

THE ISAAC NEWTON GROUP OF TELESCOPES

INSTRUMENT CHANGE CHECKLIST

INGRID AT CASS



Revision: 1.2

Date: 24/09/2002

Authors: P Jolley, M Blanken, S Rees

Description: ING Infra Red Detector

Location: WHT CASS

Storage: In the Test Focal Station

REVISION HISTORY

Revision	Date	By	Description
1.1	09/03/2002	P Jolley, M Blanken, J Mills	First controlled version
2.1	24/09/2002	P Jolley, M Blanken, J Mills, S Rees	Updated for new INGRID mounting bracket. Added move from GRACE. Added foreoptics alignment procedure. Added alignment verification using pupil imager.

CONTENTS

1.	INTRODUCTION.....	4
2.	ACTIVITIES PRIOR TO CHANGE	5
2.1.	Instrument Preparation in Test Focal Station (T.F.S.)	5
3.	ACTIVITIES ON DAY OF CHANGE.....	7
3.1.	Moving INGRID from the Test Focal Station (T.F.S.).....	8
3.2.	Moving INGRID from GRACE.....	9
3.3.	Telescope Preparation	10
3.4.	Instrument Mounting.....	10
3.5.	Electronics Rack Mounting and INGRID cabling.....	11
3.6.	Optical Alignment using Laser	14
3.6.1.	Alignment of laser onto A&G Box optical axis.....	14
3.6.2.	Alignment of foreoptics onto axis defined by laser	15
3.6.3.	Alignment verification using pupil imager	17
3.7.	Balance Telescope.....	18
3.8.	Functional Checks	18
4.	APPENDIX A – Foreoptics Mounting Procedure	19
5.	APPENDIX B – Alignment Verification using Pupil Imager.....	20

1. INTRODUCTION

This procedure covers moving INGRID to **Cass** from either the **Test Focal Station** or **GRACE**.

It does not cover moving INGRID to GRACE for operation in conjunction with NAOMI. There is/will be a separate document which covers this.

Note

This document is now (24/09/2002) substantially correct. New pictures should be taken during the next move to Cass.

Need to decide what to do if the pupil imager alignment verification procedure described in section 3.6.3 fails.

Please inform any corrections or suggested improvements to the INGRID Instrument Manager (currently Simon Rees sgr@ing.iac.es)

2. ACTIVITIES PRIOR TO CHANGE

Team required : 1 Electronics specialist
1 Mechanical specialist and assistant

2.1. Instrument Preparation in Test Focal Station (T.F.S.)

The following activities should be carried out 1 week before the change.

ACTION

TICK BOX

Steps 1 – 3 may be skipped if INGRID is already cooled down.

1. **Vacuum pumping** INGRID should be evacuated for at least 48 hours. The expected vacuum should be in the order of 1×10^{-4} or better.

2. **Cooling down** Fill INGRID immediately after pumping. This will take a considerable time. Due to the initial gas boil off, it will be necessary to top up with LN₂ regularly.

More concise information on INGRID pumping and cooling procedures can be found on: http://www.ing.iac.es/~eng/detectors/ingrid/ingrid_home.html

3. **Helium Lines** Connect up the helium pipes and control cable from the compressor to the closed cycle cooler and switch on. Make sure that the connectors are clean and the O-rings are in place.

Important note: *Don't over tighten the connectors.
Always connect the RETURN line (red) first.
When disconnecting, disconnect the SUPPLY line (green) first.*

4. **Mechanisms check** With INGRID connected to it's electronics rack, initialise the 2 filter wheels, pupil stop wheel, and the detector array focus drive and test at various positions.

Also initialise the pupil imager and check that it can be moved IN and OUT of the beam.

INGRID at Cass - Change Checklist

5. **Array** Connect INGRID up to it's SDSU controller and then connect the 2 fibres in the T.F.S. coming from 'crater' in the WHT control room. Take some test images and check that the chip reads out correctly.

The following activities should be carried out 1 day before the change (if the schedule permits).

