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FAX

Herschel / Planck Project

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subject **Approach to Herschel Instrument FPU Cryogenic Qualification**

Reference

Dear all,

In order to close the discussion on the question of the approach to the cryogenic mechanical qualification of the Herschel FPU's please find below the outline of the test sequence to be applied. The approach make due consideration of the behaviour of the CSL facility and the needs of the programme.

The main elements are:

1. Cryogenic vibration testing will be carried on FPU level at CSL.
2. testing will be performed along all three axes.
3. Sine vibration testing will be carried with the agreed load level as given in the IID-A.
4. Random vibration will be carried with the agreed load level as given in the IID-A with lowering to a flat low level plateau starting from about 150 Hz and adapted to realise adequate response at the sensitive instrument components (bolometers, coolers, mechanisms, etc).
5. The level to be applied for the frequency above 150 Hz will be defined for each instrument separately and following the outline given below.

Rationale

The random vibration test is to simulate at instrument level the responses that will be induced by the acoustic input during launch. Application of IID-A levels at the shaker head are expected to generate much higher accelerations of sensitive suspended sub-units (such as the PACS and SPIRE bolometers, sorption coolers and suspended thermal links) than experience suggests from spacecraft level acoustic tests.

In our approach, responses will be limited for the sensitive suspended units by ensuring that their responses do not exceed levels that are experienced during system level acoustic testing. The responses to be achieved (and not exceeded) for qualification are based on ISO and other experiences and are estimated to be 10g rms.

During the test a direct measurement of this output load is certainly preferable, In case this is not possible analysis and correlation with a nearby measurement point on the instrument structure needs to be performed, taking into account the model of the CSL shaker, which has already been made available to the instrument teams. Based on this, the input levels shall be controlled over the sensitive frequency band (typically above 150 Hz). The analysis will also help to check loads seen at other locations in the instrument.

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It is understood that SPIRE will control their input levels following a combination of nearby measurement and analysis, HIFI will use direct measurement and PACS will not re-qualify at full instrument level, but will perform a delta-qualification of the photometer STM FPU at 77K. For FM instrument level testing, the results of the CQM tests are used to define the notching level.

The FM System level acoustic test coupled with the instrument functional test will be the ultimate final proof of this approach, which after careful consideration is the only philosophy that we can recommend.

Best regards

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