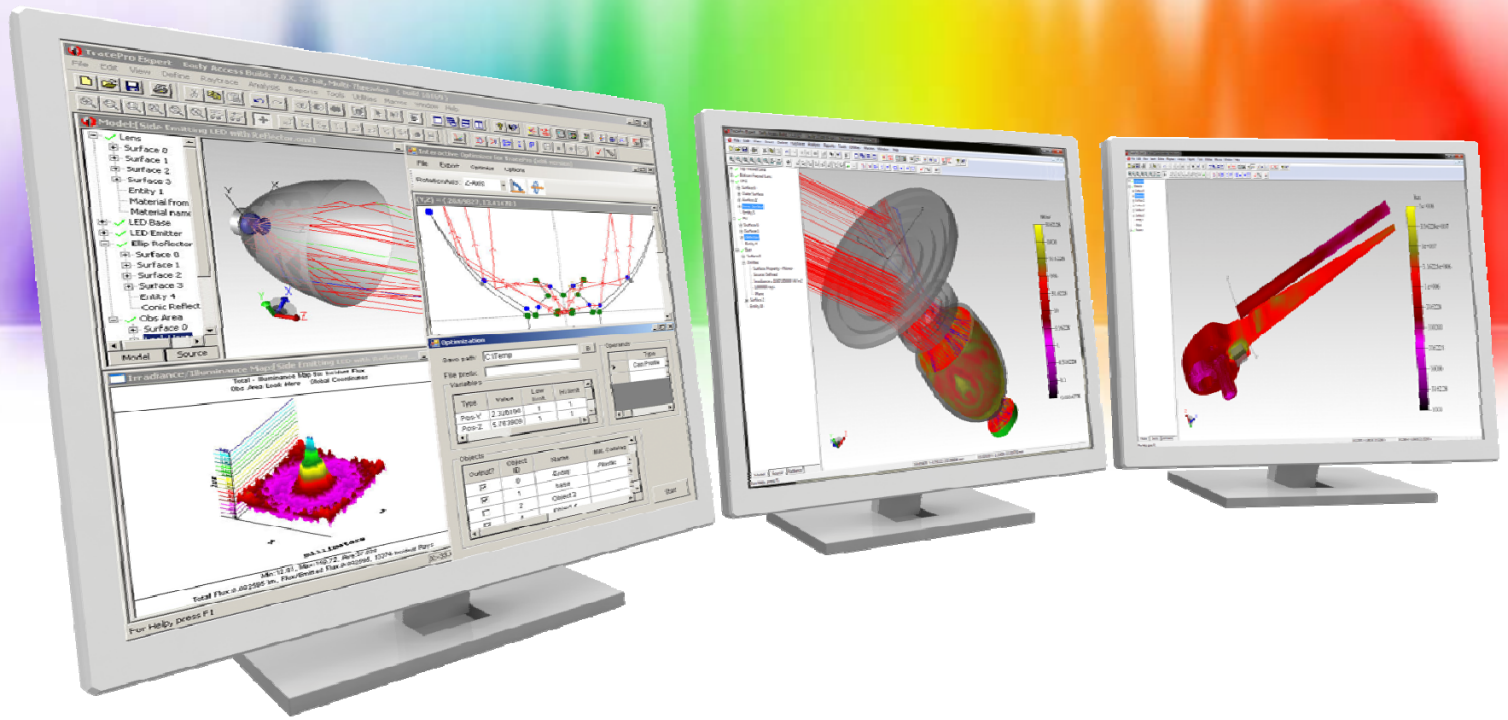
OSLO



UA PRESENTATION - INTRODUCING OSLO 6.6

8/24/2016

LAMBDA RESEARCH CORPORATION

OSLO Videos on the Lambda Research Website

Interface and Overview Videos

- **OSLO Overview** – A high level overview of the interface
- **Understanding and Using the OSLO Check Mark** – Keys to using the accept pending entry and cancel pending entry capability with spreadsheets
- **OSLO Spreadsheet Hierarchy** – Discusses nuances with the spreadsheet hierarchy
- **OSLO Lens Spreadsheet Presentation** – Effective use of the surface data spreadsheet
- **OSLO Top Menu Explanation** – An overview of the graphics windows
- **OSLO Graphics Window** – Details on the graphics window usage and output
- **OSLO Text Window and Command Line** – Text window and command line usage

OSLO Videos on the Lambda Research Website

Effective Use, Macro Programming Videos

- **Doublet Optimization Tutorial** – A set of three videos and an interactive tutorial to take a doublet from a blank page through optimization
- **OSLO Catalog Lens Presentation** – Covers effective ways to use catalog lenses
- **OSLO Catalog Lens Tutorial** – An interactive tutorial on using catalog lenses
- **OSLO Text Editors** - Walk-through of the built-in text editors within OSLO
- **OSLO Introduction to Modifying, Supplementing, and Programming** - An introduction to programming in OSLO
- **OSLO Import CCL Into Notepad++** - Importing the CCL Language into Notepad++

OSLO Manuals

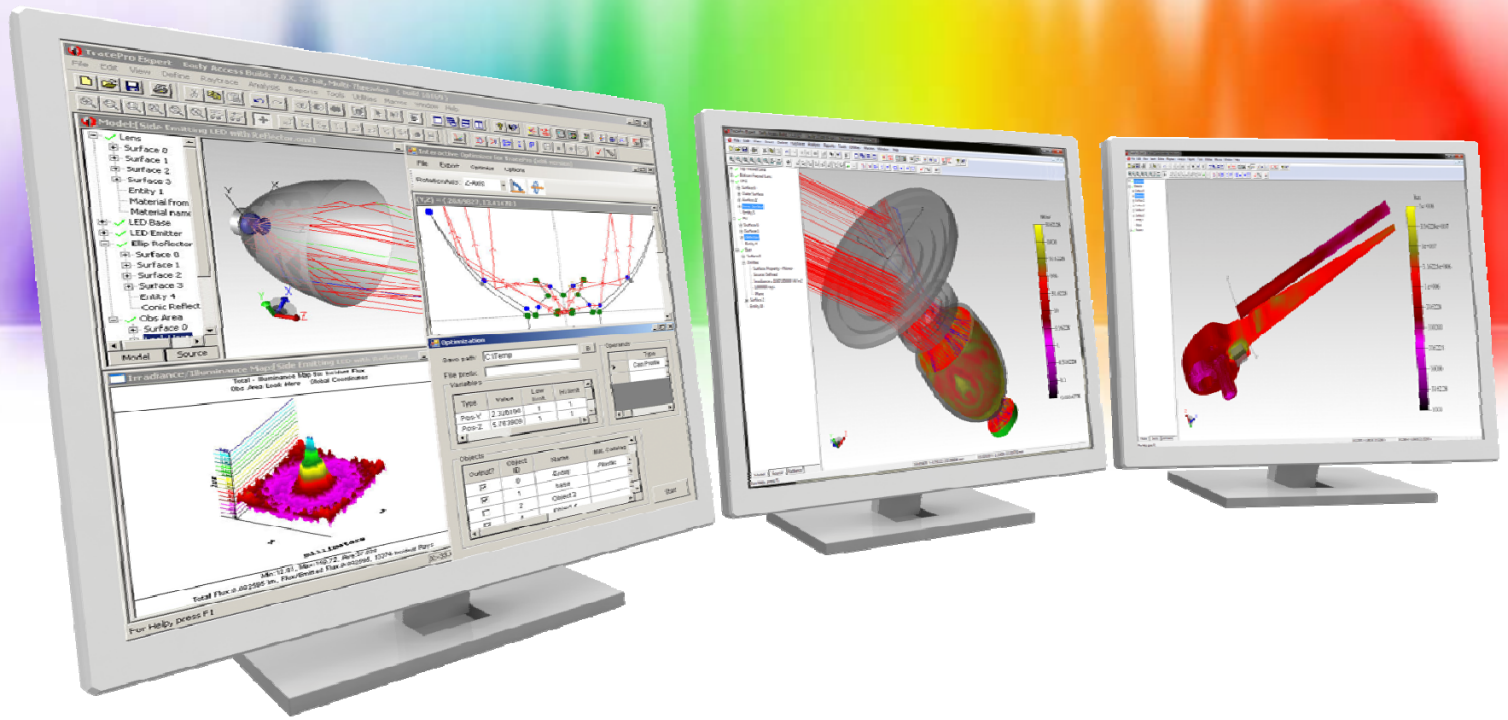
- OSLO User Guide: - http://www.lambdares.com/images/pdf/oslo-user-guide.pdf
- OSLO Optics Reference - http://www.lambdares.com/images/pdf/oslo-optics-reference.pdf

Step by Step Tutorials

The http://fp.optics.arizona.edu/sasian/opti517/ folder has multiple step by step tutorials:

- OSLO_Your_First_OSLO_Session.pdf – Good place to start learning OSLO, introduces you to the interface with a spherical mirror example
- OSLO_Schmidt_Camera.pdf – Demonstrates how to use OSLO by designing a Schmidt Camera Objective
- OSLO_Tutorial_Classroom_Demos.pdf
- OSLO_Tutorial_Gaussian_Beam_and_Fiber_Coupling.pdf
- OSLO_Tutorial_Landscape_Lens.pdf
- OSLO_Tutorial_Optimization_OSLO_Standard_or_Premium.pdf

OSLO



INTRODUCTION

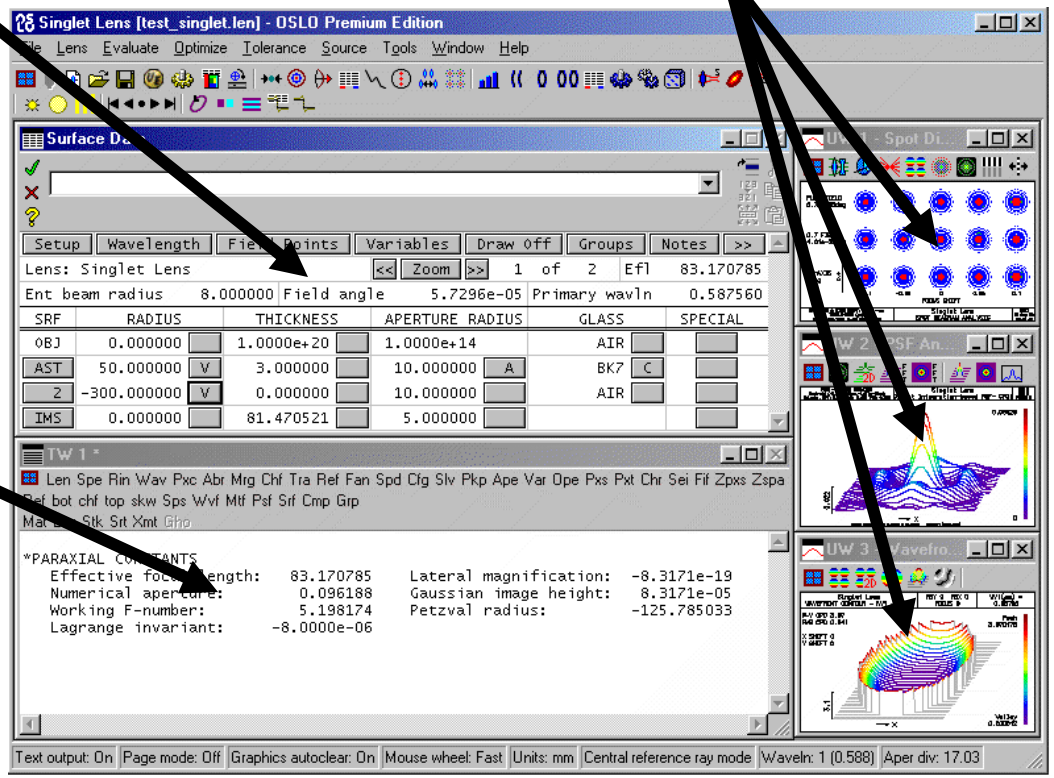
LAMBDA RESEARCH CORPORATION

Introduction

- User Interface
  - Windows Topics
    - Menus
    - Toolbars
    - Main Window Types
      - Graphics
      - Text
      - Spreadsheet
    - Other Windows
      - Command Line
      - Database
      - Editors
      - Slider Wheel
      - Catalog Lens
      - Printing
  - Setup
    - Preferences
    - Fonts
    - Mouse
    - Keyboard
  - File and Program Information

Main Window Types

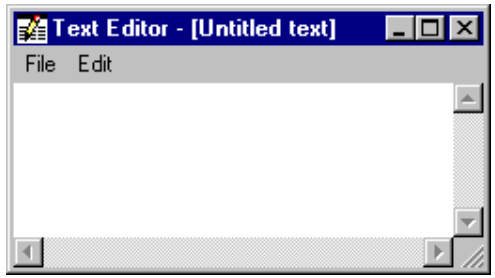
- Spreadsheet Window
  - Only one open at a time
  - Latest on top
- Graphics Window
  - Up to 32 open at a time
  - Cannot close last
- Text Window
  - Up to 2 open at a time
  - Cannot close last



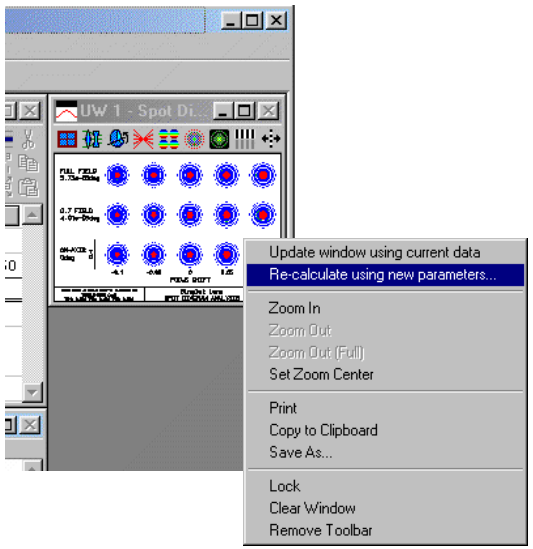
Menus

- Main Menu Structure
  - Operates similar to Microsoft menus
  - Configured in a_menu.ccl

- OSLO Editor Menu (not UltraEdit or Notepad++)
  - File & Edit items only
  - Not user configured



