MRO FTT/NAS & FLC ICD

FTT/NAS & FLC to Nasmyth Optical Table

MRO-ICD-CAM-1000-0110

The Cambridge FTT Team

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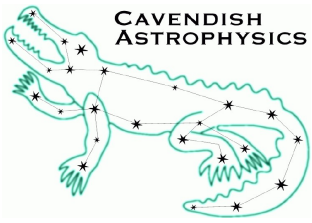

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ICD Description

ICD Number	Sub-systems		Org	Owner	Brief description and preliminary contents
MRO-ICD-CAM-1000-0110	FTT/NAS	NOT	MRAO	MF	Defines the mechanical interfaces and layout of the FTT-NAS opto-mechanical system with respect to the Nasmyth optical table and the space allocation. • FTT-NAS layout • Connections of components to Nasmyth optical table • Cover for optical table • Space envelope and FTT-NAS layout

Change Record

Revision	Date	Author(s)	Changes
0.1	2010-07-09	MF	First draft version
0.2	2012-04-25	MF	Updated for PDR
0.3	2012-04-26	MF	Applied document number & minor corrections plus conversion to LibreOffice
0.4	2012-04-28	MF	Minor corrections
1.0	2013-05-09	MF	Released

Notification List

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Scope

This document defines the relationship between the FTT-NAS opto-mechanics and the space envelope allocated to them on the Nasmyth optical table. It also specifies the form of connection to the optical table. It does not address the connections of services to the optical table, which are dealt with in another ICD. The corner-cube reflector associated with the FTT-NAS system is not currently included in this interface. Requirements for a cover are presented.

Acronyms and Abbreviations

EMCCD Electron-Multiplying Charge-Coupled Device
FTT Fast Tip-Tilt
FTTA Fast Tip-Tilt Actuator
FLC First Light Camera
GPS Global Positioning System
ICD Interface Control Document
ID Inner Diameter
ISS Interferometer Supervisory System
MROI Magdalena Ridge Observatory Interferometer
MRAO Mullard Radio Astronomy Observatory
NAS Narrow-field Acquisition System
NMT New Mexico Tech
PC Personal Computer
PSU Power Supply Unit
TBC To be confirmed
TBD To be determined
UT Unit Telescope
UTCS Unit Telescope Control System
UTE Unit Telescope Enclosure
WFS WaveFront Sensor

Documents

Drawings

AD1 INT-403-DWG-0100 rev 0.5 “Nasmyth Table Space Envelope”

Reference Documents

RD1 MRO FTT-NAS Technical Requirements INT-403-ENG-0003 rev 2.2

RD2 MRO FTT-NAS & FLT Derived Requirements MRO-TRE-CAM-0000-0101

RD3 FTT/NAS Preliminary Design Report MRO-TRE-CAM-1100-0142

1 Introduction

This ICD describes the interface issues between the FTT-NAS opto-mechanics and the UT Nasmyth optical table on which they are installed. There is no particular interface requirement other than to comply with the space envelope constraints placed upon it by the presence of other opto-mechanical assemblies also present on the optical table and a mass budget. For the FLC system the space envelope is not enforced as there is not likely to be any other assemblies on the optical table (apart from an AMOS wave-front sensor close to the where the beam exits the telescope).

2 Requirements

The requirements of the ICD are treated individually for the FLC and FTT/NAS in the subsections below.

2.1 Requirements for the FTT/NAS

The requirements placed on the FTT-NAS are: (i) it fits within the unreserved space available on the optical table and can be brought into alignment with the telescope exit beam; (ii) that the height of any component is < 450 mm; (iii) the total mass is 30 kg or less. The requirements underpinning the design of the FTT-NAS are presented in RD1 and RD2 and the space envelope and mass budget are provided in AD1.

2.2 Requirements for the FLC

The only requirements placed on FLC components are that they fit on the optical table and are less than 450 mm in height.

3 Design

3.1 FTT/NAS Interface description

The interface is the surface of the UT Nasmyth optical table. The drawing AD1 details the space envelope restrictions on the optical table.

The layout of the FTT-NAS opto-mechanics was developed taking into account the available space on the optical table. The design approach and the details of the optical design and layout are presented in RD3. Two assemblies are mounted onto the optical table: (i) the common base-plate and (ii) the EMCCD camera. The layout of the FTT-NAS system in conjunction with the space envelopes is shown in Figure 1.

