

A Cosmic Dust Sensor Based on an Array of Grid Electrodes

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Abstract

We described a low mass and high sensitivity cosmic dust trajectory sensor using a array of grid segments[1]. the sensor determines the particle velocity vector and the particle mass. An impact target is used for the detection of the impact plasma of high speed particles like interplanetary dust grains or high speed ejecta. Slower particles are measured by three planes of grid electrodes using charge induction. In contrast to conventional Dust Trajectory Sensor based on wire electrodes, grid electrodes a robust and sensitive design with a trajectory resolution of a few degree. Coulomb simulation and laboratory tests were performed in order to verify the instrument design. The signal shapes are used to derive the particle plane intersection points and to derive the exact particle trajectory. The accuracy of the instrument for the incident angle depends on the particle charge, the position of the intersection point and the signal-to-noise of the charge sensitive amplifier (CSA). There are some advantages of this grid-electrodes based design with respect to conventional trajectory sensor using individual wire electrodes: the grid segment electrodes show higher amplitudes (close to 100 % induced charge) and the overall number of measurement channels can be reduced. This allows a compact instrument with low power and mass requirements.

References

[1] Y. W. Li, R. Srama, H. Henkel et al.: Instrument study of the Lunar Dust eXplorer (LDX) for a lunar lander mission, *Adv. Space. Res.*, In Press, 2014.

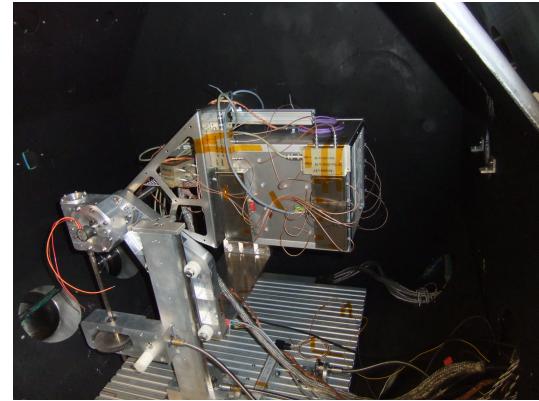


Figure 1: The set up of laboratory model of the sensor in accelerator.

Table 1: The parameters of a cosmic dust sensor based on an array of grid electrodes.

Sensor	Parameters	part name	Value
LDX	Open area		400 cm ²
		House structure	781 g
		Fastener	36 g
	Mass	E-box	384 g
		SUM	1200 g
	Voltage	CSAs	12 V
	Power	CSAs (18)	1.1 W