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DOCUMENT

ATHENA - Coordinate System Document

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CHANGE RECORD

Issue 1	**Revision** 1		
Reason for change	**Date**	**Pages**	**Paragraph(s)**

Table of contents:

1 APPLICABLE DOCUMENTS

[AD01] Space engineering: Reference coordinate system, ECSS-E-ST-10-09C, Issue 1, 31/07/2008.

2 REFERENCE DOCUMENTS

[RD01] ATHENA Science Requirements Document (SciRD), ATHENA-ESA-URD-0001

[RD02] ATHENA Mission Requirements Document (MRD), ATHENA-ESA-URD-0010

[RD03] ATHENA Product Tree, ATHENA-ESA-PT-0001

[RD04] Ariane 5 User's Manual Issue 5 revision 1, July 2011

3 INTRODUCTION & SCOPE

This document describes the mission-level coordinate systems, both spatial and temporal, used in the ATHENA mission. This document ensures the consistency of these coordinate systems through a common reference source for use at all levels of the project from SST, Payload Consortium, ESA through to industrial subcontractors.

The document will expand considerably to include definition of more coordinate systems, as well as specification of useful global transformations, as the project matures. Additional SC Reference Frames and URFs for individual units on the SC are not specified here, as they are to be defined by the SC Prime Contractor, Payload Consortium and unit suppliers in due course.

Note: This document conforms to the ECSS standard 'Reference Coordinate System' ECSS-E-ST-10-09C [AD01], and has been written in accordance with the DRD specification in Annex A of the standard.

3.1 Convention

All spatial reference frames are right-handed orthogonal and rotations follow the right-hand grip rule (thumb follows the positive direction of the axis, fingers curl in the direction of positive rotation – see the following figure). The document presents, in the form of a Franck diagram, a single example transformation chain from the initially defined spatial reference frame onwards.

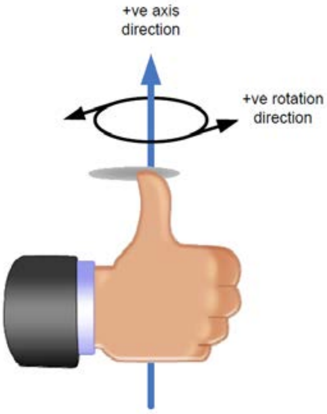

Figure 1: The right hand rule

4 COORDINATE SYSTEM DEFINITION

4.1 Summary

The following table summarises the coordinate systems currently defined for the ATHENA mission. The following figure shows a Franck diagram indicating the transformations that are described in this document.

Table 1: Coordinate system summary

Title	Acronym
Mechanical	
SC	
SC Primary Coordinate System	SC_PCS
X-IFU	
X-IFU Primary Coordinate System	X-IFU_PCS
WFI	
WFI Primary Coordinate System	WFI_PCS
LS	
Ariane 5 ECA Primary Coordinate System	A5_PCS
MAM	
MA Primary Coordinate System	MA_PCS
MM Primary Coordinate System	MM_PCS
Flight/Astronomical	
International Celestial Reference Frame	ICRF
Ecliptic Synodic Rotating Coordinate System	ESRCS
Earth-centred Equatorial Coordinate System	EME2000
WGS84 Reference Ellipsoid	WGS84
SC Reference Attitude Coordinate System	SC_RACS
Temporal	
Mission Time	MT
Modified Julian Date	MJD
Coordinated Universal Time	UTC

