



## Miniature ion precipitation analyzer of the SERENA package

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Chosen to be included in the **SERENA** instrument package on-board the Mercury **BepiColombo** mission, **Miniature Ion Precipitation Analyzer (MIPA)** is a, mass and power consumption wise, low budget sensor, optimized for monitoring of the ion precipitation flux. The sensor envelope size is 53\*85\*30mm, and the weight is 150g. The sensor head can be broken down into three main sub-units: An electrostatic deflector consisting of two 90° high voltage plates, for elevation sweeping, followed by a 128° electrostatic analyzer for energy resolution, followed by a **time-of-flight (TOF)** cell with post acceleration up to 1keV. Post-accelerated ions entering the TOF cell hits a **START** surface (monocrystal tungsten) and gets reflected onto a **STOP** (MgO coated graphite) surface. Particles hitting the **START** or **STOP** surface will give rise to secondary electron emissions. The kinetic electrons are guided towards the **START** and **STOP** ceramic channel electron **multipliers (CCEM)**, used for start and stop timing. Given the energy from the analyzer voltage and velocity from TOF measurements provide the particle mass. The sensor also comprises a specially designed UV trap. The sensor with total field of view 180°x9° provides ion measurements in the energy range 15eV-15keV with eighth angular sectors, 7% energy resolution and mass resolution sufficient to resolve mass groups 1, 2, 4, 8, 16, >32. Using CCEM's for particle detection enables operation in the extended temperature range (up to 100°C) as well as a wide dynamical range.

We present the sensor design in detail as well as observational capabilities on-board the Mercury Planetary Orbiter (**MPO**).