ASAP

Optical design and analysis software

GETTING STARTED GUIDE

Breault Research Organization, Inc.

This technical publication is for use with ASAP® 2009.

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1 GETTING STARTED

The ASAP Getting Started Guide is intended to help you install ASAP, become familiar with its landscape, learn about its features, and do a brief exercise.

This chapter describes the contents of your ASAP package: the BRO installation media, and, for new users, the hardware key. It also includes information about technical support and how to contact BRO.

ASAP INSTALLATION MEDIA

ASAP installation media provides installers for ASAP and documentation; short movies about new features, documentation, and support); and release notes (Release_Notes.txt).

Electronic documentation

The installation media includes a documentation installer. Running the installer will copy all the documentation available at the time of release to your computer in C:\Program Files\Breault. Types of documentation are listed below.

1. The *ASAP Primer* introduces ASAP concepts and use. Each of the more than 20 chapters are building blocks of knowledge to facilitate new users in understanding ASAP.
2. *ASAP Reference Guide* includes all the ASAP command topics from ASAP HTML Help.
3. Over 50 technical publications discuss how to use new and existing features.

You may also download or print ASAP documentation directly from the BRO Knowledge Base, which includes the most current versions:

http://www.breault.com/k-base.php

The documents are in Adobe® Acrobat® Reader format (PDF files) so that you can read them online, print them, or install them on your computer. The Adobe Reader can be downloaded from:

http://www.adobe.com

BRO WEB SITE

BRO recommends that you periodically visit its Web site, www.breault.com, to find out what is new. Learn about software features and optics training classes, view feature or application-specific videos in the Multimedia Gallery, and search the Knowledge Base for articles, technical publications, user guides, and white papers.

NEW ASAP USERS

If you are a new ASAP user, the following items should be in your ASAP package or sent to you by email.

Hardware authorization key

The Sentinel® SuperPro™ or SuperProNet™ hardware key is a small device that connects to the parallel or USB port of your computer. It contains an identification code for using ASAP. See “Installing the hardware key” on page 18.

Software authorization keys

Your unique set of alpha-numeric software authorization keys is sent to you via email, if you are the end user. You are prompted to enter the keys during the ASAP Setup process. The first section of the key is your BRO customer identification (ID). After installing ASAP, you can view registration information from the Help menu in the ASAP Registration dialog. See “Installing ASAP software” on page 18 and “Authorizing use of ASAP” on page 20.

SUPPORT

Maintenance Plan

Maintenance Plan members are entitled to major upgrade releases, which occur approximately every 12 months, as well as all minor ASAP releases. Major and minor releases are available via Web download. Stay current on software, access all BRO Light Source Library models, and work with experts in Technical Customer Service.

You will receive e-mail notification of software releases including up-to-date ASAP HTML Help, as well as additions to the BRO Knowledge Base and Media Gallery at www.breault.com.

Technical Customer Service

If you are a Maintenance Plan member and you have questions about ASAP that are not answered in this manual, in ASAP HTML Help, or the Knowledge Base, please contact BRO Technical Customer Service. See “Contacting BRO” on page 12. You can expect to receive a response within 24 hours of first contact.

TROUBLESHOOTING STEPS

Please perform the following troubleshooting steps before contacting BRO for technical service:

1. Determine which release of ASAP you are running.
2. Note any error messages that occurred while you were working in ASAP, and what occurred leading up to the error.
3. Check ASAP HTML Help or the Knowledge Base for information concerning the problem or question. The Knowledge Base includes Application Tips for many common issues.

Sending your input files

1. If necessary, send us your ASAP input files (such as *.inr, *.inx, *.enx, *.enz).
2. To speed up the troubleshooting process, please send a stand-alone file with a few lines of sample code to indicate the problem, and explain what you saw and what you expected.
3. Include your customer ID and the ASAP version number in your message (available on Help> Registration in ASAP).

ENGINEERING SERVICES

BRO has over 25 years experience designing, analyzing, and building optical products. We analyze and improve the performance of existing designs, or build new products to meet customer-defined specifications and requirements.

Our consulting team is staffed by optical, mechanical, and electrical engineers, the majority holding advanced degrees.You can use our unique blend of optical engineering talent to complement your existing resources, or to serve as your primary optical engineering resource.

- Industry expertise: Aerospace/Military, Automotive, Bio-optics, Consumer Electronics, Display, Optical Metrology, and Telecommunications.
- Project expertise: Stray Light Analysis, Illumination Systems, Coherent/Diffractive Systems, Optical Systems Engineering, and Source Modeling.
- Capabilities: Systems Analysis/Design, Feasibility Studies, Prototyping, Testing, Custom Software, and Evaluation Services.

For more information, visit www.breault.com, or contact BRO to discuss your engineering challenges. BRO is ISO 9001:2000 certified.

CONTACTING BRO

BRO offers several approaches, outlined below, for contacting us about product information, technical support, or optical engineering services. We welcome your feedback!

Website, Phone, Fax, E-Mail

The BRO Web site offers an extensive knowledge base, as well as new information on our software products and engineering services, training classes, show schedules, newsletters, and press releases. Please bookmark this site and visit it periodically to find out what is new.

Write to us at Breault Research Organization, Inc., 6400 E. Grant Road, Suite 350, Tucson, AZ (Arizona) 85715 USA, or phone, fax, or e-mail us:

Home Page	• www.breault.com
Knowledge Base	• http://www.breault.com/k-base.php
Software	• http://www.breault.com/software/software-overview.php
Engineering Services	• http://www.breault.com/consulting/engineering-overview.php
US/Canada	• 1-800-882-5085
Outside US/Canada	• +1-520-721-0500
Fax	• +1-520-721-9630
E-mail	• info@breault.com (product and consulting information)
	• support@breault.com (technical questions and feedback)

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ASAP Optical Software Solutions

BRO offers two editions and several add-ons of ASAP optical software solutions to match your optical design requirements. For more information, please visit our Web site, www.breault.com.

ASAP Editions and Optional Add-Ons

Edition	Solution
ASAP	Includes everything necessary to design and analyze your imaging and illumination system with the fusion of mechanical and optical engineering in mind. Includes REMOTE for distributed processing in ASAP.
ASAP PRO	Enhanced ASAP edition for complex analyses where coherent light propagation and polarization come into play.

ASAP Optional Add-Ons

(http://www.breault.com/software/asap-optional-addons.php)

BIO Toolkit (for ASAP)	Enhanced version of ASAP includes proprietary BRO plug-ins for modeling light propagation in biological tissue.
CATIA Module (for ASAP)	This module allows ASAP users to open native CATIA V5 files from within ASAP. BRO is an adopter of the CAA V5 architecture, which means CATIA users can count on accurate, seamless geometry transitions into ASAP.
ELTM Module (for ASAP)	The Exterior Lighting Test Module (ELTM) automates the task of SAE, FMVSS, and ECE test compliance for automotive industry. The ELTM Module also supports and stores user-defined tests, walks users through the setup process and presents a pass/fail indicator for each test point.

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INSTALLING ASAP

This section describes how to install, start, and uninstall ASAP, and provides computer recommendations.

BRO's computer recommendations for running ASAP are listed in the table below. When determining your computer requirements, BRO encourages you to select a system that supports optimum performance for ASAP, and uses processor resources intensively for its computation, analysis, and graphical output.

ASAP Computer Recommendations

Hardware

Computer Processor	For the latest information, please contact BRO Customer Service.
Operating System	ASAP supports the following systems: Windows® XP Windows 2000
Parallel or USB Port	Required for hardware key

NEW ASAP INSTALLATION

A typical new ASAP installation scenario involves the following sequential steps:

1. Installing the ASAP program on your hard drive from the installation media
2. Installing the SafeNet Sentinel™ SuperPro™ or SuperProNet™ hardware key on your computer
3. Starting ASAP

During installation, ASAP installs a driver so that the program can communicate with the hardware key. The ID of your hardware key is automatically entered in the Registration dialog, which is on the Help menu in ASAP.

***NOTE* Prior to installing ASAP, verify that your hardware key is NOT attached to your computer.**

See "Installing ASAP software" on page 18 and "Installing the hardware key" on page 18 for complete instructions.

Installing ASAP software

***NOTE* To install ASAP, you must first log in as Administrator or log into an account with equivalent privileges.**

1. If the hardware key is attached to the computer, remove it before installing ASAP.
2. Insert the installation media into the DVD drive. The autoplay window should automatically open.
3. If the autoplay feature is disabled, run d:\setup, where d is the drive designation for installation from a DVD.
4. To read the Release Notes, select Release Notes.txt under Install on the autoplay.
5. To install ASAP, click Install ASAP.
6. When prompted, enter your software key, and browse to the folder where you want to install ASAP. By default, ASAP is installed in the folder, C:\Program Files\ASAPyyyyVvRr, where *yyyy* is the major year version of ASAP, and *VvRr* is the current **v**ersion and **r**evision level. Previous ASAP versions are not overwritten.
7. Restart the computer after completing the installation.
8. Before you launch the installed ASAP, attach the hardware key (see “Installing the hardware key”). If you do not install the key, ASAP opens in Demo mode.

Installing the hardware key

If you are a new user, BRO includes a SafeNet Sentinel™ SuperPro™ or SuperProNet™ hardware key in your ASAP shipment to provide a unique identification number for authorizing software use.

The key is a rectangular connector for the parallel port key, or a long, narrow key device for the USB port.

Sentinel® SuperPro™ hardware keys (from SafeNet): 797 network parallel port key (top left), single-user key (top right), and USB port key (bottom)

NOTE ***Install ASAP before you attach the hardware key to the computer. Attach the hardware key before you launch the installed ASAP (see "Installing ASAP software" on page 18).***

1. Confirm that your computer system date is set correctly. If it is not, the keys could fail.
2. Power OFF the computer.
3. Plug in the hardware key. The arrows on the bottom of the key indicate which end to plug into the port.
4. If you are using the parallel port and have other devices you want to attach to it, such as printer cable, plug the devices into the other end of the key. The key does not interfere with normal use of other devices that you connect to the port.

NOTE ***You may install ASAP on multiple machines. For ASAP to launch successfully on any machine on which it is installed, you must either 1) attach your hardware key and register your software keys, or 2) be able to access your network key that is attached to your ASAP network key server, and register your software keys on the local client machine.***

STARTING ASAP

***NOTE* Attach the hardware key before you launch the installed ASAP.**

You can start ASAP from your desktop by clicking  , or from the Start menu under Programs in a folder you specified during installation.

Authorizing use of ASAP

1. The first time you start ASAP after installation, you may need to enter your unique BRO software license keys in the Registration dialog, which is on the Help menu. If you installed the hardware key, the Key ID number appears in the dialog.

***NOTE* If you do not have BRO software license keys, you can click the Demo Mode button on the Registration dialog to preview new features or try sample projects.**

2. If the license keys are *not* displayed in the License Key area, enter the key numbers from the “BRO Software Authorization Keys” document provided with your ASAP shipment.

TIP* You can copy the keys from an application like Notepad or your e-mail, and then paste them into the Registration dialog via the Clipboard. Use the** Import From Clipboard ***button in the Registration dialog. Select Help ***for instructions.***

3. Select Update to verify the numbers and store them in ASAP. If the numbers are incorrect, a message asks you to re-enter them and select Update again. The first set of software key numbers (from the left) is your BRO Customer ID.
4. If you have an ASAP network license, you or your Administrator can locate the IP address from the Registration dialog, under Network License Servers.
5. Select Close when you are ready to start ASAP.

***NOTE* If you have problems during the installation procedure, please contact Technical Customer Service.**

UNINSTALLING ASAP

In accordance with Microsoft guidelines for Windows program installations, BRO provides a simple uninstall capability for removing an existing version of ASAP from your computer. The uninstaller removes executable, Help, and related program files.

CAUTION ***To preserve the uninstall capability, do NOT alter, rename, or delete the uninstall executable and uninstall log files. These files reside in the folder in which ASAP was installed. Typical names for these files are unins000.exe and unins000.dat, respectively.***

Uninstalling ASAP in Windows

1. Log in to the Administrator account, or an account with equivalent privileges.
2. From the Start> Settings menu in Windows, select Control Panel and click the Add/Remove Programs icon. ASAP is listed along with other installed programs.
3. Highlight the version of ASAP that you want to remove. Select the Add/Remove button to uninstall ASAP.

NOTE ***The ASAP Uninstaller does not remove files that were added after the initial ASAP installation. The Uninstaller might not delete the folder in which ASAP was installed.***

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THE ASAP USER LANDSCAPE

This chapter introduces you to the layout of the ASAP user landscape—commonly called the user interface (UI). It is the visible part of the program that communicates with the hidden ASAP kernel, taking your input from the various windows and dialogs to create and analyze your optical systems. When you use the UI, ASAP reformats your input into ASAP command syntax. Whether or not you know the exact syntax of commands, you are free to focus on the optical engineering task at hand.

ASAP PRIMER BOOK

BRO highly recommends that you read the *ASAP Primer*, which introduces ASAP in a series of clearly written and illustrated chapters. Based on the ASAP Introductory Tutorial course, the Primer includes exercises to help you learn about the UI and the ASAP scripting language. A Primer PDF file is on the installation media, or find it in our Web Knowledge Base at http://www.breault.com/software/k-base.php.

BUILDER, SCRIPTING, OR BOTH?

