VISTA Data Flow System (VDFS)

FOR VISTA & WFCAM DATA

Document Title: Overview of VISTA IR Camera Data Interface Dictionaries

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Change Record

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1 Introduction

1.1 Purpose

The purpose of this document is to provide an overview of the specification of the files that are used by the software for VISTA with the IR Camera to produce FITS files. This document, which is currently at draft 0.1 only, gives an overview of the Data Interface Dictionaries for VISTA with the IR Camera. The component Data Interface Dictionaries are ASCII files. A synthesis of these is included in this overview document.

1.2 Applicable Documents

[AD1] *Data Flow for VLT Instruments Requirements Specification*, VLT-SPE-ESO-19000-1618, Issue 1.0, 21 April 1999

[AD2] *Data Interface Control Document*, GEN-SPE-ESO-19400-794, Issue 2.0, 21 May 2002.

1.3 Abbreviations and Acronyms

DICB	Data Interface Control Board
DID	Data Interface Dictionary

2 Overview

The VISTA IR Camera must supply, alongside its raw data, sufficient information to describe the data completely and to allow the VISTA Data Flow System to reduce the data.

A **Data Interface Dictionary (DID)** is a computer readable dictionary which defines all terms used by the Data Flow System to describe data from the VISTA IR camera. The special keywords used for describing data from the VISTA IR camera must be defined in a DID and includes e.g. the FITS keywords to describe the instrument state in raw data files, keywords in instrument setup files. The DID contains a complete list of term (e.g. keywords) defined for the instrument with a detailed description conforming to [AD2].

According to [AD1] DIDs must be submitted to ESO's Data Interface Control Board (DICB) for approval. For the data flow for example, version 0.5 is expected by European Instrument Integration, version 0.9 by Commissioning 1, version 1.0 by Commissioning 2, the final version at Final Instrument Delivery.

The VISTA DFS has not yet undergone PDR or FDR by ESO, and none of the ASCII file components from which this draft DID overview should be drawn have not yet been submitted to ESO's DICB for approval. Until the individual components are approved by ESO's DICB this overview document is a draft. The overview document has been provided to assist the camera software team in their design by giving an overview of all the

components of the DIDs that are expected to inform the writing of the FITS files. This document is maintained by the VISTA Data Flow System as they will have to process the data using the FITS files, and need to be sure that all necessary items are included.

3 Data Interface Dictionary -- ESO-VLT-DIC.VISTA_IR

All data generated by the VISTA IR camera are described by a set of data definitions e.g. keywords for FITS files (see [AD2]). These data definitions describe the instrument state at acquisition and are used by the Data Flow System quality control and calibration pipeline, and for further data reduction. The Dictionary is reviewed by ESO's Data Interface Control Board (DICB) to ensure that it conforms to the standards (see [AD2]).

Explicit deliveries to ESO: Files defining the Data Interface Dictionaries for the instrument conforming to the DICB standard.

Usage by ESO: The DIDs will be reviewed and accepted by DICB. After the acceptance, they will serve as the reference for the data description of raw data frames when used by the Archive, Pipeline and Quality Control.

Notes: Data Interface Dictionary documents consists of an ASCII files describing the information made available by the software system listed with the following properties (defined in detail in [AD2]):

1. Parameter name: The keyword name of the parameter
2. Class: The class to which the parameter is associated with
3. Context: With what is the parameter associated
4. Type: Parameter type
5. Value format: C-style format used to display the parameter's value
6. Unit: Parameter units.
7. Comment format: Short comment describing the parameter
8. Description: Long description

The following is the DID overview ASCII file imported into Word. Any resulting wrapping anomalies have not been changed, as the deliverables are the component ASCII files themselves, rather than this document overviewing them.

```
=================================================================

Dictionary Name:ESO-VLT-DIC.VISTA_IR-0.1.9
Scope:          INSTRUMENT
Source:         VDFS/IOA-CASU
Version Control:"@(#) $ID: ESO-VLT-DIC.VISTA_IR-0.1.9 2003/11/13 $"
Revision:       0.1.9
Date:           2003-11-13
Status:         DRAFT
Description:    Overview Data Interface Dictionary for VISTA
                telescope plus Infra Red Camera.
```

```
Parameter Name:   SIMPLE
Class:            ext-header
Context:    FITS
Type:       logical
Value Format:     %c
Unit:
Comment Format:   Standard FITS (NOST-100-2.0)
Description:      SIMPLE must be equal to "T" to conform to FITS.

Parameter Name:   NAXIS
Class:            ext-header
Context:    FITS
Type:       integer
Value Format:     %d
Unit:       cardinal
Comment Format:   number of axes of data array
Description:      VISTA data stored in multi-extension FITS, hence NAXIS=0
in
            primary header, NAXIS=2 in extension headers.

Parameter Name:   BITPIX
Class:            ext-header
Context:    FITS
Type:       integer
Value Format:     %d
Unit:
Comment Format:   number of bits per pixel value
Description:      Number of bits used to store pixel values
            Standard values are defined in NOST-100.0
            The value for VISTA IR will be
            32 32-bit twos-complement binary integer, but
            there is no primary data so BITPIX is 8 in the primary header.

Parameter Name:   EXTEND
Class:            ext-header
Context:    FITS
Type:       logical
Value Format:     %c
Unit:
Comment Format:   FITS file extension may be present
Description:      VISTAIR files will be multi-extension FITS, so EXTEND
='T'

Parameter Name:   RA
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.6f
Unit:       degrees
Comment Format:   %HOURANG RA of telescope
Description:      Telescope pointing Right Ascension, in ICRF,
            of rotator axis, expressed in decimal degrees.
            The comment field includes the value expressed in sexagesimal.
```

```
Parameter Name:   DEC
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.6f
Unit:       degrees
Comment Format:   %DECLINATION Dec of telescope
Description:      Telescope pointing declination, in ICRF, of
            rotator axis, expressed in decimal degrees.
            The comment field include the value exressed in sexagesimal.

Parameter Name:   RADECSYS
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Name of celestial reference frame
Description:      Standard reference-frame name, will normally be 'ICRS'.
            Note, this implies the EQUINOX keyword is absent.

Parameter Name:   EQUINOX
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.1f
Unit:       Year
Comment Format:   Equinox of celestial reference frame.
Description:      Equinox of reference frame, required for precessed
reference
            frames, but obsolete for International Coordinate Reference
            System.

Parameter Name:   ORIGIN
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   European Southern Observatory
Description:      Observatory source of this file.
            The value is "ESO-PARANAL" for VISTA.

Parameter Name:   TELESCOP
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ESO <TEL>
Description:      ESO telescope code as defined in GEN-SPE-ESO-00000-0794
(ESO-VISTA).

Parameter Name:   INSTRUME
Class:            ext-header
Context:    FITS
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Type:       string
Value Format:     %s
Unit:
Comment Format:   Instrument used
Description:      ESO acronym for the instrument used.
            VIRCAM for VISTA InfraRed Camera.

Parameter Name:   OBJECT
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Target description
Description:      Identification of target observed.

Parameter Name:   IMAGETYP
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Exposure type
Description:      Description of type of observation, ie OBJECT, DOMEFLAT,
SKYFLAT,
            DARK,RESET.

Parameter Name:   AIRMASS
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.5f
Unit:
Comment Format:   Averaged airmass
Description:      Average airmass for the optical axis during the exposure
            computed as described in GEN-SPE-ESO-00000-0794.

Parameter Name:   DATE
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Date this file was written
Description:      UTC date on which this file was written.
            The following format shall be used:
            YYYY-MM-DDThh:mm:ss.sss

Parameter Name:   DATE-OBS
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   UTC date at start of exposure.
Description:      UTC date of the start of the exposure.
```

```
            The format used is YYYY-MM-DDThh:mm:ss.sss

Parameter Name:   UTC
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.3f
Unit:       seconds
Comment Format:   %TIME UTC s at start since midnight
Description:      Universal Coordinated Time at start of the exposure in
seconds
            elapsed since (UTC) midnight.
            The comment includes a civil representation of the value.

Parameter Name:   REQTIME
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.3f
Unit:       seconds
Comment Format:   Requested integration time
Description:      The requested integration time, from the observing
system.
            The actual time will differ due to timing errors or use of
            an early END command.

Parameter Name:   EXPTIME
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.3f
Unit:       seconds
Comment Format:   Actual integration time
Description:      The integration time for a single observation (in the
            infrared this corresponds to DIT. Note that this
            does not represent the photon statistics).
            It may not match the requested integration time.

Parameter Name:   LST
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.3f
Unit:       sidereal seconds
Comment Format:   %TIME LST seconds since midnight
Description:      Local Sidereal Time at start of the exposure in
            seconds elapsed since sidereal midnight.
            The comment includes a civil representation of the value.

Parameter Name:   MJD-OBS
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.8f
Unit:       days
Comment Format:   Modified Julian Date at start
```

```
Description:      Modified Julian Day of the start of the exposure.
            The MJD is related to the Julian Day (JD) via the
            formula: MJD = JD-2400000.5
            The comment includes a civil representation of
            the date and time. 8 decimals are required
            for a precision of one millisecond, 5 decimals
            for a precision of one second.

Parameter Name:   OBSERVER
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Name of observer
Description:      Given name, initial(s), family name of observer

Parameter Name:   PI-COI
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Name(s) of proposer(s)
Description:      Name(s) of proposer(s) (as opposed to observer)

Parameter Name:   COMMENT
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:
Description:      This keyword is used to include comments in the header.

Parameter Name:   HISTORY
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:
Description:      This keyword is used to include history information
            in the header.

Parameter Name:   ESO-LOG
Class:            ext-header
Context:    FITS
Type:
Value Format:
Unit:
Comment Format:
Description:      This keyword is used to include operations log entries
            in the header. Normally, log records that are written
            during the exposure are also repeated for
            information purposes in the header.
```

