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Specification of insertion devices for ORION project at SIRIUS

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The pioneering ORION project will integrate a biosafety level 4 (BSL-4) laboratory with the SIRIUS synchrotron light source. The project includes three beamlines: TIMBÓ, HIBISCO, and SIBIPIRUNA, optimized for X-ray microscopy on biological materials. This study focused on evaluating Insertion Devices (IDs) for the TIMBÓ and HIBISCO beamlines, which demand high photon flux in the ranges of 3–20 keV and 16–40 keV, respectively. Achieving high photon energies with undulators in a 3 GeV synchrotron poses significant challenges. To address this, radiation emission calculations were performed for three ID types: in-air (IAU), in-vacuum (IVU), and cryogenically cooled permanent magnet (CPMU) undulators. With a numerical method based on Wigner's formalism, CPMUs were identified as optimal: a 2 m CPMU with a 14.6 mm period was identified for TIMBÓ, while HIBISCO ideal option is a 2 m CPMU with a 13.6 mm period. As a comparison of the types found for HIBISCO at 40 keV, CPMUs demonstrated approximately a 2.7x flux gain compared to IVUs, and IVUs about 3.8x the flux of IAUs. Further evaluations will consider also the impact on the electron beam dynamics and fabrication feasibility.

Footnotes

Paper preparation format

LaTeX

Region represented

America

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