



**MINUTES OF MEETING**

Herschel/Planck Project

reference	SCI-PT/011948	page	1/6 + annexes.
meeting date	11 March 02	meeting place	Estec
chairman	D. de Chambree		
copy			
subject	Herschel Alignment Meeting (HOW6)		

**participants:**

Name:	Affiliation:	Signature:
Jaqueline Fischer Edgar Hölzle	Naval Research Lab Astrium-D	Jaqueline Fischer E. Hölzle
DOMINIC DOYLE	ESA-ESTEC	Dominic Doyle
Philippe MARTIN Norbert Gies	Alcatel MPE	Philippe Martin Norbert Gies
Louwe Beintema	SRON	Louwe Beintema
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Göran Pilbratt	ESA/ESTEC/SCI-SA	Göran Pilbratt
Volker Kirschner	ESTEC	Volker Kirschner
Daniel de Chambree	ESA-ESTEC	Daniel de Chambree
Dietmar Shink	Astrium-D	Dietmar Shink

description

action

due date

General

- See Astrium budget hand-out. (annex 1)
- Pupil mismatch values cover both lateral and tilt misalignment.
- The budget given the CW internal ASE0 responsibility of  $\pm 6.5$  mm is the result of both analysis (on-going at ASE0) and of allocations.
- All summations are RMS summation with one  $\sigma$  bar error.

Axial alignment

- HIFI and SPIRE do agree with the overall axial focus budget of  $\pm 7.7$  mm assuming good confidence on the values.
- PACS has a 95% Strehl ratio for a telescope having a  $6 \mu\text{m}$  (rms) WFE, meaning that the telescope has the highest contribution to the system WFE budget.
- The telescope will be shimmed on the telescope interface structure ( $7 \text{ mm} \pm 5 \text{ mm}$ ) (shim thickness).

driven in alignment budget

description

action

due date

- PACS : there is little difference in the defocus contribution to the integration time (science parameter) depending on the telescope performance.

See annex 2

- PACS and SPIRE raise the concern that the best focus definition (best WFE) might not be identical for everybody (differences up to few mm could exist!).

- ASE0 to confirm overall axial focus budget of  $\pm 7.1$  mm for PACS (~~with RSS summation~~) as indicated in annex

Ac 1  
30/4/2  
goal.

spec	$\pm 5$	5 tel	$\pm 5$ CW	$\pm 1$ instrument	$\rightarrow$ spec *
goal	$\pm 3$	3 tel	$\pm 3$ CW	$\pm 1$ "	$\rightarrow$ goal

- For info : XMM | pointing requirement  $3\sigma$  (95%)  
                  | alignment —  $\sigma$  (RSS summation)

- All parties agree that the top level requirement of  $\pm 7.1$  mm Agreement fulfill the scientific needs of all instruments HIFI, SPIRE and PACS. (axial direction)

- ABEF to confirm their budget concerning telescope axial position accuracy (spec  $\pm 5$  mm / goal  $\pm 3$  mm)

