Naysmith Optics of the Solar-C Telescope

Institute for Astronomy

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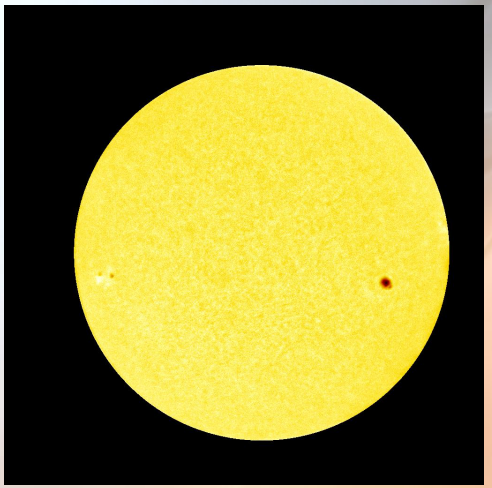
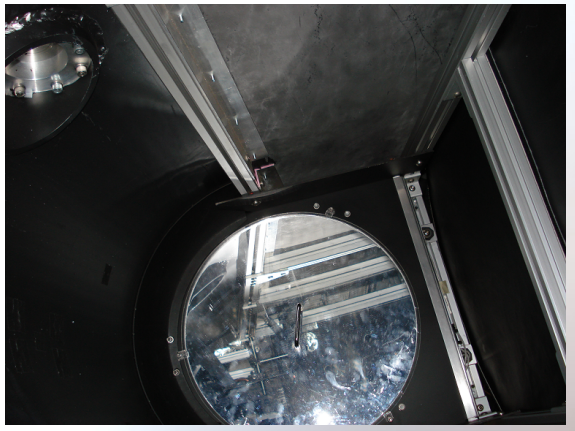
Introduction

