SEPT pitch angle distribution ASCII files

SEPT sensors onboard each STEREO spacecraft measure particle intensities in four looking directions. This angular coverage, though limited, can be used to study the intensity distribution with respect to the magnetic field vector (pitch angle distribution). In order to simplify this task, pitch-angle distribution files have been created using level 2 data from SEPT and level 1 cdf data from MAG (in spacecraft coordinates).

Filename convention

The filenames use the following convention:

sept_spacecraft_particle_bins_pad_YYYY_DOY_version.dat

where spacecraft is ahead or behind, particle is ele or ion (for electron and ions, respectively), bins are the bin numbers (from 0 to 31) used to calculate the intensities (e.g. 040506 means intensities for bins 04, 05 and 06 averaged together), YYYY is the year (four digits), DOY is the day of year (three digits), and version is the software version (currently v01).

File contents

Detailed information about the file contents is included in the file header. The files provide basically a time stamp (year and decimal day of the year), the cosine of pitch angles corresponding to the four sensor axis directions (Sun, Anti-Sun, North and South) as well as the minimum and maximum values of the pitch angle covered in each field of view, the intensities and their statistical errors and complementary plasma and magnetic field data (from PLASTIC level 2 files and MAG cdf level 1 files in the RTN frame). Time resolution is 1 minute and the timestamps mark the center of the averaging interval. The intensities are provided in the spacecraft frame, without Compton-Getting correction.

Additional information about the sensor orientation for both STEREO spacecraft is provided below. This information can be used for further analysis (e.g. Compton-Getting correction) of the directional information provided by the SEPT p.a.d. ASCII files.

STEREO Science Pointing Coordinate Frame

Figure 1 shows the definition of the Cartesian spacecraft coordinate system for both STEREO spacecraft. The origin of coordinates is located in the spacecraft´s center of mass. The optical instruments for both s/c are pointing to the +X direction (which in nominal operation mode means towards the Sun center). During nominal operation, the plane XZ is very close to the ecliptic plane, with +Z pointing away from the Earth, while Y-axis is perpendicular to the ecliptic. Note that the orientations of +Y and +Z are opposite for AHEAD and BEHIND (+Y is directed to the North ecliptic direction for AHEAD and to the South for BEHIND during normal operation mode).

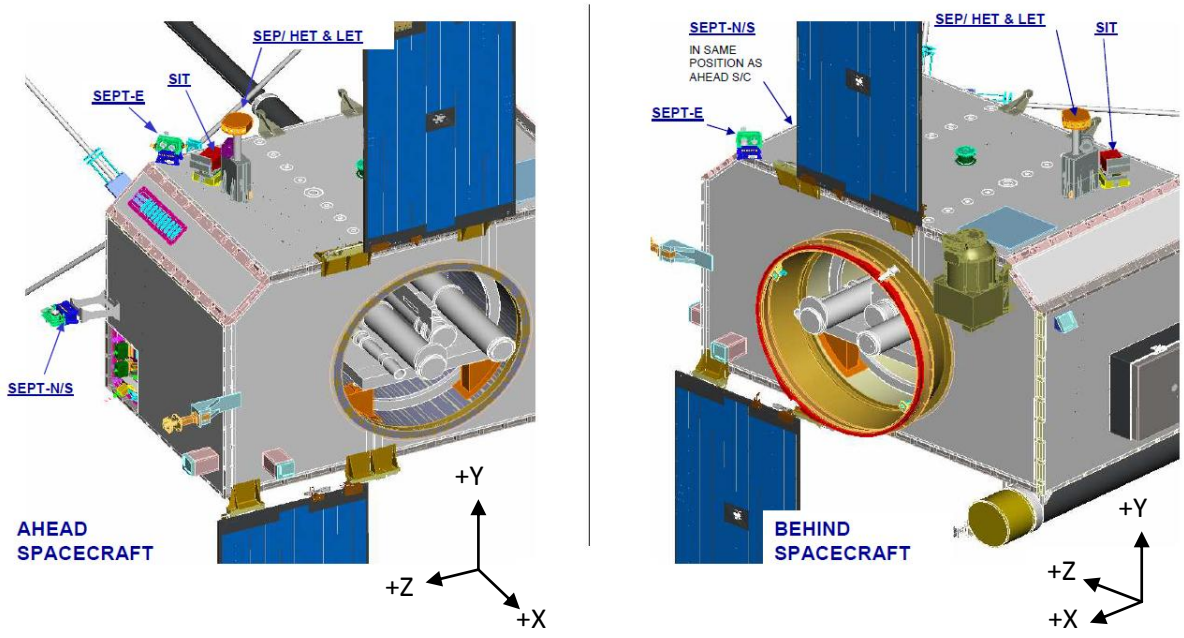

Figure 1. Spacecraft coordinate system for STEREO A and B. During nominal operation intervals, +X points to the center of the Sun for both spacecraft, while +Y points to the north for STEREO-A and to the south for STEREO-B. +Z completes the orthogonal set of axis and is pointing away from the Earth.