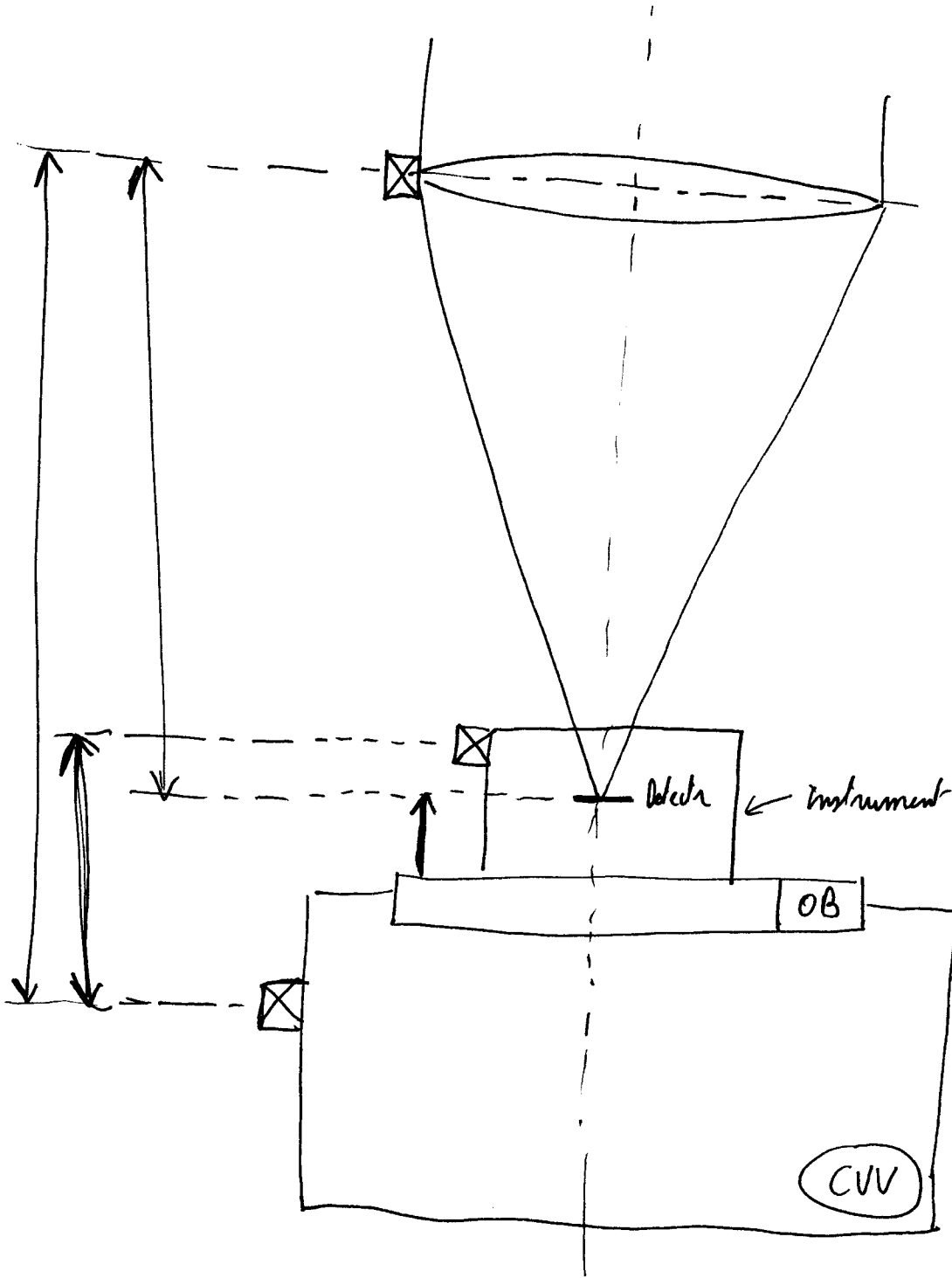
Ac 2  
15/4/02

\* with a confidence factor of  $2\sigma$  (spec) on each factor

description

action

due date



description

action

due date

lateral alignment

- The overall budget as presented by ASED is agreed by all parties provided a one sigma ( $\sigma$ ) confidence factor on the CVV internal misalignment.
- SPIRE stress the point (in accordance with their TN) that the pupil mismatch (lateral misalignment) shall be <sup>also</sup> decomposed in tilt ~~to~~ and lateral  $\Rightarrow$  ringetting problem. SPIRE to formalize their request.
- Telescope internal manufacturing (M2 position and reference frame) will be  $\pm 3\text{mm}$  with a knowledge of  $\pm 1\text{mm}$ . These values will have to be confirmed by ASEP.
- ASED to confirm the overall lateral pupil mismatch budget of  $\pm 6.8\text{mm}$  for PACS (stringent driver) as indicated in annex (telescope internal  $\pm 5\text{mm}$  (possibly  $\pm 3\text{mm}$  (see action done) / CW internal ( $\pm 6.5\text{mm}$  possibly  $\pm 1.5\text{mm}$ ) and instrument internal ( $\pm 1.8\text{mm}$ ).

Ac:3

31/3/02

Ac:4

15/4/02

Ac:5

30/4/02

goal.

description

action

due date

(axial/ lateral)

- For all these budgets, ASEF (telescope) and the 3 instruments shall provide to ASE0 (Herschel payload) their internal alignment budget and the confidence level (2 $\sigma$ )/95%).

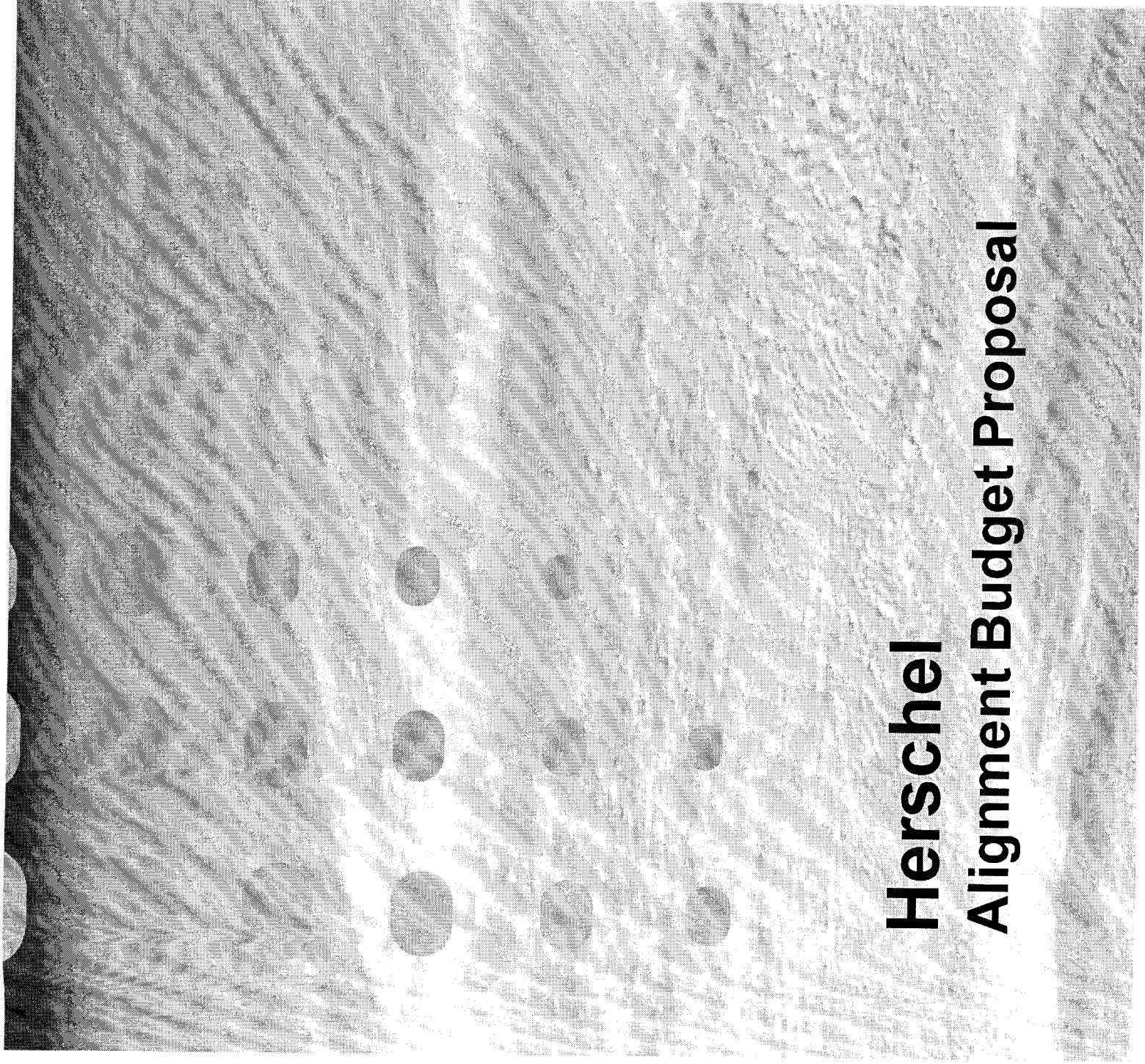
Ac: 6  
15/4/02

- Instrument team to send to ASE0 / Market their max allowable footprint at various heights.  
(for internal instrument alignment)

