



## Free VSim Training

October 22 - 23 at Tech-X in Boulder, Colorado

Tech-X Corporation will be holding a free VSim Training Session in Boulder, Colorado for 2 days starting October 22 at 9 am. A free work day will be available the following day on October 24.

Registration is free. Lunch is not included, however there are many casual restaurants within walking distance. Register [here](#).

### VSim Training Agenda

#### October 22, 2014 (Wednesday): Training

9:00am - 10:00am **Overview of VSim including new features**

10:00am - 12:00pm **VMesh**

1:30pm - 4:30pm **External Circuit Modeling**

#### October 23, 2014 (Thursday): Training continued

9:00am - 10:00am **Advanced Composer usage**

10:00am - 12:00pm **Writing your own Analysis scripts**

1:30pm - 2:00pm **Roadmap**

2:00pm - **User Questions, Simulations, and**

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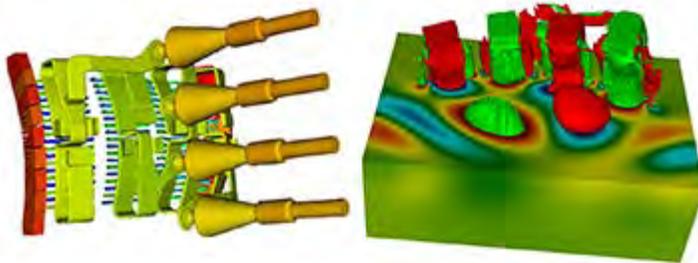
4:30pm      Feedback

October 24, 2014 (Friday): Work Day

Free time to work on your own simulations and ask for help from our inhouse experts.

## VSim Used to Model Alcator C-Mod Field-aligned Antenna on Supercomputer

The VSim Plasma Devices software has been used to model the Field Aligned ICRF Antenna on MIT's Alcator C-Mod tokamak experiment. This experiment uses RF power to heat a plasma to very hot temperatures for researching thermonuclear fusion as an energy source. The antenna geometry was imported from a CAD file, and is very challenging, because of its unusual tilted orientation, which lines up the many small faraday shield wires, and coupling slots with a very strong magnetic field. VSimPD's linear plasma model allows for modeling of plasma in contact with the Faraday screens and other metallic parts of the antenna. The simulations were performed on the Oak Ridge Leadership Class Computing Facility's (OLCF) Titan supercomputer, and used 100,000 processes.



Left: A view of the antenna strapping and feed lines. Right: Wave pattern emanating from the antenna into the plasma.

## VSim for Electromagnetics GPU Algorithms Scale to Thousands of Processes on Titan

The Oak Ridge Leadership Class Computing Facility's (OLCF) Titan supercomputer has over 18,000 GPUs, connected in parallel, and VSim for Electromagnetics has the ability to give a #2 ranking on the Top 500

### VSim Webinar: Simulation of Gyrotrons

September 24, 2014

Simulations of Gyrotrons with panelist Dr. David Smithe is scheduled for 8am PT / 11am ET / 3pm UTC. Details and free registration.

### VSim Used to Teach Plasma Acceleration Course at LA3NET School

October 1, 2014

*Advanced School on Laser Applications at Accelerators:* Overview of simulation codes at the interface VORPAL, plasma generation and interaction with the beam, particle acceleration. 11:00 am - 12:00 noon. For more information, see <https://indico.cern.ch/event/285698/timetable/#20141001>

## ANNOUNCEMENTS

### Free VSim Training

October 22 - October 23, 2014 with Optional Work Day October 24: Free VSim Training at Tech-X headquarters in Boulder, Colorado. Agenda and registration.

### Tech-X to Attend Division of Plasma Physics October 27 -31, 2014

Tech-X will be at the 56th Annual Meeting of the APS Division of Plasma Physics (DPP) in New Orleans, Louisiana. If you would like to meet us there, please contact us to arrange an appointment.

### Tech-X to Attend Gaseous Electronics Conference November 3 - November 7, 2014

Tech-X will be at the 67th Gaseous Electronics Conference (GEC) in Raleigh, North Carolina. If you would like to meet us there, please contact us to arrange an appointment.