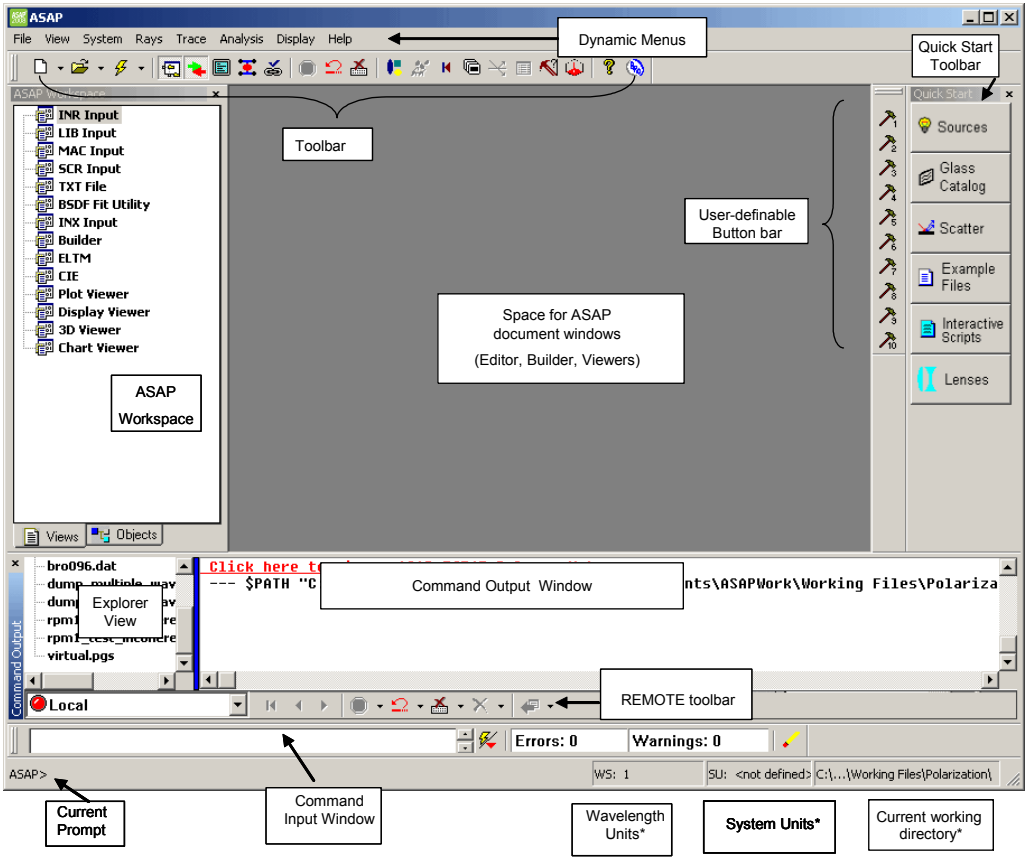
When you are a new user, you might start working primarily with the ASAP Builder, in combination with menus and dialogs, to build your optical systems. You can also work with the ASAP scripting language. As you personalize the UI to suit your needs, you will find ASAP offers a smooth, nearly seamless cross-over from the UI to command scripting.

Once you are familiar with the way ASAP works with both the ASAP Builder and the ASAP scripting language, you will know which interface is more compatible with your preferences.

ASAP will soon become—if it hasn't already—an indispensable tool for designing, analyzing, and prototyping your optical systems.

TIP When you open ASAP for the first time, the main ASAP window looks like the illustration in "ASAP window (default mode)".

***TIP* BRO recommends that you set your display monitor at 1024 x 768, with 16 million colors for ASAP. However, 800 x 600 resolution with 64K colors is acceptable.**



ASAP window (default mode)

See “ASAP Interface” on the Contents tab of ASAP HTML Help. This book, or section, includes topics about windows, menus, and toolbars to familiarize with ASAP.

NAVIGATING IN HELP

ASAP HTML Help offers you information on using ASAP. You can access ASAP HTML Help in several ways: from the Help menu, by selecting  on the menu bar, by selecting the Help button within a dialog, or from the Editor window by highlighting a command and pressing F1.

The ASAP HTML Help window offers you three ways to find information about ASAP: Contents tab, Index tab, and Search tab. BRO recommends that you take a few minutes to become familiar with Help by browsing the Contents tab (left pane). From here, you can see the scope of the entire Help system.

While the Contents tab gives you a high-level view of all the topics, you can also search Help from the Index or Search tabs. The Index narrows your search. It is a detailed topic analysis of the contents by topic titles and keywords, which are words or phrases contained in or synonymous with a topic. A full-text search broadens your search. When you enter a word or phrase in the Search tab, Help performs a full-text search and lists *all* topics in which the actual word or phrase appears.

IN AND OUT OF THE WINDOWS

While working in ASAP, several document windows are available for user tasks. You can easily move in and out of a window. ASAP Workspace reflects whichever window you have in focus:

- ASAP Workspace for viewing lists of open document windows, files, and objects.
- Command Input for entering scripting language and viewing the active local (or remote) machine, and Command Output for displaying the results.
- Builder and Editor windows for creating and refining your script files, using embedded assistants, for digitizing images, optimizing files, or performing tolerance analysis.
- Plot Viewer, Chart Viewer, 3D Viewer, and Display Viewer for displaying your work in progress, including CIE color analysis, Conformal Radiometry, and Polarization (Poincare Sphere).
- Quick Start toolbar for easily accessing sources, glasses, scatter and random models, example scripts, interactive scripts, and lenses.

- BSDF Fit Utility for fitting Harvey and polynomial models.
- Screen Editor window for designing custom dialogs.

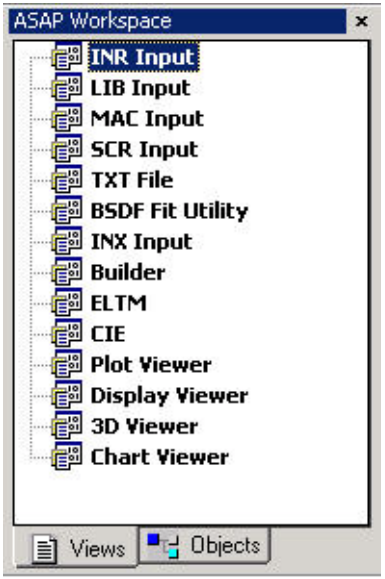
***NOTE* Each of the task windows listed above is described briefly in this chapter. Detailed information is available in ASAP HTML Help, either in the ASAP Interface book or the Features book.**

User preferences

You can set preferences in ASAP from the File menu by selecting Preferences. In addition to general settings, the User Interface Preferences dialog includes settings for the Builder, Input/Output, Custom Toolbar Editor, Quick Start toolbar, CAD Import, Plot Viewer, REMOTE, and the 3D Viewer. See “User Interface Preferences” in ASAP HTML Help.

ASAP Workspace

The ASAP Workspace window initially displays status lists on two tabs, Views and Objects.



ASAP Workspace window with active Views tab

VIEWING ASAP WINDOWS

The Views tab lists all the available ASAP windows. As you open files associated with any of these windows, ASAP Workspace lists the open file(s) below the window name with which the file type is associated. You can see which files are open, and bring a hidden window into focus by selecting the file name on the Views tab.

TRACKING OBJECTS

The Objects tab lists all objects associated with an open file. The check box next to each object is for designating which objects to include n an operation. See “ASAP Workspace” in ASAP HTML Help.

Working with projects

ASAP uses a file management concept called projects. For easy viewing and quick access, you can organize each project by linking all the files associated with it. An ASAP project file (*.apf) tracks which files are associated with a project, and the folder in which each file is stored.

CREATING A PROJECT

1. From the ASAP toolbar, select the triangular arrow next to the New button. From the drop-down list, select Project.
2. In the New Project dialog, assign a project name and specify the folder in which you want to store the ASAP project file (*.apf).

TIP ***Although it is not required, BRO recommends that you store your ASAP project file in the same folder as its associated files, if possible.***

3. From the File menu, select Preferences> General tab, and select your preferences for the project.

NOTE ***The Files tab on ASAP Workspace becomes visible only after a project is created or loaded.***

LOADING A PROJECT

1. From the File menu, select Project> Load. From the Open Project dialog, select Files of type: ASAP Project (*.apf), and browse to the folder that includes the project file you want. Click Open.
2. After the project files open in the ASAP Workspace window, select a file name on the Files tab to open it in its associated window (for example, Builder, Editor, or Plot).

OPENING A SAMPLE PROJECT

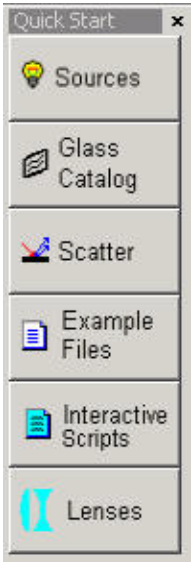
Sample projects are complete working examples of optical systems built in ASAP, along with brief documentation in the form of text files.

1. From the File menu, select Project> Load.
2. Browse asapyyyyvxrx\Project\Samples in your Program Files folder.
3. Double-click a project folder of your choice.
4. Double-click the project (*.apf) file you want to open.

Quick Start toolbar

The ASAP window includes the Quick Start toolbar on the right, as shown in “ASAP window (default mode)” on page 24. The toolbar gives you quick access to

- Light sources,
- Glass media, scatter models and roughness models,
- Example scripts,
- Interactive and user-defined scripts, and
- Lenses.

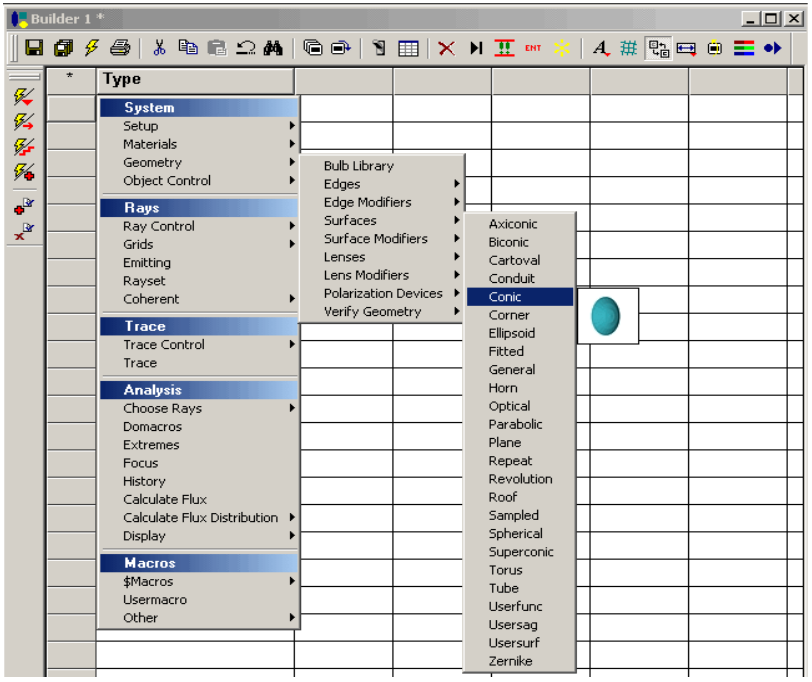


Quick Start Toolbar

See “Quick Start Toolbar” in ASAP HTML Help.

Builder

The Builder offers a simple approach to building your system. Designed for both new and experienced ASAP users, the Builder introduces you to the concepts of using ASAP. You can create the entire system in one window, using most standard spreadsheet navigation features, and save it with the file extension, *.enx (XML file), or *.enz (compressed XML file). All ASAP commands are available by double-clicking an empty cell in the Type column (see figure below).



Creating a system in the Builder window

The following sampling of features gives you an idea of what you can do in the Builder:

- **Built-in ASAP command structure**
  Since you enter Builder input in a sequence that mimics the ASAP command structure, you are actually learning about this command structure in a more user-supportive environment. ASAP automatically translates your input into correct syntax, so that entry errors are far less common and easier to identify.

- **Preview**
  Use this feature before entering any Trace or Analysis commands in the Builder. Test your geometry (single or multiple items) via the preview capability in the Builder. Your geometry is displayed in the 3D Viewer.

- **Exploded lenses**
  View all the component surfaces of a lens in the Builder. These surfaces are normally hidden until exploded.

- **Tolerancing Analysis**

This feature simplifies the tolerance analysis capabilities of ASAP by making it available in the Builder. An automatic Monte Carlo analysis generates random perturbations (uniform or normal distribution) to an existing geometry from the tolerance table. (Tolerancing is also available in the ASAP Editor.)

- **Digitizing**
  The Digitizer feature is a visual tool for acquiring digitized data from an existing Builder file (as well as an INR file) suitable for digitizing for simulation purposes. See “Digitizer in ASAP” in ASAP HTML Help.
- **View pictures of the geometry**
  Before selecting geometry from the Builder context menu, you can preview a thumb-nail picture of each edge, lens, surface, emitter, and grid command.
- **Tear-off command menus**
  For ease of use, you can detach (or "tear off") a submenu and either dock it to an edge of the Builder window, or float it anywhere on the window. Right-click a submenu title, such as System and select Dock or Floating.
- **Copy and paste**
  If you need to duplicate information either within the same Builder *.enx file or another Builder file, use Copy and Paste to save time and reduce errors.
- **Line status**
  Designate specific rows to include or exclude in your run to experiment with results.

For more information on the Builder, see “Defining the System in the Builder” on page 53 of the *Quick Tour*. See “Builder Window Overview” in ASAP HTML Help.

Command Input

The dockable and expandable Command Input window is where you enter ASAP commands. You can easily work in the Command Input window, and move among a variety of other windows, such as the Builder or Editor.

Command Input window (with entered command)

You can enter commands either by typing the command name or selecting a previously submitted command (select the down arrow on the right of the box to

see the list). The commands you enter in this window are submitted to ASAP when you select Run from the File menu, or press Enter.

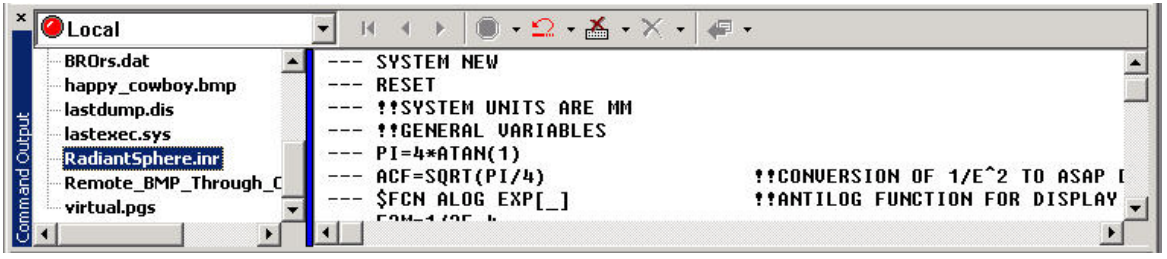
You can work interactively from the Command Input Window, or in the background (at your system prompt) in batch mode. Since the output files are fully compatible with the graphic capabilities in ASAP, you can easily view or manipulate graphics.

