Abstract
The first Delta undulator for Sirius, a 3 GeV 4th generation synchrotron light source located in Brazil, is currently being built. It will be the first undulator of this type to be used in a storage ring based light source. The undulator has a 1.2 m long pure permanent magnet structure with 21 periods of 52.5 mm, a 13.6 mm fixed gap and four magnetic arrays that can be moved in the longitudinal direction to provide full polarization control. This paper presents an overview of the Delta undulator project regarding its design, construction, measurements and field correction methods.

MAGNETIC DESIGN

The python version of the Radia software was used for the field integrals calculations and the Simcenter MAGNET software, for the magnetic force simulations. A simulated annealing algorithm was implemented for the end design optimization.

MAGNETIC FIELD CORRECTION: PRELIMINARY RESULTS

Field correction steps:
• Blocks sorted based on single block measurements
• Field integral of each magnet holder (12 blocks) corrected with block rotations and virtual shimming
• Assembly of a few periods in the undulator structure followed by field correction with virtual shimming (the current assembly has 9 periods)

MECHANICAL DESIGN: SUB-ASSEMBLY

The magnet holders (AA7075-T6) are fixed to the slide base using a dovetail type geometry and locked by a clamping system using a tapered wedge tightened by a front drive screw, in such way that the magnet holders can be sequentially mounted and bolted to each other to prevent slipping. Each magnet is fixed with two opposite clamps (AA7075-T6) by screws, enabling adjustments of ±0.25 mm by using brass shims at the magnets base.

VACUUM CHAMBER

• Extruded 6063-T6 aluminum vacuum chamber
• Inner vertical aperture of 7.6 mm and inner horizontal aperture of 13 mm
• 5 mm diameter cooling channel with water flow of 1L/min (185W heat load)
• NEG coated with a film thickness of 0.6 µm
• Final pressure of \(1.5 \times 10^{-10}\) mbar achieved in the NEG activation tests

STATUS REPORT OF SIRIUS DELTA UNDULATOR

January-2022

Instalation in the storage ring scheduled for

NEXT STEPS

• Assembly of the remaining magnet holders in the undulator structure
• Magnetic field correction for the full undulator
• Instalation in the storage ring scheduled for January-2022

ACKNOWLEDGMENT

This project is the product of the work of dozens of people who are part of the CNPEM engineering team. The authors would like to thank everyone who contributed for the results presented herein. We would also like to thank Sergio Lordano Luiz for providing the brilliance data simulated for the undulator.

CONTROL SYSTEM

Cassettes Longitudinal Movement
Range ± 20–25 mm
Position repeatability 0.2 µm
Speed 2 to 8 mm/s
Acceleration 20 mm/s²

MAGNETIC MEASUREMENT SYSTEMS

• Individual blocks measured with a Helmholtz coil system
• Field map obtained with a 0.75 mm thickness low-noise 3-axis SENIS hall probe
• Field integrals measured with a in-house developed single stretched wire system

Matplotlib V. 3.0.2

Stretched Wire Measurement Errors

Horizontal first field integral 9 G cm
Vertical first field integral 3 G cm
Horizontal second field integral 2.8 kG cm²
Vertical second field integral 0.8 kG cm²

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