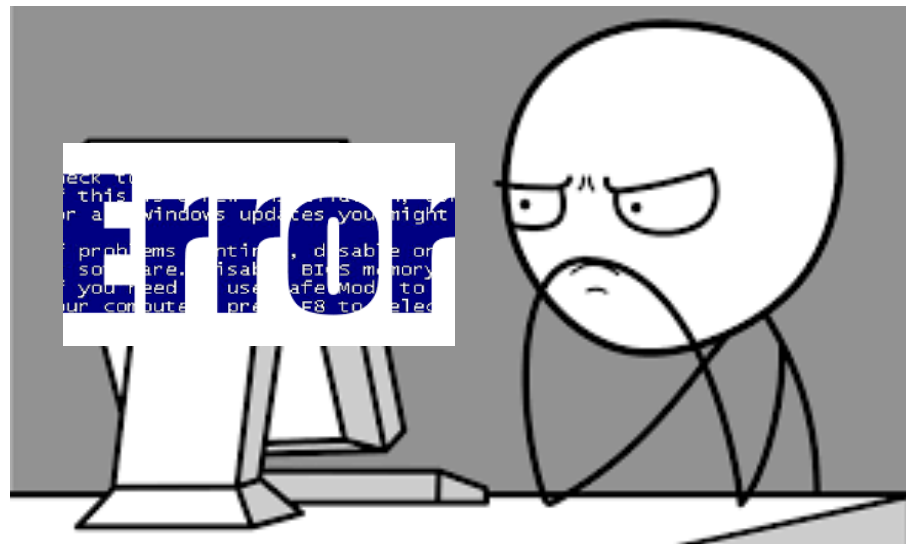


# Troubleshooting & Gotchas

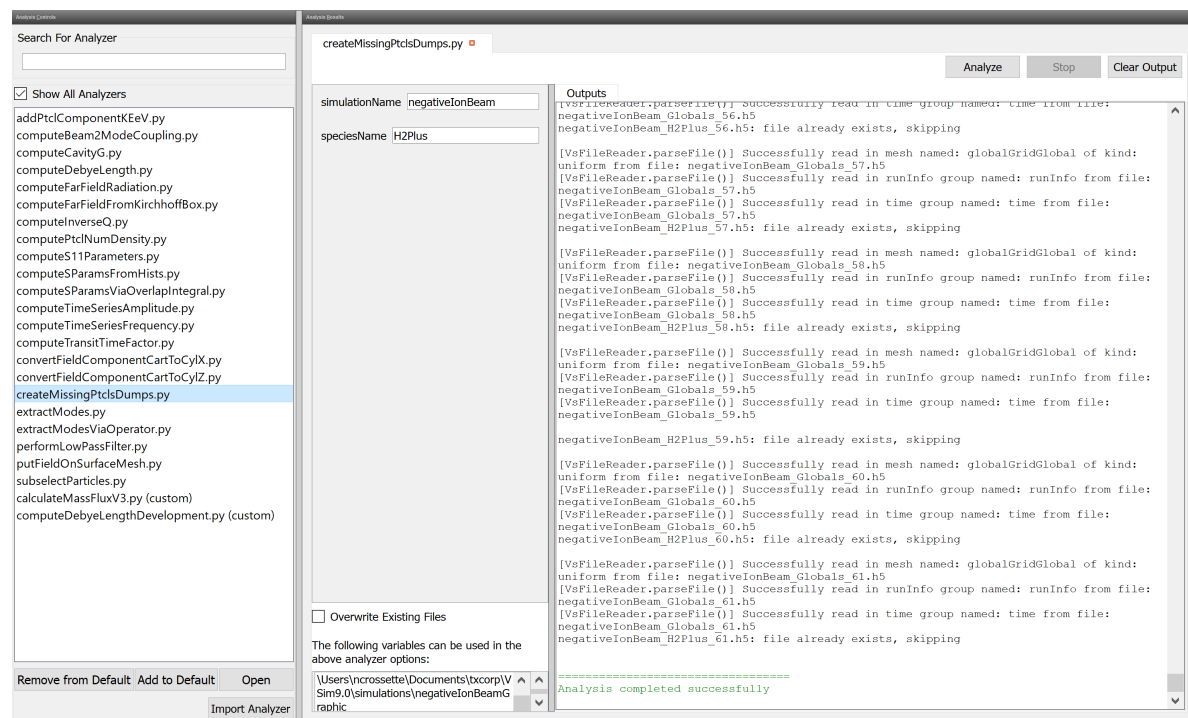


## Common Issues

- Forgetting to set a material to a shape/geometry
- Avoid underscores in naming files (especially imported .stls)
- Avoid dashes (-) in object names (like boundary conditions, histories, particle species)
- Duplicate Naming (don't do it)
- Particle related crash (check guard cells, wrong bounds on sinks)
- Virtual Cathode: emitting too many particles  $\frac{I}{v^2} < 2 * 10^{-6}$
- ALWAYS RESOLVE SMALLEST FEATURE (debye length, light wavelength, geometrical feature): Fields leaking out of cavities.