3.1.1 Common base-plate

The common base-plate is an aluminium slab onto which the dichroic pick-off, focussing objective and two fold mirrors are installed. It is positioned so that the dichroic intercepts the telescope output beam at an angle of 15.5º while avoiding space reserved for the automated alignment system and any future adaptive optics system. This base-plate is located on three pre-positioned kinematic seats (of similar material to the surface of the optical table) which are fixed to the surface by clamps which utilise the nearest available screw-holes in the table. The height of the base-plate can be adjusted at each seat so that non-flatness of the optical table can be accommodated.

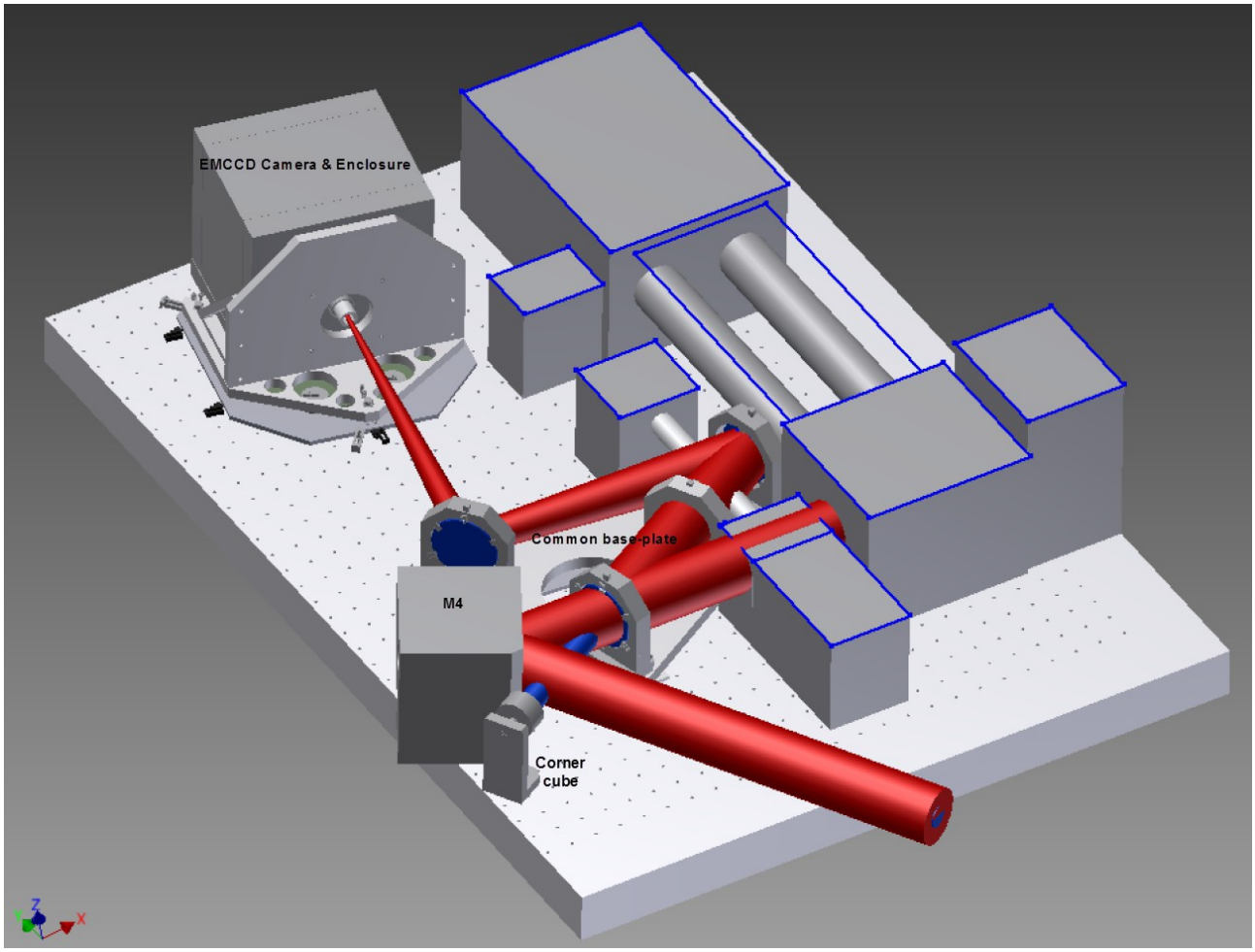

Figure 1: Layout of the FTT-NAS assemblies and other space envelopes on the optical table.

