



FTT/NAS vs FLC

Comparison of Technical Requirements

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Change Record

Revision	Date	Authors	Changes
0.1	2010-04-12	JSY	First draft
0.2	2010-04-23	JSY	Second draft
1.0	2010-05-19	JSY	Added document identifier, no other changes
1.1	2010-05-20	JSY	Updated version numbers of referenced documents, no other changes needed

Objective

To compare the technical requirements for the Fast Tip-Tilt/Narrow-field Acquisition System with those for the MROI First Light Camera that will be used initially.

Referenced Documents

The following documents are incorporated by reference:

INT-403-ENG-0003 rev 2.2 “Technical Requirements: Fast Tip-Tilt/Narrow-field Acquisition System”

INT-403-TSP-0107 rev 1.0 “Technical Requirements: First Light Camera”

Acronyms used in this document

API Application Programming Interface

FLC First Light Camera

FOV Field Of View

FTT Fast Tip-Tilt

FTTA Fast Tip-Tilt Actuator

FWHM Full Width at Half Maximum

GUI Graphical User Interface

ICD Interface Control Document

ISS Interferometer Supervisory System

MROI Magdalena Ridge Observatory Interferometer

NA Narrow-field Acquisition

UT Unit Telescope

UTM Unit Telescope Mount

WFE WaveFront Error

1 Introduction

The First Light Camera (FLC) system will be used for commissioning and integration of the first AMOS-delivered Unit Telescope (UT) at the Magdalena Ridge Observatory Interferometer (MROI). The FLC will be a precursor for the more capable Fast Tip-Tilt/Narrow-field Acquisition System (FTT/NAS) described in INT-403-ENG-0003: owing to delays in procuring the FTT/NAS, the FLC is being procured to coincide with the arrival of the first UT. The FTT/NAS will be delivered later and will replace the FLC for regular MROI scientific operations.

This document is intended to clarify the relationship between the FTT/NAS and FLC technical requirements. The following sections contain tables enumerating the FTT/NAS requirements. For each requirement, there is an indication of whether an identical requirement applies to the FLC, and if not, whether an alternative (typically less stringent) requirement applies. Additional requirements specified by the UTM vendor apply to the FLC — please consult INT-403-TSP-0107 for details.

The content of this document is for information only and is not intended to specify any requirements for either the FTT/NAS or the FLC.

2 Comparison of FTT/NAS and FLC Requirements

2.1 Operating mode & functional requirements comparison

FTT/NAS Req. No.	Same for FLC?	FLC-UR	Description	Comments
1	Yes	1-03	Mode switching time < 5 s	Goal 1 s
2	Yes	1-01	Provision of idle mode	
3	Yes	1-02	Command response (idle mode)	
4	No		Provision of fast tip-tilt mode	
5	N/A		Estimate image FWHM in fast tip-tilt mode at ≥ 0.1 Hz	
6	Yes	1-01	Provision of acquisition mode	Offsets delivered at ~ 1 Hz
7	Yes	1-02	Estimate of image FWHM in acquisition mode	
8	Yes	1-01	Provision of acquisition check mode (Exp. time ≤ 10 s)	Multiple exposures permissible
9	Yes	1-01	Provision of dark frame mode	
10	Yes	1-02	Master dark frame transmission and retrieval	
11	Yes	1-02	Use of dark frame	
12	Yes	1-01	Provision of flatfield mode (Exp. time ≤ 100 s)	Multiple exposures permissible
13	Yes	1-02	Master flatfield frame transmission and retrieval	
14	Yes	1-02	Use of flatfield	
15	N/A		Coordinate transformations	
16	No		Sensor spectral bandwidth: 350–1000 nm	Alternative FLC-UR2-03
17	No		Space for future dichroic slide	
18	No		Application of dispersion offset	
19	No		Off-axis tip-tilt sensing distance ≤ 10 arcseconds	
20	No		Facility for accepting & using off-axis offsets	
21	N/A		Continuous tracking through offset changes	
22	N/A		Linearity of centroiding	