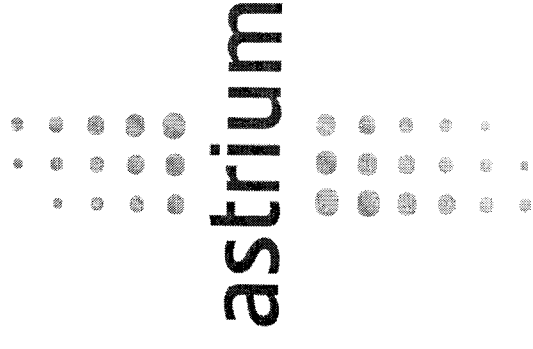
Ac: 7  
31/3/02

- ASE0 to provide instrument teams the required height position for footprint analysis.

Ac: 8  
15/3/02



# Herschel Alignment Budget Proposal



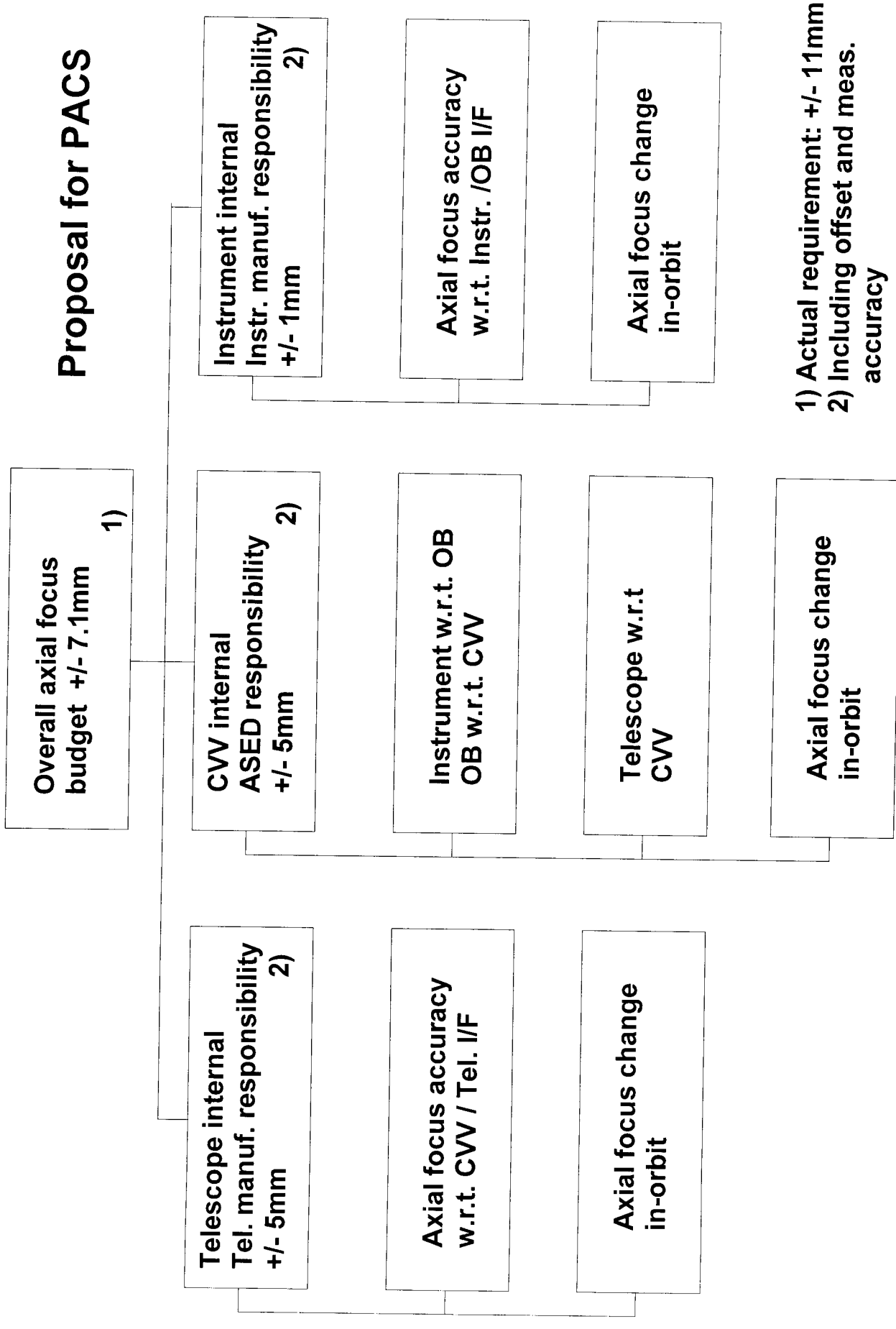
D. Schink  
Date: 11.03.02

## **Content**

- Axial Alignment Budget**
- Axial Budget for PACS**
- Axial Budget for HIFI / SPIRE**
- Lateral Alignment Budget**
- Pupil Mismatch for PACS**
- Pupil Mismatch for HIFI / SPIRE**