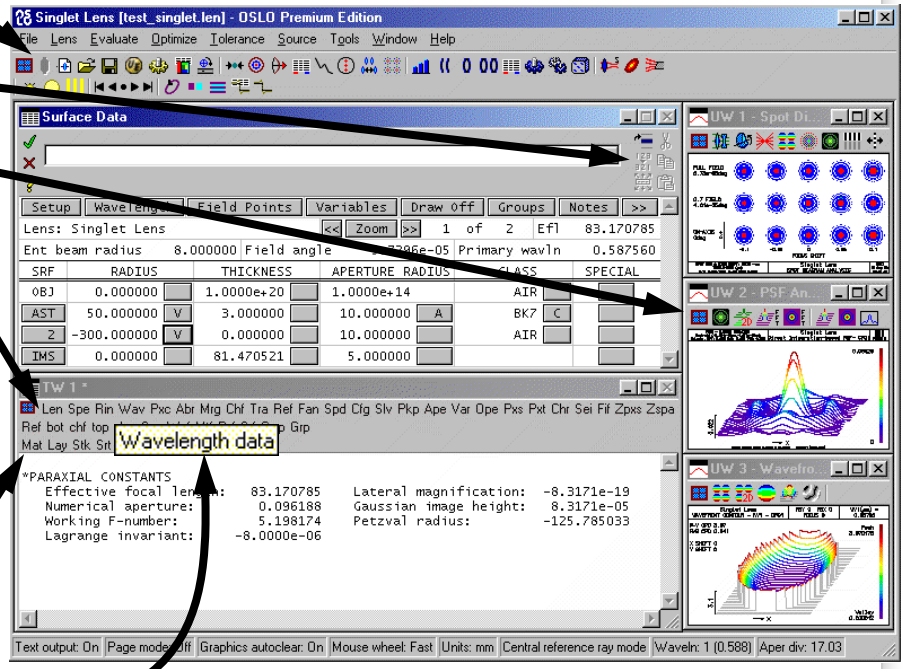
- Popup Menus
  - Right-click (not user configured)
  - Attached to SS buttons (not user configured)
  - Attached to toolbars (user configured)



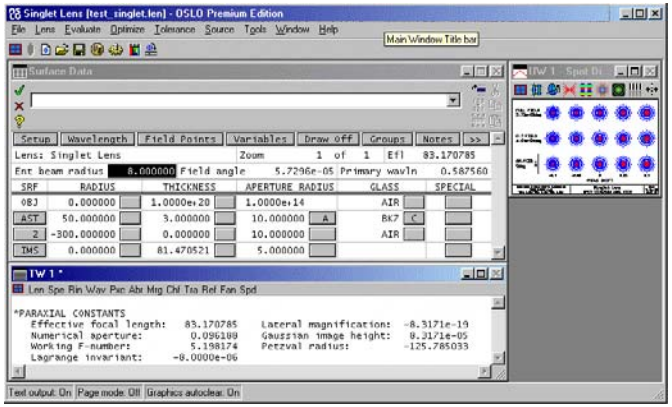
Toolbars

- Main Toolbar (multiple rows)
- Spreadheet Toolbar (multiple rows)
- Graphics Toolbar (single row)
- Text Toolbars (multiple rows)

- OSLO toolbars are different from Microsoft:
  - Not dockable
  - Text buttons allowed in OSLO
  - Immediate tool tips
  - Configured in ...inc/a_toolbar.h
  - Programmable in CCL



Main Windows Styles

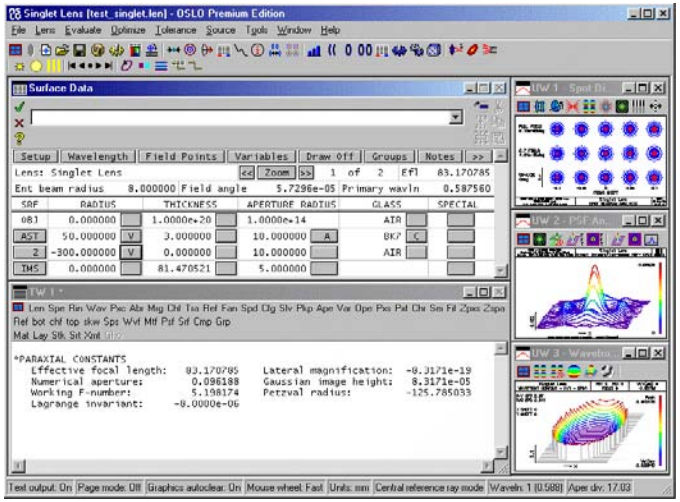


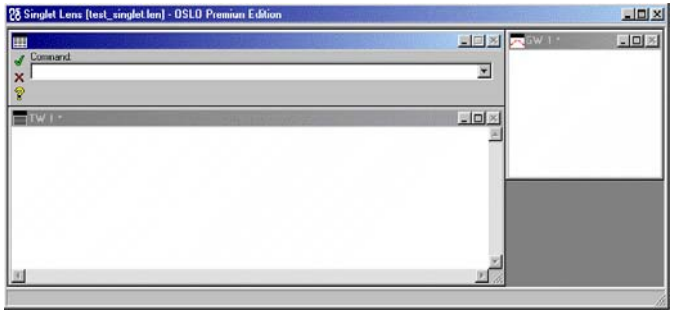
Standard Style

Default display, used for routine tasks

Enhanced Style

Customized from Standard with additional toolbars



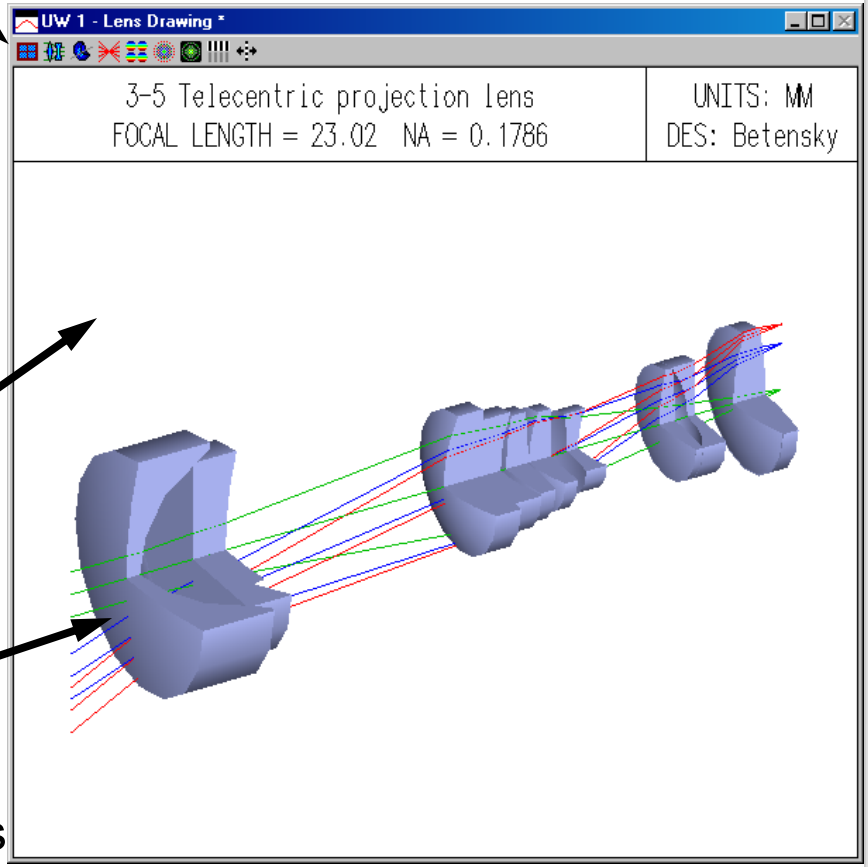


Command (Basic) Style

No menus or toolbars, useful for command line input

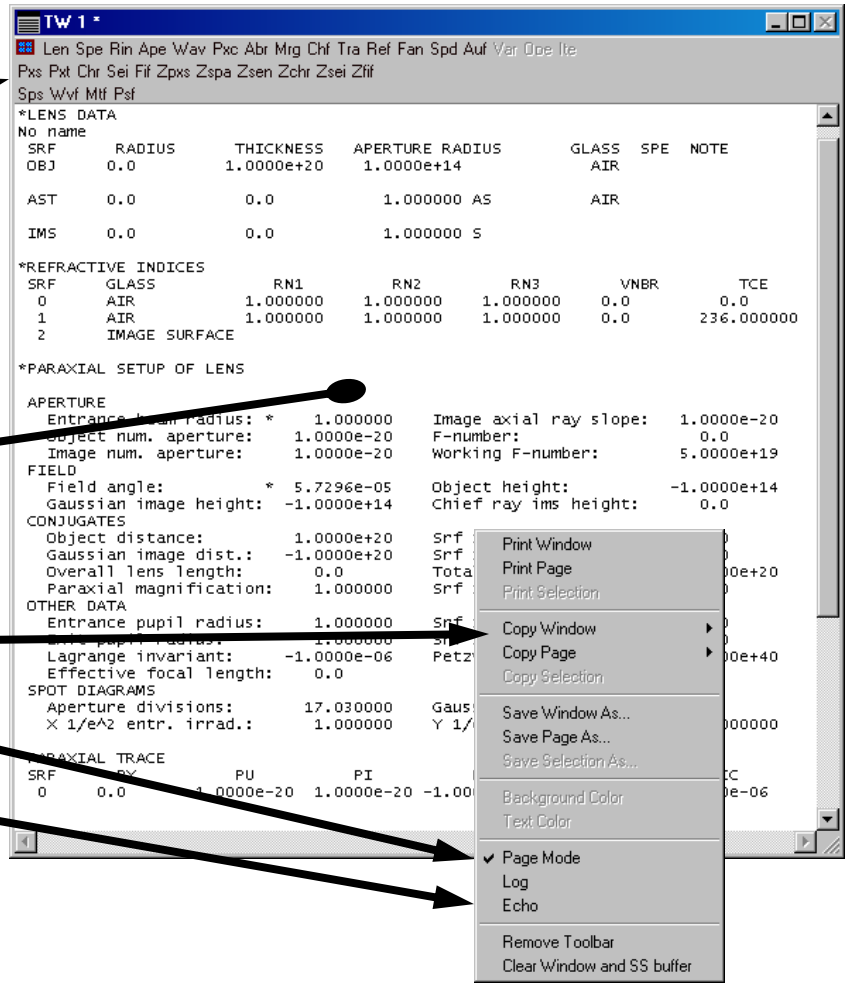
Graphics Windows

- Up to 32 Windows with Optional Toolbars
- Extensive Vector Graphics
  - Clipped viewports
  - Zoomable (mouse wheel support)
  - Mouse events
  - 3D drawing functions
  - Fully resizable
  - Black or white background
  - Right-click support
- Limited OpenGL graphics
  - Internally generated lens drawings
  - Shaded contour plots



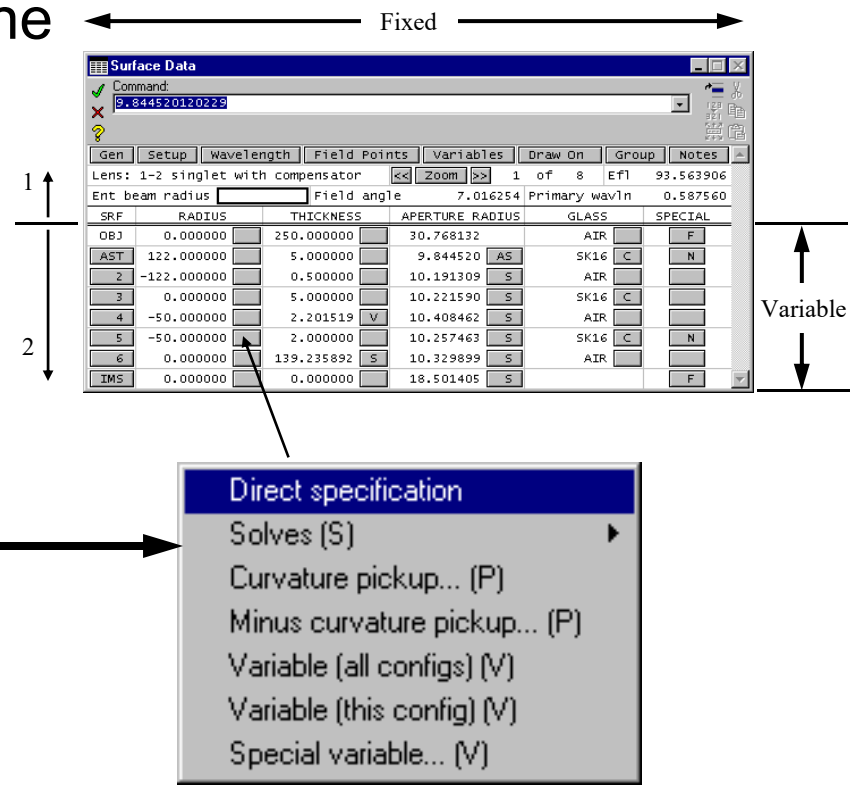
Text Windows

- Up to 2 Text Windows
  - Optional toolbars
  - Variable width, variable height
  - Up to 2000 lines
  - Spreadsheet Buffer Support
  - Right-Click Support
    - Windows Clipboard Support
    - Page or Terminal mode
    - Optional Command Echo
  - Text Output on/off preference



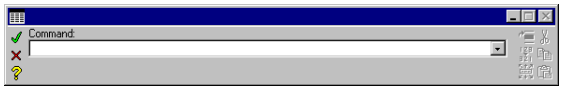
Spreadsheets (SS)

- Drop Down from Command Line
  - Fixed width, variable height
  - Keyboard or mouse navigation
  - Lens data spreadsheet has 2 sections for cell navigation
- Data Entry
  - Command line
  - List cells
  - Button pop-up menus
- Spreadsheets Invoke Other Spreadsheets
  - Multiple spreadsheets organized in a stack on top of each other (FILO)
  - Revert feature for lens data

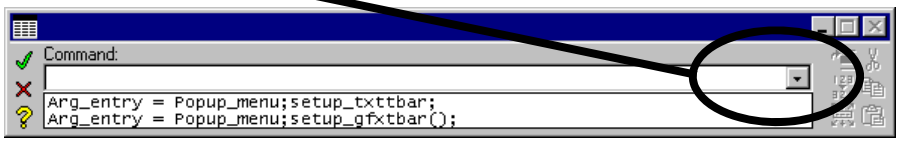


Command Line

- Command Line is Windows ComboBox

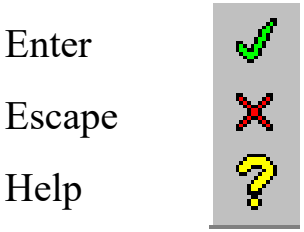


  - Max length is 256 characters
  - Drop down list is history buffer
    - Click drop down arrow:
    - Press `F4` on keyboard
    - Press `Ctrl + PageUp`
    - Press `Ctrl + PageDown`



