

Telescope Mechanics

TITLE

CG-Set – Science Instrument Interface

Code: DCI/TELE/0062-R

Issue: 1.A

Date: 22/06/2017

No. of pages: 14

C/D: Yes

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Changes record

Issue	Date	Section	Change code	Brief description
1.A	22/06/17	All	All	First version

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Configuration items

Code	Name

Interfaces (only for ICD's)

Interface Code	Element 1	Element 2	Name
I-IN-TL-002	TL-IR-CG	IN	Cassegrain Rotator - Instrumentation
I-IN-SE-002	SE-CG-TC	IN-OS	Cassegrain Transport Cart – OSIRIS Instrument

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Applicable documents

N°	Document title	Code	Issue
A1	Cassegrain Focal Station Envelopes	DR/GTC/002	1.H
A2	Cassegrain Instrument Rotator – Instrumentation Interface flange	DR/I-IN-TL-002/000	1.A
A3	Science Instrument – Cassegrain Transportation Cart	DR/I-IN-SE-002/002	1.A

Reference documents

N°	Document title	Code	Issue
R1	Cassegrain Set (CG-Set) Specifications	ESP/TELE/0216-R	1.A

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List of acronyms and abbreviations

AG	Acquisition and Guiding
CG-Set	Set formed by the Instrument Rotator, AG-Mechanics, Electronics Cabinet and Support Elements
COG	Centre Of Gravity
FE	Finite Elements
FEM	Finite Elements Model
GCS	GTC Control System
GTC	Gran Telescopio Canarias
TBC	To Be Confirmed
TBD	To Be Defined

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1 INTRODUCTION

1.1 Summary

This document contains interface requirements between any Scientific Instrument at Cassegrain and the Instrument Rotator as well as the interface between OSIRIS and the Cassegrain Transportation Cart.

1.2 Requirements and guidelines

“Shall” is used for requirements no matter how stable they are, whereas “should” is reserved for guidelines. Requirements are mandatory and guidelines are not mandatory, although their fulfilment should be strongly pursued.

1.3 Verification deliverables

Requirements and guidelines verification is mandatory as long as a Verification Deliverable is specified. Verification Deliverables are documents or section of documents demonstrating design or product compliance with the corresponding requirement at the different Project review milestones through the Design and Product Phases.

Verification Deliverables expected at Design Phase are mostly specifically addressed (trade-offs, analysis or calculations). When referred as design “Description and justification” justification of the requirement compliance is required as well (by any of the mentioned methods or e.g. rationale for a component choice). Requirements whose fulfilment can be straight forward demonstrated with a mere “Description” of the corresponding aspect of the design are referred as such in the Verification deliverables paragraphs

During the Product Phase, the kind of written justification expected to show compliance is specified rather than a particular test or analysis (with exceptions). Specific test, analysis, etc... shall be proposed by the contractor within the verification matrix/verification plan, unless otherwise required. When “Inspection Report” is required compliance shall be visually or manually verified and certified in a written manner with the signature of the vericator. Inspection and/or Test Reports can be grouped in one or several documents, as desired.

1.4 Unstable and undefined requirements

Unstable or undefined requirements are identified by “TBC” or “TBD” respectively.

1.5 Requirements code

Requirements are numbered with the last code in the upper level title (between quotes) before the Requirement. The coding is RQ/EC/NNN where:

“RQ” is fixed and means Specification.

“EC” is the Configuration Element code (GTC Product Tree) to which the Requirement applies.

“NNN” is the Requirement number (used for the document chapter hierarchy).

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In the example, bellow, all requirements hanging from 5.2 have the code SP/TL-IR-CR/... The “Instrument Rotator Concept” Shall have the code SP/TL-IR-CR/5.2.1.1.

5.2 Instrument Rotator (SP/TL-IR-CR/NNN)

5.2.1 Functional Requirements

5.2.1.1 Instrument Rotator Concept

In the case two codes appear between quotes, there shall be two identical requirements with different codes.

2 DEFINITIONS

2.1 Science Instrument

Equipment used for scientific purpose to be attached to one of the GTC focal stations and gather astronomical data from celestial targets with Science purposes. The Science Instrument is Out of Scope of this specification. The CG-Set interfaces the Science Instrument at the Science Instrument flange. For the purpose of this specification the Science Instrument shall be considered as a mass connected to the Science Instrument interface flange of the Instrument Rotator but it will not introduce any stiffness to that flange.