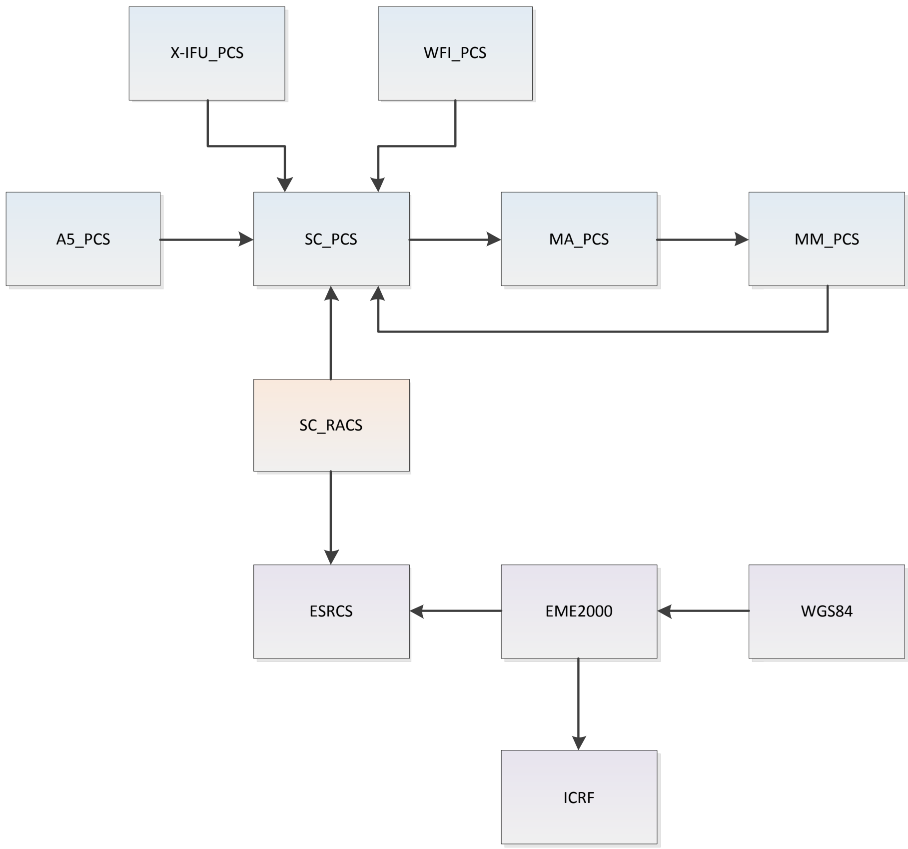

Figure 2: Franck diagram showing the transformations presented in this document

4.2 Mechanical Coordinate Systems

4.2.1 SC Primary Coordinate System

Table 2: SC_PCS definition

Type	Title	ID
SC fixed, Cartesian	SC Primary Coordinate System	SC_PCS
Definition		
$+X_{SC\_PCS}$	Transverse axis, on and parallel with the launcher interface plane, fixed to a physical mark on the interface ring, aligned such that it is parallel with the Sun direction when the SC_PCS is aligned with the SC_RACS.	
$+Y_{SC\_PCS}$	Transverse axes, completing the right-handed orthogonal triad (also on and parallel with the launcher interface plane).	
$+Z_{SC\_PCS}$	Longitudinal axis, perpendicular to the launcher interface plane, pointing towards the Focal Plane Instruments.	
Origin	Geometric centre of the launcher interface (located on the separation plane between the launcher and the spacecraft).	
Rationale: The SC_PCS is the principal mechanical reference frame for the SC.		
Transformation: -		
Translation: -		
Rotation: -		
Order: -		
Comments: -		
Formula: -		

