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FRIDA: THE AO SECOND GENERATION INSTRUMENT FOR GTC, STATUS REPORT

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RESUMEN

FRIDA (in**FR**rared **I**mager and **D**issector for the **A**daptive optics system of the Gran Telescopio Canarias) está siendo diseñado como un instrumento con óptica limitada por difracción con capacidades de imagen de banda ancha y angosta y espectroscopía integral de campo en el intervalo de longitudes de onda 0.9–2.4 μm. FRIDA es un proyecto de colaboración entre los socios principales de GTC; a saber, España, México y la Universidad de Florida. En este trabajo se presentan los avances del desarrollo del proyecto.

ABSTRACT

FRIDA (in**FR**rared **I**mager and **D**issector for the **A**daptive optics system of the Gran Telescopio Canarias) is being designed as a diffraction limited instrument with broad and narrow band imaging and integral field spectroscopy capabilities to operate in the wavelength range 0.9–2.4 μm. FRIDA is a collaborative project between the main GTC partners, namely, Spain, Mexico and University of Florida. The present paper provides an updated overview of the instrument development.

Key Words: instrumentation: spectrographs

1. INTRODUCTION

GTC is the single largest operating optical/infrared telescope in the world and as such, gathers more photons than any other optical/infrared telescope. The angular resolution of a telescope is proportional to λ/D, and so once the adaptive optics system is operating (GTCAO), the GTC will have the finest resolution of any infrared telescope. Furthermore, when observing point sources in the background limit, the combination of light grasp and diffraction limit will give GTC a D^4 advantage over smaller telescopes. FRIDA has been designed with diffraction-limited optics to avoid degrading the hard-won image quality delivered by (GTCAO). FRIDA will be sensitive in the near infrared regime, where the highest Strehl ratios are achieved, and will deliver high quality imagery in broad and narrow bands and spatially resolved spectroscopy with the use of an integral field unit (IFU). FRIDA is being designed to be installed at the Nasmyth platform, behind the adaptive optics system. It will use a single 2048 × 2048 Hawaii 2 Rockwell detector. The same detector will be used for the imaging and IFS operating modes.

FRIDA is a collaborative project, each institution having a well defined responsibility of the work packages. Instituto Astrofísico de Canarias is performing all tasks related with the detector, the high level hardware and software and it coordinates the tasks in the control team. CIDESI is responsible of the complete mechanical work packages. University of Florida is developing the Integral Field Unit and the focusing mechanism. Universidad Complutense de Madrid is performing the data factory pipeline. UNAM is in charge of coordinating the science group, the optics and the assembly, integration and tests, low level control of mechanisms and the overall management of the project. UNAM has the leadership of this project.

2. PROJECT STATUS

The FRIDA project was accepted officially in March 2005 by GRANTECAN. FRIDA optical design was reviewed on July 2006 and several changes were suggested mainly for the spectrograph design and the IFU design. The Preliminary Design Review (PDR) was held in August 2007 where the panel

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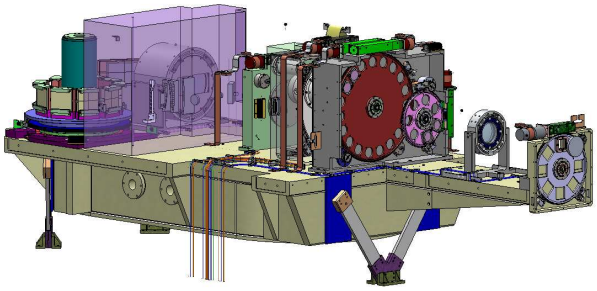

Fig. 1. FRIDA cold bench and mechanisms.

recommended some changes of the design, mainly: the cryostat support structure and the optical and mechanical design of the cameras wheel. The instrument layout is based on a rectangular cryostat with a nose, necessary by the envelops restrictions between GTCAO and FRIDA. In this nose it is placed the input window, the focal plane wheel and the collimator (see Figure 1). Figure 2 shows the FRIDA cryostat and support structure.

Since PDR to this date the instrument design has been optimized and transferred into a detailed design. Prototypes were built to test several key mechanisms. In the prototyping phase we validated several critical subsystems: the collimator optomechanics, the focal plane wheel and the gratings carrousel. Other work packages developed to CDR level are:

- Instrument high level requirements
- Observing modes and observing strategies
- Calibration programs and strategies
- Commissioning plan
- Optical design, optical performance, tolerance analysis, scattered light and ghosts analysis have been optimized and concluded.
- Mechanical design of all the mechanisms and subsystems has been done.
- Science detector characterization has been done
- Hardware, software and all cabling already defined
- Assembly and verification plan already defined
- The whole design is in compliance with all system and top level requirements

The critical design review was held in Mexico City last September with positive results. The review panel recommendations about some items have been evaluated by the FRIDA team who consider that those can be resolved in brief.

Fig. 2. FRIDA Cryostat and support structure.

In order to minimize risks, delays and to have more control on procurement and manufacture processes, the instrument will be developed within FRIDA's institutions. Electronics control and software will be developed by IAC, UCM and IA-UNAM. All lenses will be manufactured by UNAM or under UNAM's supervision in Mexico. Only the IFU manufacture will be subcontracted by UF under supervision of S.S. Eikenberry and S. Cuevas. CIDESI has all the necessary infrastructure to perform the mechanical manufacture of the whole instrument.

At present we are aiming to close all the pending tasks of the CDR by January 2012. We are starting the procurement and fabrication at subsystem level phase. The integration and tests at system level are scheduled by 2014, The laboratory acceptance in December 2014, the GTC site acceptance and commissioning in 2015.

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