

Divertor spectroscopy

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1. Purpose / Application

The system measures the hydrogen and impurity emission in visible range around the divertor region. We have three spectroscopy systems, each of them has different feature and purpose. Please see below for the details.

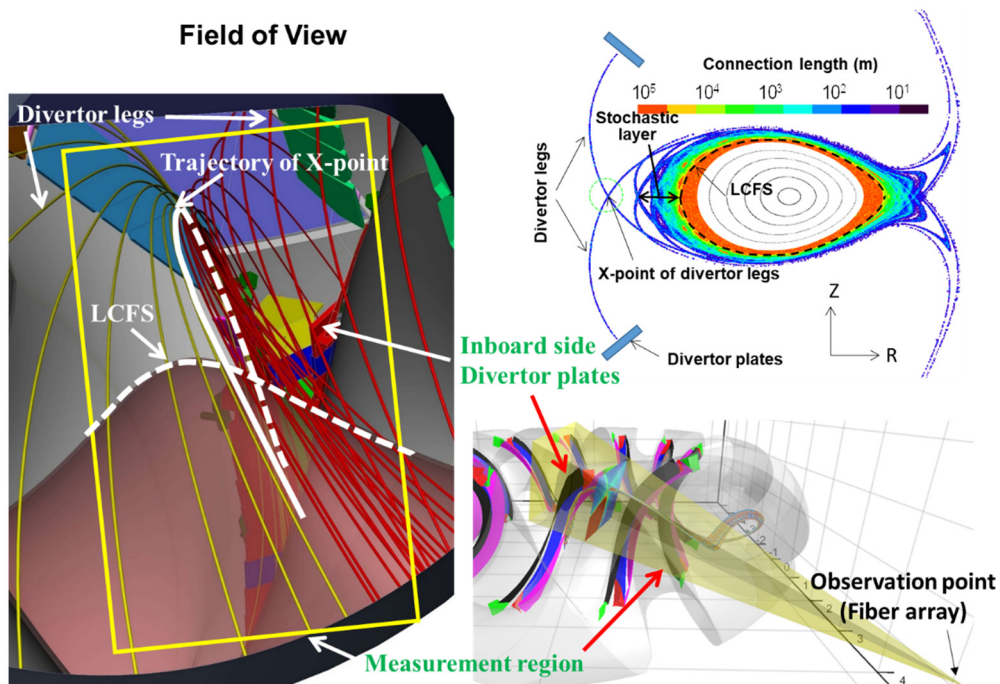
2. Name of analysis (Kaiseki) data / module of MyView2

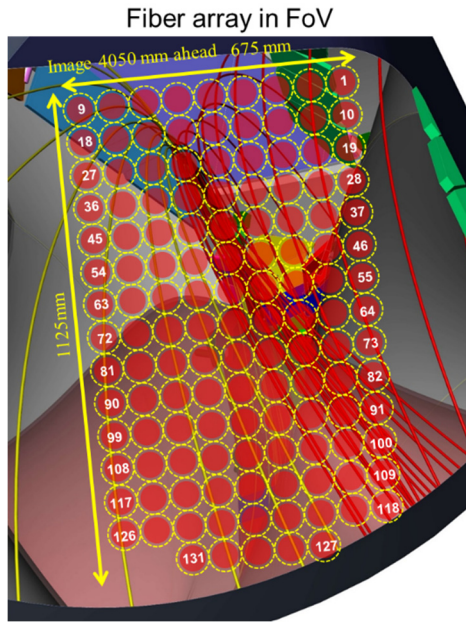
Spec_div1 (4-O port)

3. General Description (Port, field line, time resolution, spatial resolution, number of channels, etc.)

7-O port system

This system measures 2D distributions of emission around the divertor region. The field of view covers divertor plate, divertor legs, stochastic layer and LCFS region. Since the FoV is almost tangential to the magnetic field lines, the correlation between the emission and magnetic field structure can be studied as well as flow velocity of impurity by analyzing Doppler shift of the spectra [1,2].





Specification

Fiber core diameter : 50 μ m (131+2ch)
Lens magnification : 1200

Spectrometer : MK-300
(BUNKOUKEIKI co., Ltd)
Focal length : 300 mm
F-number : 4.4
Wavelength range : 200 ~ 1000 nm
Diffraction grating :
150gr/mm ($\Delta\lambda \sim 1.07\text{nm}$ @ 546nm)
(measurement range for 256 pixel: 150nm)
300gr/mm ($\Delta\lambda \sim 0.54\text{nm}$ @ 546nm)
(measurement range for 256 pixel: 74 nm)
2400gr/mm ($\Delta\lambda \sim 0.06\text{nm}$ @ 546nm)
(measurement range for 256 pixel: 5.8 nm)

