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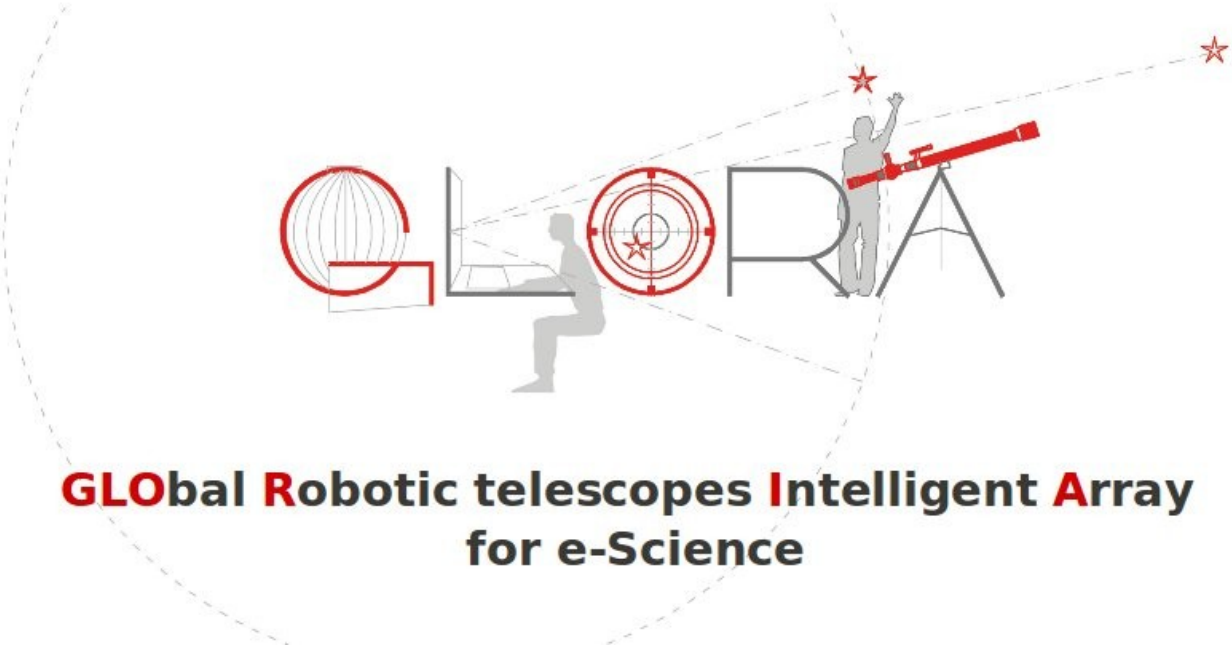

Online experiment web interface available to users

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Authors:	Aleksander Filip ZARNECKI (UNIWARSAW) Alberto J. CASTRO-TIRADO (CSIC) Miquel SERRA-RICART (IAC) Fernando SERENA (UPM) Miguel A. PIO (IAC) Juan CABELLO (UMA) Michael PROUZA (IP-ASCR)
Collaborators:	Esteban GONZÁLEZ (UPM) Lech MANKIEWICZ (UNIWARSAW) Chris LINTOTT (UOXF) Robert SIMPSON (UOXF) Martin JELINEK (CSIC) Marcin ZAREMBA (UNIWARSAW) Mikolaj CWIOK (UNIWARSAW)
Revised by:	Fernando SERENA (UPM)
Approved by:	Francisco Manuel SÁNCHEZ (UPM)

Distribution List:

Name	Affiliation	Date
Francisco Manuel SÁNCHEZ	UPM	January 4th, 2013
Fernando SERENA	UPM	January 4th, 2013
Esteban GONZÁLEZ	UPM	January 4th, 2013
Aleksander Filip ZARNECKI	UNIWARSAW	January 4th, 2013
Lech MANKIEWICZ	UNIWARSAW	January 4th, 2013
Marcin ZAREMBA	UNIWARSAW	January 4th, 2013
Mikolaj CWIOK	UNIWARSAW	January 4th, 2013
Michael PROUZA	IP-ASCR	January 4th, 2013
Juan CABELLO	UMA	January 4th, 2013
Miquel SERRA-RICART	IAC	January 4th, 2013
Miguel A. PIO	IAC	January 4th, 2013
Chris LINTOTT	UOXF	January 4th, 2013
Robert SIMPSON	UOXF	January 4th, 2013
Alberto J. CASTRO-TIRADO	CSIC	January 4th, 2013
Martin JELINEK	CSIC	January 4th, 2013