2.2 Rotator (or Instrument Rotator)

Machine supporting the Science Instrument and the AG Mechanics and rotating these to carry out field de-rotation, i.e. counteract the Earth rotation.

2.3 Telescope Tube

Is the structural part of the GTC Telescope subject to motion in elevation axis, it supports the Primary Mirror (M1), Secondary Mirror (M2) and Tertiary Mirror (M3) as well as the Cassegrain and Folded Cassegrain focal stations. The Telescope Tube interfaces the CG-Set at the Rotator Attachment flange.

2.4 Elevation Axis

Rotation axis of the Telescope Tube.

2.5 Cassegrain Coordinate System

A coordinate system defined as follows (see Fig. 1):

- Origin at the Cassegrain focus of the telescope (in the Tube Axis, 7400 mm “bellow” the Elevation Axis).
- X-Axis is parallel to the Elevation Axis and points towards the Nasmyth A platform.
- Z-axis in the direction of the Tube Axis towards the secondary mirror (M2).
- Y-Axis forms a right-handed coordinate system with the two previous.

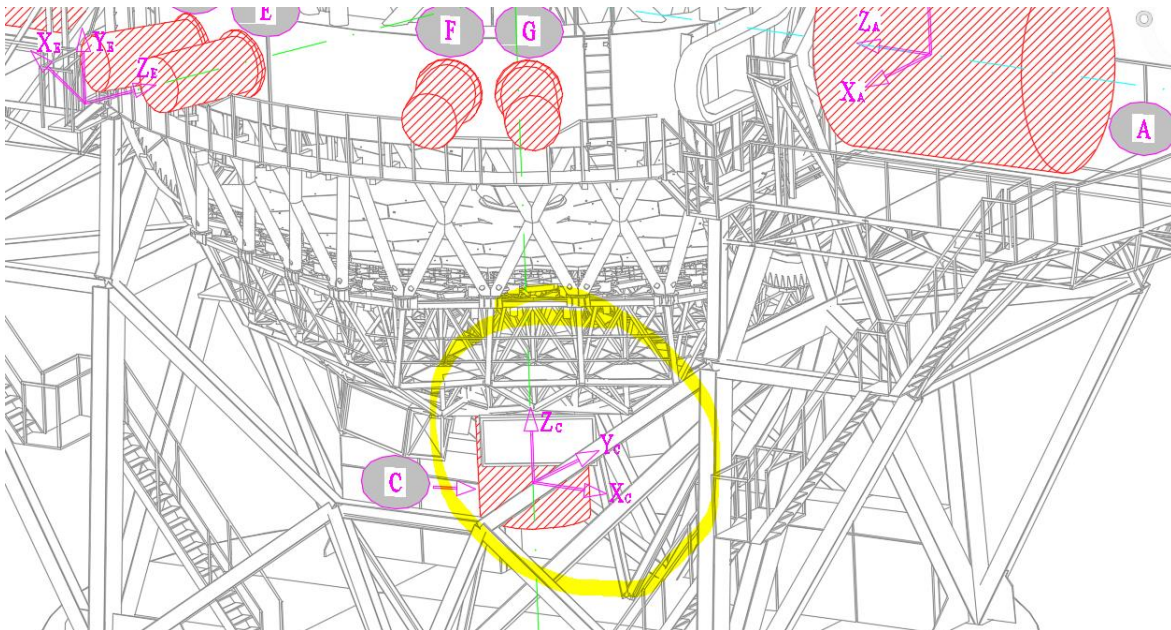


Fig. 1- Detail of the Cassegrain coordinate system

The Cassegrain Coordinate System rotates with the Telescope Tube around the Elevation Axis.

2.6 Science Instrument Coordinate System

The Science Instrument Coordinate System coincides with the Cassegrain Coordinate System for the nominal design, however, it is solidary attached to the Science Instrument, and therefore subject to gravity or manufacturing displacements and rotations of the Science Instrument flange.

