esa

FIRST/Planck Project

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External: SPIRE, PACS, HIFI

Subject : FIRST/Planck - Definition of 3.8 m Telescope

Please find below the results of a meeting that was held with the FIRST instrument teams in order to establish a set of requirement for the study on the 3.8 m diameter FIRST telescope. This follows an action item placed on ESA during the meeting in COI.

The meeting covered two further points, i.e. the sensitivity of the instruments to detect/measure the telescope focus (relevant for the discussion of the refocussing mechanism) and status and definition of the Payload module/Focal Plane Unit Straylight Model.

1. Definition of 3.8 m Telescope

The optical specification of the FIRST telescope has been reviewed in order to provide a proposal for the definition of the 3.8 m telescope.
As a result of the discussion a baseline telescope specification has been agreed and the main requirements are given below. The numbering system is taken from the present telescope specification and only those requirements that affect the optical design are included.

Requirement	3.5 m Requirement	3.8 m Requirement
TEPE-015	The optical free diameter of the Primary Reflector shall be 3500 mm +2mm, - 0 mm.	The optical free diameter of the Primary Reflector shall be 3800 mm +2mm, - 0 mm.
TEPE-020	The f-number of the Primary Reflector shall be as resulting from use of the same mould as resulting for the 3.8 primary	The f-number of the Primary Reflector shall be 0.5

Requirement	3.5 m Requirement	3.8 m Requirement
TEPE-0030	The distance of the primary reflector vertex-best on axis focus shall be - by construction value t_b = 975 mm ± 10 mm - this value shall be measured with the accuracy defined in 4.3.3	The distance of the primary reflector vertex-best on axis focus shall be - by construction value t_b = 975 mm ± 10 mm - this value shall be measured with the accuracy defined in 4.3.3
TEPE-045	Operating wavelength range 80 µm to 670 µm	Operating wavelength range 80 µm to 670 µm
TEPE-070	The system focal length shall be 28.5 m ± 0.05 m And the system f-number of the telescope shall be f/D = 8.68, where D is the diameter of the effective aperture	The system focal length shall be 30.9 m ± 0.05 m And the system f-number of the telescope shall be f/D = 8.68, where D is the diameter of the effective aperture
TEPE-075	The Field-of-view (FOV) shall be ± 0.25°, free of vignetting	The Field-of-view (FOV) shall be ± 0.23°, free of vignetting

One major element in the consideration for the adapted specification for the 3.8 m telescope was that the mould would be identical, i.e. tailored to the maximum size of a 3.8 m reflector, but the 3.5 m diameter part compatible with the design of the 3.5 m reflector.
The f-number of the 3.8 m primary reflector has been set to the value previous given for the 3.5 m primary reflector, i.e. 0.5. One main reason for this was to keep the secondary mirror at a reasonable height, i.e. not increasing significantly the height of the sunshade.

During the discussion the concern was raised w.r.t. the opto-mechanical design of the telescope.
The design of the telescope, i.e. as presented during the review meeting at JPL, is at present not adequate to provide the input required by the instrument teams (especially SPIRE) for their detailed optical design. Since the development plan is not yet existing, can you include and confirm that the telescope design will be detailed to a level as required by the instruments?

It was realised by all instrument teams that a change of the size of the telescope from 3.5 m to 3.8 m will require certain changes inside the instruments. The amount of adaptation is not yet clear and will be investigated by early 1999.

2. Refocussing Mechanism

The question was raised with the instrument teams to what extent can they are sensitive to the focus positioning in operational conditions.
The quantitative answer to this question needs some analysis work, what has to be carried out in addition to the baseline activities. We will know the due dates for this analysis by mid October.

The basic assumptions for their analysis, we agreed with them and I would like you to verify, are:

- Use the nominal telescope (3.5 m) with the optical definition as derived from the specification (the updated one, if you agree to above approach of the specification)
- Assume a WFE of the telescope of 6 μm rms (correctly focussed telescope, WFE allocated fully to spherical aberration)
- Assume nominal pointing accuracy of the s/c (i.e. jitter of 0.3arcsec, 1 min, 1 σ).

3. Payload Module/Focal Plane Unit Straylight Model

A straylight model of the SPIRE instrument can be provided for the telescope design. This model will be available early October, however, need to be extended to include the cryostat part and the "non-telescope" system elements (sunshade,...).
Since the model will be similar in format to the one used for the 3 m telescope and sent to you earlier, could you verify its compatibility with your straylight analysis approach?

Best regards

T. Passvogel