



# HELIOS USER'S GUIDE

## Revisions for HELIOS: 11.0.0

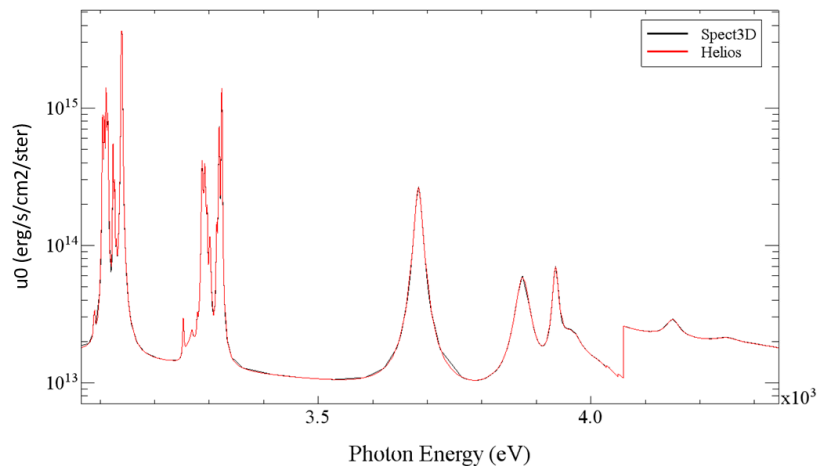
- Support for utilizing JSON-formatted workspaces has been added.
  - This option provides better support for reading/writing workspaces that use different versions of *HELIOS*.
  - JSON-formatted files can be readily modified using scripting tools such as Python.
  - To turn this option off, check the "Use non-JSON format" button on the *Directories/Files* tab of *Preferences*. By default, this option is now turned on.
  - When saving a workspace that was originally read in using the old (non-JSON) format, a warning is presented notifying the user that it is now being saved to a JSON-formatted file. (This warning can be turned on/off in the *Warnings* tab of *Preferences*.)

Workspace File

☒ Use JSON format (more flexible reading by different HELIOS versions)

☐ Use non-JSON (old) format

- The OpenGL graphics in each of *HELIOS* graphics widgets has been updated to utilize virtual buffer objects. This was done in order for *HELIOS* to work effectively on more modern computer monitors and graphics acceleration hardware.
- Multi-angle radiation transport is now enabled for 1D Spherical Geometry (in addition to 1D Planar). Significant benchmarking has been done against multiple analytic solutions. Nonetheless, this is a beta version of this model, and additional verification may be required. The following plot shows that the 1D radiation transport is consistent with Spect3D for a NLTE Ar-doped deuterium plasma at 1 keV temperature and 1 g/cc density, where "u0" is the contribution of a particular ray to the angle-averaged specific intensity in the outermost zone. Helios-CR was run, and its output was used by Spect3D. The only differences are due to slightly different photon energy gridding:



- Support has been added for 2-temperature external radiation sources. Using this option, separate spectral and drive (flux) temperatures are entered as a function of time.
- The number of time-based data output is now limited to 10,000 time steps.
- Output files in deprecated bpf format are no longer written.
- Added yield output for some fusion reactions.
- In particle transport, the particle now stop being tracked once its energy falls below ion temperature. The remaining energy is deposited in the zone where this condition is met.
- Improved performance of parallel implementation of particle transport.
- Added option for local deposition/escape of protons, deuterons, tritons. The default absorption probability is zero (free escape). Enabling this option in addition to local alpha deposition may significantly improve memory requirements and simulation time.

Charged particle transport

☒ Apply local alpha absorption probability: 1

☒ Apply local non-alpha absorption probability: 0

- Bug fixes:
  - A proper error message now appears if less than 2 times are used for incident flux from either a frequency-dependent table or from a VisRad flux file.

- Fixed element string error that could occur in DCA Atomic Elements list when D, T, or He3 isotopes are utilized.
  - Fixed possible crashes using multi-column radiation field table on the  $R_{\min}$  boundary of a CR calculation.
  - For CR calculations, frequency-dependent plot variables, as well as the photon energy grid for these variables, are now written to the exodus file as a separate array for each time step. Previously, they were written to a single variable with time as one dimension, however this caused data to be lost, or plotted incorrectly, in cases where the photon energy grid changes over time. Now, frequency-dependent variable plots will be correct when using the newest versions of Helios and Hydroplot. NOTE: old versions of Hydroplot will not be able to produce these plots for new Helios results.
  - In runs for which all time steps are CR, time-integrated frequency-dependent power loss plots did not have the correct photon energy grid on the x-axis, because it was not properly written to the exodus file. This has been fixed.
- *HydroPLOT*:
  - Bug fixes:
    - Fix for the option to use laser as an external radiation source for simulations with more than one spatial region.
    - Previously, for exodus files with more than 2,000 data output times, Hydroplot would only allow a subset of those to be plotted. However, an indexing issue caused those to be the wrong plots. This has been fixed, and there is no longer a limit to the number of available time steps to plot.
- *EOS and Opacity Viewer*
  - Bug fixes:
    - Previously, the mass conversion for plots of density was incorrect for isotopes (e.g., D and T). This has been fixed, so the conversion to g/cc is now correct.
    - Previously, derivative quantities were not being plotted correctly (specific heats,  $dP/dT$ ,  $dP/dN$  for both ions and electrons). This has been fixed. The bug did not affect anything in .prp files themselves--only the plots.