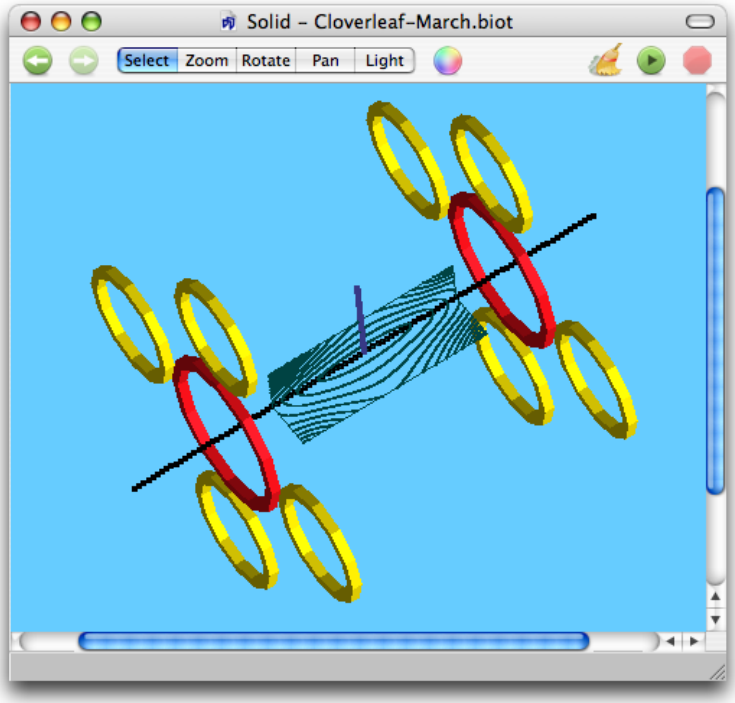
BiotSavart magnetic field calculator

for Windows XP and Mac OS X

The configuration of conductors is displayed using OpenGL 3D graphics, allowing rotation and zooming to any viewpoint.



The magnetic field updates dynamically as you modify the conductors. Great for exploring your design space!

Native GUI on Windows XP and Mac OS X platforms.

BiotSavart - what you get

Proven performance. . .

BiotSavart has been used by customers since 1991.

Many successful scientific projects have relied on BiotSavart.

. . . at a low price

Single-user license:	**$695**
Lab license:	**$895**

Includes major upgrade to version 4.1 and minor upgrades beyond that to 4.1.x. Also included is full e-mail support for one year or as long as the latest version is 4.0.x or 4.1.x, whichever is longer.

Ask us about customization

What our customers are saying

"BiotSavart is great. It is easy to very quickly go from no knowledge to complicated current configurations in less than an hour. The force calculator is spectacular, allowing for sophisticated mechanical analyses of possible magnet geometries."

- John Doyle, Harvard University

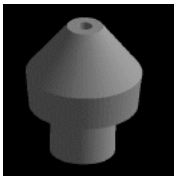
"We have had wonderful success with BiotSavart and in fact the latest set of coils we built (conical QUIC trap for BEC) matched the models almost exactly. Thanks very much for this great piece of software."

- Nick Robins, The Australian National University

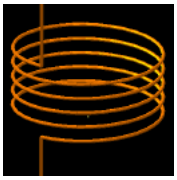
"BiotSavart has proved essential at the design stage to help us engineer the highly specific magnetic environment needed to optimize the spin-transport of state-selected atoms through an apparatus."

- Matthew Rosen, Harvard-Smithsonian Center for Astrophysics

Conductor types

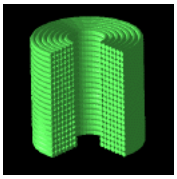


Revolved surface, field calculated as a permanent magnet.

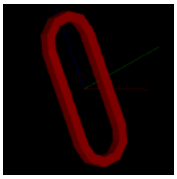


Wire following an arbitrary path.

Collection of coaxial loops.



Solenoid coil, including thin solenoid and pancake solenoid as special cases.



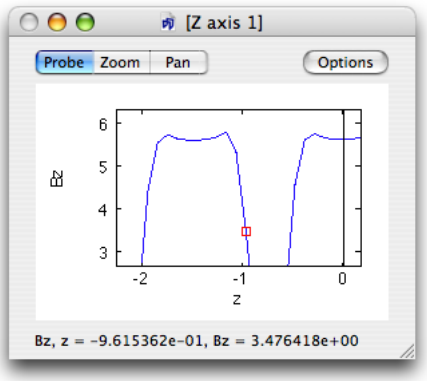
Racetrack coil (used in magnetic traps and particle accelerators).

Probes

Probes calculate the magnetic field and let you create graphics involving A_x, A_y, A_z, A, B_x, B_y, B_z, B, or any function calculated using the built-in macro language. Probe results may be exported to a file.

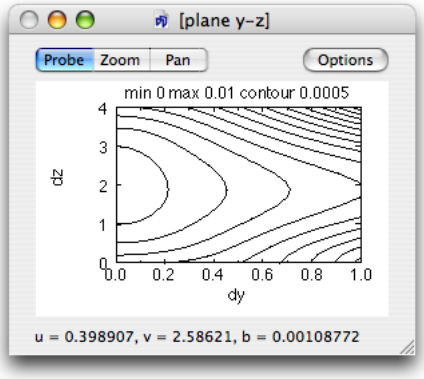
Linear probe

The linear probe lets you make graphs of the magnetic field along any path in space.



