



# HELIOS USER'S GUIDE

## Revisions for HELIOS 9.1.0

- Added ability to specify initial conditions for radiation temperature separately.

Specify Initial Conditions For Variables

- Separate electron and ion temperatures
- Separate radiation temperature
- Velocity
- Magnetic field

Initial Plasma Distribution

Mass density - Constant DT (0.212) g/cm3

Temperature - Constant 0.025 eV

Radiation Temperature - Constant 0.025 eV

- Implemented improvements in opacity re-binning algorithm. Modest changes in simulations that use coarse radiation group structure can be expected.
- Updates were made to better support graphics on high-resolution monitors.
- Built with Qt 6.2.10.
- Distribution includes new set of default PROPACEOS tables (v. 6.0.0).
- Added batch command-line option (`-n <int>`) to specify the maximum number of threads for the simulation. This option overrides the default value in *Preferences*.
- For Helios-CR:
  - Improved continuum lowering model where the electron density and the amount of IPD are determined self consistently with a combination of iteration and bisection techniques was implemented. This model can significantly affect ionization balance, especially for low temperature plasma. More details on the model can be found in the Appendix of the main documentation.
  - Improved consistency in modeling IPD for mixtures of elements.
  - Improved models for ion contribution for Stark broadening. Previously, the effect of ion contribution could have been significantly overestimated at lower densities.
  - Added support for new distribution of FAC atomic data (v. 1.5.0U).
  - Improved algorithms for photon energy mesh in photo-ionization rate calculations.
  - Options were added to *Preferences* to control iterative continuum lowering.

Preferences

Data Directories Run Directories Simulations

Parallel processing

Use parallel processing for:

- Multi-group radiation transport
- Collisional-radiative frequency-dependent opacities

Limit number of processors to:

Advanced Radiation Physics Parameters

- Separate photon energy grids for bound-bound and bound-free transitions
- Use quasi-contiguous lineshape model
- Use iterative continuum lowering

- Bug fixes:
  - Fixed rare potential crashes when using NLTE EOS with Helios-CR.
- *HydroPLOT*:
  - Built with Qt 6.2.10.
  - Bug fixes:
    -
- *EOS and Opacity Viewer*

- Built with Qt 6.2.10.
- Ionization Fraction results can now be plotted, by selecting the *Display | Ion Fractions Data* menu item. They can be plotted vs. *Ionization Stage* (giving an ionization distribution), or for a given stage vs. temperature or density. The interface uses a new plot window:

Plot

Element:

X-axis quantity:

| element | Temperature (eV) | Density (ion/cm <sup>3</sup> ) |
|---------|------------------|--------------------------------|
| B       | 2.512            | 1e+17                          |

Selected Plot

Temperature (eV)

Density (ion/cm<sup>3</sup>)

