

# MEGARA Control System

## Multi Espectrógrafo en GTC de Alta Resolución para Astronomía

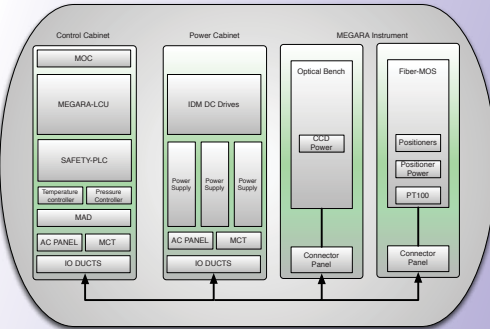
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### Abstract

MEGARA (Multi-Espectrógrafo en GTC de Alta Resolución para Astronomía) is an optical Integral-Field Unit (IFU) and Multi-Object Spectrograph (MOS) designed for the GTC 10.4m telescope in La Palma. The MEGARA Control System is responsible to move the different mechanisms of the instrument, to save and process the readout of the detector controller and to provide the necessary inputs for the MEGARA Observing Preparation Software Suite (MOPSS), the Data Factory and the Sequencer.

### Control Hardware Overview



The MEGARA hardware is divided into two physically separated cabinets. The Control cabinet will gather all the interfaces to the GTC control system and the MEGARA logical controllers. The Power Cabinet will gather all the power electronic, mainly DC motor drivers and power supplies.

**MOC:** Module used to opto-isolate the control cabinet hardware: it gathers the transceivers required to adapt the different signals and communication protocols to the fiber links.

**MAD:** Module used to remotely switch ON / OFF the cabinets hardware. The MAD is controlled via CANOpen from the Inspector GUI.

**AC PANEL:** Module responsible for the electrical protection (surge suppressor, filtering, overload breakers...). This module distributes the 230 V AC to the electronic equipment.

**MCT:** Module used to control the cabinets temperature. Thermal data and alarms are transmitted to the GTC supervision software.

**SAFETY-PLC:** an industrial PLC with failsafe inputs/outputs that handles interlocks signals.

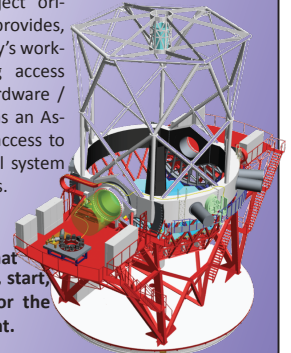
**MEGARA-LCU:** VME rack fitted with a Motorola MVME5100 running VxWorks that hosts the MEGARA Control System and the DAS control system.

### System Highlights

MEGARA control system hardware re-use GTC hardware to benefit from the technical teams "know-how", to reduce the spare parts needs and, consequently, to maximize the instrument uptime.

The distributed object oriented architecture provides, from any observatory's workstation, engineering access to the low level hardware / commands as well as an Astronomer oriented access to the MEGARA control system high level commands.

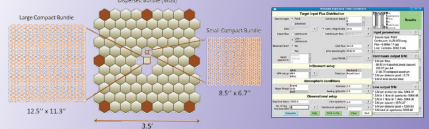
The Inspector Java GUI is a multi-users control interface that allows to configure, start, control and monitor the MEGARA instrument.



### MEGARA Observing Preparation Suite

The MOPSS consists of three software components designed to assist observers to plan their observations.

