Contribution ID: **23** Contribution code: **MOP13** Type: **Contributed Poster**

MINERVA Code Release Announcement

Monday, 22 August 2022 17:10 (20 minutes)

MINERVA is a 3-D, time-dependent simulation code of FEL amplifiers, low-gain/high-Q and high-gain/low-Q oscillators, optical klystrons (including high-gain harmonic generation) and SASE configurations [1-7]. Oscillator simulations are done in conjunction with OPC [8]. MINERVA uses the Message Passing interface on Linux, Macintosh and Windows systems and has been successfully benchmarked against many experiments. Particle dynamics are treated using the full Lorentz force equations to track particles through the optical and magnetostatic fields. Hence, MINERVA treats both fundamental and (linear and nonlinear) harmonic generation from first principles. The optical field is a superposition of Gaussian modes using the slowly-varying envelope approximation in which the x- and y-components of the field are integrated independently, and tracks the particles and fields as they propagate along the undulator line from the start-up through linear growth and into the nonlinear regime using either 2nd or 4th order Runge-Kutta integrators. MINERVA includes 3-D descriptions of planar, helical, and elliptical undulators (including a model of an APPLE-II undulator) with the fringing fields in the entry/exit transition regions. Magnetostatic field models for quadrupoles and dipoles are also included. As such, MINERVA implicitly simulates the evolution of the polarization of the optical field through an arbitrary sequence of undulators. MINERVA and OPC can be downloaded from
MINERVA: https://gitlab.utwente.nl/tnw/ap/lpno/public-projects/MINERVA/-/releases
OPC: https://gitlab.utwente.nl/tnw/ap/lpno/public-projects/Physics-OPC/-/releases
as well as user manuals, release notes and sample scripts showing to run MINERVA/OPC.

1. H.P. Freund, P.J.M. van der Slot, D.L.A.G. Grimminck, I.D. Setya and P. Falgari, "3-D, time-dependent simulation of FELs with planar, helical, and elliptical undulators,"New J. Phys. 19, 023020 (2017).
2. H.P. Freund and P.J.M. van der Slot, "Studies of a terawatt x-ray FEL,"New J. Phys. 20, 073017 (2018).
3. H.P. Freund, P.J.M. van der Slot, and Yu. Shvyd'ko, "An x-ray Regenerative Amplifier FEL using diamond pinhole mirrors,"New J. Phys. 21, 093028 (2019).
4. L.T. Campbell, H.P. Freund, J.R. Henderson, B.W.J. McNeil, P. Traczykowski, and P.J.M. van der Slot, "Analysis of ultra-short bunches in FELs,"New. J. Phys. 22, 073031 (2020).
5. H.P. Freund and P.J.M. van der Slot, "Variable polarization control in FELs,"J. Phys. Commun. 5, 085011 (2021).
6. P.J.M. van der Slot and H.P. Freund, "3-D, time-dependent analysis of high- and low-Q FEL oscillators," Appl. Sci. 11, 4978 (2021).
7. H.P. Freund, D.C. Nguyen, P.A. Sprangle, and P.J.M. van der Slot, "3-D, time-dependent simulation of a Regenerative Amplifier FEL,"Phys. Rev. ST-AB 16, 010707 (2013).
8. J.G. Karssenberg, P.J.M. van der Slot, I.V. Volokhine, J.W.J. Verschuur and K.-J. Boller "Modeling paraxial wave propagation in FEL oscillators,"J. Appl. Phys. 100, 093106 (2006).

I have read and accept the Privacy Policy Statement

Yes

Primary authors: FREUND, Henry (University of New Mexico); VAN DER SLOT, Peter (University of Twente)

Presenters: FREUND, Henry (University of New Mexico); VAN DER SLOT, Peter (University of Twente)

Session Classification: Monday posters

Track Classification: FEL Theory