MRO FTT/NAS & FLC ICD

FTT-NAS & FLC to UT Optical

MRO-ICD-CAM-1000-0111

The Cambridge FTT Team

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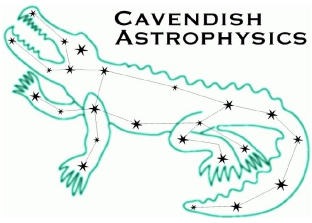

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ICD Description

ICD Number	Sub-systems		Org	Owner	Brief description and preliminary contents
MRO-ICD-CAM-1000-0111	FTT/NAS	UT	MRAO	MF	Defines the interface of the FTT-NAS opto-mechanics with relation to the exit beam of the UT at the Nasmyth table • Interface requirements • Opto-mechanical layout • Outline install method

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
0.5	2013-04-26	MF	Update prior to release Corrected and removed TBC s in section 2
1.0	2013-05-09	MF	Released

Notification List

The following people should be notified by email that a new version of this document has been issued:

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Scope

This document defines the interface between the optical beam exiting the UT outer elevation axis and the components of the FTT-NAS placed on the optical Nasmyth table. It does not address the layout of components nor space envelopes, only the relationship of the components as a system to the exit beam from the telescope.

Acronyms and Abbreviations

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

Documents

Drawings

AD1 Nasmyth Table Interface MRO-DWG-AMO-4400-091

AD2 Telescope envelope dimensions MRO-DWG-AMO-0000-091

AD3 Nasmyth Table Space Envelope INT-403-DWG-0100 rev0.5

Reference Documents

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

RD2 MROI Unit Telescope ICD MRO-ICD-AMO-0000-022 issue 7

1 Introduction

This ICD describes the relationship between the optical beam exiting the UT outer elevation axis and the components of the FTT-NAS placed on the optical Nasmyth table. The principal interface condition is that the height of the beam above the Nasmyth optical table and the height of the optical system formed by the components of the FTT-NAS should coincide.

2 Requirements

The requirements on the FTT-NAS & FLC components are as follows:

- The optical axis determined by them should coincide with the optical beam which exits the UT over the Nasmyth optical table to within ±0.25 mm.
- In the case of the FTT-NAS assembly, the angle between the incident beam from the UT and the reflected beam from the dichroic must be 30° ±0.1º (consistent with revised space envelope at M4).

3 Design

3.1 FTT/NAS Interface description

The positions of the two FTT-NAS assemblies, the common base-plate and the EMCCD camera and thermal enclosure on the Nasmyth optical table are shown in Figure 1.