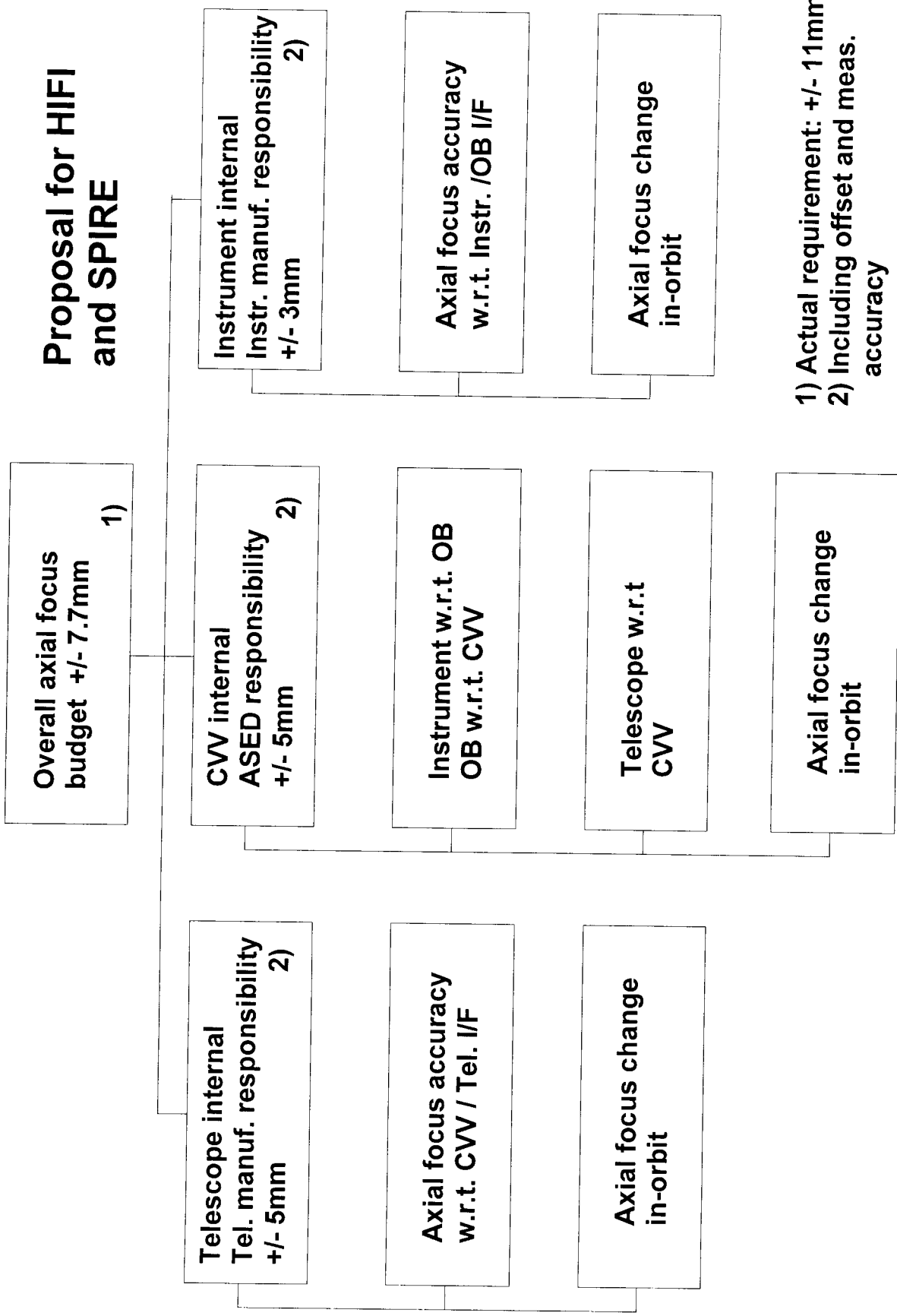


# Proposal for PACS

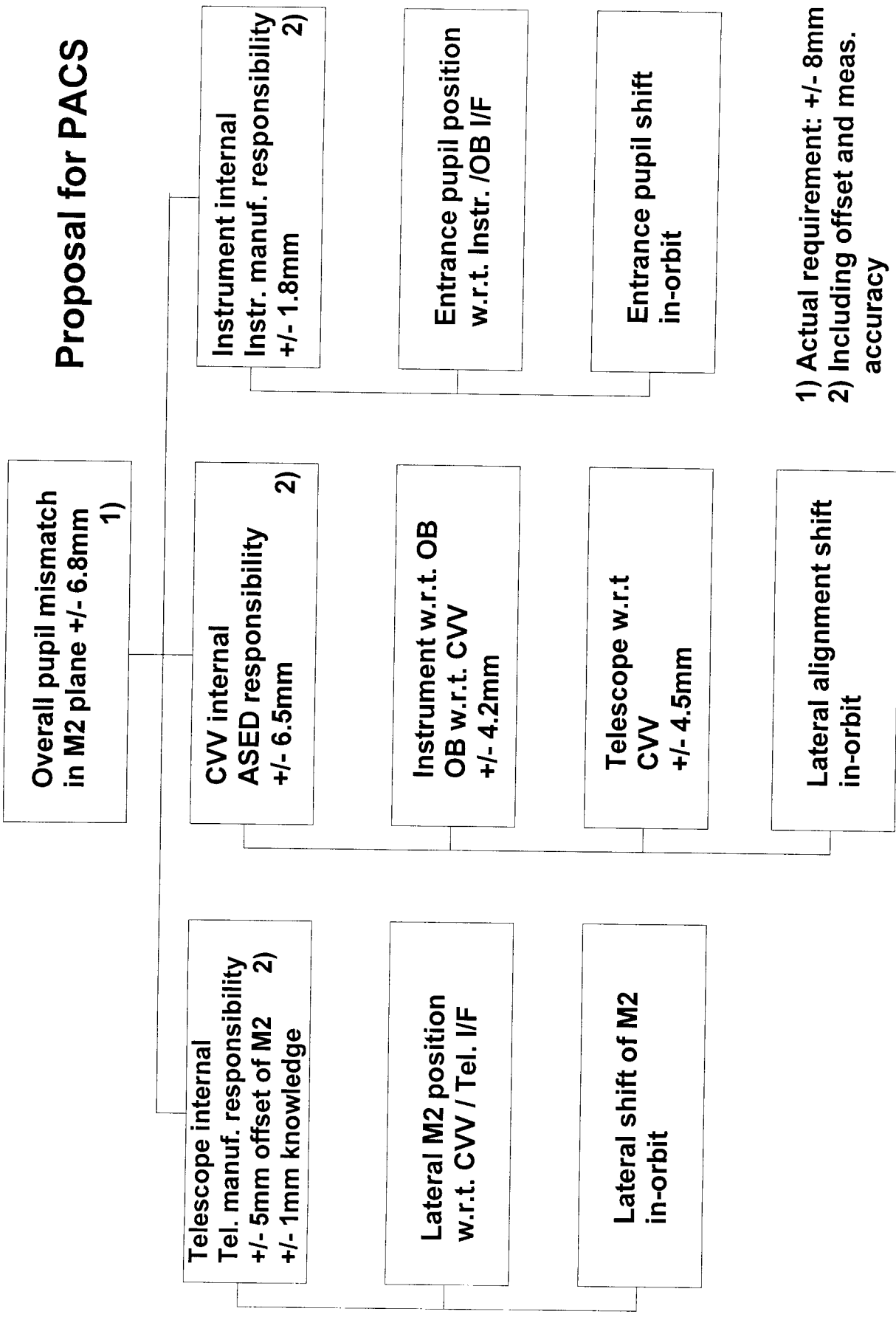


1) Actual requirement: +/- 11mm  