Planar probe

The planar probe calculates the magnetic field on any plane in space. It generates a contour plot of any desired quantity and displays it on the configuration window or on a window of its own.



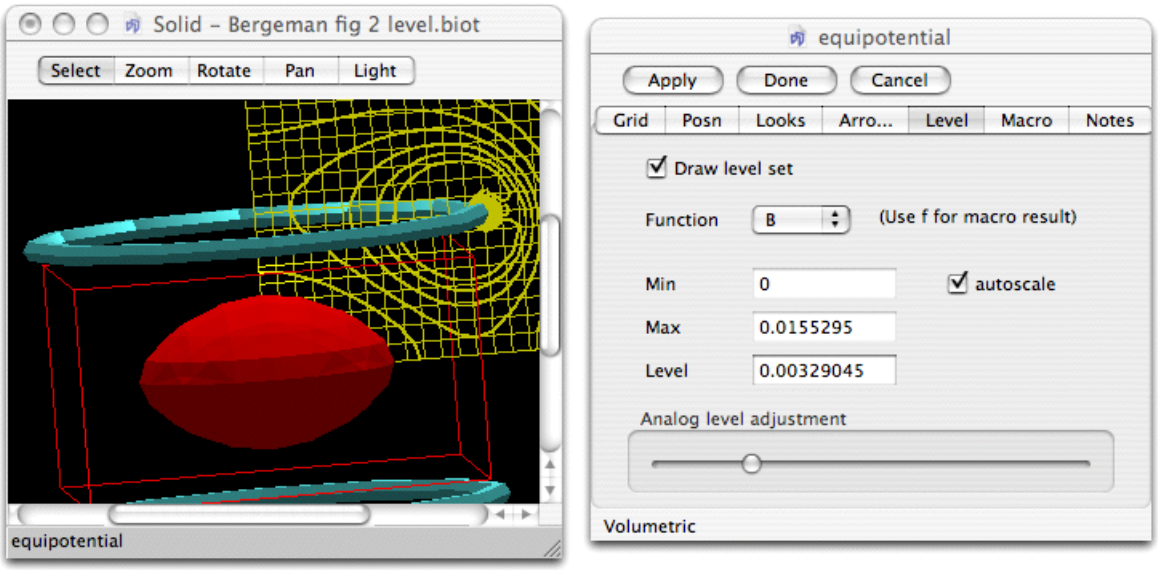
Volumetric probe

The volumetric probe samples the magnetic field on a 3D grid of points, and then lets you display level-set surfaces (surfaces of constant $|\boldsymbol{B}|$, or other quantity). A slider lets you adjust the level interactively.

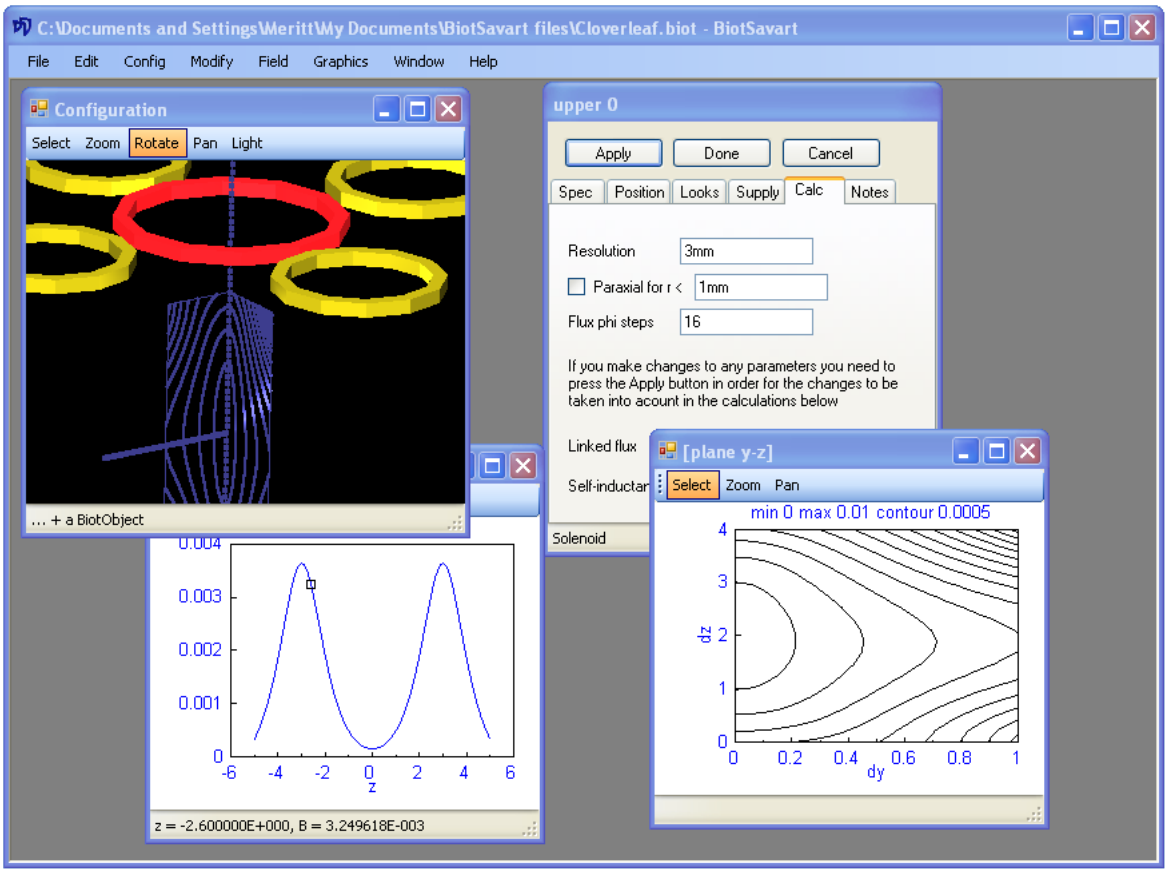
You can also make arrow plots of vector quantities $\boldsymbol{B}$ or $\boldsymbol{A}$.