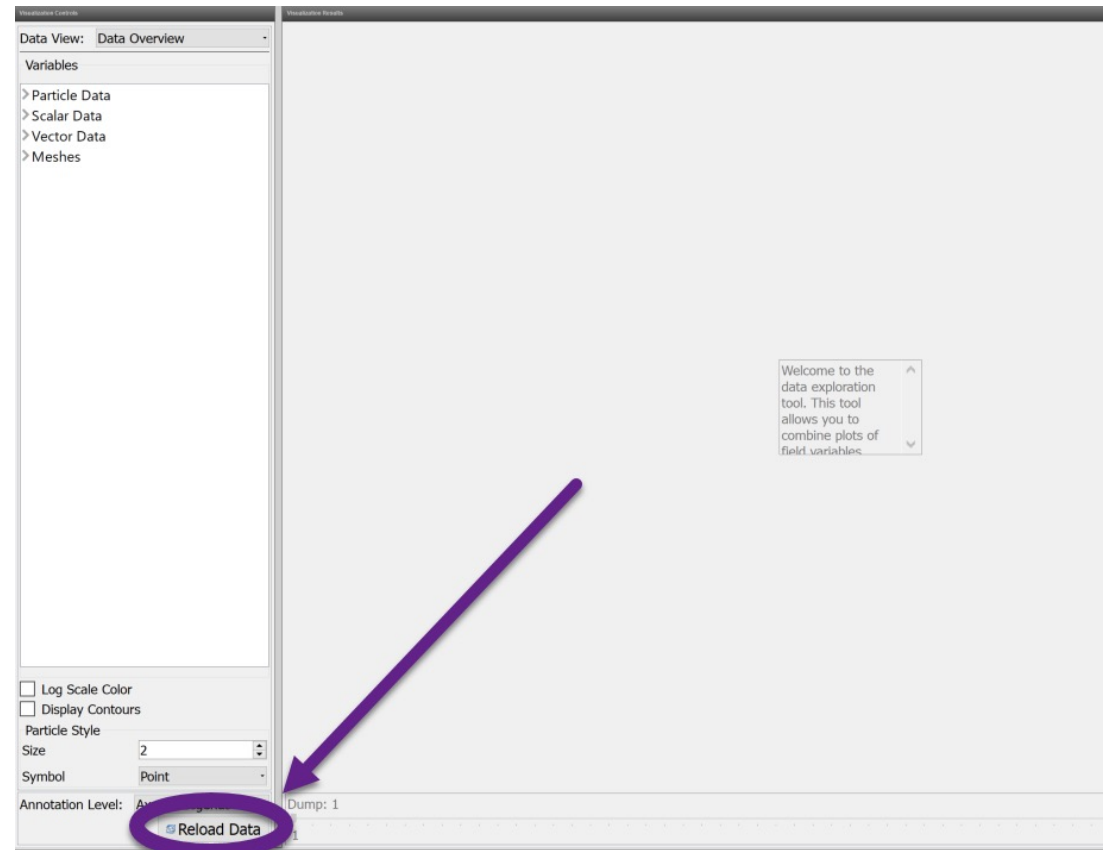
# Create Missing Particle Dumps

- **Problem:** I shouldn't see ionization until dump 5, why are there ions at dump 0?
- **Cause:** VSim does not create empty dump files if there are no particles of a particular species. The visualization will plot first particle dump first...
- **Solution:** Run analyzer "createMissingParticleDumps.py" and don't forget to RELOAD DATA!!



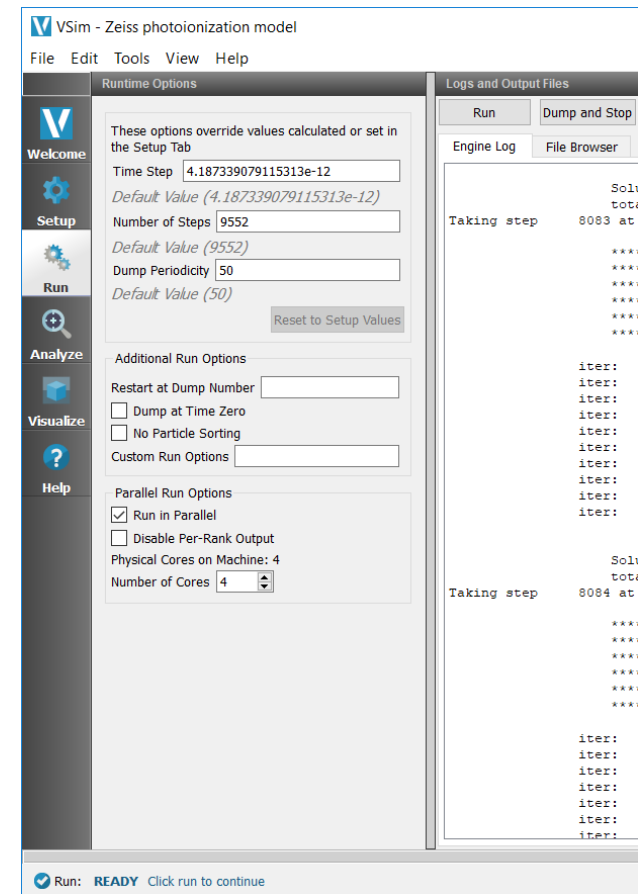
## Reload Data

- If new data has been written since your last visit to the Visualize Tab, you must press the “Reload Data” button to see the new data.
- Especially true for after running analyzers,