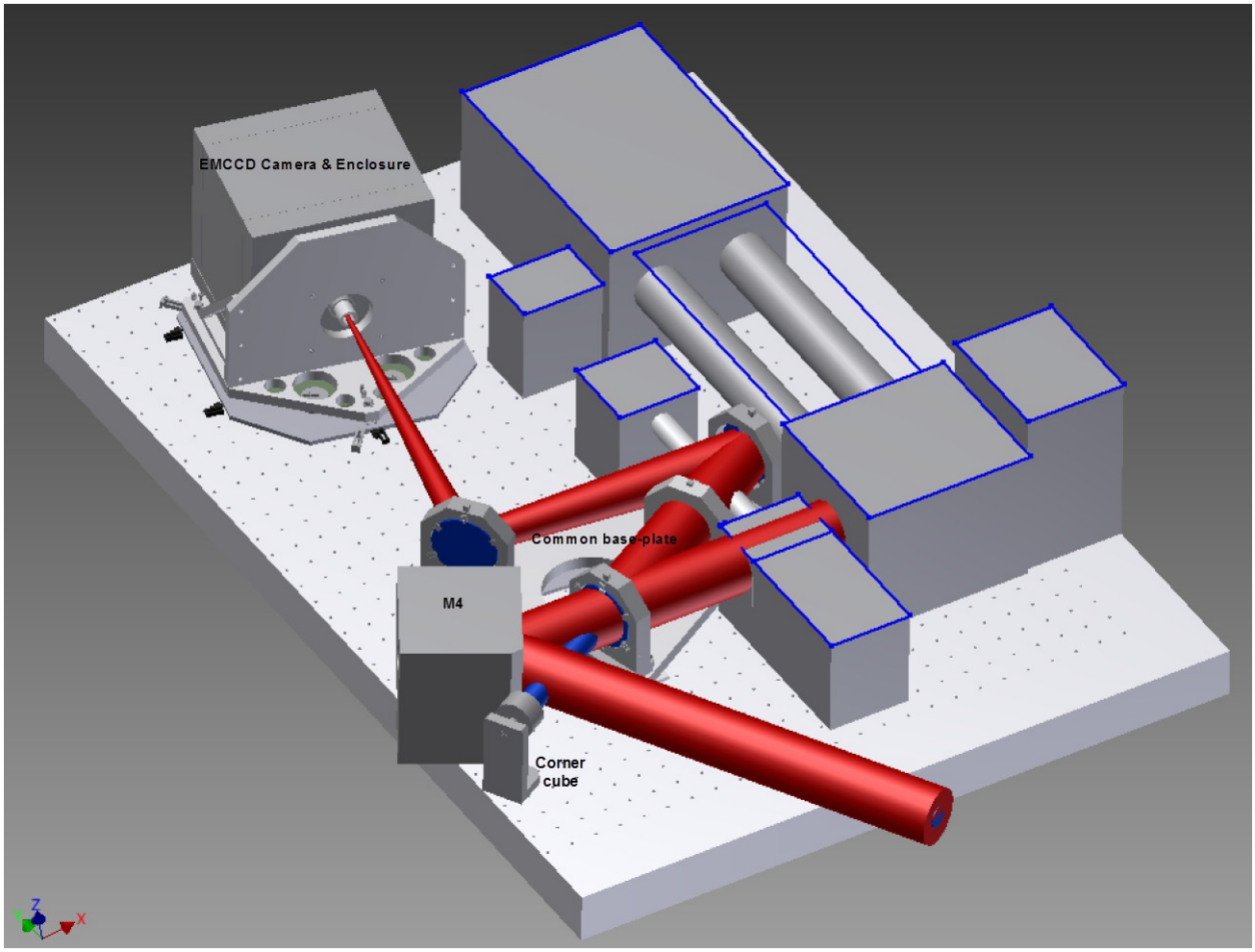

Figure 1 Layout of the FTT-NAS assemblies and other space envelopes on the optical table.

The height of the beam exiting the UTM above the Nasmyth optical table is given in AD3 as 150 mm ± 0.5 mm and the distance from the edge of the table is 497mm. The nominal height of the axis of the FTT-NAS components is designed to be 150mm.

The height and tilt of each of the FTT-NAS assemblies, common base-plate and EMCCD camera, can be individually adjusted by approximately ±2 mm using the kinematic seat adjusters or shims designed into the mounting arrangements.

The coincidence of the optical axis of the FTT-NAS and the exit beam of the UT is not critical and the placement of the FTT-NAS optical assemblies can be achieved by measurement. The non-flatness of the optical table is accounted for by adjustment of the kinematic seats of the common base-plate and the camera.

The angle at which the dichroic intersects the telescope exit beam is set by positioning the common base-plate with respect to the hole-pattern of the optical table allowing for any known tilt of the exit beam with respect to this pattern. A preliminary installation procedure is provided in the appendix. This will be incorporated into an installation document to be provided with delivery of the system.

3.2 FLC Interface

The interface is the intersection of the centre of the exit beam from the UTM and the centre of the focussing objective, the image being brought to focus at the EMCCD camera relayed through the fold mirror. Both the focus objective and the EMCCD camera are at the nominal height of the exit beam and are initially positioned by measurement with respect to the hole-pattern of the optical table. The individual assemblies clamp to the optical table, as described in 3.1 and are not dependent on the table hole-pattern matching the mounts.