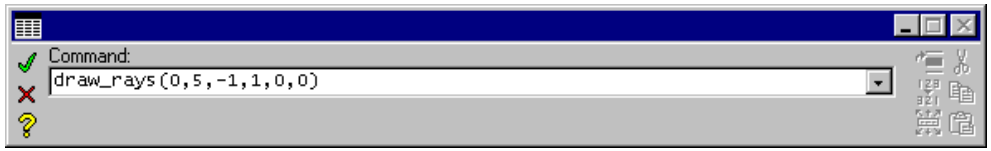
  - Windows Cut/Copy/Paste support by right click only
  - Keystrokes forwarded from Graphics & Text Windows
  - Need to click on command to edit

- Press Enter, Escape or click button:

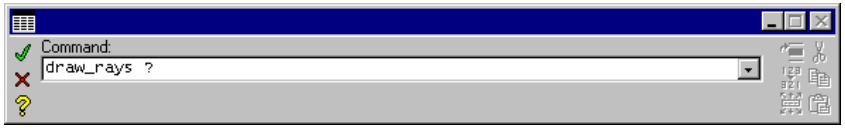


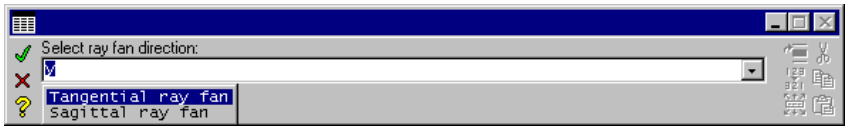
Command Line Syntax

- C-compatible or free form
  - draw_rays(0,5,-1,1,0,0)
  - draw_rays 0 5 -1 1



- Long or Short Form
  - drr and draw_rays are the same command (aliased)
- Forced Prompt Operator (?)
  - ? Causes prompts for all missing arguments

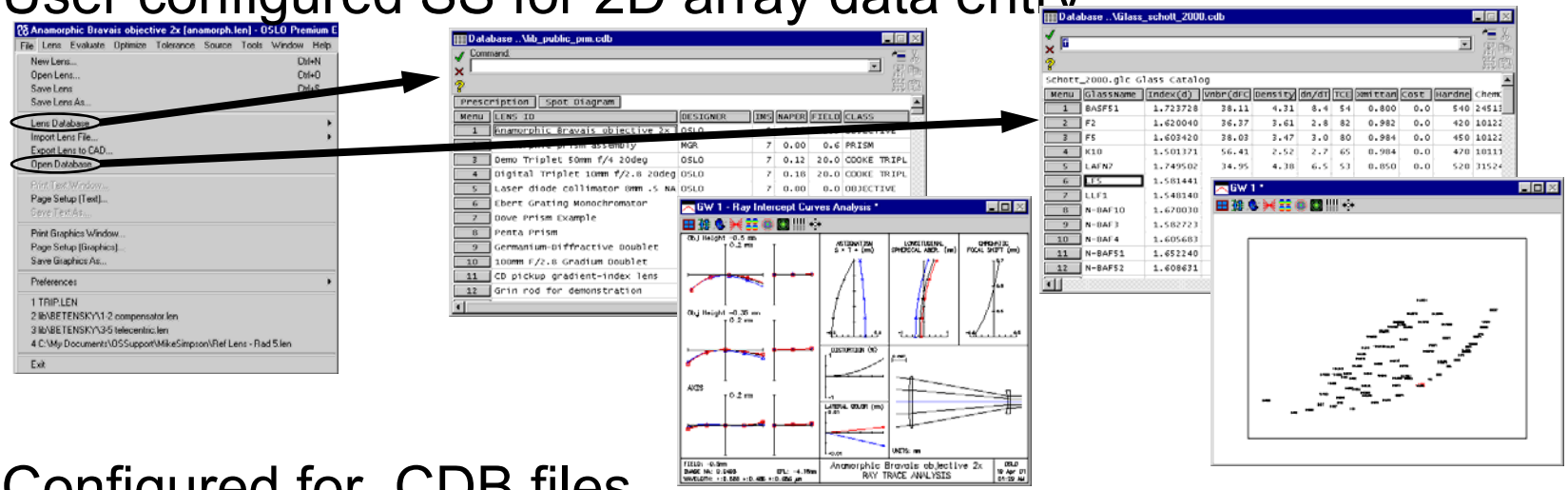




- Calculator Mode
  - 2 + 2 ENTER produces “Result = 4” message
  - SmartCells distinguish between commands and values
  - Named registers - OSLO Lens data (RD, TH, ..etc.)
  - Symbolic input: a=PI; 2*PI

Databases

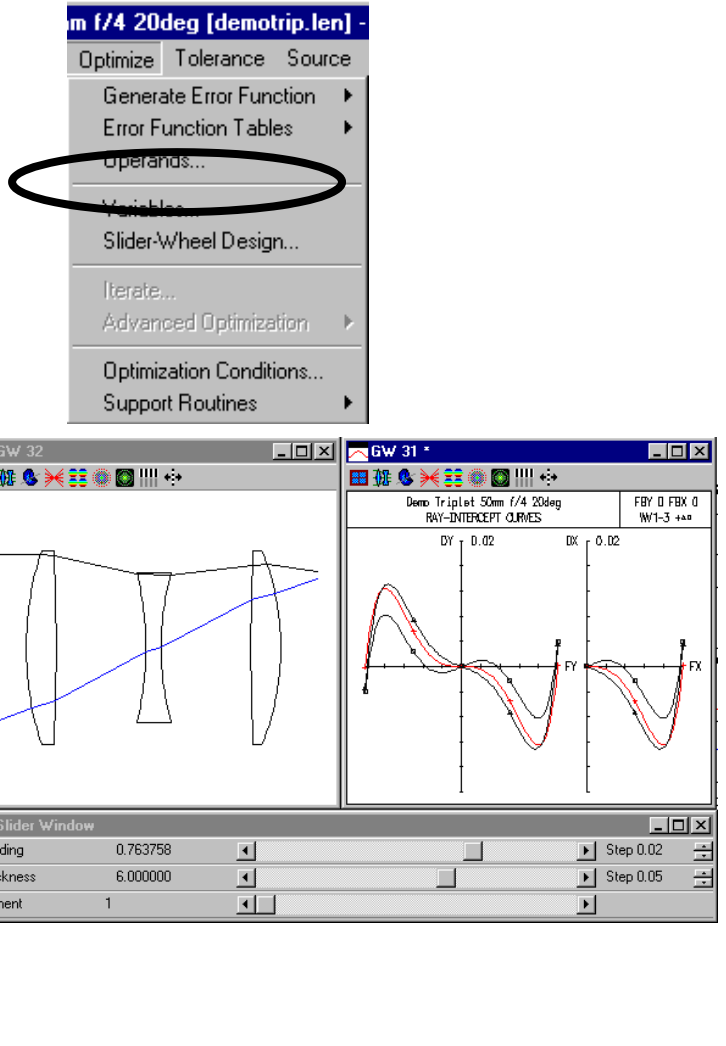
- User configured SS for 2D array data entry



- Configured for CDB files
  - Supports CSV and related files
- New Features
  - Fixed width, horizontal scrolling
  - User programmable with callback buttons
  - Limited keyboard support
  - List support

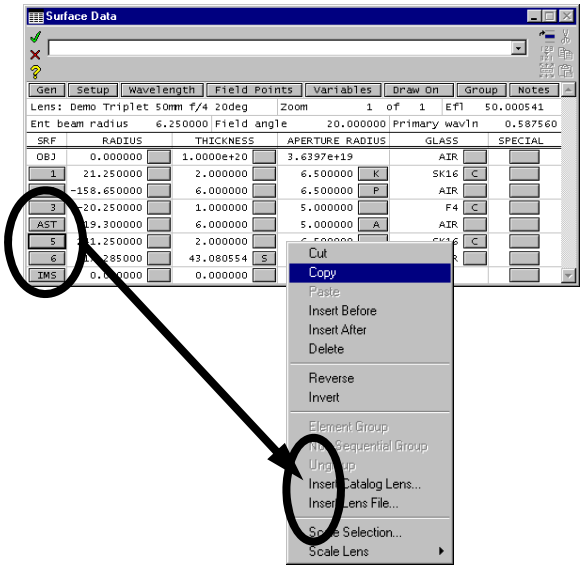
Slider Wheel Window

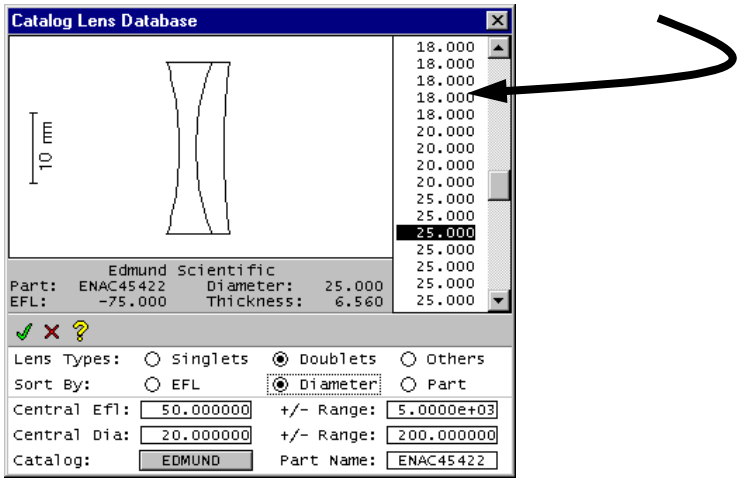
- Special Window for 32 Sliders
  - Combined with data entry spreadsheet
  - Supports mouse wheel
  - Variable range for real data
  - User programmable
  - Integer, Real, Real Fixed, and List data types



Catalog Lens Window

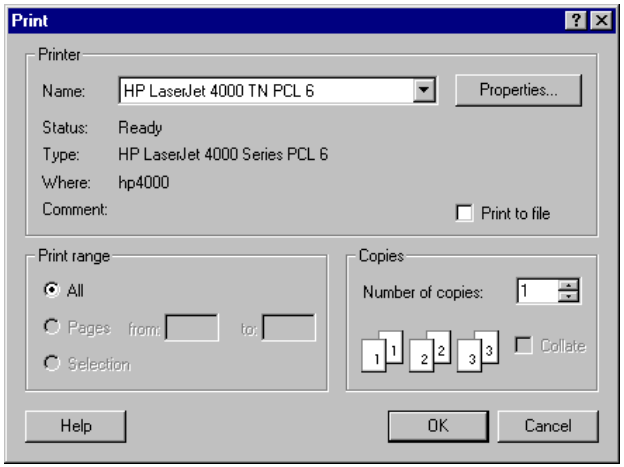
- Graphical Database for Stock Lenses
  - Scrollable lens list
  - Automatic drawing of lenses
  - Database sorting for focal length, diameter & part number
  - Range selection
  - User configurable





Printing

- Uses Standard Windows Drivers
  - Standard printer selection dialog box
  - Standard page selection dialog box
  -
- HPGL Graphics Output



- Other Protocols Supported Through Windows
  - *.wmf, *.emf files
  - *.bmp files for OpenGL output
  - Limited postscript support through Windows
- Lambda Research does not provide device support

Introduction

- Installation
- **User Interface**
  - **Windows Topics**
    - **Menus**
    - **Toolbars**
    - **Main Window Types**
      - **Graphics**
      - **Text**
      - **Spreadsheet**
    - **Other Windows**
      - **Command Line**
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      - **Editors**
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      - **Catalog Lens**
      - **Printing**
  - Setup
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    - Fonts
    - Mouse
    - Keyboard
- File and Program Information

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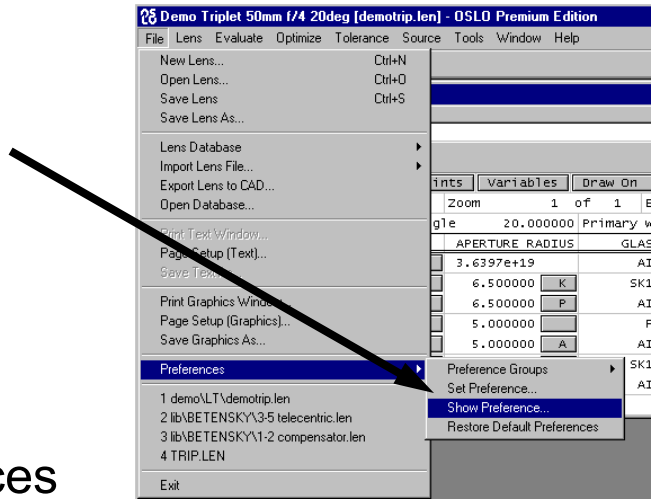
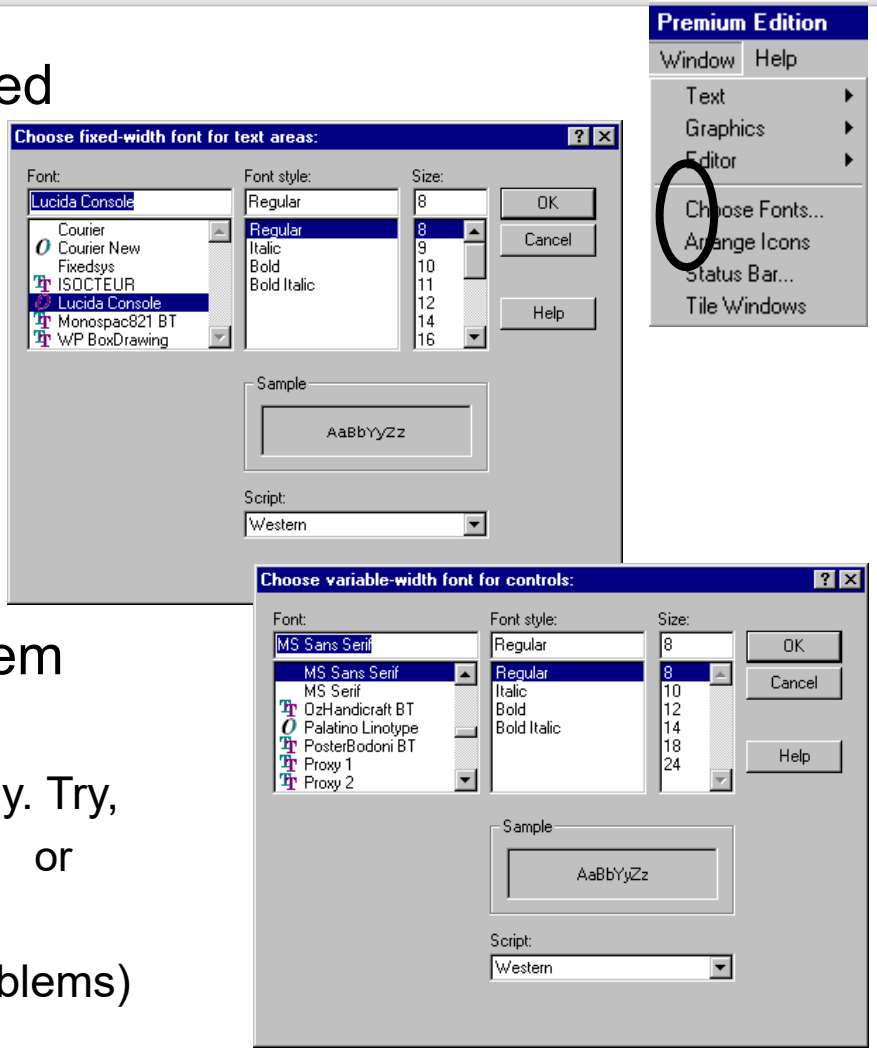
Preferences