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1. Introduction

The first year of the project was devoted to the definition of standards, as well as development of tools and algorithms for implementing on-line and off-line experiments in the GLORIA network. Preparations were concluded with the following milestones reached by M12:

- 8.1 Educational level off-line demonstrator experiment ready for installation in the network.
- 8.2 On-line demonstrator experiment ready for installation in the network.
- 8.3 Research level off-line demonstrator experiment ready for installation in the network.

Next step, which resulted in this deliverable, was to make the developed tools available to GLORIA users. Some tools are shared between on-line and off-line experiments.

This deliverable describes the users tools related to on-line experiments. Corresponding description for off-line experiments can be found in Deliverable 6.2.

User interface for doing GLORIA off-line experiments has been made available to users at the location:

http://users.gloria-project.eu/

Documentation of all tools, together with the detailed descriptions of the proposed experiments can also be found there. This document gives only a brief summary of the available functionality and main implementation aspects. We conclude with presentation of the plans for the next months.

2. Description of experiment interfaces

2.1. Available functionalities

Implemented tools and their functionalities are described in the order they are supposed to be used by GLORIA user, corresponding to steps user has to take to participate in GLORIA experiments.

- **Creating GLORIA account**

  Only registered users get full access to GLORIA network resources and are able to run all experiments. Registration is very simple. From the main web page one has to select ‘Sign in’ and then ‘Create account’. To be registered user has to give his/hers full name, screen name (to be used on the web pages; full name remains confidential, as do remaining personal details) birthday, gender and email address. Confirmation link is sent to the specified e-mail address to verify that it is correct. The initial password is also sent to this address. The whole procedure takes about 1 minute, after which the user is able to sign in to the GLORIA users web portal.

  We assume that users which have not registered to GLORIA will still be able to get access to some off-line resources, including selected off-line experiments. This will allow them to get familiar with GLORIA and should encourage them to register. Currently we allow unregistered users to access Venus Transit data and perform related demonstrator experiment (see below).

- **Browsing available experiments and their documentation**

  After registering, user can check the list of available on-line and off-line experiments. Currently two demonstrator off-line experiments are made available: one based on Venus Transit data (allowing to calculate Sun-Earth distance) and the second one on the whole-sky images from BOOTES system (allowing to observe the planet movement on the Sky). In the coming months another demonstrator experiment, based on Pi of the Sky data, will be added, focusing on identification of variable stars. Users will also be able to use developed tools for analysis of other data, both coming from GLORIA network telescopes and from external sources. In particular, telescope owners should be able too use GLORIA tools for analysis of their own data.

  For each experiment in the presented list users are able to access a detailed description, as well as to browse sample results. Some experiments (or some of their functionality, e.g. those requiring long computing time) can be restricted to more experienced users (with sufficient karma).

- **Setting the experiment, requesting observation time**

After choosing the experiment, user has to specify main parameters, which decide how the experiment is run. This can be done in terms of the so called **Observing Plan**, which combines user requirements (see detailed description below). In case of interactive demonstrator experiments, the main requirement is selecting the telescope and setting the observation time needed. The first available time slot fulfilling user request, on the telescope meeting his needs, is then allocated.

- **Doing the observation**

When the allocated time slot comes, the option to take over the control of the selected telescope will become available in the user interface page (only the viewer mode is available earlier). Different devices can be controlled by user via the implemented web portlets, depending on the configuration of the selected telescope (for the detailed description of the configuration available for demonstrator experiment see below). The user should have all the tools set-up earlier to make most efficient use of the observation time. Each observation is done in few steps, including: dome opening (if closed), filter choice, telescope positioning, focusing, exposure setting, making exposure. In addition (which is crucial for nigh-sky observations) calibration images can also be taken. The interface informs user about the remaining observation time. When it finishes, ongoing observation is interrupted. After doing observations user can access collected data, browse them in the dedicated interface or download to local disk for future analysis.