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            Only the leftmost 71 characters of the log records are
            reproduced in this keyword. The equal sign "=" is
            not allowed as the first character in the comment.

Parameter Name:   ORIGFILE
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Original File Name
Description:      Original file name delivered by data=acquisition system.

Parameter Name:   ARCFILE
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %40s
Unit:
Comment Format:   Archive File name
Description:      Unique Data Product ID within the ESO
            Data Flow System. It is composed of
            <source>.YYYY-MM-DDTHH:MM::SS.sss.fits
            where <source> is a unique data producer
            identifier (typically the name of instrument)
            and the date and time is set
            by the time of start of the exposure as
            as given through the MJD-OBS keyword in the FITS header.

Parameter Name:   CHECKSUM
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ASCII 1s-complement checksum
Description:      32 bit Cyclic Redundant Check (CRC)
            calculation of the frame. It uses the CCITT
            standard CRC polynomials.
            A description and C code can be found at
            http://archive.eso.org/DICB/checksum

Parameter Name:   RECIPE
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Data-reduction recipe to be used
Description:      Name of data-reduction procedure expected to be used
            with this exposure.

Parameter Name:   OFFSTNUM
Class:            ext-header
Context:    FITS
Type:       integer
```

```
Value Format:     %d
Unit:
Comment Format:   Value of first OBSNUM in current tile sequence
Description:      Value of first OBSNUM in current tile sequence

Parameter Name:   OBSNUM
Class:            ext-header
Context:    FITS
Type:       integer
Value Format:     %d
Unit:
Comment Format:   Observation Number
Description:      An incremental count of observations starting from
            day 1. A co-add performed in the data-acquisition system
            counts as a single observation.

Parameter Name:   GRPNUM
Class:            ext-header
Context:    FITS
Type:       integer
Value Format:     %d
Unit:
Comment Format:   Group number applied to all members
Description:      Group number applied to all members

Parameter Name:   GRPMEM
Class:            ext-header
Context:    FITS
Type:       logical
Value Format:     %c
Unit:
Comment Format:   Group membership
Description:      Group membership truth value.

Parameter Name:   STANDARD
Class:            ext-header
Context:    FITS
Type:       logical
Value Format:     %c
Unit:
Comment Format:   Standard-star observation
Description:      True if observation is of a standard star, or
            standard field.

Parameter Name:   NOFFSETS
Class:            ext-header
Context:    FITS
Type:       integer
Value Format:     %d
Unit:
Comment Format:   Number of offset positions in a field
Description:      Number of offset positions in a field

Parameter Name:   OFFSET_I
Class:            ext-header
Context:    FITS
```

```
Type:       integer
Value Format:     %d
Unit:
Comment Format:   Serial Number of offset
Description:      To keep track of which part of a pointing we are on.

Parameter Name:   NDITHER
Class:            ext-header
Context:    FITS
Type:       integer
Value Format:     %d
Unit:
Comment Format:   Number of positions in a tel dither pattern
Description:      Number of positions in a telescope dither pattern

Parameter Name:   DITHRNUM
Class:            ext-header
Context:    FITS
Type:       integer
Value Format:     %d
Unit:
Comment Format:   Value of first OBSNUM in current dither sequence
Description:      Value of first OBSNUM in current dither sequence

Parameter Name:   DITHER_I
Class:            ext-header
Context:    FITS
Type:       integer
Value Format:     %d
Unit:
Comment Format:   Serial number of this tel dither pattern
Description:      Serial number of this telescope dither pattern.

Parameter Name:   DITHER_X
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.3f
Unit:       arcsec
Comment Format:   X offset in dither pattern
Description:      X offset in dither is approximately aligned with RA
            and measured east along a great circle from the starting point.

Parameter Name:   DITHER_Y
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.3f
Unit:       arcsec
Comment Format:   Y offset in dither pattern
Description:      Y offset in dither is approximately aligned North
            (but there is no reason why one might dither through
            the South Celestial Pole) and measured along a great
            circle from the starting point.

Parameter Name:   NUSTEP
```

```
Class:            ext-header
Context:    FITS
Type:       integer
Value Format:     %d
Unit:
Comment Format:   Number of positions in microstep pattern
Description:      Number of positions in microstep pattern

Parameter Name:   USTEPNUM
Class:            ext-header
Context:    FITS
Type:       integer
Value Format:     %d
Unit:
Comment Format:   Value of first OBSNUM in current microstep sequence
Description:      Value of first OBSNUM in current microstep sequence

Parameter Name:   USTEP_I
Class:            ext-header
Context:    FITS
Type:       integer
Value Format:     %d
Unit:
Comment Format:   Serial number of microstep pattern
Description:      Serial number of microstep pattern

Parameter Name:   USTEP_X
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.3f
Unit:       arcsec
Comment Format:   X offset in microstep pattern
Description:      X offset in microstep is approximately aligned with RA
            and measured east along a great circle from the starting point.

Parameter Name:   USTEP_Y
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.3f
Unit:       arcsec
Comment Format:   Y offset in microstep pattern
Description:      X offset in microstep is approximately aligned North
            and measured along a great circle from the starting point.

Parameter Name:   INS.FILT1.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Filter identification device code
Description:      The Filter identification device code.

Parameter Name:   INS.FILT.NAME1
```

```
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Filter Name
Description:      VISTAIR only has one filter wheel and each filter only
            has one name.

Parameter Name:   INS.FILT1.NO
Class:            ext-header
Context:    FITS
Type:       integer
Value Format:     %d
Unit:       cardinal
Comment Format:   Filter wheel slot number
Description:      Filter wheel slot number

Parameter Name:   INS.FILT1.ENC
Class:            ext-header
Context:    FITS
Type:       integer
Value Format:     %d
Unit:       cardinal
Comment Format:   Filter wheel encoder position
Description:      Filter wheel encoder position

Parameter Name:   INS.PRES1.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of pressure sensor 1
Description:      Identification string for pressure sensor 1

Parameter Name:   INS.PRES1.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of pressure sensor 1
Description:      Name, or location, of pressure sensor 1

Parameter Name:   INS.PRES1.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %E
Unit:       pascals
Comment Format:   Pressure sensor 1 reading
Description:      Pressure sensor 1 reading in pascals.

Parameter Name:   INS.PRES2.NAME
Class:            ext-header
```

```
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of pressure sensor 2
Description:      Name, or location, of pressure sensor 2

Parameter Name:   INS.PRES2.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %E
Unit:       pascals
Comment Format:   Pressure sensor 2 reading
Description:      Pressure sensor 2 reading in pascals.

Parameter Name:   INS.PRES2.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of pressure sensor 2
Description:      Identification string for pressure sensor 1

Parameter Name:   INS.LAMP1.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Hardware identificaton of lamp bulb unit 1
Description:      Hardware identification of lamp bulb unit 1 (if any).

Parameter Name:   INS.LAMP1.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Name of lamp unit 1
Description:      Name of lamp unit 1 (if any).

Parameter Name:   INS.LAMP1.STATE
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Lamp 1 state on/off
Description:      Lamp 1 state, may be 'ON' or 'OFF'

Parameter Name:   INS.WHEEL.INPOS
Class:            ext-header
Context:    FITS
Type:       logical
```

```
Value Format:     %c
Unit:       bool
Comment Format:   filter in-position switch state
Description:      When a primary filter is in position, the in-position
switch should
            be closed.

Parameter Name:   INS.WHEEL.TIME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:       ISO date-time string
Comment Format:   Last filt wheel index cancel
Description:      The time that the filter-wheel mechanism last checked its
            (accurate) index mark.