- Determines Program Parameters
- To Show Preferences:
  - See File>>Preferences>>Show Preferences
  - Type shp on the Command Line
- To Set Preferences:
  - See File>>Preferences>>Set Preferences
  - Type stp on the Command Line
- Values include int_pref, real_pref, …etc.
- Saved in …/private/oslo.ini
- Look up “Preferences” in on-line help for complete list



Fonts

- Need fixed and variable spaced fonts
- Fixed Fonts
  - Spreadsheets, text output
  - Maintains columns
- Variable Fonts
  - Messages, prompts
  - More readable
- Change using OSLO menu item Windows>>Choose Fonts
  - Note: 2 dialogs open sequentially. Try,
    - Variable: MS Sans Serif - 8pt or
    - Fixed: Lucinda Console - 8pt
  - Don't use > 10pt (formatting problems)



Mouse

- Left click selects
- Right click pops up context menu
- Double click updates graphics
- Drag
  - Zooms graphics (Marquee box)
  - Selects range in spreadsheet, text output
- Shift-click changes input mode in spreadsheet
- Wheel zooms graphics, scrolls SS and sliders
- Slow mouse wheel preference(slmw)
  - 1 event/notch when on, 3 (typical) when off

Keyboard

- Text keystrokes sent to Command Line:
- CTRL + Arrows: zoom graphics
- SHIFT + Arrows: select text output
- CTRL + PageUp/PageDown: scrolls history up/down
- TAB & SHIFT TAB navigates dialogs and spreadsheets
- Keyboard arrows navigate SS but don’t cross fixed boundary
- Windows intercepts some keystrokes (e.g. F4)
- Define special keystrokes as “accelerators”
  - See “Other Accelerators” menu in a_menu.ccl

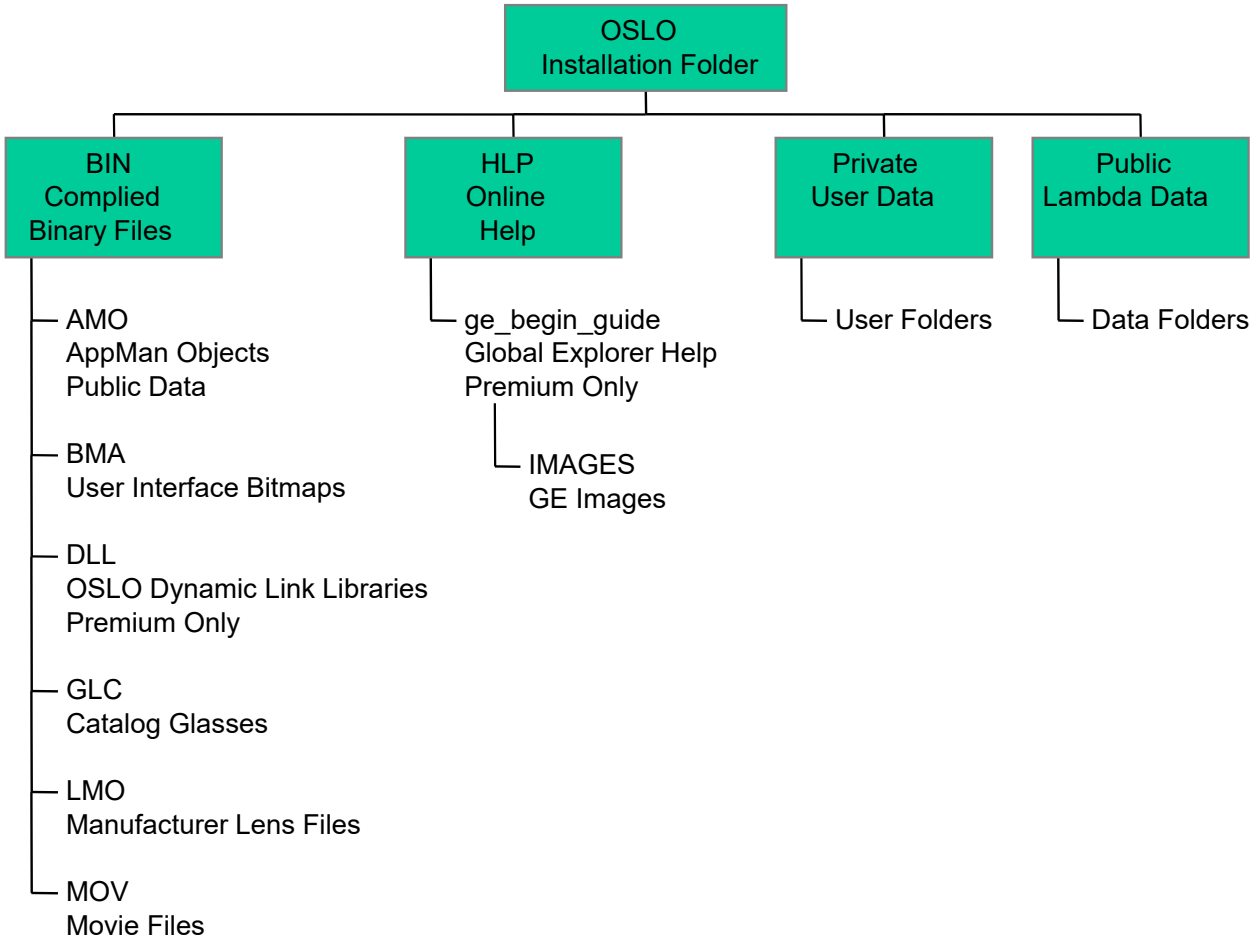
Status Bar

- Visibility set by preference shsb
- Choose Menu item:
  Window>> Configure Status Bar to set items
- Items are pre-programmed for CCL
  - Select pre-programmed items from the list
  - Use Set_Preference (stp) command to set value
    - Strcpy(Astr, “My item”
    - stp(sb04, Astr)
    - “My item appears in field 4 of status bar.

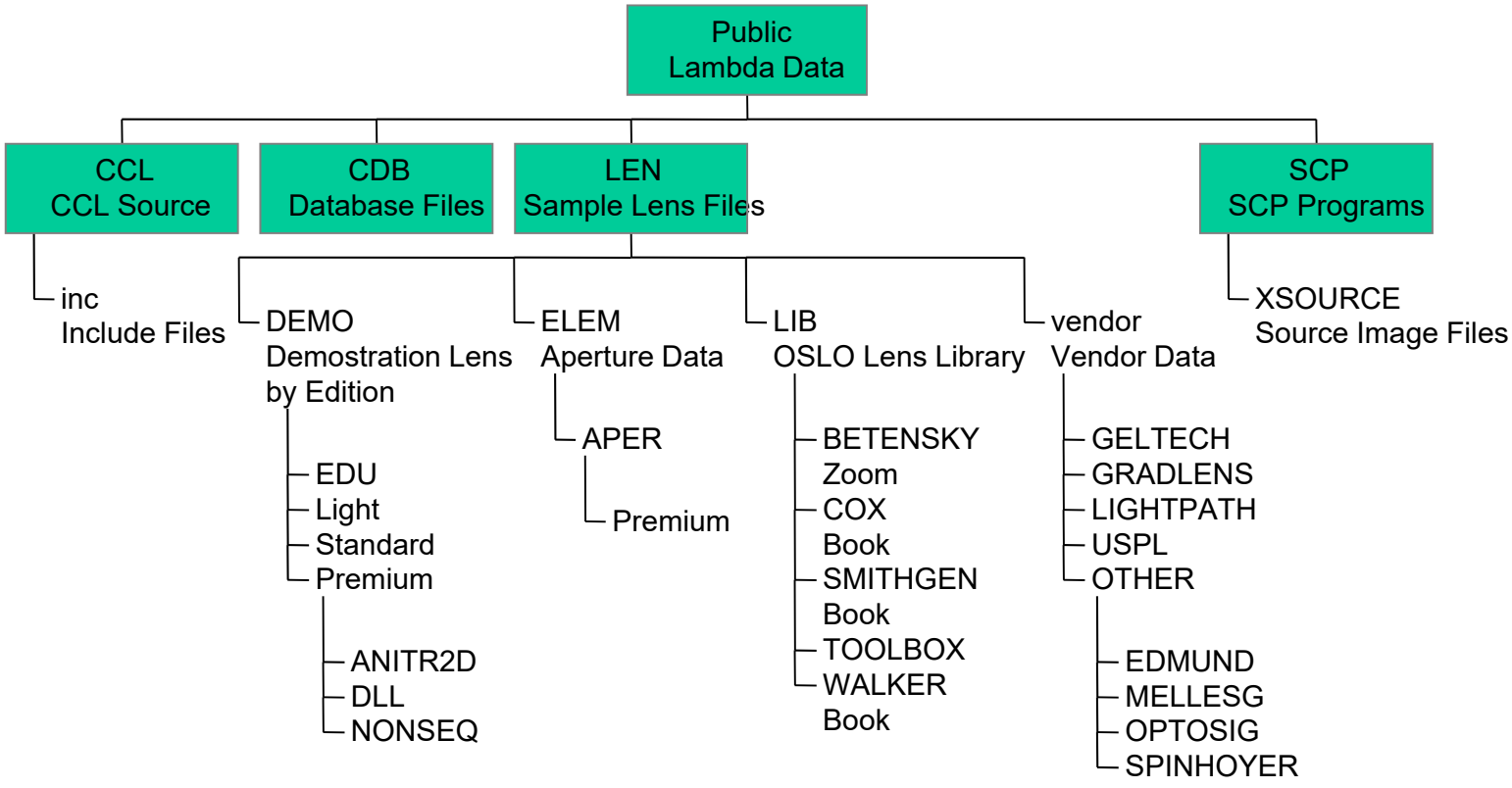
Introduction

- Installation
- User Interface
- **File and Program Information**
  - **OSLO File System**
    - **OLSO File Hierarchy**
    - **LEN/OSL Files**
    - **CCL/CCX Files**
    - **CC Source Code Files**
    - **SCP Files**
    - **CDB Files**
    - **Other OSLO Files**
    - **Import/Export Files**
  - **OSLO Functional Flow**

