



Contribution ID: 184 Contribution code: TUIBB02

Type: **Invited Oral Presentation**

Coherent Stability Considerations for High-Intensity Beam Production at FAIR

Tuesday, October 21, 2025 11:30 AM (30 minutes)

The SIS100 synchrotron and its booster SIS18 synchrotron will produce high-intensity heavy-ion beams at the space-charge limit. The transverse collective instabilities can endanger the safe operation, the single-bunch and the coupled-bunch instabilities with non-rigid oscillations are anticipated. As the major means for the instability suppression, the octupole magnets for Landau damping will be used. This can lead to additional beam loss due to nonlinearities and space-charge induced resonance crossing. The machine protection, especially for the superconducting SIS100 main magnets, demands a low-loss (a few percent) operation. Especially the 1 sec beam accumulation at the injection energy in SIS100 can become a bottleneck for the safe operation. We review the expected transverse instabilities and the octupole usage for Landau damping. The effect of space-charge for the required octupole strength is included. The particle tracking simulations and a machine learning based algorithm are used in order to find optimized octupole configurations.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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Session Classification: TUIBB WGA invited oral

Track Classification: WGA:Beam Dynamics in Rings