Plasma density recovery in ITER refractometry by single chord probing at X-wave [[1]](#footnote-1)\*)

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The paper investigates the possibility of restoring the average electron density at single-chord low-frequency (Nf = 4-12) sounding of tokamak plasma by an X-wave in plasma refractometry.

For example, ITER tokamak geometry is selected (a = 220 cm. R0 = 620 cm.). Plasma probing is carried out along the central chord (through the center of the plasma). The time of the microwave signal passing through the medium with the carrier frequency lying in the plasma transparency window (45 – 100 GHz) was measured [1].

The probing frequencies equidistant from each other in this range in the amount from 4 to 12 were chosen.

Two models were chosen as parametric models of electron density: "peak" (circular Gaussian with 4 parameters) and "plateau" (difference of two circular Gaussians with the same center with 6 parameters).

The peculiarity of the X-wave is that the refractive index of the plasma depends not only on the density of electrons, but also on the total magnetic field in the tokamak plasma.

The minimum number of required probing frequencies and measured time delays was determined. A sufficient number was determined to restore the electron density distribution and the average electron density in the ITER plasma in the most typical case ("peak", "plateau"). We evaluated the accuracy of reconstruction and robustness to noise. The problem resembles the problem of single-angle computed tomography with a small number of chords, which determined the choice of the solution by the fitting method [2].

References

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