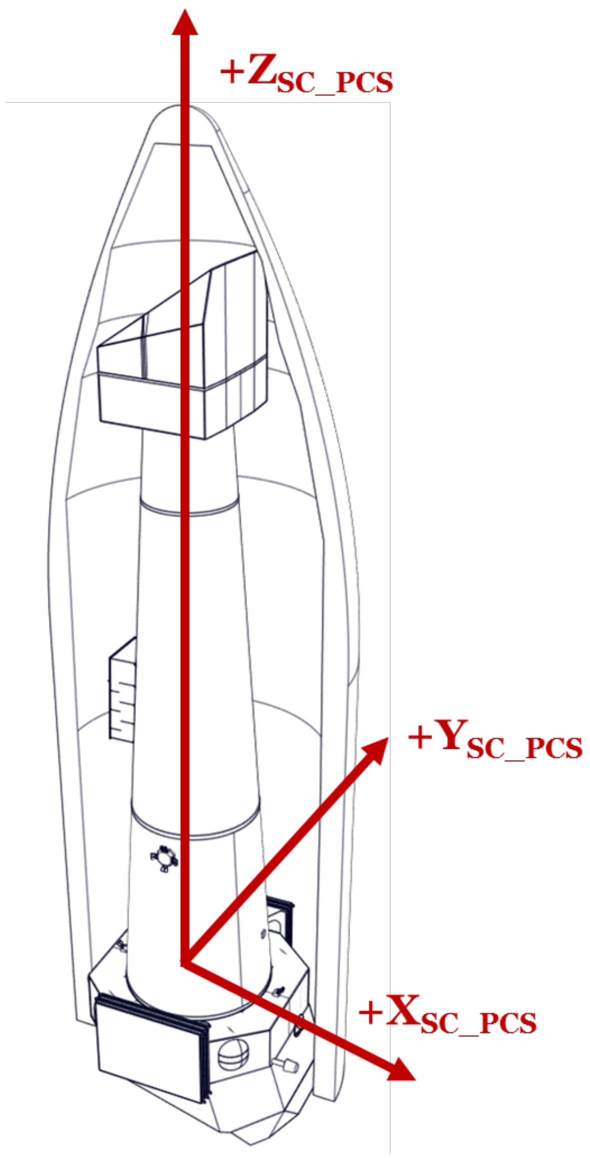

Figure 3: SC_PCS reference frame

4.2.2 X-IFU Primary Coordinate System

Table 3: X-IFU_PCS definition

Type	Title	ID
X-IFU fixed, Cartesian	X-IFU Primary Coordinate System	X-IFU_PCS
Definition		
$+X_{X-IFU\_PCS}$	Transverse axes, completing the right-handed orthogonal triad (in the Z, Y plane of the SC_PCS).	
$+Y_{X-IFU\_PCS}$	Transverse axis, parallel to the detector plane, aligned such that it is in the X,Z plane of the SC_PCS.	
$+Z_{X-IFU\_PCS}$	Longitudinal axis, perpendicular to the detector plane, pointing towards the nodal point of the Mirror when X-IFU is in the viewing position.	
Origin	Geometric centre of the X-IFU detector. Coincident to the position of the focal point whenever the X-IFU is placed for observations.	
Rationale: The X-IFU_PCS is the principal mechanical reference frame for the X-IFU instrument. The cooling chain should also reference this coordinate system.		
Transformation: X-IFU_PCS > SC_PCS.		
Translation: Defined by the coordinates of the geometric centre of the X-IFU detector in the FPA.		
Rotation: Defined by the two rotations, one around $Z_{X\text{-}IFU\_PCS}$ and another around $Y_{X\text{-}IFU\_PCS}$. $$M_{XIFU2SC} = \begin{bmatrix} 0 & 1 & 0 \\ -1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix} . \begin{bmatrix} \cos(\pi - \theta_{ISM}) & 0 & \sin(\pi - \theta_{ISM}) \\ 0 & -1 & 0 \\ -\sin(\pi - \theta_{ISM}) & 0 & \cos(\pi - \theta_{ISM}) \end{bmatrix}$$ Where θ_{ISM} is the tilt angle between the line of sight when the X-IFU instrument is in the focal point and Z_{SC_PCS}. This angle depends on the Instrument Switch Mechanism (ISM) chosen, it can be zero if a Movable Instrument Platform (MIP) solution is chosen.		
Order: -		
Comments: -		
Formula: $$\begin{bmatrix} X_{SC\_PCS} \\ Y_{SC\_PCS} \\ Z_{SC\_PCS} \end{bmatrix} = \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}_{X-IFU\_PCS} + \begin{bmatrix} 0 & 1 & 0 \\ -1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix} . \begin{bmatrix} \cos(\pi - \theta_{ISM}) & 0 & \sin(\pi - \theta_{ISM}) \\ 0 & -1 & 0 \\ -\sin(\pi - \theta_{ISM}) & 0 & \cos(\pi - \theta_{ISM}) \end{bmatrix} . \begin{bmatrix} X_{X-IFU\_PCS} \\ Y_{X-IFU\_PCS} \\ Z_{X-IFU\_PCS} \end{bmatrix}$$		

Comment [MA1]: Check.

