CHARGE

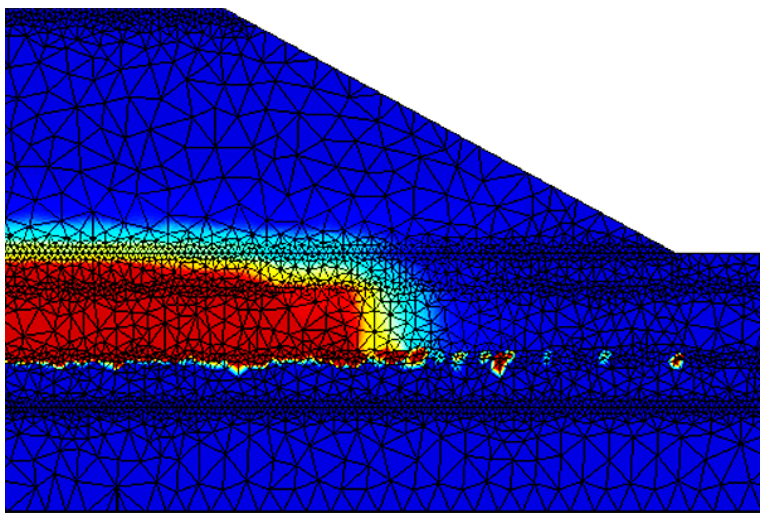
3D Charge Transport Simulator

Built on the finite element drift-diffusion method, CHARGE provides designers with the correct tools for comprehensive charge transport simulation in active photonic and optoelectronic semiconductor devices. CHARGE self-consistently solves the system of equations describing electrostatic potential (Poisson's equations) and density of free carriers (drift-diffusion equations). Automatic and guided mesh refinement tools are provided to achieve accuracy while minimizing computational effort.

CHARGE is a solver within Lumerical's **DEVICE Multiphysics Simulation Suite**, the world's first multiphysics suite purpose-built for photonics designers. The DEVICE suite enables designers to accurately model components where the complex interaction of optical, electronic, and thermal phenomena is critical to performance. As part of the Finite Element IDE, designers can quickly analyze complex active devices while benefiting from Lumerical's industry-leading usability, performance, and accuracy.

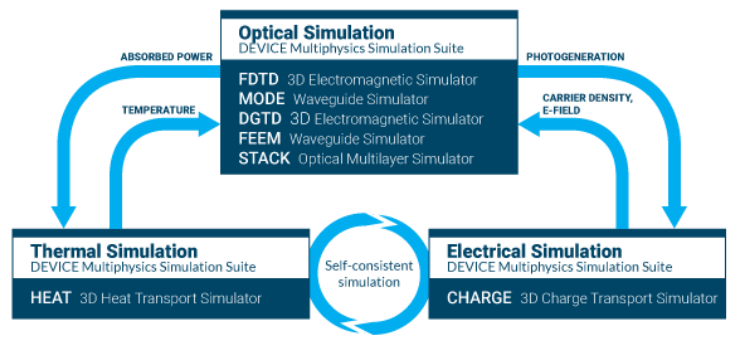
Key CHARGE applications include:

- Photovoltaic devices
- Image sensors
- Avalanche photodiodes
- Electro-optic modulators
- Semiconductor devices