Parameter Name:   INS.WHEEL.ERROR
Class:            ext-header
Context:    FITS
Type:       integer
Value Format:     %d
Unit:       steps
Comment Format:   Last fil wheel index error
Description:      The difference between the expected and the actual step
count
            last time the filter-wheel checked the index mark

Parameter Name:   INS.TEMP29.TARGET
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       degrees K
Comment Format:   Sensor 29 target
Description:      Temperature target for sensor 29 in degrees Kelvin.

Parameter Name:   INS.TEMP30.TARGET
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       degrees K
Comment Format:   Sensor 2 target
Description:      Temperature target for sensor 30 in degrees Kelvin.

Parameter Name:   INS.TEMP1.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 1
Description:      ID of temperature sensor 1

Parameter Name:   INS.TEMP1.NAME
```

```
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 1
Description:      Cryostat window cell

Parameter Name:   INS.TEMP1.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 1 reading
Description:      Temperature reading of sensor 1 in degrees Kelvin.

Parameter Name:   INS.TEMP2.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 2
Description:      ID of temperature sensor 2

Parameter Name:   INS.TEMP2.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 2
Description:      Ambient air temperature

Parameter Name:   INS.TEMP2.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 2 reading
Description:      Temperature reading of sensor 2 in degrees Kelvin.

Parameter Name:   INS.TEMP3.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 3
Description:      ID of temperature sensor 3

Parameter Name:   INS.TEMP3.NAME
Class:            ext-header
Context:    FITS
```

```
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 3
Description:      Baffle 7

Parameter Name:   INS.TEMP3.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 3 reading
Description:      Temperature reading of sensor 3 in degrees Kelvin.

Parameter Name:   INS.TEMP4.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 4
Description:      ID of temperature sensor 4

Parameter Name:   INS.TEMP4.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 4
Description:      Lens Barrel

Parameter Name:   INS.TEMP4.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 4 reading
Description:      Temperature reading of sensor 4 in degrees Kelvin.

Parameter Name:   INS.TEMP5.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 5
Description:      ID of temperature sensor 5

Parameter Name:   INS.TEMP5.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
```

```
Unit:
Comment Format:   Location of sensor 5
Description:      Liquid Nitrogen Tank

Parameter Name:   INS.TEMP5.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 5 reading
Description:      Temperature reading of sensor 5 in degrees Kelvin.

Parameter Name:   INS.TEMP6.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 6
Description:      ID of temperature sensor 6

Parameter Name:   INS.TEMP6.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 6
Description:      Cold head 1 1st stage

Parameter Name:   INS.TEMP6.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 6 reading
Description:      Temperature reading of sensor 6 in degrees Kelvin.

Parameter Name:   INS.TEMP7.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 7
Description:      ID of temperature sensor 7

Parameter Name:   INS.TEMP7.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 7
```

```
Description:      Cold head 1 2st stage

Parameter Name:   INS.TEMP7.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 7 reading
Description:      Temperature reading of sensor 7 in degrees Kelvin.

Parameter Name:   INS.TEMP8.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 8
Description:      ID of temperature sensor 8

Parameter Name:   INS.TEMP8.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 8
Description:      Cold head 2 1st stage

Parameter Name:   INS.TEMP8.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 8 reading
Description:      Temperature reading of sensor 8 in degrees Kelvin.

Parameter Name:   INS.TEMP9.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 9
Description:      ID of temperature sensor 9

Parameter Name:   INS.TEMP9.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 9
Description:      Cold head 2 2st stage
```

```
Parameter Name:   INS.TEMP9.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 9 reading
Description:      Temperature reading of sensor 9 in degrees Kelvin.

Parameter Name:   INS.TEMP10.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 10
Description:      ID of temperature sensor 10

Parameter Name:   INS.TEMP10.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 10
Description:      Cold head 3 1st stage

Parameter Name:   INS.TEMP10.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 10 reading
Description:      Temperature reading of sensor 10 in degrees Kelvin.

Parameter Name:   INS.TEMP11.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 11
Description:      ID of temperature sensor 11

Parameter Name:   INS.TEMP11.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 11
Description:      Cold head 3 2st stage

Parameter Name:   INS.TEMP11.VAL
Class:            ext-header
```

```
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 11 reading
Description:      Temperature reading of sensor 11 in degrees Kelvin.

Parameter Name:   INS.TEMP12.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 12
Description:      ID of temperature sensor 12

Parameter Name:   INS.TEMP12.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 12
Description:      Cryopump 1

Parameter Name:   INS.TEMP12.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 12 reading
Description:      Temperature reading of sensor 12 in degrees Kelvin.

Parameter Name:   INS.TEMP13.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 13
Description:      ID of temperature sensor 13

Parameter Name:   INS.TEMP13.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 13
Description:      Cryopump 2

Parameter Name:   INS.TEMP13.VAL
Class:            ext-header
Context:    FITS
Type:       double
```

```
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 13 reading
Description:      Temperature reading of sensor 13 in degrees Kelvin.

Parameter Name:   INS.TEMP14.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 14
Description:      ID of temperature sensor 14

Parameter Name:   INS.TEMP14.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 14
Description:      WFS Plate

Parameter Name:   INS.TEMP14.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 14 reading
Description:      Temperature reading of sensor 14 in degrees Kelvin.

Parameter Name:   INS.TEMP15.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 15
Description:      ID of temperature sensor 15

Parameter Name:   INS.TEMP15.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 15
Description:      WFS CCD 1

Parameter Name:   INS.TEMP15.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
```

```
Comment Format:   Temperature sensor 15 reading
Description:      Temperature reading of sensor 15 in degrees Kelvin.

Parameter Name:   INS.TEMP16.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 16
Description:      ID of temperature sensor 16

Parameter Name:   INS.TEMP16.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 16
Description:      WFS CCD 2

Parameter Name:   INS.TEMP16.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 16 reading
Description:      Temperature reading of sensor 16 in degrees Kelvin.

Parameter Name:   INS.TEMP17.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 17
Description:      ID of temperature sensor 17

Parameter Name:   INS.TEMP17.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 17
Description:      WFS CCD 3

Parameter Name:   INS.TEMP17.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 17 reading
Description:      Temperature reading of sensor 17 in degrees Kelvin.
```

```
Parameter Name:   INS.TEMP18.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 18
Description:      ID of temperature sensor 18

Parameter Name:   INS.TEMP18.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 18
Description:      WFS CCD 4

Parameter Name:   INS.TEMP18.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 18 reading
Description:      Temperature reading of sensor 18 in degrees Kelvin.

Parameter Name:   INS.TEMP19.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 19
Description:      ID of temperature sensor 19

Parameter Name:   INS.TEMP19.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 19
Description:      Filter wheel shield

Parameter Name:   INS.TEMP19.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 19 reading
Description:      Temperature reading of sensor 19 in degrees Kelvin.

Parameter Name:   INS.TEMP20.ID
```

```
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 20
Description:      ID of temperature sensor 20

Parameter Name:   INS.TEMP20.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 20
Description:      Filter wheel hub

Parameter Name:   INS.TEMP20.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 20 reading
Description:      Temperature reading of sensor 20 in degrees Kelvin.

Parameter Name:   INS.TEMP21.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 21
Description:      ID of temperature sensor 21

Parameter Name:   INS.TEMP21.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 21
Description:      Science detector 1

Parameter Name:   INS.TEMP21.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 21 reading
Description:      Temperature reading of sensor 21 in degrees Kelvin.

Parameter Name:   INS.TEMP22.ID
Class:            ext-header
Context:    FITS
```

```
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 22
Description:      ID of temperature sensor 22

Parameter Name:   INS.TEMP22.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 22
Description:      Science detector 2

Parameter Name:   INS.TEMP22.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 22 reading
Description:      Temperature reading of sensor 22 in degrees Kelvin.

Parameter Name:   INS.TEMP23.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 23
Description:      ID of temperature sensor 23

Parameter Name:   INS.TEMP23.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 23
Description:      Science detector 3

Parameter Name:   INS.TEMP23.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 23 reading
Description:      Temperature reading of sensor 23 in degrees Kelvin.

Parameter Name:   INS.TEMP24.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
```

```
Unit:
Comment Format:   ID of sensor 24
Description:      ID of temperature sensor 24

Parameter Name:   INS.TEMP24.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 24
Description:      Science detector 4

Parameter Name:   INS.TEMP24.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 24 reading
Description:      Temperature reading of sensor 24 in degrees Kelvin.