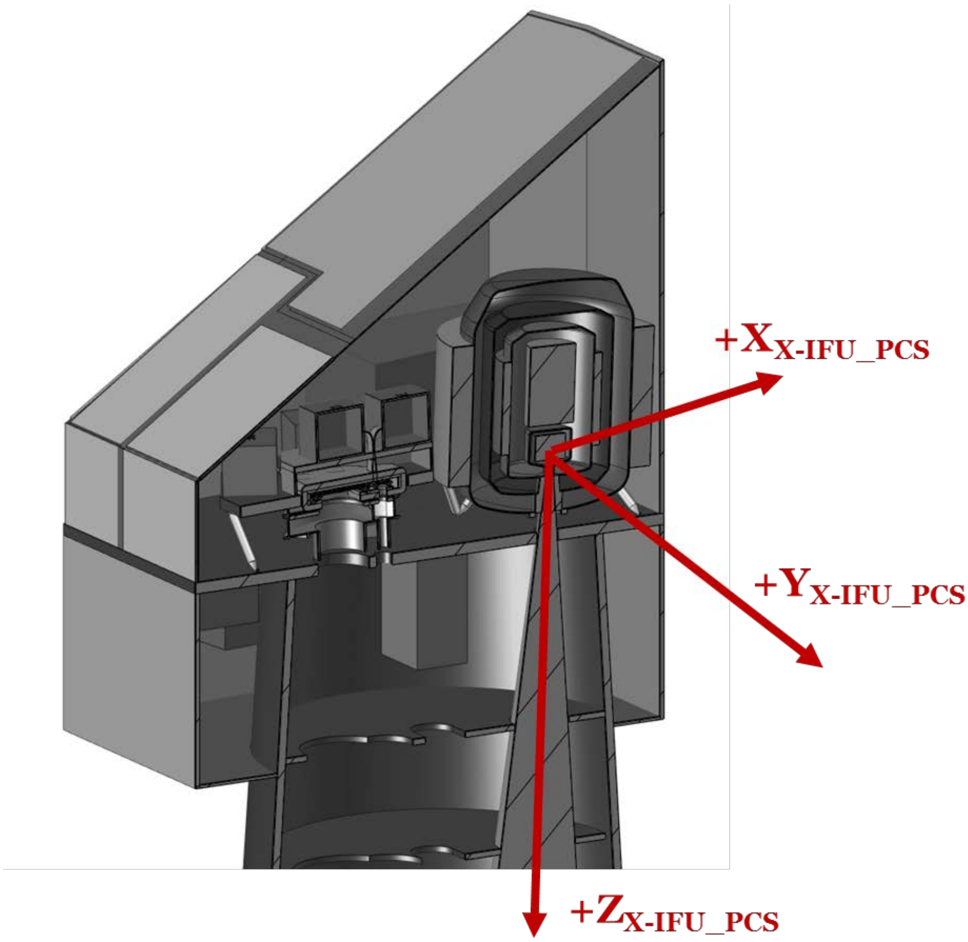

Figure 4: X-IFU_PCS reference frame

4.2.3 WFI Primary Coordinate System

Table 4: WFI_PCS definition

Type	Title	ID
WFI fixed, Cartesian	WFI Primary Coordinate System	WFI_PCS
Definition		
$+X_{WFI\_PCS}$	Transverse axes, completing the right-handed orthogonal triad (in the Z, Y plane of the SC_PCS).	
$+Y_{WFI\_PCS}$	Transverse axis, parallel to the detector plane, aligned such that it is in the X,Z plane of the SC_PCS.	
$+Z_{WFI\_PCS}$	Longitudinal axis, perpendicular to the detector plane, pointing towards the nodal point of the Mirror when WFI is in the viewing position.	
Origin	Geometric centre of the main(larger) WFI detector. Coincident to the position of the focal point whenever the WFI is placed for observations.	
Rationale: The WFI_PCS is the principal mechanical reference frame for the WFI instrument.		
Transformation: WFI_PCS > SC_PCS.		
Translation: Defined by the coordinates of the geometric centre of the main (larger) WFI detector in the FPA.		
Rotation: Defined by the two rotations, one around Z_{WFI_PCS} and another around Y_{WFI_PCS}. $M_{WFI2SC} = \begin{bmatrix} 0 & 1 & 0 \\ -1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix} . \begin{bmatrix} \cos(\pi - \theta_{ISM}) & 0 & \sin(\pi - \theta_{ISM}) \\ 0 & -1 & 0 \\ -\sin(\pi - \theta_{ISM}) & 0 & \cos(\pi - \theta_{ISM}) \end{bmatrix}$ Where θ_{ISM} is the tilt angle between the line of sight when the WFI instrument is in the focal point and Z_{SC_PCS}. This angle depends on the Instrument Switch Mechanism (ISM) chosen, it can be zero if a Movable Instrument Platform (MIP) solution is chosen.		
Order: -		
Comments: -		
Formula: $\begin{bmatrix} X_{SC\_PCS} \\ Y_{SC\_PCS} \\ Z_{SC\_PCS} \end{bmatrix} = \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}_{WFI\_PCS} + \begin{bmatrix} 0 & 1 & 0 \\ -1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix} . \begin{bmatrix} \cos(\pi - \theta_{ISM}) & 0 & \sin(\pi - \theta_{ISM}) \\ 0 & -1 & 0 \\ -\sin(\pi - \theta_{ISM}) & 0 & \cos(\pi - \theta_{ISM}) \end{bmatrix} . \begin{bmatrix} X_{WFI\_PCS} \\ Y_{WFI\_PCS} \\ Z_{WFI\_PCS} \end{bmatrix}$		

Comment [MA2]: Sign should be different compared to X-IFU.