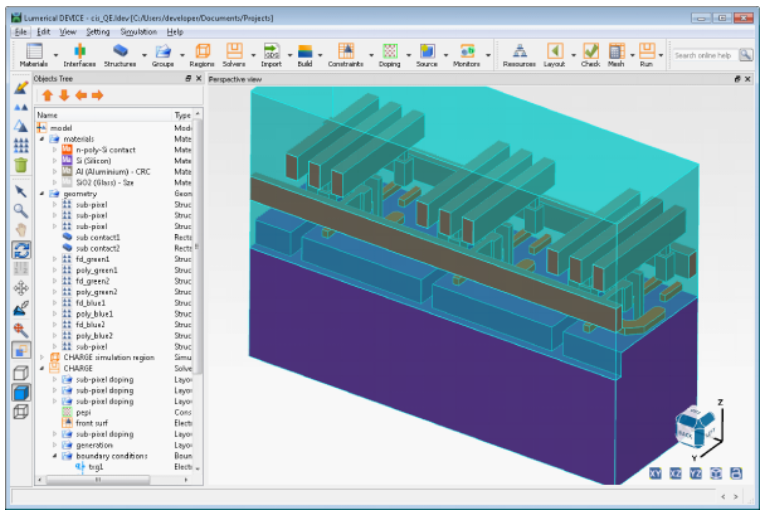
Charge Transport Solver

- 2D/3D finite element Poisson/drift-diffusion solver
- Steady-state, small signal AC and transient simulation
- Isothermal, non-isothermal, electro-thermal simulation
- Comprehensive semiconductor material models
- Includes electrical, optical, and thermal stimuli
- Automated finite element mesh generation based on doping, optical, and thermal profiles



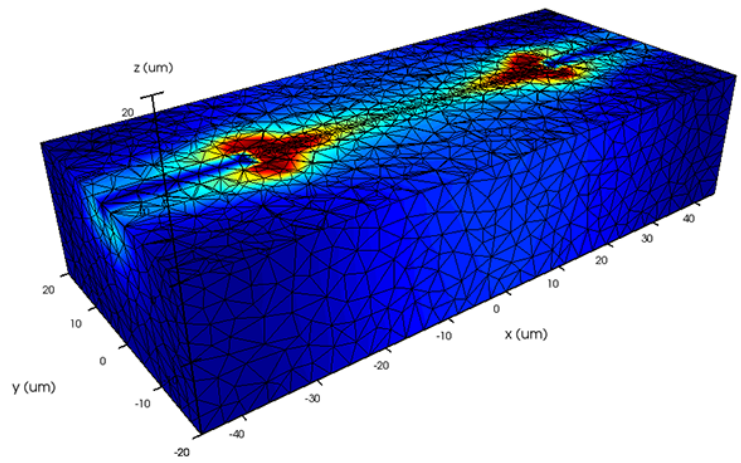
Highly integrated interoperable solvers

- Self-consistent charge and heat transport simulation
- Perform multiphysics simulations
  - Photovoltaic (FDTD/DGTD, CHARGE & HEAT)
  - Electro-optic (CHARGE & FDTD/DGTD/FDE)



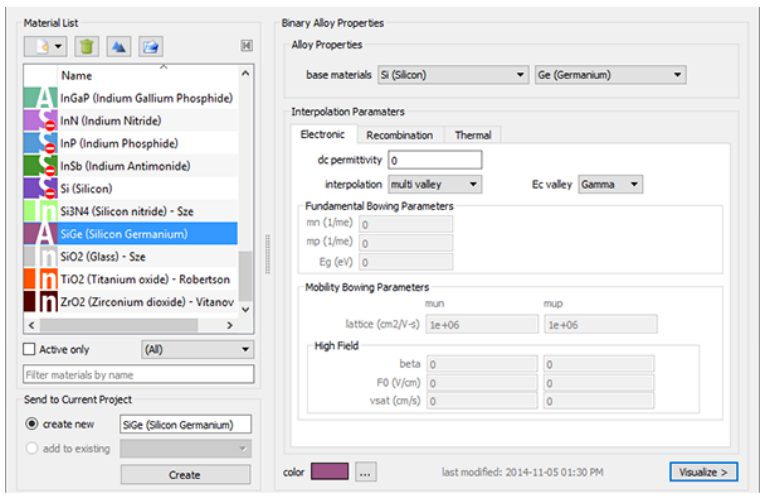
Finite Element IDE

- 1D/2D/3D modeling
- Import STL, GDSII, and STEP
- Parameterizable simulation objects
- Domain partitioned solids for easy property definition
- Geometry-linked sources and monitors
- Automatic mesh refinement based on geometry, materials, doping, refractive index, and optical or heat generation



