Development and testing of refractometer on t-11 m[[1]](#footnote-1)\*)

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Refractometry is based on measurements of the microwave signal propagating plasma delay time [1, 2]. Unlike reflectometry, it allows to obtain integral electron density from integral delay time measurements. ITER is expected to have a refractometry channel to supplement main reflectometry channel from high field side in measuring integral density. This work discusses features of a prototype refractometer application in tokamak T-11 M conditions. Propagating on T-11 M was made at frequencies, close to transparency window on ITER. However, unlike it is planned on ITER, propagating was made on vertical chords. Besides, in this prototype differential type of time delay measurement was used, although on ITER using of amplitude modulation is expected. This work also describes layout of differential refractometer (DR) prototype, based on two microwave generators with frequencies 94.1 and 95 GHz and calibrating characteristics evaluations for refractometer and Cotton-Muton polarimiter (CMP). Integral electron density was measured in two configurations: in first one refractometer was propagating in ordinary mode at vertical chord -5 cm with CMP propagating at vertical chord -1 cm; in the second one refractometer was used in extraordinary mode at vertical chord +7 cm with CMP propagating at vertical chords -1 and -13 cm. Comparison of DR and CMP data was made. Integral density, measured with DR in ordinary mode at -5 cm is appears to be close with CMP density measurements. It indicates that density profiles at given tokamak’s operating modes were flat, which was confirmed by results, given in later experiments in second configuration. Also density profile was recovered with an assumption of monotonic behavior of density profile. While working on CMP and DR data, refraction impact, as well as possible plasma horizontal shift were considered. Since in this frequency range correlation between integral density and time delay (phase difference on difference frequency) is not linear, to calculate <nl> and recover density profile recurrent method was used.

Given the experiments results, area of low electron density, moving from the center to periphery with velocity 2.5-3 m/s was found. These data is consistent with the 32-channel bolometer data. Fourier analysis also was made, which shows, that DR spectrum is similar to analogous reflectometer spectra, which were obtained on T-11 M earlier.

****References****

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVIII/E/ru/HS-Afonin.docx) [↑](#footnote-ref-1)