Implementation of amplitude modulation reflectometry for density fluctuation measurements.

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Reflectometry with amplitude modulation (AM) is based on the analysis of the phase of probing wave envelopes and was initially proposed to use for electron density profile measurements [1]. Present work is devoted to the attempts to apply AM reflectometry for turbulence studies. The first advantage of this technique is the long equivalent wavelength of probing wave envelopes which gives possibility to decrease the perturbation of probing wave envelope phase below $\pi/2$ and potentially investigate discharges with high turbulence level. The second one is the better localization of measurements due to the decreasing of undesirable phase perturbation by turbulence on the wave trip to the cut-off layer and back.

1D geometric optics approach, similar to proposed in [2], was used to estimate the response of the AM reflectometry on density fluctuation properties. It was found that, in spite of traditional reflectometry that is more sensitive to fluctuations with long radial size, AM reflectometry is sensitive to short size fluctuations.

AM reflectometer scheme was installed on T-10 tokamak for Ka band. Plasma was probed from high magnetic field side (HMFS) using extraordinary wave. Heterodyne scheme with intermediate frequency 900 MHz and modulation frequency 20-200 MHz was used in experiments. It was found that level of perturbation of reflected envelopes phase is proportional to modulation frequency. Spectrum of reflected signal contains all turbulence types that were previously found on T-10 at HMFS [3].

References