**Keck Adaptive Optics Note XXX**

**Near-Infrared Tip-Tilt Sensor System:**

**Pre-Ship Review Report**

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**DRAFT Version 0.1 (outline only)**

# Introduction

The purpose of this KAON is to summarize and assess the completeness and readiness of the Near-InfraRed (NIR) Tip-Tilt Sensor (TTS) opto-mechanical system for delivery to WM Keck Observatory in preparation of its subsequent summit installation.

The Acceptance, Integration, Test and Commissioning plan (KAON 855, section 2.1) states that each NIR TTS subsystem shall include the deliverable of

”An acceptance review document including:

* Compliance matrix for function requirements
* Compliance matrix for interface requirements
* Compliance matrix for system requirements
* Documentation to support the requirements and interface compliance”

This document constitutes this deliverable for the Caltech deliverable components of the Camera subsystem consisting of the following *excluding the Filter Changer* component which is provided by WKMO:



# Report Organization

We choose to organize this document according to broad areas of requirements compliance as follows:

Section 3 System Description Summary [*Rich]*

Section 4 Optical and Mechanical Performance [*Jason / Rich]*

Section 5 Thermal Performance *[Roger / Hector]*

Section 6 Electronics Performance [*Roger]*

Section 7 Detector Performance *[Dave / John]*

Section 8 Software Performance *[Dave / John]*

Section 9 Shipping Readiness [*Hector*]

We include the formal compliance matrices as Appendices to this document and reference their corresponding technical subsection for each of cross-referencing.

The following items are not ready for shipment to WMKO, accompanied by a suggested course of action to bring each to shipment readiness:

* *Pre-ship Exception #1: [status and proposed plan]*
* *Pre-ship Exception #2 [ status and proposed plan]*

# System Description Summary [*Rich]*

For reference, the mechanical configuration of the NIR TTS is shown in Figure 1.

*Add high-level description of key elements of this Figure.*



Figure : NIR TTS Mechanical Overview (from KAON 890)

For additional detail pertaining to the opto-mechanical design details of the NIR TTS see KAON 892 Optical Design and KAON 890 Camera Opto-Mechanical Design, which have been updated to accurately reflect the as-built system design (*XXX confirm this*).

Table : XXX *Insert table above*

# Optical and Mechanical Performance [*Jason / Rich]*

*[XXX Add possible introduction to key issues discovered / resolved / or remaining relevant to the readiness of the NIR TTS].*

# Functional Compliance

The following critical dimensions were verified to ensure that the NIR TTS camera would not interfere mechanically or optically when installed on the AO bench:

* *Requirement #XXX*

Measured Performance:

* + *We measured…*

Suggested Actions: *None*

# Interface Compliance

# System Compliance

# As-built Documentation

KAON 890 Camera Opto-Mechanical Design contains detail on the as-built mechanical design of the NIR TTS Camera. KAON 892 contains detail on the as-built optical design.

# Thermal Performance *[Roger / Hector]*

*[XXX Add possible introduction to key issues discovered / resolved / or remaining relevant to the readiness of the NIR TTS]*

# Functional Compliance

Measurements were made in the lab to determine compliance with the following thermal functional requirements calling for experimental verification:

* *Requirement #XXX*

Measured Performance:

* + *We measured…*

Suggested Actions: *None*

# Interface Compliance

# System Compliance

# As-built Documentation

KAON 902 contains detail on the as-built thermal design. KAON XXX contains detail on the Assembly and Alignment procedures including the thermal connections internal to the NIR TTS cryostat.

# Electronics Performance [*Roger]*

*[XXX Add possible introduction to key issues discovered / resolved / or remaining relevant to the readiness of the NIR TTS]*

# Functional Compliance

# Interface Compliance

# System Compliance

# As-built Documentation

KAON 888 contains detail on the as-built electronics design. KAON XXX contains detail on the Assembly and Alignment procedures including the electronics connections internal and external to the NIR TTS cryostat.

# Detector Performance *[Dave / John]*

*[XXX Add possible introduction to key issues discovered / resolved / or remaining relevant to the readiness of the NIR TTS]*

# Functional Compliance

Measurements were made in the lab to determine compliance with the following detector functional requirements calling for experimental verification:

* *Requirement #XXX*

Measured Performance:

* + *We measured…*

Suggested Actions: *None*

# Interface Compliance

# System Compliance

# As-built Documentation

KAON 894 describes the extensive inherent detector noise performance evaluation made with the NIR TTS sensor upon receipt in the Caltech Optical Observatories Test Cryostat. The results presented herein supersede those results, however, as they have been obtained with final electronics, mount, and cabling.

NIR TTS control and detector software has been installed in the *XXX* version control system as WKMO observatory. Build procedures have been delivered to WMKO and are available at *XXX*.

# Software Performance *[Dave / John]*

*[XXX Add possible introduction to key issues discovered / resolved / or remaining relevant to the readiness of the NIR TTS]*

# Functional Compliance

Measurements were made in the lab to determine compliance with the following software functional requirements calling for experimental verification:

* *Requirement #XXX*

Measured Performance:

* + *We measured…*

Suggested Actions: *None*

# Interface Compliance

# System Compliance

# As-built Documentation

The Keywords supported by the NIR TTS are described in KAON 857 Keyword Interface Spreadsheet, Tab #4.

NIR TTS control and detector software has been installed in the *XXX* version control system as WKMO observatory. Build procedures have been delivered to WMKO and are available at *XXX*.

* OM FR-19. Each opto-mechanical stage shall be provided with an appropriate servo motor and encoder to ensure that the positioning requirements can be met.

Requirements…

* + The dichroic exchanger positioning requirement is  1 mm. The focus stage positioning requirement is  0.05 mm (confirmed).

Measured Performance…

* + The positional repeatability of both stages was better than the measurement resolution of a dial indicator with 2.5 μm accuracy when driven under servo control, dramatically exceeding the requirements.

# Shipping Readiness [*Hector*]

The NIR TTS Packing and Shipment plan was distributed on *XXX* to the following persons for review:

* *Reviewer #1*
* *Reviewer #2*
* *…*

We have incorporated feedback from these reviews in version *XXX* of this document. Currently, the state of shipping readiness of the equipment described in Section 3 is summarized in Table 2.

Table . Shipping Readiness [*XXX insert table above*]