ACTION

TICK BOX

6. Place INGRID on it's handling trolley with the vacuum gauge on the inside. Use the plastic stops to prevent the gauge touching the back of the trolley.

N.B. If INGRID is to be brought up to the observing floor in the lift, the SDSU controller will need to be removed else it won't fit inside! The other option is to use the dome crane.

7. Keep INGRID connected - with the closed cycle cooler working up to the point when it needs to be moved up to the observing floor. Check that the vacuum is good (1×10^{-4} or better) and top up regularly with LN₂

PREPARATION COMPLETE

Signature :

Date :

3. ACTIVITIES ON DAY OF CHANGE

Team required :
1 Electronics specialist
1 Mechanical specialist and assistant
1 Optical Alignment Specialist

Nominal time : 4 to 6 hours

Equipment Required:
Portable lift (required for move from GRACE only)
INGRID handling trolley
INGRID hydraulic jack
Cass foreoptics
100 micron shims for Cass foreoptics
laser + laser mount
alignment targets for A&G box

If moving INGRID from the Test Focal Station start at Section 3.1.

If moving INGRID from GRACE start at Section 3.2.

3.1. Moving INGRID from the Test Focal Station (T.F.S.)

The following steps should be followed if the instrument is in the Test Focal Station. Otherwise, if the instrument is in GRACE follow the steps in Section 3.2.

ACTION

TICK BOX

1a. Ensure that there are blanks in the instrument optical path.	<input type="checkbox"/>
2a. Mount front plates from the bracket on INGRID	<input type="checkbox"/>
3a. Disconnect the electronic cabling from INGRID and remove the SDSU controller.	<input type="checkbox"/>

IMPORTANT : *It is **VITAL** that cooling via the closed cycle cooler is maintained as long as possible. The **ABSOLUTE MAXIMUM** time limit is **1.5 hours** without cooling. After this time the vacuum degrades and INGRID will need to warm up taking **3 DAYS** to recover.*

4a. To help maintain the chip temperature, switch off the compressor and disconnect the helium pipes from the closed cycle cooler, but only <u>just before moving</u> . (Item 5a)	<input type="checkbox"/>
5a. Bring the trolley with INGRID up to observing floor	<input type="checkbox"/>

Now skip to Section 3.3.

3.2. Moving INGRID from GRACE

The following steps should be followed if the instrument is in GRACE. Otherwise, if the instrument is in the Test Focal Station follow the steps in Section 3.1.

ACTION

TICK BOX

1b. Ensure that there are blanks in the instrument optical path.	<input type="checkbox"/>
--	--------------------------

2b. Disconnect the electronic cabling from INGRID and remove the SDSU controller.	<input type="checkbox"/>
---	--------------------------

IMPORTANT : *It is VITAL that cooling via the closed cycle cooler is maintained as long as possible. The ABSOLUTE MAXIMUM time limit is 1.5 hours without cooling. After this time the vacuum degrades and INGRID will need to warm up taking 3 DAYS to recover.*

3b. To help maintain the chip temperature, switch off the compressor and disconnect the helium pipes from the closed cycle cooler, but only <u>just before moving</u> . (Item 4b)	<input type="checkbox"/>
--	--------------------------

4b. Lift INGRID off the optical bench using the portable lift.	<input type="checkbox"/>
--	--------------------------

5b. Take INGRID out of GRACE and move to dome floor.	<input type="checkbox"/>
--	--------------------------

6b. Lift INGRID down to the observing floor using the main crane. Place INGRID on its handling trolley.	<input type="checkbox"/>
---	--------------------------

Now skip to Section 3.3.