Parameter Name:   INS.TEMP25.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 25
Description:      ID of temperature sensor 25

Parameter Name:   INS.TEMP25.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 25
Description:      Science detector 5

Parameter Name:   INS.TEMP25.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 25 reading
Description:      Temperature reading of sensor 25 in degrees Kelvin.

Parameter Name:   INS.TEMP26.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 26
```

```
Description:      ID of temperature sensor 26

Parameter Name:   INS.TEMP26.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 26
Description:      Science detector 6

Parameter Name:   INS.TEMP26.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 26 reading
Description:      Temperature reading of sensor 26 in degrees Kelvin.

Parameter Name:   INS.TEMP27.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 27
Description:      ID of temperature sensor 27

Parameter Name:   INS.TEMP27.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 27
Description:      Science detector 7

Parameter Name:   INS.TEMP27.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 27 reading
Description:      Temperature reading of sensor 27 in degrees Kelvin.

Parameter Name:   INS.TEMP28.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 28
Description:      ID of temperature sensor 28
```

```
Parameter Name:   INS.TEMP28.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 28
Description:      Science detector 8

Parameter Name:   INS.TEMP28.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 28 reading
Description:      Temperature reading of sensor 28 in degrees Kelvin.

Parameter Name:   INS.TEMP29.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 29
Description:      ID of temperature sensor 29

Parameter Name:   INS.TEMP29.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 29
Description:      FPA thermal plate (actual)

Parameter Name:   INS.TEMP29.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 29 reading
Description:      Temperature reading of sensor 29 in degrees Kelvin.

Parameter Name:   INS.TEMP30.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 30
Description:      ID of temperature sensor 30

Parameter Name:   INS.TEMP30.NAME
Class:            ext-header
```

```
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 30
Description:      Cryostat tube outside (actual)

Parameter Name:   INS.TEMP30.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 30 reading
Description:      Temperature reading of sensor 30 in degrees Kelvin.

Parameter Name:   INS.TEMP31.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 31
Description:      ID of temperature sensor 31

Parameter Name:   INS.TEMP31.NAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Location of sensor 31
Description:      undecided temperature sensor

Parameter Name:   INS.TEMP31.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 31 reading
Description:      Temperature reading of sensor 31 in degrees Kelvin.

Parameter Name:   INS.TEMP32.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   ID of sensor 32
Description:      ID of temperature sensor 32

Parameter Name:   INS.TEMP32.NAME
Class:            ext-header
Context:    FITS
Type:       string
```

```
Value Format:     %s
Unit:
Comment Format:   Location of sensor 32
Description:      undecided temperature sensor

Parameter Name:   INS.TEMP32.VAL
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       K
Comment Format:   Temperature sensor 32 reading
Description:      Temperature reading of sensor 32 in degrees Kelvin.

Parameter Name:   END
Class:            ext-header
Context:    FITS
Type:
Value Format:
Unit:
Comment Format:
Description:      This keyword signals the end of the header unit. It
            has to be last keyword in the header and has no value
            associated with it.
            Columns 9 to 80 shall be filled with ASCII blanks.

Parameter Name:   XTENSION
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Extension first keyword
Description:      Standard FITS first keyword in an extension header.

Parameter Name:   NAXIS
Class:            ext-header
Context:    FITS
Type:       integer
Value Format:     %d
Unit:       cardinal
Comment Format:   number of axes of data array
Description:      VISTA data stored in multi-extension FITS, hence NAXIS=0
in
            primary header, NAXIS=2 in extension headers.

Parameter Name:   NAXIS1
Class:            ext-header
Context:    FITS
Type:       integer
Value Format:     %d
Unit:       pixels
Comment Format:   Size of first axis
Description:      Standard FITS size of first axis

Parameter Name:   NAXIS2
```

```
Class:            ext-header
Context:    FITS
Type:       integer
Value Format:     %d
Unit:       pixels
Comment Format:   Size of second axis
Description:      Standard FITS size of second axis

Parameter Name:   BITPIX
Class:            ext-header
Context:    FITS
Type:       integer
Value Format:     %d
Unit:
Comment Format:   number of bits per pixel value
Description:      Number of bits used to store pixel values
            Standard values are defined in NOST-100.0
            The value for VISTA IR will be
            32 32-bit twos-complement binary integer
            Value used to specify the undefined pixel values.

Parameter Name:   EXTNAME
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   FITS extension name
Description:      Used to distinguish different extensions of the same
            type in the FITS file.

Parameter Name:   INHERIT
Class:            ext-header
Context:    FITS
Type:       logical
Value Format:     %c
Unit:       truth
Comment Format:   Extension inherits primary header
Description:      Inheritance massively cuts down on extension-header size
            by removing unecessary multiplication of header records.

Parameter Name:   DET_LIVE
Class:            ext-header
Context:    FITS
Type:       logical
Value Format:     %c
Unit:       boolean
Comment Format:   This detector is alive
Description:      A broken detector outputs its data anyway, this keyword
            flags the fact it is useless.

Parameter Name:   RADECSYS
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
```

```
Unit:
Comment Format:   Name of celestial reference frame
Description:      Standard reference-frame name, will normally be 'ICRS'.
            Note, this implies the EQUINOX keyword is absent.

Parameter Name:   EQUINOX
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.1f
Unit:       Year
Comment Format:   Equinox of celestial reference frame.
Description:      Equinox of reference frame, required for precessed
reference
            frames, but obsolete for International Coordinate Reference
            System.

Parameter Name:   CTYPE1
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Type of celestial axis 1
Description:      WCS first coordinate type, will be 'RA---ZPN' for VISTA
            optical projection.

Parameter Name:   CTYPE2
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %s
Unit:
Comment Format:   Type of celestial axis 2
Description:      WCS first coordinate type, will be 'DEC--ZPN' for VISTA
            optical projection.

Parameter Name:   CRPIX1
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       pixel
Comment Format:   Pixel coordinate of reference in axis 1
Description:      Position in pixel space along image-frame axis 1, in
            theory would be refer to the optical centre, but for
            practical reasons will be the rotator centre.

