WFCAM

UKIRT

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APPLICABLE DOCUMENTS

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TABLE OF CONTENTS

1. INTRODUCTION

The WFCAM Observing Tool provides a mechanism by which observations to be made by the WFCAM instrument may be defined using a Java-based GUI interface and stored to a database. It may be used off-line, prior to an observer's arrival at the telescope, or at the telescope itself during the observing session.

This facility is a component of the UKIRT ORAC system and is intended to follow the standards developed for the OTs for other instruments. I do not intend here to provide any more than the briefest of introductions to the general use and behaviour of OTs within ORAC; rather I focus on the OT features that are specific to WFCAM.

The OT permits a number of observations to be defined within a science program. Each observation may defined in terms of a basic telescope pointing position, a target, and a sequence of *observes* using different instrument configurations (filters, readout schemes, exposure times) and/or telescope pointing offsets. The definition may also include the name of the data reduction recipe to be applied by the ORAC-DR (data reduction) pipeline. A number of *observe types* are supported, specifically (for WFCAM) types of *OBJECT, DARK, BIAS, FLAT* and *FOCUS*. *Iterators* are provided that allow the instrument configuration to be varied between observes, and allow patterns of pointing offsets to be laid down on the sky.

In practice, it is expected that observers will normally construct their science program by including standard template observations that have already been defined by a project scientist. Such observations will (hopefully) include such ancillary observes (*DARK*s, etc) as are necessary for compatibility with the associated data reduction recipe. The observer will be expected to modify the target information to more realistic values to complete each observation definition.

2. WFCAM INSTRUMENT COMPONENT

The WFCAM Instrument Component, inserted into an observation via the **WFCAM** item in the OT's **Component** list, allows the basic instrument configuration for the observation to be defined via a GUI screen. The options available on the screen are detailed in the following table.

Option	***Type of GUI widget***	***Default value***	***Meaning***
readMode	Drop-down list	TBD	Name that encapsulates the type of detector readout mode, the camera application, and ancillary information associated with the application (such as the NDR read interval).
filter	Drop-down list	TBD	Name of the filter to be used.
exposure time	Text entry box	5.0	The desired exposure time in seconds (see note below).
coadds	Text entry box	2	The number of exposures that constitute each observe. The data from each exposure are coadded within the camera and only the result is exported.

2.1 Exposure time

Note that the exposure time that is set in the WFCAM Instrument Component definition, and elsewhere on the WFCAM OT screens, is always a desired exposure time. Although it depends on the readMode, it is unlikely that an exposure of exactly this duration is possible in practice. For example, if the readMode implies that the array will be read out non-destructively at intervals of 1.0 seconds, only exposures of 1.0, 2.0, 3.0,… etc seconds are possible. In this case, the actual exposure time applied in the camera will be rounded up to the next whole second in duration. There are other constraints that, for instance, set a minimum values on the achievable exposure time as a function of readMode – again, the actual exposure time adopted by the camera(s) will be adjusted in the light of this.

The OT maintains no knowledge of the various constraints on the limits and quantisation of exposure time so it does not reflect these at the time the observation is defined. However, it is the actual applied exposure time, rather than the desired value specified in the OT, that is recorded in the appropriate FITS item written (eventually) alongside the data.

3. WFCAM OBSERVE COMPONENTS

Observe components may be inserted into an observation sequence by selecting the appropriate item from the OT's **Observe** list. The options that are applicable for WFCAM observes are listed in the following table and detailed further below.

Component	***Observe type***	***Application***
Observe	OBJECT	A straight observe of the target object.
Dark	DARK	A dark observation with the blank filter inserted.
Bias	BIAS	The shortest possible dark observe
WFCAM Calibration	FLAT	An observe to secure a flat field.
	FOCUS	A series of integrations at different focus positions.

3.1 Observe

A requirement to observe using the current instrument configuration and target definition. Selecting the **Observe** component in the sequence brings up a simple GUI that allows the number of observes to be increased from **x1**, the default value, by means of a drop-down list. The data from each observe are stored in separate HDS container files.

3.2 Dark

The default configuration offered for an observe type of *DARK* is based on that defined by the current WFCAM instrument component, but with the filter replaced by **blank**. Selecting the **Dark** component in the sequence brings up a GUI that allows the exposure time and the number of coadds to be varied from this default. It also allows the number of *DARK*s to be increased by means of a drop-down list. If either the exposure time or number of coadds is altered, the values may be reset to the default ones using a *Reset to Default* button. There is no facility to changing the readMode for a *DARK*.

3.3 Bias

The instrument configuration adopted for an observe type of *BIAS* is entirely based on the readMode defined by the current WFCAM instrument component. The details of this configuration (other than the readMode) is not known at the OT level. Selection of the **Bias** component in the sequence brings up a GUI that displays fixed but erroneous values for both the exposure time and number of coadds. However, the number of *BIAS*s may be edited via this GUI.

3.4 WFCAM Calibration

By default, the **WFCAM Calibration** component inserts a single *FLAT* observe into the sequence. If the component is selected, the observe type may be switched from *FLAT* to *FOCUS*. For both observes, the default readMode and filter displayed, being those defined by the current WFCAM instrument component. The exposure time and number of coadds are also displayed, their default values being predefined for both observe types within the OT (in the *wfcam.cfg* file). All the fields are editable, though, and may be reset to their defaults by means of a *Reset to Default* button. As usual, the number of observes may be increased by means of a drop-down list.

3.4.1 Flat

The mechanism for performing an explicit *FLAT* observe has not been specified.

3.4.2 Focus

A *FOCUS* observe performs a series of integrations at different focus settings around a particular focus offset. The offsets and pattern of focus changes are not available or configurable at the OT level, being implemented and controlled within the lower-level instrument software. The multiple image frames secured during a *FOCUS* observe are written to a single container file for analysis.

4. ITERATORS

Selection of the **Iterator** item on the Science Program GUI gives a list of options, including ones to iterate over WFCAM instrument configuration items and over patterns of telescope offsets.

4.1 WFCAM Instrument Configuration iterator

Selecting this item, and opening it to display the WFCAM Configuration Iterator GUI allows a series of observation configurations to be defined. It is possible to iterate over any combination of the four basic WFCAM configuration items: *readMode*; *filter*; *exposure time*; and *coadds*. An **Observe** component might then be appended to the iterator so that observes are secured using each configuration.

4.2 Offset iterator

This allows a pattern of sky position offsets to be defined, relative to the base position given by the supplied target information. This pattern, corresponding to a *jitter pattern* in the terminology adopted for WFCAM, may be a regular one that employs fixed X and Y offsets between positions, or it may be defined manually point by point, or by a combination of the two techniques.

In addition, the iterator will provide a mechanism by which a smaller-scale series of offsets may be applied at each position of the jitter pattern. Such a series corresponds to a *microstep pattern* in WFCAM parlance. The observer will be able to select from a predefined list of named microstep sequences.