 2) Including offset and meas. accuracy

# Proposal for HIFI and SPIRE

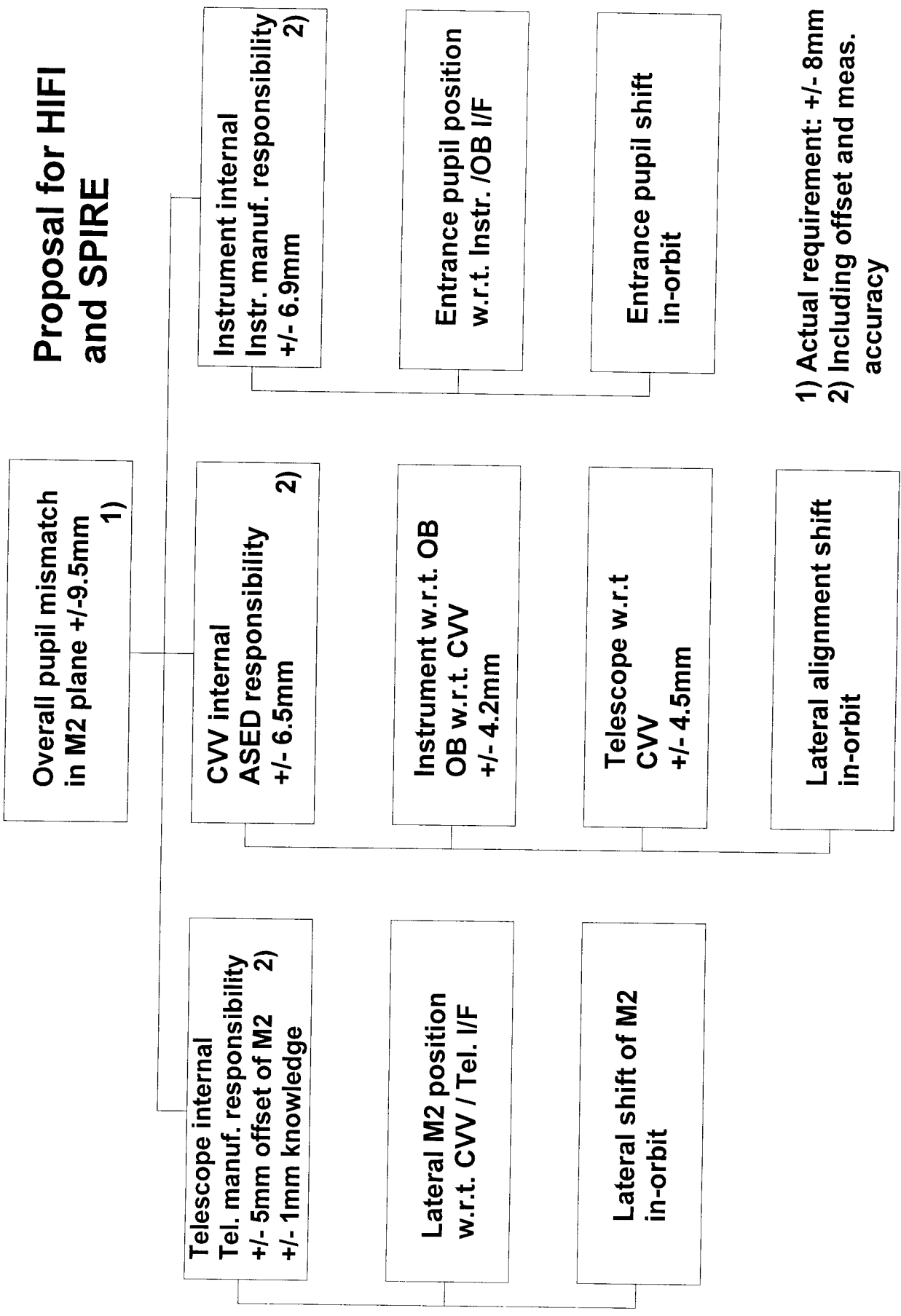