Command Output

On the left side of the Command Output window, the Explorer view provides a list of the files in the current working folder. Local refers to the client computer. If one or more servers are also open via REMOTE, a name of each computer is displayed. See “ASAP REMOTE” in ASAP HTML Help.

The dockable and expandable Command Output window, on the right, displays activity while ASAP runs the commands. Scroll this window to review previous output. By default, ASAP saves the last 10000 lines of output for display in the scroll window. This number can be adjusted up or down.

TIP Check the activity in the Command Output window during your work. It not only echoes the commands you send to the ASAP kernel, but also shows warning and error messages to help you identify a problem.

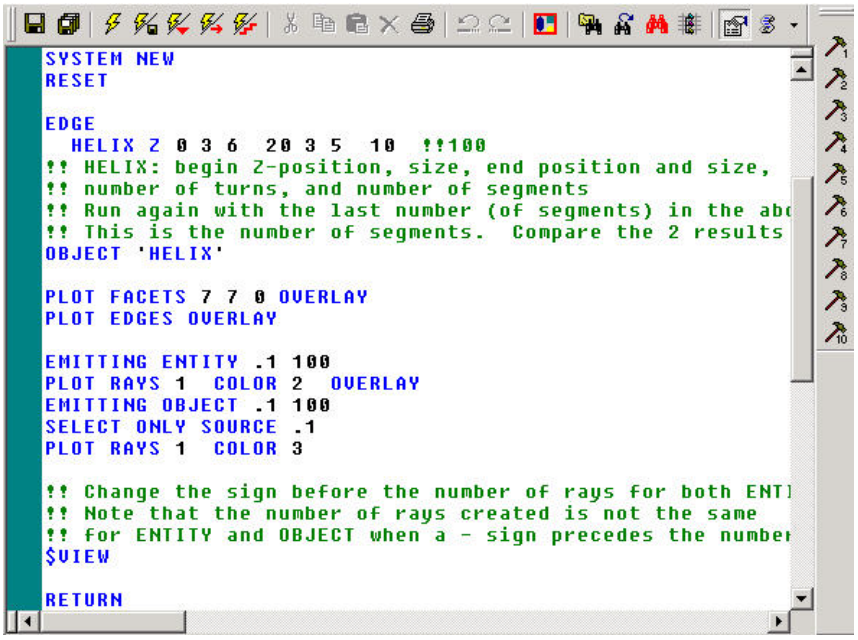


Command Output window (right) with the Explorer view (left) and REMOTE toolbar (above)

See “Command Input Window” and “Command Output Window” in ASAP HTML Help.

ASAP Editor

The Editor window supports basic text input operations, such as editing script (*.inr, *.inx, *.txt) files, cutting, and pasting. It can also send the contents of a file to the ASAP kernel for processing. A few other examples include embedded assistance for writing syntax, color syntax highlighting, keystroke macros, drag and drop text, multiple split views, and auto indentation. You can also undock the window and resize it, according to your work style. See “Editor Window” in ASAP HTML Help.



ASAP Editor window with INR script

The Editor supports a wide range of features, including tolerancing analysis (see “Tolerancing analysis in the Editor” on page 40), optimization, and digitization.

OPENING AN EDITOR WINDOW

You can open an Editor window in one of three ways:

1. From the File menu, select New.
2. On the main toolbar, select the New button.
3. Press CTRL+N.

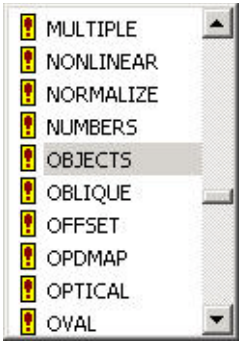
GETTING ASSISTANCE

The Editor has more than one method for accessing ASAP HTML Help:

4. From the main ASAP menu, select Help, and then select Editor Help.
5. In the Editor window, highlight a command and select F1 to open the associated Help topic or a list of Help topics.

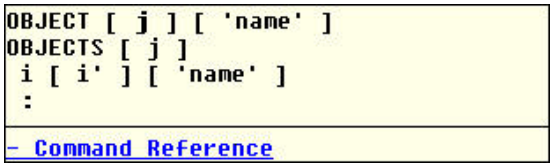
The Editor includes embedded assistants via its smartEditor™ to help you create your scripts:

- **List of ASAP commands**: To find the correct name or spelling of an ASAP command, type Ctrl+space to open a scrollable list of alphabetized commands. The first name closest to the one you typed in the Editor is highlighted in the list. To add the highlighted command in the Editor, double-click its name. Press Esc to close the context window.



Embedded assistant: list of commands

- **Tips for command syntax**: Type a command and press the space bar to open the associated command tip. If there is more than one syntax, use the forward and back arrows to view them. Click Command Reference at the bottom of the tip window to view the Help topic for that command. Note: to activate this feature, select Command Tips from the View menu.

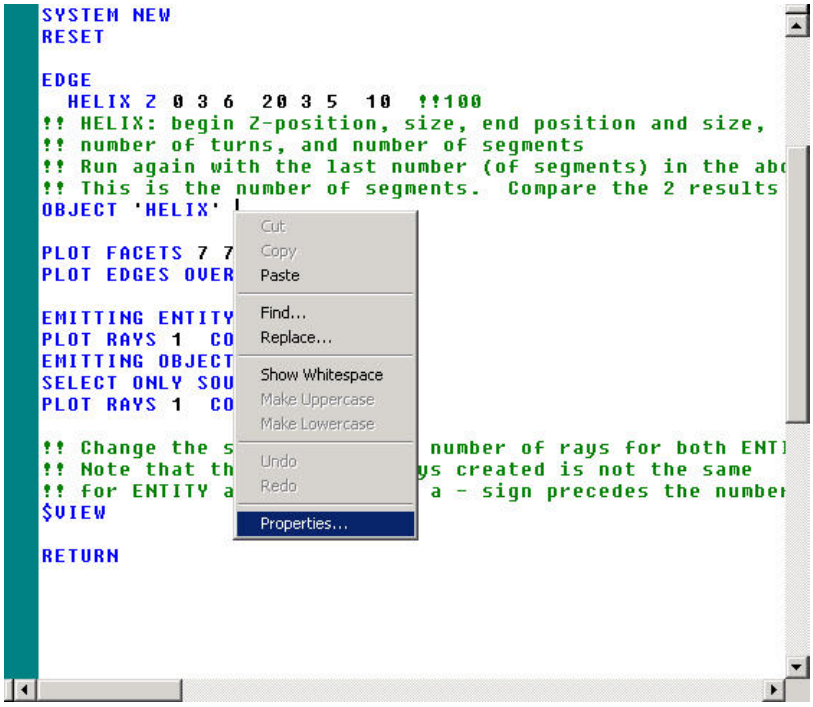


Embedded assistant: command tip

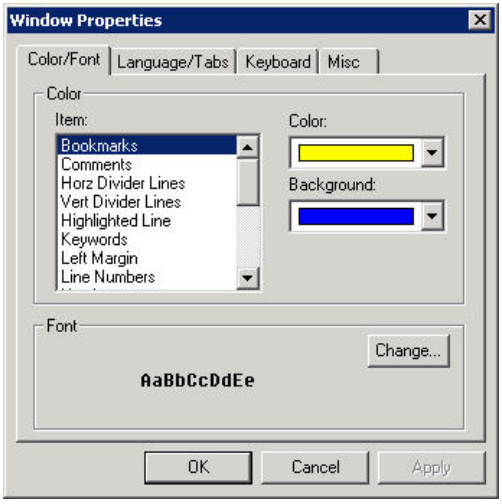
TIP ***Create or eliminate Editor windows as needed. For example, open one Editor for the system geometry, a second window for ray initialization and trace commands, and a third for analysis of the ray data. Switch from window to window, make the appropriate changes, and re-run the input until the analysis is done.***

SETTING UP EDITOR WINDOW FEATURES

The context menu in the Editor window includes a command for opening the Window Properties dialog, where you can select colors for various types of syntax, add or remove side bars, and change other properties.



ASAP Editor with color-coded script and context menu



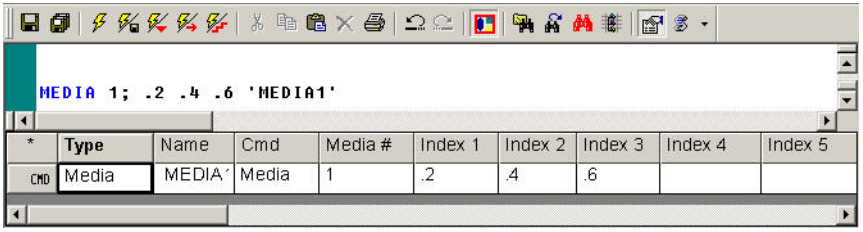
The Window Properties dialog in the Editor includes tabs for: Color/Font, Languages/Tabs, Keyboard, and Miscellaneous.

SELECTING A SCRIPTING LANGUAGE

If you are used to working in a specific scripting language, the Editor supports several languages, which you can select from the Editor toolbar: ASAPScript, VBScript, JScript, and PerlScript. Select to view the list.

QUICK SCRIPTING WITH THE MINI BUILDER

You can take advantage of the quick scripting of the ASAP Builder while working in the Editor by activating the Mini Builder. From an active Editor window, select View> Mini Builder, or select . A blank, one-line Builder opens at the bottom of the Editor window. Double-click the cell in the Type column and select the ASAP commands you want from the drop-down menu. You can move the Mini Builder line to the Editor by copying and pasting it or dragging and dropping it. The Digitizer feature can be used in the Mini Builder.



Adding a line of script in the Editor with the Mini Builder

USING SCRIPT TEMPLATES

Script templates assist in the definition and description of user-specified optical systems in ASAP. ASAP provides a collection of pre-defined script templates, or you may create your own custom script templates.

The pre-defined scripting templates contain high-level examples of ASAP commands used for creating scripts (*.inr files). These examples include system definitions, material property definitions, geometry definitions, source definitions, trace ray operations, and analysis results.

You can choose a pre-defined script template to import in your Editor file (*.inr). Import a template from File> Template by selecting a template listed on the Import Template dialog. You must have an Editor window open to access this command.

You can also create your own template to add to the pre-defined script templates and export (add) it to the list of templates. From an Editor window, enter the command script. Select the script and, from the File menu select Export Template.

PROGRAMMING COMMAND STRINGS WITH THE CUSTOM TOOLBAR

An easy way to program command strings for your frequently used commands in the Editor is via the Custom Toolbar. Up to 20 custom command tool buttons are available on the ASAP window for programming. See *"*User Interface Preferences/Custom Toolbar Editor Tab" in ASAP HTML Help.

TOLERANCING ANALYSIS IN THE EDITOR

This feature simplifies the tolerance analysis capabilities of ASAP by making it available in the Editor when an INX file is open. Analysis options include nominal, Monte Carlo, or sensitivity. See "Tolerancing in the Editor" in ASAP HTML Help. (Tolerancing is also available in the Builder.

DIGITIZING

The BRO Digitizer feature is a visual tool for acquiring digitized data from an existing INR file (as well as a Builder file) suitable for digitizing for simulation purposes. See "BRO Digitizer in ASAP" in ASAP HTML Help.

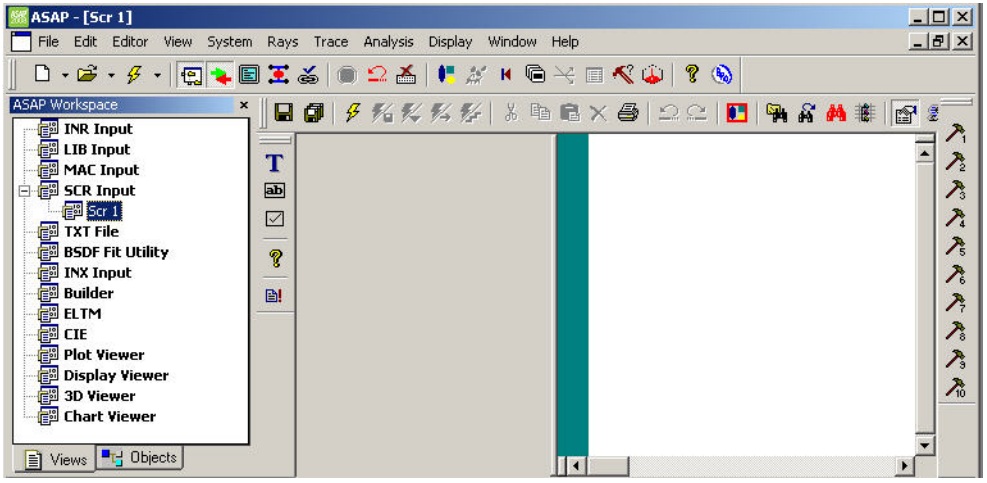
OPTIMIZATION IN THE EDITOR

The optimization feature in ASAP uses an INR file that is open in the ASAP Editor and contains optimization elements, and the Optimization Setup Summary window, where your design variables, design objectives, objective constraints, exit criteria, and optimization method are specified. See "Optimization - Overview" in ASAP HTML Help.

Screen Editor

The Screen (SCR) Editor defines a programmable screen template—a user interface—for editing input/output (I/O) dialogs. SCR dialogs can be used to create and assign values to ASAP variables. For example, use an SCR-created dialog to test a scenario of the same script multiple times with different values.

The SCR Dialog Editor supports the input/output of any ASAP macro. On the menu bar, select View> SCR Editor to open the SCR Editor document window. As you create the dialog layout in the left pane, the corresponding ASAP script is automatically created in the right pane. See “SCR (Screen) Input Editor” in ASAP HTML Help.



