

# ***CDR of the Wire Scanner Acquisition System Quality Plan***

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## 1. Scope

In this document, we report the action planned to guarantee the meet the requirements of the Wire Scanner Acquisition System, with special reference to the in-house developed hardware modules and the custom developed software.

### System Description

The WS ACQ SYS is composed of a set of in-house developed hardware modules and of a set of COTS electronic boards and modules, all of these integrated into a single ESS/ICS acquisition system by means of a custom developed software running under EPICS.

The in-house hardware modules are:

- The Analogue Front End (AFE)
- The Optical Front End (OFE)
- The Back End (BE) and the modified BE (BE<sub>mod</sub>)

The custom developed control software is used to control all the HW modules, to process the acquired data and to present them to the User, all the above by means of dedicated control panels.

## 2. Input to this quality plan

Inputs to this plan are:

- the agreed Technical Annex [1]
- the Wire Scanner conceptual design report [2]
- the Quality Plan Template [3]
- constraints in the installation of the AFE in the machine tunnel
- constraints in the installation of the OFE and BE in the racks
- the ambient in which they will operate (e.g. air temperature)
- any other additional information, either via e-mail or from discussions

## 3. Quality goals

The performance – both in terms of sensitivity to the input current and in reliability of the systems, with special reference to the in-tunnel installed modules (AFE), – are planned to be achieved by:

- adoption of commercial (COTS) rad-tolerant components from manufacturers whose reliability is renowned [3]
- Adoption of high quality components for the AFE, OFE and BE modules.
- Control on the electronic board manufacture process adopted by our supplier who will build the boards used inside the AFE OFE and BE/BE<sub>mod</sub>.

## 4. Management responsibilities within this quality plan

The local Coordinator for this Work unit is:

- Mario Ferianis, Head of the Beam Instrumentation Laboratory at Elettra.

Other personnel from Elettra that will also take part in the provision of the work and the monitoring activities defined in the Quality Plan are:

- Raffaele De Monte, senior HW SW designer on ELETTRA and FERMI, responsible for the new BPM project at ELETTRA
- Sandi Grulja, senior HW designer on ELETTRA and FERMI, responsible for the MPS system of FERMI
- Stefano Cleva, senior programmer, responsible of the firmware of the digital BPM system on ELETTRA and FERMI

## 5. Documentation and storage of data

The documentation will be prepared according to agreed templates and coding.

Data from tests will be collected inside Tests Reports.

The official language for all documents and reports is English.

Whenever possible or applicable, electronic copies of documents and reports, in standard and commonly used formats (e.g. pdf, jpeg, etc.) will be stored in on-line and off-line repositories at Elettra and ESS.

Whenever possible or applicable, paper copies will be stored as well.

## 6. Resources

In this section, we report the resources we plan to use in executing or supporting the activities related to the AFE OFE BEs.

### 6.1. Materials

All components needed for the construction and assembly of the proposed system are standard high-grade industrial products.

### 6.2. Human resources

The production and assembly of the systems will occur partially in the factory of our high quality qualified suppliers and partially in our Instrumentation Laboratory. In our Purchase Orders for the electronic boards manufacturing we will include specific quality requirements that have to be assured for qualification.

The above mentioned expert electronic engineers from Elettra will verify the factory testing procedures and assist during the factory acceptance test of the boards.

### 6.3. Infrastructure and work environment

All the incoming electronics boards will be in-house tested, at the Elettra Instrumentation Laboratory, prior to assembly into the final deliverable Modules.

## 7. Requirements

The condition (air temperature, humidity, presence of dust...) of the ambient that hosts the racks with the WS ACQ SYS may have an influence on the performance of the WS ACQ SYS itself. This information, as well as others mentioned in the Interface

Requirements Document may have an impact on the installation or the operation of the WS ACQ SYS.

## 8. Customer communication

The local Coordinator for this Work unit is:

- Mario Ferianis, Head of the Beam Instrumentation Laboratory at Elettra.

