

OSCA Alignment Guide

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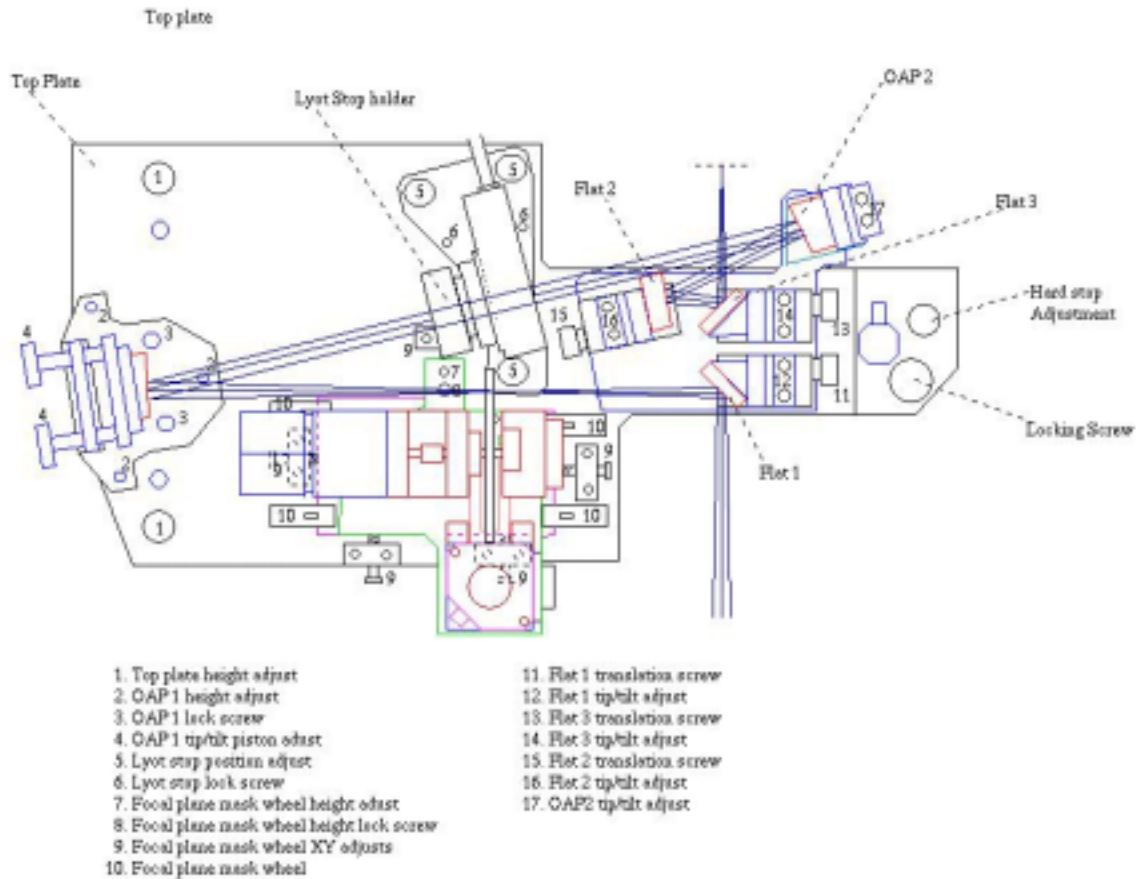
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1 Overview

Below is shown a schematic top view of the OSCA system detailing the various alignment adjustment points.



For further details on the mechanisms and electronics see the OSCA Engineering Guide.

2 Laboratory Alignment

2.1 Preliminaries

Ensure that the locking screws on the top plate height adjusters, Lyot stop height adjusters and flats 1,2,3 translation screws are loosened.

2.2 Initial laboratory alignment

1. Adjust top plate height adjustment screws (1) and the hard stop adjustment screw so that top of top plate, when deployed, is at 8.0cm, measured using ruler.
2. Check that centre of OAP1 holder is at 15.0cm height by adjusting 3 adjustment screws (2) - then lock in position with locking nuts (3).
3. Check that OAP1 and OAP2 axis (marked by dot on side of mirrors are placed horizontal to table (i.e. marks are at 90 degrees from vertical) with dot on side away from NAOMI (i.e. towards INGRID side).
4. Place flats 1 & 3 to be middle range using screws 11 and 13. Check Flats 1,2 and 3 are close to vertical with ruler. Check that tip/tilt piston adjusters (4) for OAP 1 are close to mid range.
5. Adjust component spacing **approximately** to the following distances.

Flat 1 - Focus 1	102.7mm
Focus 1 - OAP 1	152.4mm
OAP 1 - OAP 2	309.4mm
OAP 2 - Flat 2	62.9mm
Flat 2 - Flat 3	21.7mm
Flat 3 - Focus 2	63.16mm

Note:- focus 1 is at front surface of focal plane mask.