Screen Editor document window (right) and ASAP Workspace (left)

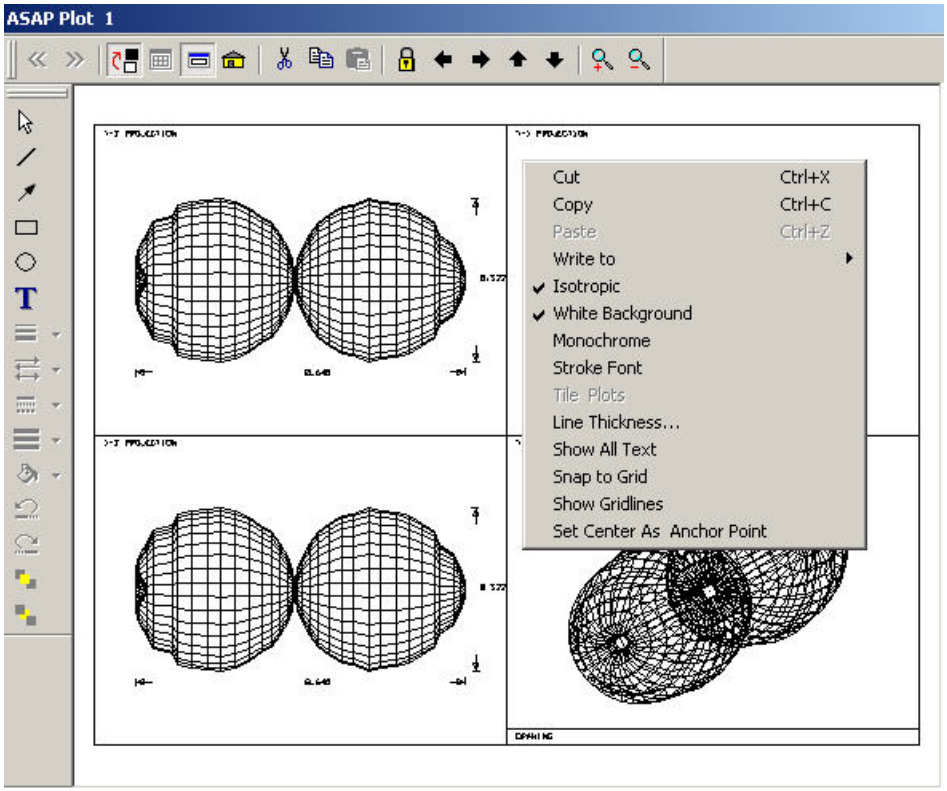
Path Explorer

The Path Explorer supports the exploration of ray history files via queries that you create. Within the user interface or from the Command Output window, you can create queries and view results in the BRO 3D Viewer. For more information, see “Path Explorer Overview” in ASAP HTML Help.

Plot Viewer

You can verify that your optical system models are correct before proceeding with analysis by viewing them in a ASAP Plot Viewer. From the Project Workspace dialog, run the Builder (*.enx, *.enz) or script files you created for your system. Create a plot by choosing the appropriate commands from the Display and

Analysis menus on the main menu bar, or from the Builder. Use the annotation toolbar (shown on the left below) to add text boxes, shapes, lines, and color.



ASAP Plot Viewer window (displaying mesh plot, right-click menu, and annotation toolbar)

See “Plot Viewer Window” in ASAP HTML Help.

Chart Viewer

The ASAP Chart Viewer window automatically opens in ASAP when data can be presented in chart form. You can save chart files in XML file format, and export them to another application for presentation purposes. Use the annotation toolbar (shown on the left below) to add text boxes, shapes, lines, and color.

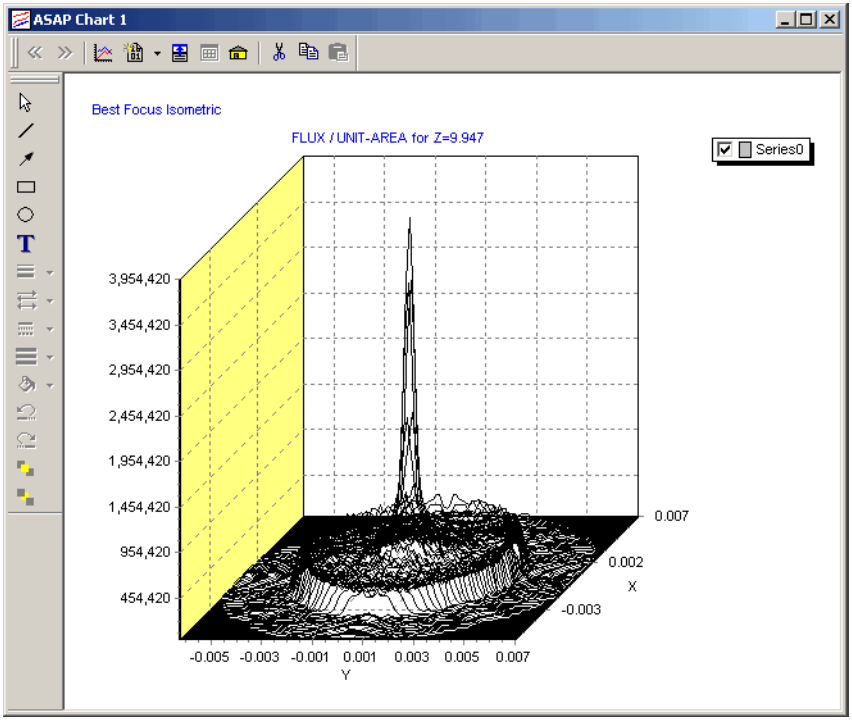


Chart window (displaying a **SPOTS POS** *distribution)*

From the File menu, select Save As. In the Save As dialog, select Chart Files (*.plx) under Files of Type. See “Chart Viewer Editor” on page 44 to learn about changing display features. See “Chart Viewer Window” in ASAP HTML Help.

CHART VIEWER EDITOR

Chart display features affect the overall appearance of charts generated in ASAP. They include those properties and methods that define the color of the chart background, titles and their position, margins, borders, background images, frame and axis, pen colors and widths, 3D, and walls. Nearly all chart properties are available for editing in the Chart Editor. To open the Chart Editor, select  (Edit Chart Properties) on the Chart Viewer toolbar.

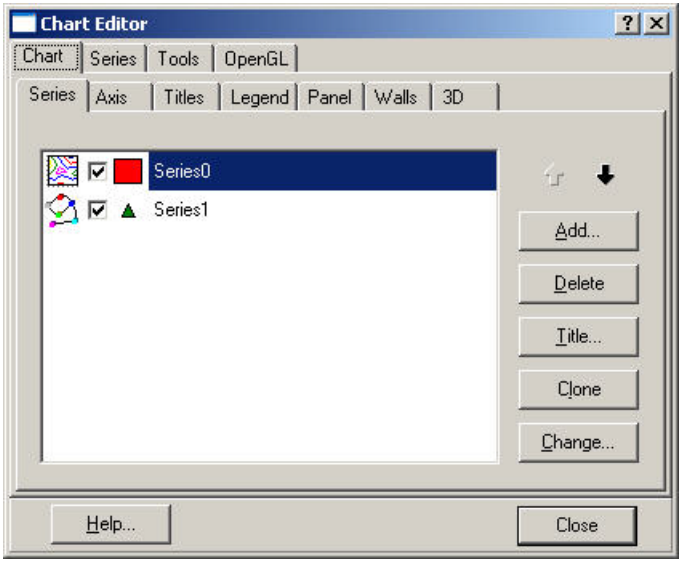
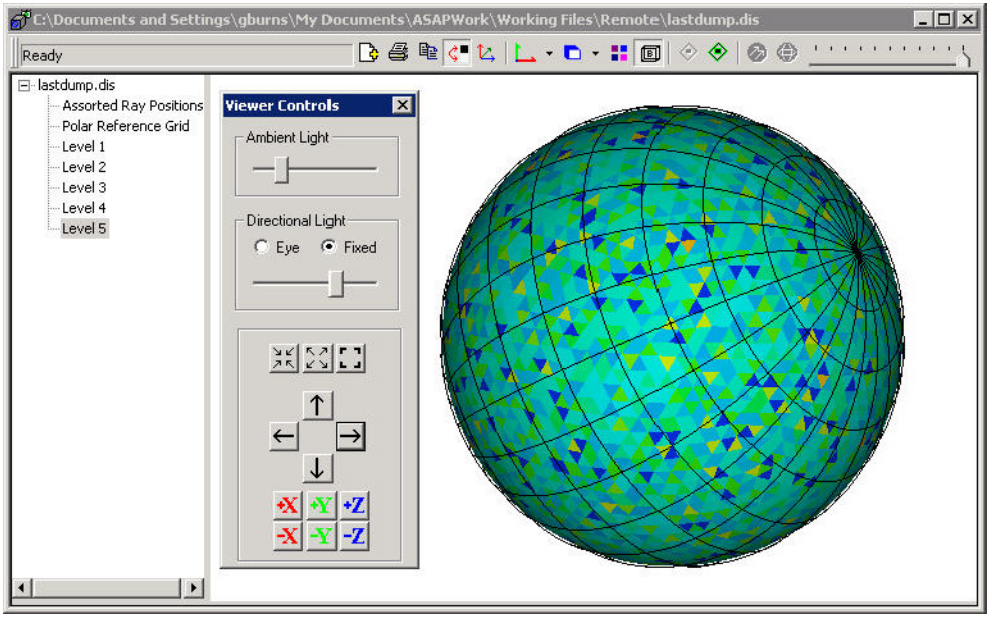


Chart Editor dialog for applying chart properties

3D Viewer

While ASAP generates 2D plots in the various plot windows, it also stores full 3D plot data in a vector (*.vcr) file. To view the contents of the current vector file, select 3D View from the System menu or ASAP Workspace. This launches the 3D Viewer window, and opens the current vector file in the 3D Viewer.



Viewing plot data in the 3D Viewer window

For more information, see “3D Viewer Window Overview” on the Contents tab in ASAP HTML Help.

POINCARE SPHERE VISUALIZATION

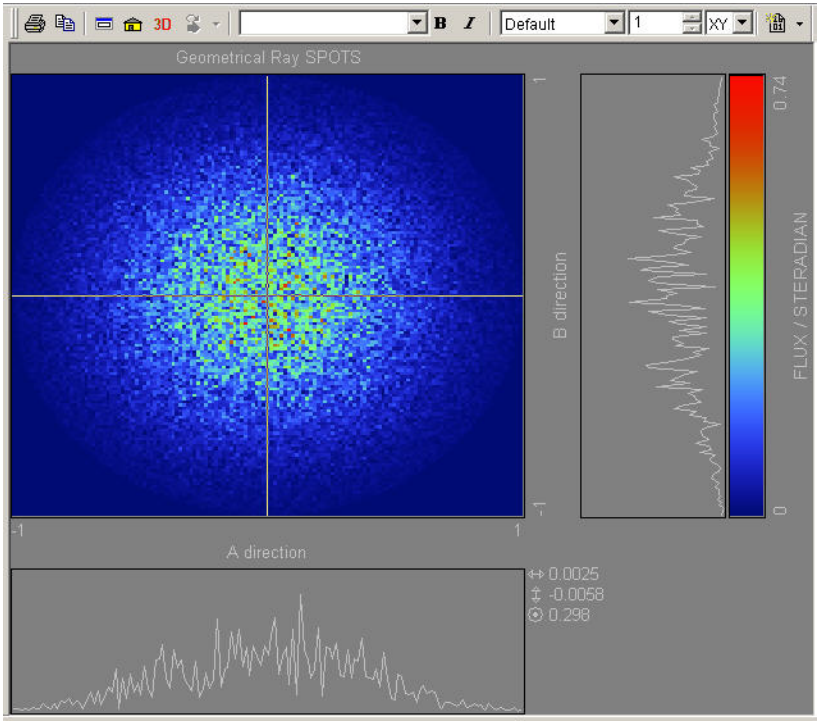
The Poincare Sphere Visualization Tool (PSVT) displays the polarization state of rays in the 3D Viewer. A suitable ASAP display (DIS) file that contains polarization data must be available to view the sphere. When you open a DIS file with polarization data, the 3D Viewer window changes. A Poincare sphere is displayed in the graphics window. See “Polarization - Poincare Sphere Visualization Tool in 3D Viewer” in ASAP HTML Help.

CONFORMAL RADIOMETRY

Conformal Radiometry provides a framework for collecting, tabulating, and visualizing optical ray data that are spatially localized by their intersections with identified surfaces. The feature, which uses the 3D Viewer, can be used to determine the distribution of light over a faceted surface. See “Conformal Radiometry” in ASAP HTML Help.

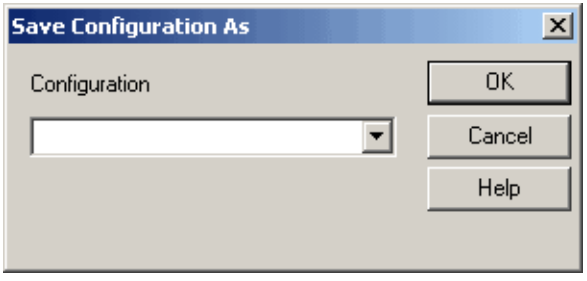
Display Viewer

The Display Viewer graphics window displays your distribution data files. You can create a picture of the distribution and control contours, palettes, cursors, and labeling for better viewing and more exact analysis of your data. See “Display Viewer Window Overview” in ASAP HTML Help.



ASAP Display Viewer window

Right-click context menus are available in the Display Viewer for changing display settings. If you change the default settings and want to save the settings for future use, select Configuration from the Display Viewer menu, and select Save. From the Save Configuration As dialog, open the drop-down box and select one of the user-defined views to overwrite.



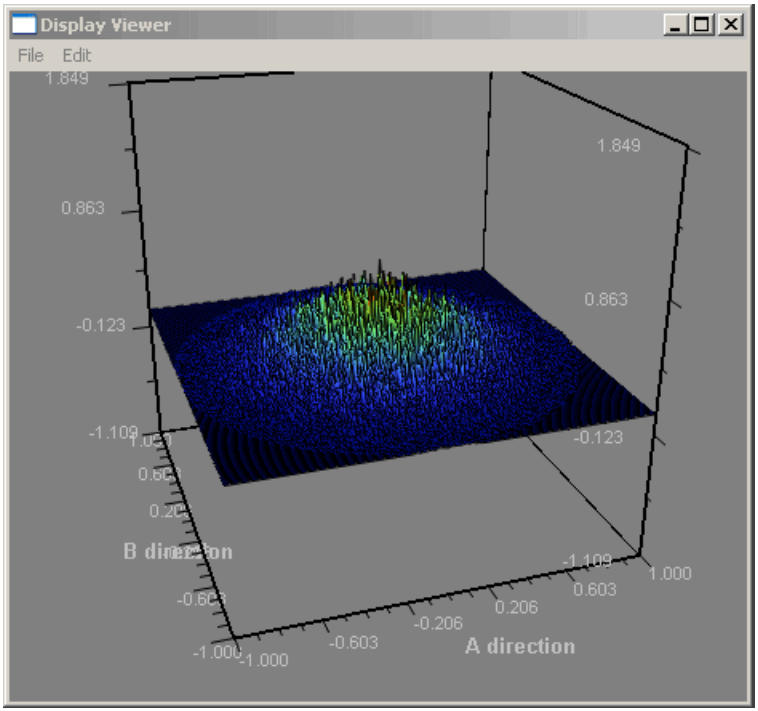
Save Configuration dialog in Display Viewer

TILE VIEW

To tile multiple Display Viewer windows, right-click Display Viewer in ASAP Workspace, and select Tile from the context menu.