3. Infrastructure details and implementation aspects

3.1. Solar telescopes used in the demonstrator experiment

The TADs (TAD means “Telescopio Abierto Divulgación”, Outreach Open Telescope, and the “s” means “Solar”) is part of a system of two telescopes that can be controlled remotely. With the help of GLORIA everyone, using a simple internet connection, with the help of a simple web tools, will be able to use this telescopes directly as if he were in front of them. These telescopes were already accessible in the past, based on the Ciclope Astro framework. However, GLORIA will allow to extent the available functionality.

The two telescopes (TADs and TADn) are installed at the Observatorio del Teide (Institute of Astrophysics of the Canary Islands, in Tenerife), more specific, at -16°30'35 of Longitude and at +28°18'00 of Latitude, in a height of 2390 meters from sea level.

Figure 1: The Teide Observatory (Tenerife, Spain) managed by the Instituto de Astrofísica de Canarias

The geographical location of the observatory (between the solar observatories of the East and West), combined with transparency and excellent astronomical quality of the sky, have contributed to the Teide Observatory preferably reserves the study of the sun, it's best to focus solar Europeans telescopes, but it has also night telescopes,taking advantage of sky quality.

3.2. Telescope infrastructure specification

Infrastructure, which can be controlled by user doing demonstrator experiment includes:

1. Main Telescope: The Tube is from the American company, Lunt Solar Systems, a telescope of 152 mm of aperture, with a focal length of 900 mm and a F6 of focal ratio, being one of the biggest solar telescopes of its characteristics, with an internal Etalon centered in one line of Halpha (656 nm <0.65 Angstrom), that allows to observe the solar photosphere in detail. It is an unobstructed internal HD Etalon with a Pressure Tuner allows for <0.65 Angstrom bandpass, providing slightly higher surface detail without the loss of edge detail.

Figure 2: Image of both Telescopes. Left the night Telescope TADn and right the solar telescope, TADs (Credits: Juan C. Casado)

As image device it has connected a DBK camera model 41AU02.AS, with a sensor of 1/ 2 " CCD, Sony, and a resolution of 1280x960 pixels, which work in colour.

2. **Second Telescope**: Attached to the main Tube, as a finder but also used as a telescope to have images of the full Sun, the TADs has a Telescope from the company BORG, model 77ED II with a 77 mm of aperture and 500 mm of focal length. Apochromatic ED lens with low dispersion to prevent light scattering problems in those areas that are the guiding stars of high magnitude. And it has a DMK camera 41AU02.AS, with specifications similar to the DBK that has the Main Tube, but in monochrome.

3. Focuser: The focus of the optical system is controlled through a motorized focus system (set of encoders and digital controller JMI's Mobile American manufacturer). The set consists of a motor unit for Motofocus approach, complemented by DROMF encoder unit and control system that allows Smart-focus autofocus the two cameras. But in the Ethalon filter, they also have the same type of focuser to allow precise tuning of the core line in the Halpha, resulting in a high quality images.

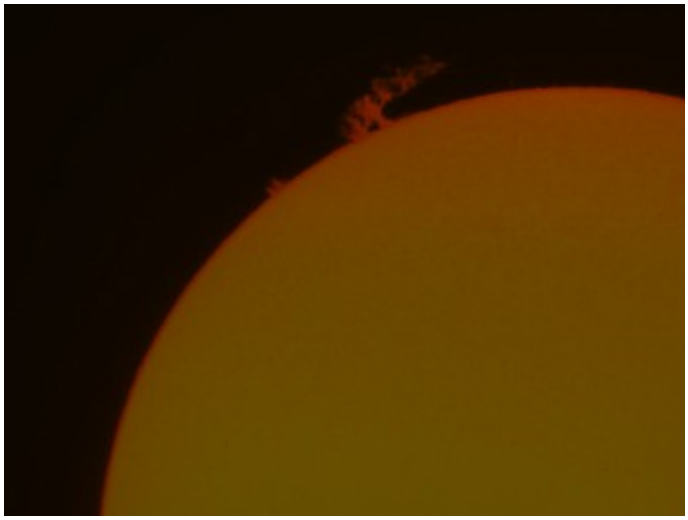

Figure 3: An example of an image taken with the Main Tube of the Solar Chromosphere. Credits: M. Serra-Ricart.