### Tech-X to Attend American Vacuum Society International Symposium November 9 - 14, 2014

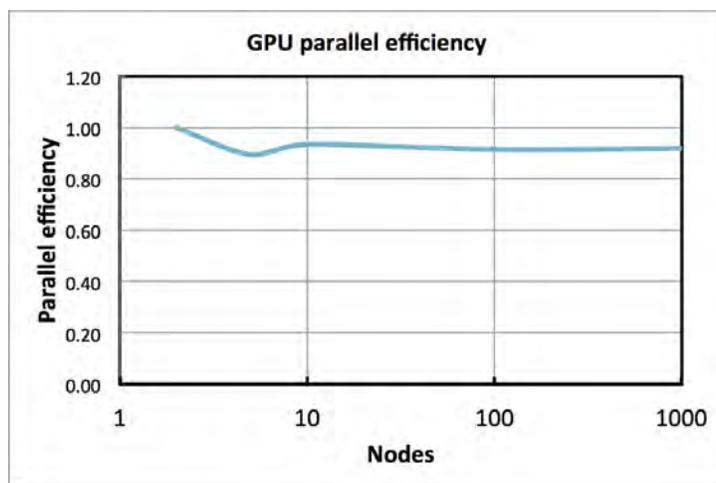
Tech-X will be at the American Vacuum Society (AVS) International Symposium in Baltimore, Maryland. If you would like to meet us there, please contact us to arrange an appointment.

## PUBLICATIONS

M. Kundrapu, J. Loverich, K. Beckwith, P. Stoltz, A. Shashurin, and M. Keidar, "Electromagnetic Wave Propagation In The Plasma Layer of A Reentry Vehicle", 41st International

supercomputers in the world, listed at [Top 500 Computer Supercomputers](#). Taking advantage of this power can be difficult because of the difficulty of exposing the parallelism that GPU accelerators required. VSim for Electromagnetics has the ability to perform parallel GPU computations on this massive scale.

A recent study of timing and scaling shows near ideal weak scaling with existing scaling up to 1000 Nvidia K20X GPUs with each GPU having 2688 CUDA cores for a truly massive simulation. Future work with GPUs on Titan will broaden the scope of the scaling studies to include more processes, more algorithms, and different parallel decomposition options to enable even more effective exploitation of these resources.



**Above: Near ideal scaling of large scale GPU EM simulation on Titan supercomputer. Here parallel efficiency is Ideal Run Time divided by Actual Run Time, where ideal run time is for a minimally small sized problem that was still parallel, e.g., 3 processes. Each process included 165k cells.**

Contact [David Smithe](#) for more information about VSim.

## Tech-X Joins NERSC NESAP Code Teams to Leverage Cori

Vorpal, the code developed by Tech-X Corporation and used by the Tech-X VSim product, has been named as one of the science codes targeted for specialized training and early access to Cori, the Cray XC supercomputer scheduled to be deployed at NERSC in 2016. Cori is a collaboration with supercomputing vendors Intel and Cray.

Along with 43 other science code teams in various areas of Scientific Computing Research, Energy Sciences, and Biological and Environmental Research, Tech-X, led by

Conference On Plasma Science and  
20th International Conference on  
High-Power Particle Beams,  
Washington DC, May 2014.  
<http://arxiv.org/abs/1407.4431>

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cofounder and principle investigator John Cary, will participate in the code optimization program for the NERSC Exascale Science Applications Program (NESAP). Tech-X's participation will ensure that Vorpal code will leverage Cori's Knights Landing manycore architecture.

Prof. Cary said, "Tech-X is proud to collaborate with NERSC both to deliver science results in support of the Department of Energy mission and to help understand how the high-end computing research of NERSC and the Department of Energy can be transitioned to the commercial sector."

Read more at <http://www.hpcwire.com/2014/09/03/nersc-reveals-44-nesap-code-teams/>

## **VSim 7.2 Enhancement: New VSim Average Field Feature**

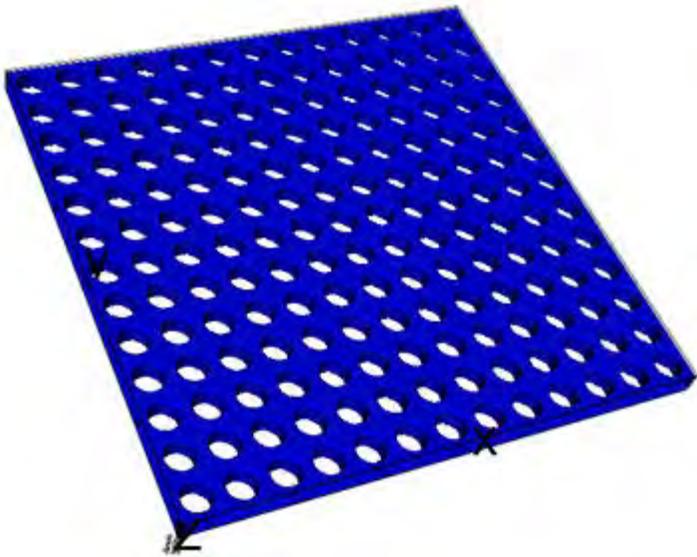
As of VSim Release 7.2 there will be two kinds of average field macros: `averageField()` and `averageFieldWindow()`. The `averageField()` macro finds a trailing average; it works like a low-pass filter, just point it to a field and give it a trailing factor. The `averageFieldWindow()` macro takes an unweighted window average of any field, dumps it, and repeats.