Parameter Name:   CRPIX2
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       pixel
Comment Format:   Pixel coordinate of reference in axis 2
Description:      Position in pixel space along image-frame axis 2, in
```

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            theory would be refer to the optical centre, but for
            practical reasons will be the rotator centre.

Parameter Name:   CRVAL1
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.12f
Unit:       degree
Comment Format:   RA of reference point
Description:      Right Ascension of reference point, will be referred to
            the rotation centre.

Parameter Name:   CRVAL2
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.12f
Unit:       degree
Comment Format:   Dec of reference point
Description:      Declination of reference point, will be referred to
            the rotation centre.

Parameter Name:   CD1_1
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %12E
Unit:
Comment Format:   Transformation matrix element
Description:      Near unit-matrix used for rotation and shear.

Parameter Name:   CD1_2
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %12E
Unit:
Comment Format:   Transformation matrix element
Description:      Near unit-matrix used for rotation and shear.

Parameter Name:   CD2_1
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %12E
Unit:
Comment Format:   Transformation matrix element
Description:      Near unit-matrix used for rotation and shear.

Parameter Name:   CD2_2
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %12E
Unit:
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Comment Format:   Transformation matrix element
Description:      Near unit-matrix used for rotation and shear.

Parameter Name:   PV2_1
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %12E
Unit:       dimensionless
Comment Format:   linear term in ZPN
Description:      The Zenithal Polynomial (ZPN) projection requires PVi_j
            attached to the latitude coordinate (2). All default to
            zero so need PV2_1 = 1.0

Parameter Name:   PV2_2
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %12E
Unit:       dimensionless
Comment Format:   quadratic term in ZPN
Description:      The Zenithal Polynomial (ZPN) projection requires PVi_j
            attached to the latitude coordinate (2). All default to
            zero so probably won't need PV2_2 = 1.0

Parameter Name:   PV2_3
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %12E
Unit:       dimensionless
Comment Format:   cubic term in ZPN
Description:      The ZPN projection requires PVi_j attached to the
latitude
            coordinate (2). PV2_3 is the cubic term (arising from
            the wide-field corrector).

Parameter Name:   PV2_4
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %12E
Unit:       dimensionless
Comment Format:   forth-order term in ZPN
Description:      The Zenithal Polynomial (ZPN) projection requires PVi_j
            attached to the latitude coordinate (2). All default to
            zero so probably won't need PV2_4.

Parameter Name:   PV2_5
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %12E
Unit:       dimensionless
Comment Format:   fifth-order term in ZPN
Description:      The Zenithal Polynomial (ZPN) projection requires PVi_j
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            attached to the latitude coordinate (2). All default to
            zero so probably won't need PV2_5.

Parameter Name:   TEL.FOCU.LEN
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.3f
Unit:       m
Comment Format:   Focal length (m)
Description:

Parameter Name:   TEL.FOCU.SCALE
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.3f
Unit:       arcsec/m
Comment Format:   Focal scale (arcsec/mm)
Description:

Parameter Name:   TEL.FOCU.VALUE
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.3f
Unit:       mm
Comment Format:   M2 setting (mm)
Description:

Parameter Name:   TEL.PARANG.END
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.3f
Unit:       deg
Comment Format:   Parallactic angle at end (deg)
Description:

Parameter Name:   TEL.PARANG.START
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.3f
Unit:       deg
Comment Format:   Parallactic angle at start (deg)
Description:

Parameter Name:   TEL.AIRM.END
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.3f
Unit:
Comment Format:   Airmass at end
Description:
```

```
Parameter Name:   TEL.AIRM.START
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.3f
Unit:
Comment Format:   Airmass at start
Description:

Parameter Name:   TEL.TRAK.STATUS
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %10s
Unit:
Comment Format:   Tracking status
Description:

Parameter Name:   TEL.TRAK.RATEA
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.6f
Unit:       arcsec/sec
Comment Format:   Tracking rate in RA (arcsec/sec)
Description:

Parameter Name:   TEL.TRAK.RATED
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.6f
Unit:       arcsec/sec
Comment Format:   Tracking rate in DEC (arcsec/sec)
Description:

Parameter Name:   TEL.DOME.STATUS
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %10s
Unit:
Comment Format:   Dome status
Description:

Parameter Name:   ADA.GUID.STATUS
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %10s
Unit:
Comment Format:   Status of autoguider
Description:

Parameter Name:   ADA.GUID.RA
```

```
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.6f
Unit:       deg
Comment Format:   %HOURANG Guide star RA J2000
Description:

Parameter Name:   ADA.GUID.DEC
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.5f
Unit:       deg
Comment Format:   %DEGREE Guide star DEC J2000
Description:

Parameter Name:   ADA.POSANG
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.5f
Unit:       deg
Comment Format:   Position angle at start
Description:
            Position angle of the adapter on the sky at
            exposure start. This angle, often called adapter offset,
            is measured counter clockwise (N=0, E=90)

Parameter Name:   ADA.ABSROT.START
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.5f
Unit:       deg
Comment Format:   Abs rot angle at exp start (deg)
Description:
            Absolute rotator angle of rotator at exposure
            start. The reference frame is given in
            VLT-SPE-ESO-11400-0798

Parameter Name:   TEL.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %30s
Unit:
Comment Format:   TCS version number
Description:
            cmm version number of the integration module
            (tcsBUILD/ntt), which defines the version of all
            TCS modules.

Parameter Name:   TEL.DID
Class:            ext-header
Context:    FITS
```

```
Type:       string
Value Format:     %30s
Unit:
Comment Format:   Data dictionary for TEL
Description:

Parameter Name:   TEL.DATE
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %10s
Unit:
Comment Format:   TCS installation date
Description:
            Date when installation script was executed

Parameter Name:   ADA.ABSROT.END
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.5f
Unit:       deg
Comment Format:   Abs rot angle at exp end (deg)
Description:
            Absolute rotator angle of rotator at exposure
            end. The reference frame is given in
            VLT-SPE-ESO-11400-0798

Parameter Name:   ADA.ABSROT.PPOS
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %.5s
Unit:
Comment Format:   sign of probe position
Description:
            sign of probe position (POS, NEG)

Parameter Name:   ADA.WFS1.RA
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.6f
Unit:       degree
Comment Format:   RA of WFS star 1
Description:      The RA of the star used on the first wave-front sensor.

Parameter Name:   ADA.WFS1.DEC
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.6f
Unit:       degree
Comment Format:   Dec of WFS star 1
Description:      The Declination of the star used on the first wave-front
sensor.
```

```
Parameter Name:   ADA.WFS2.RA
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.6f
Unit:       degree
Comment Format:   RA of WFS star 2
Description:      The RA of the star used on the first wave-front sensor.

Parameter Name:   ADA.WFS2.DEC
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.6f
Unit:       degree
Comment Format:   Dec of WFS star 2
Description:      The Declination of the star used on the first wave-front
sensor.

Parameter Name:   TEL.ALT
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.3f
Unit:       deg
Comment Format:   Alt angle at start (deg)
Description:

Parameter Name:   TEL.AZ
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.3f
Unit:       deg
Comment Format:   Az angle at start (deg) S=0,W=90
Description:

Parameter Name:   TEL.GEOELEV
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.0f
Unit:       m
Comment Format:   Elevation above sea level (m)
Description:

Parameter Name:   TEL.GEOLAT
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.4f
Unit:       deg.
Comment Format:   Tel geo latitute (+=North) (deg)
Description:
```

```
Parameter Name:   TEL.GEOLON
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.4f
Unit:       deg.
Comment Format:   Tel geo longitude (+=East) (deg)
Description:

Parameter Name:   TEL.OPER
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %30s
Unit:
Comment Format:   Telescope Operator
Description:

Parameter Name:   TEL.FOCU.ID
Class:            ext-header
Context:    FITS
Type:       string
Value Format:     %10s
Unit:
Comment Format:   Telescope focus station ID
Description:

Parameter Name:   TEL.TH.M1.TEMP
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       C
Comment Format:   M1 superficial temperature
Description:
            (th)

Parameter Name:   TEL.MOON.RA
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.6f
Unit:       deg
Comment Format:   %HOURANG RA (J2000) (deg)
Description:
            Coordinates are given in J2000 mean places and reflect the
            actual moon position at the time of exposure start

Parameter Name:   TEL.AMBI.FWHM.START
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       arcsec
Comment Format:   Observatory Seeing queried from ASM
Description:
```

```
            Site seeing at start as queried periodically from the ASM,
            full width half maximum at 0.5 um wavelength.

Parameter Name:   TEL.AMBI.FWHM.END
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       arcsec
Comment Format:   Observatory Seeing queried from ASM
Description:
            Site seeing at end as queried periodically from the ASM,
            full width half maximum at 0.5 um wavelength.

Parameter Name:   TEL.AMBI.TEMP
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       C
Comment Format:   Observatory ambient temperature queried from ASM
Description:
            Average site ambient temperature,
            as queried periodically from the ASM.

Parameter Name:   TEL.AMBI.RHUM
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.f
Unit:       percent
Comment Format:   Observatory ambient relative humidity queried from ASM
Description:
            Average site ambient relative humidity
            as queried periodically from the ASM.

Parameter Name:   TEL.AMBI.WINDDIR
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.f
Unit:       deg
Comment Format:   Observatory ambient wind direction queried from ASM (N=0
E=90)
Description:
            Average site ambient wind direction
            as queried periodically from the ASM.

Parameter Name:   TEL.AMBI.WINDSP
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.2f
Unit:       m/s
Comment Format:   Observatory ambient wind speed queried from ASM
Description:
```

```
            Average site ambient wind speed measured
            as queried periodically from the ASM.

Parameter Name:   TEL.MOON.DEC
Class:            ext-header
Context:    FITS
Type:       double
Value Format:     %.5f
Unit:       deg
Comment Format:   %DEGREE DEC (J2000) (deg)
Description:
            Coordinates are given in J2000 mean places and reflect the
            actual moon position at the time of exposure start
```

4 Example FITS header -- VISTA.FITS

It may be useful to be able to look at the following example FITS file which is constructed using the keywords above.