4. The Mount: The previous two telescopes are supported by a mount of Losmandy equatorial, G11 type, an excellent mounting performance, mechanical strength and reliability. This mount has a recommended maximum load capacity of 25 kg. The mount is controlled with the additional system GEMINI II GOTO system with a remote control that includes the typical functions of search and tracking and backlash settings, PEC and autoguiding making. System connectivity is Ethernet. The motors that move the mount are high quality servomotors, and all the system is fed with 12-18V DC.
5. **Dome**: The dome is motorized and remote controlled. The design of the same type is rectangular and thereby the slider is completely free telescope at the time of observation or protected data collection and the end of the night.

4. Plans

4.1. Scheduled observations within the GLORIA network

In order to manage all observation requests by users, GLORIA will provide a schedule mechanism. User requests are defined in terms of the so called observing plans. Scheduling mechanism will manage observing plans associated to the batch on-line experiments. GLORIA will provide two kind of scheduler entities:

- Local-scheduler: each telescope has a scheduler of its own.
- Central-scheduler: this provides the global robotic network schedule.

In this model, considering a job as an execution request of an Observing Plan, the central-scheduler advertises this to the local-schedulers of telescopes that can do the job, and each local-scheduler will reply with either a proposal (for how and when it can do it), or a refusal. The central scheduler accepts the best proposal (determined by policy), and waits for confirmation that the job is complete, or for an apology that the job was not or will not be carried out according to the original proposal. The central- scheduler manages all jobs in the GLORIA system, receiving new jobs from the authoring tool, advertising them (and re-advertising as necessary), accepting the best proposal (taking into account a global policy) and retiring tasks when they are done.

4.2. Observing plan

Following user requests, observing plan is prepared in the form of an XML file, containing everything the scheduler needs to know to carry out the observation.

- **Constraints**. Possible constraints are:
  - specific time window

- specific telescope (or selection from a set)
- specific filters
- height above horizon
- moon separation
- time after dusk/before dawn
- tracking capability
- targets that must be visible in the observing plan execution

- **Instructions**. The instructions section is either:
  - TARGET. Astronomical target. The first Instruction must be this, but a plan may have more than one.
  - LOOP. Used to indicate repetitions of the entire block.
  - EXPOSE. Commands and exposure: defines timing, repetitions or duration, and filters .
  - EXPOSE MANUALLY. This instruction gives the control of the telescope to the user through GLORIA web site.

An example of online Observing Plan could be:

```
constraint duration 3200 seconds
constraint time exactly 20120530T220000
constraint filters R,I → Required Filters by user.
constraint target M41→ This target must be visible.
target M41 → Moves the mount to M41 (initialization).
expose manually → Gives the control to user.
```

Local schedulers have to take all constraints and requested actions (instructions) into account when replying to the request (advertisement) from the central scheduler. In particular, some telescopes will not accept observation plans including EXPOSE MANUALLY instruction.

4.3. Second online demonstrator with FRAM (scheduled observations)

We decided to use FRAM telescope as a test-ground for GLORIA scheduler, which will also serve as the base for the second demonstrator experiment. In general, two requirements must be satisfied to integrate a telescope in the scheduling system:

- Its RTDs must be developed and integrated inside RTS.
- It must provide a local-scheduler.

At this moment in time, GLORIA will recognize it as a telescope of the network and it could execute user jobs. It is expected that FRAM will be fully integrated into this system in spring 2013.

GLORIA Partners

UPM
Universidad Politécnica de Madrid
SPAIN

AUAV
Astronomical Institute, Academy of Sciences of the Czech Republic
CZECH REPUBLIC

CSIC
Consejo Superior de Investigaciones Científicas
SPAIN

INAT & CVUT
Czech Technical University in Prague
CZECH REPUBLIC

IP-ASCR
Institute of Physics of the Academy of Sciences of the Czech Republic
CZECH REPUBLIC

IAC
Instituto de Astrofísica de Canarias
SPAIN

INAF
Istituto Nazionale di Astrofisica
ITALY

SAO
Special Astrophysical Observatory of Russian Academy of Sciences
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