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ヘリオトロンＪにおける高速可視光イメージ計測による周辺乱流構造の可視化
Measurement of visible-light image by using fast cameras for visualization of edge-plasma turbulence structure in Heliotron J

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To visualize the structure of edge plasma fluctuations, an imaging system with high frame-speed video cameras has been installed at #11.5 section in Heliotron J. we are especially interested in the spatial motion of a filamentary structure of the edge turbulence.

Fig.1. shows the designed system. By using an imaging system, which can simultaneously take two images of the same area with different angles, we can extract 3D images of filaments structures from the raw data of the fast camera.

From the raw images taken by the fast camera, filamentary structures are successfully extracted by removing the background and noise from the raw data (Figs. 2 and 3).

Since the two imaging system is not identically the same, some pre-processing is necessary before applying a 3-D reconstruction procedure. The first one is to detect the matching points from the two images, where we use the Scale-invariant feature transform (SIFT) method, which can identify a set of corresponding points of interest in two images. Interest points are detected using the Difference of Gaussian detector thus providing similarity invariance. The features are invariant to image scale and rotation. The second one is establishment of coordinate. By using clear images for calibration, such as a probe image inserted at the same observation section or other images taken in the calibration experiments, we can coalesce to form a coherent coordinate for two different coordinates of two images. By combining two pre-processing, we can set exact interest points for the rather vague image of the filamentary structures.

The 3-D reconstruction will be examined based on a multi-view stereo approach [1].

In the poster presentation, we will discuss the details of SIFT and the improved method.

[1]Tsang Kin Ting, Interactive 3D Model Reconstruction from Images and Quasi-Dense Points, Master thesis, Hong Kong University of Science and Technology, 2004.

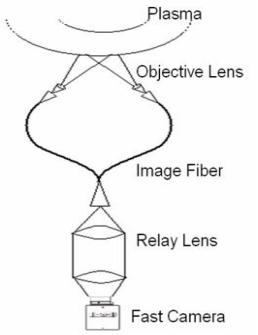

Fig. 1. #11.5 fast camera system

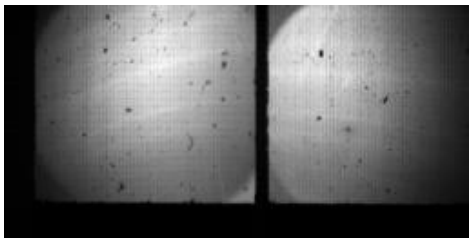

Fig. 2. Example of raw image (Two imaging including left and right)

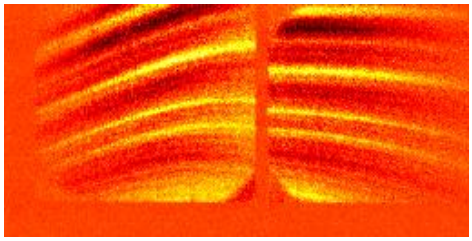

Fig. 3. Example of the extracted filamentary structure