Contribution ID: **1837** Contribution code: **MOPM043** Type: **Poster Presentation**

Comparison of particle in cell and soft-Gaussian beam-beam solvers

Monday 2 June 2025 16:00 (2 hours)

A crucial component for designing particle colliders is the assessment of beam-beam effects at collisions. Particle In Cell (PIC) solvers are popular numerical tools, which solve the Poisson equation for the electromagnetic (EM) potential
Φ produced by the colliding beam's bunches spread on a discretized grid, and compute the Lorentz force acting on the particles subjected to the gradient of Φ. The main limitation of this approach is the high computational cost, which can be alleviated at the expense of accuracy by using approximation techniques, such as the soft-Gaussian approximation, which assumes the bunch particles to have transverse Gaussian distributions. Both methods are widely used in the accelerator physics community. The Xsuite framework is the first multiparticle tracking tool, which aims to support both approaches. This contribution compares the performance of their Xsuite implementation.

Footnotes

Paper preparation format

LaTeX

Region represented

Europe

Funding Agency

EU Future Circular Collider Innovation Study (FCCIS) project under the Grant Agreement ID 951754

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Session Classification: Monday Poster Session

Track Classification: MC1 :Colliders and Related Accelerators: MC1.A02 Lepton Circular Colliders