3.1.2 EMCCD Camera

The EMCCD camera mount is also seated on adjustable kinematic seats which are set into a steel interface plate which is clamped to the optical table surface as described in 3.1.1 for the common base-plate. The camera thermal enclosure is supported separately from the table using a sheet of low thermal conductivity glass fibre composite and is referenced to the steel interface plate but not clamped.

3.2 FLC Interface description

The interface is the surface of the UT Nasmyth optical table. The individual assemblies provided for the FLC camera are (i) a focussing objective, (ii) a fold mirror and (iii) the EMCCD camera, mount and thermal enclosure (exactly as provided for the FTT/NAS). A typical, but not obligatory layout for the FLC is shown in Figure 2.

3.2.1 FLC focussing objective

The lens mount is almost identical in design to that of the FTT/NAS although the lens is simpler and has different dimensions. Because there is no need for a common base-plate the lens mount is attached to the optical table using specially designed spacers which clamp to the table.

3.2.2 Fold mirror

The fold mirror and mount are identical to those provided for the FTT/NAS. The mount is attached to the optical table using specially designed spacers which clamp to the table.

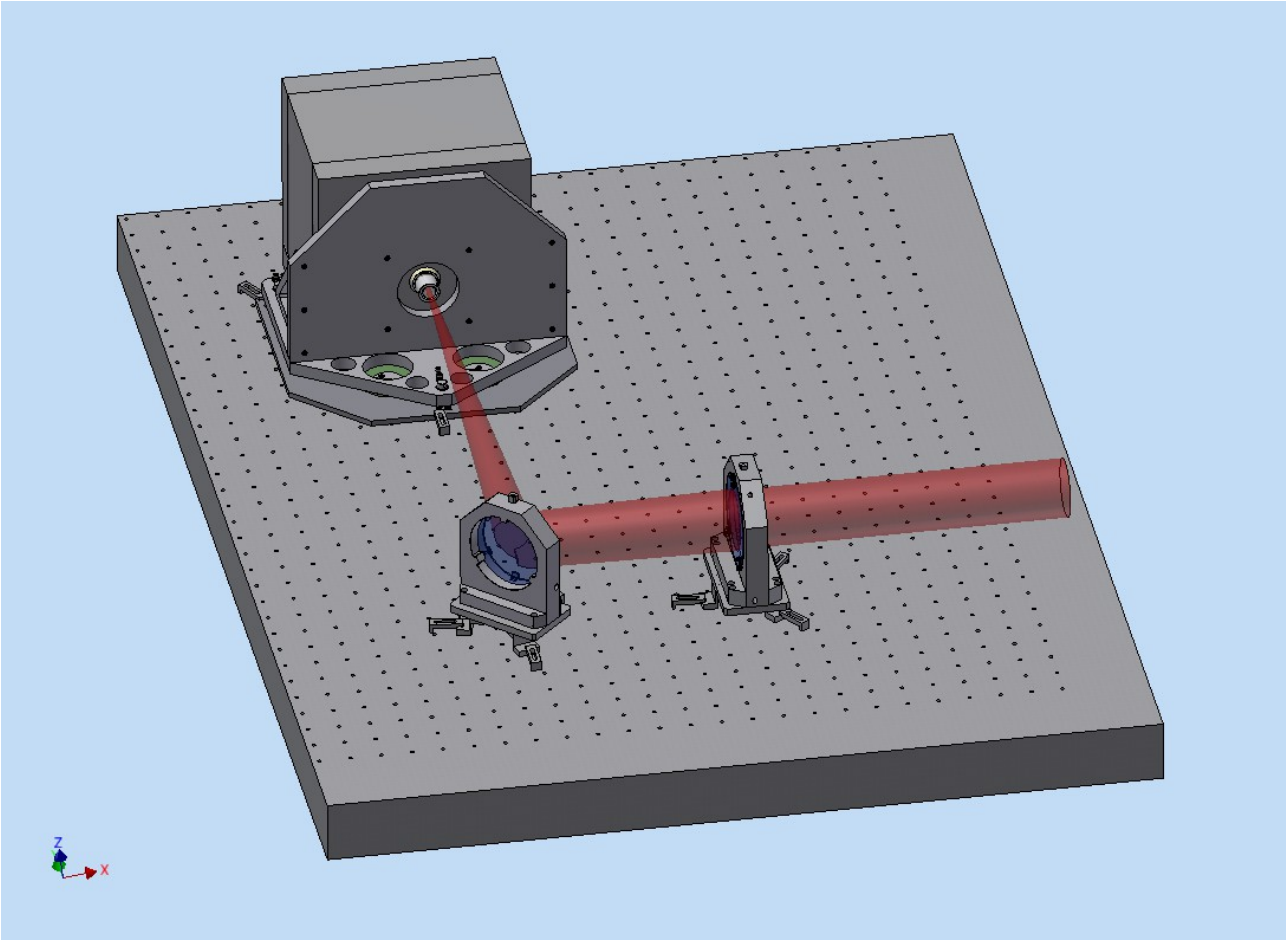

Figure 2: Illustration of a typical layout for the FLC camera. The camera, the fold mirror and the focus objective are clamped to the optical table and are not dependent on hole positions. Focus can be achieved by moving either the camera or the lens although special adjusters are available for moving the camera base-plate.

3.2.3 EMCCD camera

The same camera, mount and thermal enclosure provided for the FTT/NAS is used for the FLC. It attaches to the optical table using the method outlined in 3.1.2.