## 9. Design, development and construction Processes

The hardware modules (AFE OFE and BEs) part of the WS ACQ SYS are in-house design made at Elettra. In doing this, we have adopted:

- Standard formats for PCB cards, standard size and component series (e.g. SMD resistances or capacitances), standard frames (crates) from renown manufacturers;
- Altium Designer™ software for the creation of schematics, gerber files, BoM;
- standard copper thickness for PCB, and standard connectors for interfacing them to the “outer world”;
- while manufacturing similar hardware modules, like the boards of the Cavity BPM system of FERMI or the boards for the Machine Protection System of FERMI, we have already made a selection and pre-qualification of the supplier for the realization of PCB and assembly of components;
- to use electronic components easily available on the European market
- to use electronic components tested for years, but far from possible obsolescence
- before shipping to external Laboratories, all MPS modules (namely RAD-fet units) are tested (100%) and calibrated in the Beam Instrumentation Laboratory at Elettra.
- For the design of mechanical part the following CAD tools have been used
- All mechanical parts will be manufactured in the ELETTRA workshop using numerical machinery
- The assembly of all mechanical parts will be carried out in the Instrumentation Laboratory at ELETTRA

## 10. Purchasing

For the in-house developed modules, namely the AFE the OFE and the BEs we plan:

- to outsource the printed circuit boards (PCB) construction and components placing
- to buy as COTS all mechanical components (enclosure) which match the general system requirements and in particular the quality and dimensional requirements

The manufacturing and component placing of the developed boards will be carried out by highly specialized local companies, using state of art automatic pick&place machines as well as automated testing tools including visual inspection, x=ray imaging and pin per pin verification

The purchase order assignment will be carried out as a standard purchase. Reports on all carried out factory tests (in English) will be provided.

## **11. Production and service provision**

Adequate technical specifications will be made available to the supplier including in-house generated the Gerber files and BoM.

### **Identification and traceability**

Each manufactured board as well as each assembled unit will be provided with its own and unique Serial Number.

## **12. Preservation of product**

The systems require no special packaging or delivery precautions besides the standard ones adopted in shipping electronic equipment.

## **13. Control of incoming product**

Besides the in-factory tests, we will perform 100% tests on the incoming units to double check the compliance to the original design. Non-complying boards will be rejected. Non-conformities will be notified in writing (English) to the supplier.

## **14. Monitoring and measurement**

Besides the in-factory tests and calibrations, no additional monitoring actions are needed considering the limited volumes and already mentioned 100% quality inspection.

## **15. Implementation and revision of the quality plan**

### **15.1. Review and acceptance of the quality plan**

This is the first release of the Quality Plan.

### **15.2. Implementation of the quality plan**

The latest updated copy of the plan is available in a repository accessible by the personnel of the Power Supplies Laboratory at Elettra. Any new revision will be also send for notification and storage to the Elettra IKC ESS Project assistant and to ESS.

### **15.3. Revision of the quality plan**

The persons at Elettra in charge for the provision of the WS ACQ SYS paragraph 4.) is:

Mario Ferianis

He can modify and update the quality plan. The approved revisions will be distributed and stored as described in the previous sub-paragraph.

#### 15.4. Authorized deviations to this quality plan

Elettra and ESS have still to discuss this point.

## 16. Glossary

Term	Definition
COTS	Commercial of the shelf
AFE	Analogue Front End module
OFE	Optical Front End module
BE	Back End module
FAT	Factory Acceptance Tests
BoM	Bill of Materials: list of components to use in building something.

## 17. References

- [1] dddd
- [2] ghjtfm
- [3] *IKC AIK 17.2 – Technical Requirements, Wire Scanner Acquisition System*  
ESS-0055341, Rev. 1 (3), Apr. 7, 2016
- [4] *ESS template for Project Quality Plan*, ESS-0037830, Rev. 1 (12), Sept. 22, 2015
- [5] *Analog Device XFCB technology rad tolerant devices*

## DOCUMENT REVISION HISTORY

Revision	Reason for and description of change	Author	Date
1	First issue	Mario Ferianis	18-02-16