4 Appendix

4.1 Install of FTT-NAS opto-mechanics:

1. The common base-plate of the optical assembly will be positioned by direct measurement relative to the (pre-determined) axis of the telescope exit beam and the edge of the table closest to the enclosure, taking into account the space envelope defined in AD3.
2. The defining kinematic seats for the base-plate will be set in place using measurement of the position of the cone seat and the angle of the parallel bar seat. The flat seat is then set by relative measurement to these and does not have to be accurate.
3. Before fitting, the common base-plate height is set to produce a specific distance from the Nasmyth table, taking into account the (pre-determined) height of the telescope exit beam axis above the optical table.
4. The common base-plate is fitted onto the kinematic seats. A precision level is used to check the level of the Nasmyth table and the level of the common base-plate. A straight-edge is used to project the surface of the base-plate to the location of the camera mount and the height of this with respect to the Nasmyth table is checked. Based on these measurements the tilt of the common base-plate will be adjusted if necessary to take account of any non-flatness of the Nasmyth table affecting the locations of the kinematic seats.
5. The camera position is initially set by dead reckoning and its steel base-plate (with embedded kinematic seats) is positioned relative to the common base-plate. Since the camera base-plate clamps to the optical table it is easy to re-position and there are screw blocks that mount to the optical table to help do this.
6. As a check on alignment a laser can be set on the Nasmyth beam axis using simple targetry before mounting the FTT system. The beam from this will propagate through to the camera position and a check performed by reading out the camera.

4.2 Install of FLC assemblies

1. The layout for the three assemblies, lens, fold mirror and EMCCD camera is not fixed to any particular orientation or position but the procedure is easier if the lens and camera axes are orthogonal and line up with the hole-pattern on the optical table.
2. The EMCCD camera should be mounted conveniently near to the end of the optical table (where the services terminate) and be aligned so that the axis of the camera input tube is above a line of holes in

the optical table.

3. The fold mirror is mounted so that the reflecting surface is at 45º to, and intersects the line of holes running from the camera axis and the pre-determined axis of the exit beam from the telescope.
4. The focussing objective mount is then placed symmetrically about the axis of the telescope exit beam so that the lens axis is coincident to within ±0.5 mm [TBC]. The position of the lens along the telescope exit beam axis should be determined by its known focal length and the length of the folded beam to the position of the EMCCD focal plane. The lens can be translated along the telescope exit beam axis to achieve focus on the camera.

4.3 FTT/NAS system heights

The maximum heights of the FTT/NAS components and the nominal height of the telescope exit beam above the surface of the Nasmyth optical table is shown in Figure 2 below.

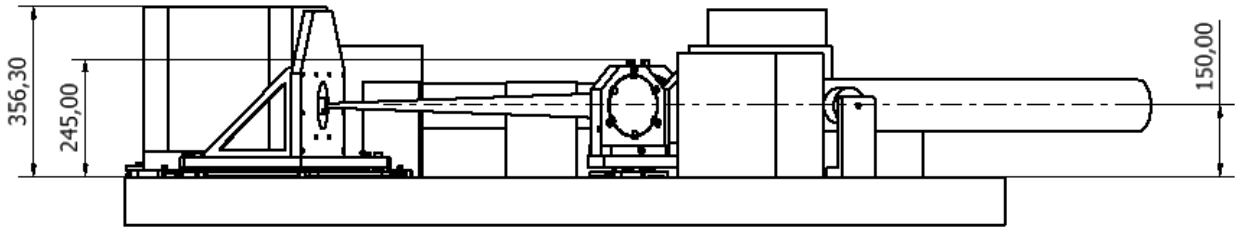

Figure 2 Nominal height of the FTT/NAS assemblies and the telescope exit beam above the Nasmyth optical table.

The position of the FTT/NAS assemblies with respect to the space envelopes of other subsystems and the nominal position of the exit beam from the telescope is shown in Figure 3. The position of the AAS modules close to the camera is shown as 900 mm so that there is sufficient clearance from the common base-plate and the camera enclosure.