# Proposal for PACS



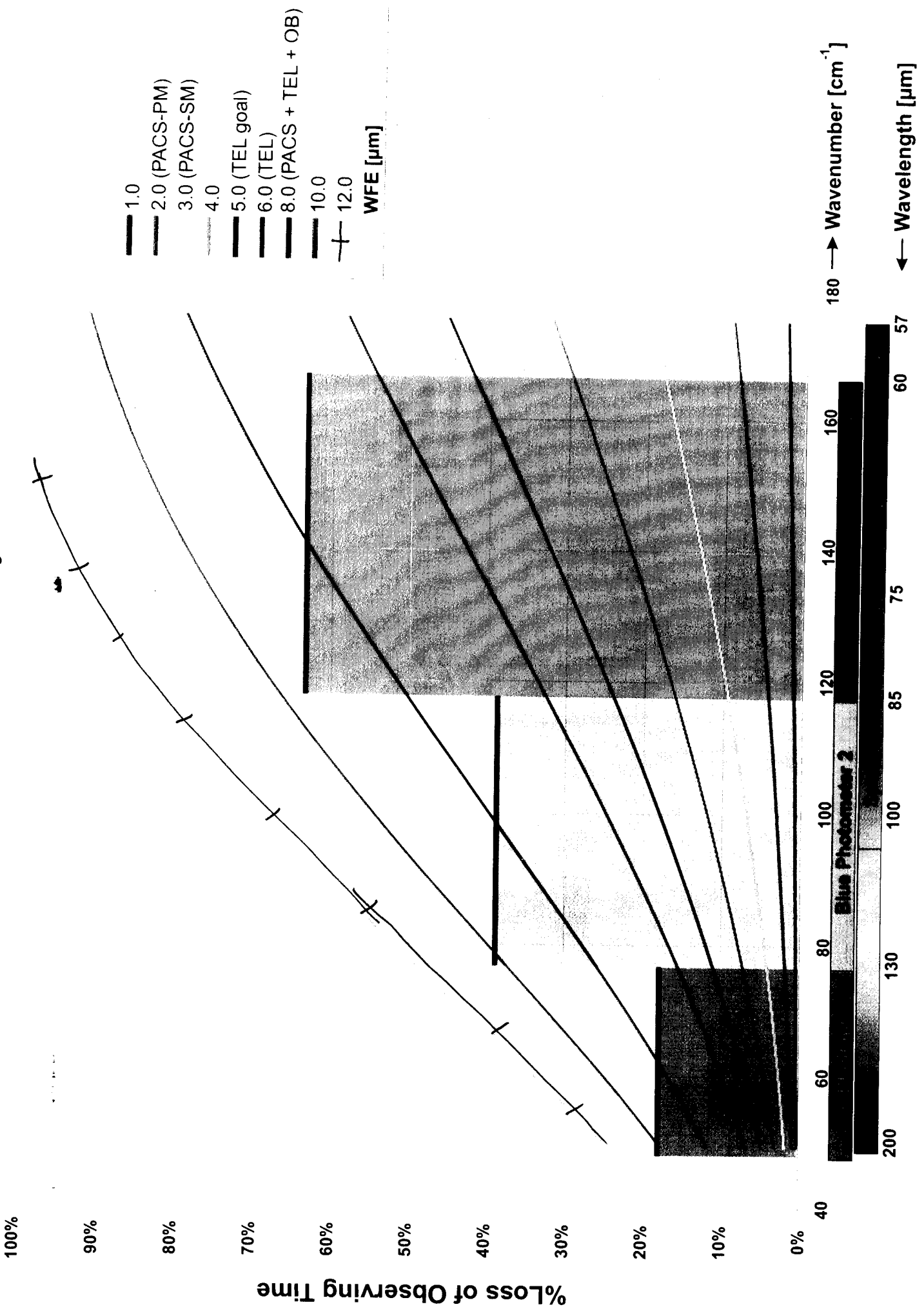
- 1) Actual requirement: +/- 8mm
- 2) Including offset and meas. accuracy

