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**High-fidelity Bayesian inference of transient FRC plasma perturbations in C-2W** P. NORGAARD, T. BALTZ, M. DIKOVSKY, S. GERAEDTS, I. LANGMORE, T. MADAMS, N. NEIBAUER, J. PLATT, R. VON BEHREN, Google, J. ROMERO, S. DETTRICK, M. THOMPSON, E. TRASK, H. GOTA, R. MENDOZA, N. BOLTE, T. ROCHE, TAE Technologies, TAE TECHNOLOGIES TEAM, GOOGLE TEAM — A holistic, high-fidelity plasma reconstruction based on Bayesian inference is applied to study the advanced beam-driven Field Reversed Configuration (FRC) in the C-2W machine[1] at TAE Technologies, Inc. The method employs a statistical distribution of possible plasma states, including variables that persist across time points to enhance resolution of plasma dynamics. This implementation of time-linked Bayesian inference is used to evaluate electron density fluctuations at the C-2W midplane. Likely values and statistical confidence intervals are generated for density perturbation mode amplitudes, frequencies, and radial profiles. Synthesis of multiple high-frequency diagnostics provides significantly increased reconstruction fidelity compared to single instrument analysis. These include FIR interferometry, Mirnov magnetic field probes, and neutral beam induced secondary electron emission detection. This analysis is performed at 2 us resolution for the entire 10 - 30 ms plasma lifetime via distributed computing. Results include evaluation of the midplane density profile evolution, and observation of low-level intermittent azimuthal modes that rotate about the machine axis with frequencies in the range of 10-100 kHz.

[1] H. Gota et al., Nucl. Fusion 59, 112009 (2019).

Peter Norgaard
Google

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