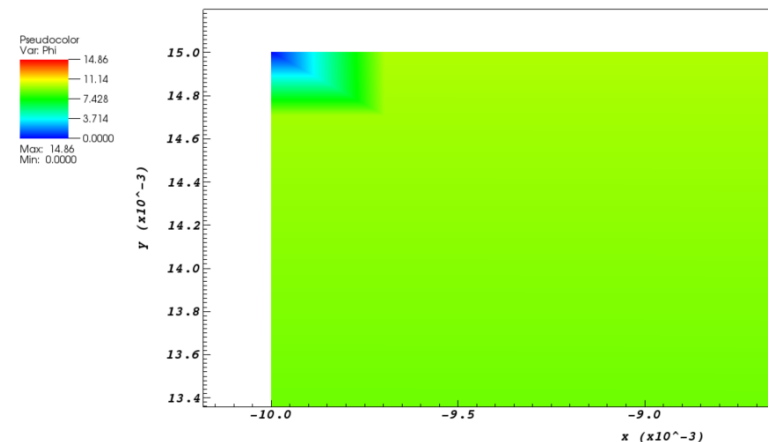
## Run Window

- If you set a Time Step/Number of Steps/Dump Periodicity in “Basic Settings” to a constant or parameter, changing the timestep in the Setup tab doesn’t automatically update the RUN values.
- Press “Reset to Setup Values” to update the run values.
- Run tab values are *Persistent*.



## For 2019

- Cylindrical loading? Fixed as of VSim 9.0.1?
  - -> In general, to ensure particle loading is being done as expected, use histories
- Boundary conditions at corners. Which takes priority when two slab boundaries meet at a corner.
  - -> Use Partial Boundary conditions

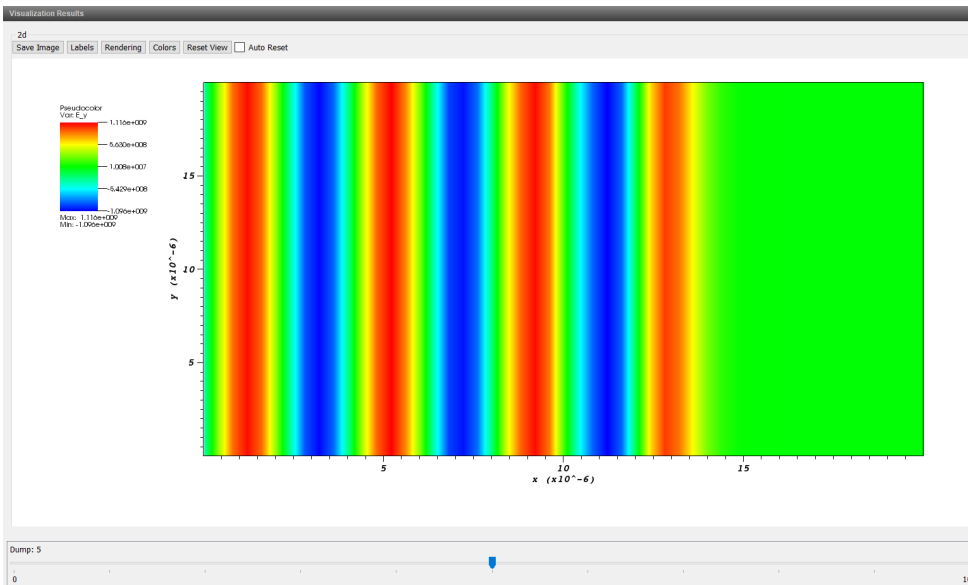


# Violating Courant the Condition

```
$ DX = LX/NX
$ DY = LY/NY
$ DZ = LZ/NZ
$ DT = standardTimeStep(1.,Timestep_Factor)
```

```
$ LAMBDA = LX/WAVELENGTHS
$ FREQUENCY = LIGHTSPEED/LAMBDA
$ OMEGA = 2. * PI * FREQUENCY
```

