ALCATEL SPACE

HERSCHEL/PLANCK

REF. : H-P-ASP-MN- 6584

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COMPTE RENDU DE REUNION / *MINUTES OF MEETING* | LIEU / *PLACE : Telecon SPIRE/ESA/ASP*

OBJET / *PURPOSE :*

SPIRE Line of sight estimation accuracy telecon

CLASSIFICATION :

PARTICIPANTS *ATTENDEES*	SOCIETE *FIRM*	SIGNATURE *SIGNATURE*	PARTICIPANTS *ATTENDEES*	SOCIETE *FIRM*	SIGNATURE *SIGNATURE*
Bruce SWINYARD	SPIRE		D. GUICHON	ASP	
I. RASMUSSEN	ESA		Carsten SCHARMBERG	SPIRE	
Eric SAWYER	SPIRE				
REDACTEUR / *WRITTEN BY* : DG					

CONCLUSION :

DISTRIBUTION : PARTICIPANTS / *ATTENDEES*	POUR ACTION : *FOR FURTHER ACTION*	Attendants
	POUR INFORMATION : *FOR INFORMATION*	B. Collaudin, G. Boubrovik, P. Rideau, Y. Roche, P. Couzin

APPROUVE PAR / *APPROVED BY*				
NOM / *NAME*				
SIGNATURE / *SIGNATURE*				

SUITE / *CONTINUED* :

ACTION

1. Introduction

Agenda has been distributed by B. Collaudin email « instrument Line of sight estimation accuracy » dated 30-06-05. It is :

1. Confirmation of the compliance to IID-A requirement
- 1 arcsec maximum
- goal : identification of conditions to achieve 0.6 arcsec
- applicability to all detector LOS
- verification method
2. Available sources for calibration (results of calibration sterring group – AI of pointing meeting in Estec (4 dec 2003))
3. Operation necessary to reach the mode where best accuracy is achieved
4. AOB

As an input for the telecon, Matt Griffin has distributed by mail "Astrometric accuracy achievable with SPIRE" dated 04-07-2005 an update of SPIRE-UCF-NOT-001818 (issue 2) ([R1]) together with SPIRE-UCF-NOT-002315 issue 1 ([R2]).

2. Confirmation of the compliance to IID-A requirement

- 1 arcsec maximum

Alcatel recall the context of the IID-A requirement.

In order to achieve the best performances, the long term error between the instrument reference and the scientific mode attitude sensors has to be calibrated. The calibration phase aims mainly at the reduction of the bias errors.

This system calibration is mandatory mainly because of launch which will causes relative misalignment between instrument and ACMS Line Of Sight. So an extensive initial calibration (also called main calibration) will be necessary during the performance verification phase. Then periodic check (also called calibration check) and calibration parameter update will be performed.

The calibration will be performed such as to point both the instrument and the ACMS sensors (Star Tracker) toward targets with well known directions (reference sources). The resulting ACMS attitude estimation will be compared with payload attitude data resulting in an estimation of the bias between instrument and ACMS sensors line of sight. The result of the calibration process is then used for commanding the pointing of the spacecraft (bias compensation).

The bias will not be estimated perfectly but a calibration residual will remain. This residual depends of the ACMS attitude estimation and also of the instrument attitude estimation accuracy using the reference source at the time of the calibration. This is the origin of IID-A requirement.

Discussion about of SPIRE-UCF-NOT-001818 issue 2 and SPIRE-UCF-NOT-002315 issue 1:

⇨ Section 1 of [R1] states that the beam steering mirror which is used to create the 7-point jiggle map. SPIRE confirm that the spacecraft attitude target will remain the same during this operation (no nodding is today foreseen). The typical duration of observation will be few minutes.

⇨ As the satellite is not moving, the SRPE contribution in section 3.4 of [R1] can be deleted.

⇨ According to conclusion of [R2], the optimum grid spacing is 0.3 beam. ASP asks if equivalent of figure 10 and 11 are available for 0.3 beam. This should quantify $\delta\theta_{stat}$ error. — AI#1 SPIRE TBD-05

SPIRE will assess the possibility to run this simulation.

⇨ SPIRE indicates that there is no need to use the peak up mode for achieving the required accuracy.

⇨ The simulations reported in [R2] are considering a constant telescope error (called APE in R2). The applied error is constant all over the simulation. This doesn't simulate the real behaviour of the spacecraft. — AI#2 ASP 15-JULY-05

Alcatel will detail the frequency content of APE. — AI#3 SPIRE TBD-05

SPIRE will update the [R2] simulations based the Alcatel input

⇨ Frequency class of the error : — AI#4 SPIRE TBD-05

SPIRE confirm that $\delta\theta_{stat}$ and $\Delta\theta_{RPE}$ are random contribution and $\delta\theta_{pos}$ and $\delta\theta_{SRPE}$ are bias contributions.
$\delta\theta_{pos}$ could be very small depending of the source. SPIRE will update [R1] adding references where $\delta\theta_{pos}$ is quantified.