3.3. Telescope Preparation

- | | |
|--|--------------------------|
| 7. Shutdown the observing system and record in the WHT logbook that an INSTRUMENT CHANGE is in progress. | <input type="checkbox"/> |
| 8. Switch on the oil pumps and the main axis (ALT and AZ) servo-amp breakers and move the telescope to zenith park (if not already there). | <input type="checkbox"/> |
| 9. Switch off the circuit breakers and oil pumps then <u>Lock Off</u> the telescope. Mount the locking cables on the telescope. | <input type="checkbox"/> |

3.4. Instrument Mounting

- | | |
|---|--------------------------|
| 10. Mount the fore-optics tube on INGRID. See Appendix A – Foreoptics Mounting Procedure. | <input type="checkbox"/> |
| 11. Mount the lifting plate on the closed cycle cooler’s anti-vibration mount. | <input type="checkbox"/> |
| 12. Rotate INGRID 90 degrees on the handling trolley and put in the filler tube.

Note: it’s normal that when inserting the filler tube a certain amount of LN2 will boil off. However, it’s important to make sure that the ‘O’ ring doesn’t freeze. Insert the tube as quickly as possible. If any LN2 comes out the ‘O’ ring would have frozen and needs removing. This may take several attempts. | <input type="checkbox"/> |
| 13. After rotating INGRID so that the closed cycle cooler is down mount the top plate on INGRID. | <input type="checkbox"/> |
| 14. Use the dome crane to lift INGRID onto the hydraulic jack. | <input type="checkbox"/> |
| 15. Move INGRID into place and bolt it to A&G box bracket. Use piston spacer to check position from telescope. | <input type="checkbox"/> |
| 16. Reconnect the helium pipes and control cable to the closed cycle cooler and turn on the compressor <u>immediately</u> . | <input type="checkbox"/> |

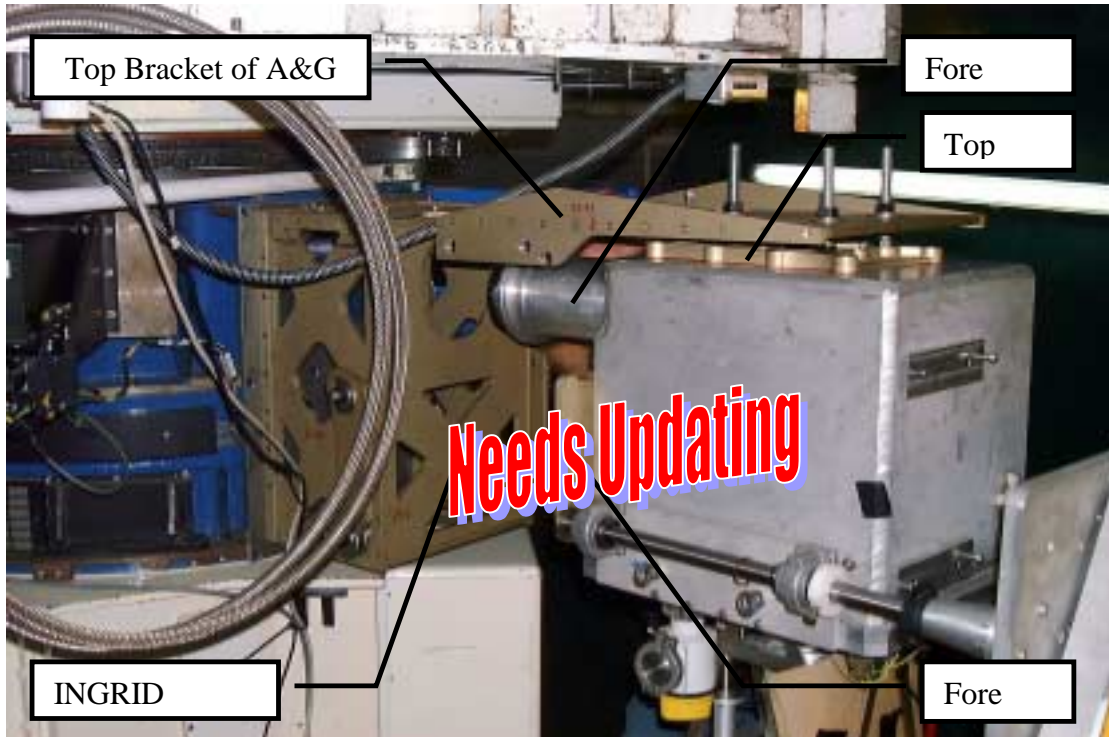


Figure 1 Need appropriate caption here !

