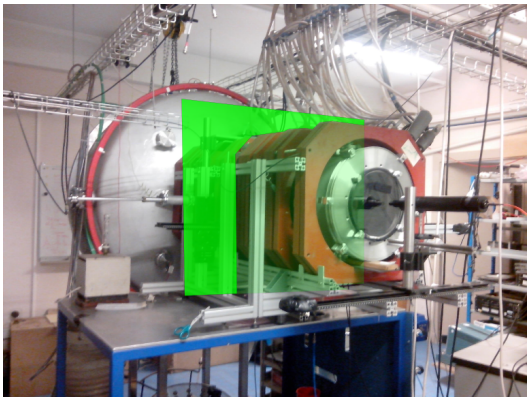
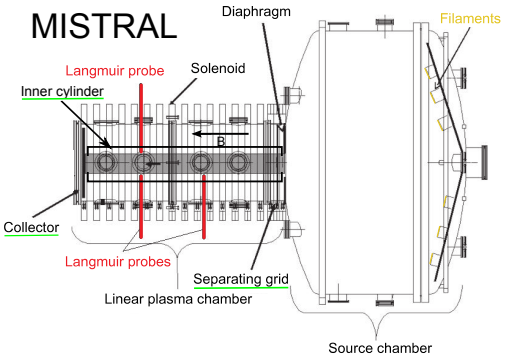
Goal of this document: Global description of the tomographic diagnostic on the device called MISTRAL in order to compare numerical result of tomographic inversion on it. Here is a picture of the experiment with the measured section of the plasma trough lateral apertures:

In MISTRAL, the plasma is created in a large source chamber (1.4 m diameter, 1 m





length) using a thermoionic discharge with 32 tungsten filaments and is then injected in a one meter long cylindrical magnetized interaction chamber. The plasma's behaviour is affected by several tunable parameters, such as the gas pressure ($1 - 6.10^{-4}$ mbar), the discharge energy ($30 - 40$ eV), the magnetic field intensity (150 Gauss), and the polarization of each end of the column and of the inner cylinder (-25 to $+25$ V). The given windows of parameters are the one chosen to get stable modes rotating at 3 to 8 kHz.

We take advantage of the stability of those modes during several hours to simulates 32 simultaneous acquisitions using a single optical fibre moved to different positions and synchronizing the acquisitions with the plasma rotation. The fibre is collimated to collect light from a plasma cone between 8 and 13mm wide. A carbon based coating has been applied inside the vessel to limit excessive noise due to light reflections. Depending on the brightness of the plasma, two optical detectors can be used: a photomultiplier with a gain of about 10^{6-7}, or a photodiode. Both detectors measure the visible light from the plasma without spectral filtering. The light mainly comes from the argon lines, which in the coronal model, is directly proportional to the electron density n_e. Different tomographic inversions are made to compare the quality of each numerical method, and especially the pixels shapes.

Geometry description (see Fig.1)

This origin is the bottom left corner of our system and is taken at a physical spot on the experiment, but is in an empty space in the inversions. The chosen unit is the millimetre. Since this is still an evolving diagnostic, the positions will most likely change for each experiment. We give here an example of values (used for the experiment showed here). For each set of data, a text file with all geometric data will be joined for easier copy/past.

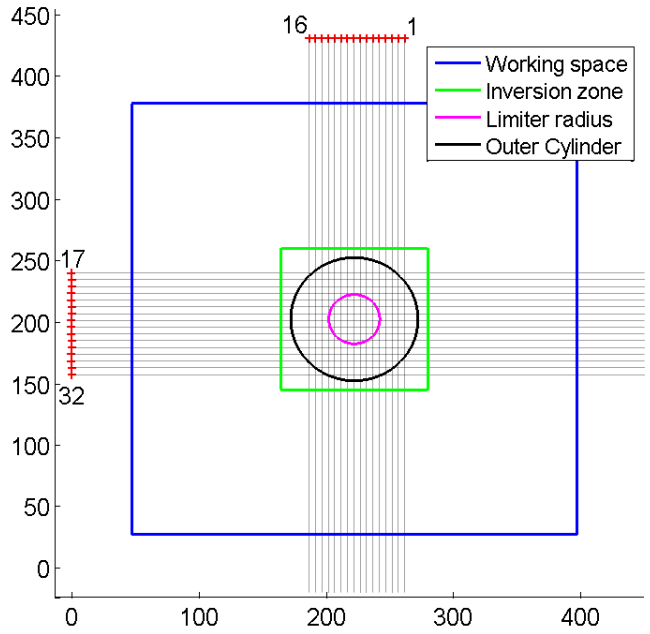


Figure 1: Global geometry of the tomographic measurements

Center of the column	$(222, 202)$
Size of the considered space	350
Size of the region where the inversion is done	115
Limiter radius (= red circle)	40
Outer cylinder radius (= black circle)	10
LoS 1 to 16 positions (top LoS)	$x = 261.5, 256.5, 251.5, ... - 5..., 191.5, 186.5$ $y = 430$
LoS 17 to 32 positions (lateral LoS)	$x = 0$ $y = 239.5, 234.0, 228.5, \ldots - 5.5 \ldots, 162.5, 157.0$
Sensor diameter (circular sensor)	5
LoS pread half-angle (Cone shape)	0.0186 rad

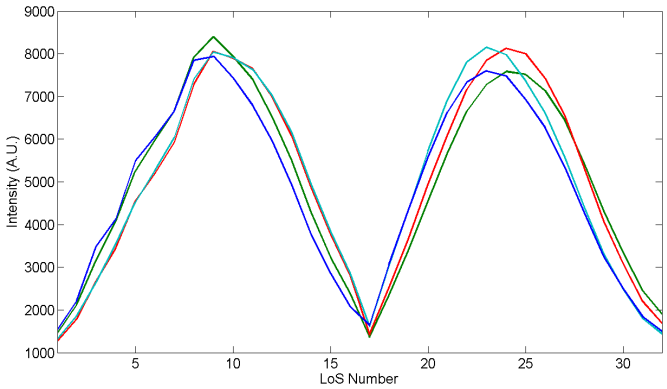


Figure 2: Example of different set of data (signal for each sensor #1 to #32)