# Proposal for HIFI and SPIRE

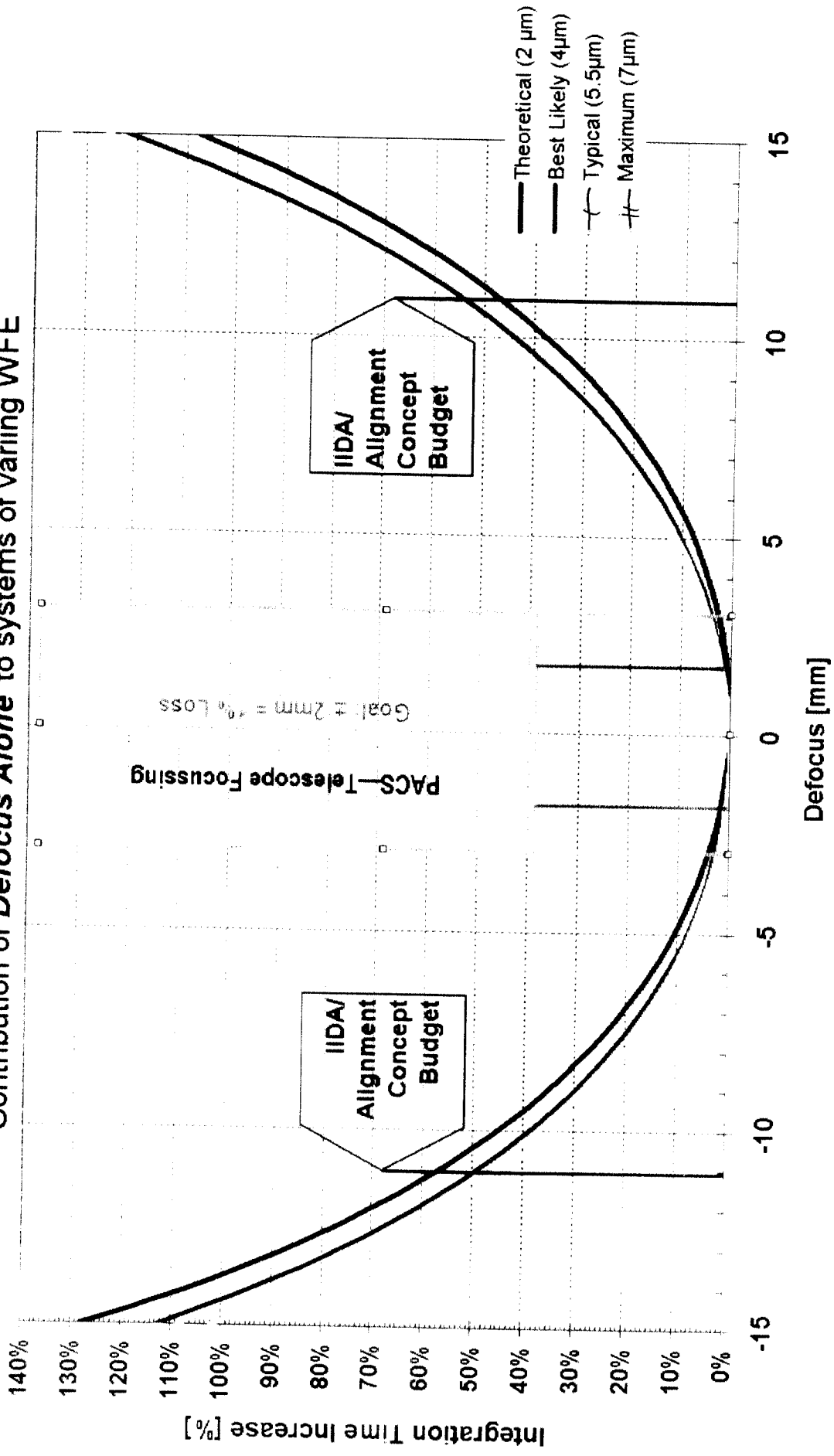


- 1) Actual requirement: +/- 8mm
- 2) Including offset and meas. accuracy

# Science Loss vs. Total System WFE



### Integration Time Increase to Reach Limiting Magnitude Contribution of Defocus Alone to systems of varying WFE



<b>COMPTE RENDU DE REUNION / MINUTES OF MEETING</b>	LIEU / PLACE : <b>BRUXELLES</b>
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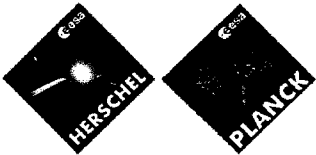
OBJET / PURPOSE : <b>TELECOM WORKING GROUP #3</b>	CLASSIFICATION :
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<u>DISTRIBUTION :</u>	POUR ACTION : FOR FURTHER ACTION
PARTICIPANTS / ATTENDEES	POUR INFORMATION : FOR INFORMATION

APPROUVE PAR / APPROVED BY

NOM / NAME				
SIGNATURE / SIGNATURE				

 <b>ALCATEL</b> SPACE		REF. : HP-ASPI-MN.xxxx	
		DATE : 18/12/01	PAGE : 2/12
<b>COMPTE RENDU DE REUNION / MINUTES OF MEETING</b>		LIEU / PLACE :	

SUITE / CONTINUED :

ACTION

\* March development sequence

Schedule of RF tests as / RF 99 - mid-march 02  
 after a mid off

\* Update on Design

No significant modification is seen slight optimization  
 on both focal distances (due to studies about  
 subt increase to 15° and consequent elongation  
 by the mass of the top part of the primary  
 reflector)

\* WFE

- WFE degradation is understood as the degradation of a perfectly manufactured and perfectly aligned telescope (i.e. with the theoretical use perfect WFE)
- Theoretical WFE comes from the previous studies where the telescope was optimized (actually by Alcatel though through a WFE / WFE degradation later defined by ESA in the telescope specifications)
- In some situations that this is still valid also performed by ASI / MITA



SUITE / CONTINUED :

ACTION

In terms of tests, both WFO and zero degradation will be achieved. For RF tests result evaluation, real horn patterns will be used also (though the specification refers open antenna/theoretical horns).

La Alcatel will define their needs in terms of dates at which real horn characteristics are required (to perform "real" telescope performance)

#1 (Alcatel)  
30/06/02

- In the present budget, a separate box exists for the corrugation whereas for future this is included in the WFO - to be clarified when antenna specifications is re-addressed (the one applies to the box entitled "misalignment of 200")

- All studies relating to SS7 - I have with apologies as defined in the specification - Apologies requested for the secondary mass set as 0.003<sup>(\*)</sup> for this mass was specified in the spec as critical as the most probable mass of discrepancy of the 2000 zero degradation (based on WFO and RF).

SUITE / CONTINUED :

ACTION

Preliminary assessment for the 2002 as seen by ESA is close to 0.31 - no discrepancy to be checked/addressed between ESA/ESA/MS and Alcatel



- FP0 contribution → instrument allocations specified globally for the FP0 (not known per hour) → eventually, in a second step, this could be refined but the overall allocation (coming from the alignment approach/plan) should first be addressed → Actually the allocation is driven by the most sensitive hour (not to misalignment/ WFE degradation → i.e. the 057 Gilly hour).

↳ instruments will verify that they are compliant with the allocation (cf alignment plan)

(not to forget the WFE/MS alignment → already covered by an old action)

- But how position (telescope FP0 overall budget) is also defined globally → how this is addressed here → done in the instruments responsibility
- 2002 proposal → study priority for next year budget (see attachment #1) or 2001 Sun plan A

#12 Instruments  
30/06/02


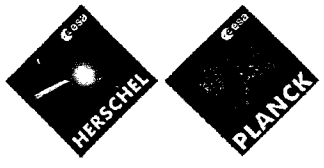
		REF. : HP-ASPI-MN.xxxx	
		DATE : 18/12/01	PAGE : 5/12
<b>COMPTE RENDU DE REUNION / MINUTES OF MEETING</b>		LIEU / PLACE :	

SUITE / CONTINUED :

ACTION

and states that at some stage this should be globally considered <sup>at system level</sup>. Alcatel points out that the project specification covers the new kind of telescope's reflection at this level

The slide called "case proposal" should be understood as a numerical example of what a collection spec could be so as to be compatible with the telescope spec. The only message here is that the 2 specs are not yet compliant


		REF. : HP-ASPI-MN.xxxx	
		DATE : 18/12/01	PAGE : 6/12
COMpte Rendu de Reunion / MINUTES OF MEETING		LIEU / PLACE :	

SUITE / CONTINUED :

ACTION

\* RF Engineering

- Diffing input calculation → the hexagon calculation are not necessarily as tight by definition as can be calculated globally and the computer method still applies.

- Diffing value presented was  with a sensitivity analysis down to  $\pm 0.3 \mu\text{m}$

↳ for the new tube ESA thinks that the one value + the Page formula should provide the same result

- Ohmic losses → cryogenic temperature should lead to a more favorable approximation than the factor 2 but no data is known to quantify that (in the proposed analytical model).