- Solar-C Telescope
- Naysmith Optics
- Simulation Tools
- Final Design





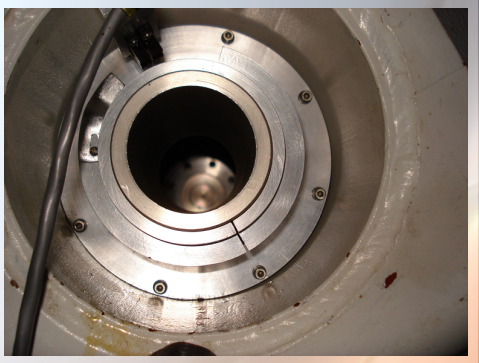
Solar-C Telescope

Solar-C Telescope

0.50 m Primary Mirror

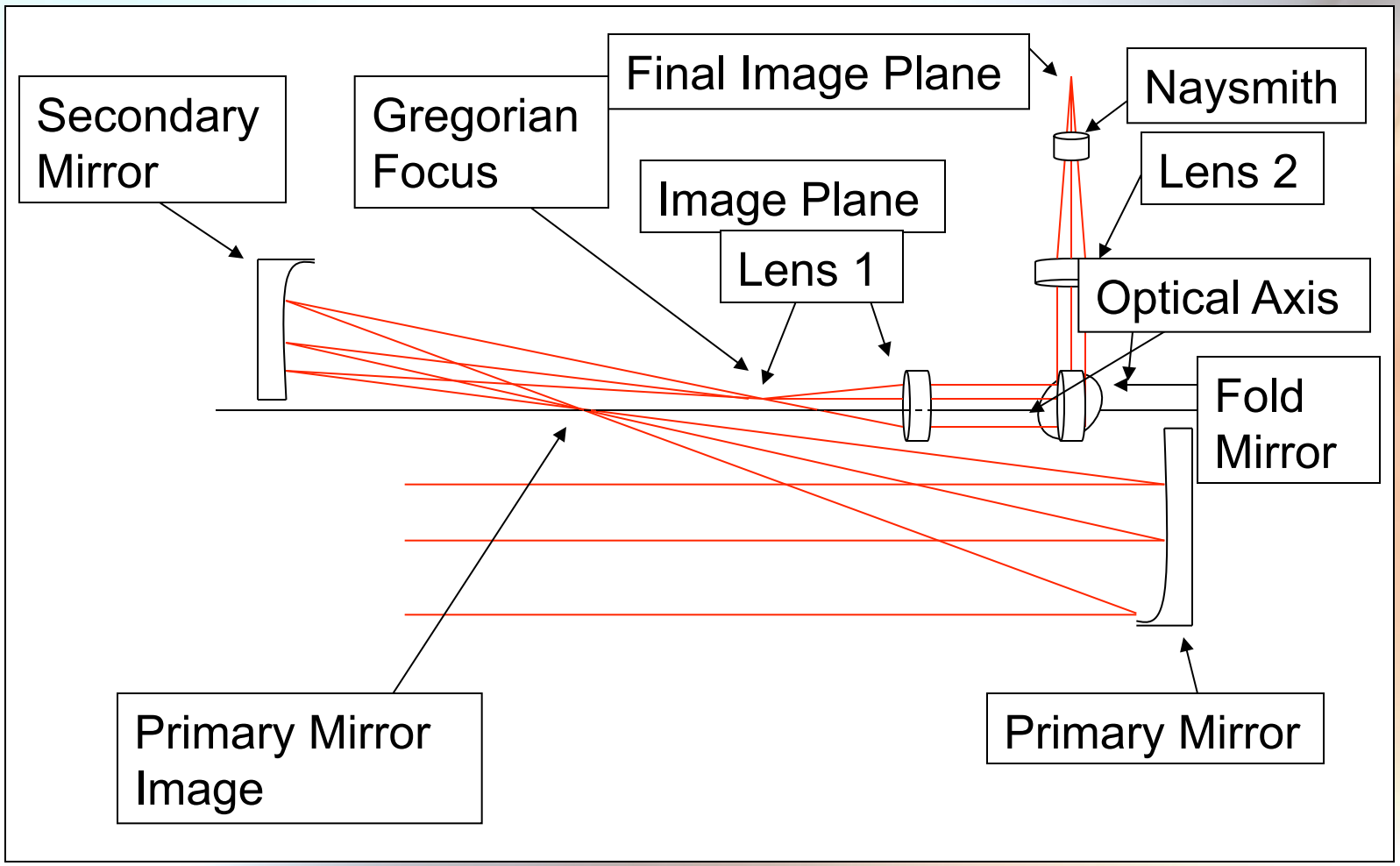
Objective

- Design the Naysmith Optics for the Solar-C Telescope



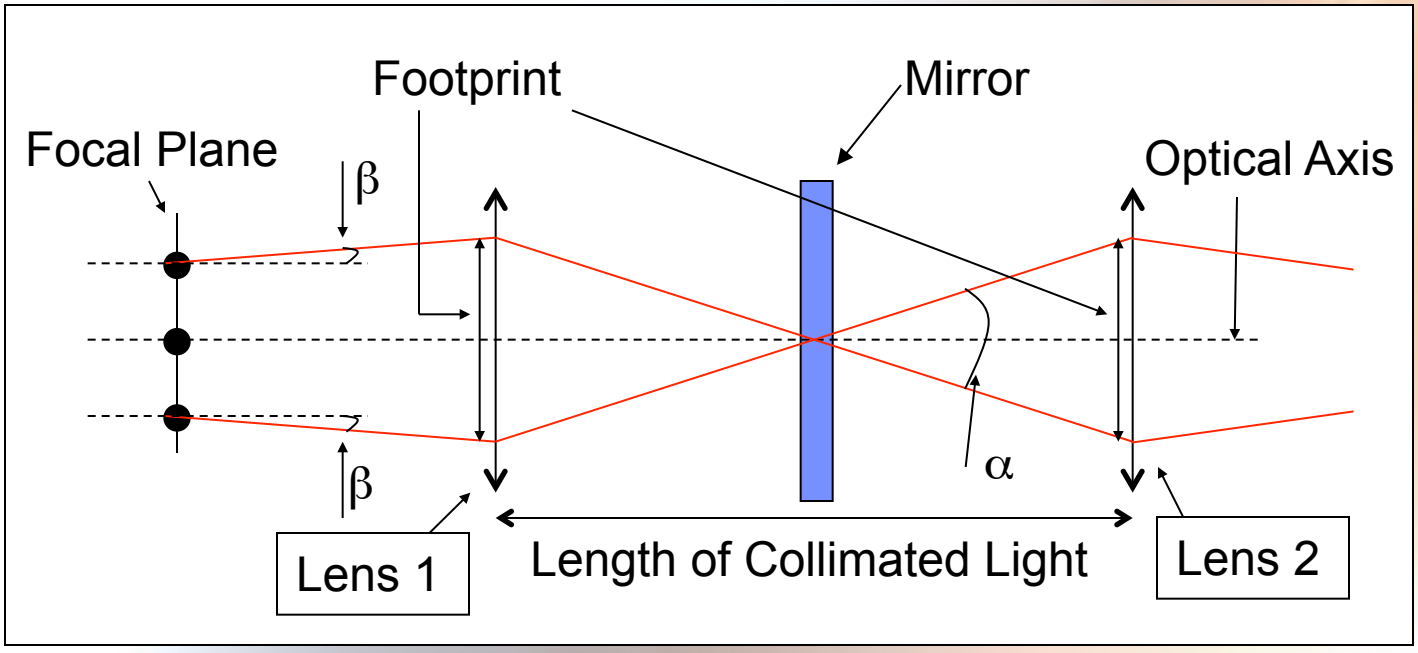
  - Geometric Ray Tracing
    - Optical Light Path in Solar-C
    - Relative Positioning of the Imaging and Optics
  - Zemax
    - Optical Design Simulator
    - Simulates Response of Lenses
    - Graphs and Diagrams for Aberration Correction

Solar-C Naysmith Optics



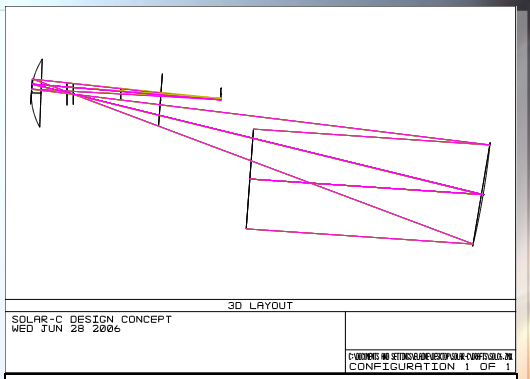
Solar-C Naysmith Optics

- Two Lens and Mirror Combination to Extract Image
  - First lens – Collimate the Light
  - Mirror – 45° Tilt
  - Second lens – Focus the Light
- Magnification
  - Second Lens Focal Length : First Lens Focal Length
- Length of Collimated Light
  - Optical Invariant and Footprint of Light on First Lens



