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# Automated measurement of bolometer line of sight alignment and characteristics for application in ITER

Dipl.-Ing. Univ. Florian Olivier Penzel

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*'After all, beauty is in the eye of the beholder,  
and what we see is scattered light'*

Stover, J. C.

Optical scattering: Measurement and analysis.  
Bellingham, Wash: SPIE Press (2012).



## **Abstract**

The bolometer diagnostic is used in fusion experiments to derive the total radiated power of the plasma and its spatial distribution. The line of sight (LOS) alignment and characteristic of a bolometer camera is a crucial parameter for the measurement accuracy of the diagnostic as it is an input to the tomographic reconstruction for determining the radiation profile. Therefore, a robot based LOS measurement device has been developed which allows the fully automatic measurement of the two dimensional transmission function of a bolometer camera. It has been used to assess the performance of different collimator prototypes being developed for the future tokamak fusion experiment ITER. Measures to mitigate stray light have been identified and differences from the transmission expected due to the design parameters could be evaluated. Additionally, the measurement device has been integrated in the tokamak ASDEX Upgrade during a maintenance shutdown to measure the LOS alignment and characteristic of the integrated bolometer cameras. As a result, internal camera reflections causing systematically elevated values of the radiation measurements and misalignments of the LOS in the order of 2°-3° from the theoretical alignment have been determined. The misalignments are not a major problem for ASDEX Upgrade, but for ITER the LOS will have to pass through narrow gaps (10-20 mm) between the plasma facing components and therefore have to be aligned about one order of magnitude better than in ASDEX Upgrade. Alternatively a similar in-situ LOS calibration device will be needed to determine the final bolometer LOS characteristic in ITER.



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