CCD detector : 25.4 x 6.7 mm
(1024 x 256 pixels 1pixel=26x26 μ m)

4-O port system

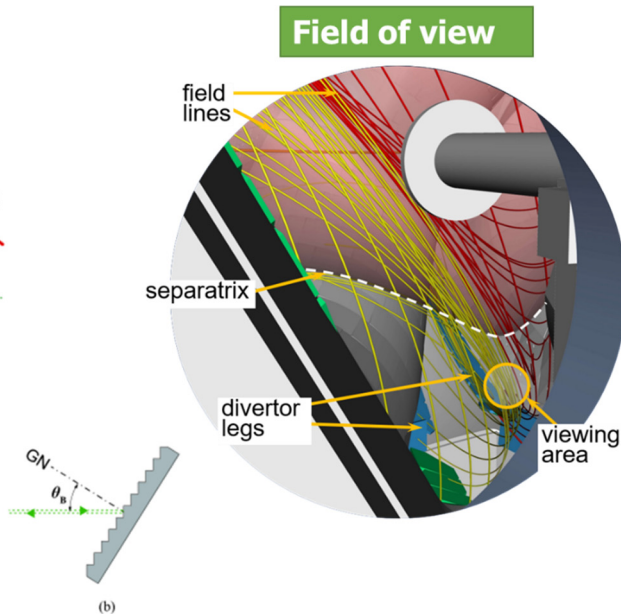
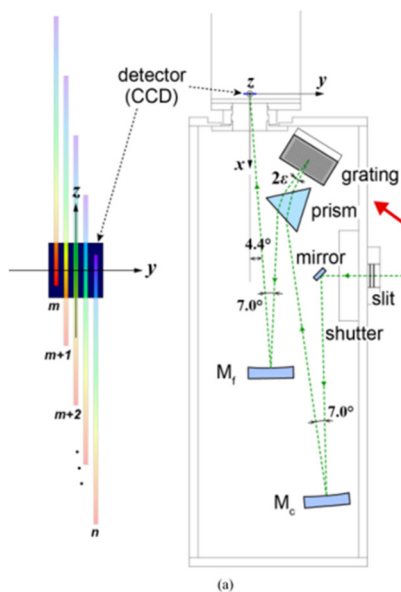
This system measures the visible range of wide range with good wavelength resolution. The system views the divertor region. The FoV is almost tangential to the magnetic field line (divertor legs). The data can be used to analyze impurity flow velocity, Fulcher band etc [3,4].

Specification (Echelle spectrometer)

Wavelength range: 400-800nm

Resolution: $\delta\lambda \sim 0.05\text{nm}$

Echelle spectrometer



9-O port system

This system views inboard divertor array (9-I) with tungsten coating. Mainly used to measure tungsten emission measurements (WI) for evaluation of W source.

Specification

Fiber core diameter: 230 μ m

Lends magnification: 435

Spectrometer: M50TP-GT (BUNKOUKEIKI co. Ltd)

Focal length: 500mm

F-number: 5.3

Wavelength range: 300-780 nm

Diffraction grating:

1200gr/mm

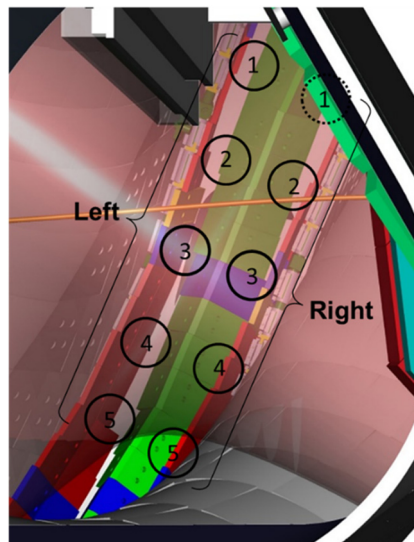
1800gr/mm

2400gr/mm

CCD: W 27.6mm x H 6.9 mm (2045 x 512 pixels, pixel size:13.5 μ m)

Fiber array with collimator lens is installed with 10 channels.

Field of view of the measurement system



4. Requirement in use

5. Description of analysis (Kaiseki) data / module of MyView2

Spec_div1 (4-O port): temporal evolution of Balmer series, carbon emission (CIII, CII, CIV etc), and He emission (HeI)

6. Others

References

- [1] M. Kobayashi et al., Review of Scientific Instruments vol.88 (2017) 033501.
- [2] T. Kobayashi et al., Review of Scientific Instruments vol.89 (2018) 123502.
- [3] A. Kuzmin et al., Plasma and Fusion Research vol.13 (2018) 3402058-3402058.
- [4] A. Kuzmin et al., Nuclear Materials and Energy vol.17 (2018) 217-221.