An example

A screen capture showing an antihelmholtz coil, a planar probe displaying contours of $|\boldsymbol{B}|$ and a volumetric probe displaying a level surface of $|\boldsymbol{B}|$:



Windows XP screenshot

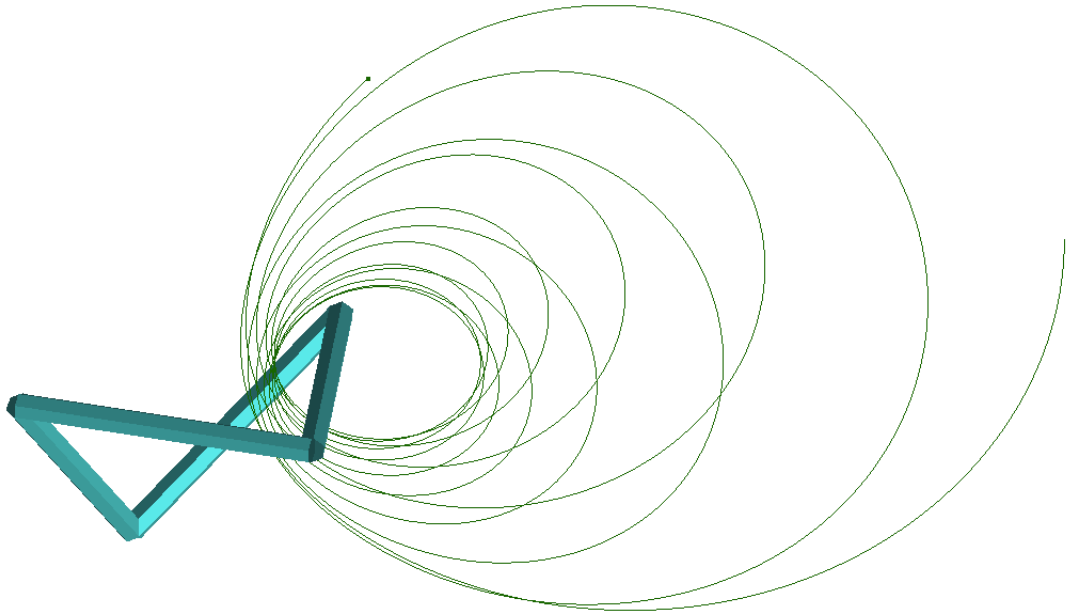


Configuration window shows a 3D view of the conductors, that you can select by clicking on them.

Other windows show interactive graphs of calculated field profiles along lines or on planes (contour plot).

Dialog boxes are opened to modify the conductors, so you can modify them in parallel.

Field line tracing



Magnetic field lines are traced from a user-specified starting point using the fundamental equation

$$\frac{d\boldsymbol{x}}{ds} = \frac{\boldsymbol{B}(\boldsymbol{x})}{|\boldsymbol{B}(\boldsymbol{x})|}$$

Here s denotes the path length along the field line. This differential equation is integrated using the fourth-order Runge-Kutta method.

Force and torque calculations

The force $\boldsymbol{F}$ acting on a conductor is found from

$$\boldsymbol{F} = \int dV\, \boldsymbol{J} \times \boldsymbol{B}$$

where $\boldsymbol{J}$ is the current density in the conductor and $\boldsymbol{B}(\boldsymbol{r})$ is the magnetic induction.

The torque $\boldsymbol{N}$ acting on a conductor is found from

$$\boldsymbol{N} = \int dV\, (\boldsymbol{r} - \boldsymbol{r_0}) \times (\boldsymbol{J} \times \boldsymbol{B})$$

where $\boldsymbol{r}_0$ is the center about which the torque is calculated.

Inductance calculations

The flux Φ linked by a conductor is obtained from the vector potential $\boldsymbol{A}(\boldsymbol{r})$ by the volume integral

$$\Phi = \int dV\, \boldsymbol{A} \cdot \boldsymbol{W}$$

where $\boldsymbol{W}$ is the vector winding density (if the current in the conductor were set to I the current density would be $\boldsymbol{J} = I\boldsymbol{W}$).

LensForge, the premiere lens design program for Mac OS X

We are developing LensForge as a cost-effective tool for physicists, engineers, and lens designers. Through a process of continual improvement, we are making LensForge uniquely valuable to our customers.