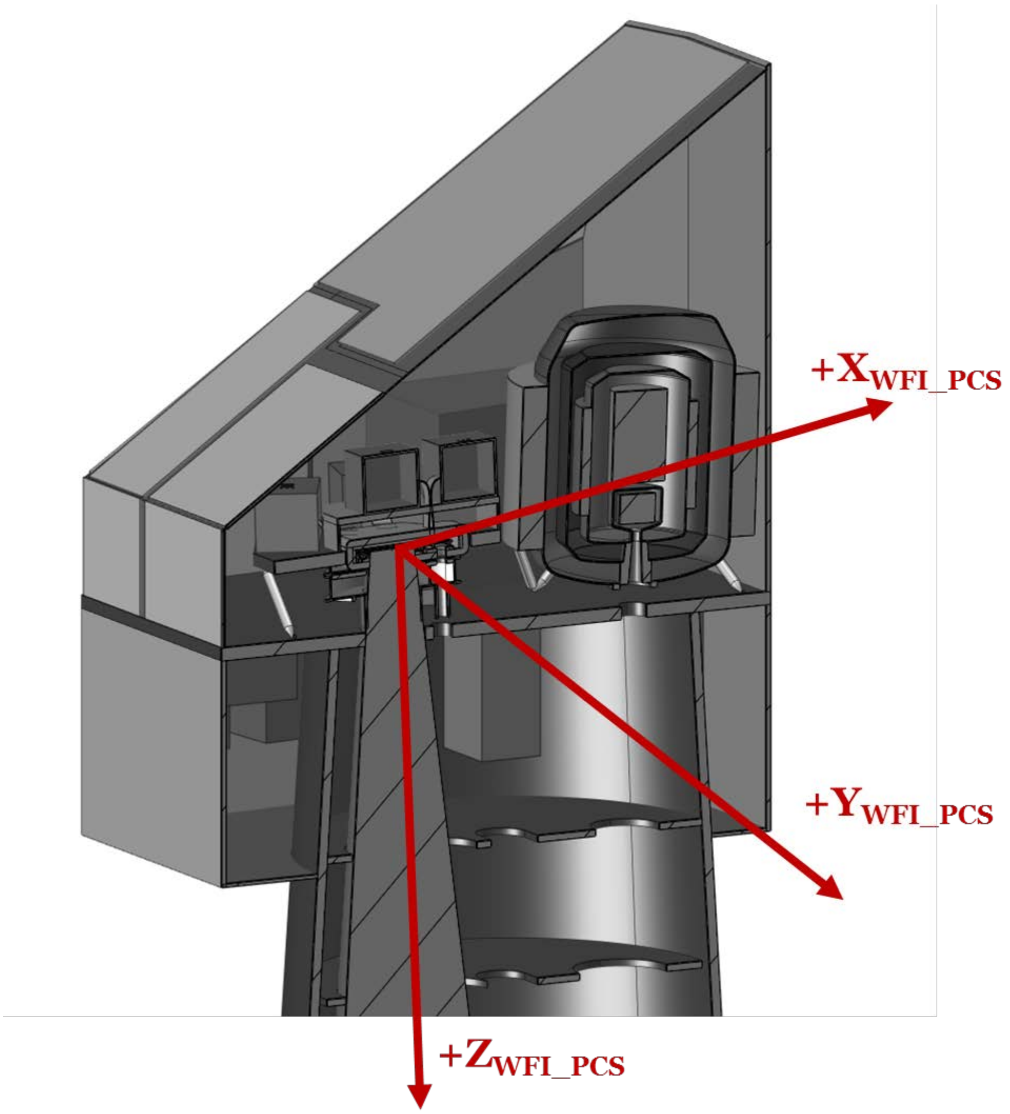

Figure 5: WFI_PCS reference frame

4.2.4 Ariane 5 Primary Coordinate System

Type	Title	ID
ARIANE-5 fixed, Cartesian	ARIANE-5 Primary Coordinate System	ARIANE-5_PCS
Definition		
$+X_{ARIANE-5\_PCS}$	See [RD04]	
$+Y_{ARIANE-5\_PCS}$	See [RD04]	
$+Z_{ARIANE-5\_PCS}$	See [RD04]	
Origin	See [RD04]	
Rationale: The ARIANE-5_PCS is the principal mechanical reference frame for the Launch segment elements.		
Transformation: ARIANE-5_PCS > SC_PCS.		
Translation: Defined by the coordinates of the geometric centre of the main (larger) ARIANE-5 detector in the FPA.		
Rotation: $M_{ARIANE-52SC} = \begin{bmatrix} 0 & 1 & 0 \\ -1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$		
Order: -		
Comments: -		
Formula: $\begin{bmatrix} X_{SC\_PCS} \\ Y_{SC\_PCS} \\ Z_{SC\_PCS} \end{bmatrix} = \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}_{\mathrm{ARIANE-5\_PCS}} + \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{bmatrix} . \begin{bmatrix} X_{\mathrm{ARIANE-5\_PCS}} \\ Y_{\mathrm{ARIANE-5\_PCS}} \\ Z_{\mathrm{ARIANE-5\_PCS}} \end{bmatrix}$		

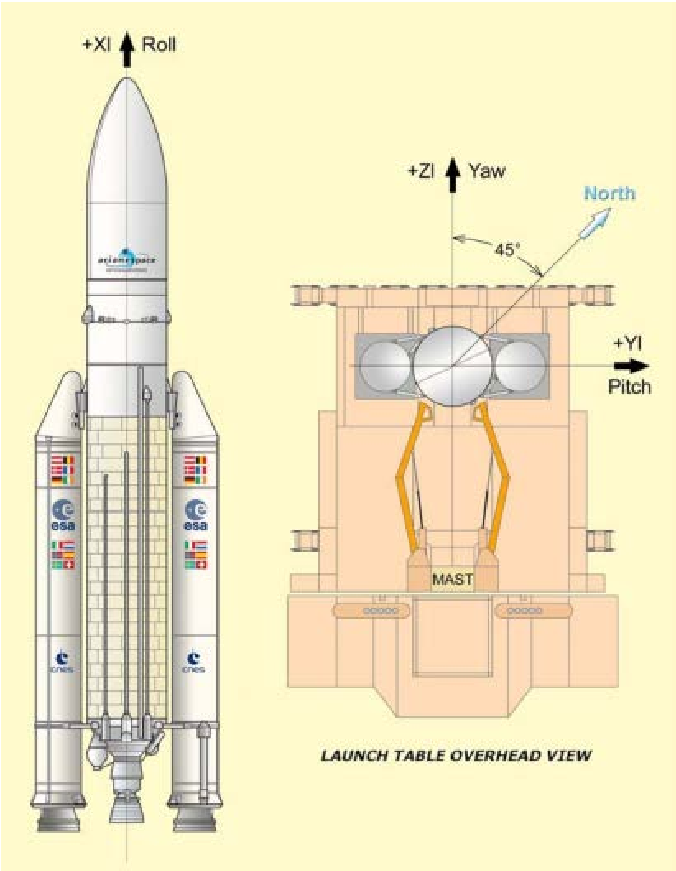

Figure 6: Ariane 5 coordinate system [RD04]

4.2.5 Mirror Assembly Primary Coordinate System

Table 5: MA_PCS definition

Type	Title	ID
MA fixed, Cartesian	MA Primary Coordinate System	MA_PCS
Definition		
$+X_{MA\_PCS}$	Orthogonal to the optical axis of the Mirror Assembly. We arbitrarily align this to $+X_{SC\_PCS}$ from the SC_PCS when the Mirror Assembly is in the canonical upright position, aligned with the SC_PSC.	
$+Y_{MA\_PCS}$	Orthogonal to $+X_{MA\_PCS}$ and $+Z_{MA\_PCS}$, completing the right-handed orthogonal triad.	
$+Z_{MA\_PCS}$	The optical axis of the telescope, positive direction towards the focal plane.	
Origin	Nodal point of the Mirror Assembly.	
Rationale: The MA_PCS is the principal mechanical reference frame for the Mirror Assembly & Telescope.		
Transformation: MA_PCS > SC_PCS.		
Translation: Defined by the coordinates of the Nodal Point of the Mirror Assembly.		
Rotation: $M_{MM2SC} = \begin{bmatrix} \cos(\theta_{MM2SC}) & \sin(\theta_{MM2SC}) & 0 \\ -\sin(\theta_{MM2SC}) & \cos(\theta_{MM2SC}) & 0 \\ 0 & 0 & 1 \end{bmatrix} . \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(\theta_{ISM}) & \sin(\theta_{ISM}) \\ 0 & -\sin(\theta_{ISM}) & \cos(\theta_{ISM}) \end{bmatrix}$ Where θ_{MM2SC} is the rotation angle around Z_{MM_PCS} that changes according to the MM location, and, θ_{ISM} is the angle between the line of sight and Z_{SC_PCS}. This angle depends on the Instrument Switch Mechanism (ISM) chosen, it can be zero if a Movable Instrument Platform (MIP) solution is chosen.		
Order: -		
Comments: -		
Formula: : $\begin{bmatrix} X_{SC\_PCS} \\ Y_{SC\_PCS} \\ Z_{SC\_PCS} \end{bmatrix} = \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}_{\mathrm{MM\_PCS}} + \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{bmatrix} . \begin{bmatrix} X_{\mathrm{MM\_PCS}} \\ Y_{\mathrm{MM\_PCS}} \\ Z_{\mathrm{MM\_PCS}} \end{bmatrix}$		