If you would like this feature before VSim 7.2 is released, you can [download the average field feature macro now](#).

## **Technical Tip: Simplified VSim Geometry Creation for Dielectrics**

VSim 7 has features that make it easy and straightforward to programmatically set up complex geometries. These features include primitive geometric objects such as boxes, cylinders, and spheres that can be set up using input blocks. Input blocks may also be used to perform boolean operations, including unions, intersections, and set differences, on those objects. There is also an input block that enables creating arrays of geometric objects, making it easy to set up periodic structures such as photonic crystals.

You can [download an example pre file](#) that shows how to set up a photonic crystal slab structure, consisting of an array of cylindrical holes in a dielectric material, by using these features. For more information about this method of geometry setup, please see the STRgn section of the [VSim](#)



Above: Photonic Crystal Slab Geometry Modeled in VSim 7.

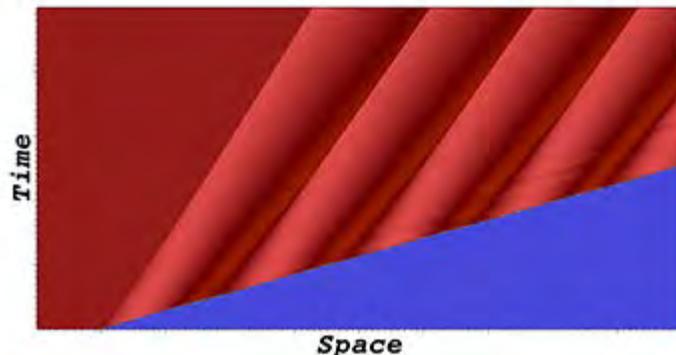


## Quickly Determining Linux Support Information

While the diversity of Linux distributions can be something to celebrate because of its large community of developers producing so many creative operating system solutions that ultimately converge on a collection of the best of the best that open source has to offer, its diversity can make it challenging to support product users with so many variations. At Tech-X, where we support some of the major scientific-related distributions, we are developing a support system that streamlines getting to heart of issues within specific Linux distributions. This support system includes developing a system information script so that a user can run one command to determine the relevant information on a specific flavor of Linux. This enables us to help users efficiently diagnose and solve support questions and issues that might be related to kernel or graphics hardware and drivers on their systems that run the VSim product.

## USim 1D Shock Validation

In the July 2014 Tech-X Newsletter, we told you work was commencing on benchmarking USim for a range of different shock tube Riemann problems. Tech-X is pleased to announce that USim for Basic Simulations has now been successfully benchmarked for most of the problems listed as tests in the 2008 paper by Stone, et al.: "[Athena: A New Code for Astrophysical MHD](#)." This paper provided validation and verification for an open source shock-capturing MHD plasma solver, which overlaps some of its capabilities with USim. Users of USim for Basic Simulations can not only try the classic Sod shock and Brio & Wu problems, but also Shu & Osher, Ryu & Jones (1995), Einfeld and Torriholm tests. Even better, USim has the capability to make space-time plots now so that one can view the characteristics of each of these shocks (see image, below). Look for a new the analyzer feature of USim for postprocessing, a feature that will be already familiar to VSim users.



Above: Characteristic Diagram for Shock Problem with USim

Contact [Kris Beckwith](#) for more information about USim.

Article contributed by [Jonathan Smith](#), Tech-X UK Ltd.

## Custom CUDA Kernels on GPULib 1.6

**Accelerate your specialized computations by extending GPULib with custom CUDA kernels.**

One of the new features of GPULib 1.6 is the ability to load and execute custom CUDA kernels at runtime. This allows developers to execute CUDA code that is not aware of GPULib or IDL. This allows developers to add computation code specific for their needs, but also drawing

on GPULib's library of routines for common functionality.

Contact [Michael Galloy](#) for more information about GPULib.

## **Tech-X Readies PTSolve, an Easy-to-use, Easy-to-install Version of PETSc**

Under a funded Department of Energy (DOE) Small Business Innovation Research (SBIR) grant, Tech-X is preparing to release a product based on PETSc, a collection of mathematical libraries from Argonne National Laboratory next month. A summary of this work, "*High Performance Solvers for Industry*," was presented at the DOE workshop [SBIR/STTR Opportunities in Advanced Computing and Networking](#) on August 6, 2014. [View the slides from the presentation.](#)