW. LH power up to ~200ms could be coupled to the plasma. Initially target plasma for LH experiments was formed by using positive convertor only where loop voltage was not available beyond 65ms to sustain plasma current inductively. Toroidal magnetic field was kept at ~1.4T. In this configuration, plasma current up to ~220ms could be sustained with PAM launcher and significant current could be driven with zero loop voltage towards the end of the plasma shot. Further, to have longer Ohmic discharges, negative convertor was augmented with positive convertor, to provide more Ohmic flux, thereby providing loop voltage up to ~330ms. Plasma current up to ~430ms could be sustained with PAM launcher when target plasma was formed with negative convertor and significant plasma current could be maintained with zero loop voltage towards the end of the shot. LH experiments were carried out with both hydrogen and deuterium plasmas. Experiments suggest that low RC of PAM launcher could be maintained in the presence of ECRH pulse and it remained insensitive to plasma movements. The enhancement in the photon counts, measured by scintillation CdTe detector and the 2nd harmonic ECE signal, with the injection of lower hybrid waves, confirmed the generation of suprathermal electrons due to interaction of LHWs with plasma and eventually driving plasma current non-inductively. The spectral broadening of the pump waves represented by the pump width is also observed indicating PDI effects at the plasma edge.

In this paper, the first experimental results obtained with PAM launcher in ADITYA-U plasmas will be presented and discussed in details along with future work plans.

Primary author: SHARMA, Promod Kumar (Institute for Plasma Research)

Co-authors: Mr KUMAR, J. (INSTITUTE FOR PLASMA RESEARCH); Mr AMBULKAR, K. K. (INSTITUTE FOR PLASMA RESEARCH); Mr PARMAR, P. R. (INSTITUTE FOR PLASMA RESEARCH); VIRANI, C. G. (INSTITUTE FOR PLASMA RESEARCH); Ms SHARMA, S. (INSTITUTE FOR PLASMA RESEARCH); Mr SINGH, C. (INSTITUTE FOR PLASMA RESEARCH); Mr THAKUR, A. L. (INSTITUTE FOR PLASMA RESEARCH); Dr GHOSH, J. (INSTITUTE FOR PLASMA RESEARCH); Mr TANNA, R. (INSTITUTE FOR PLASMA RESEARCH); Dr PATHAK, S. K. (INSTITUTE FOR PLASMA RESEARCH); Ms SIJU, V. (INSTITUTE FOR PLASMA RESEARCH); TEAM, ADITYA; TEAM, Diagnostic

Presenter: SHARMA, Promod Kumar (Institute for Plasma Research)

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