Comment [MA3]: To be updated

Comment [MA4]: To be updated

4.2.6 MM Primary Coordinate System

Table 6: MM_PCS definition

Type	Title	ID
MM fixed, Cartesian	MM Primary Coordinate System	MM_PCS
Definition		
$+X_{MM\_PCS}$	Transverse direction, orthogonal to the dowel pins. Aligned with the azimuthal direction of the MA (ideal case) when the MM is assembled in the Mirror Assembly.	
$+Y_{MM\_PCS}$	Transverse direction, orthogonal to the dowel pins. Aligned with the radial direction of the MA (ideal case) when the MM is assembled in the Mirror Assembly.	
$+Z_{MM\_PCS}$	Longitudinal direction. Parallel to the dowel pins, positive direction pointing from the Parallel stack to the Hyperbolic stack. Parallel to $+Z_{MA\_PCS}$ (ideal case) when the MM is mounted in the Mirror Assembly.	
Origin	Geometric centre of the stack projection at the imaginary plane between the Parallel stack to the Hyperbolic stack.	
Rationale: The MM_PCS is the principal mechanical reference frame for the MM.		
Transformation: MM_PCS > SC_PCS.		
Translation: Defined by the coordinates of the centre of the stack projection at the imaginary plane between the Parallel stack to the Hyperbolic stack for a particular MM.		
Rotation: $M_{MM2SC} = \begin{bmatrix} \cos(\theta_{MM2SC}) & \sin(\theta_{MM2SC}) & 0 \\ -\sin(\theta_{MM2SC}) & \cos(\theta_{MM2SC}) & 0 \\ 0 & 0 & 1 \end{bmatrix} . \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(\theta_{ISM}) & \sin(\theta_{ISM}) \\ 0 & -\sin(\theta_{ISM}) & \cos(\theta_{ISM}) \end{bmatrix}$		
Where θ_{MM2SC} is the rotation angle around Z_{MM_PCS} that changes according to the MM location, and, θ_{ISM} is the angle between the line of sight and Z_{SC_PCS}. This angle depends on the Instrument Switch Mechanism (ISM) chosen, it can be zero if a Movable Instrument Platform (MIP) solution is chosen.		
Order: -		
Comments: -		
Formula: : $\begin{bmatrix} X_{SC\_PCS} \\ Y_{SC\_PCS} \\ Z_{SC\_PCS} \end{bmatrix} = \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}_{\mathrm{MM\_PCS}} + \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{bmatrix} . \begin{bmatrix} X_{\mathrm{MM\_PCS}} \\ Y_{\mathrm{MM\_PCS}} \\ Z_{\mathrm{MM\_PCS}} \end{bmatrix}$		

Comment [MA5]: Better to put MM_PSC to MA_PCS here.

Comment [MA6]: To be updated for new prescription.