3.5. Electronics Rack Mounting and INGRID cabling

- | | |
|---|--|
| 17. Using the Genie lift, move the INGRID electronics rack into place and bolt it onto the Cass turntable CCW ring. | |
| 18. Replace the SDSU controller. <i>N.B.</i> <u>Check that it's power cable is a tight fit.</u> Splaying the pins of the Molex connector may be necessary if the plug is loose. | |
| 19. The diagram on page 6 shows all the connections between INGRID and it's electronics rack. <i>N.B.</i> The VME crate network connection (which previously used a co-axial ethernet link) has now been changed to a UTP system. | |
| 20. Secure the cables between the rack and INGRID and the fibre optic links. These are clearly marked and go to the Cass F.O. distribution box. | |

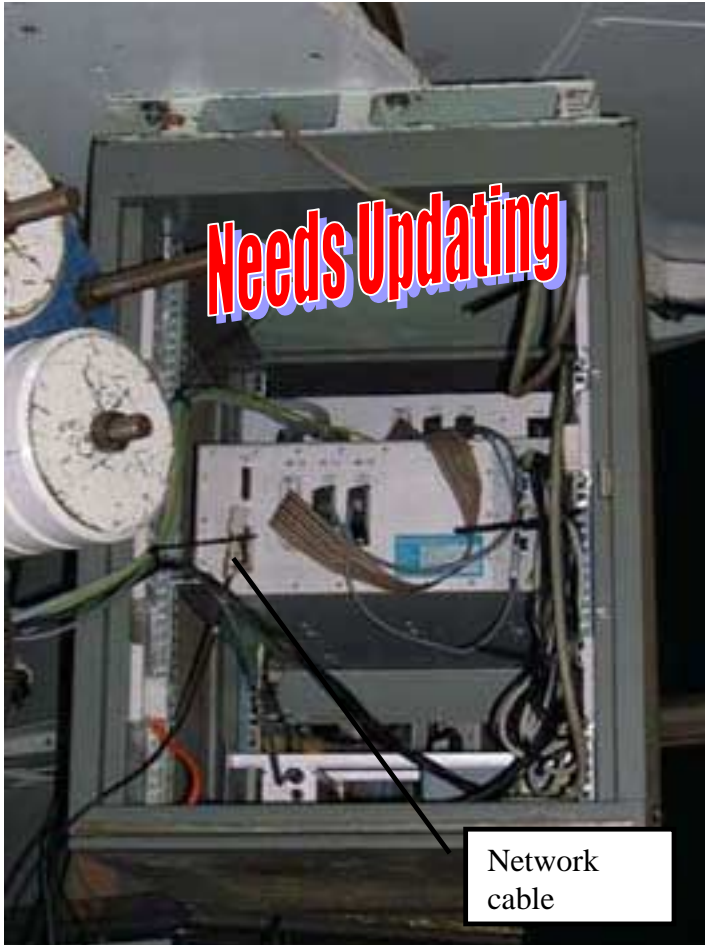


Figure 2 INGRID electronics rack

INGRID AT CASS

CABLES AND CONNECTIONS

ejm 17/4/01 v1.1

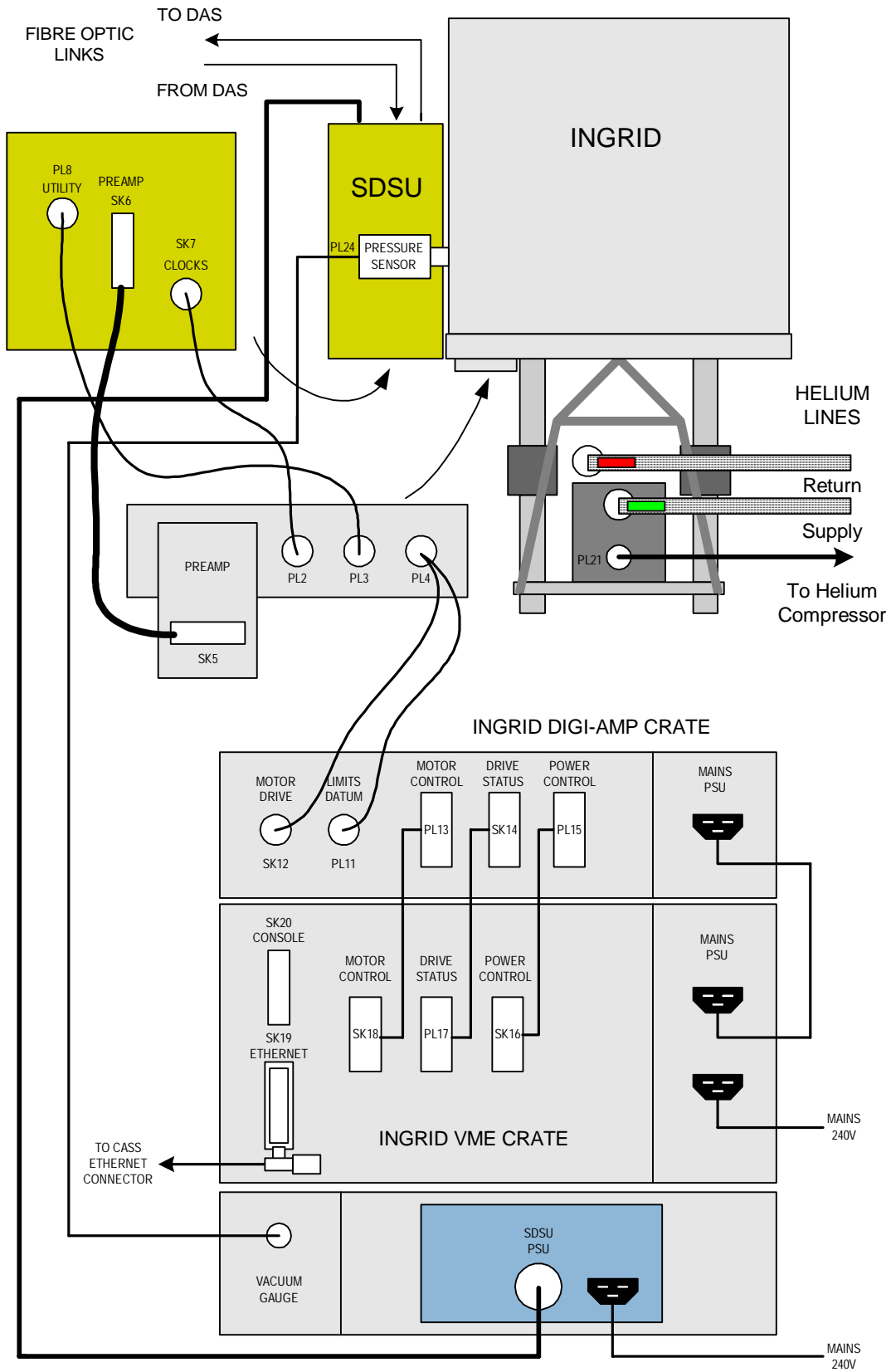


Figure 3 Electrical connections and Helium lines

P. Jolley – M. Blanken – S. Rees – J. Mills

24/09/2002



Figure 4 General view of INGRID showing the helium pipes and cables

3.6. Optical Alignment using Laser

The laser alignment process is a two step operation. First, the laser has to be setup so that it is aligned with the A&G box optical axis. Secondly the INGRID foreoptics are aligned to the axis defined by the laser. If the foreoptics have been put on correctly (See Appendix A - Foreoptics mounting procedure) this will guarantee that the instrument is correctly aligned as well.

