

Fast imaging on TORPEX

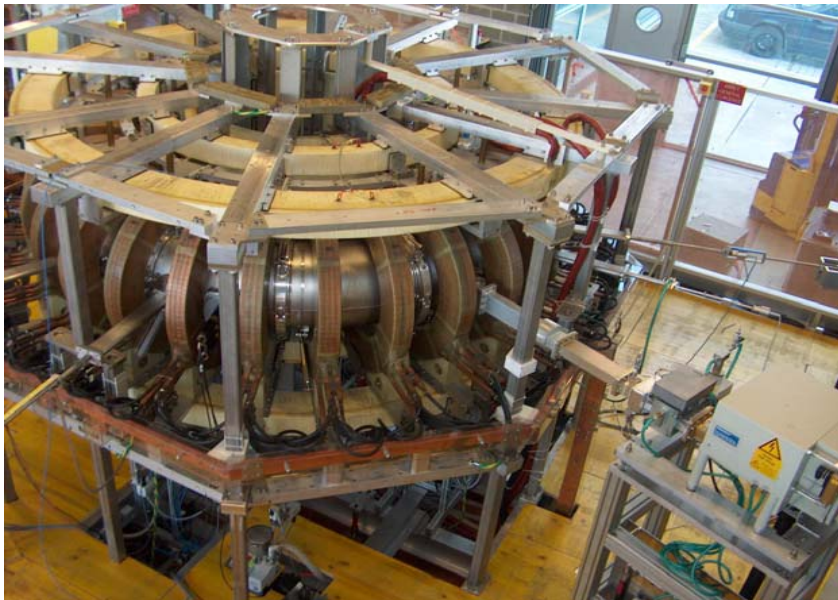
Ivo Furno, Ambrogio Fasoli, Davoud Iraji,
and

TORPEX basic plasma physics group

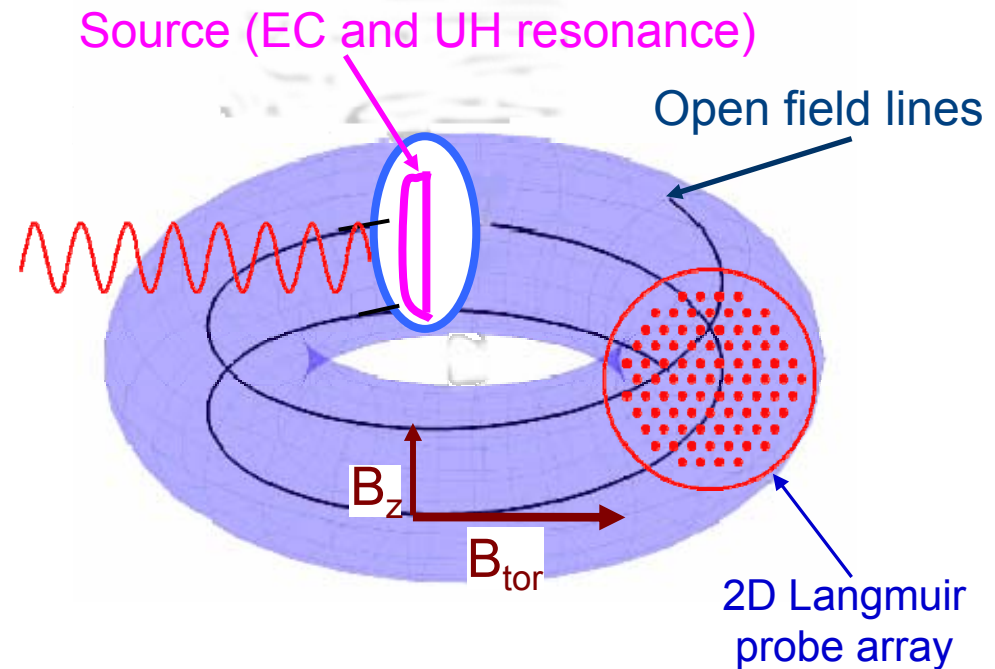
*Centre de Recherches en Physique des Plasmas (CRPP)
École Polytechnique Fédérale de Lausanne, Switzerland (EPFL)*

