Technical summary

- **Minimagnetosphere System**
  - Two active coils in a dipolar configuration, arranged coaxially: one on the upper face and one on the lower face of the CubeSat along the z-axis.
  - Powered with currents in opposite directions to generate a dipole magnetic field that extends protection around the satellite.
- **Coil Design**
  - Coils made by winding enameled copper wire with a diameter optimized to minimize electrical resistance and Joule losses.
  - Alternatively, FPCB technology for flexible printed circuits, reducing volume and mass.
  - Each coil contains a ferritic ferromagnetic core—ferrite or mu-metal—chosen for its high relative permeability and low hysteresis, which amplifies the magnetic field by reducing the required number of turns or current.
- **Support Structure**
  - A lightweight frame—aluminum or carbon fiber—designed to withstand launch vibrations and thermal variations in orbit.
- **Power and Control System**
  - High-current drivers based on MOSFET or IGBT with PWM control to modulate the current in the coils according to the detected particle flux.
  - Energy supplied by high-efficiency solar panels, supported by Li-ion batteries with an advanced Battery Management System and, if necessary, by supercapacitors to handle current spikes.
- **Monitoring and Validation System**
  - Three CCD sensors: one positioned in the protected area (maximum deflection), one in the unprotected area (reference), and possibly one in an intermediate zone to monitor partially deflected radiation.
  - Additional sensors such as PIN diodes and miniaturized Geiger counters to record the radiation dose and the current generated by particle impacts.
  - Three-axis magnetometers to monitor the overall magnetic field in real time and calibrate the system.
  - Electrical and thermal sensors—current, voltage, and thermistors—to control energy consumption and temperature of critical components.
- **Attitude Control System**
  - Integration of magnetorquers and an onboard magnetometer to coordinate activation of the magnetic field and synchronize with the Earth's magnetic field.
- **Communication**

  - A communication module to transmit the data gathered by the sensors and the ADCS, enabling in-orbit calibration and experimental validation.

- **Mass Specifications**
  - Coils and ferromagnetic core: about 30 g.
  - Support structure: 150–200 g.
  - Circuitry and high-current drivers: 100–150 g.
  - Sensors and energy storage system: 100–150 g.