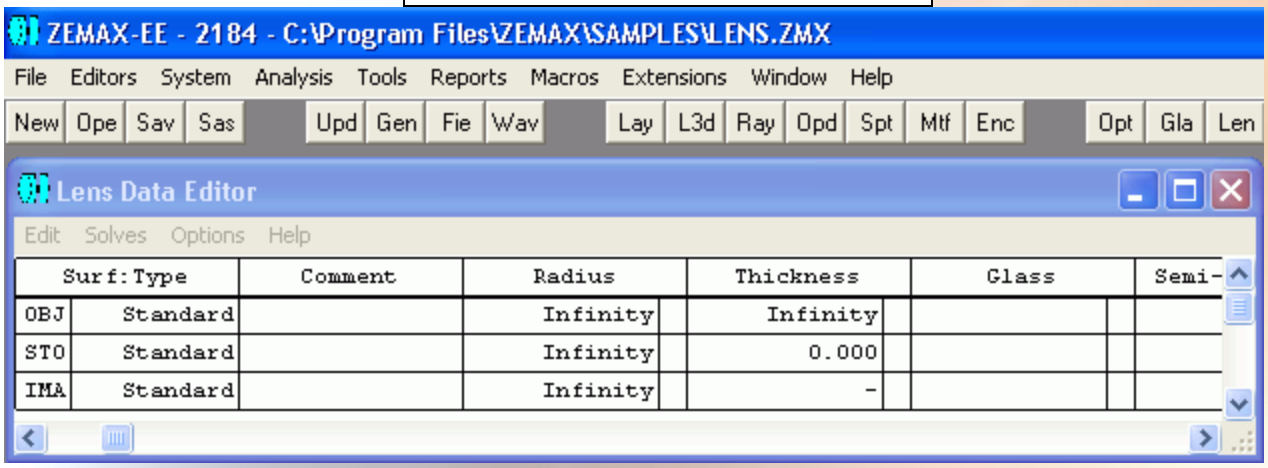
Zemax Simulations

- Analyzing Design
  - Geometric Ray Tracing
  - Calculates Aberrations
    - Ray Fan Diagrams
    - Spot Diagrams
    - Encircled Energy Diagrams



Geometric Ray Trace

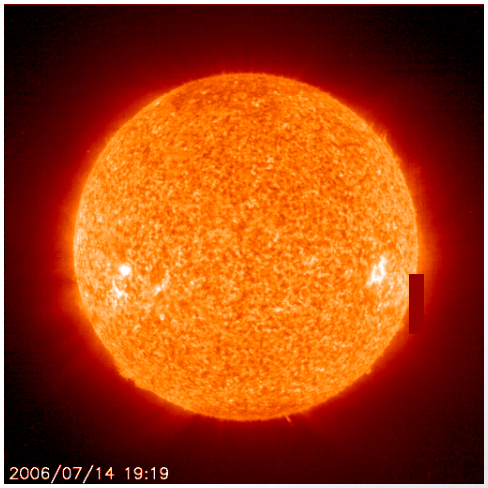
Screen Shot of Zemax



Aberrations

- Something that Blurs Out an Image
- Types of Aberrations
  - Spherical, Focal, and Chromatic