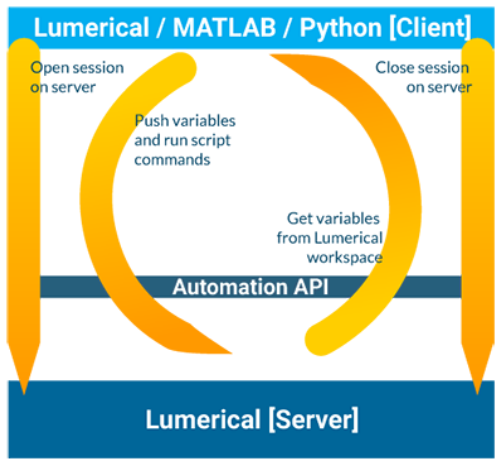
Self-consistent Charge/Heat Modeling

- Self-heating effects
- High-current devices
- Requires both CHARGE and HEAT licenses



Comprehensive Material Models

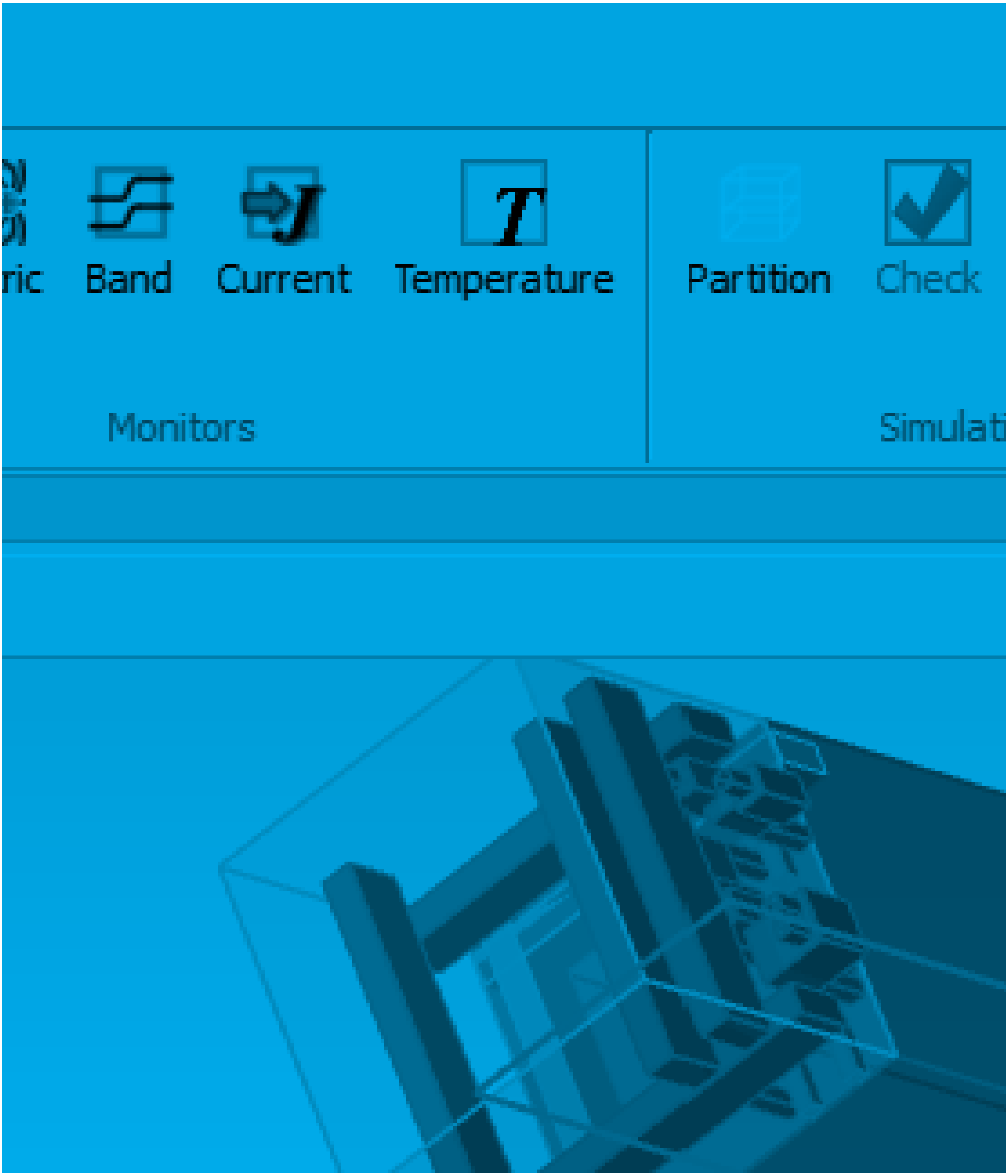
- Flexible visual database
- More than 500 customizable electronic and thermal properties and models for accurate simulation of complex effects
- Scriptable material properties