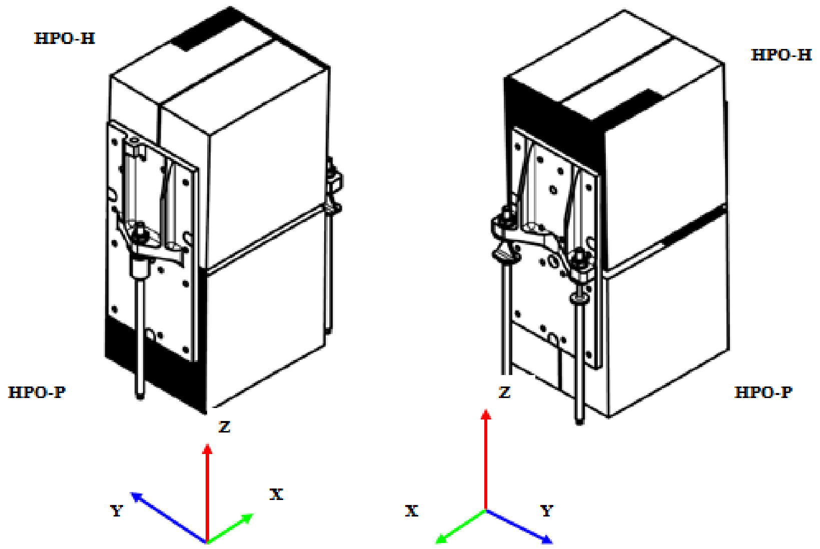

Figure 7: MM_PCS

4.3 Flight/Astronomy Coordinate Systems

4.3.1 Ecliptic Synodic Rotating Coordinate System

Table 7: ESRCS definition

Type	Title	ID
Rotating	Ecliptic Synodic Rotating Coordinate System.	ESRCS
Definition		
$+X_{\mathrm{ESRCS}}$	The X axis is in the ecliptic plane, aligned with the Sun-Earth line, pointing away from the Sun.	
$+Y_{\mathrm{ESRCS}}$	The Y axis is in the ecliptic plane, orthogonal to the Sun-Earth line.	
$+Z_{\mathrm{ESRCS}}$	The Z axis is perpendicular to the ecliptic plane, pointing to celestial north, completing the right-handed orthogonal triad.	
Origin	Centre of gravity of the ATHENA SC.	
Rationale: The ESRCS is the principal flight frame for the SC during NOP and EOP.		
Transformation: From SC_PCS.		
Translation: From the geometric centre of the launcher interface (located on the separation plane between the launcher and the spacecraft) to the centre of gravity of the SC.		
Rotation: $M_{ESR2SC} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(\alpha) & \sin(\alpha) \\ 0 & -\sin(\alpha) & \cos(\alpha) \end{bmatrix} \cdot \begin{bmatrix} \cos(\beta) & 0 & \sin(\beta) \\ 0 & 1 & 0 \\ -\sin(\beta) & 0 & \cos(\beta) \end{bmatrix} \cdot \begin{bmatrix} \cos(\theta) & \sin(\theta) & 0 \\ -\sin(\theta) & \cos(\theta) & 0 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} -1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & -1 & 0 \end{bmatrix}$ Where α is pitch angle, β is the roll angle, and the θ is the yaw angle as defined in Figure 9.		
Order: -		
Comments: -		
Formula: $\begin{bmatrix} X_{SC\_PCS} \\ Y_{SC\_PCS} \\ Z_{SC\_PCS} \end{bmatrix} = \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}_{\mathrm{ESRCS}} + \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(\alpha) & \sin(\alpha) \\ 0 & -\sin(\alpha) & \cos(\alpha) \end{bmatrix} \cdot \begin{bmatrix} \cos(\beta) & 0 & \sin(\beta) \\ 0 & 1 & 0 \\ -\sin(\beta) & 0 & \cos(\beta) \end{bmatrix} \cdot \begin{bmatrix} \cos(\theta) & \sin(\theta) & 0 \\ -\sin(\theta) & \cos(\theta) & 0 \\ 0 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} -1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & -1 & 0 \end{bmatrix} \cdot \begin{bmatrix} X_{\mathrm{ESRCS}} \\ Y_{\mathrm{ESRCS}} \\ Z_{\mathrm{ESRCS}} \end{bmatrix}$		

Comment [MA7]: Need to check.

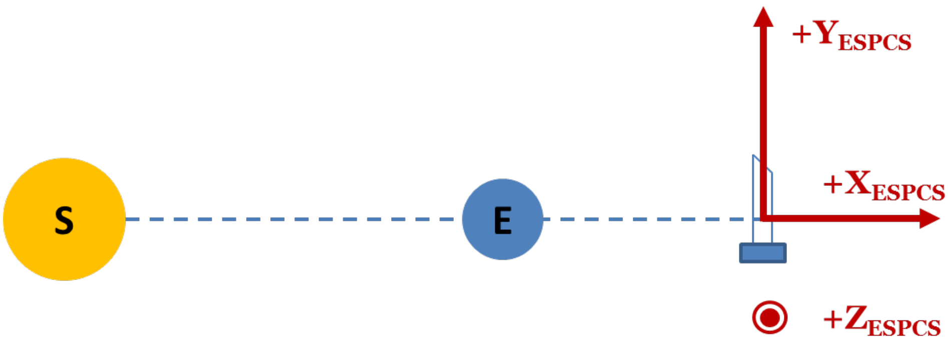

Figure 8: ESRCS

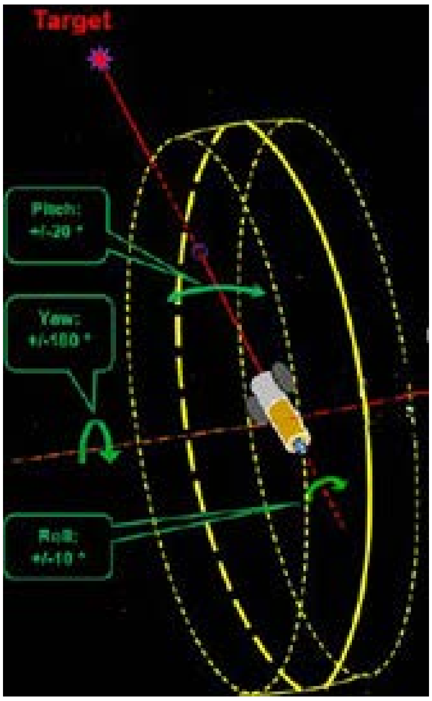

Figure 9: ATHENA SC pointing/attitude angles

4.3.2 *Earth-Centred Equatorial Coordinate System*

Table 8: EME2000 definition

Type	Title	ID
Pseudo-inertial	Earth-Centred Equatorial Coordinate System	EME2000
Definition		
$+X_{EME2000}$	The X axis is aligned with the intersection of the equatorial and ecliptic reference frames at J2000 (i.e. this is pointing approximately at the Sun at vernal equinox).	
$+Y_{EME2000}$	Completes the triad (rotated by 90◦ East about the celestial equator).	
$+Z_{EME2000}$	The Z axis is the rotation axis of the Earth at J2000.	
Origin	At the centre of the Earth.	
Rationale: The relative geometry between the SC and the ground station is expressed in the Earth-centred equatorial reference frame in order to calculate ground coverage.		
Transformation: -		
Translation: -		
Rotation: -		
Order: -		
Comments: This reference frame is the EME2000 standard, with the Earth's Mean Equator and Equinox as of 12:00 Terrestrial Time on 1st January 2000.		
Formula: -		