Focused Image of Sun

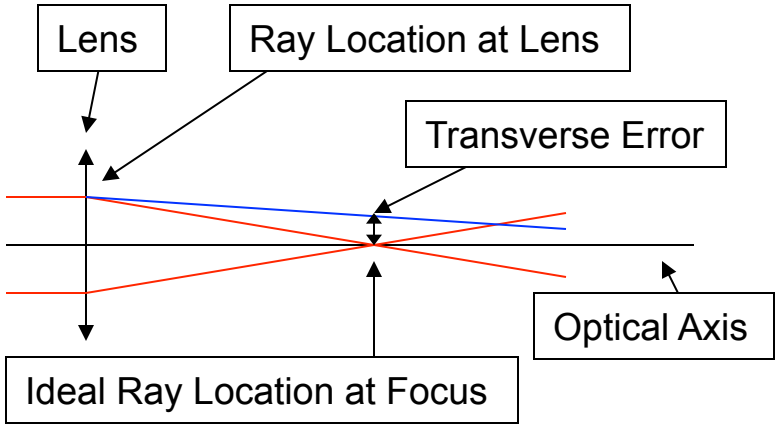


Out of Focused Image of the Sun

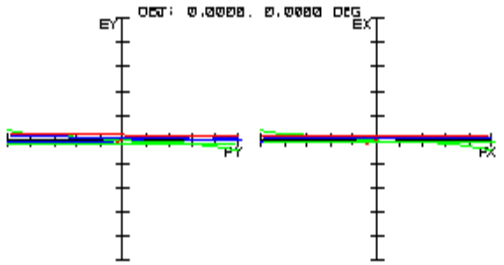
- Minimize the Aberrations

Ray Fan Diagrams

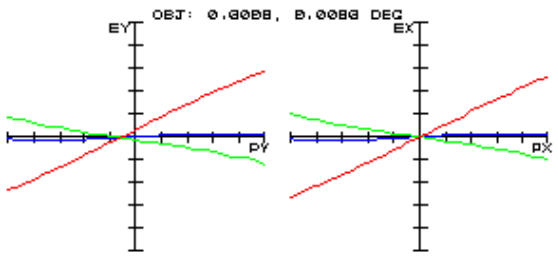
Transverse Error Diagram



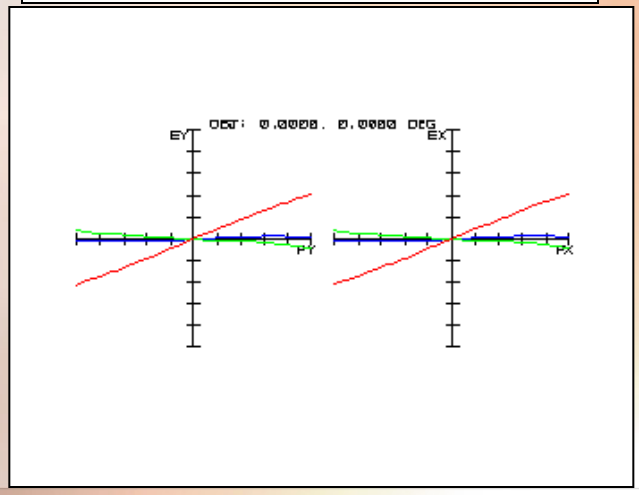
