ELECTRIC FIELD DOUBLE PROBE ANTENNA FOR THE BEPICOLOMBO/MMO SATELLITE.

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Introduction: The Space Science Department of the European Space Agency has been developing double probe antennas for 30 years. The first antennas were successfully operated on the GEOS-1, -2 and ISEE-1 satellites in 1977-1982. The proved concept was also used for the NASA Polar satellite, launched in 1996. However, it was quickly found on Polar that this type of antenna can be unstable in certain occasions. Based upon detailed studies, a new design was approved for the four Cluster satellites, launched in summer 2000. Now after one year of measurements, we know that the new sensor design is providing us with electric field observations of unprecedented quality. Therefore we are proposing to use the same proven technique on the BepiColombo/MMO satellite.

Instrumentation: Electric field measurements are made with a double probe antenna that consists of a pair of electric probes that are placed on the tips of two opposing booms. On a spinning satellite the booms are made of a thin wire and can be quite long, of several tens of meters, in order to have the sensors in a low-noise environment. In addition, the high-quality quasi-static electric field measurements require that the pre-amplifiers are located close to the sensors, outside the main electronics compartment placed inside the satellite. This will be a challenge for a Mercury mission as the environment is very hot. Based upon an initial thermal analysis, however, we have been able to design a pre-amplifier box that can provide a pleasant environment for the instrument electronics.

Scientific Objectives: The main variables monitored with a double probe antenna are the two-dimensional electric fields in the spin plane and the spacecraft potential where the latter is proportional to the electron density. These measurements are of fundamental importance when the structure and dynamics of the Mercury plasma environment is studied. With such observations, one can investigate the problems related to acceleration of charged particles, plasma drifts and flows, plasma waves, and variations of the plasma density. These are important issues as we will attempt to understand the Mercury plasma environment and how it respond to the solar wind variations.