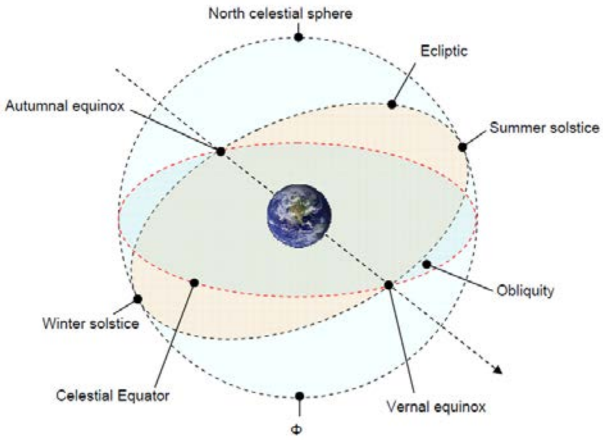

Figure 10: EME2000 reference frame

4.3.3 WGS84 Reference Ellipsoid

Table 9: WGS84 definition

Type	Title	ID
Rotating, spherical polar.	WGS84 Reference Ellipsoid	WGS84
Definition		
$+X_{SC\_PCS}$	The meridian of zero longitude is the IERS reference meridian.	
$+Y_{SC\_PCS}$	0° at the equator of the Earth	
Origin	At the centre of the Earth.	
Rationale: The WGS84 is the principal mechanical reference frame for the SC.		
Transformation: WGS84 > EME2000		
Translation: none		
Rotation: none		
Order: -		
Comments: This reference frame is the WGS84 standard according to the latest revision [RD02]. The Earth coordinates provided by ESOC in the EME2000 reference frame are assumed to coincide with the origin of the WGS84 at the Earth CoM.		

Formula:

$$X = [N + h]\cos(\phi)\cos(\lambda)$$

$$Y = [N + h]\cos(\phi)\sin(\lambda)$$

$$Z = \left[\cos^2(\alpha)N + h\right]\sin(\phi)$$

Parameter	Value
a (major radius)	6378137
b (minor radius)	6356752.3142
f (flattening)	3.35281066474748E-03

Where:

$$N = \frac{a}{\sqrt{1 - (\sin(\phi)\sin(\alpha))^2}}$$

$$\alpha = \arccos\left(\frac{b}{a}\right)$$

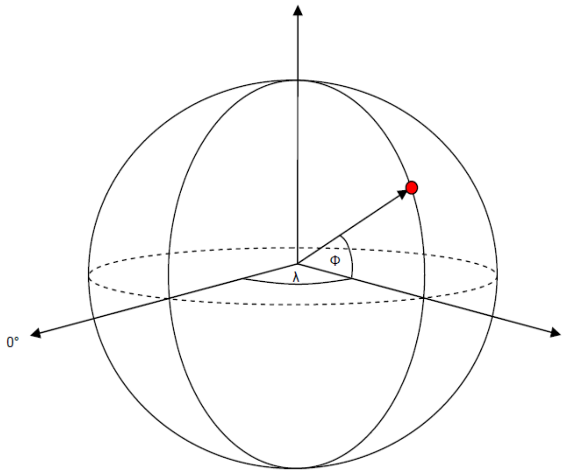

Figure 11: WGS84 reference frame

4.3.4 SC Reference Attitude Coordinate System

Comment [t8]: Can this be the SC_PCS with the origin at the CoG?

Table 10: SC_RACS definition

Type	Title	ID
SC fixed, Cartesian	SC Reference Attitude Coordinate System	SC_RACS
Definition		
$+X_{SC\_PCS}$	Transverse axis, on the launcher interface plane, fixed to a physical mark on the interface ring, aligned such that it is parallel with the Sun direction when the SC_PCS is aligned with the SC_RACS.	
$+Y_{SC\_PCS}$	Transverse axes, completing the right-handed orthogonal triad.	
$+Z_{SC\_PCS}$	Longitudinal axis, perpendicular to the launcher interface plane, pointing towards the Focal Plane Instruments.	
Origin	Geometric centre of the launcher interface (located on the separation plane between the launcher and the spacecraft).	
Rationale: The SC_PCS is the principal mechanical reference frame for the SC.		
Transformation: -		
Translation: -		
Rotation: -		
Order: -		
Comments: -		
Formula: -		

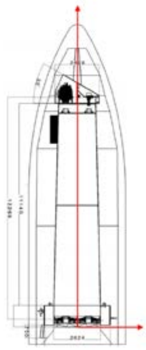

Figure 12: SC_PCS

4.4 Temporal Coordinate Systems

4.4.1 Mission Time (MT)

The instantaneous mission time relative to T0 (launch) is used.

4.4.2 Modified Julian Date (MJD)

Trajectory and related mission analysis uses the MJD. The Modified Julian Day is found by rounding downward. The MJD was introduced by the Smithsonian Astrophysical Observatory in 1957 to record the orbit of Sputnik. The MJD Epoch commences on 00:00 November 17th, 1858, Wednesday, and accordingly the conversion from Julian Date to Modified Julian Date has the following form:

$$MJD = JD - 2400000.5$$

An alternative zero epoch can be used for MJD, i.e. 00:00 January 1st 2000. This is denoted by MJD2000.

4.4.3 UTC (Coordinated Universal Time)

Primary time standard by which the world regulates clocks and time. UTC is a time standard that succeeded Greenwich Mean Time (GMT) which became a time-zone used by some countries. For practical purposes UTC = GMT, and there are never changes for Daylight Saving Time.