First results on the plasma fluctuations of the TORPEX device in the new magnetic field configurations

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1. Introduction

The Tорoidal Plasma ExРeriment features a Simple Magnetized Torus configuration (SMT) using a small vertical magnetic field superimposed to the main toroidal field, resulting in helical open magnetic field lines. A new experimental set-up based on an in-vessel toroidal copper wire has recently been implemented into TORPEX to produce a poloidal magnetic field, driving a current with a dedicated external power supply. This leads to a rotational transform and to a magnetic configuration similar to the tokamak one:
- Scrape-Off Layer region.
- Core region.
- Closed-to-open magnetic field lines transition.

2. Tорoidal Plasma ExРeriment

**Main parameters:**
- $R = 1.6\text{ m}$
- $a = 0.2\text{ m}$
- $B_T \approx 76\text{ mT}$
- $B_p \approx 3\text{ T}$ ($B_p \approx 30\text{ A}$)
- $n_e \approx 10^{19}\text{ cm}^{-3}$
- $T_e \approx 5\text{ eV}$
- $f_{\text{EC}} \approx 2.45\text{ GHz}$

**Main features:**
- Gases: $\text{H}_2$, $\text{He}$, $\text{Ne}$, $\text{Ar}$.
- Density gradients.
- Magnetic field gradients and curvature.
- High plasma reproducibility.
- High flexibility of the control parameters.

3. In-vessel toroidal wire system

**Experimental set-up:**
- Toroidal copper wire with 1 cm radius.
- 1 vertical feedthrough actively cooled.
- 3 vertical supports.
- 4 horizontal supports.
- Current up to 1 kA.

4. Simulated magnetic field

**Magnetic field on the poloidal cross section with 630 A in the toroidal wire.**

5. 1-D plasma profiles

**Measurements on the LFS, at $z = 0$, using $\text{H}_2$ gas and a constant magnetron power $P_{\text{magn}} \approx 150\text{ W}$.** A current of 630 A in the toroidal wire and 30 A in the vertical field coils has been used.

6. 2-D plasma profiles

**Picture of HEXTIP inside the vacuum vessel and corresponding mapping of the probes.**

**Time-averaged electron density with and without the poloidal magnetic field.**

7. Conclusions and outlook

First measurements of plasma fluctuations and background parameters have been performed on the TORPEX device with new magnetic field configurations, both in 1-D and 2-D.

**Outlook:**
- Plasma turbulence characterization;
- Comparison of the experimental results with linear/non-linear fluid simulations;
- Exploration of more complicated magnetic field configurations.

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References


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