

3D structure of density fluctuations in T-10 tokamak and new approach for current profile estimation.

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Previous correlation reflectometry investigations in T-10 tokamak revealed the existence of several density fluctuation types and strong radial and poloidal variation of their amplitudes and correlation properties. This paper presents the new measurements of the 3D spatial distributions of the amplitudes, radial correlation lengths and long range correlations along the field lines of the different turbulence types. Experiments were carried out in OH and ECRH heated discharges. The density fluctuations were measured by correlation reflectometry using ordinary mode probing and new T-10 antenna set with four horn arrays distributed toroidally and poloidally over tokamak torus. Experiments confirmed previously found strong poloidal amplitude asymmetry of Broad Band (BB) and Quasi-Coherent (QC, typically 110-170 kHz) and uniform poloidal distribution of Stochastic Low Frequency (SLF, 0-50 kHz) density fluctuations. Presence of those turbulence types was also proved by measurements with Heavy Ion Beam Probe. Radial correlation measurements were made at four poloidal angles to understand the poloidal dependence of the radial correlation length for different fluctuation types. The significant decrease of the radial correlation lengths with towards high magnetic field side was observed for all turbulence types. The long range correlations along the field lines were measured by reflectometers in two cross-section separated by 1/4 of torus. Reflectometers have the same frequency thus provide reflection from the same magnetic surface. Reflection radii are chosen by frequency variation of the launched wave from shot to shot in a series of reproducible discharges. Measurements were carried out at low and high magnetic field side with two currents and simultaneous reverse of toroidal magnetic field and plasma current. Resonance radii were also calculating using 3D tracing of the magnetic field line and demonstrate good agreement with experiments. These results allow to propose the new approach for the current profile estimation in tokamaks.

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Primary author: Dr VERSHKOV, Vladimir (NRC "Kurchatov institute")

Co-authors: Dr MELNIKOV, Alexandr (NRC "Kurchatov institute"); Mr GORSHKOV, Alexey (NRC "Kurchatov institute"); Mr SERGEEV, Dmitry (NRC "Kurchatov institute"); Dr SHELUKHIN, Dmitry (NRC "Kurchatov institute"); Mr KHABANOV, Filipp (NRC "Kurchatov institute"); Mr SUBBOTIN, Georgy (NRC "Kurchatov institute"); Mr ASADULIN, Gleb (NRC "Kurchatov institute"); Mr BELBAS, Igor (NRC "Kurchatov institute"); Mr ELISEEV, Leonid (NRC "Kurchatov institute"); Dr BULDAKOV, Maxim (NRC "Kurchatov institute"); Mr DRABINSKII, Mikhail (NRC "Kurchatov institute"); Mr MYALTON, Tatyana (NRC "Kurchatov institute"); Mr TRUKHIN, Vladimir (NRC "Kurchatov institute")

Presenter: Dr VERSHKOV, Vladimir (NRC "Kurchatov institute")

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