Scope
This note outlines the options for the PACS/SPIRE parallel mode from a SPIRE operational point of view and details the tests that might be carried out during the EQM testing to validate the parallel mode.

Reference Documents
RD1   SPIRE Instrument Users Manual – To Be Issued
RD2   SPIRE COOLER RECYCLING SCOS PROCEDURE - SPIRE-RAL-PRC-002267

Overview of Parallel Mode
The SPIRE/PACS parallel mode is envisaged to be used for observations where imaging studies of large(r) fields are required using as many "Herschel" photometer bands as possible. This could either be done in scanning mode – with the telescope slewing across the sky – or in raster mode with one or both of the chopping mirrors in PACS and SPIRE running. It is already agreed that in this mode moth instruments will take half the available data rate – 60 kbit/s. It is also necessary that both 300 mK coolers must have been recycled before the observation commences.

SPIRE Operational Mode
SPIRE will switch to SPIRE Parallel from the already defined PHOT Standby mode (see RD1). In this mode the detectors and JFETs are on and the BSM is held at its centre position. To enter Parallel mode we request data at a rate commensurate with the bandwidth available. Our baseline option is to sample all channels from the three photometer arrays at half the nominal rate – i.e. 10 Hz. At this rate we will only be able to slew across the sky at about 30 arcsec/sec. In practice the slew rate will be determined by PACS. The other possible mode would need SPIRE to chop with its BSM – here the chop rate would be limited to 1 Hz rather than the full 2 Hz in order to allow four samples per chop half cycle. We intend to test the interoperability of SPIRE and PACS for these two options and the ability of the Herschel cryogenic system to allow both coolers to be recycled.

Testing Parallel Mode
Cooler Recycling
Figure 1 shows the power flowing through the links of the various parts of the SPIRE (and PACS) cooler to the cryostat during the recycle operation. It should, principle, be possible to recycle the coolers simultaneously – i.e. keeping both pumps at >40 K. However, during the heating of the pump and especially when the pump heat switch closes there is high power flowing to the L0 level. In order to equalise the power during heating the pump, and the power spike when the pump heat switch is closed we suggest that the two coolers are recycled 25 minutes apart. The SPIRE cooler recycling procedure to be employed during EQM testing is given in RD2 – assuming PACS has a similar procedure we can start either 25 minutes after the first and monitor instrument and cryostat temperatures during the procedure.

SPIRE to PHOT Standby
Following recycle SPIRE returns to the SPIRE Ready mode. To go to PHOT Standby the JFETs are switched on; the detector biases are set and the BSM switched on and commanded to its (0,0) position. The SPIRE CQM instrument has only one photometer array and working JFET unit and only coils are fitted for the BSM. However the STM JFETs are supplied with resistors that mimic the power dissipation of the flight units; we will switch all JFETs on and set the detector bias. The power dissipation in the BSM will be mimicked using an external power supply as the drive

electronics delivered with the CQM (QM0) are not capable of providing the correct drives for the static coils.

SPIRE to Parallel (Scan)
Switching to the scan type parallel mode is straightforward – all that is required is to demand the full photometer data frames at approximately 10 Hz. The precise rate will depend on the bias frequency as the sampling is clocked on the bias.

SPIRE to Parallel (Chop)
To mimic the power dissipation whilst chopping we will increase the voltage to the BSM coils from the external power supply. No other changes need to be made to the SPIRE operations.

Test Outcome
Carrying out these tests on the EQM will allow us to:

  a) Validate the joint commanding and command phases between SPIRE and PACS
  b) Validate the joint data generation and collection
  c) Test the ability of the Herschel system to allow near simultaneous cooler recycle
  d) Characterise the thermal environment during parallel mode operations
  e) Test electromagnetic compatibility between SPIRE and PACS

All these outcomes can be validated using the SCOS and QLA displays for SPIRE to monitor command execution; data reception; temperatures and detector signals. The last point will require further offline analysis to verify the detailed noise performance.
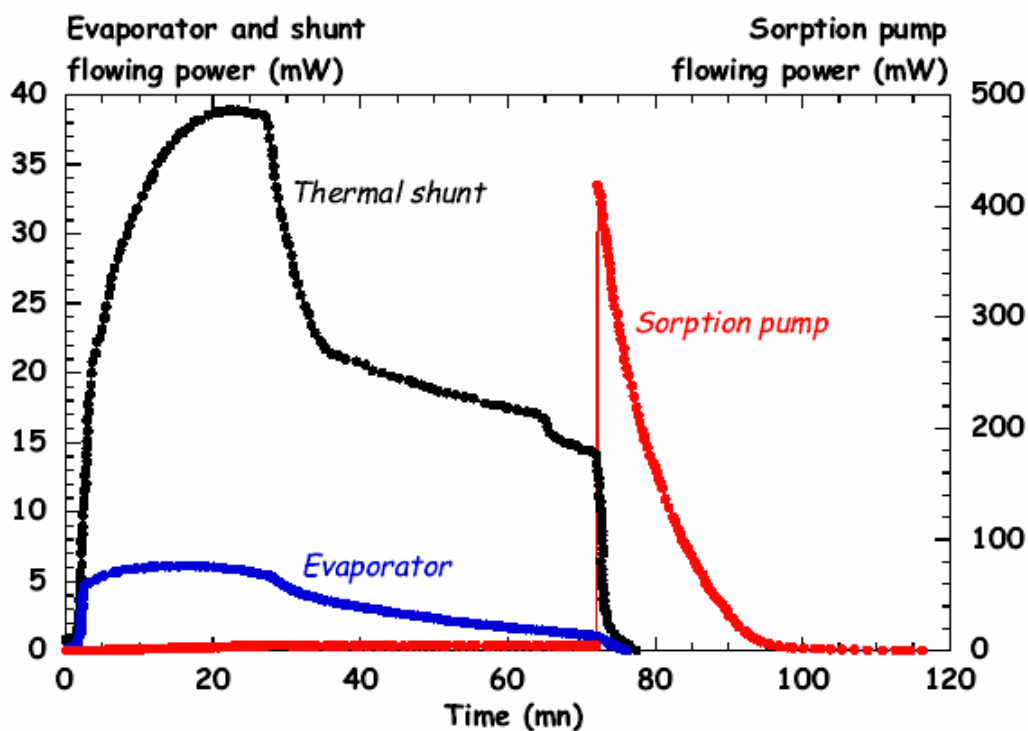

Figure 1: Power profile during SPIRE cooler recycle – the black and blue curves are during the heating of the pump with the evaporator heat switch closed and the red curve is the power through the pump strap once the pump heat switch closes.