

HTPD 2018



Contribution ID : 56

Type : not specified

10.41 Overview of the Wendelstein 7-X phase contrast imaging diagnostic and results from the OP1.2a campaign

Wednesday, 18 April 2018 10:31 (120)

A phase contrast imaging (PCI) diagnostic [1] was developed and installed for the Wendelstein 7-X (W7-X) OP1.2a campaign which took place in the latter half of 2017 [2]. The PCI technique applied to plasmas provides measurements of coherent and turbulent fluctuations in the electron density. These fluctuations act as a phase grating to the incident coherent light from a CO₂ laser. Collection optics gather both the scattered ($m=\pm 1$) and unscattered ($m=0$) components. An optical element called a phase plate, which is located at a focal plane of the optical system, provides a $\pi/2$ phase shift to the unscattered component. Following this, the optics create an image at the detectors whose intensity is linear in the absolute electron density perturbation. The W7-X PCI system can measure fluctuations with wavenumbers perpendicular to the laser beam in the range of approximately 0.5 cm^{-1} to 20 cm^{-1} , and frequencies in the range of 1 kHz to approximately 1 MHz. We will present an overview of the diagnostic design and capabilities, and will highlight measurements from the OP1.2a campaign that illustrate Alfvénic activity and changes in broadband turbulent spectra with magnetic configuration. This work is supported by the US Department of Energy. [1] Porkolab et al., IEEE Trans. Plasm

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Session Classification : Session #10, Wednesday Morning Poster Session