3D VIEW OF DATA

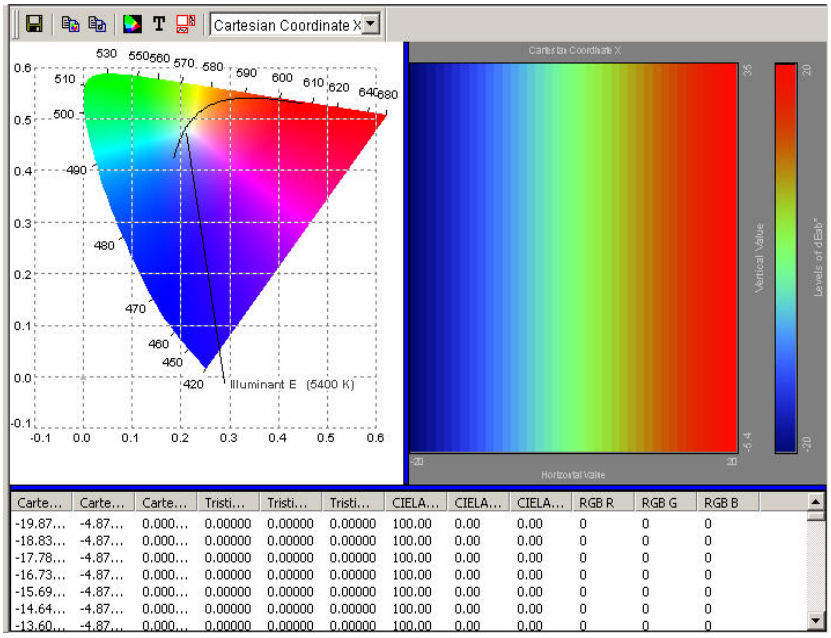
The 3D feature in the Display Viewer offers a way to visualize portions (or slices) of data. The 3D view gives visual height information of pixels, rather than only the 2D, flat view.



3D view of data in the Display Viewer

CIE analysis

CIE (International Commission on Illumination) analysis tests for uniformity of projected light on a surface. The output is displayed in the CIE window and includes chromaticity plots. You can analyze CIE color output, customize data display, render color intensity, and view output from CIE color analysis tests.



CIE analysis in ASAP

See “CIE Color Analysis Overview” in ASAP HTML Help. You must have a substantial number of rays to see the results.

Optimization

ASAP provides the structure for enhanced optimization capabilities. Included in ASAP are three general-purpose optimization methods: Brent’s Method, Downhill Simplex, and Simulated Annealing. The Optimization feature in ASAP includes a provision for saving the current state of the optimization in a text file.

BRO Digitizer

The BRO Digitizer allows you to transfer graphical input from an electronic picture into numerical data for use with a variety of ASAP commands via a guided user interface. You can use the BRO Digitizer to digitize data for context-sensitive

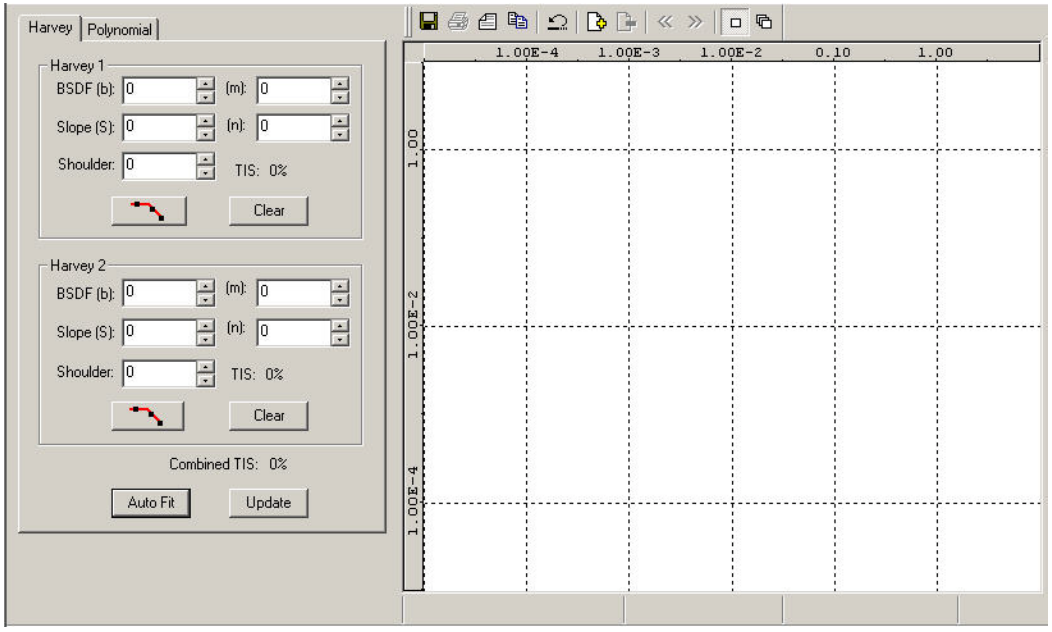
commands in the ASAP scripting language (INR files), or in its spreadsheet-style Builder or MiniBuilder cells. See ASAP HTML Help for topics on this tool.

REMOTE distributed processing

With REMOTE in ASAP, you can initialize and perform distributed processing tasks on dozens, or possibly hundreds, of networked computers by licensing REMOTE sessions in bundles ranging from 1 to 100 sessions. The user interface gives you control of tasking available computers, processors, and cores, and retrieving data from REMOTE sessions

BSDF Fit utility

In most instances where it is appropriate to apply the Harvey model or the Polynomial model, you can use the BSDF Fit utility, which is integrated with ASAP.



BSDF Fit utility window

See “BSDF Fit Utility Overview” in ASAP HTML Help.

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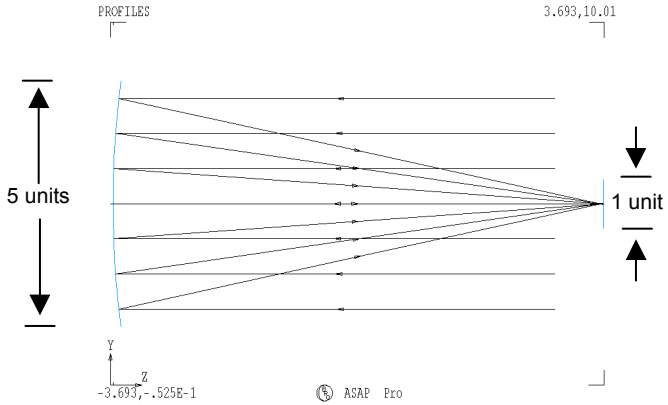
5

A Quick Tour of ASAP

Perhaps the best way to get an overview of ASAP is from a simple example. In this chapter you will create a small concave mirror with a spherical surface, and trace rays to see the type of image it produces. The geometry consists only of the mirror, and a detector to collect the rays.



Mirror diameter = 5 units
Mirror radius of curvature = 20 units
Detector diameter = 1 unit

Ray trace of concave mirror

Although the problem is simple, we will use the same four steps that are fundamental to all ASAP simulations:

1. Building the system
2. Creating the source
3. Tracing the rays
4. Performing the analysis

We will step through this procedure to give you a feel for the process, and then look at each of the steps in detail in the next few sections.

Before beginning the work of building a system, there are a few tasks to take care of.

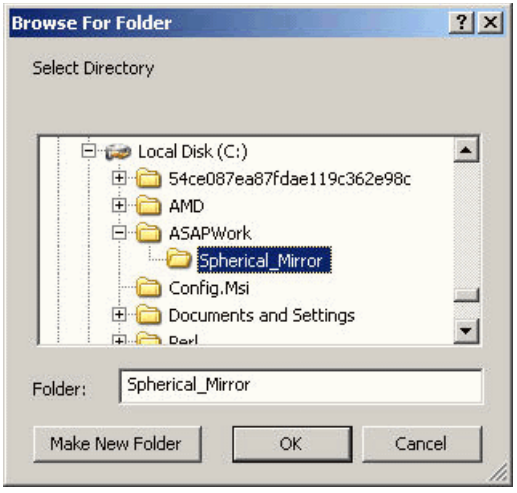
Preliminary tasks

1 Use the Windows Explorer or My Computer to create a new folder for this project.

For example, use a folder at the location, c:\ASAP Work and name it Spherical Mirror Project. You may select any path that is convenient for you. This is where ASAP will store all the working files associated with this project.

2 Start ASAP by double-clicking the ASAP icon on the desktop.

3 From the File menu (on the main toolbar), select Set Working directory.



Choosing your Working Directory

By double-clicking the top-level icon (c:\ drive, for example), you can expand the list to see your entire drive. Select the new folder created in the previous step.

4 From the main toolbar, select the triangular arrow next to (New). From the drop-down list, select Builder.

5 From the File menu, select Save As, and give the file a name (for example, Spherical Mirror).

BUILDING THE SYSTEM

Now for the preliminary steps in the Builder. You can start by defining the properties, which tell ASAP about the transmission and reflection characteristics of the various surfaces in your system. See the sidebar below, “Defining the System in the Builder”.

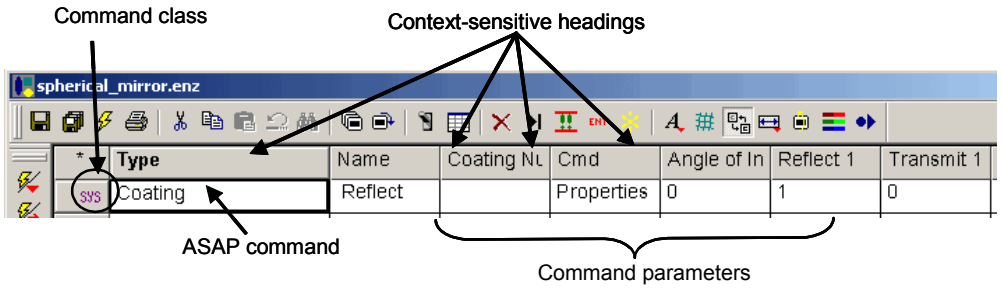
ASAP is able to calculate Fresnel coefficients with real or complex indices of refraction, multi-layer thin-film coatings, or custom coatings specified by your own model. But for this problem, we will define some simple ideal coatings for the mirror and detector. This first coating is for the mirror.

DEFINING THE SYSTEM IN THE BUILDER

The ASAP Builder is a spreadsheet-style window for defining geometry, properties, and sources, as well as for tracing rays and performing analysis. When the Builder window is the main focus, the ASAP toolbar changes to include the Edit, Preview, and Builder menus.

ASAP toolbar when Builder is active

Each row is used to enter a single ASAP command. You begin entering a command by double-clicking in the left-most cell of a new row to open a context menu. The menu lists all the available Builder commands. Once you have entered a command, ASAP generates context-sensitive headings at the top of each column applicable to that row. The headings prompt you to enter appropriate command parameters for the highlighted cell.



Spreadsheet-style rows and columns

Making a new entry in the Builder

1 Double-click in the left-most cell under the Type column in the first line of the spreadsheet.

A context menu of commands opens.

2 From the context menu, select System> Materials> Coatings.

Column headings describe the various parameters in the cells below. The Type column displays Coatings and the Cmd column displays Properties.

3 Double-click the cell in the Name column, and assign a name to the coating.

In our example, we have assigned Reflect. We will refer to this type of coating later, using this name.

4 Press the Tab key, or click another cell to complete the entry.

5 In the same way, set Reflect 1 to 1 and Transmit 1 to 0.

The coating lets you define an ideal mirror coating that reflects 100% of the incident flux and transmits none.

You have finished the first entry. The remaining columns can remain blank. (They could be used to define additional reflection and transmission coefficients when more than one wavelength is used.)

***TIP* New entries can go in the next available blank row of the Builder spreadsheet, or you can skip lines for ease of reading. ASAP ignores blank rows when it runs a file. To insert a new blank line, right-click in the Type column and select** Insert**.**

The only other coating you need is an absorbing coating, for placing on the detector to stop the rays.

6 Create the coating as in the previous steps, but this time name it Absorb, and set the Reflect 1 and Transmit 1 columns to 0.

INCLUDING OTHER PARAMETERS

In many cases, the preliminary setup of our system will also include other parameters, like the definition of a set of system units, one or more wavelengths, and perhaps the properties of some refractive media. You can skip those parameters in this simple example, since you will not be doing anything for now that depends on wavelength or the absolute dimensions of the objects.

DEFINING THE MIRROR

Once the coatings are defined, you can proceed to build the system geometry. Only two geometric elements exist in this model: the spherical mirror and the detector.

***NOTE* Because ASAP is a non-sequential ray-trace program, the geometric elements do not need to be defined in any particular order. You may start with the mirror.**

1. Double-click the left-most cell of a new row, below the coating properties. This time, select System> Geometry> Surfaces> Spherical from the popup menu.

Notice how the column headings have changed to correspond to this new command.

2. Name this element Mirror.
3. We want to define a mirror *perpendicular* to the Z axis, which is the default.

The Z axis is the traditional optical axis for simple systems.

4. Leave the location of the mirror at the origin (Z=0), which is also the default.
5. Give the mirror a radius of curvature of 20 units.
6. Select Ellipse as the aperture shape.

