Tech-X Corporation invites you to visit us at Table #2 at the 11th IEEE International Vacuum Electronics Conference, May 18 - 20 in Monterey.

We are proud to present the most recent release of our electromagnetic plasma simulation software, VORPAL (http://vorpal.txcorp.com). VORPAL 4.0 provides for the first time parallel and multi-core capability to the Windows platform (as with previous versions, VORPAL 4.0 also runs in parallel on the Linux and Macintosh platforms). Let VORPAL 4.0 help you take full advantage of your multi-core desktop computer. Other new capabilities include:

- cylindrical coordinates for electromagnetic simulation
- automated eigenfrequency and eigenmode extraction from time-domain simulation
- new secondary electron models that allow simulations of complex metallic and dielectric boundaries of arbitrary shape without stairsteps
- improved post-processing, including automated import into the VisIt software for advanced visualization

Stop by our table to see a demonstration of any of these new features of VORPAL 4.0. Our technical staff will be available at the booth and will be happy to discuss the details of how VORPAL might fit your modeling needs.

Personnel from Tech-X will be presenting the following paper and posters:

Session K: Modeling II
Thursday / 1:30 PM - 3:00 PM / DeAnza II

19.4 - **Multi-Physics Simulations with VORPAL** *(2:30 PM - 2:50 PM)*

David Smithe, Peter Stoltz, Dan Karipides
Tech-X Corporation, Boulder, CO, USA

Haipeng Wang, Kai Tian, Gary Cheng
JLab, Newport News, VA, USA

The VORPAL finite-difference time-domain particle-in-cell simulation tool has traditionally been used for accelerator, electromagnetic, and plasma simulations. Approximately two years ago, a generalized PDE (partial differential equation) capability was added to the software, and we are now developing this capability to provide multi-physics simulations capability. Our project focus is on integrated thermal & electromagnetic simulations for superconducting RF accelerators. But we are interested in broadening the scope of applications to include vacuum electronics and other physical processes in addition to EM and thermal. We present benchmarking exercises comparing the VORPAL simulations to experimental measurement, and to other multi-physics software.

Session K: Poster II
Wednesday / 1:30 PM - 5:30 PM / DeAnza III

22 - **Design of Multistage Depressed Collectors Using 3D Conformal Finite-Difference Time-Domain Particle-In-Cell Simulations**

M. C. Lin, P. Stoltz, D. Smithe
Tech-X Corporation, Boulder, CO, USA

H. Song
Department of Electrical and Computer Engineering, University of Colorado, Colorado Springs, Colorado Springs, CO, USA

S. J. Kim, S. H. Jang
Agency for Defense Development, South Korea

G. W. Choi, J. J. Choi
Department of Radio Science and Engineering, Kwangwoon University, South Korea

The feasibility of designing a multistage depressed collector using conformal finite-difference time-domain particle-in-cell simulations has been studied. A feedback mechanism is implemented to provide stable time-dependent voltages for each stage of the depressed collector. An arbitrary space-time dependent spent beam distribution can be given in our time-domain simulations. We demonstrate the design of a five-stage depressed collector recovering a triangular spent beam distribution achieving an energy recovery efficiency of 70%.

Session K: Poster IV
Thursday / 1:30 PM - 5:30 PM / DeAnza III

4 - **Design and Analysis of a Microfabricated Ladder Type Slow-Wave Structure for a Millimeter-Wave Traveling-Wave Tube**

Christopher Douglas, Hoyoung Song
University of Colorado at Colorado Springs, Colorado Springs, CO, USA

Ming-Chieh Lin, David Smithe, Peter Stoltz
Tech-X Corp., Boulder, CO, USA

The modeling, simulation, and analysis of a ladder type millimeter-wave traveling-wave tube (TWT) slow-wave structure (SWS) are presented. The simulation contains both cold and hot tests using VORPAL [1], a particle-in-cell (PIC) simulator that uses the conformal finite difference time domain (CFDTD) method. Beam design, dispersion, gain, and particle analysis of the ladder circuit are described.