4. Set up parallel pencil laser beam at 15cm height along row of holes on optical table. Place OSCA (with Lyot stop removed) in beam orthogonal to laser axis with beam hitting centre of flat 1 (use adjustment blocks secured to table to adjust position of OSCA base. You can align the OSCA base with a set of holes in the optical table.).
5. Adjust flat 1 top adjusters (12) so that beam is hitting centre of OAP 2.
6. Adjust OAP 2 tip/tilt screws (4) so that beam is hitting centre of OAP 2.
7. Adjust OAP 2 (screws 17) so that beam is hitting flat 2 approximately half way between centre and edge of mirror next to collimated beam.
8. Adjust flat 2 (screws 16) such that the beam hits the middle of flat 3.
9. Adjust flat 3 (screws 13 and 14) so that beam emerges from OSCA at same height and along the same axis as original beam. This also may need some re adjustment of flat 2).

2.2 Fine laboratory alignment

1. Set up F/16 alignment beam using laser microscope/ pinhole (see figure 2.1) and lens ensuring beam is at 15cm height and axis is aligned with optical table holes. Set video camera with alignment lens to view focus of F/16 beam.

Figure 2.1 Schematic of optical F16 beam test set up

2. Place OSCA in beam (with Lyot stop removed) keeping OSCA base orthogonal to the laser axis (use the base adjustment blocks). Roughly adjust whole unit until beam from laser is on middle of flat 1 and passing through focal plane mask and onto centre of OAP2.
3. Ensure a parallel beam is coming from OAP 1 by using the parallel beam tool. This is an optical flat that is placed into the beam after OAP 1 and the reflected images from the back and front face interfere to produce fringes. Move the whole OSCA assembly forward until the fringes are horizontal. This means that the system is collimated.
4. Adjust OAP 1 tip/tilt adjusters (4) until collimated beam is in centre of OAP 2. Lock OAP1 in place with locking nuts (3). Again this may be an iterative process if tightening locking nuts cause a shift of the beam.
5. Adjust OAP 2 tip/tilt adjusters (17) until edge of circular image is approximately 2mm from edge of flat 2 (INGRID side).
6. Adjust flat 2 and 3 until image is in focus and diffraction rings can be seen and is at the same place as the original focus. (This procedure does not ensure that the beam is exiting OSCA along the original optical axis. However this can be rectified in the final GHRIL alignment process).
7. Move focal plane mask wheel with adjustment screws 9 and 7 until surface (or focal plane mask if visible) of mask is in focus and mask is positioned on the artificial star centre. To remove ghosting effects the focal mask wheel should be angled (rotated anti-clockwise) such that the reflection from the front surface of the mask misses flat 1 and that the double pass reflection from the front surface misses OAP 1.

Lock mask wheel base with clamps 10 and height with locking screw 8 (this may be an iterative process to compensate for flexure as the locking screws and clamps are tightened).