Ideal Lens



Singlet Lens

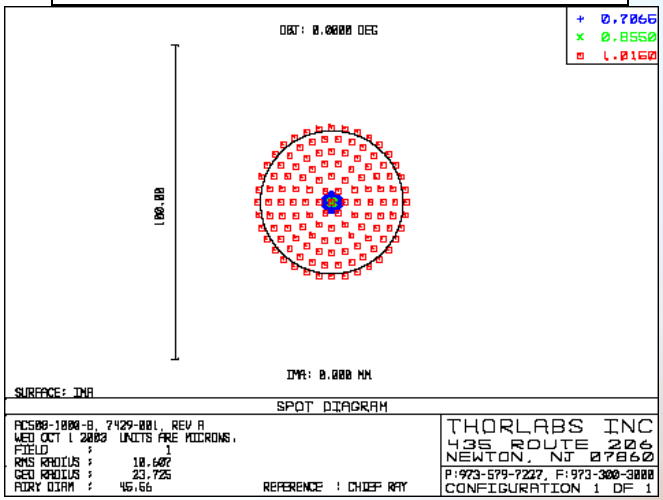


Doublet Lens



Spot Diagrams

Ideal Lens



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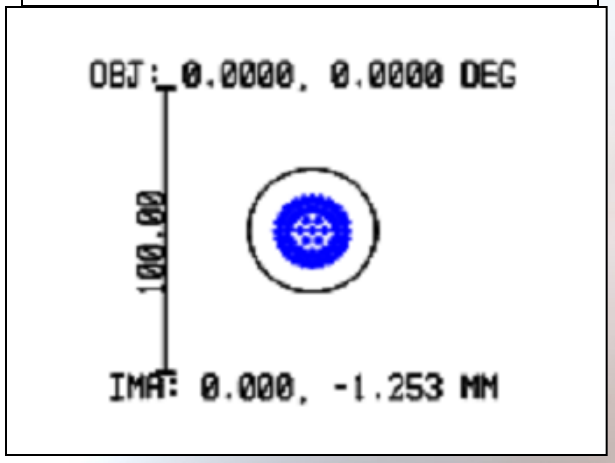
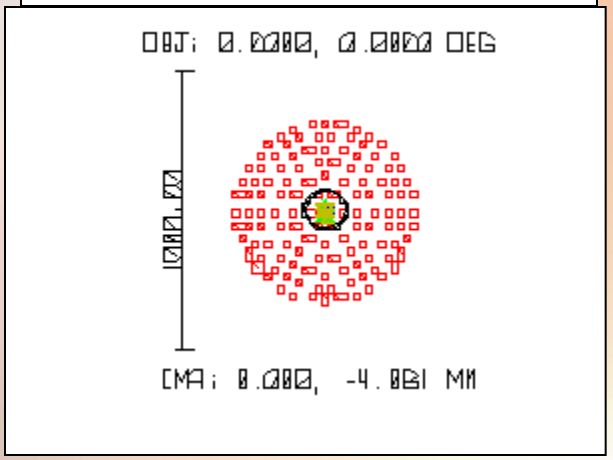
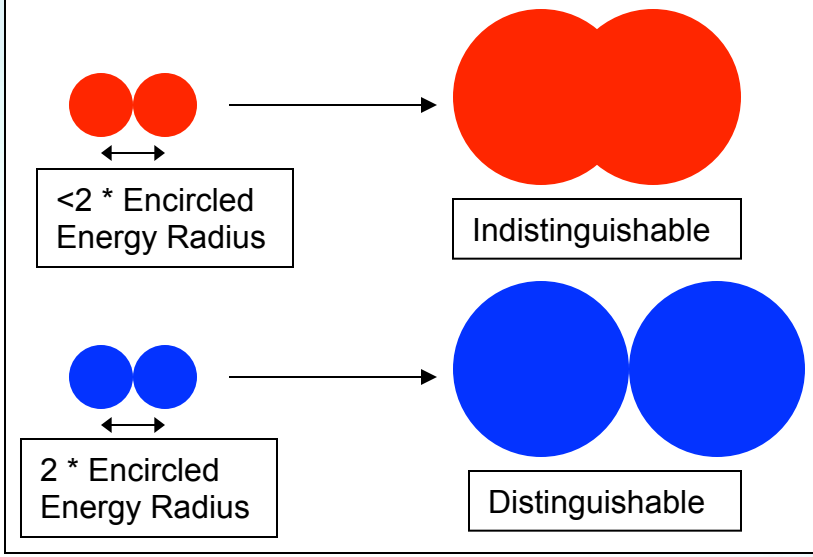