3.6.1. Alignment of laser onto A&G Box optical axis

- | | |
|---|--|
| 21. Clear the A&G port on the opposite side of INGRID (port F) | |
| 22. Fit the laser mount in the M6 hole | |
| 23. Place the alignment targets at the laser and at the INGRID side of the A&G box | |
| IMPORTANT: <u>Move blanks into the beam of INGRID to ensure no laser light falls on the detector</u> | |

INGRID at Cass - Change Checklist

- | | |
|--|--------------------------|
| 24. Protect INGRID from direct laser light unless you are positive there are blanks in the filter wheel | <input type="checkbox"/> |
| 25. Align the laser with the targets (see figure 5).
<i>N.B. <u>Remove all mirrors from the beam in the A&G box first.</u></i> | <input type="checkbox"/> |
| 26. When the laser alignment is complete remove the targets from the A&G box (but only if you are sure there are blanks in the filter wheel).

The laser is now aligned to the optical axis of the A&G box. | <input type="checkbox"/> |

3.6.2. Alignment of foreoptics onto axis defined by laser

- | | |
|---|--------------------------|
| 27. INGRID is aligned both in translation and tilt using the bolts on the mounting bracket.

Adjust INGRID until the back-reflections from the foreoptics are over each other and forming an interference pattern of a minimum of 2 complete sets of rings (see figures 6 & 7). Additionally the pattern should be evenly illuminated.

<i>N.B. This step is probably the single most important part of the instrument change procedure. It is very fiddly and may take up to three hours to get it right. Your persistence will pay off in making the INGRID observer happy !</i>

<i>We are investigating ways to simplify the process.</i> | <input type="checkbox"/> |
| 28. Fasten all INGRID bolts and check that the alignment hasn't changed. | <input type="checkbox"/> |
| 29. Remove the laser from telescope and close the A&G port used for the laser alignment. | <input type="checkbox"/> |

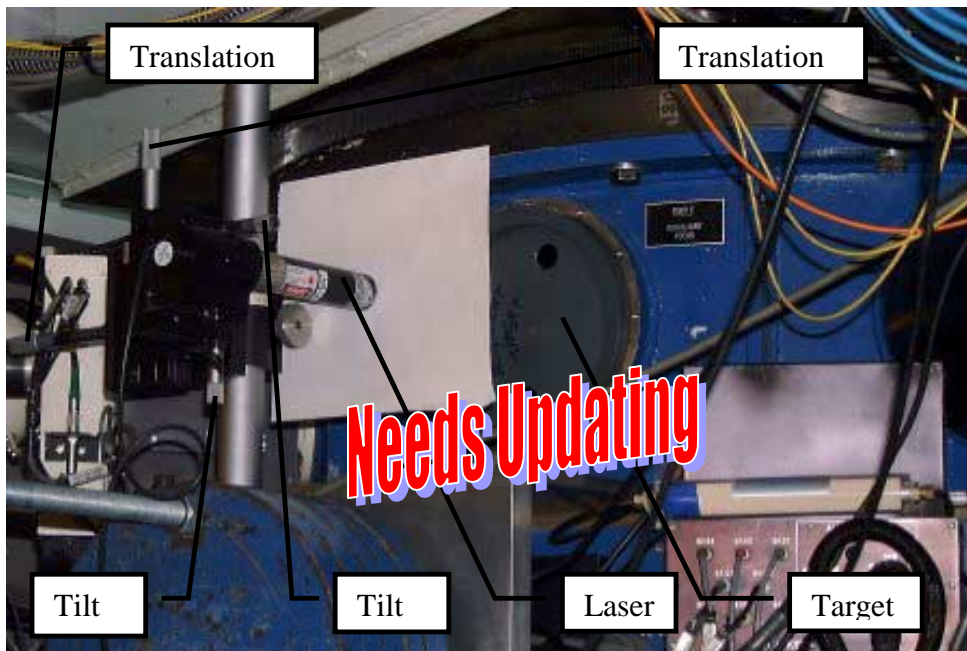


Figure 5 Laser setup on opposite A&G box port (F) to INGRID and adjustment micrometers

