Design Confirmation and Operational Concept meeting, Notes and Actions

wht-naomi-61

Internal document number AOW/SYS/AJL/3.0/11/96/Design Confirmation and OCD
Present: RMM, RAH, SPW, MW, AJL, SAB (part of meeting only).

Location: Durham
Date: 21 Nov. 1996.

Purpose of meeting

To complete as far as possible the discussion on the ramifications of the new folding-flat pick-off design, to confirm the recommendations in MW's 'Decisions' note related to the design and to check that the Nasmyth calibration unit concept was compatible with the proposed system design and operation. The intention was then to confirm the list of all the system components which need to be considered in the OCD and to note which system documents need to be up-dated to reflect the specification and design changes.

Documents which need to be up-dated as a result of the discussions/decisions are illustrated by a number (1) to (6) after the relevant discussion, along with the initial of the person responsible for the up-date. Key to the numbers is given in the 'Documentation' section.

Nasmyth calibration unit.

Requirements are to provide:

1. on-axis diffraction-limited (DL) source
2. fast tip-tilt motion on the above source
3. an on-axis non-DL source (~1 arcsec)
4. a ~10mm (40 arcsec) flat-field source for IR and optical science (note added by AJL 25/11/96: to illuminate full 1024sq array at 0".04/pxl needs 60 arcsec, therefore this number requires confirmation)
5. off-axis capabilities: focal plane mapping
6. off-axis capabilities: measurement of aberrations
7. simulate telescope pupil using mask
8. feed pre-correction camera
9. inject f/11 laser alignment beam (~25mW ??)
10. possibly inject laser pencil beam
11. ND and spectral filters to control source intensity and colour
12. turbulence generator ??
13. static aberration system ??

Design

MW presented his design concept, involving two OAPs feeding light from an integrating sphere unit via a tip-tilt mirror in the collimated beam between the OAPs. Laser light can be fed in via

an additional mirror in the collimated beam path or by moving the tip-tilt mirror to a complete new position. A pupil mask would also be located in the collimate beam. Masks in front of the ISU would provide a point source, an array of point sources and the ~ 1" source. These would allow light to fall on geometrically similar mask at the first Nasmyth focus. The latter would define the DL image(s). A uniform field would be provided by a larger hole, limited to ~ 40" at the NAOMI focal plane (may need to bo 60").

Discussion

1. First concept for providing off-axis aberration and focal plane mapping is to have focal plane mask with an attached lenslet array.
2. Alternative, preferred if light levels are confirmed sufficient, is single image-plane mask plus corresponding mask with larger holes in front of ISU. (2AJL, 3RAH, 5AJL, 6MW)
3. The focal plane mask hole size for to provide a diffraction limited sub-aperture image was thought to be 0.2mm. (DL FWHM ~ 0".47). To be confirmed.
4. Effects of non-telecentricity of these approaches needs to be confirmed. Initially thought to be small.
5. The Nasmyth focus mask to measure off-axis aberrations and to map the focal plane would not be required more than once per night - ideally only once per initial set-up and therefore can be inserted by hand (3RAH, 5AJL, 6MW)
6. If necessary, a focal plane mask illuminated by light from fibres could be tried - potentially this could solve non-telecentricity problem but fibre illumination may have uniformity problems.
7. A star would be used to measure off-axis aberrations including telescope, but the effectiveness of correcting telescope off-axis aberrations by calculation will be tried early on (7RMM)
8. The hand inserted mask at the first focus defines the NAOMI focus (3RAH)
9. To first order, focal plane curvature here can be ignored.
10. If focal plane mask is inserted any re-conjugation optics will have to move ~10mm away from focus. What effect does this have?
11. Two targets are need on the optical chassis, for use with the micro-alignment telescope. This may require removal of the FSM - NOT A GOOD IDEA! Is there an alternative? (3RAH, 5AJL??)
12. Default approach will be to design pupil simulation mask into calibration unit rather than using one in front of DM (2AJL,3RAH,5AJL,6MW)
13. Effect of pupil simulation mask to be tried empirically in ELECTRA as soon as possible. This was thought to be more efficient than *ab initio* calculation.
14. Approximate requirement figures for uniformity of pupil illumination were agreed initially as follows: 25% between sub-apertures; 5% within a sub-aperture. The latter number particularly needs confirming by modelling.
15. Prefer to inject laser after tip-tilt mirror, rather than move whole tip-tilt mirror unit to pick up laser beam (3RAH, 4RAH??, 6MW??)
16. Turbulence generation will be like ELECTRA's; simple, hand-inserted and 'no big deal' (2AJL, 3RAH, 6MW)
17. Likewise for static aberration input, which is mostly envisaged for use during lab and initial telescope set-up and not for routine observation (2AJL,3RAH, 6MW)

Tip-tilt sensor

1. SPW's suggestion with regard to using a new, smaller WFS for the laser system (it doesn't need an ADC and has less demanding offset ranges) downstream of the current WFS, whose space would be used then for a tip-tilt sensor, was very well received.
2. RGO should devise, at a minimal effort level, one ~ sketch-level design concept for re-installation of a tip-tilt sensor in the current system (4RAH)
3. The back-focal distance from the field lens should be chosen initially to optimise overall performance. Only if there were negligible performance losses but some useful space or other advantages to be gained from going to a non-optimal distance (e.g. 30mm) should a non-optimal distance be adopted. RMM should be consulted if 'negligible' needs tighter definition! (3RAH, 4RAH)

Wavefront sensor

1. The concept was to have the pick-off as the only moving component requiring 0".01 accuracy. Therefore it should not be attached to a general moving base with the camera, collimator or lenslet optics. (4RAH, 5AJL, 7RMM??)
2. It was agreed to adopt the proposed 90? angle for the WFS pick-off and the new pick-off design in general. No fatal flaws had been uncovered in consideration of the design (2AJL, 3RAH, 4RAH, 5AJL, 7RMM)

NOTE added on 22/11/96: a mis-understanding has been uncovered concerning the 90? angle. The current RGO design does NOT have the WFS axis at a 90? angle to the optical axis because the pick-off and fold mirror support would be fouled when the pick-off is at one extreme of its range. ABG will detail the problem and propose a solution which involves encroaching on the tip-tilt sensor space envelope.