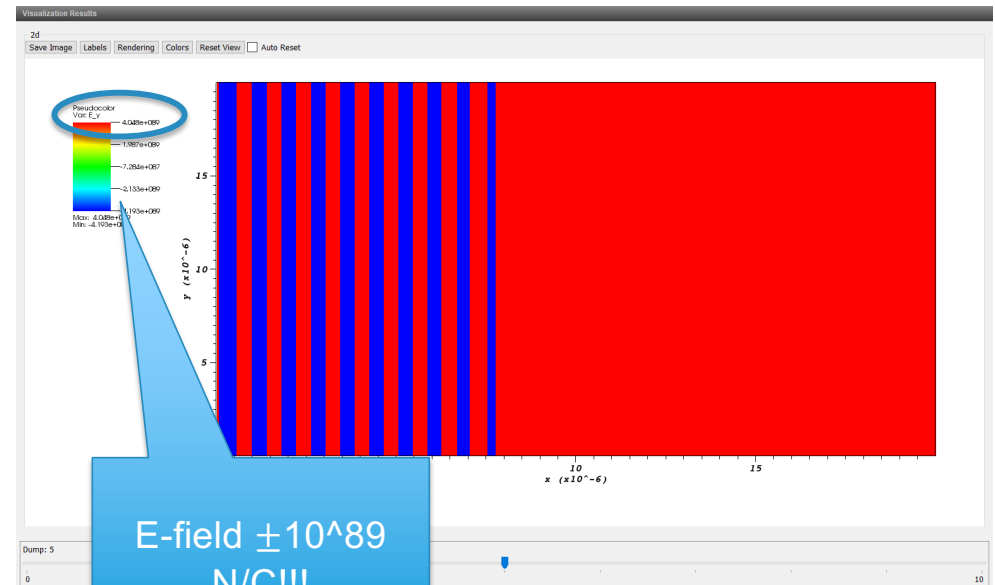
GOOD!  $c \, dt < dx$



```
$ DX = LX/NX
$ DY = LY/NY
$ DZ = LZ/NZ
$ DT = standardTimeStep(5.0,Timestep_Factor)
```

```
$ LAMBDA = LX/WAVELENGTHS
$ FREQUENCY = LIGHTSPEED/LAMBDA
$ OMEGA = 2. * PI * FREQUENCY
```

BAD!  $c \, dt > dx$



E-field  $\pm 10^{89}$   
N/C!!!

# Debye Heating: One sign of grid heating

VSimComposer - Electrostatic Particle in Cell

File Edit Tools Window Help

Runtime Options

Standard Advanced MPI

CAUTION: Overrides Existing Values

Time Step [s] 249.04242843e-12

Number of Time Steps 50

Dump Periodicity [time steps] 10

Restart at Dump Number

Dump at Time Zero ☒

Reset Options

Logs and Output Files

Engine Log File Browser

```

Solution time: 0.000000 (sec.)
total iterations: 7
Dumping all at time 1.24521e-008 and clock time Mon Sep 04 12:18:57.579 2017
Globals dumped at clock time Mon Sep 04 12:18:57.616 2017
Dumping grid boundaries at clock time Mon Sep 04 12:18:57.616 2017
Dumped grid boundaries at clock time Mon Sep 04 12:18:57.616 2017
Sorting electrons at time 1.24521e-008 and clock time Mon Sep 04 12:18:57.616 2017.
Sorted electrons at time 1.24521e-008 and clock time Mon Sep 04 12:18:57.732 2017.
Dumping electrons at clock time Mon Sep 04 12:18:57.732 2017
Dumped electrons at clock time Mon Sep 04 12:18:57.779 2017
No fluids to dump.
Dumping histories at clock time Mon Sep 04 12:18:57.779 2017
Dumped histories at clock time Mon Sep 04 12:18:57.779 2017
No SumRhoJ to dump.
Dumping all multifiels at clock time Mon Sep 04 12:18:57.779 2017
Dumping rho at clock time Mon Sep 04 12:18:57.779 2017
Dumped rho at clock time Mon Sep 04 12:18:57.779 2017
Dumping phi at clock time Mon Sep 04 12:18:57.779 2017
Dumped phi at clock time Mon Sep 04 12:18:57.779 2017
Dumping edgeE at clock time Mon Sep 04 12:18:57.779 2017
Dumped edgeE at clock time Mon Sep 04 12:18:57.779 2017
Dumping nodalE at clock time Mon Sep 04 12:18:57.779 2017
Dumped nodalE at clock time Mon Sep 04 12:18:57.779 2017
Dumping nodalB at clock time Mon Sep 04 12:18:57.779 2017
Dumped nodalB at clock time Mon Sep 04 12:18:57.779 2017
Dumped all multifiels at clock time Mon Sep 04 12:18:57.817 2017
No electromagnetic fields to dump.
No collisions to dump.
No electromagnetic fields to dump.
Dumped all at time 1.24521e-008 and clock time Mon Sep 04 12:18:57.817 2017.
Main loop ended at clock time Mon Sep 04 12:18:57.817 2017
For all ranks, total average particle process time = 0 seconds.
For all ranks, last average particle process time = 0 seconds.
Deleting domain.
OUTPUT SUMMARY:
There were 1 Notices encountered in this run.
There were 0 Warnings encountered in this run.
See above for more information.
VORPAL completed.
NOTE: A VSimBase license was needed to run this simulation.
----- END ENGINE OUTPUT -----

Notices:
NOTICE: Species electrons limited 695077 velocities on rank 0.

Engine completed successfully.
To see results, click on the "Visualize" icon in the icon panel.
    
```

