

# Update on VSim simulations

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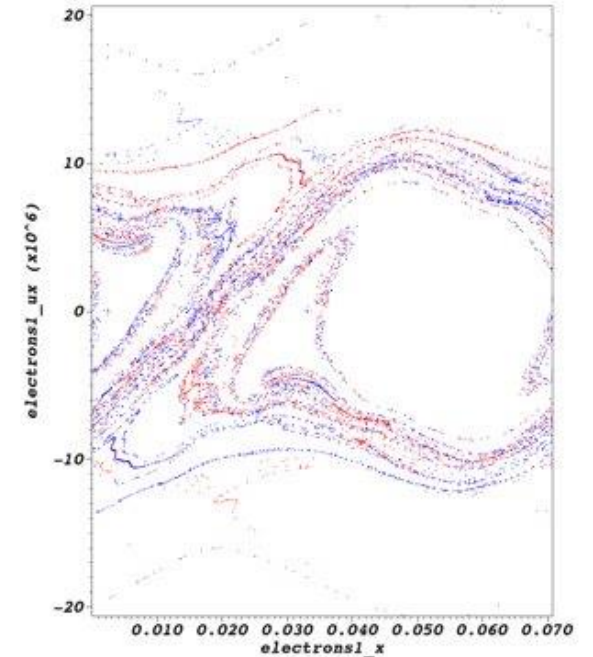
# VSim on SCARF

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- Available versions
  - **8.1.0** - can run Vorpak in queue, cannot open GUI (requires old libraries)
  - **9.0.2** - can run Vorpak in queue and from GUI, cannot use GUI output Visualiser (problem with ssh X11 forwarding)
    - Visual setup has no license (only text-based setup possible)
  - **10.0.0** - can run Vorpak in queue, cannot open GUI
    - Visual setup has no license (only text-based setup possible)
- Output data format – **.h5**
- Several analyzers available as Python scripts (e.g. convert field from cart. to cyl., create particle tracks, compute emittance on plane)

# Example 1: Two-stream instability

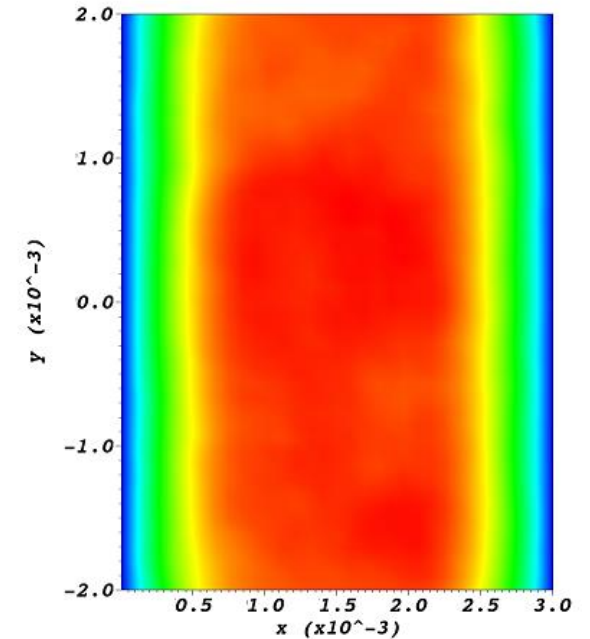
- 2 counter-streaming beams of electrons in a periodic system (1D)
- Small sinusoidal perturbation in velocity space
- Parameters:
  - Number of cells = 32
  - Number of particles per cell = 128
  - Electron density =  $2e14$
  - Number of wavelengths to simulate
  - Average velocity
  - Number of steps
- 10,000 steps (dump data every 100) run in about one minute (no parallelisation)
- Output:  $x$ ,  $u_x$ ,  $u_y$ ,  $u_z$  for each particle type
- GUI Visualiser: Phase space, Binning, 1-D Fields ( $E$ ,  $B$ ,  $J$ ), History (of predefined variables)



$(x, u_x)$  phase space

# Example 2: Electrostatic particle in cell

- Computes the electrostatic potential and field in a box with conducting walls and particle absorbers (2D)
- Immobile, background neutralising charge density
- Some parameters:
  - Number of cells in each direction = 65 x 42
  - Number of macroparticles per cell = 200
  - Length of domain in each direction = 3cm x 4cm
  - Parameters required to calculate the Debye length and plasma period
  - Parameters required for function which describes the thermal velocity of electrons
  - Electron density =  $5e14 \text{ m}^{-3}$
  - Number of steps + Number of steps per plasma period = 20
- 10 steps (dump data every 10) run in about 9s (no parallelisation)
- Output: x, ux, uy, uz for each particle type
- GUI Visualiser: Phase space, Binning, Fields Analysis (E, B, J), History (of predefined variables)



Electric potential