SEPT Sensor orientation with respect to the spacecraft

SEPT onboard each STEREO spacecraft consists of two separate double particle telescopes: SEPT-E and SEP-NS. During nominal operation mode, SEPT-E is looking in the ecliptic plane along the Parker spiral magnetic field both towards and away from the Sun, and SEPT-NS looking vertical to the ecliptic plane towards North and South. That means that the SEPT-E sensor axis is contained in the XZ plane, along a line rotated 45 degrees with respect to the spacecraft X-axis (Figure 2), while SEPT-NS axis is parallel to the Y-axis.

Fields of view

Each double SEPT telescope block consists of four conical fields of view (two for ions and two for electrons, pointing in opposite directions). The full aperture of the cone is 52.0 degrees for the ion telescopes and 52.8 degrees for the electron telescopes.

Naming conventions

Level 2 and 3 data sets name the SEPT telescopes according to the nominal pointing direction: Sun (pointing along the Parker Spiral towards the Sun), Anti-Sun (along the Parker Spiral, pointing away from

the Sun), North (looking to the North ecliptic hemisphere) and South (looking to the South ecliptic hemisphere). Level 1 CDF files use a naming convention based in the labels of the Particle Detector Front End (PDFE) electronics. The correspondence between both systems is shown in Table 1.

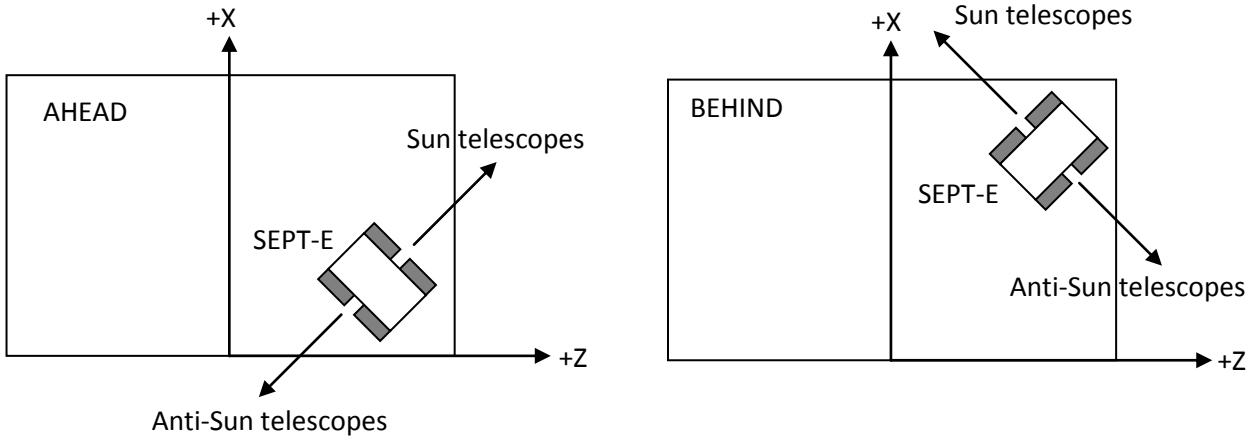

Figure 2. Pointing of the sunward and antisunward-looking SEPT-E apertures with respect to the spacecraft coordinate system. The +Y axis points perpendicular to the figure (upwards). Note that the nominal spacecraft orientations are opposite for STEREO-A (+Y pointing northwards) and STEREO-B (+Y pointing southwards).

Table 1: Telescope Classification

Histogram	CDF Variable	STEREO-A	STEREO-B
PDFE0	Spec_0_E	electron tel. looking anti-sun	electron tel. looking Sun
	Spec_0_NS	electron tel. looking North	electron tel. looking South
PDFE1	Spec_1_E	proton tel. looking Sun	proton tel. looking anti-sun
	Spec_1_NS	proton tel. looking South	proton tel. looking North
PDFE2	Spec_2_E	electron tel. looking Sun	electron tel. looking anti-sun
	Spec_2_NS	electron tel. looking South	electron tel. looking North
PDFE3	Spec_3_E	proton tel. looking anti-sun	proton tel. looking Sun
	Spec_3_NS	proton tel. looking North	proton tel. looking South