Contribution ID: **20** Contribution code: **TUC2**   Type: **Invited Oral Presentation**

UV Laser System(s) for Laser Cooling of Relativistic Bunched Ion Beams at the SIS100

Tuesday 28 October 2025 14:00 (30 minutes)

Laser cooling is a promising technique to achieve a narrow momentum distribution of relativistic bunched ions in accelerators. This technique allows efficient cooling, especially for highly relativistic ion beams and heavy ions, with cooling times on the order of seconds. Previous experiments at the ESR have successfully demonstrated laser cooling of relativistic bunched ion beams with both a continuous wave (cw) and a pulsed laser system. For the efficient application of laser cooling at the new SIS100 facility at GSI FAIR, three laser systems will be used simultaneously to ensure optimal cooling.

Two high-power laser systems for laser cooling at the SIS100 are being developed at the TU Darmstadt: a cw and a pulsed laser system. The pulsed laser achieves a maximum UV output of up to 5 W with a tunable frequency range of over 3 THz around a center wavelength of 257.4 nm. The pulse duration can be varied between 50 to 735 ps, thus allowing a flexible width of the cooling force, while the adjustable repetition rate between 1 and 10 MHz provides easy synchronisation with the ion bunches. In a beam experiment with bunched $^{12}C^{3+}$ ions at the ESR Helmholtzzentrum GSI in 2021, laser cooling was successfully demonstrated employing this laser system.

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

Author: GRUNWITZ, Tamina (Technical University of Darmstadt)

Co-authors: LANGFELD, Benedikt (Technical University of Darmstadt); WINTERS, Danyal (GSI Helmholtz Centre for Heavy Ion Research); SCHWARZ, Denise (Technical University of Darmstadt); GUMM, Jens (Technical University of Darmstadt); KLAMMES, Sebastian (GSI Helmholtz Centre for Heavy Ion Research); WALTHER, Thomas (Technical University of Darmstadt)

Presenter: GRUNWITZ, Tamina (Technical University of Darmstadt)

Session Classification: Laser Cooling Session

Track Classification: COOL'25