Filename VISTA.FITS

```
SIMPLE  =                    T / Standard FITS (NOST-100-2.0)
NAXIS   =                    0 / number of axes of data array
BITPIX  =                    8 / number of bits per pixel value
EXTEND  =                    T / FITS file extension may be present
RA      =           123.123457 / 00:00:00.123 RA of telescope
DEC     =           -12.123457 / -00:00:00.12 Dec of telescope
RADECSYS= 'ICRS    '           / Name of celestial reference frame
EQUINOX =               2000.0 / Equinox of celestial reference frame.
ORIGIN  = 'ESO     '           / European Southern Observatory
TELESCOP= 'ESO-VISTA'          / ESO <TEL>
INSTRUME= 'VIRCAM  '           / Instrument used
OBJECT  = 'Sirius  '           / Target description
IMAGETYP= 'OBJECT  '           / Exposure type
AIRMASS =              1.12346 / Averaged airmass
DATE    = '2003-11-13T16:31:06.000' / Date this file was written
DATE-OBS= '2004-12-25T09:00:00.123' / UTC date at start of exposure.
UTC     =            86399.123 / 00:00:00.123 UTC s at start since midnight
REQTIME =                5.000 / Requested integration time
EXPTIME =                5.123 / Actual integration time
LST     =            80000.123 / 00:00:00.123 LST seconds since midnight
MJD-OBS =       54321.12345678 / Modified Julian Date at start
OBSERVER= 'P Bunclark'         / Name of observer
PI-COI  = 'J Lewis '           / Name(s) of proposer(s)
COMMENT General comment
HISTORY Historical Fact
ESO-LOG
ORIGFILE= 'VIS_Ima.1.fits'     / Original File Name
ARCFILE = '/dev/null                                ' / Archive File name
CHECKSUM= 'Pd3jPc3hPc3h'       / ASCII 1s-complement checksum
RECIPE  = 'QUICK_LOOK'         / Data-reduction recipe to be used
OFFSTNUM=                 1234 / Value of first OBSNUM in current tile
sequence
OBSNUM  =             12345678 / Observation Number
```

```
GRPNUM  =                  666 / Group number applied to all members
GRPMEM  =                    T / Group membership
STANDARD=                    F / Standard-star observation
NOFFSETS=                    6 / Number of offset positions in a field
OFFSET_I=                    2 / Serial Number of offset
NDITHER =                    6 / Number of positions in a tel dither
pattern
DITHRNUM=                 1236 / Value of first OBSNUM in current dither
sequenc
DITHER_I=                    3 / Serial number of this tel dither pattern
DITHER_X=                3.330 / X offset in dither pattern
DITHER_Y=                0.000 / Y offset in dither pattern
NUSTEP  =                    4 / Number of positions in microstep pattern
USTEPNUM=                 1237 / Value of first OBSNUM in current microstep
sequ
USTEP_I =                    1 / Serial number of microstep pattern
USTEP_X =                1.123 / X offset in microstep pattern
USTEP_Y =                1.123 / Y offset in microstep pattern
HIERARC ESO INS FILT1 ID       = 'J       '    / Filter identification
device co
HIERARC ESO INS FILT NAME1     = 'VIS#J/04_ESO843' / Filter Name
HIERARC ESO INS FILT1 NO       =            2  / Filter wheel slot number
HIERARC ESO INS FILT1 ENC      =         1234  / Filter wheel encoder
position
HIERARC ESO INS PRES1 ID       = 'P1      '    / ID of pressure sensor 1
HIERARC ESO INS PRES1 NAME     = 'Cryostat'    / Location of pressure
sensor 1
HIERARC ESO INS PRES1 VAL      = 1.000000E-04  / Pressure sensor 1 reading
HIERARC ESO INS PRES2 NAME     = 'Ambient '    / Location of pressure
sensor 2
HIERARC ESO INS PRES2 VAL      = 1.000100E+00  / Pressure sensor 2 reading
HIERARC ESO INS PRES2 ID       = 'P2      '    / ID of pressure sensor 2
HIERARC ESO INS LAMP1 ID       = 'L1      '    / Hardware identificaton of
lamp
HIERARC ESO INS LAMP1 NAME     = 'Bluebell'    / Name of lamp unit 1
HIERARC ESO INS LAMP1 STATE    = 'OFF     '    / Lamp 1 state on/off
HIERARC ESO INS WHEEL INPOS    =            T  / filter in-position switch
state
HIERARC ESO INS WHEEL TIME     = '2006-03-05T16:17:18.123' / Last filt
wheel ind
HIERARC ESO INS WHEEL ERROR    =           -6  / Last fil wheel index error
HIERARC ESO INS TEMP29 TARGET  =       160.00  / Sensor 29 target
HIERARC ESO INS TEMP30 TARGET  =       160.00  / Sensor 2 target
HIERARC ESO INS TEMP1 ID       = 'ID1     '    / ID of sensor 1
HIERARC ESO INS TEMP1 NAME     = 'Cryostat window cell ' / Location of
sensor 1
HIERARC ESO INS TEMP1 VAL      =       260.10  / Temperature sensor 1
reading
HIERARC ESO INS TEMP2 ID       = 'ID2     '    / ID of sensor 2
HIERARC ESO INS TEMP2 NAME     = 'Ambient air temperature ' / Location of
sensor
HIERARC ESO INS TEMP2 VAL      =       260.10  / Temperature sensor 2
reading
HIERARC ESO INS TEMP3 ID       = 'ID3     '    / ID of sensor 3
HIERARC ESO INS TEMP3 NAME     = 'Baffle 7 '   / Location of sensor 3
```

```
HIERARC ESO INS TEMP3 VAL      =       260.10  / Temperature sensor 3
reading
HIERARC ESO INS TEMP4 ID       = 'ID4     '    / ID of sensor 4
HIERARC ESO INS TEMP4 NAME     = 'Lens Barrel ' / Location of sensor 4
HIERARC ESO INS TEMP4 VAL      =       260.10  / Temperature sensor 4
reading
HIERARC ESO INS TEMP5 ID       = 'ID5     '    / ID of sensor 5
HIERARC ESO INS TEMP5 NAME     = 'Liquid Nitrogen Tank ' / Location of
sensor 5
HIERARC ESO INS TEMP5 VAL      =       260.10  / Temperature sensor 5
reading
HIERARC ESO INS TEMP6 ID       = 'ID6     '    / ID of sensor 6
HIERARC ESO INS TEMP6 NAME     = 'Cold head 1 1st stage ' / Location of
sensor 6
HIERARC ESO INS TEMP6 VAL      =       260.10  / Temperature sensor 6
reading
HIERARC ESO INS TEMP7 ID       = 'ID7     '    / ID of sensor 7
HIERARC ESO INS TEMP7 NAME     = 'Cold head 1 2st stage ' / Location of
sensor 7
HIERARC ESO INS TEMP7 VAL      =       260.10  / Temperature sensor 7
reading
HIERARC ESO INS TEMP8 ID       = 'ID8     '    / ID of sensor 8
HIERARC ESO INS TEMP8 NAME     = 'Cold head 2 1st stage ' / Location of
sensor 8
HIERARC ESO INS TEMP8 VAL      =       260.10  / Temperature sensor 8
reading
HIERARC ESO INS TEMP9 ID       = 'ID9     '    / ID of sensor 9
HIERARC ESO INS TEMP9 NAME     = 'Cold head 2 2st stage ' / Location of
sensor 9
HIERARC ESO INS TEMP9 VAL      =       260.10  / Temperature sensor 9
reading
HIERARC ESO INS TEMP10 ID      = 'ID10    '    / ID of sensor 10
HIERARC ESO INS TEMP10 NAME    = 'Cold head 3 1st stage ' / Location of
sensor 1
HIERARC ESO INS TEMP10 VAL     =       260.10  / Temperature sensor 10
reading
HIERARC ESO INS TEMP11 ID      = 'ID11    '    / ID of sensor 11
HIERARC ESO INS TEMP11 NAME    = 'Cold head 3 2st stage ' / Location of
sensor 1
HIERARC ESO INS TEMP11 VAL     =       260.10  / Temperature sensor 11
reading
HIERARC ESO INS TEMP12 ID      = 'ID12    '    / ID of sensor 12
HIERARC ESO INS TEMP12 NAME    = 'Cryopump 1 ' / Location of sensor 12
HIERARC ESO INS TEMP12 VAL     =       260.10  / Temperature sensor 12
reading
HIERARC ESO INS TEMP13 ID      = 'ID13    '    / ID of sensor 13
HIERARC ESO INS TEMP13 NAME    = 'Cryopump 2 ' / Location of sensor 13
HIERARC ESO INS TEMP13 VAL     =       260.10  / Temperature sensor 13
reading
HIERARC ESO INS TEMP14 ID      = 'ID14    '    / ID of sensor 14
HIERARC ESO INS TEMP14 NAME    = 'WFS Plate '  / Location of sensor 14