The Aperture column describes the shape of the mirror. By double-clicking this cell, you will see the choices in the drop-down box. You want a circular mirror, so select Ellipse on the Aperture option.

7. Set both Semiwidth X and Semiwidth Y to 2.5 units, making a circular mirror with a diameter of five units.

The remaining columns could be used to place a hole in the aperture. You could use this, for example, if you want to make a Cassegrain telescope system. In this example, you can leave those cells blank.

Defining optical properties

Next, we need to define some optical properties for this mirror. You can give it the characteristics of the coating that you named Reflect earlier.

1 Start a new entry by double-clicking the Type column cell, below the mirror definition. Select System> Object Control> Object Modifiers> Interface from the context menu. Change the coating from Bare to Reflect.

This gives the mirror the 100% reflectivity you defined earlier. The media on both sides of the mirror surface can remain set to the default value: Air. (You would change one or both of these in the case of a refractive interface.) You can preview the mirror with the BRO 3D Viewer. For information on the 3D Viewer, please see ASAP HTML Help

2 From the toolbar, select Preview> All.

The All menu command shows you a 3D view of the current system.

NOTE While ASAP is preparing data for the preview, you will see activity in the Command Output window. As you will see later, this window reveals the communication between the ASAP user interface and the kernel. You could have achieved the same result by sequentially typing the commands into the Command Input window yourself.

3 Try to manipulate the system, using the button toolbar above the 3D Viewer window. (Each button reveals a ToolTip as the pointer goes over it. The status bar includes a more detailed description.)

Defining the detector

The final geometric element in this model is the detector. Start this new entry as before by double-clicking the left cell of a new row. As always, you can leave blank rows, if you like. Select System> Geometry> Surfaces> Plane. Define the detector as follows:

Name	• Detector
Axis	• Z
Location	• 10
Aperture	• Ellipse
Semiwidth X	• 0.5
Semiwidth Y	• 0.5

1. View the results with Preview > All to see both the mirror and the detector. Close the 3D Viewer.
2. Add the optical properties as before, from the context menu (System> Object Control> Object Modifiers > Interface > Coating). This time, replace Bare with Absorb to use the coating we defined that neither reflects nor transmits. When we trace rays later, this will cause the rays to stop on this surface.
3. Save your Builder file (File> Save).

***NOTE* Builder files can be saved in two formats: *.enx, an XML format and *.enz, a compressed XML format.**

The system is now complete. Your Builder window should appear as shown below.

***TIP* Remember that when you look at the Builder, the column headings correspond only to the row or cell that is currently selected. In this example, the Detector row was selected.**

*	Type	Name	Option	Axis	Location	Aperture	Semiwidth X	Semiwidth Y
SYS	Coating	Reflect		Properties	0	1	0	
SYS	Coating	Absorb		Properties	0	0	0	
OBJ	Spherical	Mirror	Z	0	20	0	Ellipse	2.5
MOD	Interface	Coating	COATING	Reflect	Air	Air		
OBJ	Plane	Detector	Axis	Z	10	Ellipse	0.5	0.5

Viewing Builder entries, with the Detector row selected

CREATING A SOURCE

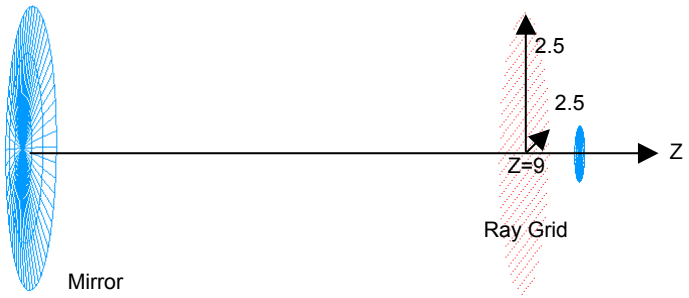
For this example, you will define a grid of parallel rays. This is a two-step process in ASAP.

Defining a grid of parallel rays in ASAP

- Define where the rays start.
- Define the direction at which they point.

1 Double-click the first cell of a new row in the Builder, somewhere below the geometry definitions. From the context menus, select Rays> Grids> Grid. Set the parameters in each Builder column as follows:

Option	• Ellipse
Axis	• Z
Position	• 9
X Axis Min	• -2.5
X Axis Max	• 2.5
Y Axis Min	• -2.5
Y Axis Max	• 2.5
X Axis Rays	• 100
Y Axis Rays	• 100
Aperture	• (leave blank)
Random	• (leave blank)



Illustrated parameters for Grid Elliptic *source*

These parameters set the location of the starting point of a grid of rays. They are all located on a plane perpendicular to the Z axis, 9 units from the origin (the vertex of the mirror). They fill a circle of radius 2.5 units. If the array were rectangular, there would be 10,000 rays total (100 on a side). Since you asked for an elliptical distribution to match the shape of the mirror, the 100x100 rectangular grid is trimmed with an ellipse, and the corners will be missing.

***NOTE** You have placed the rays between the mirror and the detector so that no rays can strike the detector before interacting with the mirror. In a more realistic model, the detector could be made from two surfaces, a front and a back.*

2 Double-click the left cell of the next row and select Rays> Grids> Source.

The `DIRECTION` command sets the directions of the rays. There are three fields to set: Vector A, Vector B, and Vector C. These three values are components of a direction vector along the X, Y and Z axes, respectively.

3 Set Vector A and Vector B to zero, and Vector C to -1.

This directs the rays from their starting points near the detector, along the -Z direction toward the mirror. The two source-definition lines in the last completed row of the Builder window should look like the following figure when you are finished:

*	Type	Cmd	Option	Vector A	Vector B	Vector C	Vector A'	Vector B'	Vector C'	Vector A''
ENT	Grid	Elliptic	Z	9	-2.5	2.5	-2.5	2.5	100	100
CMD	Source	Direction		0	0	1				

Viewing Builder entries for ray direction

This is a good time to save your Builder file again.

4 From the File menu, select Save.

TRACING THE RAYS

Having defined the system and a ray source, the most difficult tasks are done. The job of tracing the rays falls entirely to ASAP. ASAP traces each ray from its initial position along its prescribed direction, interacting with any objects it finds in its path. ASAP makes no assumptions about the order in which the rays strike the geometrical elements. (This is the essence of non-sequential ray tracing.) How the rays interact with each object depends on the properties of that object. This process continues until all rays can be processed.

If you have entered everything correctly into the Builder window, you can expect every ray to intersect with the mirror, reflect, and proceed to the detector. Later, you will view a profile of the system, and plot some of the rays as they are traced to make sure that everything is going as planned.

RUNNING THE BUILDER

Although you have previewed your system several times, you have never actually instructed ASAP to build the system. This is accomplished by "running" the Builder to place both the system definitions and the rays into their respective databases in memory.

Running a Builder file

1 Start by clicking  (End) on the ASAP toolbar. This initializes ASAP and prevents you from running the same system more than once.

2 From the Builder toolbar, click  (Run).

Watch the ASAP Command Output window while ASAP is running. The commands sent to the ASAP kernel are echoed in this window. If any errors occur, ASAP reports them here. Scroll up the window to check for errors.

See the sidebar, "Errors Found While Running the Builder" on page 61, which illustrates what happens when you omit one of the essential parameters in a Builder entry. In this example, the number of rays to place along one of the `GRID` dimensions was omitted.

ERRORS FOUND WHILE RUNNING THE BUILDER

ENT	Grid	Elliptic	Z	9	-2.5	2.5	-2.5	2.5	100	
CMD	Source	Direction		0	0	-1				

If you make an error in the Builder, such as leaving out a critical parameter (see above illustration), ASAP writes an error message to the Command Output Window as soon as you run the Builder (see illustration on right).

Some parameters in the Builder are optional, and some are not. Generally, the Builder offers a default value for the parameters that are required. In this example, the default value for the number of rays in the minor axis direction was removed, and replacement value was not entered. As a result, ASAP has issued an error message.

If you make an error, correct it in the Builder, click  to reinitialize ASAP, and rerun the Builder.

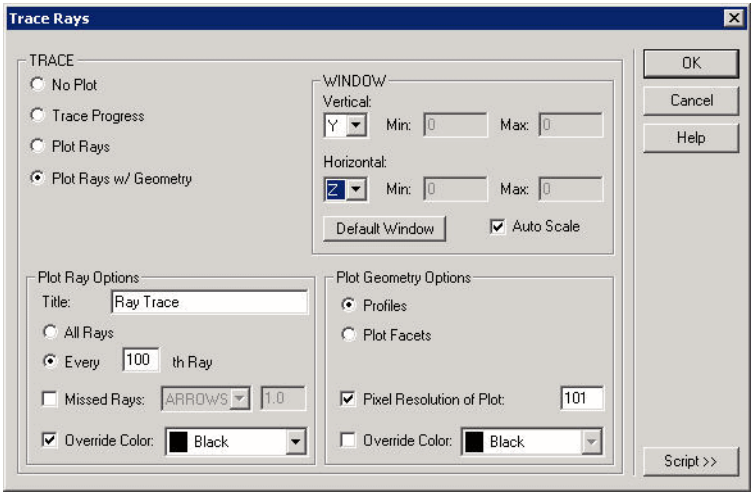
```
--- INTERFACE COATING REFLECT AIR AIR
--- ENT OBJECT;PLANE Z 0 ELLIPSE 0.5 0.5 'DETECTOR'
--- LOCAL -1.0 1.0 -2.0 1.0 -1.0 1.0
--- GRID ELLIPTIC Z 9 -2.5 2.5 -2.5 2.5 100
***                                    ^ERROR
   GRID ELLIP requires at least a total of 10 entries

--- GRID ELLIPTIC X x y y' z z' n n' [ c ] [ RANDOM f ]
                  Y y z z' x x'
                  Z z x x' y y'
--- $IO INPUT CLOSE
```

GRAPHICS FOR THE RAY TRACE

You do not have to graphically plot the ray paths while they are traced, but it is useful for verification purposes to plot the ray paths with the geometry. In ASAP, ray tracing is an entirely mathematical process, during which ray intersections and new ray trajectories are calculated as the rays interact with the various interfaces. It generally takes far longer to draw the ray graphics than it does to do the calculations involved in tracing rays.

***TIP* Display at least a few rays as you trace them to verify that the rays were created in the right place, and that you pointed them in the correct direction.**

1. From the toolbar, select Trace> Trace Rays. The Trace Rays dialog controls the parameters and geometry of the ray trace.



Parameters for plot window and ray trace plot

2. From the TRACE area of the dialog, select Plot Rays w/ Geometry.
3. In the Plot Ray Options area, enter Ray Trace in the Title textbox. Specify Every 100th Ray.
4. Select Override Color, and choose the color in which you would like the rays to appear.
5. In the WINDOW area, make sure that Vertical is set to Y and Horizontal is set to Z. Check Auto Scale to ensure that the Min and Max values associated with each

axis are set at 0 (the Min/Max values are grayed out). This instructs ASAP to scale the plot automatically.

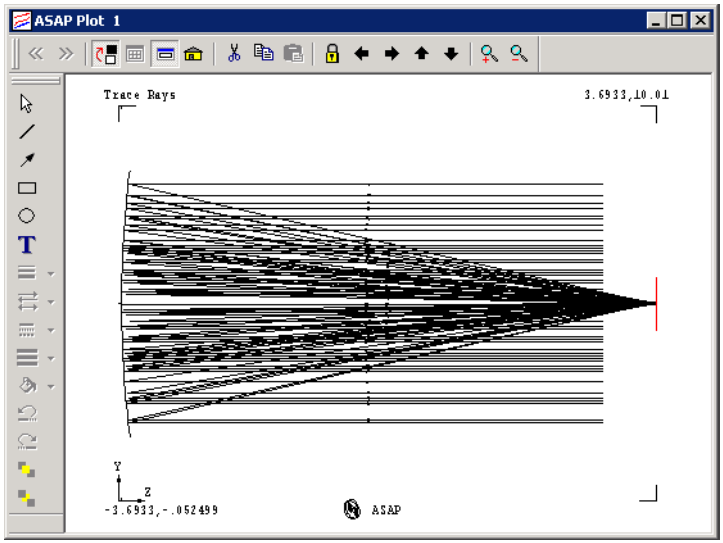
6 In the Plot Geometry Options area, select Profiles.

7 Check Pixel Resolution of Plot, and enter a resolution value of 101.

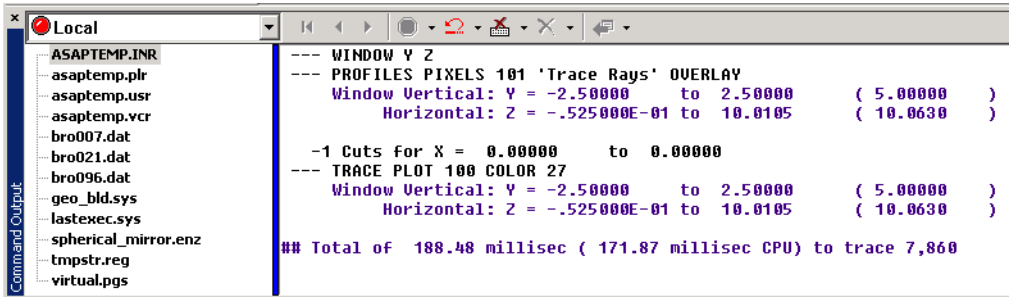
The Pixel Resolution setting controls the resolution of the graphic, dividing the vertical direction into 101 elements.

8 Click OK.

The Command Output and ASAP Plot windows should appear more or less as shown below. Some of the values may differ, depending on the speed of your computer. However, the Command Output window must be free of errors and warnings, and the rays must converge on the detector as expected.



First ray trace plot



Information about the plot, displayed in the Command Output window

9 Keep the Plot Viewer open. You may close the Builder window.

Performing tracing and analysis in the Builder

So far, we have used the menu items and dialogs to demonstrate the tracing and analysis parts of an ASAP simulation. All these actions can be done with commands in the Builder file. First, we set the window with the Window command from System> Geometry> Verify Geometry> Graphics> Window, and change the axis to Z. Next, we set the Pixels command from System> Geometry> Verify Geometry> Graphics> Pixels.

