Etendue Optimization and exit slit optics alignment for Fast Doppler spectroscopy (FDS) system

Abstract

Objective of Project:
Etendue calculation of Fast Doppler diagnostics.
Design and fabrication of cylindrical lens mount for precise optics alignment, characterization of data acquisition system and measurement of spectral line shape of neutral Hydrogen, and carbon ion's spectral lines.
Brief Description of the project
A Fast Doppler Spectroscopy (FDS) diagnostic is developed to investigate impurity ion flow velocity dynamics during the sawtooth crash and tearing mode instability in ADITYA-U tokamak. The FDS diagnostics will measure impurity flow velocity by detecting Doppler shifted line at 464.7 nm of C2+ ions. The newly developed FDS system is having 1 m spectrometer and employs photo multiplier tubes (PMT) to obtain temporal resolution of ~ tens of μs, as compared to that of few ms of conventional Doppler spectroscopy system. The light from ADITYA-U edge plasma is collected using an optical fiber and lens mounted on tangential port of tokamak. A collection optics is placed at exit slit to feed light to eight PMTs. The exit slit optics consist of a combination of cylindrical lenses and an array of 8 optical fibers. The combination of cylindrical lenses is used to de-magnifying slit image and to couple light efficiently to 8 nos of optical fiber.
The primary task is having detailed etendue calculation and finding optimized technique to achieve better light collection at both input and output ports of spectrometer. Moreover, appropriate spectral line shape measurement depends upon alignment of the pair of cylindrical lens and optical fiber array system. Any such misalignment can result into distorted spectral line shape measurement. Therefore, a special cylindrical lens mount has to be designed, fabricate and use it for precise alignment of cylindrical lens system. Using this, precise magnification control in both wavelength and height can be achieved. Further, task includes measurement of shift in C2+ ion line (?= 464.7 nm) to obtain impurity flow velocity.

Academic Project Requirements:

1) Required No. of student(s) for academic project: 1

2) Name of course with branch/discipline: M.Sc. Physics

3) Academic Project duration:

(a) Total academic project duration: 8 Weeks
(b) Student's presence at IPR for academic project work: 5 Full working Days per week

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