LensForge license: $495.

Ask us about customization!

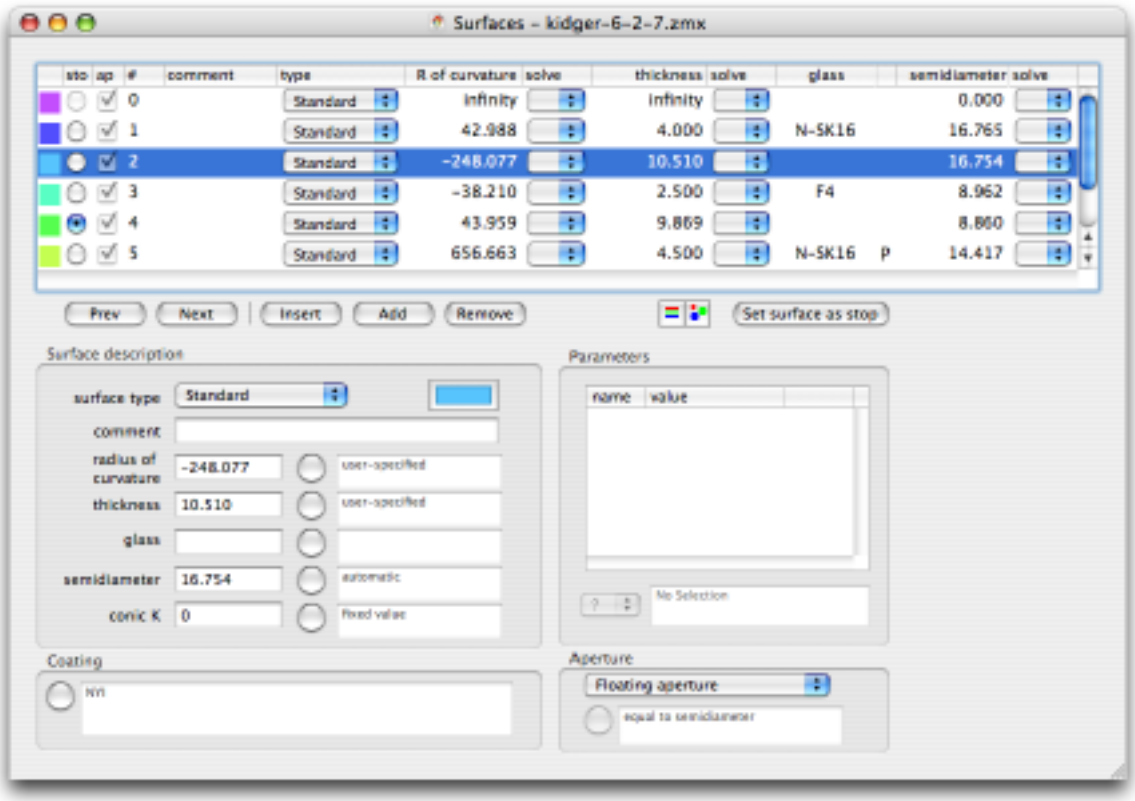
> "One of the real values I see in this software is the ability to see in nearly real time the effects of a change. It can really help to develop intuition and understanding of the design process."
>
> *- Tommy Arends, Technology Consultant, Bellevue, WA*

> "I'm very impressed at the speed and precision of your modifications to Lensforge."
>
> *- Tom Kornack, Twinleaf LLC*

User interface

LensForge makes extensive use of user interface features of Apple's Cocoa API to improve your productivity. For example, the surface worksheet lets you select multiple surfaces and change values like radius of curvature for all surfaces at the same time. Also, lenses may be dragged from the stock lens catalog browser into the surface worksheet.

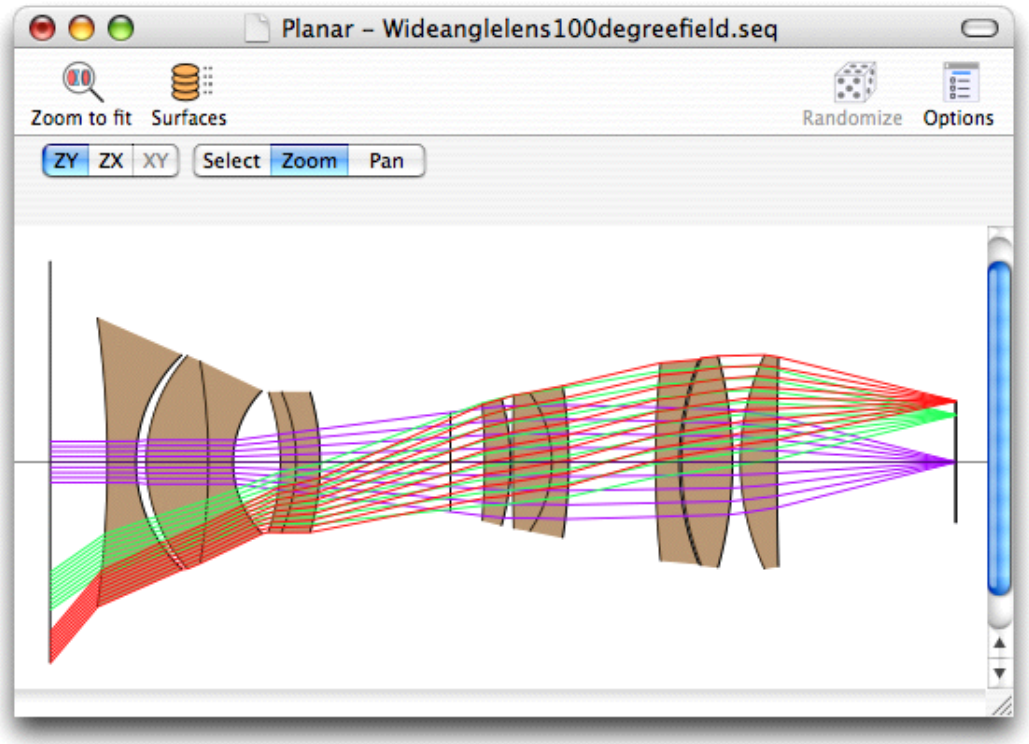
The surface worksheet:



Accurate ray tracing

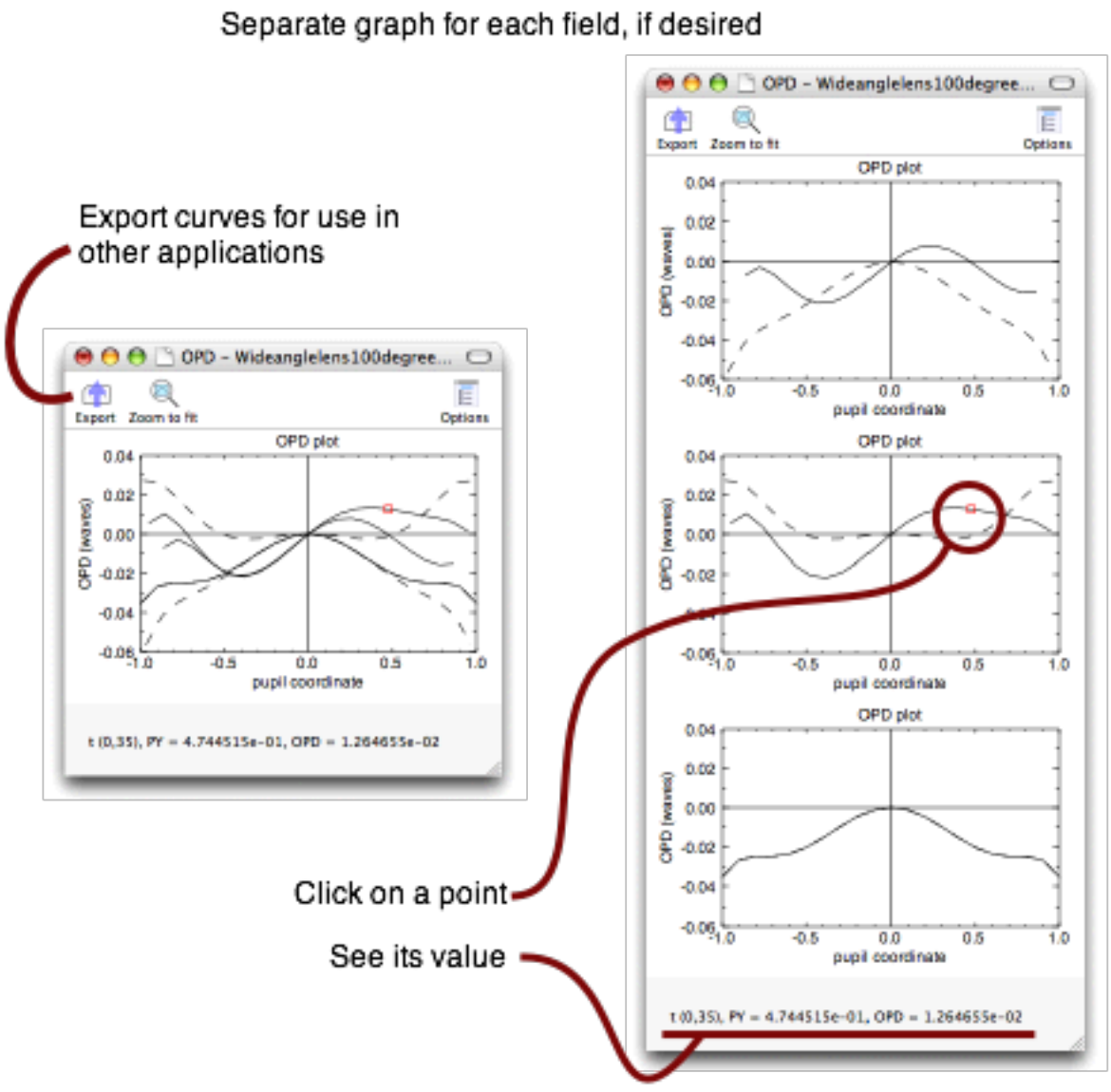
LensForge traces meridional and skew rays using a physical formalism that describes the full nonlinearity of Snell's law of refraction without recourse to trigonometric functions. Negative index of refraction is handled naturally. The optical path length traversed by each ray is accumulated for use in diffraction diagnostics.