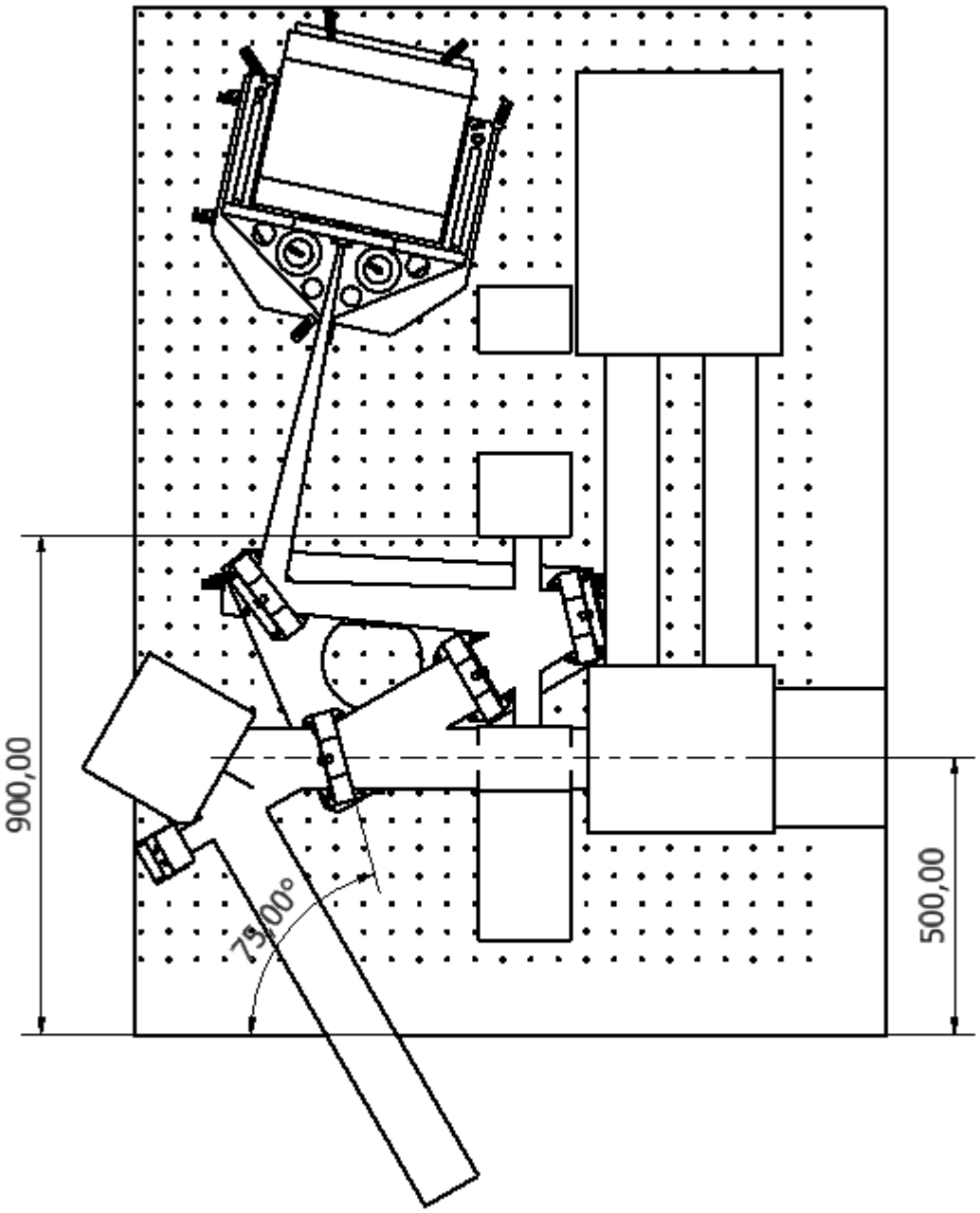

Figure 3 Plan view of the position of the FTT/NAS assemblies and the telescope exit beam with respect to the Nasmyth optical table.