In synthesis, SPIRE agree that 1 arcsec is acheivable. Better performance will be difficult to achieve.

- goal : identification of conditions to achieve 0.6 arcsec

The highest quality of measurement of the position is 0.5 arcsec (see section 3.5 of [R1]). This is in line with gaol requirement. The associated conditions are among other things :

⇨ Negligible telescope beam asymmetry
⇨ Negligible RPE

SPIRE to identify in detail the conditions (instrument external and internal conditions) for achieving 0.5 arcsec accuracy. SPIRE will elaborate a budget to analyse different contributor weight and to be able to identify different conditions to achieve the goal.

AI#5 SPIRE TBD-05

- applicability to all detector LOS

The note mentions «the boresight of the SPIRE instrument ». There are several detector LOSs in the SPIRE instrument.
The alignment between the different line of sight will be measured on ground (including before and after vibration testing). Even if the launch effect is expected to be small, The 3 detector lines of sight will be estimated in flight using the same philosophy.

Nevertheless ,the accuracy will be different (typically 1", 1.5" and 2).
SPIRE will update [R1] note including other detector accuracy.

AI#6 SPIRE TBD-05

- verification method

In addition to the simulation campaign, SPIRE Line of sight estimation accuracy will be verified by test during Optical alignment test.

3. Available sources for calibration (results of calibration sterring group – AI of pointing meeting in Estec (4 dec 2003))

Section 2 of [R1] provides a list of suitable objects for system calibration. Alcatel asks if a catalog of these objects is existing (ex : LOS given in J2000 or inertial frame) and which objects have been used for the simulations reported by SPIRE-UCF-NOT-002315 issue 1.

SPIRE will provide a catalog suitable objects for system calibration.
SPIRE need for this the visibility tool to be provided by ESOC FD.

AI#7 SPIRE TBD-05

4. Operation necessary to reach the mode where best accuracy is achieved

The instrument operation and spacecraft operation are independent since the attitude of the spacecraft remains constant during the 7-point map.

5. AOB

Values of Ky and Kz :

Values have been provided in AVM Test Specification SPIRE Peak-up Mode Test reference SPIRE-RAL-NOT-002372 issue 1.
They have been commented by Alcatel saying that this gives a possible correction of 327.67 arcsec ($4.8481368110954e^{-8}*2^{15}$). System Requirement Specification says that maximum allowed correction is 10 arcsec (upper correction will be discarded by ACMS). If 10 arcsec is confirmed, Ky and Kz could be optimised.
SPIRE will confirm the ky and Kz values of SPIRE-RAL-NOT-002372 issue 1. AI#8 SPIRE TBD-05

Ground peak up testing

The AVM case has been analysed via AVM Test Specification SPIRE Peak-up Mode Test reference SPIRE-RAL-NOT-002372 issue 1.
Associated questions are :

- ⇨ What is the procedure to reach the REDY mode (mentioned in section 2.3) ?
- ⇨ Is the associated command list send by ground TC ? Where are they described (HPSDB) ?
- ⇨ Is the AVM procedure applicable to The Spacecraft case ?

SPIRE will answer the above questions about ground peak up testing AI#9 SPIRE TBD-05

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INITIATOR Firm / person	ACTION N°	ACTION DESCRIPTION	ACTIONEE Firm / person	DATE DUE
ALCATEL	01	SPIRE will assess the possibility to run this simulation (grid spacing is 0.3 beam).	SPIRE	TBD
SPIRE	02	Alcatel will detail the frequency content of APE.	ALCATEL	15-JULY-05
ALCATEL	03	SPIRE will update the [R2] simulations based the Alcatel input	SPIRE	TBD
ALCATEL	04	SPIRE will update [R1] adding references where $\delta\theta_{pos}$ is quantified.	SPIRE	TBD
ALCATEL	05	SPIRE to identify in detail the conditions (instrument external and internal conditions) for achieving 0.5arcsec accuracy. SPIRE will elaborate a budget to analyse different contributor weight and be able to identify different conditions to achieve the goal.	SPIRE	TBD
ALCATEL	06	SPIRE will update [R1] note including other detector accuracy.	SPIRE	TBD
ALCATEL	07	SPIRE will provide a catalog suitable objects for system calibration	SPIRE	TBD
ALCATEL	08	SPIRE will confirm the ky and Kz values of SPIRE-RAL-NOT-002372 issue 1.	SPIRE	TBD
ALCATEL	09	SPIRE will answer the above questions about ground peak up testing	SPIRE	TBD

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