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Radiation Shielding Aspects and Monte Carlo Analysis of the 4th Generation Storage Ring in Korea

Thursday, November 14, 2024 1:00 PM (1h 30m)

The 4^{th} Generation Storage Ring (4^{th} GSR) facility has been under development in Korea since July 2021. Storage ring has a circumference of 799.297 m with a beam emittance of 62 pm.rad. It will operate with a stored electron energy of 4 GeV and a current of 400 mA. The facility includes a 200-MeV Linac operating at 2 Hz, a booster ring, and a storage ring (SR), both housed within the same tunnel.
In previous work, bulk shielding calculations were performed using the semi-empirical SHIELD11 code [1]. This work used FLUKA to accurately determine SR tunnel shielding structure, assuming a 90% injection efficiency into SR at 4 mA/2min. Electron beam loss scenarios were divided into two types normal and abnormal losses. Since electron beam injection from Linac to booster, beam extraction from booster, and injection from booster to SR are close to each other, shielding calculations were classified into injection and non-injection areas, where specific thicknesses considered for each area. In injection area, normal operation beam loss scenarios included uniform beam loss over SR and booster ring, as well as losses at injection and extraction septa between Linac, booster, and SR. The total dose rate was calculated by summing the dose rates from these scenarios. FLUKA results confirmed that tunnel shielding structure effectively keeps the dose rate within dose limits.
Appropriate shielding criteria were determined based on Nuclear Safety Act in Korea and the ALARA principle. These simulations aim to provide an overall radiological framework for shielding the 4^{th} GSR in Korea under current designed conditions.

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[1] N. S. Jung, Radiation Shielding Evaluation of 4^{th} Generation Storage Ring in Korea, 11th International Workshop on Radiation Safety at Synchrotron Radiation Sources (RadSynch23), ESRF, France (2023).

Contribution track

ICABU WG1. Accelerator Systems

Paper submission Plan

Yes

Best Presentation

No

Primary author: BAKHTIARI, Mahdi (Pohang Accelerator Laboratory, POSTECH, South Korea)

Co-authors: JUNG, Nam-Suk (Pohang Accelerator Laboratory / POSTECH); LEE, Hee-Seock (Pohang Accelerator Laboratory, POSTECH, South Korea)

Presenter: BAKHTIARI, Mahdi (Pohang Accelerator Laboratory, POSTECH, South Korea)

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