Notice: Species electrons limited  
##### velocities

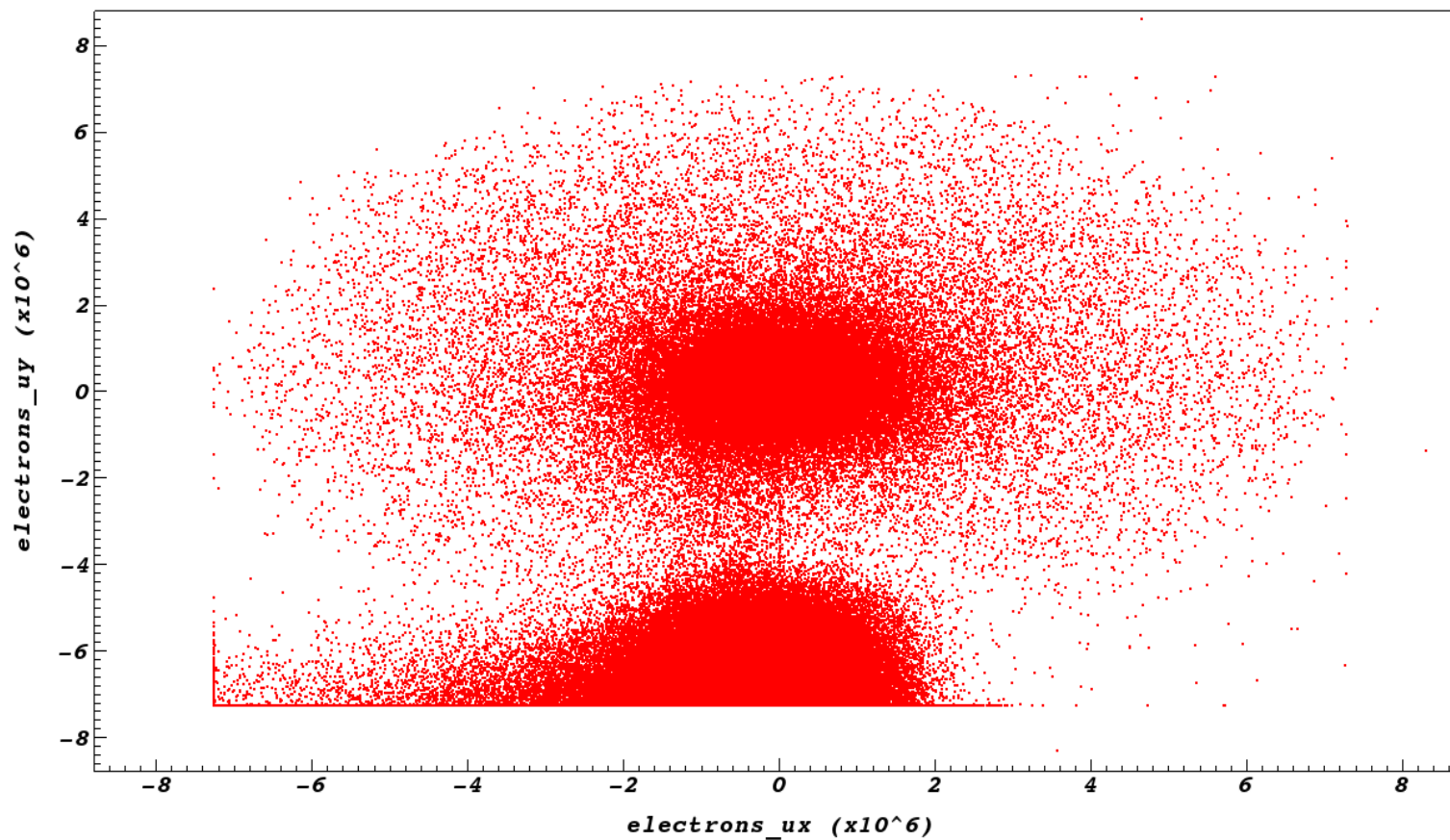




