

FRACTAL SLNE: Engineering expertise for scientific projects. System Engineering and RAMS analysis services

A. Pérez-Calpena¹, M.L. García-Vargas¹

FRACTAL SLNE (Las Rozas de Madrid, E-28231, Spain). Contact: ana.perez@fractal-es.com,
marisa.garcia@fractal-es.com

Abstract — FRACTAL S.L.N.E. is a private technological company specialized in astronomical instrumentation and scientific software. FRACTAL designs and develops technological projects with scientific goals and also provides services in the areas of Astronomy, Management, System Engineering, Optics, Opto-mechanics, Mechanics, Electro-mechanics, Cryogenics, Detectors, Data Acquisition Systems and Software.

Within System engineering services for scientific projects, we can prepare and implement the System Engineering Plan, perform RAMS analyses and prepare the Operation and Maintenance Plan. As an example, we describe in this contribution the RAMS analyses that have been performed by FRACTAL in the framework of MEGARA project.

Index Terms — Astronomy, System Engineering, RAMS.

I. FRACTAL OVERVIEW

FRACTAL started its activity in May 2006 (founded in September, 2005). Our main area of expertise is the development of professional astronomical instrumentation and software.

Most of FRACTAL's consultants worked previously at GRANTECAN, company in charge of the development of the GTC 10-m telescope. FRACTAL's General Manager was for more than 9 years the Head of the Instrumentation Group at the GTC Project Office.

FRACTAL has an expert, stable and committed team that covers the subjects of Astronomy, Management, System Engineering, Optics, Opto-mechanics, Mechanics, Electro-mechanics, Cryogenics, Detectors, Data Acquisition Systems and Software (Real Time Systems, Distributed Systems, Mechanisms Control, Data Base, Telescope's Control Systems and Data Reduction).

FRACTAL main activities are:

- Management, design and development of technological projects with scientific goals.
- Consultancy and services in the different engineering areas covered by our team.
- Professional training in Management, System engineering, Optical, Mechanical, Data acquisition and Software areas.
- Software engineering for System engineering and scientific applications.

II. FRACTAL PROJECTS

We focus our services mainly on the Research Centres and Universities that need to carry out Instrumentation and Software projects, establishing fruitful relationships to fulfil their goals.

Most of our clients are public centres:

- At Spain we have worked for CAB, CSIC, IAA, IAC, IIEEC, IFAE, IFCA, IGN, INTA, ITA, OAN, UAM, UCM, Univ. of Cantabria, Univ. of Salamanca, Universidad del País Vasco and University of Valencia, as well as for Calar Alto Observatory.

- As non-Spanish customers: ESO (Germany), PPARC (UK), IA-UNAM (México), INAOE (México) among others.

Besides, national companies and technological centres have attended our training courses (e.g. AIMEN, ASTI, IDOM, INSA, LIDAX, Tekniker, LPI, Iberoptics, SENER etc.).



Fig. 1. Snapshot of several FRACTAL projects. We include here instrumentation projects, management services and the development of different web portals for scientific projects, web databases and the FRACTAL Systems and Projects Suite.

III. SYSTEM ENGINEERING AND RAMS ANALYSIS SERVICES

Systems Engineering is essential for the success of projects, especially the more complex ones, which include different professional disciplines and whose partners and working groups are often geographically distributed.

The services in System Engineering that FRACTAL can provide are:

- Systems Engineering Plan Definition to describe the approach, techniques, tools, organization and plan to control the technical effort needed to reach the project goals. FRACTAL has developed its own tools to ease the System Engineering activities.

- RAMS Plan to assure that the reliability, availability, maintainability and safety requirements of the systems are taken into account in the design and to track its fulfilment through all the project phases.

- Operation and Maintenance Plan to be defined these important aspects from the beginning of the project.

IV. RAMS ANALYSIS AT THE MEGARA PROJECTS

MEGARA (Multi-Espectrógrafo en GTC de Alta Resolución para Astronomía) is a fiber-fed spectrograph with an optical Integral-Field Unit (IFU) and a set of robotic positioners for multi-object spectroscopy that will be installed at Folded-Cassegrain focus of the GTC 10.4-m telescope. The fibers will feed the spectrograph that shall be located at one of the Nasmyth platforms.

MEGARA Consortium is led by the Universidad Complutense de Madrid (UCM) and is also participated by the Instituto Nacional de Astrofísica, Óptica y Electrónica (INAOE, Mexico), the Instituto de Astrofísica de Andalucía (IAA-CSIC) and the Universidad Politécnica de Madrid (UPM).

FRACTAL is providing UCM engineering services in Management, System engineering, optical and mechanical design and detector and data acquisition systems.

In particular FRACTAL is responsible for MEGARA System Engineer Plan.

During the Preliminary Design Phase the following RAMS analyses have been carried out:

- Maintainability Analysis, where the system maintenance feasibility is analyzed with the goal of minimizing and facilitating the instrument maintenance during the operation phase.

- Failure Analysis (FMECA), where the potential failure modes of the system are identified and evaluated.
- Reliability Analysis, where the percentage of time that the system could be unavailable is estimated.
- Spare analysis, where the outputs from the FMECA's and reliability analyses are taken into account in order to provide a spare parts list that include the spare part that must be maintained at the different maintenance levels (i.e., observatory and sea-level base).
- Safety Analysis, where the hazards that could happen to the persons that are involved in the use and maintenance of the system area analyzed.

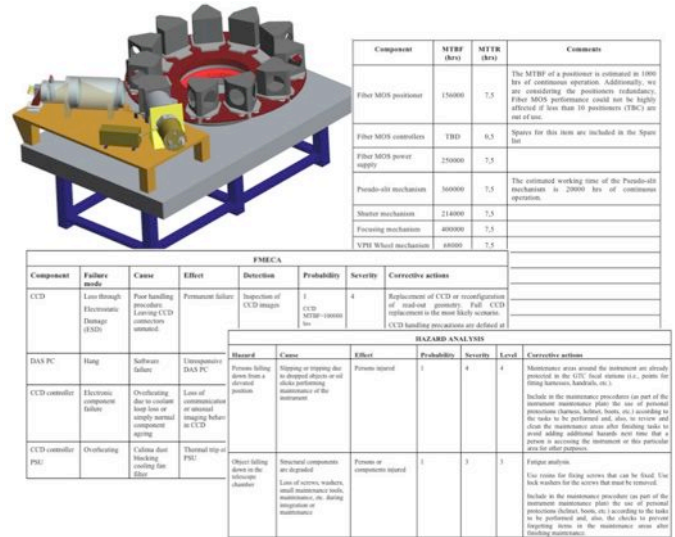


Fig. 1. RAMS analysis performed for the MEGARA project at the Preliminary Design phase. The MEGARA spectrograph is included in the figure as well as the reliability budget, FMECA and Hazard analysis presented at PDR.

VI. CONCLUSION

FRACTAL is a technological company specialized at astronomical instrumentation projects. We can provide services in different areas including System Engineering and RAMS. The case of MEGARA, where FRACTAL has been in charge of these areas of the project, is quickly summarized in this abstract.

ACKNOWLEDGEMENT

- MEGARA consortium (<http://guaix.fis.ucm.es/megara>)