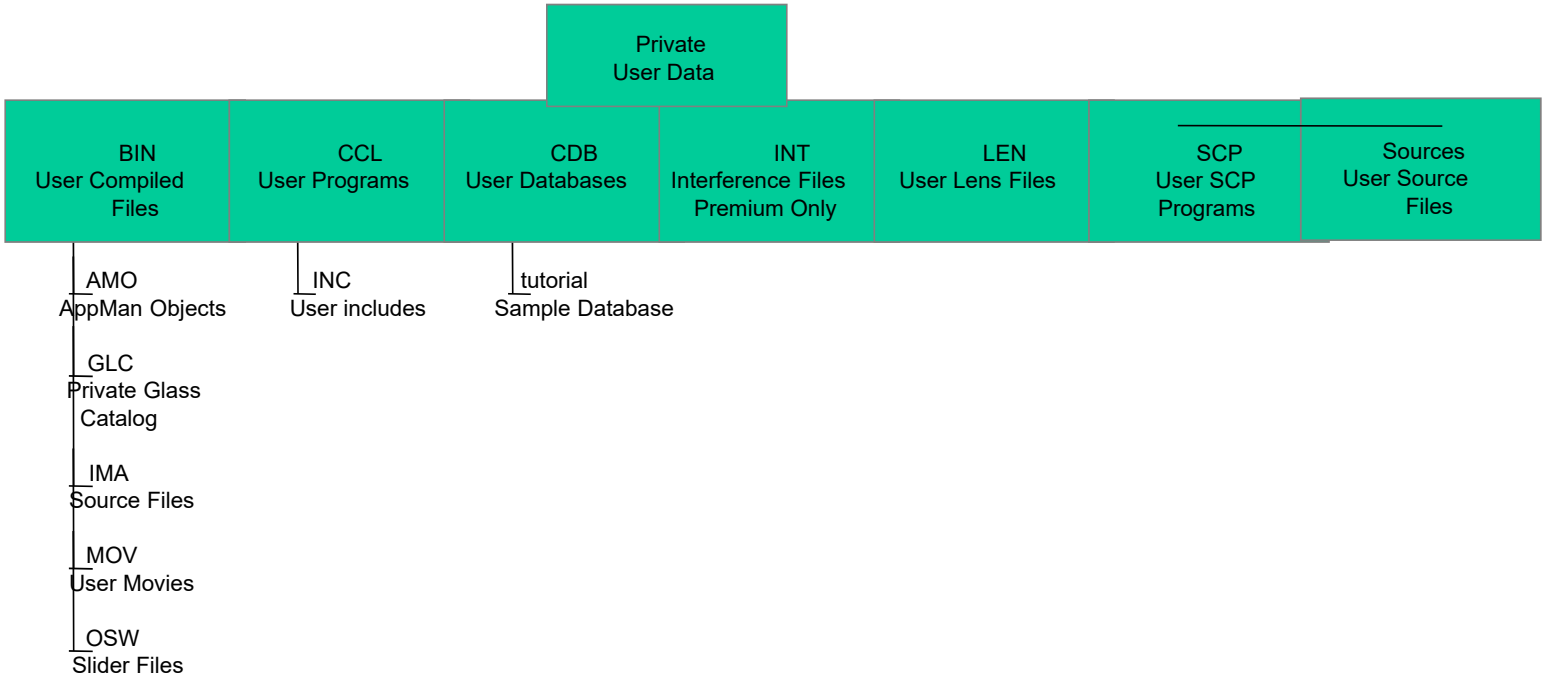
OSLO File Hierarchy



Public Folders

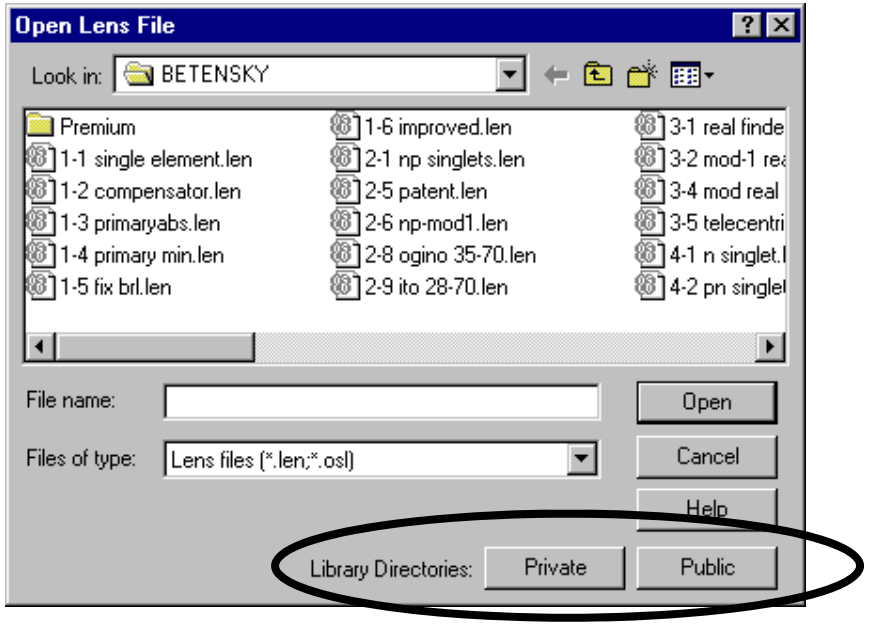


Private Folders



OSLO File System

- Public and Private Directories
  - Public Files marked “read-only”
  - Private set by OSDATA environment variable in win.ini
  - Also uses “current” LENS and TEXT directories
- Special File Types
  - LEN or OSL
    (set under *preferences*)
  - SCP
  - CCL
  - CDB
- Uses Modified Windows Dialog Box:



LEN/OSL Files

- LEN is current format
- Text files containing optical prescriptions by listing commands
  - //OSLO header line
  - LEN NEW …more lines… END (lens surface data)
  - CFG NEW …more lines… END (multi-configuration data)
  - Miscellaneous data lines (operating conditions)
  - VAR NEW …more lines… END (optimization variable data)
  - RST NEW …more lines… END (rayset data)
  - OPE NEW …more lines… END (optimization operand data)
- Use literal or symbolic data
- Insert one lens into another

CCL/CCX Files (1)

- CCL: Compiled Command Language Similar to Java
- File Name not significant
  - Scanccl.ccl used from the command line locates commands
  - File prefix groups commands
- All CCL Files Compiled to *.AMO
  - AMO: AppMan Object file
- Automatically Compiled with OSLO Editor
- Incremental Compile/Link
- “Private Files” Outrank “Public Files” in Usage Order
- Use *.CCX for In-Process Files

CCL/CCX Files (2)

- File Locations of Special CCL Commands
  - Argument definitions & globals: a_global.ccl
  - Strings: a_string.ccl
  - Lists: a_list.ccl
  - Menus: a_menu.ccl
  - Toolbars: …/inc/a_toolbar.h

SCP Files

- SCP: Star Command Procedure
  - Not as efficient nor as powerful as CCL
  - SCP is meant to be used to create simple scripts
  - SCP is a subset of CCL
- Search Order
  - Cmdname:filename
  - Current file, if specified
  - Default.scp
- File Format

```
*cmdname
ccl command line statement;
ccl command line statement;
- etc. -
*cmdname
ccl command line statement;
ccl command line statement;

- etc.  -
```

CDB Files

- Compatible with Excel, ...etc.
- Used for OSLO Lens Library, Source Database
- Edited with OSLO database spreadsheet
- Format is “Delimited Data” (*.CSV, *.TAB) with a Readable Header:

```
,=lbc...cdb6%4d%9.3f%9.1f%9.3f%-6.6ts%9.1f%12.6f
BK7=1.5168,SILICA=1.45846 \tlex_6,,,,,,,,,,
LensID,Radius1,Thickness,Radius2,Glass,Diameter,Focal Length
1,25.95,4,0,BK7,20,0.0
2,-184,2,184,SILICA,30,0.0
3,21.577,6.9,-21.577,BK7,20,0.0
…more lines...
```

Other OSLO Files

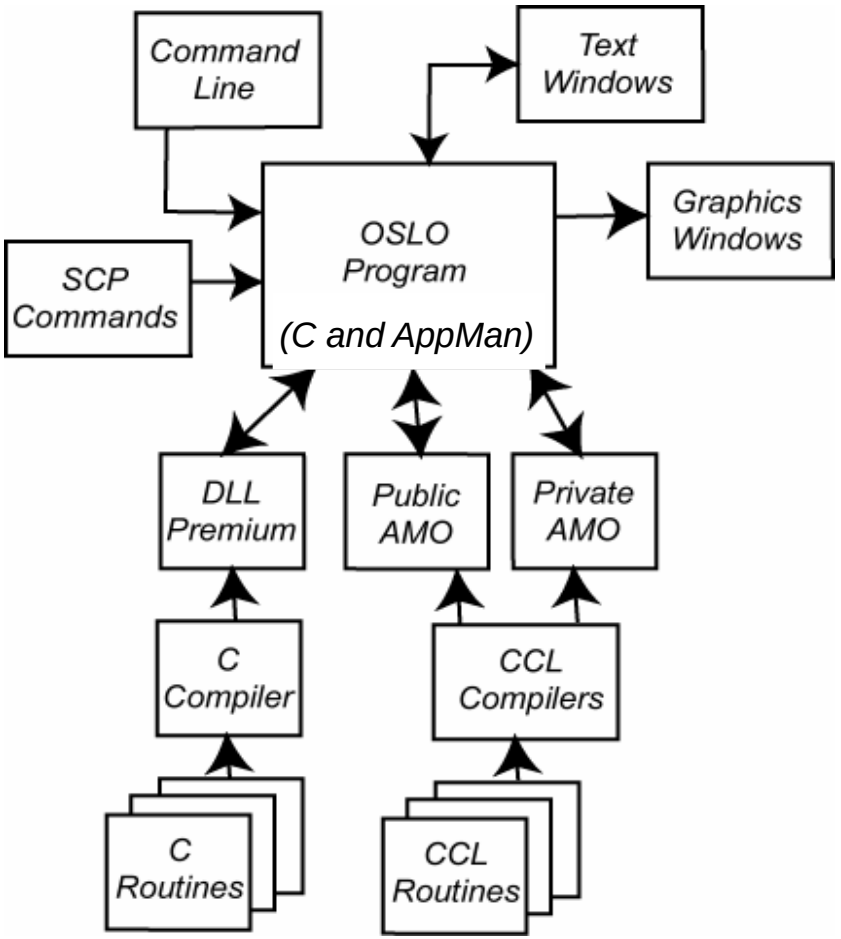
- *.GLC: Glass Data
- *. LMO: Lens Module (catalog lens)
- *. TGL: Test Glass
- *. OMD: Coating Material Data
- *. OCD: Coating Prescription Data
- *. MOV: Movie
- *. INT: Interferogram
- *. AMO: Appman Object Code

Import/Export Files

- Import Data From
  - Code V (*.SEQ)
  - GENII (*.LNS, *. LEN)
  - Sigma (*. DAT, *. LNS, *. LEN)
  - Zemax (*. ZMX)
- Export to CAD
  - IGES (*.IGS)
  - DXF (*.DXF - 3D only) Tested with AutoCad & Design Cad
  - IGES support for Mastercam (COM Opticam format)
  - STEP - conics only

OSLO Functional Flow

- OSLO is built on CCL
- OSLOxxxx.exe
  (all versions of OSLO):
  - Include library routines
    (from C)
  - Loads compiled CCL routines
    (from AMO files) for execution



Lens Drawing

- Drawing Conditions
  - Location of drawings, space for ray trajectories
  - Appearance (rings, spokes, apertures, mirror hatching)
  - Rays to show (object points, fans, etc)
  - Rays are not same as field point set or ray set
- Drawing Types
  - Plan View (Strictly 2D, not a projection)
  - Wire Frame (3D, uses color for surfaces)
  - Hidden Line (also incorrectly called solid model)
  - Shaded (Uses OpenGL)
- Zoom Drawing
  - Shows all positions

Element Drawing

- ISO 10110 Compatible
  - Tabular format
  - Default SS shows ISO standard values
- Enter Data, Drawing automatically produced
  - Tolerances
  - Fabrication data
- Singlets Only
- Portrait Format Preferred

Evaluation Setup

- Set Current Object Point
  - Automatically traces reference ray
  - Use caution in interpreting, not always used
- Set Current Wavelength
  - Used for analysis as default, indicated if not 1
- Set Current Configuration
  - Sets configuration for analysis
- Autofocus
  - Adds shift to image surface
- General Conditions

General Conditions

- Evaluation mode, Aberration mode
- Units, OPD in waves
- Ray aiming type, Ray aiming mode
- Wavefront reference sphere position
- Symmetry State, Aperture checking
- Solves in alternate configurations
- Zernike polynomial reference axis
- Global reference surface for ray data
- Evaluation z-axis
- Source astigmatic distance
- Temperature, Pressure
- Use equal image space ray increments
- Polarization Ray Trace, Calculate diffraction efficiency

Paraxial Analysis

- Paraxial Constants
  - Pxc, Pxs commands
- Paraxial Ray Trace
  - Pxt (in either XZ or YZ plane)
- Zoom Setup
  - Data for all zoom positions

Aberrations

- Aberration Coefficients
  - 3^{rd}, 5^{th}, 7^{th} SA
  - Seidel Pupil aberrations
  - Buchdahl Fifth-Order
    - M1 – M12
    - Intrinsic/Transferred contributions
  - 3^{rd} order axial gradient contributions
  - Transverse, Angular, Unconverted, Wavefront (3^{rd})
- Zernike Coefficients
- Zoom Group Sensitivity
- Aldis Theorem Contributions

Reference Ray Definition

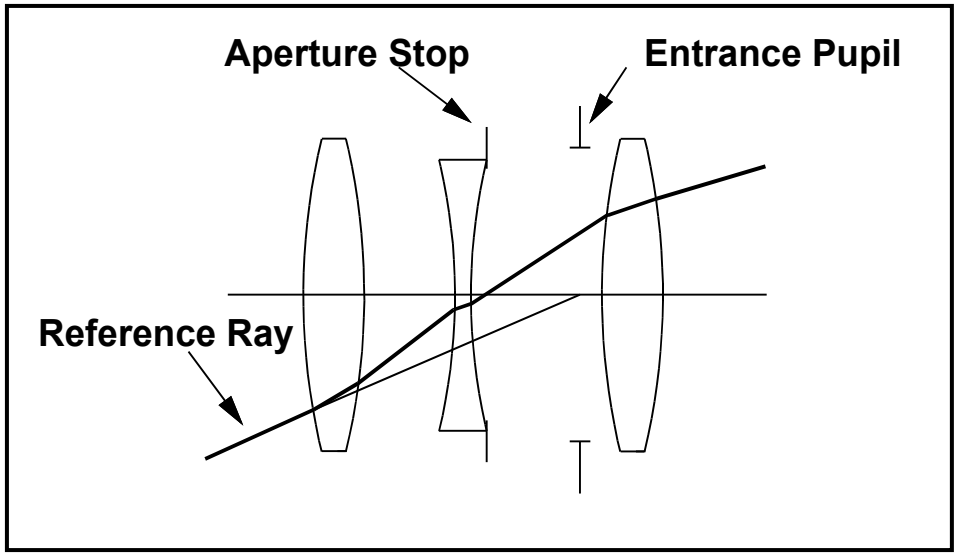
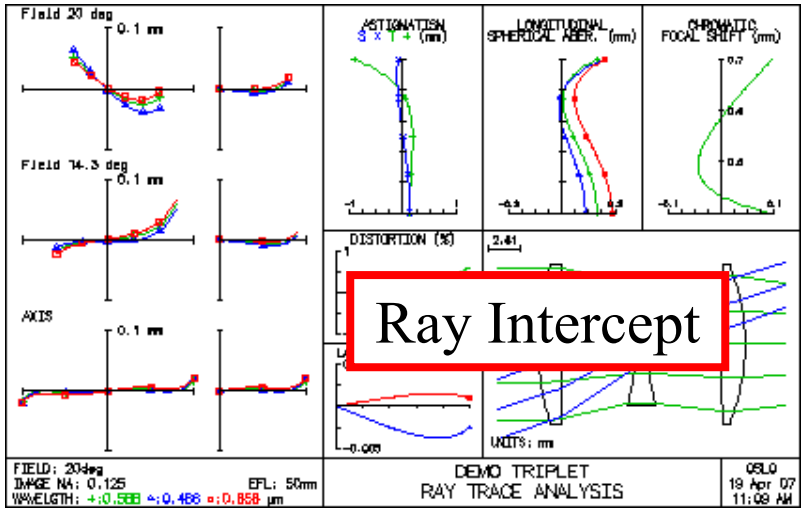