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The TORPEX device



[A. Fasoli et al., Phys. Plasmas **13**, 055902 (2006)]



- ❑ Toroidal device: $R=1$ m, $a=0.2$ m
- ❑ Plasma production: magnetron
(2.45 GHz, < 20 kW, ~ 1 s);
- ❑ Extensive set of diagnostics
(Electrostatic, magnetic,... probes)

H_2 , D, He, Ne, Ar plasmas

$T_e = 2 - 20$ eV

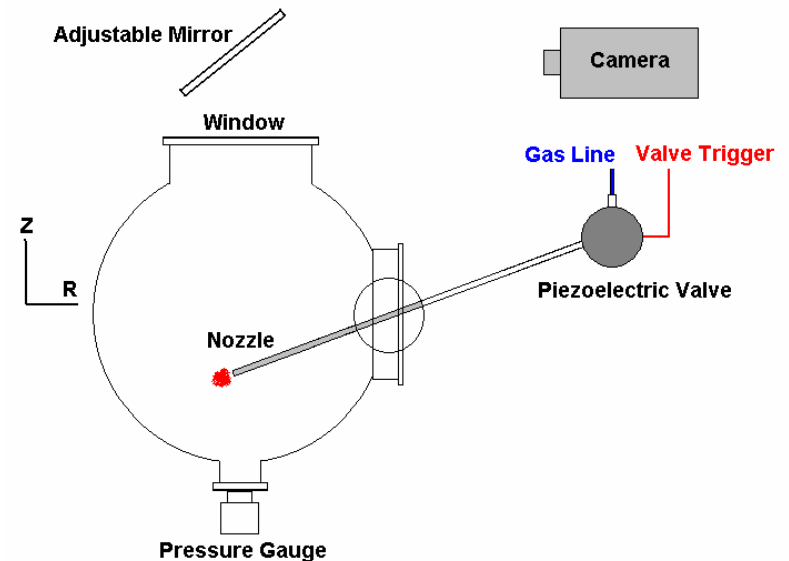
$n_e = 0.1 - 5 \times 10^{16} \text{ m}^{-3}$

Fast imaging tools



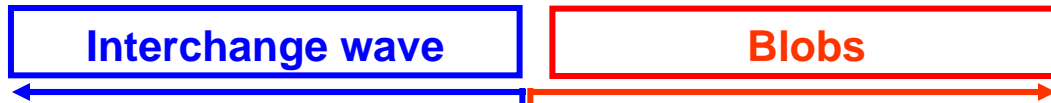
- ❑ Photron Ultima APX-RS fast camera
- ❑ 1024 x 1024-pixels CMOS sensor
- ❑ at full chip, resolution up to 3,000 fps
- ❑ at reduce chip size, up to 250 kfps
- ❑ 8GB memory
- ❑ Multiple views are possible

