

Dust detector

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1. Objective

Dust control is an important issue related to accumulations of impurity source in core plasmas, in-vessel tritium inventories and a safe maintenance of in-vessel components in the fusion devices, such as ITER and DEMO. In particular, the real-time measurement is required to observe dust production rates and erosion rates of the plasma facing materials.

A dust counting by the electrostatic dust detector is stated from the 17th experimental campaign in LHD. The development of this electrostatic dust detector was carried out in Princeton Plasma Physics Laboratory (PPPL) [1]. Two closely interlocking combs of copper traces on a circuit board are biased at 50V. A distance between each line of combs is 30 μm and it was determined by diameters of collected dust particles in LHD. When conductive dust particles settle on the surface of detector, a spark is generated creating a transient short circuit and the resulting current pulse is detected electronically.

Two detectors were set on the vacuum flange, and one side is facing to the plasma side as the main detector. The other side is covered by mica plate and facing to a flange as the blank detector. The blank detector measures electronic noise signals. Detectors were installed at the lower side port in LHD. The distance from the last closed magnetic surface to detector surface is about 3 m.

This real-time diagnostic of surface dust was successfully started in LHD. A natural dust ejected to LHD plasma and then plasma radiation increased at 4.85s. Dust detector had 5 counts on the main detector at about 5.1s. Number of counts on detector is higher than blind one. This time delay of 0.15s is normal from previous experiences in NSTX tokamak, and these 5 counts are detected by settled dust particles

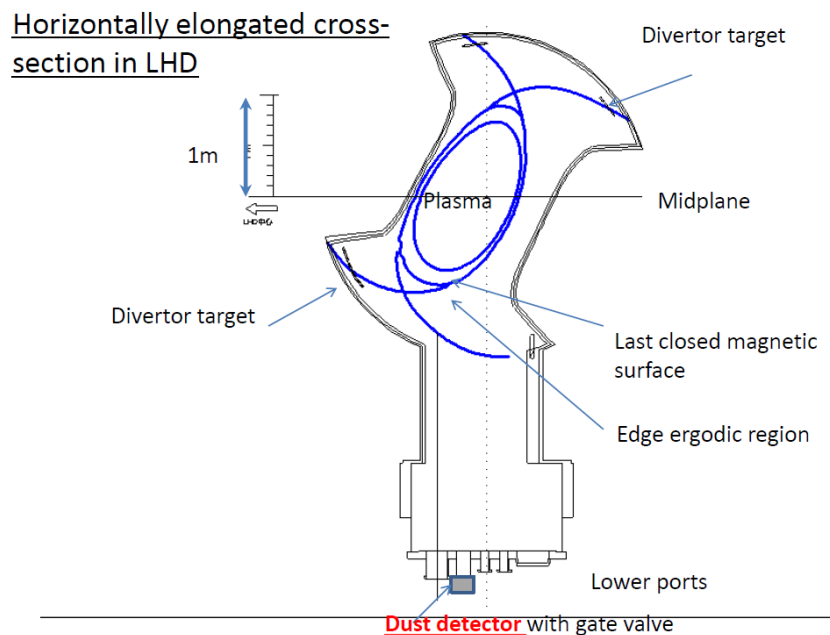


Fig. 1 A schematic drawing of the dust detector system at the vertical cross-section of LHD

Dust detector appears to detect real dust in LHD at \sim ng/cm²/s levels on some discharges. in FY2013 campaign

2. Experimental setup

2.1 Locations

3.5 L port

2.2 Data acquisition system

Output data were stored in LABCOM system.

References

[1] C.H.Skinner, et al., "First real-time detection of surface dust in a tokamak", Rev. Sci. Inst. 81 (2010) 10E102.