SCUBA-2
Spectrometer Project

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Responses to FTS-2 PDR Review Panel Recommendations

1) Define the date of delivery to the telescope site as 6 months after SCUBA-2 delivery. Review whether budget limitations might require an earlier completion date.

The current goal is to complete construction and software development by mid 2007, with commissioning before the end of 2007. If this is to work, then commissioning would have to occur during the initial SCUBA-2 commissioning period, which may cause conflicts. As the delivery/commissioning of SCUBA-2 may be delayed, commissioning of FTS-2 may need to be scheduled later in 2008, which is beyond the current budget. In this case, we would aim to deliver FTS-2 before the end of 2007, and have to find other funding to cover costs of the FTS-2 commissioning period.

2) Establish a strawman date for the CDR by end of July 2005. Goal: sometime in the December 2005 to February 2006 timeframe.

The CDR date was delayed as a result of unforeseen complications in the optical modelling.

3) Start procurement of long-lead items before the CDR. Define these items by September 2005.

The only items with lead times long enough to affect delivery date at the time of the CDR are the optics. With the optical model now finished, only the details of the mounting features required on the rear surfaces of the mirrors are needed before the optics can be ordered. Lead time is estimated at 2 months.

4) Complete details of the optical design by September 2005. In particular, model the spot patterns and image quality at the SCUBA-2 focal plane. Supply a description of the design to the PDR panel.

The optical design has now been completed by INO.

5) Design for the ability to operate the FTS in either of two modes, dual input or single input. It is not clear that the dual-input mode will work on extended sources. An ambient load that can be remotely inserted and removed in front of one of the input ports should be an integral part of the design.

It has been deemed impractical to produce an active blackbody load to null both the 450 and 850 bands simultaneously. The only option for providing a single port mode is to introduce an ambient load near a pupil location before the input beamsplitter. The current plan involves a relatively simple mechanism to flip an Eccosorb shutter into the beam. Since this mechanism is simple and relatively inexpensive, we will incorporate a shutter into both ports of the interferometer, to provide more thorough diagnostics.

6) Define all instrumentation spares that might be needed and should be included as part of the FTS delivery. Assess the availability and costs of these items.

It has been decided that the RTS client for the POL-2 and FTS-2 instruments will be the same unit. The POL-2 project will purchase the unit for delivery at commissioning, and the FTS-2 project will purchase an identical unit (minus the rack) to be used as a spare. This will have no impact on the project budgets.

Spares will also be provided for the BB mechanism (minimal cost), several mirror actuators (cost of ~$400 CDN ea), and pickoff mirror drive motor (~ $600 CDN).

7) Determine any equipment that could be common to both the FTS and the Polarimeter. Computers were suggested as an example.

The RTS client computer and interface electronics will be common between the POL-2 and FTS-2 instruments.

8) Coordinate between JCMT and FTS personnel during August 2005 to set a date for implementation of the JCMT observation sequencer as a planning and testing tool.

This item still remains to be done- there needs to be a discussion between the JAC and FTS-2 (and POL-2 ?) groups to identify what is required to produce the new OT components. Integrating FTS-2 into the existing JCMT OT should be relatively straight forward; since most of the required features already exist (e.g. visualizing the second input FTS port location will be very similar to the existing chop iterator). A summer student was employed to model the effect of the FTS input port rotation on observation planning. A report is included in the CDR documentation.

9) Consider developing high fidelity simulations of expected data for use in testing and commissioning.

This is ongoing. Atmospheric modelling code has been revised, and we will be investigating adapting the recently completed SPIRE instrument simulator for use with FTS-2.

10) The portion of the FTS / SCUBA-2 Interface Control Document that specifies lifting apparatuses & procedures should be reviewed and approved by the JCMT operations staff.

These aspects of the PDR design were developed in consultation with JCMT staff. However, the mechanical framework is currently being modified, and so the lifting details will have to be re-visited. There is no reason to expect that the lifting requirements cannot be met by suitable design of the FTS framework within the space available now that the optics positions have been finalized.

11) Coordinate among groups to define a data header format. In particular, establish the format for splicing information into the data header.

The basic FTS-2 parameters have been assigned positions in the data format specification. There may still be a few instrumental parameters that need to be added (e.g. location of the single-port BB, temperatures, etc) which will require further discussion, although this should not be complicated.

12) Develop a financial summary chart (Spending Profile) with planned and actual yearly expenditures shown independent of carry-over. This will make it easier to compare with yearly allocations. It should be possible to also show carry-over funds and totals on this type of chart.

See the CDR project management plan document.

13) The built-in laser is deemed by the project to no longer be needed. The requirement to supply this laser should be reviewed and, if necessary, changed or eliminated.

This requirement has been removed. The internal FTS optics will be aligned using simple laser tools, while alignment to the telescope will require knowledge of the image location at the bearing tube followed by fine tuning of the FTS feed optics based on image quality at the array.

14) Determine whether a shift in position of the mirror stage would create room to mount the beamsplitter more rigidly. The input mirrors might be adjusted slightly out-of-plane to accommodate this shift.

The modifications to the optical design have allowed us to shrink the beamsplitter diameters considerably. This allows a much more rigid mounting arrangement. Since the PDR, we have been notified by JCMT staff that the cryostat mounting plate requires an extra 50 mm of space between the A-frame and the FTS. However, there is now at least 25mm of space between the moving mirrors and the framework, so there is room for sufficient bracing of the beamsplitter plate on both sides.

Where practical, vibration modes in the structure will be analyzed using FEA. However, we will test the stiffness of all optical mounts when the system is integrated by using optical interferometry while vibrating the system.

15) Consider the reduced S/N that results from integrating over a Nyquist interval in continuous scanning mode. Consider using a higher readout rate if feasible or a lower scanning speed.

We agree that this is an intrinsic problem with the readout scheme, although the high-frequency roll-off will have predictable characteristics. The effect is wavelength dependant, with the 450 band being more heavily affected than the 850. Readout at the engineering frame rates is not practical due to limitations in processing speed and the fact that the required pre-processing will only be done on the 200 Hz frames. The solution will be to either scan slower (by a factor of a few times) than the speeds given in the PDR in order to reduce the modulation frequencies to ~$1/10^{th}$ of the 200 Hz frame rate, or to accept the degraded S/N. The slower scan speeds will result in larger data arrays, but recent DR optimizations should still allow ‘real-time’ processing. See the CDR documentation for the analysis of this effect.