↳ ESA agrees on Alcatel using the analytical model

for now (later <sup>collectively</sup> arrangements are planned at Alcatel) + roughness / outgassing effect considered as included in the factor 2

- Therm-cracks → For gas degradation no cracks should be measured. For the OPA, and for all budgets no cracks (for structural other case) will be considered (100%)

→ ESA to evaluate an option to be taken for the next arrangements

15/12/02  
ESA

SUITE / CONTINUED :

ACTION

- Rayleigh → the 0.2  $\mu$ m rms spec is not the only one  
 to see - 0.30 and -0.32 specifications → various way, low  
 coupling  
 → Again, analytical computation for gain degradation (Rayl.)  
 is also applicable for ESA


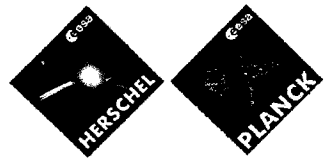
- Galvanization → number of particles is related to the RMS  
 (total integrated scattering). Of course, this assumes a  
 certain distribution and repetition (no "grouping" of the  
 particles) → the blue book suggests several models considered  
 by ESA as more appropriate (more conservative).

↳ ESA to evaluate which of the blue book models #4 (ESA)  
 to use. 12/03/02

Molecular contamination (water, ...) is linked to transmission  
 loss (See cleanliness plan)

- Internal straylight → optical coupling will come out from  
 the 7000A experiment study (See 7000A presentation)



↳ Don't take into account (Do not) for consistency with  
 the internal light design (as provided by ESA)

		REF. : HP-ASPI-MN.xxxx	
		DATE : 18/12/01	PAGE : 8/12
COMpte Rendu de Reunion / MINUTES OF MEETING		LIEU / PLACE :	

SUITE / CONTINUED :

ACTION

- Baffle modelling method a following next study, all gaps are now filled (covered by GFD / M comparison).  
↳ GFD method considered appropriate.
- CFI presents their own evaluation (based on the baffle geometry provided by Alcatel - our previous session) of the impact of the baffle onto the planned measurements.
- For the PDR, the far at side lobes will be computed at all frequencies (reduced number of cuts = 16 cuts) + at a few frequencies, calculation of the full sphere.
- Multimoded bases → Exact geometry of the multimoded bases provided by IRI have been used in ELFIR. Output is the sound map (complex) on all surfaces from which are derived the radiation patterns.  
↳ Results provided here are based on an iso-orientation of the 16 cuts considered → other repartitions possible (and/or linked to the balancers → data not available at Alcatel) → actual data to be provided by IRI (large explanation ongoing)

		REF. : HP-ASPI-MN.xxxx	
		DATE : 18/12/01	PAGE : 9/12
<b>COMPTE RENDU DE REUNION / MINUTES OF MEETING</b>		LIEU / PLACE :	

SUITE / CONTINUED :

ACTION

Once data is available, the proposed modeling method will be available  $\rightarrow$  what then, Alcatel will work with the single mode have defined in the specifications.

\* RF tests

- low GHz received and tested  $\rightarrow$  around 100 dB dynamic range obtained.
- Archamps reflector -> one is 30 cm oval but on a smaller scale it is down 3 fold  $\rightarrow$  this led to selecting the 10 cm / 3 cm grid spacing for the 3D measurement of the SR/PR
- Est thinks that measuring the actual horn pattern at the RFR should be characterized (eventually after the test)
- Detail of the RFR test are detailed in the test specification as was flexibility exist with the same elementary measurements planned in other cases by EA of this document (and also in the test TRR planned on 14/03). The detail could be reviewed.

SUITE / CONTINUED :

ACTION

\* Alignment Plan

- WFE optimisation / OP/SR/FPV alignment sequence set up and LOS alignment are discussed
- WFE measurement methods for OI/dummy collectors and FPI telescope as seen so far by Contracts are foreseen. For the FPI, optical WFE measurements will be performed at La. Gan (present assumption)

\* AI of last TWG

S22/5 - Positioner accuracy gives  $0.002^\circ$  error in angle

↳ At 3 GHz this leads at to 2.8% error in ellipticity


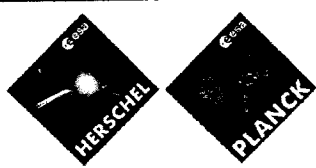
- 60 GHz ----- 2.7%

→ This will not be enough to remove the ellipticity with 1% at all frequencies → other solutions will be investigated (e.g. active feed scanner)

Values presented above in line with those presented in the Adair's study

S22/1 - Active plan not RFOD test discrepancy with the modelling now somewhat changed due to the "residual"



		REF. : HP-ASPI-MN.xxxx	
		DATE : 18/12/01	PAGE : 11/12
<b>COMPTE RENDU DE REUNION / MINUTES OF MEETING</b>		LIEU / PLACE :	

SUITE / CONTINUED :

ACTION

of the REDT schedule (tests at 30 GHz first, then modelling according to principles defined by TERA) → any discrepancy will anyway have to be addressed (test problem? modelling problem? design problem?) and corrected (new tests foreseeable during the second REDT test slot normally decided to be GHz if found necessary)

↳ Not to forget the date at which the Antennas reflectors must be sent back (action on-going to try and extend the export license).

### \* Alignment Plan (Continued)

- The document edited for the SRR will be updated for the 2008 (annual work) = no major change to be
- So far 8 WPA requirements in the field are planned. Alcatel will explain how this is sufficient to characterizing the whole telescope.

Planck Telescope Working Group meeting March 8, 2002 at DSRI

WFE budget at 857 GHz

Optical design		22.8 $\mu\text{m}$ RMS	
Multimoded horns		26.9 $\mu\text{m}$	
Telescope structure etc		29.6 $\mu\text{m}$	
subtotal		46.0 $\mu\text{m}$	
Reflectors (PERF-015)	goal	22.7 $\mu\text{m}$	spec 34.1 $\mu\text{m}$
Combined		51.3 $\mu\text{m}$	57.3 $\mu\text{m}$

[Reminder: Planck Phase A study

Each reflector	WFE RMS	20.0 $\mu\text{m}$
combined		28.3 $\mu\text{m}$
Total WFE budget		<60.0 $\mu\text{m}$ ]