2D Movable Gas Puffing System

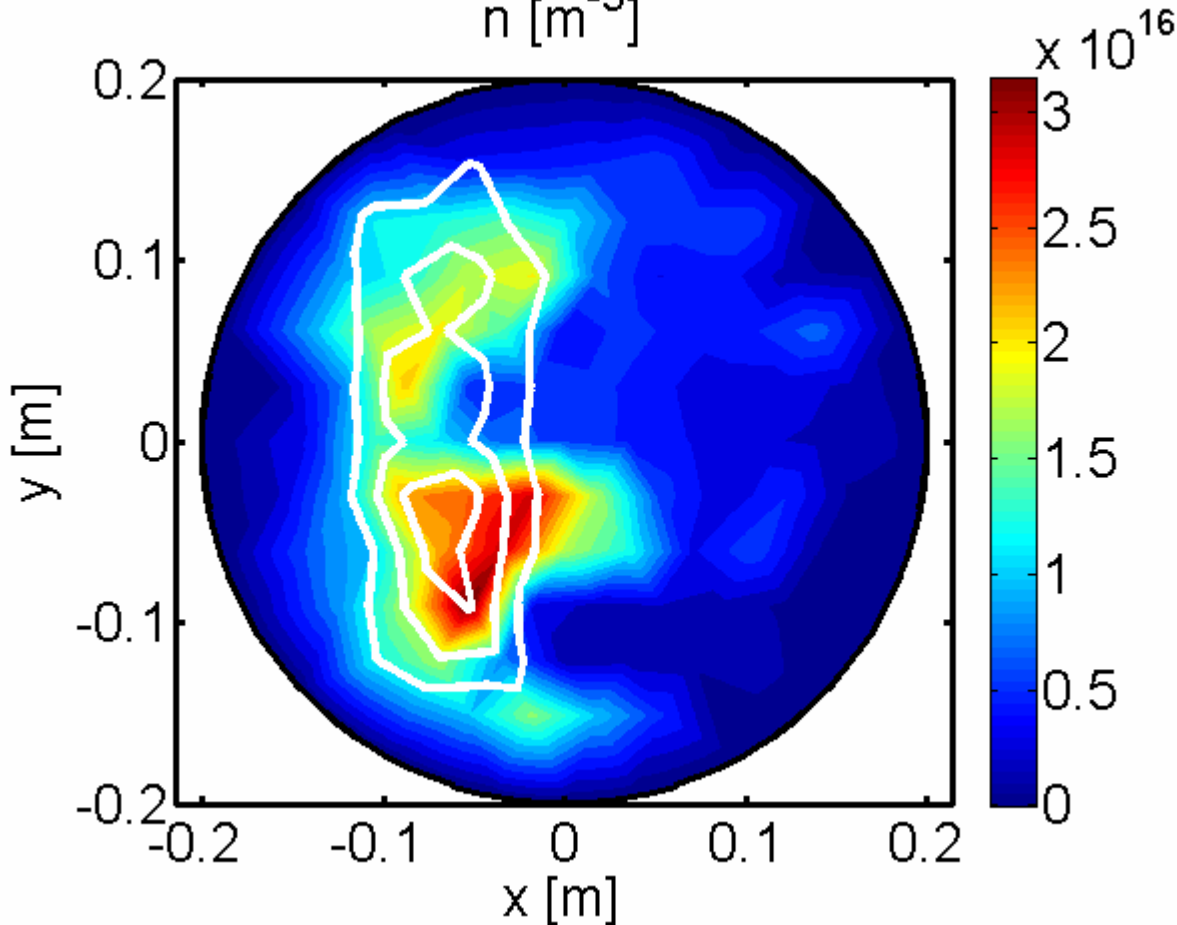


- ❑ Gas Puffing Imaging (GPI) system
- ❑ Fast piezoelectric valve, time response ~ 2 ms
- ❑ Ceramic tube with a 50-200 μ m nozzle
- ❑ Installed onto a 2D positioning system covering almost the whole poloidal section