3 GHRIL Alignment

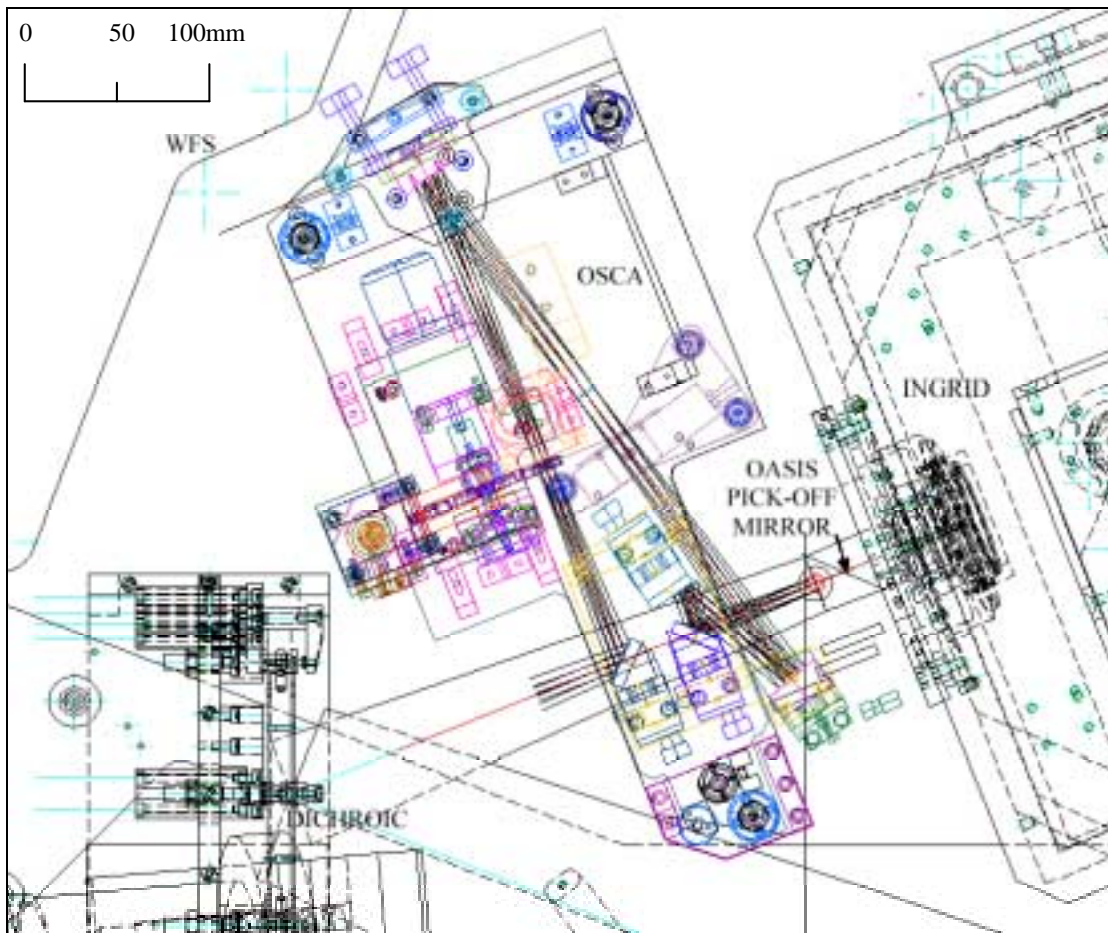


Figure 3.1 Schematic showing position of OSCA relative to NAOMI and INGRID instrument

3.1 Preliminaries

Before aligning OSCA it is important that the NAOMI pupil is well aligned with the telescope pupil and that the INGRID pupil (with OSCA clear stop) is well aligned with both.

3.2 GHRIL alignment procedure

1. To initially align the OSCA at GHRIL the NAOMI laser alignment system should be installed in place (perhaps with 50/50 beamsplitter instead of infra-red dichroic).
2. Place OSCA (with Lyot stop removed and focal plane mask 1 selected) on the GHRIL table and roughly adjust the whole system so that the laser beam hits centre

of first flat and is reflected through the focal mask on to the centre of OAP1 and then on centre to OAP2 and out of the system on the centre of the INGRID lens.

3. Adjust OSCA along the laser beam so that the distance from the front surface of INGRID to the middle of the last flat in OSCA is ~90mm. Attach screw adjustments to table for fine alignment.
4. Remove laser alignment and insert artificial star source (remembering to switch to IR dichroic). Move OSCA up or down beam using the screw attachments until image is focused on INGRID (image of focal plane mask should also now be in focus).
5. Re insert laser alignment system. Check that the laser alignment beam still passes through system and hits centre of OAPs. If there is any misalignment rotate whole system using alignment screws. Remove laser and recheck focus. If focus has shifted refocus position using procedure 4 and then check alignment again.
6. Remove laser alignment system and switch in the INGRID pupil viewing mode. Adjust flat 3 in OSCA in tip and tilt (screws 14) until pupil is aligned in INGRID. As the INGRID system is telecentric this now means the beam from OSCA is entering the INGRID system orthogonally. (If it is now necessary to translate the image on INGRID this can be done by moving flat 3 using translation adjuster 13, though refocusing adjustment may need to be done by moving flat 2 (screw 15)
7. Insert the Lyot pupil mask in OSCA, switch in pupil viewing mode in OSCA. Using the Lyot mask height adjusters (which also allow a slight XY adjustment) move the OSCA pupil until it is aligned (centred on) with the NAOMI and INGRID pupils. (If the alignment is out of range of the Lyot stop height adjusters, the pupil can also be aligned by moving OAP 1, though this should be avoided if possible). If necessary the focal position of the Lyot mask can be adjusted by removing the mask holder and adjusting the grub screw stop on the holder. The centring of the Lyot stop can also be tested at this stage by rotating the Lyot stop using the Engineering GUI (see OSCA software guide).

If the Lyot stop is not truly centred (centre rotation is greater than 2 pixels) then the Lyot stop can be adjusted by either loosening the screws attaching the Lyot stop rotator attachment or by loosening the screws attached the Lyot mask to its holder. The direction that is needed to be moved can be ascertained by attaching a non symmetrical piece of tape to one of the 4 quadrants of the Lyot mask and taking images with INGRID at 4 four 90 degrees rotated positions to find the centre of rotation. After doing this the pupil may need to be realigned using the procedure above.