The ray-tracing algorithms used have been validated using challenging lens designs, such as this wide-angle lens:



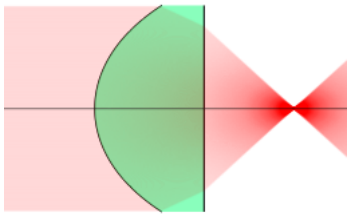
Interactive diagnostic plots help speed investigation of lens designs

For example, OPD (Optical path difference):



Essential surface types

- Plane, sphere, conicoid, asphere.
- Polynomial in x and y.
- Reflecting surfaces.



Comprehensive glass data

- Catalogs: Hikari, Hoya, Ohara, Schott, Sumita.
- Plastic materials.
- Define new glasses by curve fitting index of refraction data.

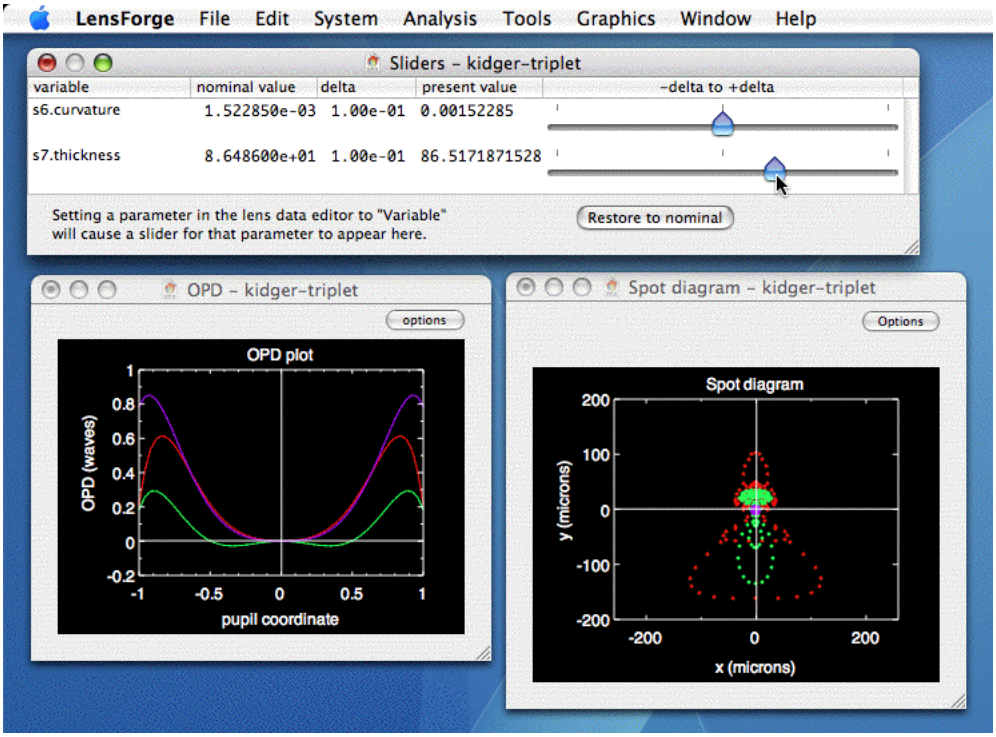
Diverse diagnostic plots

- Ray and OPD fan
- Distortion
- Field curvature
- OSC fan
- Spot diagram
- Geometrical OFT & MTF vs spatial frequency
- Thru-focus GOFT & GMTF

Sliders

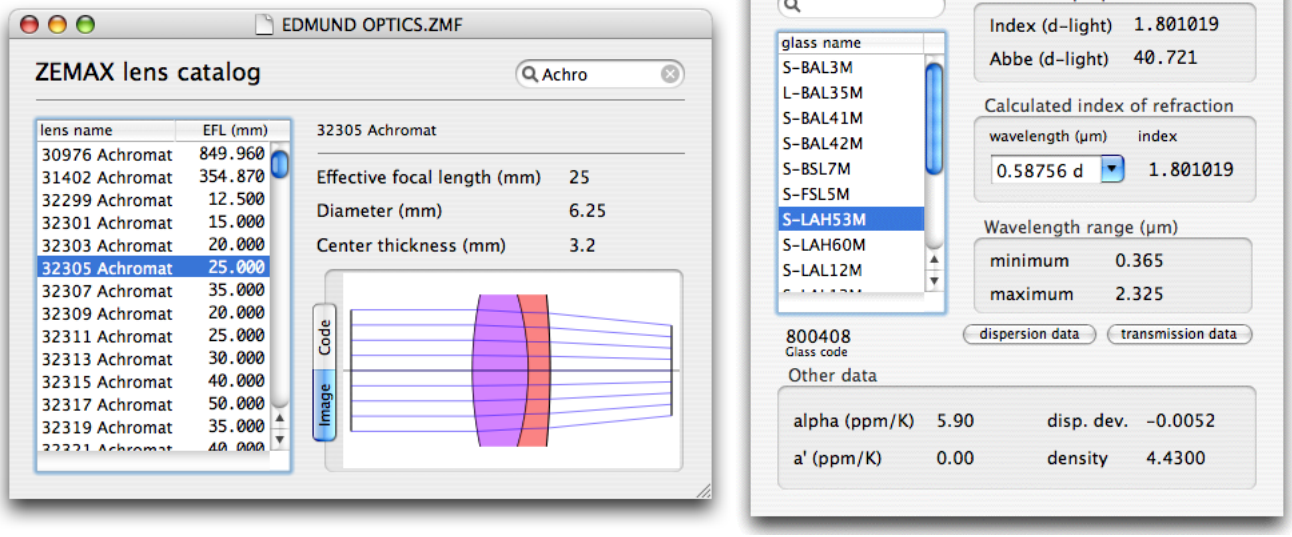
> "The purpose of computing is insight, not numbers."
>
> *- Richard Hamming*

. . . and a good way to gain insight into a lens design is to observe how things change as you refocus, change air spaces, and so on. The sliders feature of LensForge lets you change your lens design in an analog fashion while watching how various characteristics (e.g., spot diagrams) are affected.



