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# Novel Position-Sensitive Ion-Current Detector Arrays Using a Self-Collection Method for Secondary-Electron Suppression

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Recent findings of the importance of radially sheared electric-field formation in plasmas enhance the requirements of spatial-profile measurements of ion-confining potentials and ion-current signals simultaneously. For instance, the frequency analyses of end-loss ion-energy spectrometer arrays (IES) signals show the existence of electron drift waves, giving a peaked structure over a few kHz and turbulence-like fluctuations without any coherent azimuthal phasing relation below a few kHz during a weaker sheared period. On the other hand, some finite levels of turbulent fluctuations and remarkable suppression of turbulence are found during a stronger sheared period with ECH. This encourages the usefulness of potentials and radial electric-field shear for confinement improvements.

For the purpose of observations of these important parameters, we have been developing several types of multigridded electrostatic ion-energy spectrometers and ion-current detectors because of their compact-sized simple structures and convenient handling without the effects on the plasma-confining magnetic fields of the plasma device. These ion-diagnostics are proposed to obtain precise ion-energy spectra and absolute values of ion currents without any perturbations from simultaneously incident energetic electrons into the arrays. For instance, the ion-current detector consists of a set of parallel metal plates with respect to lines of ambient magnetic forces of a plasma device for analyzing incident ion currents along with a grid for shielding the collector against strays due to the metal-plate biasing. One of the most essential characteristic properties of the proposed detector is based on the physics principle of a “self-collection”mechanism for suppressing the effects of secondary-electron emission from a metal collector. Availability of the detector is clearly demonstrated in the GAMMA10 plasma experiments.

**Primary author:** Dr HIRATA, M (Plasma Research Centre, University of Tsukuba,)

**Co-author:** Dr KOHAGURA, Junko (Plasma Research Centre, University of Tsukuba)

**Presenter:** Dr KOHAGURA, Junko (Plasma Research Centre, University of Tsukuba)

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