



## **THOR Fields and Wave Processor – FWP**

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If selected, Turbulence Heating Observer (THOR) will become the first spacecraft mission dedicated to the study of plasma turbulence. The Fields and Waves Processor (FWP) is an integrated electronics unit for all electromagnetic field measurements performed by THOR. FWP will interface with all THOR fields sensors: electric field antennas of the EFI instrument, the MAG fluxgate magnetometer, and search-coil magnetometer (SCM), and perform signal digitization and on-board data processing. FWP box will house multiple data acquisition sub-units and signal analyzers all sharing a common power supply and data processing unit and thus a single data and power interface to the spacecraft. Integrating all the electromagnetic field measurements in a single unit will improve the consistency of field measurement and accuracy of time synchronization.

The scientific value of highly sensitive electric and magnetic field measurements in space has been demonstrated by Cluster (among other spacecraft) and THOR instrumentation will further improve on this heritage. Large dynamic range of the instruments will be complemented by a thorough electromagnetic cleanliness program, which will prevent perturbation of field measurements by interference from payload and platform subsystems.

Taking advantage of the capabilities of modern electronics and the large telemetry bandwidth of THOR, FWP will provide multi-component electromagnetic field waveforms and spectral data products at a high time resolution. Fully synchronized sampling of many signals will allow to resolve wave phase information and estimate wavelength via interferometric correlations between EFI probes. FWP will also implement a plasma resonance sounder and a digital plasma quasi-thermal noise analyzer designed to provide high cadence measurements of plasma density and temperature complementary to data from particle instruments. FWP will rapidly transmit information about magnetic field vector and spacecraft potential to the particle instrument data processing unit (PPU) via a dedicated digital link. This information will help particle instruments to optimize energy and angular sweeps and calculate on-board moments. FWP will also coordinate the acquisition of high resolution waveform snapshots with very high time resolution electron data from the TEA instrument. This combined wave/particle measurement will provide the ultimate dataset for investigation of wave-particle interactions on electron scales.

The FWP instrument shall be designed and built by an international consortium of scientific institutes from Czech Republic, Poland, France, UK, Sweden and Austria.