



## **High-time resolution particle instrumentation for cross-scale coupling studies in Earth's plasma sheet**

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The non-local nature of the processes governing the dynamical evolution of Earth's magnetotail calls for the definition of a new type of multi-spacecraft mission. Beyond multi-point missions with four or five spacecraft like Cluster-II, THEMIS, and MMS, the next frontier is a mission that allows simultaneous monitoring of physical processes occurring on fluid, ions and electrons scales. With about ten spacecraft required for cross-scale coupling studies, severe constraints on the mass and power budget allocated to each satellite is a strong driver in the definition of the mission. Cluster-II measurements strengthen the need of measuring 3D particle distribution functions at high-time resolution. MMS strategy is to multiply the number of top-hat analysers with quasi-2D field of view. We present another option, the design of a 3D high-time resolution electrostatic analyser allowing a complete pitch-angle coverage with just two instruments. The basic properties of the 3D electrostatic optics are presented and it is shown how Cross-Scale would benefit from this new design.