

OOPIC^{Pro}

OOPIC Pro solves challenging problems in basic research; aids in plasma-processing equipment design, analysis, and optimization; and provides a tool for plasma physics education.

OOPIC Pro particle-in-cell plasma and beam simulation uses proven, easy-to-use simulations to validate your intuition, optimize designs, and verify results. Interactivity, coupled with rich diagnostic visualization, build your understanding of plasma dynamics and provide you with a deeper insight into plasma behavior.

Created by scientists and programmers with years of plasma simulation experience and offered at an affordable price, **OOPIC Pro** is the most cost effective solution on the market. Additionally, Tech-X Corporation offers technical support services, consulting services and maintains a lively user community for **OOPIC Pro**.

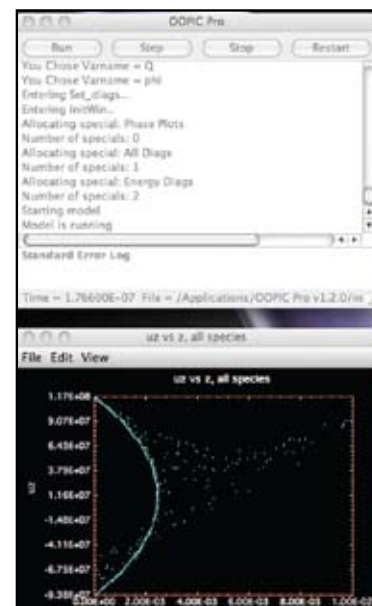
The intuitive user interface allows the user to select and edit model input files, control simulations, set data dump and plotting parameters, and simultaneously visualize results in multiple ways as the simulation is running. Users get immediate feedback from more than a dozen 2D and 3D diagnostics. **OOPIC Pro** runs on all typical laptop and workstation hardware and is compatible with Linux, Mac OS X, and Windows.

OOPIC Pro simulates physical systems including plasmas; beams of charged particles with self-consistent and externally generated electric and magnetic fields; multiple species; low-to-moderate density neutral gasses; and a wide variety of boundary conditions. **OOPIC Pro** has electrostatic and electromagnetic field solvers for 2D geometries in both x-y (slab) and r-z (cylindrical) coordinates, and includes Monte Carlo collision and ionization models.

OOPIC PRO IS EASY TO USE AND LEARN

OOPIC Pro comes with example input files, enabling a new user to begin Particle-In-Cell (PIC) simulations of relevant physical systems just minutes after installation. The interactive GUI allows the user to immediately see a wide range of dynamic 2D and 3D diagnostic windows, showing the step-by-step evolution of field quantities, particle motion, and time histories of aggregate quantities such as energy or average temperature. The flexible and intuitive syntax of the input files, combined with the immediate feedback from the diagnostic windows, enables new users to quickly modify the example input files to meet their needs.

Once users have a basic understanding of OOPIC Pro features and capabilities, they can then refer to the User's Guide for details regarding the full modeling capabilities. The free email discussion list available at oopic-users@fusion.txcorp.com provides a forum for new users to learn tricks and techniques from OOPIC Pro users and developers. Consulting services are available from Tech-X Corporation to users who need assistance in the development of input files or who require special purpose modifications of the source code.



DISPLAYING DIAGNOSTICS DURING SIMULATION BUILDS INTUITION

Plasma physics includes many phenomena that are not immediately obvious, and sometimes even counter-intuitive. By allowing researchers to observe the simulated system as it evolves in time, OOPIC Pro provides users real physical insight into the underlying dynamics of their plasma or beam system – whether it's an existing experiment/device or exploration of a new concept. Instead of looking at a series of graphs describing a given phenomenon, users can interactively select, modify and view diagnostic plots in real time.

INTERACTIVE CONTROL ENABLES RAPID, ITERATIVE MODEL REFINEMENTS

OOPIC Pro users can select and control the diagnostic windows while the simulation is running, enabling them to quickly discover any problems with the model setup or parameter values. There is no need to wait for a simulation to finish and then to create diagnostics (post-processing). With the detailed information gained from the diagnostics, the user can appropriately modify the input file directly from the OOPIC Pro interface and restart, allowing for rapid refinement and improvements.