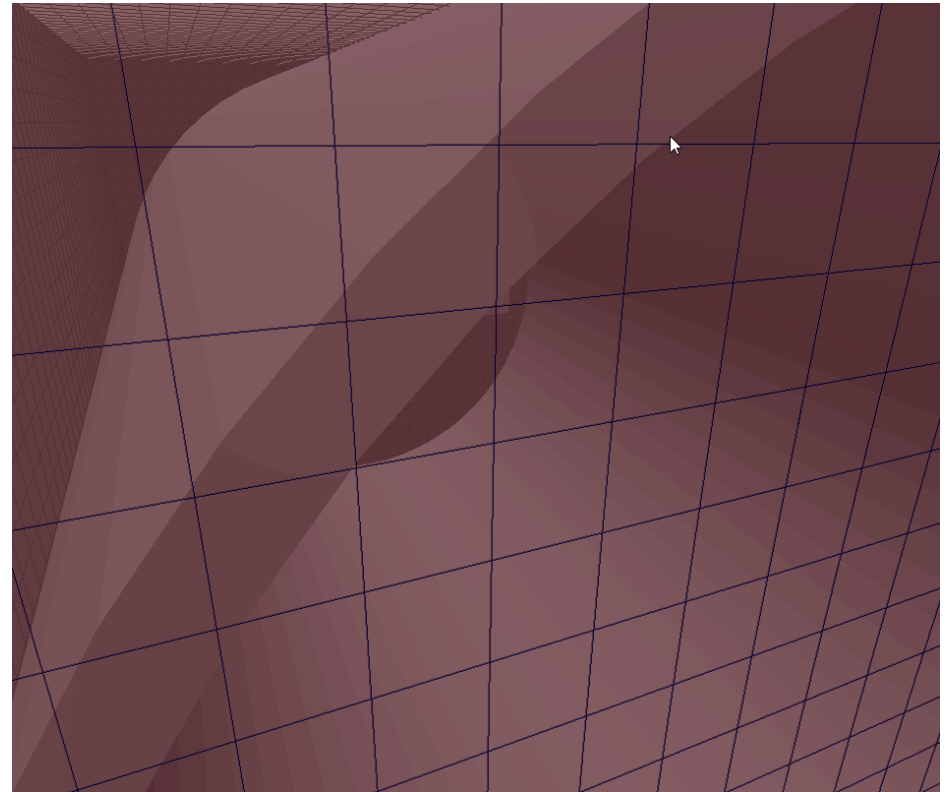
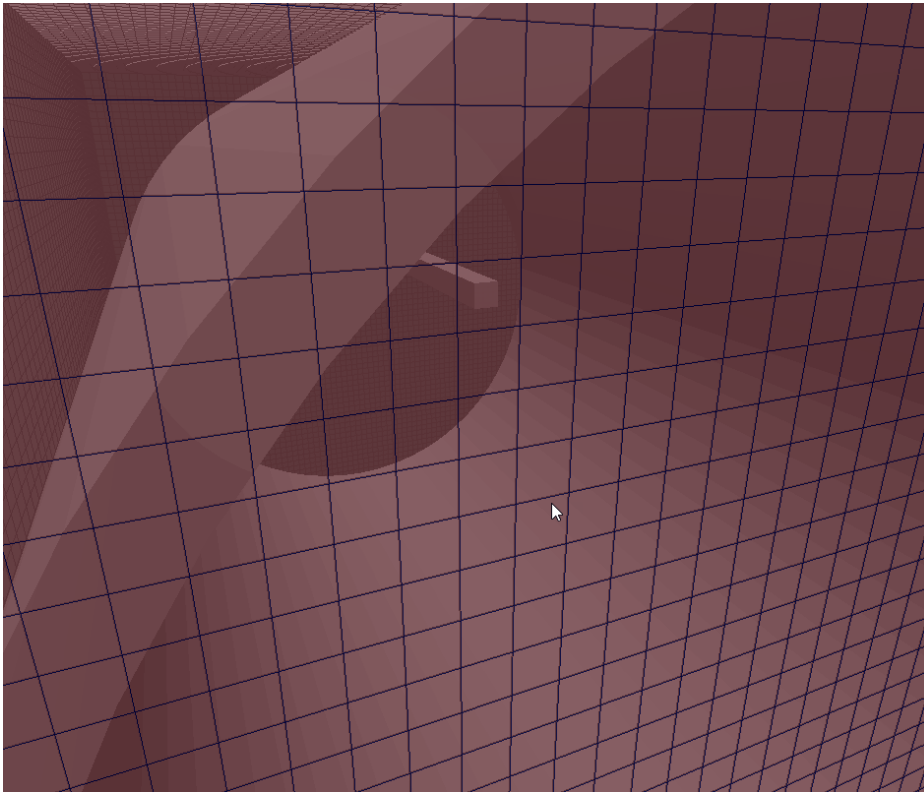
# TECH-X

