ANNEX 3

TECHNICAL SPECIFICATIONS

REFURBISHMENT OF THE CONTROL SYSTEM OF THE EXISTING EU5.0 UNDULATOR
DYNA CHIRO PROJECT

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1 Subject of the supply

A magnetic undulator is required for the new MOST beamline on Elettra. This insertion device must provide variable polarisation (linear horizontal and vertical, elliptical, circular) in the energy range 200-2000 eV. It has been decided that the parameters of an existing undulator (EU5.0, developed in 2008 as a prototype for the FERMI radiators) can provide these characteristics.

This document provides technical specifications for the refurbishment of the drive and drive control system of this device.

2 Responsibilities of the contractor

The contractor is responsible for:

- design of the control system and of the necessary electrical and mechanical modifications
- procurement of materials and components
- implementation of the new control system and of the necessary modifications
- execution of the required magnetic measurements and analysis of the measurement results

The manufacturer shall secure complete compliance with the technical requirements. However, in case deviations from these specifications are necessary, a written communication shall be submitted for review to CERIC, who must approve these changes in writing prior to proceeding further.

3 Technical requirements

3.1 General Requirements

The Contractor and his subcontractors should have a suitable and current quality certificate issued by a relevant Quality Assurance Organization such as ISO 9001:2008 or its equivalent with respect to design, production and testing of all the systems and equipment provided by it.

3.2 Specifications for the refurbishment of the control system of the existing EU5.0 undulator

While the mechanical and magnetic parts of the existing EU5.0 undulator are adequate to satisfy the project needs, a proper control system for the gap and phase driving motors was never implemented, since the device was only operated in the magnetic measurement laboratory and never installed on the storage ring.

