

# PLC-driven electronic design for the next generation of Astronomical Ground-Based Instrumentation and its integration in a concurrent engineering environment

Minigrant RSN5

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## Team members

Name	Role	Affiliation
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## Abstract

In the last few years, PLC-based control automation has become the standard for the new class of astronomical ground-based instrumentation.

The industrial approach offers many design opportunities, some of which have yet to be fully explored.

The main objective of this proposal is to acquire the know-how to exploit these opportunities. Furthermore, an in-depth study will be conducted to develop the necessary skills to integrate the electronics development process with the other aspects of the design, with the ultimate aim of achieving an innovative concurrent design approach. Concurrent engineering allows for a far more efficient and quick design process. This know-how will find implementation in both current and future projects, with immediate application in MORFEO.

# Status of the project

## First deliverable – Development of know-how on PLC functionalities

### Work done:

- Acquisition of material (PLC CPU, safety modules, HMI panel, EtherCAT switch, additional modules) on MORFEO funds
- In-house tests
- Discussions with INAF and ESO experts on aspects of PLC implementation

### Next steps:

- Multiple dedicated Beckhoff courses for the three members of the team (last quarter of 2023/first quarter of 2023) – 5-7k€ depending on number of sessions (costs include traveling expenses - TBC)
- Further tests

## Second deliverable – Development of know-how on concurrent engineering

### Work done:

- Ongoing dialogue with ESA experts
- Tests with COMET software tool for management of concurrent design sessions
- School on 3D modeling and eXtended reality at INAF OAPa – 1.4k€ (costs for traveling expenses)

### Next steps:

- Dedicated course on concurrent engineering for the three members of the team, possibly by COMET distributors - costs TBD
- Study of possible alternative tools (e.g. OpenMBEE)
- Keep ongoing talks with expert in the field for guidance and open discussions on methodologies and tools

# Status of the project

## Third deliverable – Implementation of the acquired know-how

### Work done:

- Full support to the activities for the acquisition of the relevant hardware and software tools for the creation of the Concurrent Design Facility (CDF) at INAF – OACN, in Naples – funded through the PNRR STILES project
- Implementation of concurrent design strategies on aspects of the mechanical and electronic design and RAM analysis in MORFEO
- Possible implementation of PLC safety architecture in MORFEO

### Next steps:

- Further study on effective implementation of specific PLC functionalities in MORFEO and future projects
- Conclusion of acquisition process and follow-up activities for the realization of the Naples CDF
- Possible acquisition of dedicated hardware for the minigrant activities (TBD)

## Fourth deliverable – Sharing of the acquired experience

### Work done:

- Preparation of abstracts for SPIE Proceedings in Yokohama (June 2024)
- Support in the functional design of the Concurrent Design Facility

### Next steps:

- Preparation and presentation of the SPIE Proceedings papers
- Participation to the SECESA Conference on Concurrent Engineering in Strasbourg (September 2024)
- Active sharing of the acquired methodologies, both through presentations and on-hand sessions, especially once the Concurrent Design Facility in Naples is ready, at the end of the STILES activities (2024/2025 onwards)