SIMULATIONS EMPOWERING YOUR INNOVATIONS

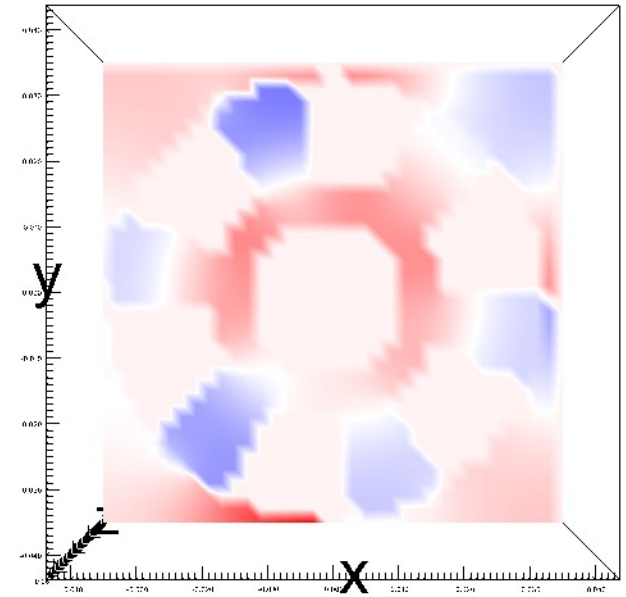
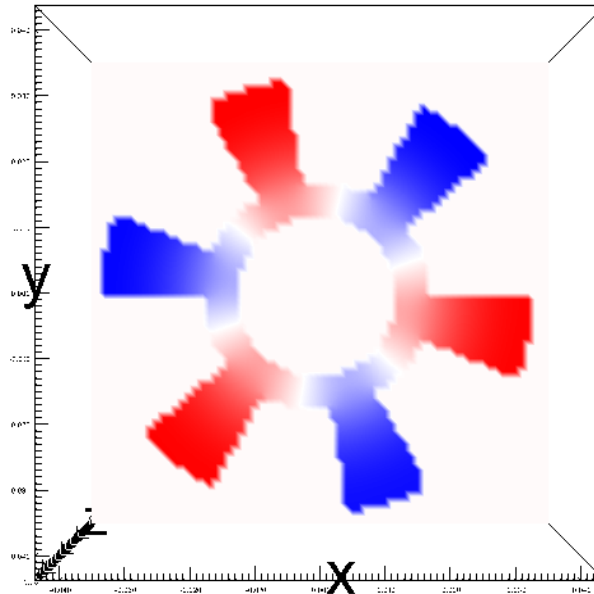
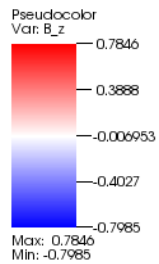
Scatter  
Var: electrons\_ux,  
electrons\_uy



## Resolving Smallest Feature



## Resolving Smallest Feature



## Troubleshooting Tools

- Check the .in file. \*Vars.py file (should be fully expanded)
  - unevaluated variables
  - macro/function/logic substitutions
  - \$if blocks
- Documentation (available online, from the Help tab, and installed in distribution)
- Run Log
- Verbosity
- Support

## Bad .in File

Editor

ionBeamSputtering.sdf ionBeamSputtering.pre ionBeamSputtering.in

Simulation

- Description
- Constants
- Parameters
  - Basic Settings
  - Functions
- SpaceTimeFunctions
  - BEAMMASK**
- Materials
- Geometries
- Grids
- Field Dynamics
- Particle Dynamics
- Histories

Property	Value
kind	expression
description	mask for the beam profile
expression	$H(\text{BEAM\_RADIUS} * \text{BEAMRADIUS} - y * y) * (\text{LEN\_X} / (2 * \text{BEAM\_RADIUS}))$

VSim - Ion Beam Sputtering

File Edit Tools View Help

ionBeamSputtering.sdf ionBeamSputtering.pre ionBeamSputtering.in

Simulation Setup is Ready Save and Setup

```
605     kind = expression
606     expression = 46453.57952373723+gauss(0.0)
607 </STFunc>
608
609 <STFunc component1>
610     kind = expression
611     expression = 0.0+gauss(0.0)
612 </STFunc>
613
614 <STFunc component2>
615     kind = expression
616     expression = 0.0+gauss(0.0)
617 </STFunc>
618
619 </VelocityGenerator>
620
621 <STFunc relMacroFluxFunc>
622     kind = expression
623     expression = (H(0.0135*BEAMRADIUS-y*y)*(0.2/(2*0.0135)))
624 </STFunc>
625
626 <PositionGenerator posGen>
627     kind = bitRevSlabPosGen
628
629 <Slab emitSurface>
630     lowerBounds = [0.0006250000000000001 -0.05 0.0]
631     upperBounds = [0.0006250000000000001 0.05 1.0]
632 </Slab>
633
```

Find: BEAMRADIUS

Replace With:

☐ Case Sensitive ☐ Whole Words ☐ Regular Expressions

Matches: 2

Replace Replace All

Setup: COMPLETED Click run to continue

Show Log

## Documentation

- [VSim Documentation](#) has been re-organized for VSim 9
  - Installation
    - Help Getting VSim installed on Linux, Windows, and Mac.
    - Release Notes
  - User Guide
    - The “HOW TO” guide for VSim. Information on workflow for setting up, running, troubleshooting, and visualization.
  - Examples
    - Example simulations demonstrating physics capabilities and simulation setup.
  - Customization
    - How to write your own macros and analysis scripts.
  - Reference
    - Glossary/Encyclopedia of VSim features.