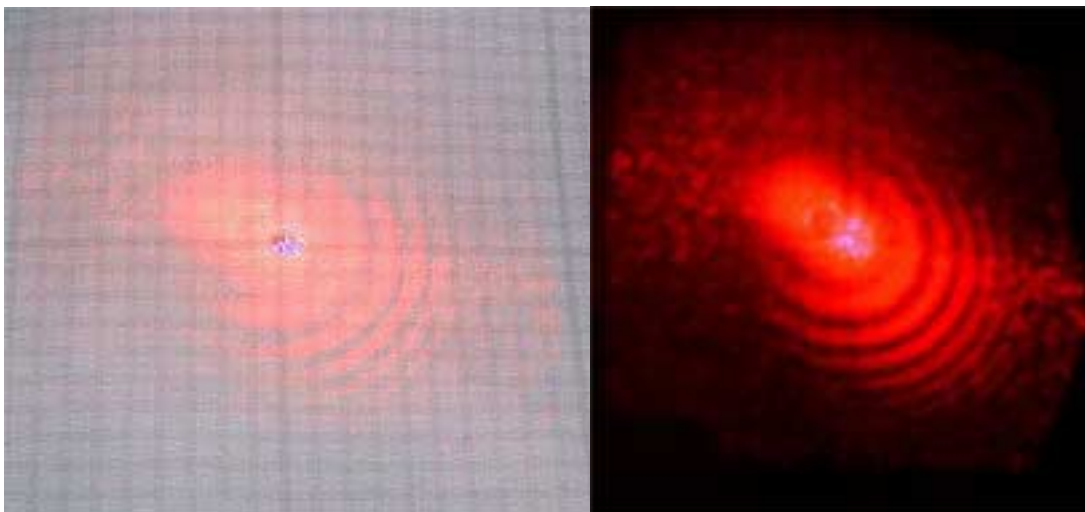


Figure 6 Interference pattern 03/10/00

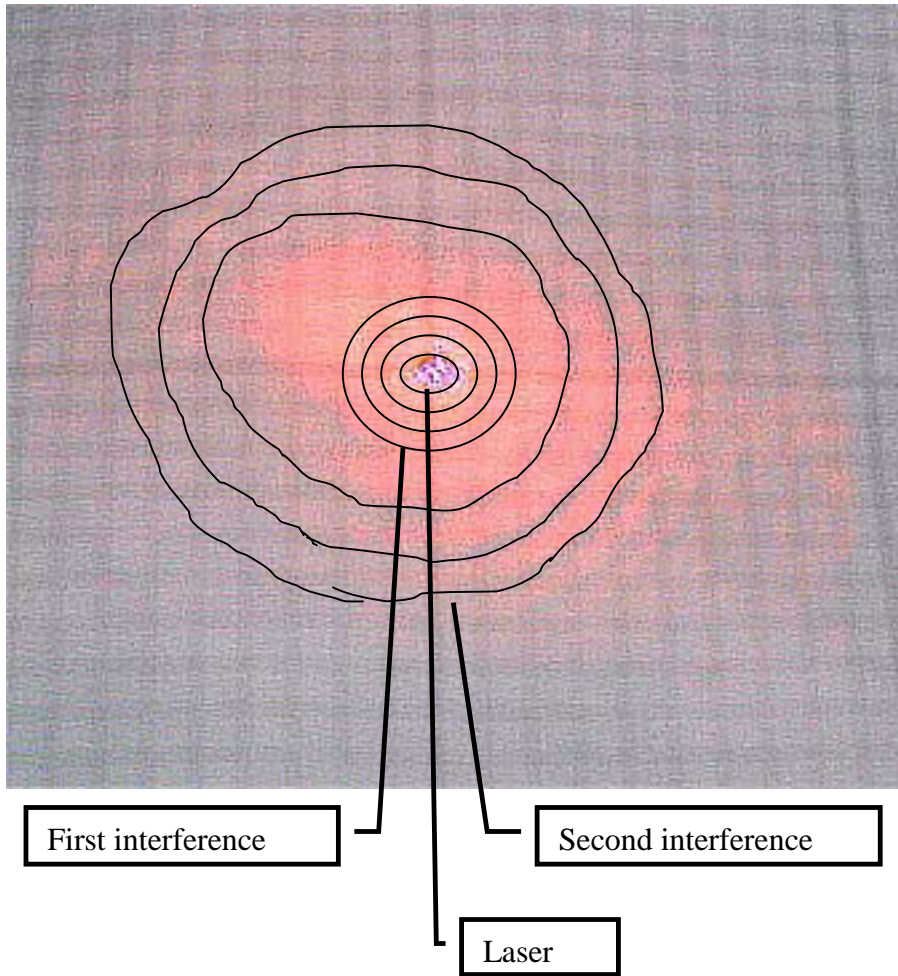


Figure 7 Interference fringes

3.6.3. Alignment verification using pupil imager

30. Follow the alignment verification procedure defined in Appendix B to check that the instrument is now correctly aligned.

To be determined – what do we do if this step fails ?



3.7. Balance Telescope

31. Release the telescope from the ties when you are sure it is near to balance, but slightly bottom end heavy

32. Carry out the final balancing using the motorised counterweights

33. Record in the WHT logbook that the INSTRUMENT CHANGE procedure has been completed. **Unlock the telescope.**

3.8. Functional Checks

34. Check out INGRID using the DE-Check list in the red book in the control room. The version on the WEB is always the most recent. If the paper copy is an older version, the latest version can be found at:

http://www.ing.iac.es/~eng/ops/wht/ingrid_checks.html

INSTRUMENT CHANGED COMPLETED

CHANGE COMPLETE

Signature :

Date :

HAND-OVER TO SUPPORT ASTRONOMER

SET-UP COMPLETE

Signature :

Date :

4. APPENDIX A – Foreoptics Mounting Procedure

- | | |
|---|--------------------------|
| <p>1. Place the fore optics on INGRID and insert the three screws.</p> | <input type="checkbox"/> |
| <p>2. Place the correct number of shims between the foreoptics feet and the flange on the INGRID jacket .</p> <p>Each shim should be 100 microns. The correct number of shims for each position is written on the foreoptics.</p> <p>This step aligns the foreoptics in ‘tilt’.</p> | <input type="checkbox"/> |
| <p>3. Push the foreoptics tube to ensure the two grub screws around the edge (painted white) are in contact with INGRID’s flange.</p> <p>This step aligns the optics in ‘translation’.</p> | <input type="checkbox"/> |