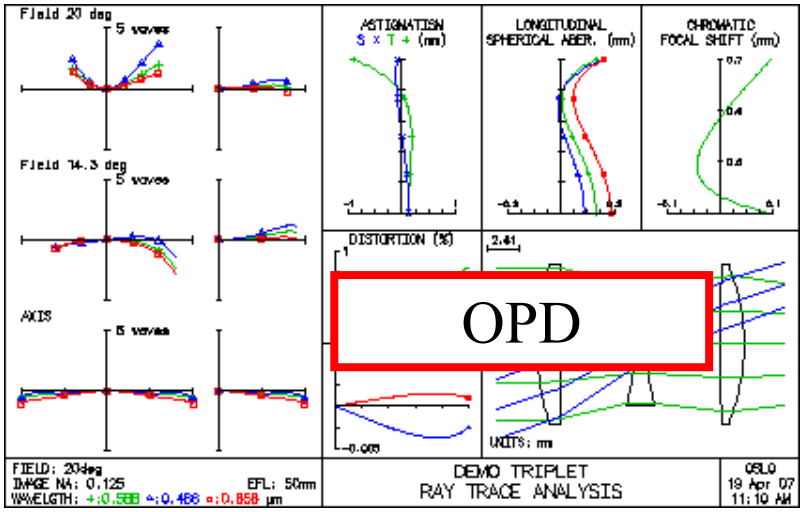
Image Evaluation

- Ray Analysis
- Spot Diagrams
- Wavefront Analysis
- Point Spread Function
- Modulation Transfer Function
- Through-Focus MTF
- Slider Wheel Interaction with any Analysis