DUMP BINARY DATA FILES FOR SUBSEQUENT RESTART OR POST-PROCESSING

OOPIC Pro allows users to save data files for post-processing or to continue a simulation at a later time. This can be done periodically, so that in case of a power outage or other unexpected computer failure, the simulation can be resumed from the most recent dump. In this scenario, the latest dump can overwrite the previous dump, in order to save disk space. Such periodic dumps can also be generated without any overwriting, enabling the user to go back and restart the simulation at previous times of particular interest for closer examination. The data dumps support the standard HDF5 file format, which facilitates special-purpose post-processing – such as the generation of publication quality plots – using standard software tools, IDL, MATLAB and Mathematica. OOPIC Pro is distributed with example IDL scripts.

GENERATE IMAGE SEQUENCES TO MAKE MOVIES

OOPIC Pro can generate periodic image sequences while running – the user simply opens the diagnostic windows of interest, then specifies where and how often the corresponding image files should be generated. The image sequence associated with each diagnostic window has a unique base name, and each image name is post-pended with the number of time steps completed. This makes it convenient for software tools such as ImageMagick (on Linux) or QuickTime Pro (on Mac OS X and Windows) to generate a movie from the image sequence. Such movies provide an excellent means of conveying results to collaborators, students and seminar audiences. Presentation of the physical processes in beam and plasma systems are much more clearly conveyed with animated movies and diagnostics than with static plots. For the simulation of very large systems – when the run-time is hours or days, rather than minutes – these movies enable the user to see the system evolve on a dramatically compressed time scale.

COMMAND LINE EXECUTION FOR LONG BATCH RUNS OR PARAMETER SCANS

OOPIC Pro can also be executed from the command line, without using the GUI. This enables batch-mode operation, which is especially useful for very long runs and for the implementation of parameter scans from a script.

PARALLEL COMPUTATIONS FOR QUICKER RESULTS

For the Linux environment, OOPIC Pro now supports parallel execution, allowing researchers to obtain results more quickly by attacking problems with multiple computational processing units.

RELIABLE AND PROVEN BASED ON A DECADE OF RESEARCH AND DEVELOPMENT

OOPIC Pro is based on the OOPIC physics kernel, which was originally developed at the University of California Berkeley, beginning in 1993, by members of the Plasma Theory and Simulation Group (PTSG). Since 1998, Tech-X Corporation. physicists have been working in collaboration with PTSG staff to improve and generalize the physics kernel. The OOPIC physics kernel has been used by researchers around the world since 1995 to simulate a wide range of challenging problems. These include plasma display panels, ion implantation, high-power microwave devices, advanced particle acceleration concepts, and many other systems.

MONTE CARLO COLLISIONS AND MODELING OF IONIZATION PHYSICS

OOPIC Pro includes Monte Carlo collision (MCC) algorithms for modeling collisions of charged particles with a variety of neutral background gasses, including such effects as ion/neutral charge exchange, elastic electron scattering, inelastic scattering due to electron impact excitation, and electron impact ionization. OOPIC Pro can also simulate field-induced tunneling ionization of select neutral gasses and charged macro-particles.

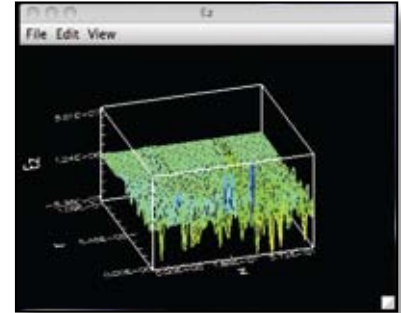
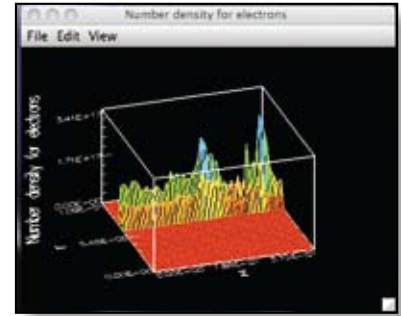
SUPPORTS MULTIPLE PLATFORMS AND STANDARD HARDWARE

OOPIC Pro runs on all typical laptop and workstation hardware and supports Linux, Mac OS X, and Windows allowing it to be easily used in classroom demonstrations.

ABOUT TECH-X CORPORATION

Tech-X Corporation is committed to technical excellence and innovation. We are dedicated to advances in science and engineering. Our scientists and software engineers address specific research questions and deliver quantifiable results, culminating in specialized skills, advanced technologies, and commercial products that enable large-scale computing solutions and offer a greater understanding of physical processes.

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