Built-in catalog browsers

LensForge lets you browse catalogs from lens and glass vendors published in the ZMF and AGF formats.

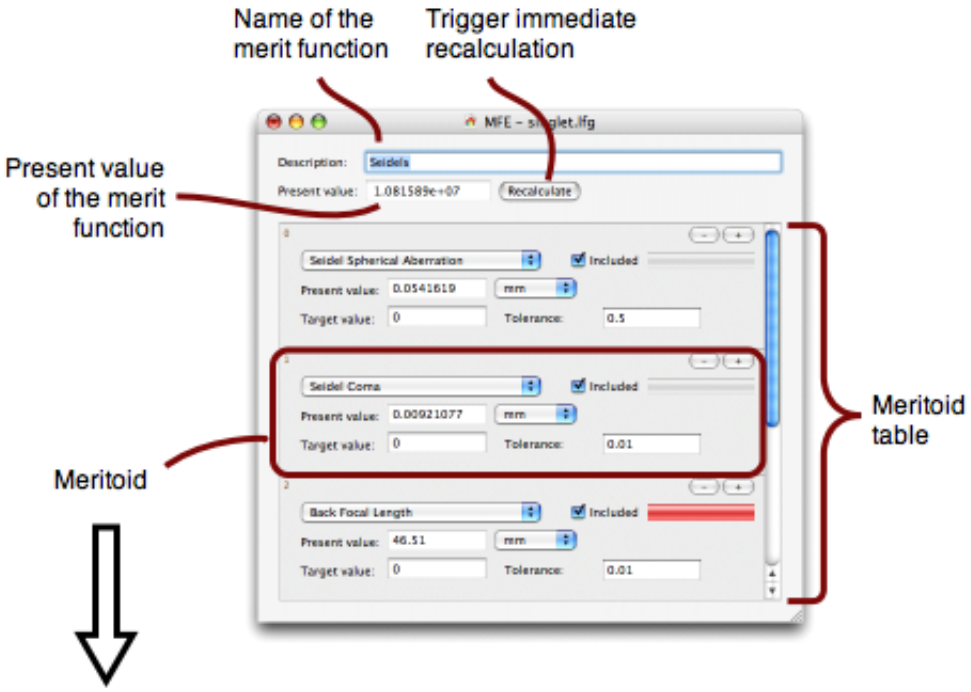


The ZMF browser includes a search box to isolate desired lenses, as well as a thumbnail of the selected lens.

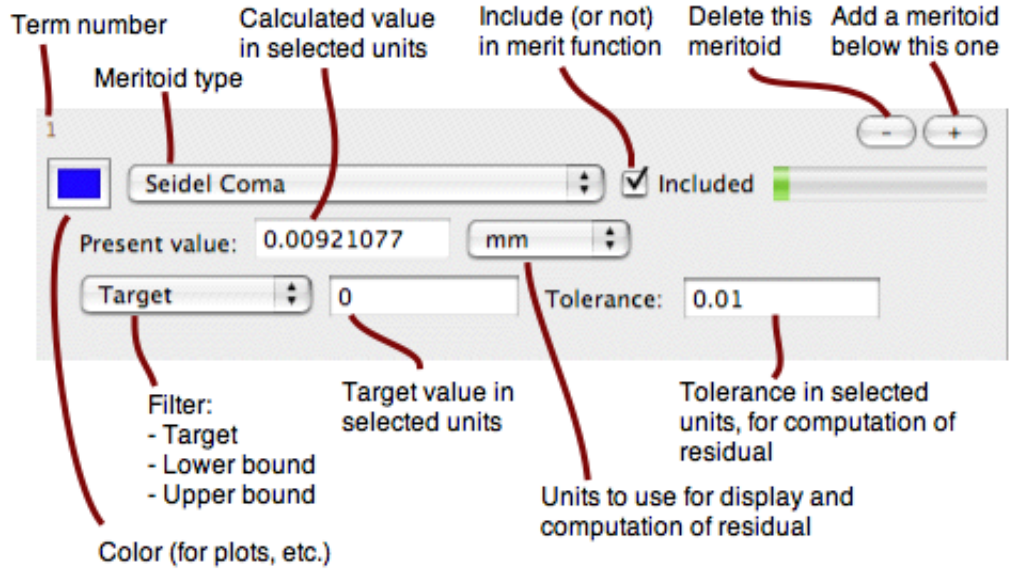
The AGF browser includes a search box and includes a refractive index calculator.

You can drag lenses and glasses from these browser windows into your lens design.