3.3 FTT/NAS Mass budget

The total mass of the common base-plate assembly is approximately 26.7 kg, including all the optics and mounts, and the kinematic seats that clamp to the optical table. The total mass of the EMCCD camera assembly, including mount, base and thermal enclosure is approximately 30.6 kg. The allowance for all FTT/NAS components in the mass budget provided in AD1 is 30 kg (10 kg for the dichroic assembly and 20 kg for everything else). Hence this design is over budget by approximately 27 kg and it is unlikely that the mass can be reduced much without affecting the stability of the system.

The implication is that the Nasmyth optical table will have a slightly lower resonant frequency (assuming that the adaptive optics unit of mass 50 kg was fitted). Without the AO unit the total mass on the table will be less than budgeted by 23 kg.

3.4 Nasmyth table cover

This has not been specifically addressed because of concerns about thermal gradients which may be introduced and potential vibrations being induced into the table from a large cover. To offer some protection for the optics it should be possible to provide a small cover for the common base-plate assembly which is fixed to the optical table. Any larger cover to protect the whole table area should be fixed to the enclosure.

There is, however, a space of 100 mm above the tallest assembly on the optical table, the camera mount and thermal enclosure which should be more than sufficient room for accommodating a cover.

4 Appendix

The nominal height of the telescope exit beam above the surface of the Nasmyth optical table is shown in Figure 3 and the nominal position is shown in Figure 4 below.

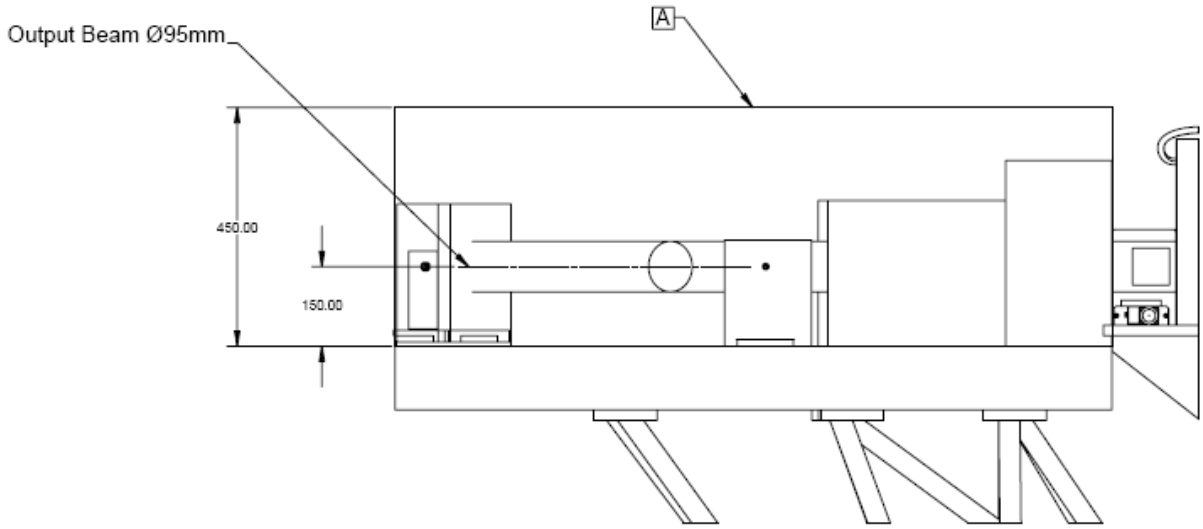

Figure 3: Nominal height of the telescope exit beam above the Nasmyth optical table.