HIERARC ESO INS TEMP14 VAL     =       260.10  / Temperature sensor 14
reading
HIERARC ESO INS TEMP15 ID      = 'ID15    '    / ID of sensor 15
HIERARC ESO INS TEMP15 NAME    = 'WFS CCD 1 '  / Location of sensor 15
```

```
HIERARC ESO INS TEMP15 VAL     =       260.10  / Temperature sensor 15
reading
HIERARC ESO INS TEMP16 ID      = 'ID16    '    / ID of sensor 16
HIERARC ESO INS TEMP16 NAME    = 'WFS CCD 2 '  / Location of sensor 16
HIERARC ESO INS TEMP16 VAL     =       260.10  / Temperature sensor 16
reading
HIERARC ESO INS TEMP17 ID      = 'ID17    '    / ID of sensor 17
HIERARC ESO INS TEMP17 NAME    = 'WFS CCD 3 '  / Location of sensor 17
HIERARC ESO INS TEMP17 VAL     =       260.10  / Temperature sensor 17
reading
HIERARC ESO INS TEMP18 ID      = 'ID18    '    / ID of sensor 18
HIERARC ESO INS TEMP18 NAME    = 'WFS CCD 4 '  / Location of sensor 18
HIERARC ESO INS TEMP18 VAL     =       260.10  / Temperature sensor 18
reading
HIERARC ESO INS TEMP19 ID      = 'ID19    '    / ID of sensor 19
HIERARC ESO INS TEMP19 NAME    = 'Filter wheel shield ' / Location of
sensor 19
HIERARC ESO INS TEMP19 VAL     =       260.10  / Temperature sensor 19
reading
HIERARC ESO INS TEMP20 ID      = 'ID20    '    / ID of sensor 20
HIERARC ESO INS TEMP20 NAME    = 'Filter wheel hub ' / Location of sensor
20
HIERARC ESO INS TEMP20 VAL     =       260.10  / Temperature sensor 20
reading
HIERARC ESO INS TEMP21 ID      = 'ID21    '    / ID of sensor 21
HIERARC ESO INS TEMP21 NAME    = 'Science detector 1 ' / Location of sensor
21
HIERARC ESO INS TEMP21 VAL     =       260.10  / Temperature sensor 21
reading
HIERARC ESO INS TEMP22 ID      = 'ID22    '    / ID of sensor 22
HIERARC ESO INS TEMP22 NAME    = 'Science detector 2 ' / Location of sensor
22
HIERARC ESO INS TEMP22 VAL     =       260.10  / Temperature sensor 22
reading
HIERARC ESO INS TEMP23 ID      = 'ID23    '    / ID of sensor 23
HIERARC ESO INS TEMP23 NAME    = 'Science detector 3 ' / Location of sensor
23
HIERARC ESO INS TEMP23 VAL     =       260.10  / Temperature sensor 23
reading
HIERARC ESO INS TEMP24 ID      = 'ID24    '    / ID of sensor 24
HIERARC ESO INS TEMP24 NAME    = 'Science detector 4 ' / Location of sensor
24
HIERARC ESO INS TEMP24 VAL     =       260.10  / Temperature sensor 24
reading
HIERARC ESO INS TEMP25 ID      = 'ID25    '    / ID of sensor 25
HIERARC ESO INS TEMP25 NAME    = 'Science detector 5 ' / Location of sensor
25
HIERARC ESO INS TEMP25 VAL     =       260.10  / Temperature sensor 25
reading
HIERARC ESO INS TEMP26 ID      = 'ID26    '    / ID of sensor 26
HIERARC ESO INS TEMP26 NAME    = 'Science detector 6 ' / Location of sensor
26
HIERARC ESO INS TEMP26 VAL     =       260.10  / Temperature sensor 26
reading
HIERARC ESO INS TEMP27 ID      = 'ID27    '    / ID of sensor 27
```

```
HIERARC ESO INS TEMP27 NAME    = 'Science detector 7 ' / Location of sensor
27
HIERARC ESO INS TEMP27 VAL     =       260.10  / Temperature sensor 27
reading
HIERARC ESO INS TEMP28 ID      = 'ID28    '    / ID of sensor 28
HIERARC ESO INS TEMP28 NAME    = 'Science detector 8 ' / Location of sensor
28
HIERARC ESO INS TEMP28 VAL     =       260.10  / Temperature sensor 28
reading
HIERARC ESO INS TEMP29 ID      = 'ID29    '    / ID of sensor 29
HIERARC ESO INS TEMP29 NAME    = 'FPA thermal plate (actual) ' / Location
of sen
HIERARC ESO INS TEMP29 VAL     =       260.10  / Temperature sensor 29
reading
HIERARC ESO INS TEMP30 ID      = 'ID30    '    / ID of sensor 30
HIERARC ESO INS TEMP30 NAME    = 'Cryostat tube outside (actual) ' /
Location of
HIERARC ESO INS TEMP30 VAL     =       260.10  / Temperature sensor 30
reading
HIERARC ESO INS TEMP31 ID      = 'ID31    '    / ID of sensor 31
HIERARC ESO INS TEMP31 NAME    = 'undecided temperature sensor ' / Location
of s
HIERARC ESO INS TEMP31 VAL     =       260.10  / Temperature sensor 31
reading
HIERARC ESO INS TEMP32 ID      = 'ID32    '    / ID of sensor 32
HIERARC ESO INS TEMP32 NAME    = 'undecided temperature sensor ' / Location
of s
HIERARC ESO INS TEMP32 VAL     =       260.10  / Temperature sensor 32
reading
HIERARC ESO OBS DID         = 'ESO-VLT-DIC.OBS' / OBS Dictionary
HIERARC ESO OBS ID          =             666 / Observation block ID
HIERARC ESO OBS NAME        = 'DITHER                         ' / OB name
HIERARC ESO OBS GRP         = 'ABCD    '       / linked blocks
HIERARC ESO OBS OBSERVER    = 'Bunclark                       ' / Observer
Name
HIERARC ESO OBS PI-COI ID   =             162 / ESO internal PI-COI ID
HIERARC ESO OBS PI-COI NAME = 'Lewis                          ' / PI-COI
name
HIERARC ESO OBS PROG ID     = '68.A-0281(A)        ' / ESO program
identificatio
HIERARC ESO OBS TPLNO       =               2 / Template number within OB
HIERARC ESO OBS TARG NAME   = 'South Pole                     ' / OB
target nam
HIERARC ESO OBS START       = '2006-03-05T07:20:00.123' / OB start time
HIERARC ESO OBS EXECTIME    =               0 / Expected execution time
HIERARC ESO TPL PRESEQ      = 'VIS_img_obs_Dither.seq' / Sequencer script
HIERARC ESO TPL START       = '2006-03-05T07:20:00.123' / TPL start time
HIERARC ESO TPL DID         = 'ESO-VLT-DIC.TPL-1.9           ' / Data
dictionary
HIERARC ESO TPL ID          = 'VIS_img_obs_Dither
'
HIERARC ESO TPL NAME        = 'VIS Dithered mode sequence
'
HIERARC ESO TPL NEXP        =               6 / Number of exposures within
temp
```

```
HIERARC ESO TPL EXPNO       =                2 / Exposure number within
template
HIERARC ESO TPL VERSION     = '1.1     '       / Version of the template
HIERARC ESO DPR DID         = 'ESO-VLT-DIC.DPR-1.8' / DPR Dictionary
HIERARC ESO DPR CATG        = 'SCIENCE                        ' /
Observation cat
HIERARC ESO DPR TYPE        = 'OBJECT                         ' /
Observation typ
HIERARC ESO DPR TECH        = 'IMAGE                          ' /
Observation tec
HIERARC ESO TEL FOCU LEN       =        4.120  / Focal length (m)
HIERARC ESO TEL FOCU SCALE     =       24.000  / Focal scale (arcsec/mm)
HIERARC ESO TEL FOCU VALUE     =    12345.120  / M2 setting (mm)
HIERARC ESO TEL PARANG END     =       45.000  / Parallactic angle at end
(deg)
HIERARC ESO TEL PARANG START   =       47.000  / Parallactic angle at start
(deg
HIERARC ESO TEL AIRM END       =        1.001  / Airmass at end
HIERARC ESO TEL AIRM START     =        1.002  / Airmass at start
HIERARC ESO TEL TRAK STATUS    = 'ON        '  / Tracking status
HIERARC ESO TEL TRAK RATEA     =     0.000000  / Tracking rate in RA
(arcsec/sec
HIERARC ESO TEL TRAK RATED     =     0.000000  / Tracking rate in DEC
(arcsec/se
HIERARC ESO TEL DOME STATUS    = 'FULLY-OPEN'  / Dome status
HIERARC ESO ADA GUID STATUS    = 'ON        '  / Status of autoguider
HIERARC ESO ADA GUID RA        =   180.000000  / 00:00:00.123 Guide star RA
J200
HIERARC ESO ADA GUID DEC       =    -45.00000  / %DEGREE Guide star DEC
J2000
HIERARC ESO ADA POSANG         =     33.00000  / Position angle at start
HIERARC ESO ADA ABSROT START   =      2.00000  / Abs rot angle at exp start
(deg
HIERARC ESO TEL ID             = 'v 3.45                       ' / TCS
version
HIERARC ESO TEL DID            = 'ESO-VLT-DIC.TCS-1.33         ' / Data
diction
