USE OF WEBCAMS AS TOOLS FOR ALIGNMENT AND SUPERVISION OF A THOMSON SCATTERING SYSTEM IN THE NEAR INFRARED

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Precise and stable alignment is a major concern of Thomson scattering systems (TS), which have become a standard diagnostic to measure electron temperature and density profiles in fusion-relevant plasmas. Even small angular deviations of the laser beams from their nominal positions lead to loss of calibration and, as a consequence, to unreliable measurements of the electron density profiles. The design of the Thomson scattering system on the TCV tokamak relies on good passive stability of the setup. Nevertheless, occasional perturbations (e.g. plasma disruptions) and slow thermal drifts of the alignment cannot be excluded. The requirements for stability are severe since the beam path from the location of the lasers to the tokamak is ~25m long and includes several folding mirrors.

As a tool for the alignment of the TS system on TCV on a regular basis and for monitoring purposes, a set of 9 commercial webcams were installed at several reference points along the laser beam path. These webcams have the advantage of being cheap, easy to install, compact and, after a simple modification, have adequate response at the laser wavelength of 1.06μm. They view the actual laser beam position by recording the scattered light from an intercepting optical surface (mirror or window). At the same time they produce an image of the background, which may contain a fixed marker or reference point. In this way a deviation of the beam from its nominal location may be immediately and easily detected. The real-time images from all 9 cameras are accessible via a Web browser. This installation has proven to be extremely useful in the early detection of alignment problems and as a tool during the alignment procedure.

Details of the implementation on TCV and criteria for the selection of the cameras will be given. The response of the selected cameras under different illumination conditions has been quantified to provide guidelines for optimum installation.

Although the cameras cannot compete with systems designed for the recording of laser beam profiles, they can be used as monitors for the spot size on an intercepting optical component, as will be demonstrated by several examples.

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