Operating mode & functional requirements comparison continued

FTT/NAS Req. No.	Same for FLC?	FLC-UR	Description	Comments
46	N/A		Fast tip-tilt mode FOV $\geq 3'' \times 3''$	
47	N/A		Closed-loop 3dB bandwidth: 10–40 Hz	
48	No		Sinusoidal dither facility: $\leq 2''$ at up to 10 Hz	
49	N/A		Latency of dither function ≤ 1 ms	
50	Yes	2-01	Acquisition mode FOV $\geq 60'' \times 60''$	Goal $100'' \times 100''$ (FTT/NAS only)
51	Yes	1-02	Selection of (tip-tilt) reference object	
52	Yes	1-02	Facility to override reference object selection	
53	No		Relocation procedure	
54	N/A		Provision of relocation hardware	
55	N/A		Withstanding shock-loads of $\leq X$ g	
56	N/A		Relocation time ≤ 2 hrs	

2.2 Performance requirements comparison

FTT/NAS Req. No.	Same for FLC?	FLC-UR	Description	Comments
57	No		Environmental conditions for operation: Electronics housing temp in range $+10$ to $+40^\circ$ C, ambient temperature in range -5 to $+20^\circ$ C, ambient relative humidity in range 10% to 70%	Alternative FLC-UR2-16
58	No		Environmental conditions for survivability: ambient temperature in range -25 to $+40^\circ$ C, ambient relative humidity in range 5% to 95%	Alternative FLC-UR2-16
59	N/A		Dichroic clear aperture ≥ 110 mm	
60	N/A		Dichroic throughput $\geq 97\%$	
61	N/A		Dichroic diattenuation $\leq 1\%$	
62	N/A		Dichroic surface quality: 60:40 or better	
63	N/A		Dichroic transmitted WFE ≤ 16.4 nm	
64	No		Limiting magnitude for acquisition $V = 16$	Alternative FLC-UR2-07
65	N/A		Residual tip-tilt in fast tip-tilt mode $\leq 0.015'''$ at $V = 16$ or brighter	
66	No		Stability of tip-tilt zero-point: $0.015'''$ for $\Delta T \leq 5^\circ$	Alternative FLC-UR2-15

2.3 Software requirements comparison

FTT/NAS Req. No.	Same for FLC?	FLC-UR	Description	Comments
23	Yes	3-04	Provision and documentation of API	
24	Yes	3-05	Control of system functions using API	
25	No		Demonstration of GUI(s)	Alternative FLC-UR2-09 & 2-10
26	Yes	2-09	Operation of GUI(s) from control room	
27	Yes	3-03	Disabling of GUI controls	
28	Yes	3-09	Operation from laptop	
29	Yes	3-03	Run GUI while streaming to ISS data collector	
30	Yes	1-04	Operation without ISS, (FTTA), UTM	
31	No		Stand-alone archiving capability	Alternative FLC-UR2-14
32	N/A		Recording/display of multiple datasets	
33	N/A		Local storage for detector image data and telemetry ≥ 2 GB	
34	No		Stand-alone image recording at user-selectable rate \leq rate of original acquisition	
35	N/A		Stand-alone telemetry data items	
36	N/A		Stand-alone recording: time-stamps accurate to 1 ms	
37	Yes	3-06	Data transmission to ISS	
38	Yes	3-07	Time-stamps on data transmitted to ISS accurate to 1 ms	
39	N/A		Reduced-data-rate low-latency (≤ 0.2 s) transmission to ISS	
40	N/A		Sub-sampling for reduced data rate (at ≥ 10 Hz)	
41	N/A		Reduced-data-rate telemetry items to ISS	
42	N/A		Full-data-rate high-latency (≤ 300 s) transmission to ISS	
43	N/A		Reliable protocol for full-data-rate transmission to ISS	
44	Yes	3-06	Full-data-rate telemetry items to ISS	
45	Yes	3-08	Alternative: Full-data-rate low-latency (≤ 0.2 s) transmission to ISS	

2.4 Thermal, power & maintenance requirements comparison

FTT/NAS Req. No.	Same for FLC?	FLC-UR	Description	Comments
67	No		Use of electronics housing	
68	No		Surface temp close to beam path within 2° C of ambient	
69	No		Total power consumption \leq 250 W	
70	No		Routine maintenance interval \geq 3 months	
71	No		Design lifetime of 10 years	
72	No		Provision of maintenance plan for control system software & hardware	

2.5 Interface requirements comparison

FTT/NAS Req. No.	Same for FLC?	FLC-UR	Description	Comments
73	Yes	FLC-UR3-01	Provision of list of ICDs and enumeration of authors	
74	No		Compatibility with agreed space envelope	FLC may use all of Nasmyth table