HIERARC ESO TEL DATE           = '2006-05-03'  / TCS installation date
HIERARC ESO ADA ABSROT END     =      3.00000  / Abs rot angle at exp end
(deg)
HIERARC ESO ADA ABSROT PPOS    = posit         / sign of probe position
HIERARC ESO ADA WFS1 RA        =    12.123457  / RA of WFS star 1
HIERARC ESO ADA WFS1 DEC       =   -75.987654  / Dec of WFS star 1
HIERARC ESO ADA WFS2 RA        =    12.123457  / RA of WFS star 2
HIERARC ESO ADA WFS2 DEC       =   -75.987654  / Dec of WFS star 2
HIERARC ESO TEL ALT            =       80.000  / Alt angle at start (deg)
HIERARC ESO TEL AZ             =       10.000  / Az angle at start (deg)
S=0,W=9
HIERARC ESO TEL GEOELEV        =         2335  / Elevation above sea level
(m)
HIERARC ESO TEL GEOLAT         =     -29.2543  / Tel geo latitute (+=North)
(deg
HIERARC ESO TEL GEOLON         =     -70.7346  / Tel geo longitude (+=East)
(deg
HIERARC ESO TEL OPER           = 'Senor Operador               ' /
Telescope Op
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HIERARC ESO TEL FOCU ID        = 'CA        '  / Telescope focus station ID
HIERARC ESO TEL TH M1 TEMP     =         8.12  / M1 superficial temperature
HIERARC ESO TEL MOON RA        =    10.000000  / 00:00:00.123 RA (J2000)
(deg)
HIERARC ESO TEL AMBI FWHM START=         0.50  / Observatory Seeing queried
from
HIERARC ESO TEL AMBI FWHM END  =         0.70  / Observatory Seeing queried
from
HIERARC ESO TEL AMBI TEMP      =         4.20  / Observatory ambient
temperature
HIERARC ESO TEL AMBI RHUM      =            5  / Observatory ambient
relative hu
HIERARC ESO TEL AMBI WINDDIR   =          340  / Observatory ambient wind
direct
HIERARC ESO TEL AMBI WINDSP    =        15.00  / Observatory ambient wind
speed
HIERARC ESO TEL MOON DEC       =     20.00000  / %DEGREE DEC (J2000) (deg)
END

XTENSION= 'IMAGE   '           / Extension first keyword
NAXIS   =                    2 / number of axes of data array
NAXIS1  =                 2048 / Size of first axis
NAXIS2  =                 2048 / Size of second axis
BITPIX  =                   32 / number of bits per pixel value
EXTNAME = 'WIN1.CHIP1.OUT1'    / FITS extension name
INHERIT =                    T / Extension inherits primary header
DET_LIVE=                    T / This detector is alive
RADECSYS= 'ICRS    '           / Name of celestial reference frame
EQUINOX =               2000.0 / Equinox of celestial reference frame.
CTYPE1  = 'RA---ZPN'           / Type of celestial axis 1
CTYPE2  = 'DEC--ZPN'           / Type of celestial axis 2
CRPIX1  =          12345678.12 / Pixel coordinate of reference in axis 1
CRPIX2  =         -12345678.12 / Pixel coordinate of reference in axis 2
CRVAL1  =     270.123456780000 / RA of reference point
CRVAL2  =     -75.123456780000 / Dec of reference point
CD1_1   = 1.000000E-02         / Transformation matrix element
CD1_2   = 1.000000E-04         / Transformation matrix element
CD2_1   = -1.000000E-05        / Transformation matrix element
CD2_2   = -1.000000E-02        / Transformation matrix element
PV2_1   = 1.000000E+00         / linear term in ZPN
PV2_2   = 0.000000E+00         / quadratic term in ZPN
PV2_3   = 4.200000E+01         / cubic term in ZPN
PV2_4   = 0.000000E+00         / forth-order term in ZPN
PV2_5   = 0.000000E+00         / fifth-order term in ZPN
HIERARC ESO DET16 MINDIT    =        0.0000000 / Minimum DIT
HIERARC ESO DET16 MODE NAME = '        '       / DCS Detector Mode
HIERARC ESO DET16 MODEi NAME= '        '       / DCS Detector Mode
HIERARC ESO DET16 NC IDIV   =                1 / # of Sub-Divs for R-O
HIERARC ESO DET16 NC NSAMPPIX=               1 / # of Samples/Pixel
HIERARC ESO DET16 NCORRS    =                0 / Read-Out Mode
HIERARC ESO DET16 RSPEED    =                1 / Read-Speed Factor
HIERARC ESO DET16 IRACE ADCi NAME= 'VIRGO   '  / Name for ADC Board
HIERARC ESO DET16 IRACE ADCi HEADER=                 1 / Header of ADC Board
HIERARC ESO DET16 IRACE ADCi ENABLE=                 1 / Enable ADC Board
(0/1)
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HIERARC ESO DET16 IRACE ADCi FILTERi=                1 / ADC Filter
Adjustment
HIERARC ESO DET16 IRACE ADCi DELAY=               15 / ADC Delay Adjustment
HIERARC ESO DET16 NCORRS NAME= 'NORMAL  '       / Read-Out Mode Name
HIERARC ESO DET16 NDIT      =               10 / # of Sub-Integrations
HIERARC ESO DET16 NDITSKIP  =                0 / DITs skipped at 1st.INT
HIERARC ESO DET16 NDSAMPLES =                0 / # of Non-Dest. Samples
HIERARC ESO DET16 NDSKIP    =                0 / Samples skipped per DIT
HIERARC ESO DET16 RSPEEDADD =                0 / Read-Speed Add
HIERARC ESO DET16 VOLTi CLKHINMi= '3.3     '   / Name of High Clock
HIERARC ESO DET16 VOLTi CLKHITi=           0.0000 / Tel Value High Clock
HIERARC ESO DET16 VOLTi CLKHIi=           0.0000 / Set Value High Clock
HIERARC ESO DET16 VOLTi CLKLONMi= '        '   / Name of Low Clock
HIERARC ESO DET16 IRACE SEQCONT=                F / Sequencer Cont. Mode
HIERARC ESO DET16 IRACE SEQINT=                  / Sequencer Intr. at Stop
HIERARC ESO DET16 VOLTi CLKLOTi=           0.0000 / Tel Value Low Clock
HIERARC ESO DET16 VOLTi DCNMi= 'FRED    '       / Name of DC Voltage
HIERARC ESO DET16 VOLTi DCTAi=           4.9000 / Tel Value 1 for DC
HIERARC ESO DET16 VOLTi CLKLOi=           0.1000 / Set Value Low Clock
HIERARC ESO DET16 VOLTi DCi =           0.0000 / Set Value DC Voltage
HIERARC ESO DET16 CHIP TYPE = 'RAYTHEON'        / The Type of Det Chip
HIERARC ESO DET16 CON OPMODE= 'SIMULATION'      / Operational Mode
HIERARC ESO DET16 FRAM TYPE = 'DIT     '        / Frame type
HIERARC ESO DET16 CHOP CYCSKIP=                 0 / # of Chop Cycles to Skip
HIERARC ESO DET16 CHOP NCYCLES=                 0 / # of Chop Cycles
HIERARC ESO DET16 CHOP ST   =                   / Chopping On/Off
HIERARC ESO DET16 CHOP FREQ = 0.000000          / Chopping Frequency
HIERARC ESO DET16 CHIP ID   = 'ATC-Virgo'       / Detector ID
HIERARC ESO DET16 CHIP NAME = 'VIRCAM  '        / Detector name
HIERARC ESO DET16 CHIP NX   =              2048 / Pixels in X
HIERARC ESO DET16 CHIP NY   =              2048 / Pixels in Y
HIERARC ESO DET16 CHIP PXSPACE= 2.000e-05       / Pixel-Pixel Spacing
HIERARC ESO DET16 EXP NO    =              9876 / Exposure Number
HIERARC ESO DET16 FRAM UTC  = '2006-03-05T10:11:12' / Time Recv Frame
HIERARC ESO DET16 FRAM NO   =                 2 / Frame number
HIERARC ESO DET16 VOLTi DCTBi=           0.0000 / Tel Value 2 for DC
HIERARC ESO DET16 WIN NX    =              2048 / # of Pixels in X
HIERARC ESO DET16 DID       = '        '        / Dictionary Name and
Revision
HIERARC ESO DET16 DIT       =        0.0000000 / Integration Time
HIERARC ESO DET16 DITDELAY  =            0.000 / Pause Between DITs
HIERARC ESO DET16 EXP UTC   = '2006-03-05T10:11:12' / File Creation Time
HIERARC ESO DET16 EXP NAME  = '        '        / Exposure Name
HIERARC ESO DET16 WIN NY    =              2048 / # of Pixels in Y
HIERARC ESO DET16 WIN STARTX= 1.000000          / Lower Left X Ref
HIERARC ESO DET16 WIN STARTY= 1.000000          / Lower left Y Ref
HIERARC ESO DET16 WIN TYPE  =                 0 / Win-Type
END
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