Merit function editor

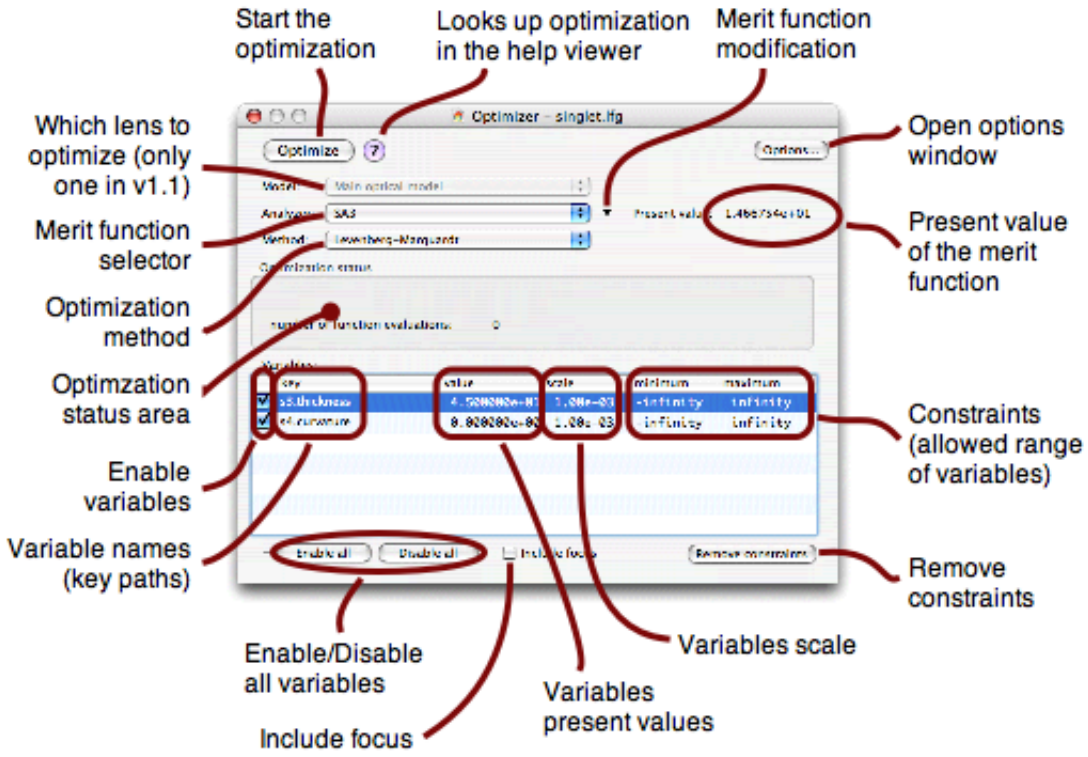


Meritoid detail



Optimization

The optimizer finds the minimum of any of your defined merit functions using the Levenberg-Marquardt (damped least squares) or Nelder-Mead algorithms.



Merit plots

You can also plot the value of the merit function (value or residuals) as a function of any construction parameter.

File Compatibility

LensForge can read and write supported surface types from lens files in ZEMAX® format. It can also use ZEMAX glass files and stock lens catalogs.

LensForge can also read supported surface types from Code V® and OSLO® lens files.

The ability to write OSLO lens files is being developed.

Code V is a registered trademark of Optical Research Associates. OSLO is a registered trademark of Lambda Research Corporation. ZEMAX is a registered trademark of ZEMAX Development Corporation.

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Need a subroutine library?

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- Ray optics.
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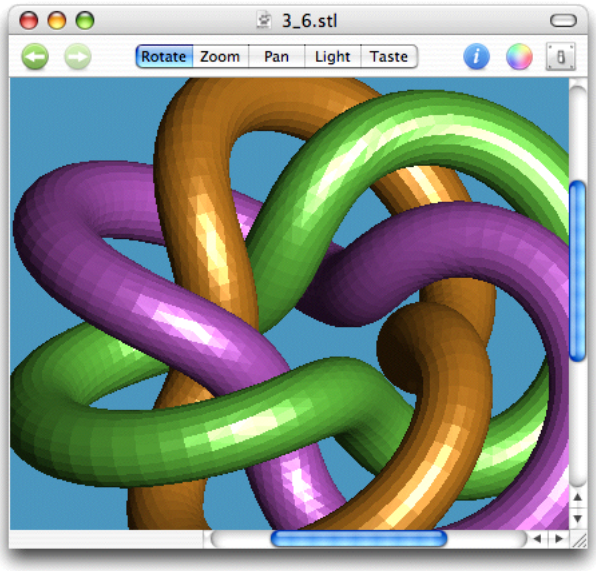
'topeScope solid model tool



- Mac OS X
- Reads stl, gts, nff, q3o, obj, off, ply, tri, uo.
- Writes stl, obj, ply, uo
- Mesh coloring
- Information (extents, volume, etc.)
- Morphing (translate, rotate, scale, mirror)
- Merging solid models
- Mesh repair

About Ripplon Software

Ripplon Software Inc. was incorporated in 1995. The goal of Ripplon is to produce easy-to-use interactive powerful software for science.

Meritt Reynolds, the author of these software products, is an experimental physicist who obtained his Ph.D. at the University of British Columbia in 1989. He has worked as a physicist both in academia and in industry.