3. The design goal for the WFS calibration unit feed is to be over the top of the pick-off. If this design approach encounters significant problems, encroachment on the current tip-tilt sensor space envelope may be considered. (2AJL??, 4RAH)
4. Global alignment of the WFS to the optical chassis would be done by mechanical spacers and shims. It was noted that the effect of the wedge dichroic and compensating plate would be to move the WFS unit closer to the optical chassis.
5. It was agreed that the flat fielding of the WFS camera was likely to be required infrequently and a diffusing screen could therefore be placed by hand in the WFS optics when a flat-field measurement is required.

Deformable mirror

1. A motorised mounting stage for the DM should be adopted allowing x and y position movement for alignment purposes. This should be position encoded and repeatable to an accuracy to be confirmed by RAH - it was expected it would be an undemanding specification ~ 0.2mm. (2AJL,3RAH, 5AJL, 7RMM)
2. For alignment purposes a dummy flat should be designed which is mountable on the same stage as the DM. (3RAH, 5AJL)
3. This dummy flat should have an option to be turned precisely towards each of the OAPs, to be used in auto-reflect mode for alignment checks. (3RAH)

(AJL note - I want to understand better how this will be used before it gets firmly incorporated in the specifications)

Dichroic mirror

1. It was agreed to adopt the proposal for a wedge-shaped dichroic plus a compensating plate, based on the spot diagrams MW and SPW had produced. (2AJL, 3RAH)
2. The spots showed major gains in on-axis performance with relatively small gain (and even possible loss) at 29 arcsec radii.
3. An additional reason for the decision made was that the DM offset would not be able to compensate simultaneously for the dichroic effects in the IR science path and the optical science path.
4. RMM is to confirm the parameters for which their design is to be optimised (e.g. on axis, or to 20" ..... plus any wavelength considerations).

Instrumentation

1. It was agreed that any spectrometer to be used with NAOMI would need to have an independent imaging mode to enable source acquisition to be performed onto the smallest slit sizes (1RMM??, 2AJL)

Safety

1. If the need for a ~25mW laser is confirmed, the safety implications should be noted and included in procedure descriptions. This would apply particularly if a need to remove the spatial filter is identified.

Other Issues

1. **The Fast Steering Mirror** offsets of ? 5" were agreed to be sufficient to enable a spectrometer slit to be mapped onto probe space, using a probe-WFS -FSM closed loop with no offset to the TCS. (RAH to include in OCD methods).
2. **The beam height** specification was agreed to be 150mm, as with the new pick-off design no demand has at yet been received for more space than this would allow. (3RAH,4RAH if necessary - probably no change)
3. Use of **single segments of the DM,** with surrounding segments at full tilt away from it, in the **alignment of the DM to the lenslet array**, was agreed as a workable method. (RAH to include in OCD methods)
4. RGO will carry through two **WFS camera designs** as it was not possible to determine which of the two main camera options was most likely to be adopted. (4RAH)

Documentation

Documents which need to be up-dated as a result of the changes are:

1. Science requirements document
2. Technical Description document
3. Optical chassis WP document
4. WFS WP document
5. Operational Concept Document
6. MW's Calibration Unit document
7. Software URD

It was agreed that the appropriately modified documents would be released together, to maintain a consistent set. The goal date for this should be end of November.

Actions

1. MW, SPW to determine whether ISU source feeds producing calibration images need to be made more telecentric than current preferred solution allows. (by 26/11/96)
2. MW to design pupil simulator into Nasmyth calibration unit. (by 29/11/96)
3. RMM to request ELECTRA makes lab measurement of effect of telescope pupil ASAP. (by 17/01/97)
4. MW to calculate that number of photons the ISU provides to the WFS using the proposed two mask alignment method. This should include any colour filters. (by 29/11/96)
5. SPW to confirm that a diffusing screen in the WFS will provide sufficiently uniform illumination. Also to confirm it is easy to insert and describe where is can be inserted. (by 29/11/96)
6. RMM to confirm during ELECTRA/MARTINI future alignment operations whether 25mW laser is likely to be required for NAOMI alignment. (by 28/03/97)
7. RGO to provide one reasonable concept for re-installation of tip-tilt sensor, but not to use more than minimal effort in looking at this design. (by 20/12/96)
8. MW to calculate the effect of moving the conjugation lens ~ 10mm from Nasmyth focus so that its off-axis aberration and focal plane astrometry effects can be determined using the same focal-plane mask method as for normal NAOMI calibration. (Low priority as the conjugation option is not in the current implementation so should not unduly drive design or methods) (by 20/12/96)
9. MW, RAH to confirm pupil illumination uniformity requirements and compare with that produced by enlarging holes in ISU mask feeding light to focal plane mask. (by 06/12/96)
10. SPW, MW to calculate optimum field lens position and compare with ~ 30mm position, then confirm which to adopt by consultation with RMM. (by 29/11/96)
11. AJL, RMM, RAH, MW to up-date NAOMI documents as listed. (by 29/11/96)
12. ABG to describe problem with 90? pick-off angle to WFS and propose solution which still allows this to be implemented. (by 26/11/96)