# Notes on NAOMI - ICS requirements

**wht-naomi-90**

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**Andy Longmore, Richard Myers**

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## Introduction

These notes are intended primarily as guidance for development of an INGRID software plan, including instrument control and data interfaces, relevant to NAOMI. However, much of the content is applicable to any instrument which is intended for use with NAOMI. The notes cover, the type of data which NAOMI needs to obtain from INGRID during set-up and calibration, the requirement for NAOMI information to be attachable to science instrument files and control features which are needed for NAOMI to function efficiently. Information has been taken from NAOMI technical and scientific documents as follows.
SciOpReq: Top Level Scientific and Operational Requirements for NAOMI
Techdesc: Technical Description of NAOMI
iguide.doc: a (still draft version) software and electronics interface requirement summary written by Richard Myers

## Windowed Fast Data Acquisition

SciOpReq clause 12(a). *The interface to the IR science instrument shall, as a minimum, permit the AO system to inititiate a windowed or non-windowed exposure, to confirm the completion of the exposure and to obtain the data. This entire sequence should complete in no longer than 0.1 seconds for a 128x128 pixel window.*
NAOMI needs to be able to set the integration time and window size. A standard format needs to be agreed for these images, which can be the raw IR images. Ideally NAOMI wants to be able to initiate a rapid but controlled sequence of such exposures while it varies certain DM parameters. NAOMI will have software to analyse the image properties to determine the quality factor of the IR image (such analysis software is not the responsibility of the INGRID system). This allows rapid iteration towards minimising non-common path errors between the science and WFS detectors.

## Synchronised Top-Level Control System Requirements

The operations in the following sub-sections need to be synchronised between the Science Instrument Control System, the Telescope Control System, the AO Control System and any generic Observatory *Control System* (e.g. top level GUI).

### *Dithering and Closed-Loop Offsets*

SciOpReq Clause 12(b) currently states *The science instrument shall as a minimum be able to command the AO system to open or close the control loops and to perform a specified closed-loop offset.* We believe this clause needs to be re-stated: *Opening and closing the AO system loops and performing telescope offsets with these loops closed needs to be synchronised between the Control Systems.*

The overall requirement is that any TCS pointing changes required by INGRID (whether required for dithering or slews) must be co-ordinated with the NAOMI loop state (open/closed) and probe offsetting/TCS offloading systems.
NAOMI will provide external services to any external nexus of control. Commands would need to be such that NAOMI could distinguish between slews to target and dithering, both of which NAOMI needs to know about. (These actions may be processed by an external interlock manager.) It is important for the

dithering command that it cannot be confused with a general Telescope Slew command, for which AO loops must be Open. The Dither Offset, once received by NAOMI, will initiate a controlled motion of the pick-off and co-ordinated offloads to the TCS.

### *Focus*

The overall requirement is that focus changes required by the IR camera are co-ordinated with the NAOMI focus control and TCS offloads.
NAOMI will have a feature in which any 'long' term focus error will be taken out by off-loads to the Telescope Focus system. If INGRID also sends focus change demands to the TCS (e.g. during filter changes) these should be identifiable as different from the NAOMI off-load commands and the control system should ensure actions resulting from the focus change demands do not become confused. Note that any focus command sent independently to the TCS would be simply cancelled by the AO system if the loopes were closed.

### *Telescope Slews*

Wherever Telescope Slew commands originate, NAOMI must know about them, be able to distinguish them from Dither commmands, and the interlock manage must be able to prohibit slews until the AO loops are open.

### *Science Data Headers*

The *Control System(s)* must be able to synchronise provision of header information to be attached to the Science Data Files. NAOMI will need to attach information relevant to the status of the AO system to the data files.

## General Comments

### *Implementation*

The above requirements have been made independently of implementation details (hopefully). In practice, NAOMI is likely (and willing) to be able to operate either as a server or client for the tasks.

### *Other Relevant Information*

Appended are other clauses from SciOpReq which relate to Software standards and to user requirements. They include specifications which may no longer be correct because the concept of the overall *WHT Control System* architecture has changed. Discussions about INGRID software and *control system* software in general should note these and feed back relevant information where the NAOMI clauses are no longer apt.

From Clause 15 (User Interface)
*(e) The NAOMI control system and hardware shall provide system state monitoring facilities sufficient to assist a non-AO expert astronomer and a trained support TO in determining the readily the integrity of the global system state and for a reasonable level of trouble shooting.* ***Where appropriate this shall include information about instrument and telescope systems.***

*(f) In the interests of operational clarity, it shall be possible to switch off but to recover easily all non-essential tools and displays.*

From Clause 22 (User Software)
*(a) IRAF should be assumed as the offline astronomical data analysis environment (i.e. any application provided should not require the existence of some other complete astronomical data reduction environment).*

*(b) The FINAL archival format should be DISKFITS.*

From Clause 20 (Software Standards)
Items of particular relevance within this might be the need for recoverability of the whole system to a known state and the security features.

*(c) The system supervisory software delivered shall be compilable on a single work station.*

*(d) Procedures and configurations controlling general alignment, calibration, acquisition and observing sequences and states shall be accessible to the observer for viewing and on-line editing. These processes shall be made easy for the observer to understand and carry out.*

*(e) In the event of a system failure or anticipated imminent failure, priority shall be given to first preserving system component safety and then any data taken but not yet permanently saved.*

*(f) System parameters (including those from the telescope and instrument) which are likely to be required by an observer in post-observing analysis and data reduction shall be saved such that thet can be automatically tagged to the raw data with which they are associated.*

*(g) It shall be made easy to re-start the NAOMI system by recovering to certain pre-defined configurations, including a standard intialisation setup, a 'last completed observation' configuration and a previous night 'preferred' configuration.*

*(h) The NAOMI system shall have a safe close-down procedure form both an operational and a non-operational (i.e. system hung or failed) state.*