# **Developmental status of Supra Thermal & Energetic Particle Spectrometer (STEPS),** A subsystem of ASPEX payload

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# **Aditya Solar wind & Particle Experiment (ASPEX)**

>ASPEX is one of the payloads on board Aditya – L1 mission, to be placed in a halo orbit around the L1 Lagrangian point, lying between the Sun and the Earth.

 $\geq$  Scientific objective is to study the variations of solar wind properties; distribution and spectral characteristics of supra-thermal ions and solar energetic particles (SEPs), as a function of magnitude and location of the solar explosions occurring on the Sun during the solar cycle.

>It will make in-situ, multi directional measurements of alpha particles and protons in the energy range of 100 eV/n to 5 MeV/n.

 $\succ$  This will be the first time when such a large energy range measurements will be carried out from multiple directions at L1 point with 3 – axis stabilized spacecraft.

> Early warning of space weather will be transmitted to the Earth for necessary protection.

### **Supra Thermal & Energetic Particle Spectrometer (STEPS)**

- > STEPS is an independent science package of ASPEX payload.
- $\succ$  It will measure the protons, alpha and other heavier particles in the energy range of 20 keV/n to 5 MeV/n.
- $\succ$  It has been configured into 3 packages:
  - STEPS1 detector package

#### **Magnetic assembly**



With 6 mm shielding thickness of MS material		
Distance (cm)	Magnetic field	
	(gauss)	
0		



Fig. 1: Mounting location of ASPEX payload (SWIS & STEPS) on Aditya – L1 S/c

### **STEPS** orientations

Туре	Direction	FOVAxis	FOV Cone
Species separated spectra	Sun pointing	12° W of S/c–Sun line, In ecliptic plane	<b>±8</b> °
	Parker Spiral Pointing	50° W of S/c–Sun line, In ecliptic plane	±15°
	<b>Earth Pointing</b>	24° W of S/c–Earth line, In ecliptic plane	±20°
Species Integrated spectra	Between Sun and Parker spiral	27.5° W of S/c–Sun line, In ecliptic plane,	±7.5°
	North Pointing	Perpendicular to ecliptic plane towards North	±20°
	South Pointing	Perpendicular to ecliptic plane towards South	±20°

#### **Testing of Si detector (single element) with X – ray sources**



# **Detector configuration for STEPS (species separated spectra)**

Magnets for electron deflection





### **Thermal chamber test**

Fig. 9: Testing of single element Si detector (with discrete components). Results show that energy threshold is < 10 keV.

# **Testing of Si detector (single element) with particles**





Fig. 4: Double window Si detector (300 µm thick)



Fig. 5: STEPS detector assembly with double window Si detector and Scintillator detector

Array of Si PM (PCB size:

28 mm x 5 mm x 1.6 mm)





Bottom side

#### Si PM (4mm x 4 mm)

Fig. 6: Plastic Scintillator with Si Photomultiplier (SiPM) readout



#### Summary

