



# **SURPRISE**

**SUPER-RESOLVED COMPRESSIVE INSTRUMENT IN THE VISIBLE  
AND MEDIUM INFRARED FOR EARTH OBSERVATION APPLICATIONS**



**Deliverables “Scanning System” [D6.3] and “Test  
Equipment (OGSE)” [D6.5]**

**Saitec**



## 1. Summary of Deliverable content

In order to validate SURPRISE demonstrator and to perform significant and effective tests, a specific system, named Target Scanning System (TSS), has been developed and manufactured. The deliverables present the Target Scanning System to be used for AIT (Assembly, Integration and Test) activities for SURPRISE demonstrator. The system is composed by two main subsystems:

1. Control Unit (CU), which is an assembled rack 19" used to control the mechanical parts of the Test Bench and to interface the Mechanical Bench to the Master Unit by CSEM;
2. A Mechanical Bench supporting a set of custom targets, studied and designed to guarantee the best test performances for the demonstrator: in fact, the several modules supported represent the scenes to be observed by SURPRISE demonstrator. This means that by moving and changing target position, the scene observed by SURPRISE demonstrator changes.

The system is embedded with a software package to control the CU, move the targets and perform tests sessions. The software was developed to allow a double use. As an integrated embedded software, when the Master Unit is connected, the software receives commands from the Master Unit and sends controls to the CU moving the targets. Used as a visual software, it allows the control of targets bypassing the Master Unit. This double use is strategic since it offers the chance to execute different kinds of tests at different level of the integration process.

As per laboratory setup, the CU and the bench hosting the targets are expected to be at a certain distance from SURPRISE demonstrator to test its capabilities to observe and reconstruct the different images.

## 2. Main Innovations / New knowledge

### 2.1 Control Unit

The Control Unit (CU) is an assembled rack 19" provided of wheels and handles, easy to move and composed by several modules, such as:

- Power Distribution Unit (PDU), containing on/off switches, safety breakers and an emergency mushroom;
- Power Supply Unit (PSU), provided with Power Supply for linear and rotary actuators (Motion controls) and Power Supply for local Front-End electronics (Auxiliary controls);
- A blind panel with led lights notifying the status of the units connected to the CU (actuators, IR sources, RTD);
- Processing Unit (PU);
- PC service interface (SIF) providing interface for the connection to external monitor, keyboard, mouse; interface for connection to the Master Unit; communication I/F and ethernet switch; factory recovery disk.
- Front End Unit (FEU) which is the interface for the connection to Mechanical Bench and provides on one hand the front-end electronics for the RTDs, infrared sources, halogen illuminators, interlock switch, on the other hand power and control lines for linear and rotary stages;



- Power Input Unit (PIU).

When in test configuration, the CU is placed far away from the Mechanical Bench, therefore for user safety reasons, an emergency mushroom is installed and can be used in remote configuration.

## 2.2 Mechanical Bench

The Mechanical Bench is a structure composed by two motorized linear stages and one motorized rotary stage, protected by a cover plate and placed on a laboratory bench provided with adjustable feet for alignment purposes. The target to be observed is visible through a hole in the cover plate, so that it fulfils its protection role, with no impact on tests that can be safely executed. The stages are provided with specific levelling mechanism in order to meet the strict accuracy levels required for SURPRISE tests. The stages support the target linearly and rotary moving it with really high precision offsets.

Each target is a diamond shaped module rotated by 45° compared to the floor, representing the scene to be observed and reconstructed by the demonstrator. According to the scope of test activities, different types of targets have been developed in order to cover all the tests required for SURPRISE demonstrator:

- Calibration target for linear and rotary axes characterization at the beginning of a test session;
- Spatial resolution target is provided with a standard 1951 USAF resolution target and a custom 45 mm sided chessboard with 0.9375mm side square cells.
- Spectral resolution target made with a patented color checker board;
- Image reconstruction target uses a 100% natural stone paper;
- IR sources target for the performance verification in the IR band was realized using IR sources on a PCB with a black matte solder mask to limit the reflections effects.

Each target has been manufactured following specific choices in terms of colors, materials, finish and substrate in order to achieve matte and diffusive reflectance surface suitable for front light illumination, reflective illumination, natural illumination applications. These characteristics will ensure reliable tests on SURPRISE demonstrator performances. In addition to these characteristics, weights constraints had to be respected too; indeed, the study of targets weights was crucial to ensure movements precisions and accuracy required for the axes with the aim to perform tests compliant with the specification requirements.

*This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 870390.*

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