| <p>4. Tighten the three screws until the shims do not fall out. Now tighten the screws in order. Start with the screw not having any shims and go counter clock wise through the other screws.</p> | <input type="checkbox"/> |

5. APPENDIX B – Alignment Verification using Pupil Imager

- | | |
|---|--------------------------|
| 1. Start up the WHT Observing System (INGRID at Cass configuration). | <input type="checkbox"/> |
| 2. After ensuring they have been correctly datumed set the instrument mechanisms in the following configuration:

pupil stop: cass-h
filter wheel 1: h
filter wheel 2: clear
focus drive: -1200
pupil imager: IN | <input type="checkbox"/> |
| 3. Ensure the INGRID silvered flat has been placed in the optical path of the A & G box. Open the mirror covers and turn the dome lights ON . | <input type="checkbox"/> |
| 4. Take a few ‘ glances ’ adjusting exposure times for best image quality. | <input type="checkbox"/> |
| 4. When best exposure time has been determined take a ‘ run ’, giving it the title “ pi_in_lon ”. | <input type="checkbox"/> |
| 5. Turn the dome lights OFF , remove other light sources from the WHT dome and take another run of identical exposure time, giving it the title “ pi_in_loff ”. | <input type="checkbox"/> |
| 6. Take the pupil imager OUT and repeat the exposures with the dome lights both ON and OFF . Give the images the titles “ pi_out_lon ” and “ pi_out_loff ”. | <input type="checkbox"/> |

INGRID at Cass - Change Checklist

7. Examine the images to determine whether the instrument is adequately aligned. You may need to use the help of a **daytime support astronomer**.

8. Close the mirror covers and restore the INGRID mechanisms to their default values (blanks in the optical path, instrument focus set to nominal value).