

## **OPTICAL DESIGN STUDY OF THE KSTAR THOMSON SCATTERING DIAGNOSTIC\***

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A Multi-Channel Thomson Scattering System viewing the edge and core of the Korea Superconducting Tokamak Advanced Research (KSTAR) plasma will be installed at the midplane port Bay-N. An engineering design study was undertaken at PPPL in collaboration with the Korea Basic Science Institute (KBSI) to determine the optimal optics design. Design criteria for this study can be divided into three categories; environmental, mechanical and optical. Environmental design factors include thermal and nuclear radiation from long pulse operation as well as vacuum and machine high temperature bake conditioning. Mechanical criteria include cassette geometry and robust optics mounts designed for ease of maintenance. The optical design factors included lens or mirror performance measured by spot size, Etendue and spatial resolution. Other important optical and mechanical design factors are the fabrication of a fiber optics array and the design of an in-vacuum shutter. All designs have common design features; the Thomson Scattering laser, an in-vacuum shutter, a quartz heat shield and primary vacuum window, a set of optical elements and a fiber optic bundle. Neutron radiation damage was a major factor in the choice of competing optical designs. A mirror based design will have a single view of the laser. The advantage of a mirror based design is primarily from longer radiation resistance life. Other advantages include less optical elements and fewer losses from surface reflections. The main difficulty in a mirror based design is the mechanical design of the fiber optic array and obscuration losses from the fiber array. A lens based design will be divided into two groups; one viewing the "edge" and the other viewing the "core". The primary advantage of a lens based design is the much simpler fiber optics array and fiber bundle handling. Both the mirror based design and the lens design are constrained by physical limits of the Bay-N cassette and interference with the Bay-N microwave launcher.

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