Toroidal visible array

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1. Objective

- [1] Toroidal distribution of H α and HeI
- [2] Ratio of helium to hydrogen: $n_H/(n_H+n_{He})$ or $n_D/(n_D+n_{He})^*$
- [3] Particle recycling and edge τ_P

*Separation of H and D is difficult with an interference filter

2. Apparatuses

2.1. Toroidal array

- Toroidal array basically consists of 9 toroidal optical fiber channels (see Fig. 1).
 - (#2-O, #3-O, 4-O, #5-O #6-O, #7-O, #8-O, 9-O, #10-O with different position at each port and different viewing angle)
- H α and HeI line emissions passing through an interference filter are detected by photomultiplier.
- Time resolution: 0.1ms



Fig. 1. Viewing chords of toroidal array

2.2. Port assembly

- Example: #5-O port (see Fig. 2)
- Observation area: including separatrix X-point



Fig. 2. Viewing chords at #5-O port

2.3. Filter assembly

- Two filter assemblies for H α and HeI (see Fig. 3)



Fig. 3. Filter assembly

3. Operation of toroidal array

- Before experiment: opening shutters and turning on power supply

- After experiment: closing shutters and turning off power supply

4. Available data by "Retrieve"

Kaiseki-data server

- ha1 (H α), ha2 (HeI), hhe (H/(H+He) or D/(D+He))

5. Remarks

- Signals sometimes include an impurity line, e.g. $H\alpha$ blended with CI. It depends on the experimental scenario.

- Densities of $n_e > 1 \times 10^{13} \text{ cm}^{-3}$ is necessary for good signal quality.
- Example of data analysis (see Fig. 4)



Fig. 4. H/(H+He) ratios as a function of shot# for discharges (a) with and (b) without He-glow.

References

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and others