# Engine Output: Notices and Warnings

## OUTPUT SUMMARY:

There were 2 Notices encountered in this run.  
There were 5 Warnings encountered in this run.  
See above for more information.

VORPAL completed.

NOTE: A VSimPD license was needed to run this simulation.

----- END ENGINE OUTPUT -----

## Notices:

NOTICE: No mask specified, emitting fromentire slab emitSurface specified in position generator

NOTICE: For position generator, bitRevSlab, ptclsPerCell not specified. Taking from owning species.

## Warnings:

WARNING: Detected overlapping sinks in PtclSinkArray. Change verbosity to VP\_DEBUG to see more information.

WARNING: Detected overlapping sinks in PtclSinkArray. Change verbosity to VP\_DEBUG to see more information.

WARNING: Detected overlapping sinks in PtclSinkArray. Change verbosity to VP\_DEBUG to see more information.

WARNING: Detected overlapping sinks in PtclSinkArray. Change verbosity to VP\_DEBUG to see more information.

WARNING: Detected overlapping sinks in PtclSinkArray. Change verbosity to VP\_DEBUG to see more information.

Engine completed successfully.

To see results, click on the "Visualize" icon in the icon panel.

## Engine Output: ERRORS (Epetra)

```
DEBUG2: C:\vorpall-VSIM-8.1\vorpall\vpctrl\VpDomain.cpp, line 351, Domain VpDomain::buildMonteCarloHandlers() returning.  
ERROR: In setting up simulation:  
Problem found setting up MultiField:
```

```
Epetra error -1 occurred calling FillComplete() on matrix..
```

```
Lines from 'simpleParticleExtraction_NOELCTRODE.pre' processed.  
Finished with 'simpleParticleExtraction_NOELCTRODE.pre'.
```

```
Error building solvers.
```

```
----- END ENGINE OUTPUT -----
```

```
Engine completed with error: VORPAL INPUT-FILE ERROR (code 5)
```

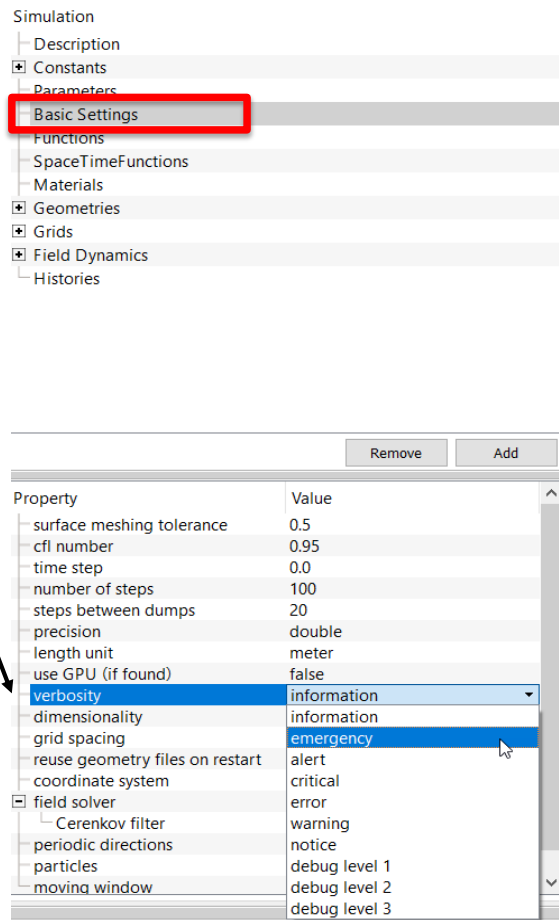


## Lets Look At the Troubleshooting Guide

<https://txcorp.com/images/docs/vsim/latest/VSIMDocumentation.html>

## Verbosity

Verbosity: how wordy would you like VSim's output?



Simulation

- Description
- Constants
- Parameters
  - Basic Settings**
  - Functions
  - SpaceTimeFunctions
  - Materials
- Geometries
- Grids
- Field Dynamics
- Histories

Property Value

surface meshing tolerance	0.5
cfl number	0.95
time step	0.0
number of steps	100
steps between dumps	20
precision	double
length unit	meter
use GPU (if found)	false
<b>verbosity</b>	<b>information</b>
dimensionality	information
grid spacing	emergency
reuse geometry files on restart	alert
coordinate system	critical
field solver	error
Cerenkov filter	warning
periodic directions	notice
particles	debug level 1
moving window	debug level 2
	debug level 3

```
147 $ import verbosity
148 $ import mathphys
149 $ import esGridBoundary
150 $ import solverbcs
```

```
200 # General simulation parameters
201 dimension = 3
202 floattype = double
203 dumpPeriodicity = DUMP_PERIOD
204 dt = DT
205 nsteps = NSTEPS
206 verbosity = VP DEBUG3
```

# Contacting Support

Email: [support@txcorp.com](mailto:support@txcorp.com)