Introduction:

The cryostat study team wishes to investigate the impact of instrument operations on the thermal stability of the three levels within the FIRST cryostat. The SPIRE instrument will undergo several mode changes during its operations that might affect the thermal stability of the gas cooled temperature stages. In this note two examples of mode changes are offered for analysis: going from a warm cooler to a cold (300 mK) one – Cooler Recycling – and changing from photometer to spectrometer operation.

SPIRE Cooler Recycling:

During the ground contact period, the SPIRE instrument will go from its observing state to the Cooler recycle mode and then back to its observing state. During this time the cooler will be recycled leading to a large thermal load on the strap to the LHe tank. Following recycling the detectors are switched on again and the mechanisms etc set to their operating points. In the first transient analysis case the instrument is supposed to perform a calibration operation and then be set to observe a source using the beam steering mirror in full chop mode. In the table below the thermal dissipation at the various levels is crudely represented as a timeline for the JFET detector option. The other detector options can be substituted by reference to the input data presented by the SPIRE team to the Cryostat Study.

Time (h:mm:ss)	Sub-system	Status	Temp Stage	Power Dissipation*
0:00:00	Cold Read-out Electronics	OFF	L2	0
0:00:00	Cold Mechanisms/calibrators	OFF	L1	0
0:00:00	Cooler	OFF	L0	0
0:00:01	Cooler evaporator HS Cooler pump HS	ON OFF	L0 L0	1 W (Transient)
0:00:02	Cooler heater	ON	L0	90 mW
0:30:00	Cooler heater	OFF	L0	0
0:30:01	Cooler evaporator HS Cooler pump HS	OFF ON	L0 L0	? (Sorption pump heaters)
0:30:00 to 2:00:00	Cooler/detectors	Cryopumping to 300 mK	L0	0
2:00:00	Cold Readout Electronics	ON	L2	33 mW
2:10:00	Calibrator	ON	L1	2 mW
2:12:00	Calibrator	OFF	L1	0 mW
2:12:01	Beam Steering Mirror	ON (Chop 5 Hz)	L1	4 mW

Table 1: Timeline for cooler recycling.