Automation

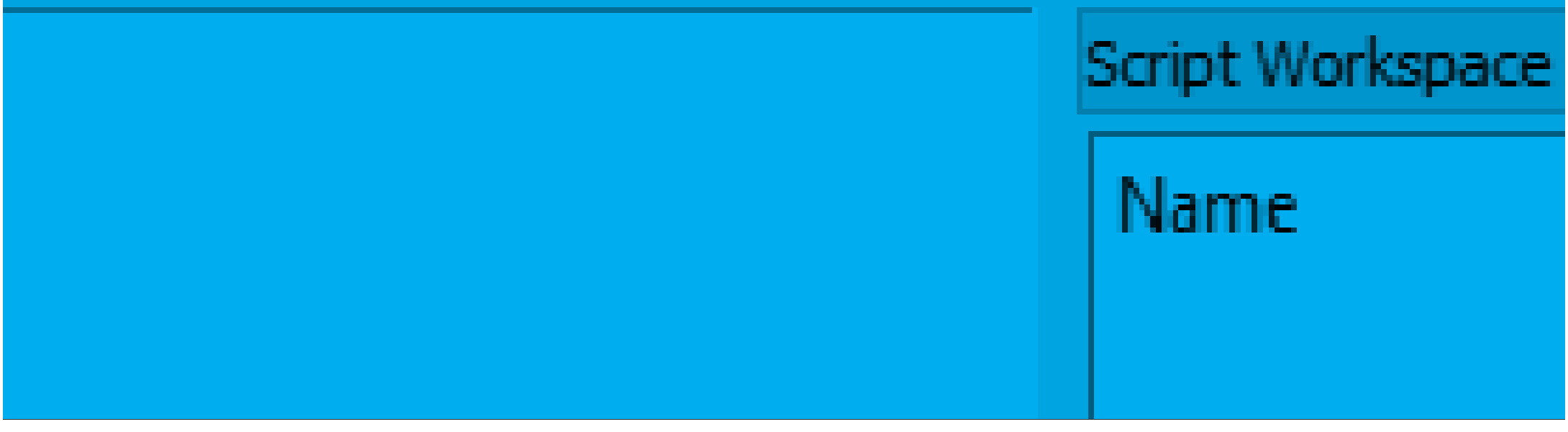
Lumerical tools are interoperable through the Lumerical scripting language, Automation API, and Python and MATLAB APIs.

- Build, run, and control simulations across multiple tools.
- Use a single file to run optical, thermal, and electrical simulations before post-processing the data in MATLAB.



Want to know more about CHARGE?
Ready for a quote?

Contact Lumerical



Get started now with a free 30-day trial.

Evaluate for Free