It can be defined by:

- The Z-axis:
 - perpendicular to the Science Instrument flange plane (average if deformed)
 - intersects the Science Instrument flange plane at the centre of the centring diameter
 - positive towards the Pupil.
- The origin: at the Z axis, at -196mm from the Science Instrument flange plane.
- The X axis: pointing to the same mounting pin of the flange as the X-axis of the Cassegrain Coordinate system does.
- The Y-axis forms a right-handed coordinate system with the X and Z axes..

3 SCOPE

The Requirements in this document apply to the following interfaces:

- Cassegrain Rotator - Instrumentation
- Cassegrain Transport Cart – OSIRIS Instrument

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4 CASSEGRAIN ROTATOR-SCIENCE INSTRUMENT INTERFACE (RQ/II-IN-TL-002/N.N.N.)

4.1 Reference Temperature

The reference temperature for all the dimensions and tolerances, unless otherwise specified, shall be 8.5°C. This affects all drawings and metrology reports requiring possible extrapolations.

Verification Deliverables

Design phase: All drawings must specify the reference temperature.

Product phase: Metrology reports shall specify measurement temperature, measurements and extrapolated dimensions.

4.2 Science Instrument dimensional envelope

Both, Science Instrument and Instrument Rotator, shall respect the Instrument dimensional envelope defined in drawing A1.

Verification Deliverables

Design phase: 3D Model, drawings

Product phase: Inspection report, Metrology report

4.3 Attachment flange of the Science Instrument to the Instrument Rotator

Science instruments will be attached to the Instrument Rotator on an attachment flange whose dimensions and tolerances are defined in drawing A1 unless otherwise agreed with GRANTECAN¹. The material is TBD.

The angular position of the mounting pins shall coincide with the X- and Y-axis of the Cassegrain Coordinate System (2.5) when the rotation axis of the instrument rotator is in 0° position (see R1).

Verification Deliverables

Design phase: 3D Model, drawings

Product phase: Inspection report, Metrology report

4.4 Attachment of Science Instrument non-rotating modules

The Rotator attachment flange shall have a matrix of through threaded holes (36 holes M16 TBC) for attaching potential non-rotating modules of the Science Instrument.

Verification Deliverables

¹ The Z-axis position of the flange is not fully constrained yet by the Scientific Instrument configuration at Rotator procurement time.

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Design phase: 3D Model, drawings

Product phase: Inspection report, Metrology report

4.5 Instrument mass and mass-moment

The rotating module of the science instrument shall have a maximum mass of 2800 kg (goal 2400 kg) and a maximum first mass-moment of 15000 Nm with regard to the interface flange plane.

Verification Deliverables

Design phase:

- Instrument: Design document (mass budget). 3D model
- Rotator: Design document (Bearing choice justification)

Product phase:

- Instrument: Test report
- Rotator: Test report (performance tests with instrument dummy)

4.6 Instrument mass eccentricity

The torque on the Instrument Rotator axis due to mass eccentricity of the Science Instrument shall be lower than 750Nm (goal 150Nm).

Verification Deliverables

Design phase:

- Instrument: Design document (mass budget). 3D model
- Rotator: Design document (Motor, brakes justification).

Product phase:

- Instrument: Test report
- Rotator: Test report (tests with instrument dummy)

4.7 Instrument Mass Inertia

The maximum mass inertia of the instrument over the rotation axis of the Instrument rotator shall be 2000 kgm².

Verification Deliverables

Design phase:

- Instrument: Design document (mass budget). 3D model
- Rotator: Design document (Motor, brakes justification).

Product phase:

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- Instrument: Test report
- Rotator: Test report (tests with instrument dummy)

5 CASSEGRAIN TRANSPORT CART – OSIRIS INTERFACE (RQ/I-IN-SE-002/N.N.N.)

5.1 Attachment

The attachment of OSIRIS to the Cassegrain Transport Cart shall be as defined in A3.

Verification Deliverables

Design phase: 3D model, drawings

Product phase: metrology report

5.2 Osiris mass for transportation

Osiris maximum mass on the Transport Cart shall be 2400kg (cabinets are detached from Osiris before lifting down from the Cassegrain Focus).

Verification Deliverables

Design phase: Design document (Transport Cart description and justification)