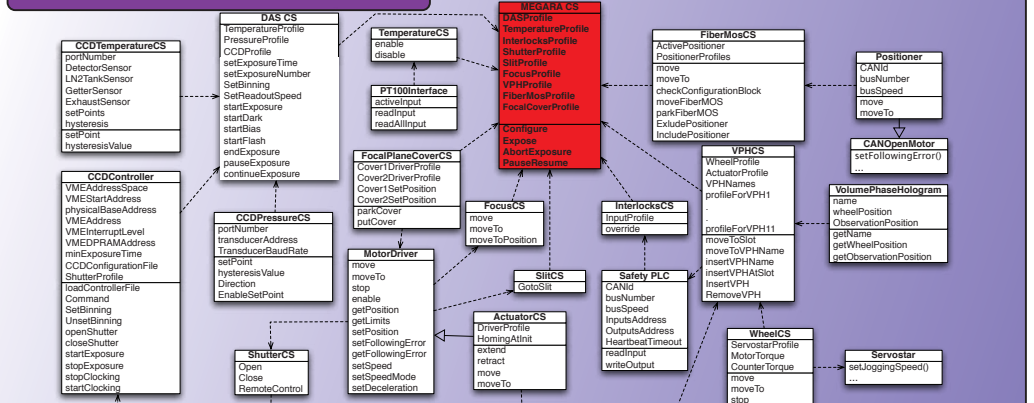
**Exposure Time Calculator** estimates the SNRs and limit magnitudes for a given observational setup.



**Image Simulator** creates images simulating the output of the instrument depending on the observational strategy adopted for observing a given source.

**Fiber MOS Positioning Tool** allows to generate the best combination of Fiber MOS pointing parameters and spatial configuration of the RPs, to observe a list of user-selected sources.

### Software Overview

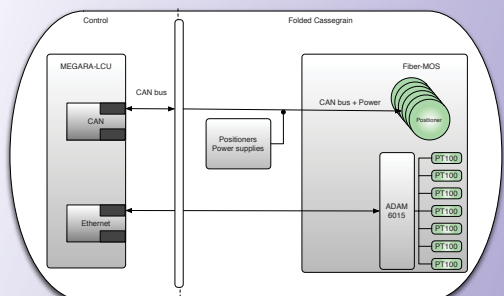


All the classes inherit from the GCS Device superclass that embeds: a state machine, an interface to the telescope alarms Manager and to the data Monitor Manager. The CORBA based communication layer allows to deploy the system on several servers, to communicate with all the other Device components and to access classes' public methods from the Inspector GUI.

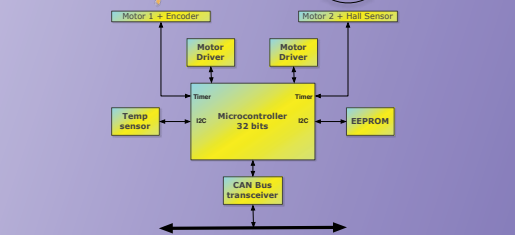
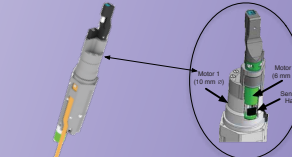
### Fiber MOS

The Fiber MOS allows placing fiber mini-bundles anywhere in the central 3.5 x 3.5 arcmin<sup>2</sup> FOV around the two IFU bundles.

The Fiber MOS is composed by 100 two axis micro positioners moving mini-bundles made of 7 fibers each. A positioner has an embedded Freescale microcontroller running a CANOpen library that implements the CANOpen Device Profile Drives and Motion Control Standard (DSP 402).



MEGARA fiber positioner robots use independent positioning for each fiber bundle. The objective is to maximize the flexibility of the system offering a great deal of spatial configurations.



Positioners achieve the required positions using a combination of 2 rotation movements. The system precision is critical and must fit the science requirements.

### MEGARA Data Factory (MDF)

MDF outputs are data corrected from the instrument signatures that can be used at the different levels of either data acquisition or analysis (See poster by S. Pascual et. al about DRP).

During an observation the images produced by MEGARA are displayed on the Inspector Panel. The user has also the possibility to load and visualize images and other data processed by the DFP.

### Data Reduction Pipeline (DRP)

The DRP provides data in physical units as required by scientific analysis. The DRP is not integrated with the GTC Control System. The user has the possibility to modify the data processing parameters.

### Data Factory Pipeline (DFP)

This GTC component will be used exclusively to compute data products required to complete data acquisition. It will not produce any scientific quality data. The results of a particular run of the DFP can be browsed and loaded from the Inspector GUI.



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