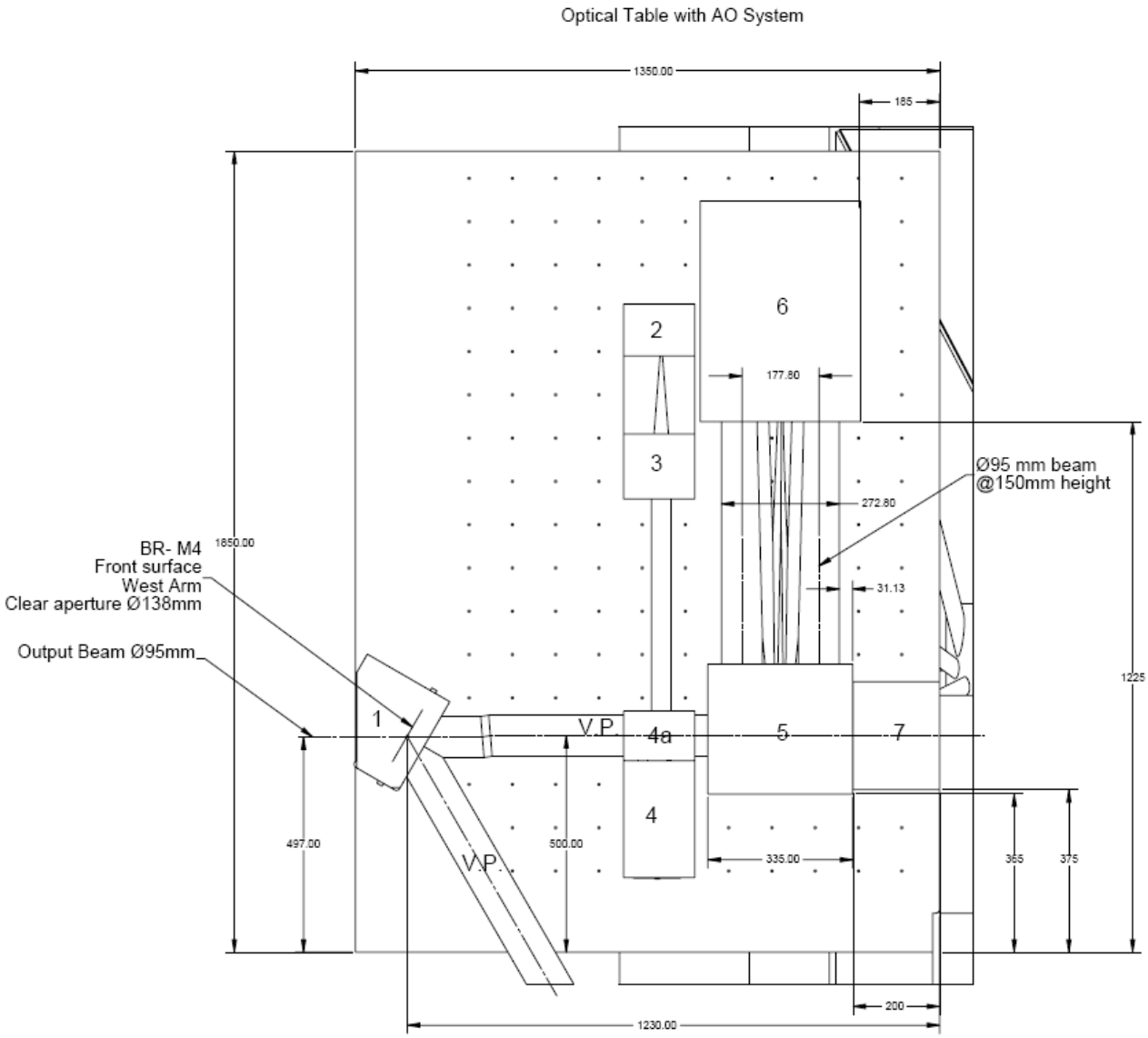

Figure 4: Plan view of the position of the telescope exit beam with respect to the Nasmyth optical table.