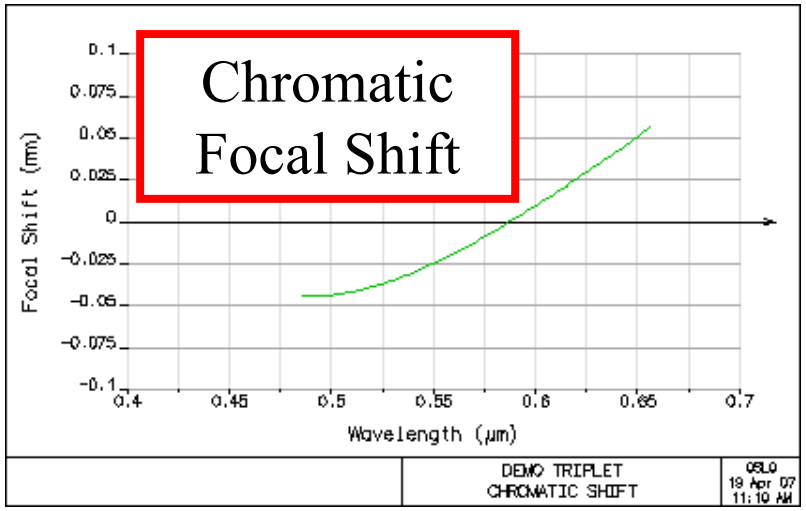
Ray Analysis Examples



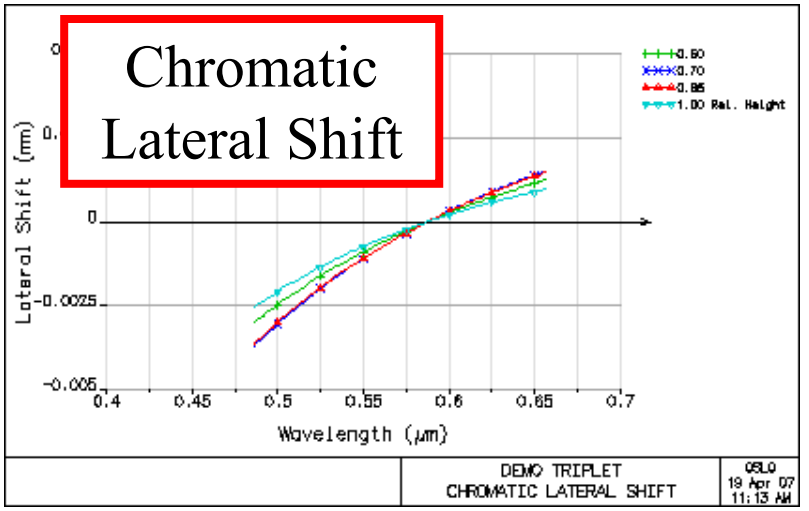
Ray Intercept



OPD



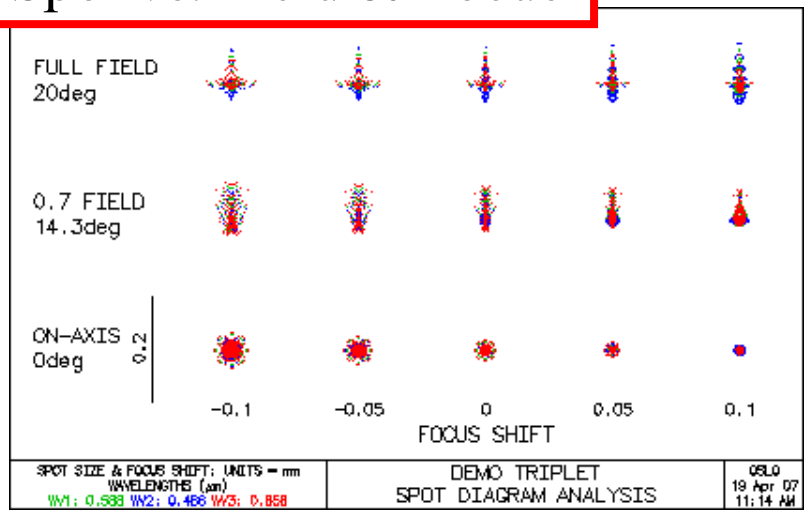
Chromatic Focal Shift



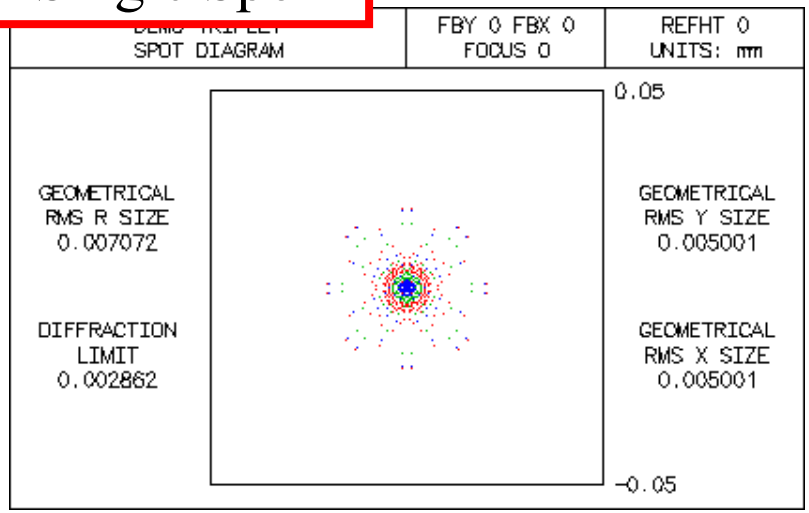
Chromatic Lateral Shift

Spot Diagram Example

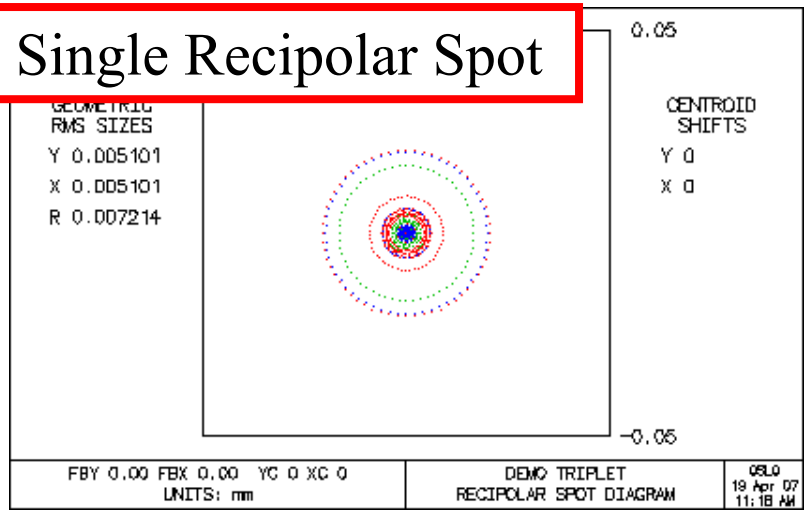
Spot vs. Field & Focus



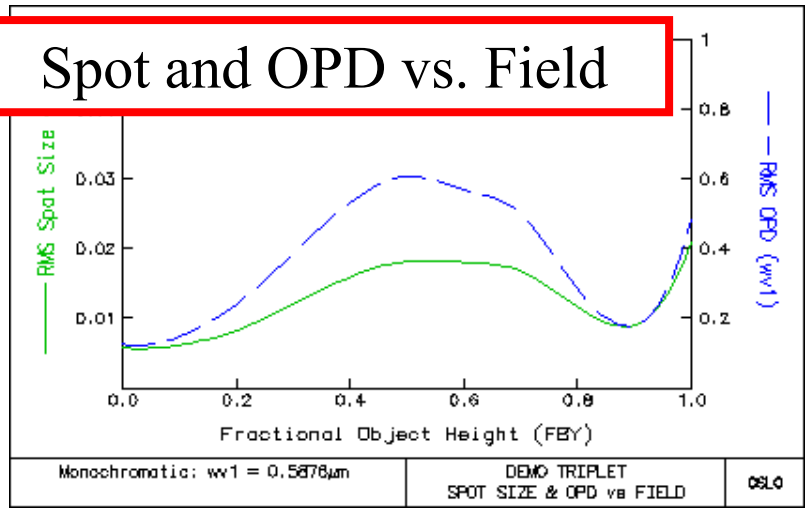
Single Spot



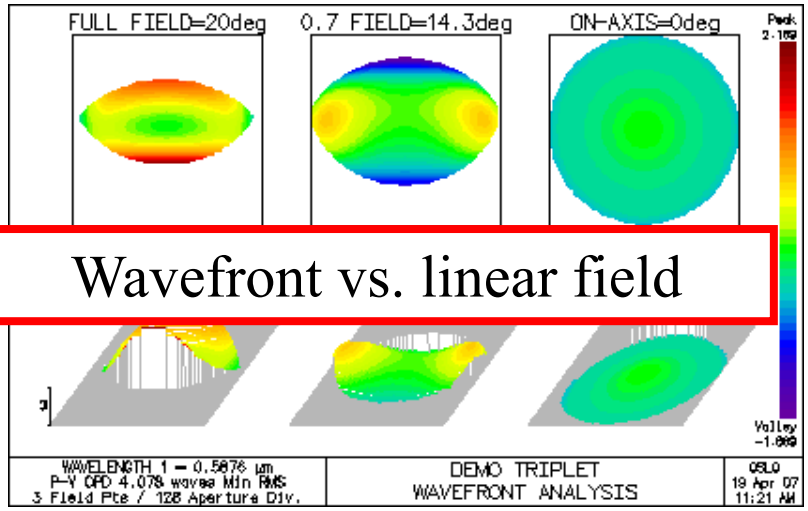
Single Recipolar Spot



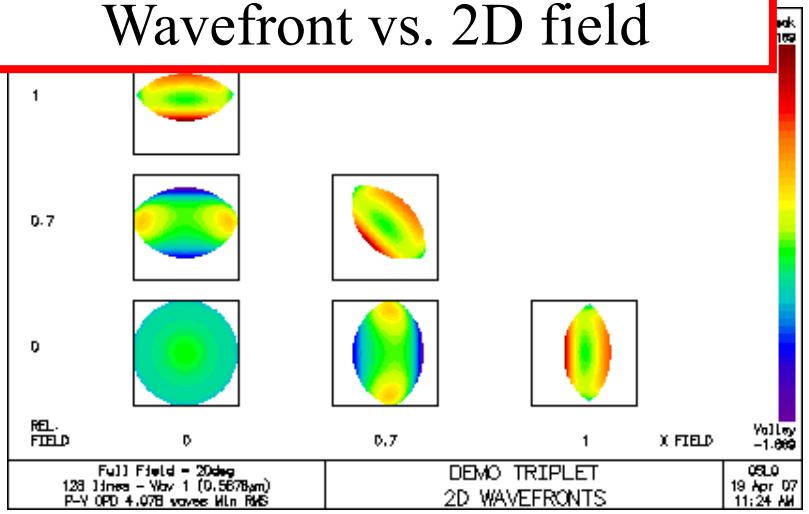
Spot and OPD vs. Field



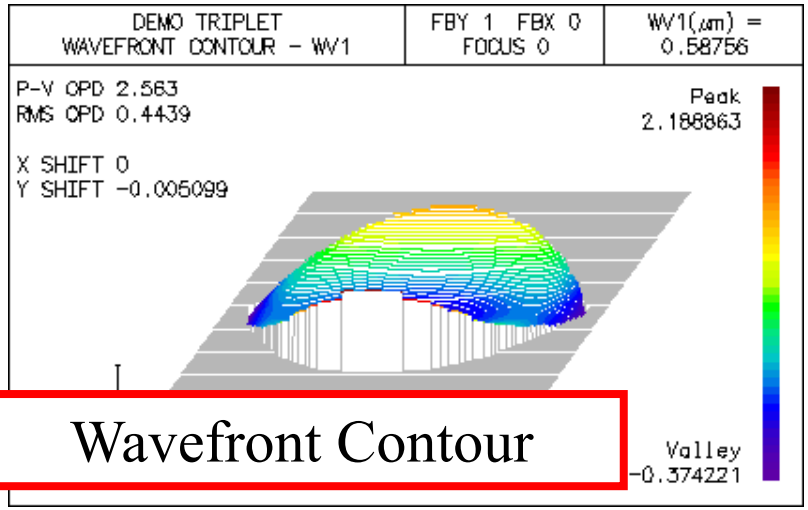
Wavefront Analysis Examples



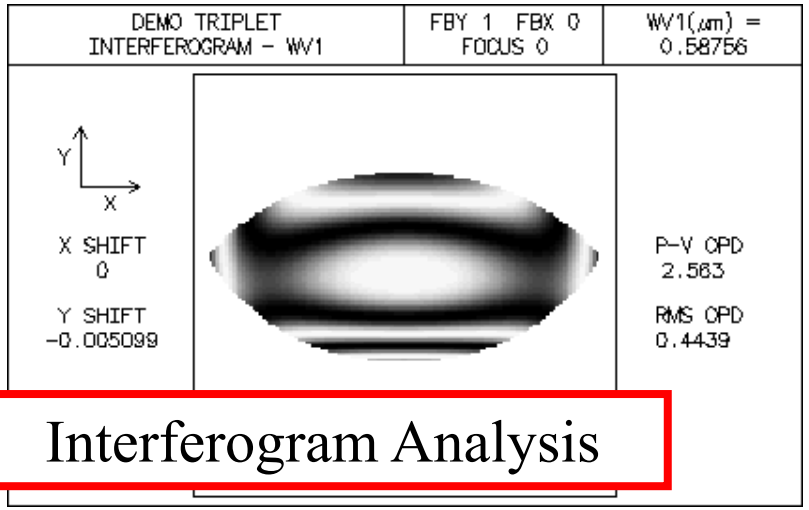
Wavefront vs. linear field



Wavefront vs. 2D field



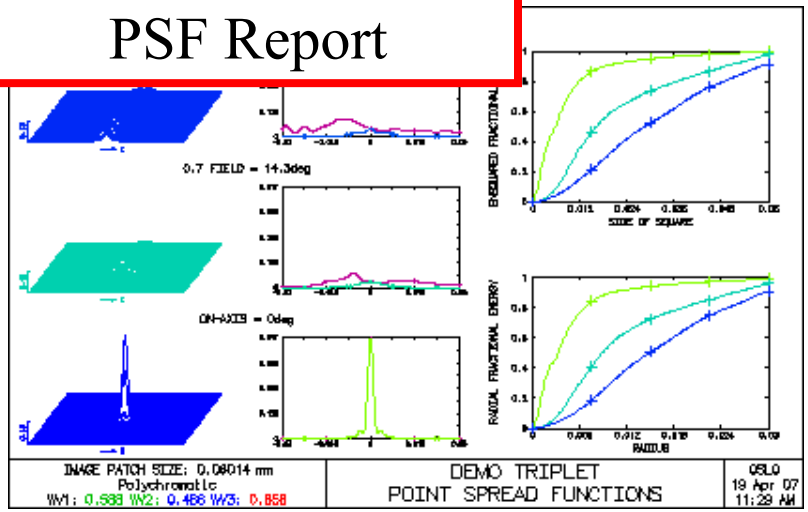
Wavefront Contour



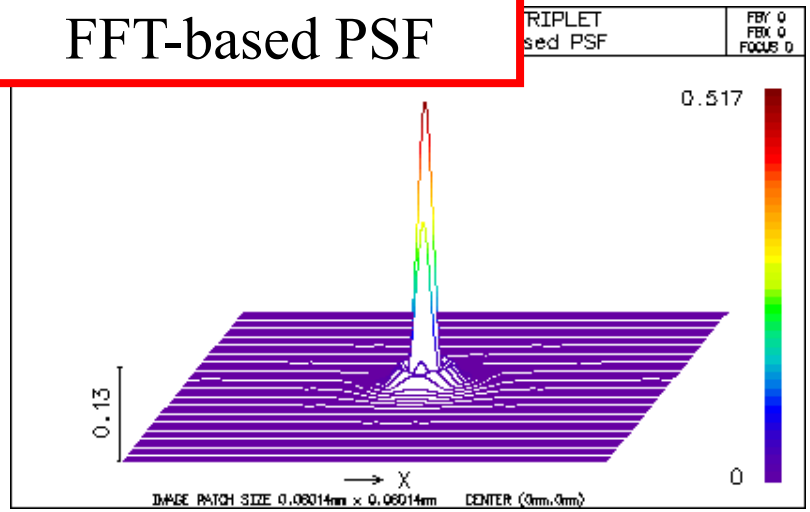
Interferogram Analysis

Point Spread Function Examples

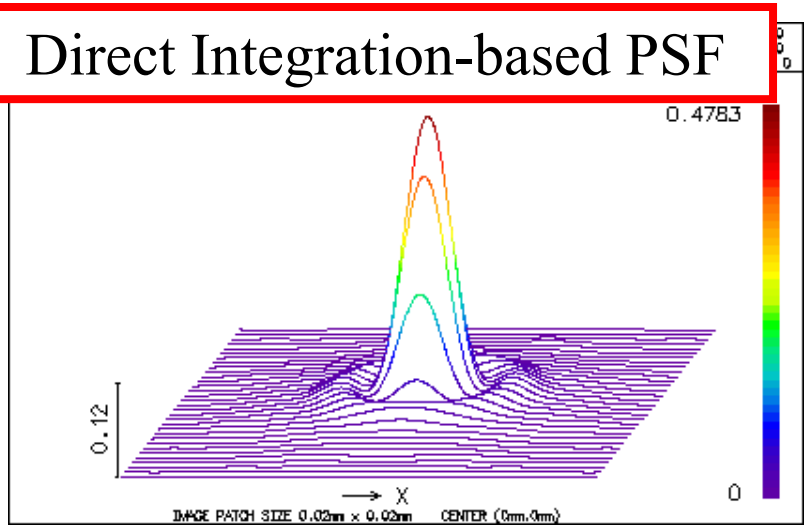
PSF Report



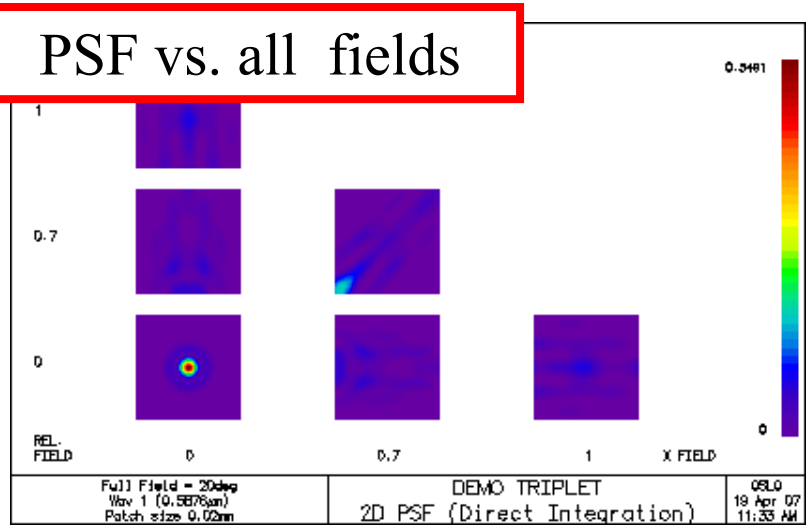