Strength: well established and diagnosed plasma



$n \text{ [m}^{-3}\text{]}$

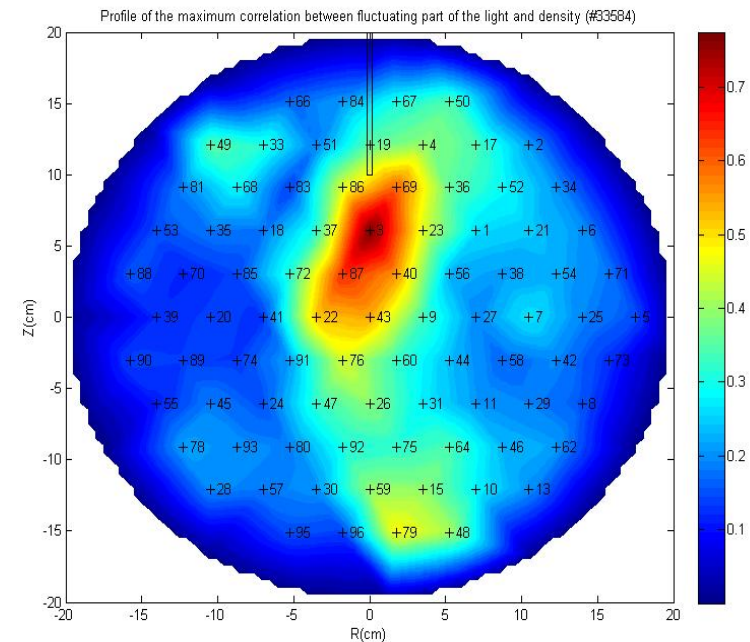
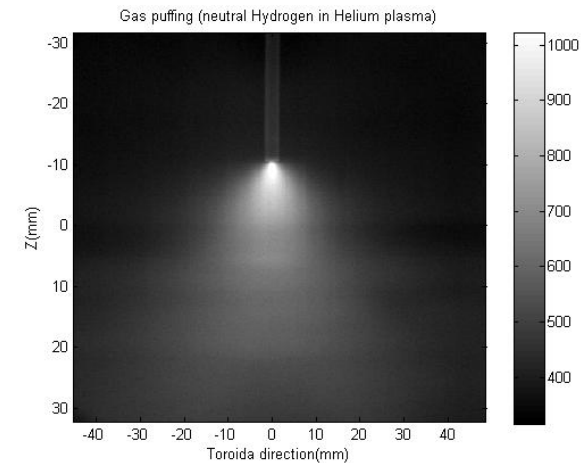
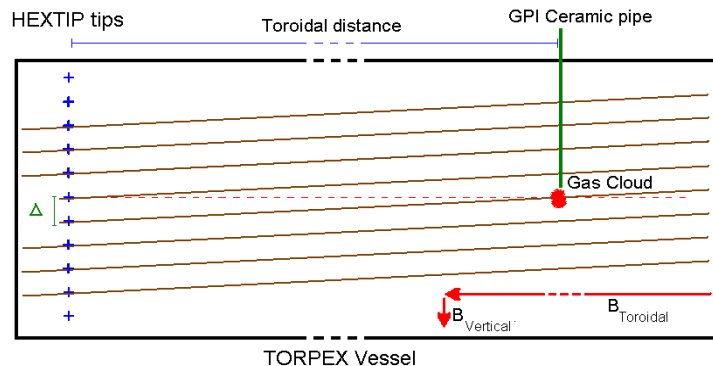


- Drift and interchange waves
 - $k(\omega)$, 2D imaging
- Blobs - intermittency
 - Statistical properties, 2D imaging
- Correlating GPI signals with other fluctuating signals such as
 - $I_{\text{sat}}, V_{\text{pl}}, T_{\text{e}}, \dots$
- Compare spatial, spectral, statistical properties

Example: correlation of visible light and I_{sat}

The maximum correlation exceeds 0.8 and is located at the same radial position as the nozzle and 4cm below its vertical position.

This displacement is compatible with the pitch angle of the field lines and the toroidal distance between the nozzle and the HEXTIP.



More to come...

- ❑ Possibility of combining multiple cameras to have stereoscopic view
- ❑ Fast camera and dedicated laptop are extremely portable to other devices (already shared between TORPEX and TCV)
- ❑ Use of filters to select line emission
- ❑ Soon test of a fast image intensifier
 - Reduce integration time
 - Imaging of fast ion beam (???)
 - Combine with active imaging such as LIF to obtain v-resolved measurements