Now, we can choose to look at a faceted plot or a profile of the system geometry, or both. If all the plots are to be viewed in the same window, use the Overlay option to keep open the plot window for the next plot. In our case, use the Overlay option for the Profiles and Plot Facets choices. However, do not use the option on the Trace Plot command, since this would leave the plot window open for the analysis plots. The ray trace and plot commands are found on Trace> Trace. Select the Plot option on the Trace command. The Builder file should now look like the following figure.

*	Type	Start Object	End Object	Step		List	List Rays	Plot	Plot Rays
CMD	Window	Axis	Y			Z			
CMD	Pixels	39	1	Off					
CMD	Plot	facets	5	5	0			Overlay	
CMD	Profiles	0	0	-1			OVERLAY		
CMD	Trace							Plot	100

Trace Plot command added

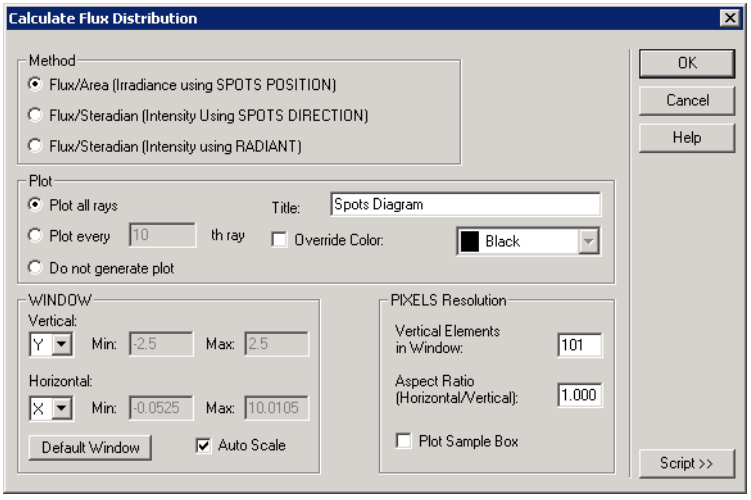
The same graphics resulting from the dialogs are produced again. Verify the results by running the Builder file.

PERFORMING THE ANALYSIS

The last step in the process is analyzing the results. In this case, you will see the type of image you have produced on the detector. Begin by making a spots diagram that shows where each ray landed.

Making the spots diagram

1 From the Analysis menu, select Calculate Flux Distribution to open the Calculate Flux Distribution dialog.



Settings for the spots diagram

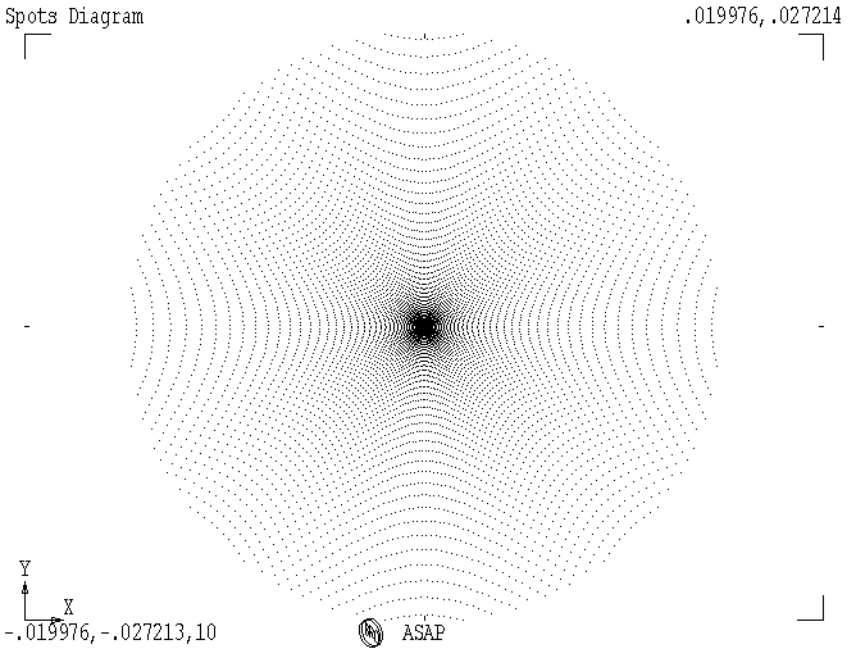
2 In the Method section, select Flux/Area (Irradiance using SPOTS POSITION).

3 Select Plot all rays from the Plot section, and enter Spots Diagram in the Title textbox.

4 In the WINDOW section, select Y for Vertical and X for Horizontal. Select Auto Scale.

5 In the PIXELS Resolution section, enter 101 in the Vertical Elements in Window textbox, and 1.000 in the Aspect Ratio textbox.

6 Click OK to produce the diagram.



Spots diagram

NOTE ***The spots diagram shows some plotting artifacts resulting from the regular nature of the grid source you used, rather than from the optical properties of the objects.***

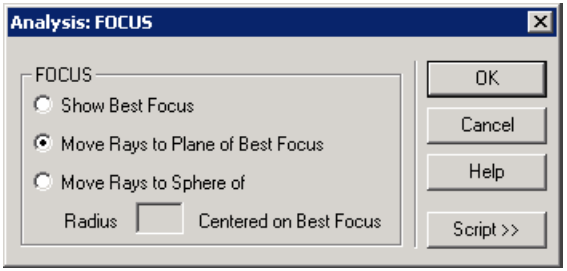
BEST FOCUS

You placed the detector at a position equal to half the radius of curvature of the spherical mirror. But is this the best focus? ASAP has, among its many analytical tools, a utility that shifts the rays along their trajectories to find the best root mean square (RMS) focus.

Determining best focus

1 From the toolbar, select Analysis> Focus Rays.

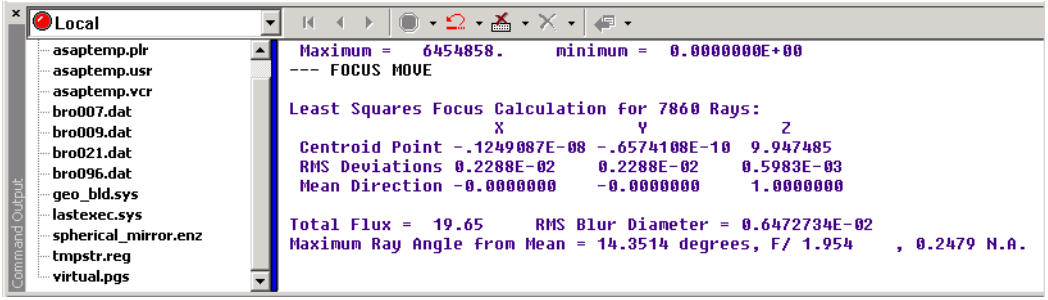
You will see the dialog shown below.



Move rays to plane of best focus

Ask ASAP to move the rays to the plane of best focus. Click OK.

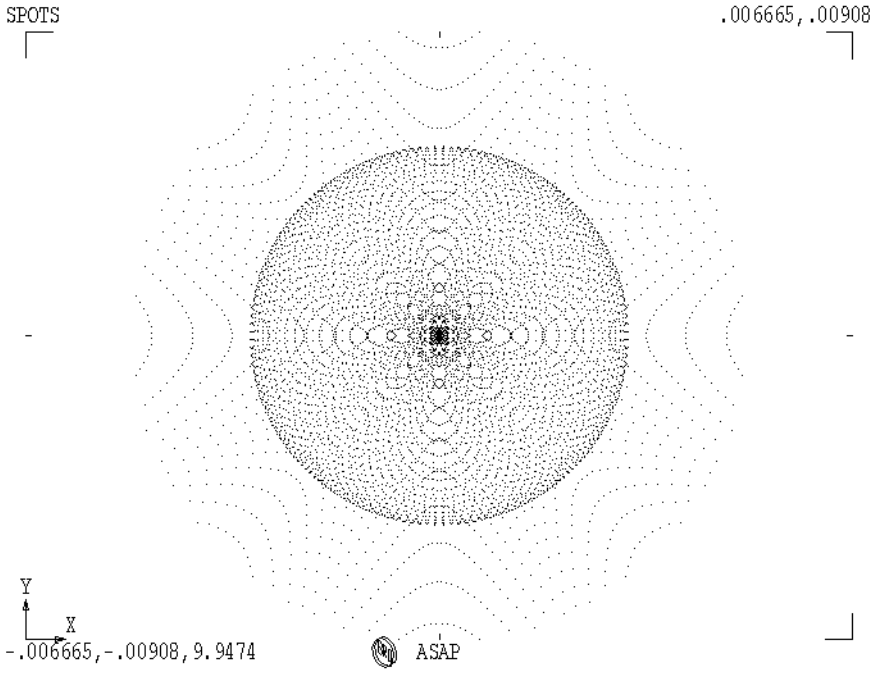
When you click OK, you will see, by looking in the Command Output window, that the best RMS focus is actually at Z=9.947485, rather than 10 units where you placed the detector.



Best focus output

2 Next, make another spots diagram to see the effect of the small shift in focus.

This change is quite noticeable, both in the appearance and size of the resulting spot. From the scale of the two diagrams, notice that the overall size of the spot was reduced by a factor of three, as theory predicts.



Spots at best RMS focus

The values displayed are the X and Y coordinates of our autoscaled window at the Z-position of 9.947.

***NOTE* Compare the change in scale between the X (vertical) extent of this spots diagram with the previous diagram performed, with the rays located at half the radius of curvature.**

Before proceeding to visual analysis results, we will create the Builder commands to produce the same results as shown above for the Spots diagram, before and after determining best focus.

The window needs to be reset so that we can view the results perpendicular to the propagation axis of the rays; that is, the plot window should be in the X-Y plane. If the pixel value needs to be changed for the analysis, this is the time to make the change. These commands are found on the Builder menu: System> Geometry> Verify Geometry> Graphics> Window, and on System> Geometry> Verify Geometry> Graphics> Pixels. Let ASAP autoscale the window size. Select 101 (or some other value) for the pixel resolution, as was done above in the dialogs for these two settings.

Finally, the Spots diagram is on the Builder menu: Analysis> Calculate Flux Distribution> Spots. Since the detector is not placed at the best focus position (we do not know the best position yet), we need to find the best focus position on Analysis> Focus> Spots. Repeat the commands for the plot window and the spots diagram after the Focus Move column. The Builder file should now have the following appearance for the recently added commands.

*	Type	Option	Cmd	Unit Option		Attribute		Object	Number O
CMD	Window	Axis	Y			Z			
CMD	Pixels	39	1	Off					
CMD	Plot	facets	5	5	0			Overlay	
CMD	Profiles	0	0	-1			OVERLAY		
CMD	Trace							Plot	100
CMD	Window	Axis	Y			X			
CMD	Pixels	101	1	Off					
CMD	Spots	Direction	DIRECTION						
CMD	Focus			Move					
CMD	Window	Axis	Y			X			
CMD	Spots	Position	POSITION						

Spots position

The graphics results are the same as those produced with the dialogs. Verify these results by running the Builder file.

VISUALIZING THE RESULTS

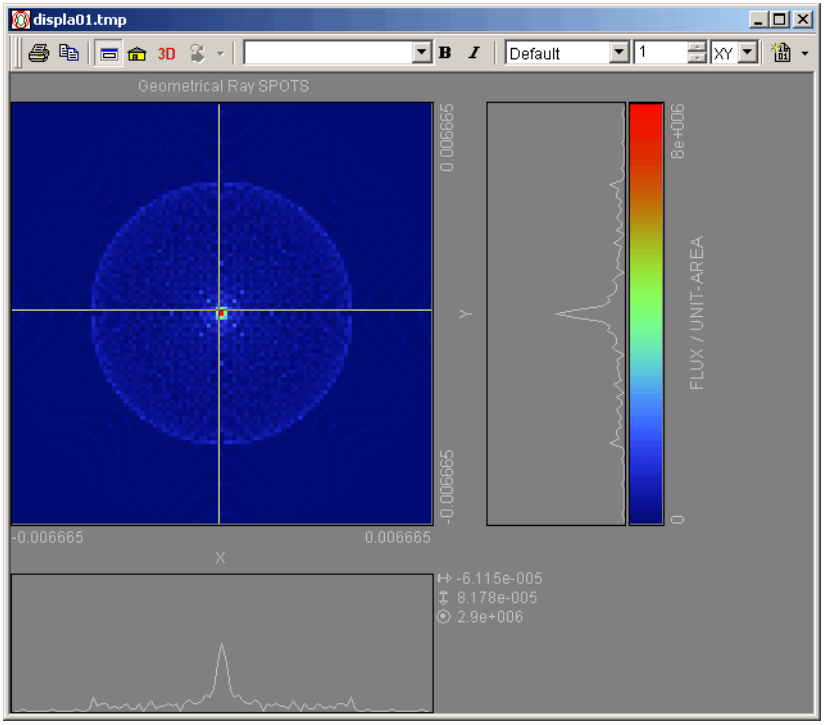
Once the spot diagram has been made, these results can be further analyzed with a variety of analysis and visualization tools on the Display menus. We will highlight just a few of them.

***NOTE* If the ASAP toolbar does not show the Display menu, the window that is in focus needs to be changed. Click in the ASAP Workspace window to return to the main ASAP toolbar.**

Using the visualization tools

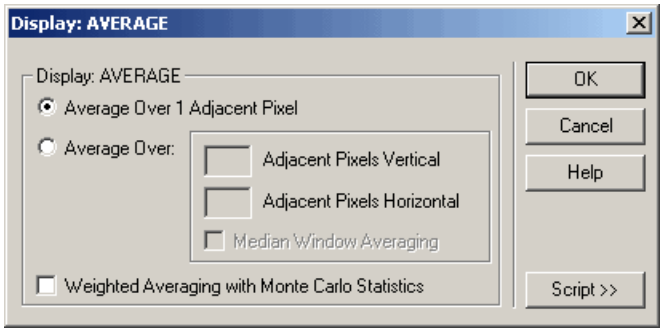
1 From the toolbar, select Display> Graphics> Picture.

You will see the regular patterns again, which result from our use of a rectangular grid of rays with fixed spacing.