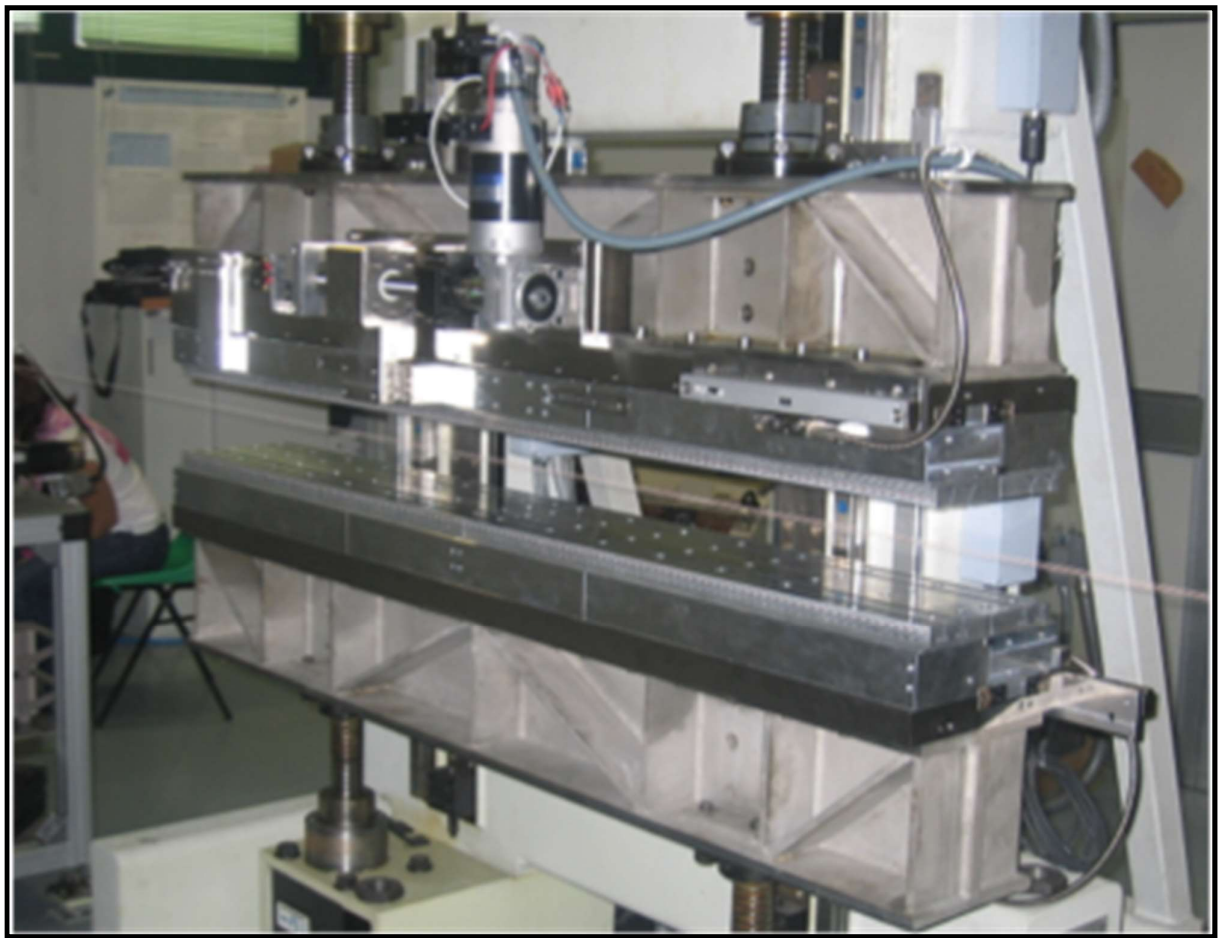

Figure 1: The undulator structure in the insertion device laboratory

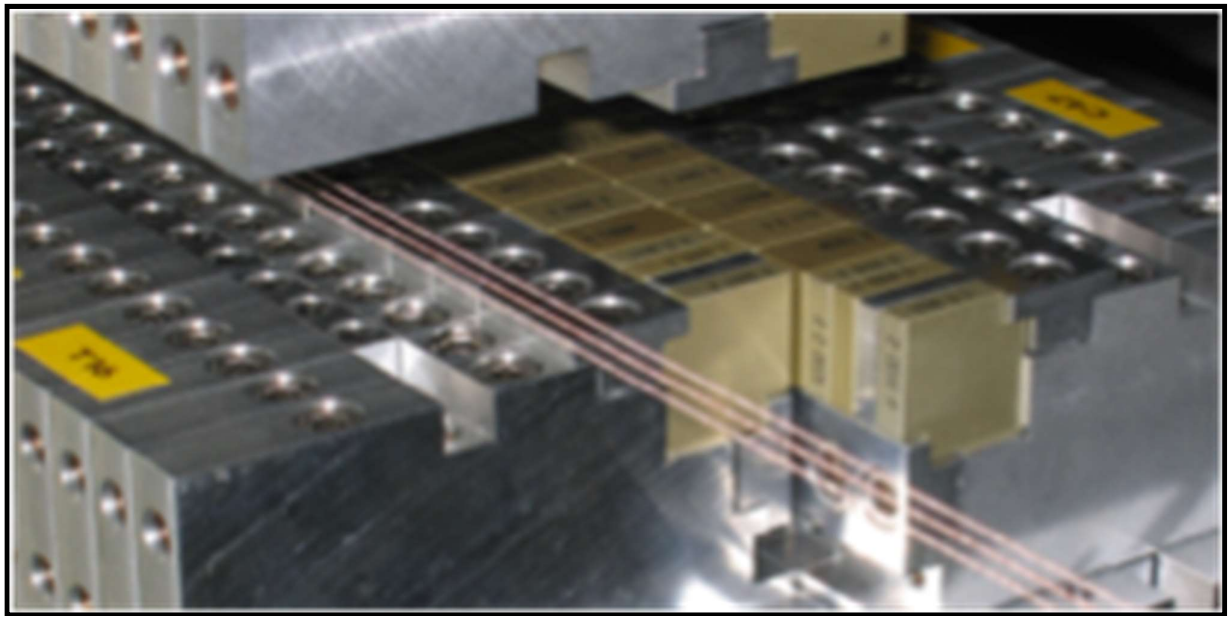

Figure 2: The undulator (magnetic structure) during magnetic fielld measurements

Therefore, a new drive and drive control system has to be designed and implemented to ensure the functionalities and the reliability required for its operation as a tuneable, adjustable polarisation radiation source. This will require a refurbishment of the electrical and electronic components (motors, encoders, switches, etc). Some mechanical modifications and/or replacement of parts may also be necessary. Consequently, dismounting of existing motors, encoders, switches and other related components will be also part of the work.

The main specifications of the control system are the following:

- it must be designed to achieve and then to maintain the desired gap and phase with a precision of 5 micron or better, including backlash.

- the four gap drive motors and the two phase drive motors (six motorised axes in total) must be controlled synchronously by hardware and software. The system must be designed to prevent excessive supporting beams misalignment that could damage the linear rails.

- All axes must be equipped with synchronous motors, absolute linear encoders with at least 1 um resolution, adjustable end switches with power cut functionality at both extremes of the working range. The gap and phase changing speed must be adjustable between 0.1 and 2 mm/s.

- The control system rack must be connected to the undulator using 10 m long detachable cables using suitable connectors. A connection box, to be positioned on the undulator frame, must be provided.

- The system must allow local operation using industrial style control interfaces (touch screens or similar) from both the control rack and the connection box. It must also allow remote control over TCP/IP, exchanging "datablocks" with a Tango-based accelerator control system.

In addition to the above work, the magnetic field properties (field profiles, phase error, trajectory, multipoles) must be measured at a number of gap and phases in order to provide a calibration table to be used for proper operation of the desired undulator parameters.

3.3 Fabrication drawings

Drawings of the new or modified mechanical and electrical components must be provided. Electronic file format of these drawings will be agreed between the contractor and CERIC.

4 Tests

4.1 Dimensional and tolerances tests

4.2 Inspections, design and manufacturing criteria

4.3 Factory acceptance test

A factory acceptance test (FAT) must be performed before the shipment, demonstrating the full functionality and the required performance of the control system. The contractor is responsible for conducting the test with the presence of Elettra-Sincrtotrone Trieste personnel.

4.4 Final report

A test report shall be provided to CERIC for approval before the shipment. This report must include the following:

- datasheets of all the commercial components

- an instruction manual for the control system describing hardware, software, functionality and troubleshooting.

- the source code of the software developed.

- a set of magnetic field measurements performed on a grid of gap and phases, indicatively 20 gap values and 20 phase values. Results must include on-axis magnetic field profile, off-axis field integrals and associated multipole errors (quadrupole, sextupole and octupole), trajectory, resonant photon energy and phase error.

CERIC reserves the right to reject the material in case the requested documentation is not provided.

4.5 Site acceptance test

The refurbished undulator will be tested again at Elettra (Site Acceptance Test – SAT). The SAT will consist in repeating the same tests performed during the SAT. Possibly a sub-set of the magnetic measurements will be repeated in the Insertion Devices Laboratory to validate the results provided by the manufacturer.

5 Packaging

Safe transportation of the undulator to prevent hazards and damage due to transportation conditions and weather must be provided by a suitable packaging. 5-G Shock indicators must be attached to package.