



## Technical Note

CQM warm alignment verification:  
Summary of tests and results

**Ref:** SPIRE-RAL-NOT-  
001807

**Issue:** 1.0

**Date:** 11/09/2003

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**TITLE:** CQM warm alignment verification: summary of tests and results

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### DISTRIBUTION

- SPIRE Project Team (RAL) => already informed via email
- SPIRE LAM Team (LAM) => already informed via email



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### CHANGE RECORDS

ISSUE	DATE	SECTION	REASON FOR CHANGE
1.0	11/09/03	All	First issue of the document

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### Applicable and Reference documents

None



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## 1. INTRODUCTION

This note reports on the optical alignment verification activities performed during the SPIRE CQM integration phase in August/September 03. Reports were already sent in form of email to relevant SPIRE project personnel and they are simply reproduced here for the info and archive tracking in SPIRE database.

Optical alignment activities are limited on CQM due to re-used of STM (or AM) FPU structure and optics except for the modification described in the following sections (change of mirror CM3, modification to the Photometer 2K box). Pictures taken during the test will be added to this report once they will be available from LAM.

## 2. ALIGNMENT VERIFICATION AFTER REPLACEMENT OF MIRROR CM3

*Email sent to RAL Project team (ES, BS, DG, JD, DS, TL) & LAM (KD, AO, GR) on 22/08/03:*

**Subject:** SPIRE: report on alignment verif. for CQM

Dear all,

Yesterday and today during Alain's visit at RAL, we performed an optical verification (at room temperature) of the SPIRE CQM optical chain (based on the STM + new CM3 mirror fitted beginning of August). This was restricted to the Photometer side (better image quality over full field in the visible).

The original procedure (i.e. assuming no specific actions to perform as new CM3 expected as per design) for OGSE set-up & alignment was re-used. Pupil imaging tests were performed (no Hartmann test) with sources (LEDs + fibre to maximum signal especially in PLW because of the low transmission of the dummy dichroics) and CCD image acquisition data are stored at RAL with copy to LAM.

Quick look at the results showed the following: the pupil shift as measured at M2 seems limited, at the centre, to ~5-7mm in the vertical direction (Z axis). The close to 50mm shift previously measured during the STM warm optical alignment (and dominated by first CM3 tilt) has disappeared showing the correction in the new CM3. Some image distortion of the projected CS-tool image is still visible in the vertical direction mostly. Pupil aberrations at the edge seem not too dependent strongly on field position (few mm shift max between extreme field positions).

Focus tests were performed using the aligned MAT and CCD attached to it. Best results are, as expected obtained for the Dtool in PLW position (focal plane position for which there are optimised for their visible wavelength).

Pupil imaging tests were performed with & without Phot. cover and with light sources in PSW and PLW. Reproducibility of the results in the different config was found good and mostly limited only by signal degradation in PLW due to lack of transmission from dichroics.

A ghost path may have been found. Actually with this back-illuminated system, several of them exist but all except one can propagate beyond the entrance focal plane. The others are stopped or trapped by internal baffle & structural elements. Investigation of the path showed the following: PSW (half of field positions are affected only) -> ? (inside Phot. box) -> edge of PM8 -> edge of CM5 -> FP entrance cavity sidewall (pocket region). This path is not stopped by the Phot. internal baffle and goes directly through CFIL1 aperture with a focal image (caustic) between CM5 and the FP entrance cavity sidewall. PMW seems unaffected and lack of contrast in the ghost image makes it difficult to conclude about its presence for PLW. The stray mechanism inside the Phot. 2K box is difficult to probe and therefore identify but it was checked that the dummy dichroics or the light sources used were not the generator.



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The OGSE (mainly MAT bench + Theo) was left in place (i.e. aligned if nobody touches it) as well as the instrument on the white trolley so as to be able to be of quick used for further check (e.g. after Phot. Box modif. next week?). The spacers below the BSM (PCAL hole compensation) should also stay until no more optical verif (limited to Phot. only) are needed.

Best regards,

Marc Ferlet.

### 3. ALIGNMENT STABILITY CHECK AFTER PHOTOMETER 2K BOX FEET MODIFICATION

Email sent to RAL Project team (ES, BS, JD, DS) & LAM (KD, AO) on 28/08/03:

**Subject:** SPIRE CQM: report on optical verification after Phot. 2K box change

Dear all,

For electrical reason, modification on the feet of the Photometer 2K box have been performed today in the lab on the CQM. Following this task, verification of the impact on instrument alignment was suggested. This verification was made in 2 steps: measurement of the pupil shift at M2 (from image of the cold stop) before & after the modifications on the feet. The internal optics of the Phot box being not affected as well as the common optics attached to the SOB, the change in feet interface with SOB would induce a displacement of the cold stop re-imaged by common optics on M2. Results show a small displacement of the CStool projected image at M2: centre  $\sim 0.5\text{-}0.6\text{mm}$ , +Y edge:  $\sim 0.9\text{mm}$  (manual-visual recording); -Y edge:  $\sim 0.25\text{mm}$  (measured via CCDcam images from Dtools central LED in PLW). With a magnification of  $\sim 6.67$  between SPIRE cold stop and M2 this leads to an average cold stop displacement  $< 0.1\text{mm}$  laterally which is in line with what was expected from the magnitude of the modification (see below). These values are close to the uncertainty error level of the verification method and are an order of magnitude smaller than the overall offset found last week during the alignment check (see previous report in last Friday email).

The interface change, baseline to be of the order of  $\sim 0.1\text{mm}$  of extra electrical insulation layer at interface, may as well slightly displaced the overall box affecting path length between PM8 and 9 and pointing. This was qualitatively (due to weak signal) checked via monitoring (before & after) of the Dtool central LED in PLW from the previously aligned MAT and no significant change was detected. NB: Eventual effect (on the instrument+MGSE set-up stability) of removal and refitting of the Phot 2K box was monitored by theodolite on SOR and taken out by adapted distribution of weights on supporting HOB. CCD camera acquisitions with Dtools in PLW have also been sent to LAM (to Alain via FTP).

Due to need to use the white trolley, for MTD transfer into cryolab, the instrument has been moved, consequently the alignment lost and as no need of further complete check was foreseen, external OGSE was moved out of the way.

Regards,

Marc Ferlet.