FFT-based PSF



Direct Integration-based PSF

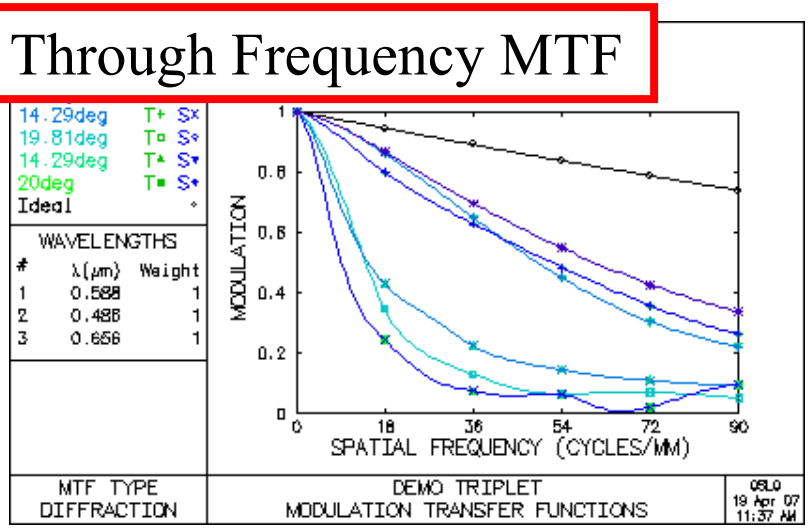


PSF vs. all fields

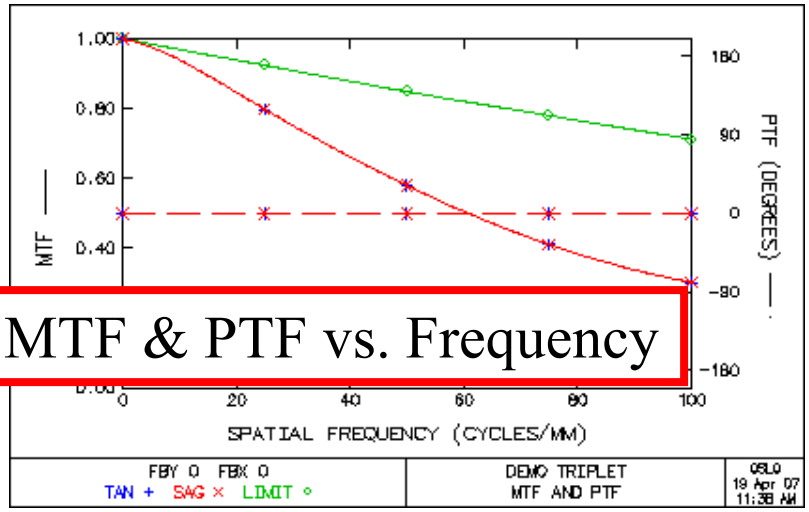


Modulation Transfer Function Examples

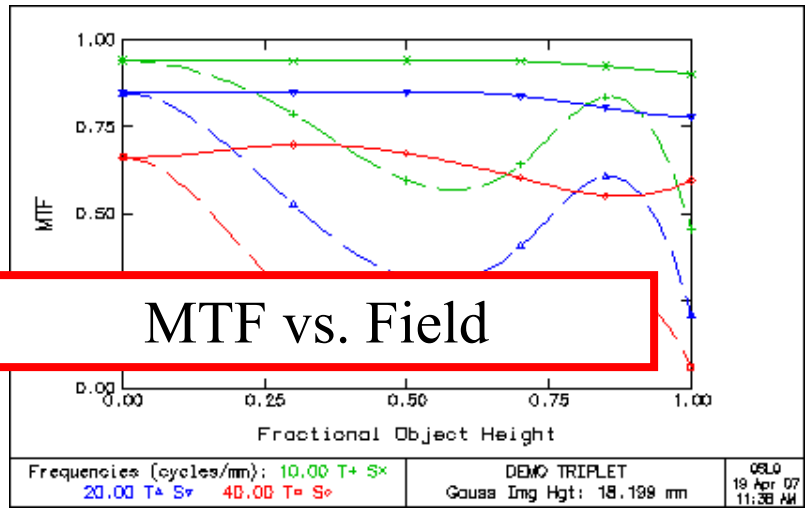
Through Frequency MTF



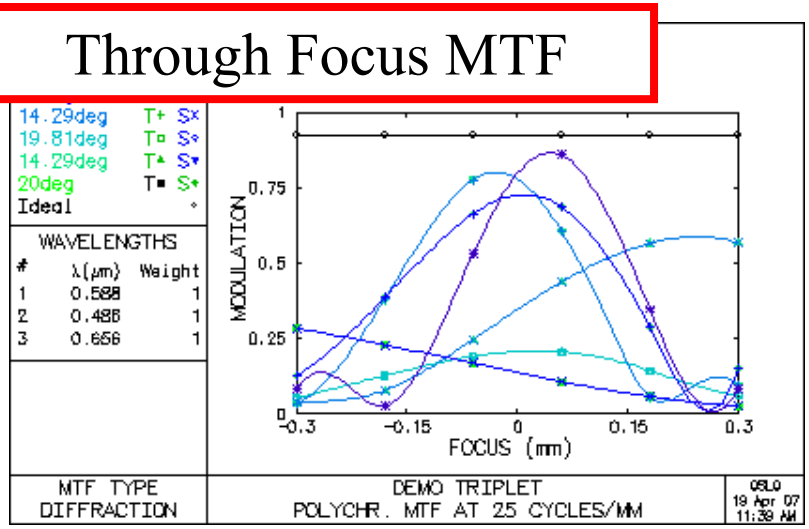
MTF & PTF vs. Frequency



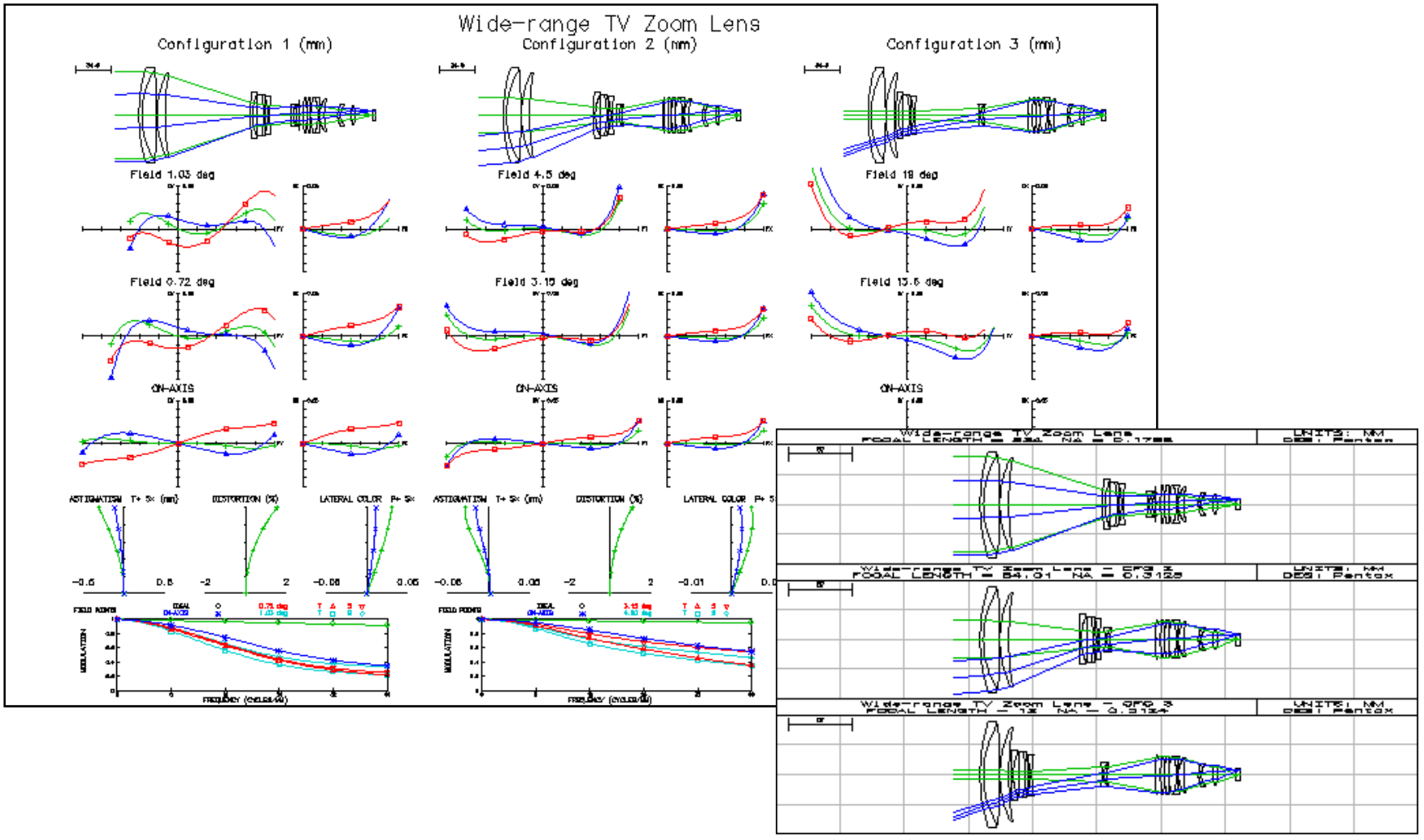
MTF vs. Field



Through Focus MTF



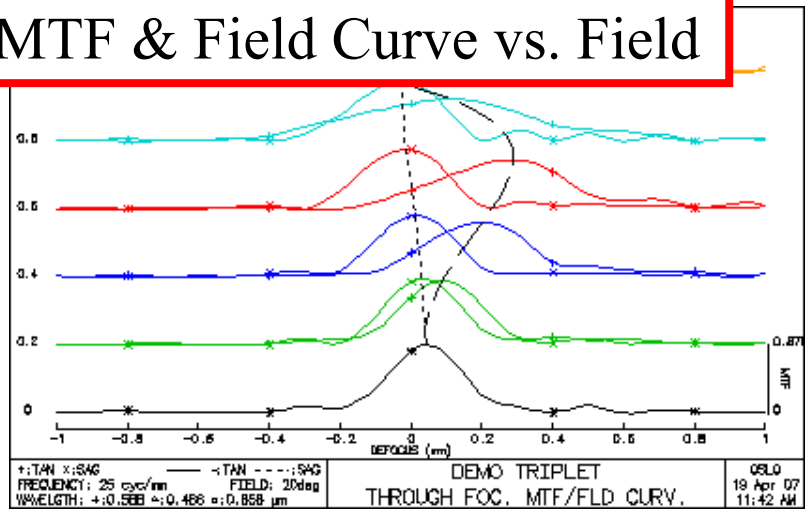
Zoom Lens Analyses



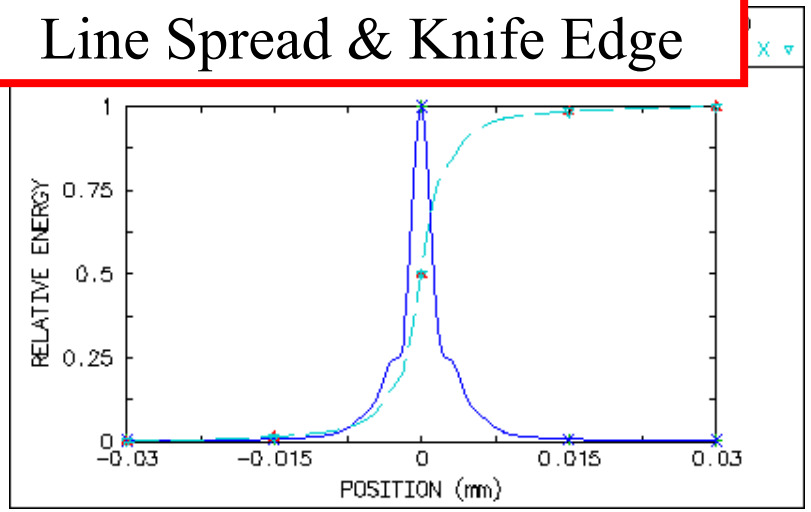
OSLO

Other Analyses

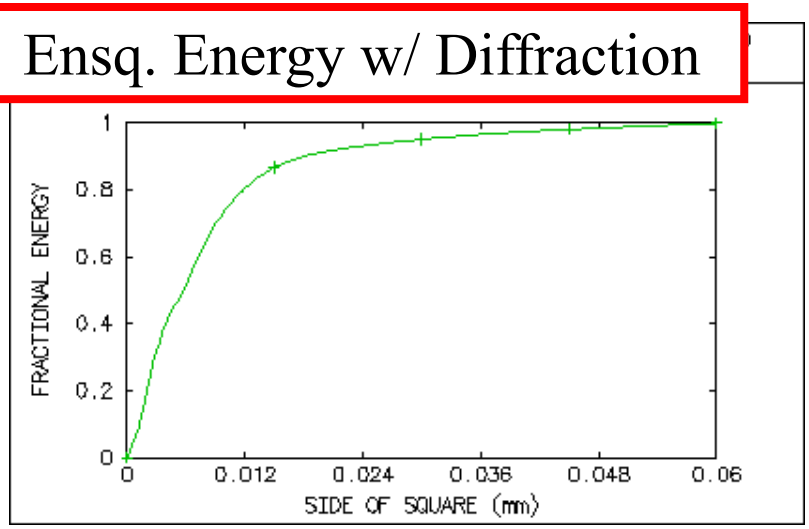
MTF & Field Curve vs. Field



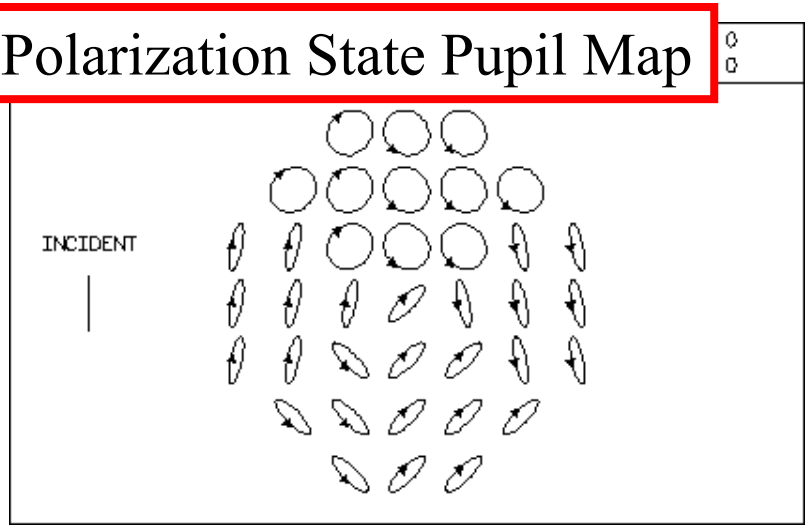
Line Spread & Knife Edge



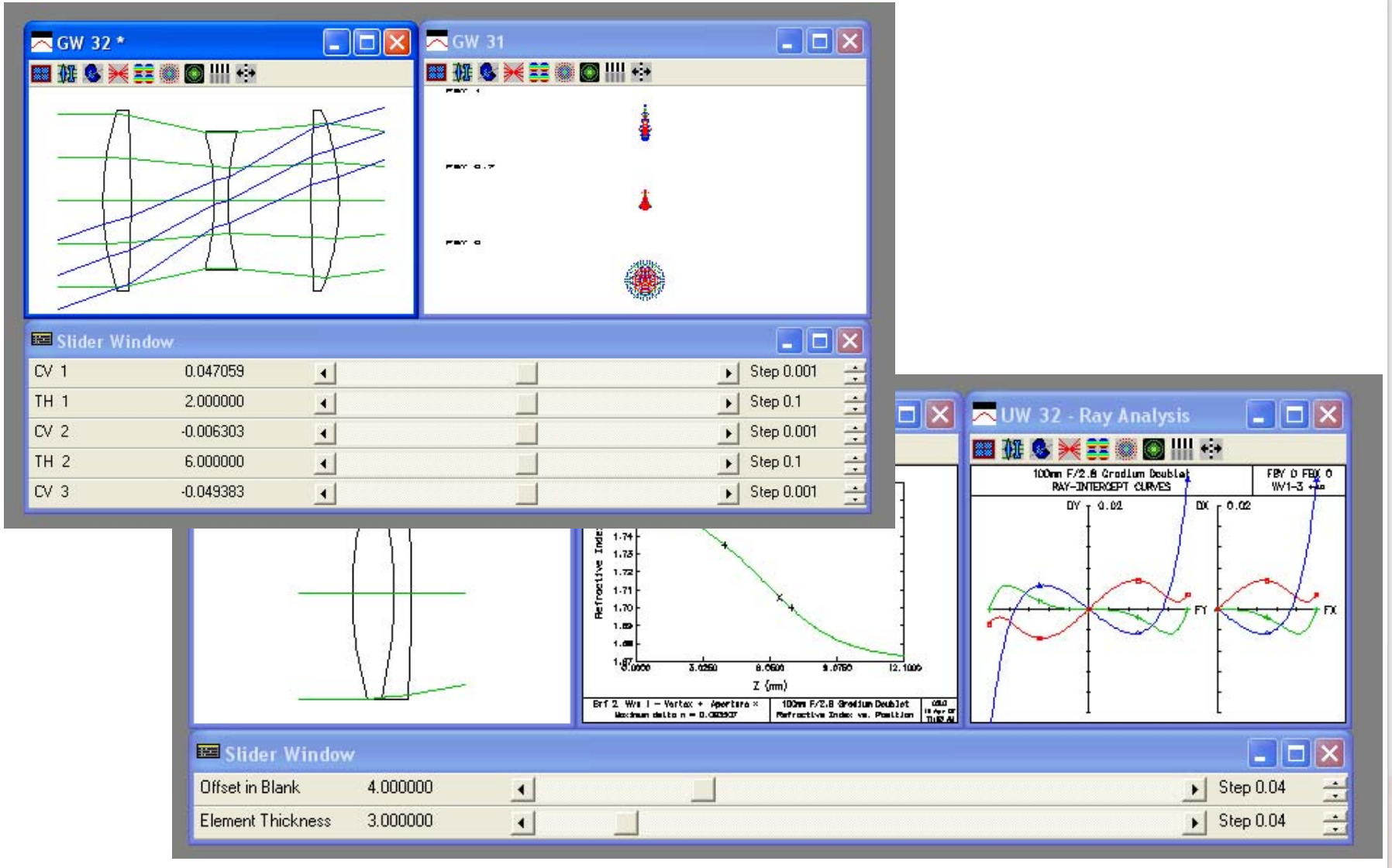
Ensq. Energy w/ Diffraction



Polarization State Pupil Map



Slider Wheel Interaction with any Analysis



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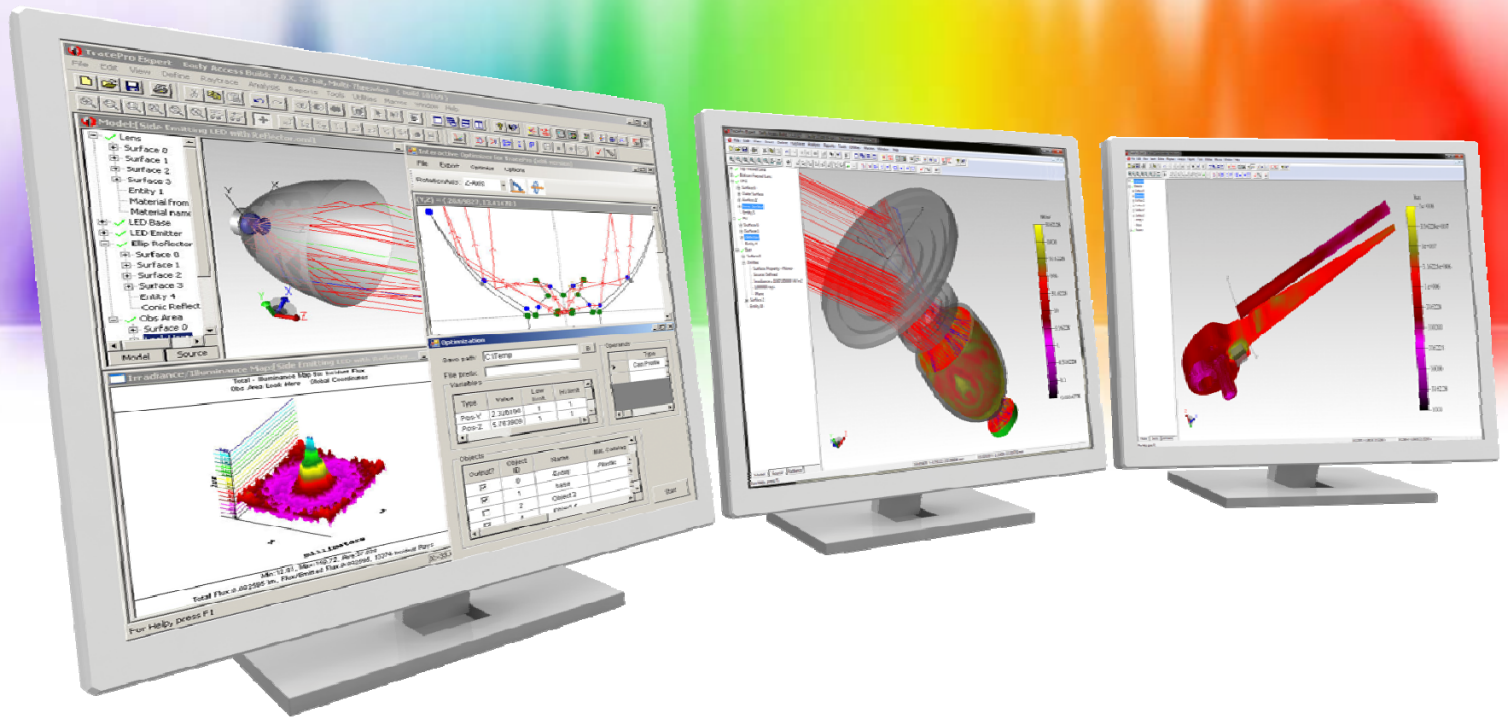

INTERACTIVE TRIPLET DEMONSTRATION

LAMBDA RESEARCH CORPORATION