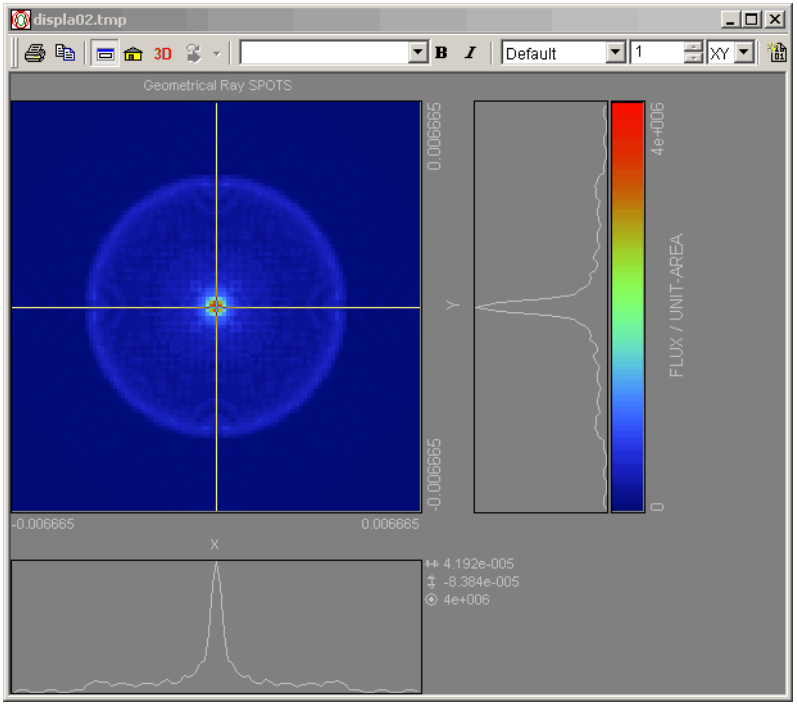
Spots diagram in Display Viewer window

2 Next, apply some averaging. From the Display menu select Processing> Average. In the Display: AVERAGE dialog, click Average Over 1 Adjacent Pixel. Click OK.



Apply averaging

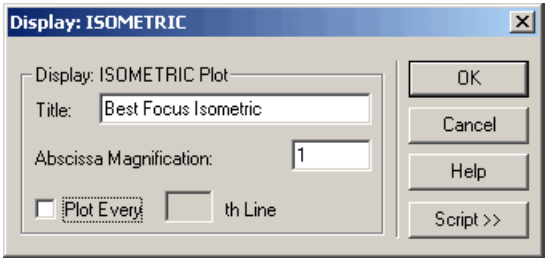
3 Make another picture with Display> Graphics> Picture to see the effect.



Effect of averaging over one adjacent pixel

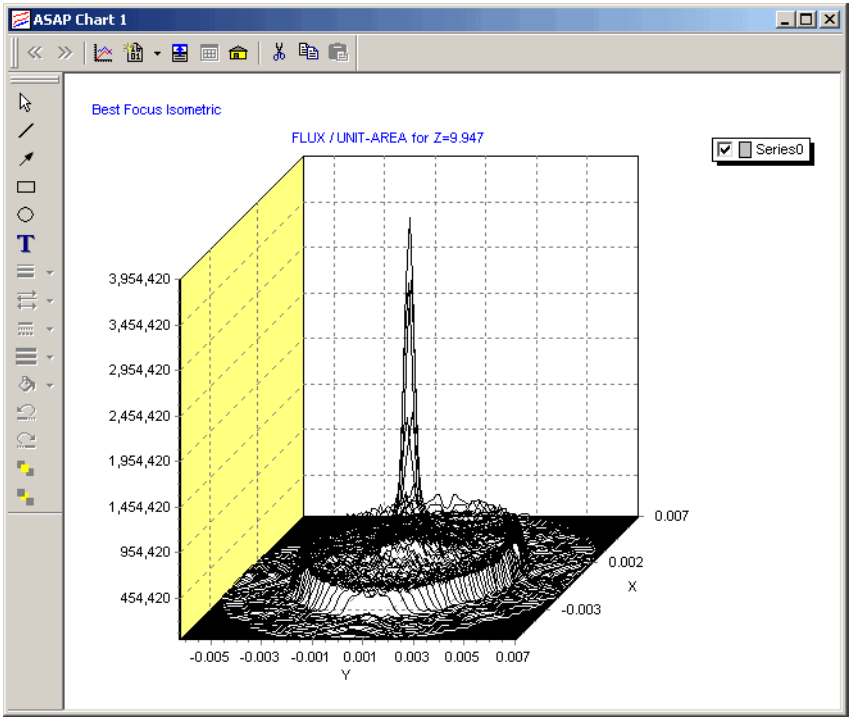
You can change the display settings by right-clicking in the area of the Display Viewer that you want to change.

4 Next, from the Display menu, select Graphics> Isometric.



Display isometric plot

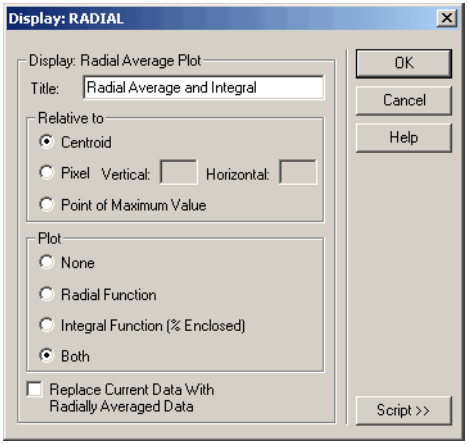
5 Enter Best Focus Isometric in the Title textbox, and 1 in the Abscissa Magnification textbox. Click OK to view the plot in the ASAP Chart window.



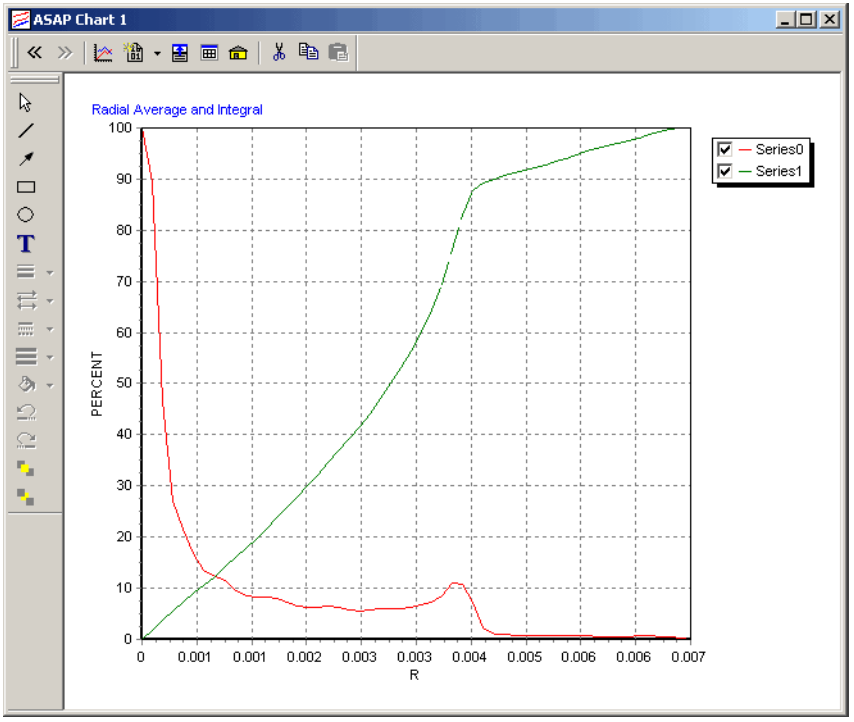
Best focus isometric plot

Finally, do a radial average of the image and plot with a cross-section of the averaged image, and the enclosed energy as a function of radius.

6 Select from the Display menu, Graphics> Radial. Use the options shown in the Display: RADIAL dialog below to explore where the flux is concentrated at the image.



Radial averaging of plot



Plot of radial average and integral

Performing visualization in the Builder

Now, Builder commands for the visualization tools will be used. The Display command uses a file created with the Spots Distribution command. The Picture command is a good way to visualize the flux distribution command.

1. Display and Picture are found on Analysis> Display> Display and Analysis> Display> Graphics> Picture.
2. Find the picture results with and without averaging.
3. Perform the Display command again, before averaging the numbers in the distribution file.

Finally, we want to look at other views of the distribution file. An isometric view and a radially averaged view are both useful for seeing some summary characteristics of the distribution.

4. Find the viewing commands on Analysis> Display> Graphics> Isotropic and on Analysis> Display> Graphics> Radial.

The Builder file now ends with the last commands we just used.

*	Type	Pixel i	Pixel j	Weight Op	
CMD	Display				
CMD	Picture				
CMD	Display				
CMD	Average	1	1		
CMD	Average	1	1		
CMD	Picture				
CMD	Isometric				
CMD	Radial	Pixel			Both

Radial command added

The graphic results are, once again, the same as those produced with dialogs. Verify this by running the Builder file.

SUMMARY

While completing this quick tour of the basic ASAP analysis process, you worked through the four basic steps required for all ASAP work:

- Creating a system, including geometrical entities, and assigning optical properties to these entities.
- Creating a source.

In this case the source was a grid of parallel rays. This may represent an extended source at infinity or a collimated source.

- Tracing the rays through the system and onto a detector.
- Performing some basic analysis.

You looked at a spots diagram before and after finding the best focus. After making a spots diagram, you created a distribution file, sorting the rays according to their location on the detector. This tour was a starting point to other forms of analysis and visualization, such as averaging.

Much more is possible during each of the four stages. ASAP excels at providing you with the flexibility to apply a powerful set of tools to a large range of problems.

6

IMPORTING AND EXPORTING

You can import or export several types of files, either those generated by ASAP or those used as inputs to ASAP. These file types are outlined below. For more detailed information, see *Importing/Exporting* in ASAP HTML Help.

BRO LIGHT SOURCE LIBRARY AND WIZARD

The BRO Light Source Library, available to ASAP customers with current software maintenance agreements, is a collection of U.S. and European source models that can be imported directly into ASAP projects. Current sources include filament, light-emitting diode (LED), arc, and cold cathode fluorescent (CCF). The Light Source Library reduces planning and prototyping costs by eliminating the need to scan, measure, and model industry sources.

To view a catalog of sources, go to the BRO Web page:

www.breault.com/software/asap-lightsourcelib.php.

Once ASAP is installed, you can access the Library either from the Quick Start toolbar on the Sources tab, or from the Rays menu in ASAP. A wizard is available in ASAP to walk you through the process of using the library.

Two main steps are required when using the BRO Light Source Library wizard: Create and save rayset(s), and Writing ASAP script commands to a template. Each of these steps is described in ASAP HTML Help, and in the technical publication, *ASAP Light Source Library Wizard*.

EXTERIOR LIGHTING TEST MODULE (ELTM)

The Exterior Lighting Test Module (ELTM) imports your geometry files to determine whether it is in compliance with standard government lighting tests. For more information, see “ELTM - Exterior Lighting Test Module Overview” in ASAP HTML Help. ELTM is an optional add-on for ASAP.

CAD SUPPORT

IGES files

ASAP includes an integrated IGES file translator, smartIGES™. You can translate IGES (Initial Graphics Exchange Specification) files to ASAP format for performing optical analyses on geometries initially created in a CAD program. Using the IGES files translator, you can import your Rhinoceros® (Rhino) models as system geometry for optical analysis.

ASAP also supports exporting CAD files with IGES. See ASAP HTML Help.

SolidWorks geometry

Use the SolidWorks Parts Only 3D modeling engine with ASAP to assign object and layer names. Import SolidWorks® geometry files from SolidWorks, with ASAP. These files are saved in the GTX file format via the Save As dialog.

XML-based CAD file format for Rhino

ASAP supports an XML-based CAD file format for Rhino. It contains information about the geometry, and the optical properties of each object. Optical information stays with the geometry when going between the codes.

CATIA files

Users can import CATIA files via the CAA V5 plug-in with the optional add-on CATIA Module for ASAP.

CODE V, OSLO, SYNOPSYS, AND ZEMAX FILES

ASAP PRO includes the fully integrated capability of importing CODE V®, OSLO®, SYNOPSYS™, and ZEMAX® files. You can open these file types (*.seq, *.len, or *.zmx) in ASAP from the Open dialog on the File menu.

With the Zemax translator, you can import an existing ZEMAX file into ASAP, and set preferences for translating the ZEMAX lens design data, surface type options, and output options in ASAP. From the ZEMAX data, ASAP calculates the location and orientation of each surface in a single global coordinate system, determines the transformation matrix for each surface required to transform the surface from its local coordinate system to the global coordinate system, and

decomposes the transformation matrix into the angles and positioning variables required by ASAP.

The GLA2CAT utility in ASAP converts a ZEMAX.AGF catalog or an OSLO.GLC glass catalog to an ASAP.CAT format. For information, see the Help topic, “Converting Lens Design Glass Catalogs”.

DXF FILES

ASAP includes a bidirectional DXF/CAD (digital exchange format/computer-aided design) conversion. ASAP can convert all AutoCAD® DXF surface definitions (and BLOCKS)—up to and including AutoCAD release 12—to ASAP EDGE-based objects. For importing, use the file, Dxf2asap.exe in the asap\bin folder on your hard drive. For exporting, select Export to CAD on the File menu.

REFLECTORCAD FILES

You can use ASAP to check the output of a reflector you created in ReflectorCAD™. Follow instructions in ReflectorCAD Help for changing appearance-related settings in ReflectorCAD for output appearance and contouring. Before exporting the ReflectorCAD file to ASAP, you must convert the ReflectorCAD file to an ASAP *.inr input file. Use the Export>To ASAP command in ReflectorCAD on the File menu to do this step. (You may also import an ASAP source distribution file into ReflectorCAD with the Dis2Sdf.exe utility. (See the ReflectorCAD User’s Guide.)

APART FILES

If you are an APART™ user, two conversion programs are provided in APART for converting system data into ASAP input: AP2RBS and AP2RBE.

PLOT FILES

The utility, HPGLNP.exe reads ASAP plot (*.plr) files and creates Hewlett-Packard files to export for plotting. The PSCSRIP.exe utility reads ASAP *.plr files and creates PostScript files for printing. Both utilities are in the <asap install>\bin folder on your hard drive.

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