Doublet Lens

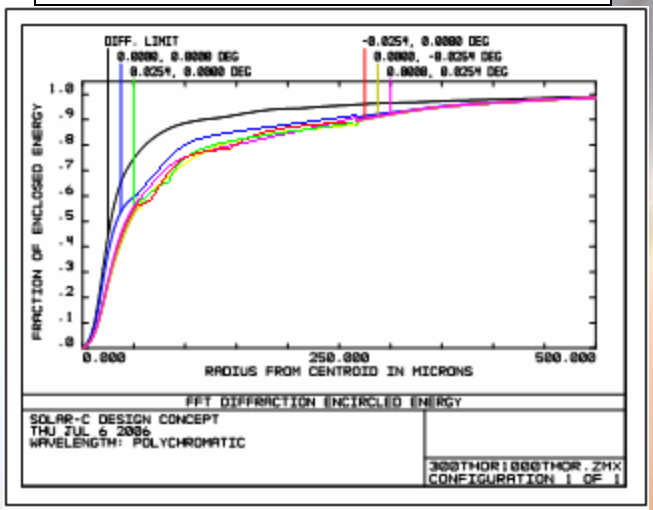


Encircled Energy Diagrams

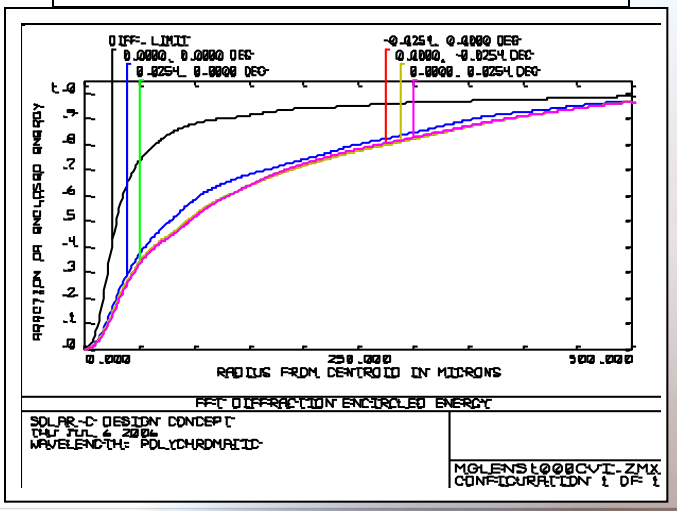
Encircled Energy Radius Diagram



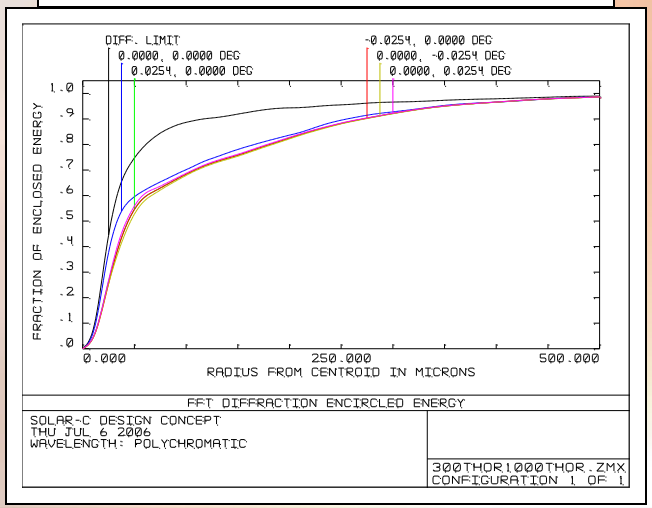
Ideal Lens



Singlet Lens



Doublet Lens

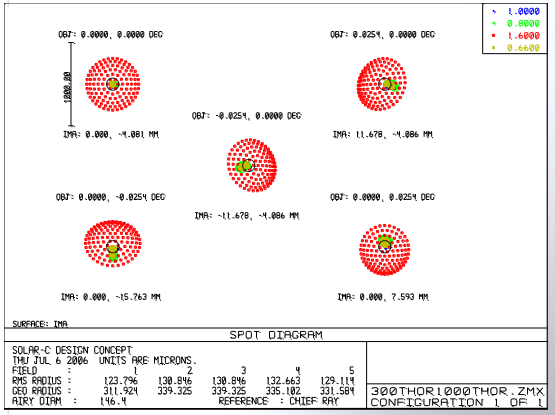


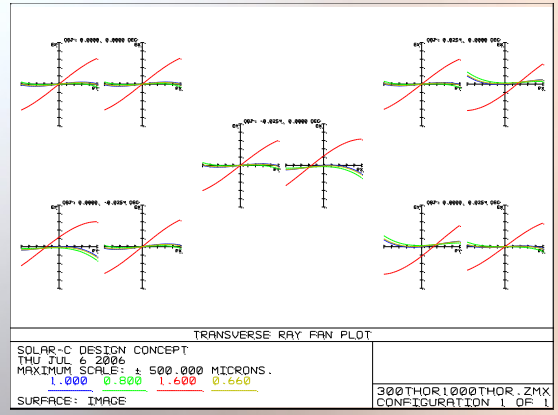
Naysmith Optics Zemax Simulations

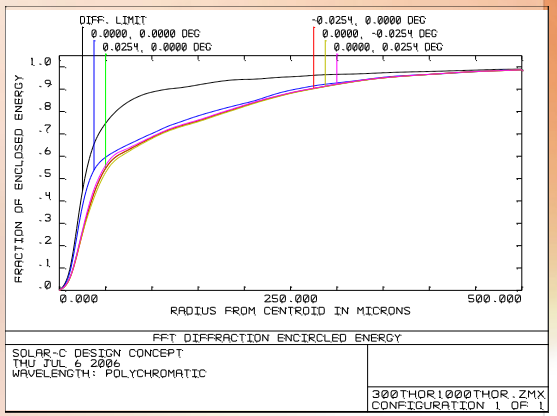
- Lenses and Mirror Combinations
  - Diffraction Limited Spot Sizes, Minimal Aberrations, Small Radius of Encircled Energy
  - Bandwidth of a System
  - Optics Selection

Zemax Simulations for the Solar-C Telescope with Naysmith Optics

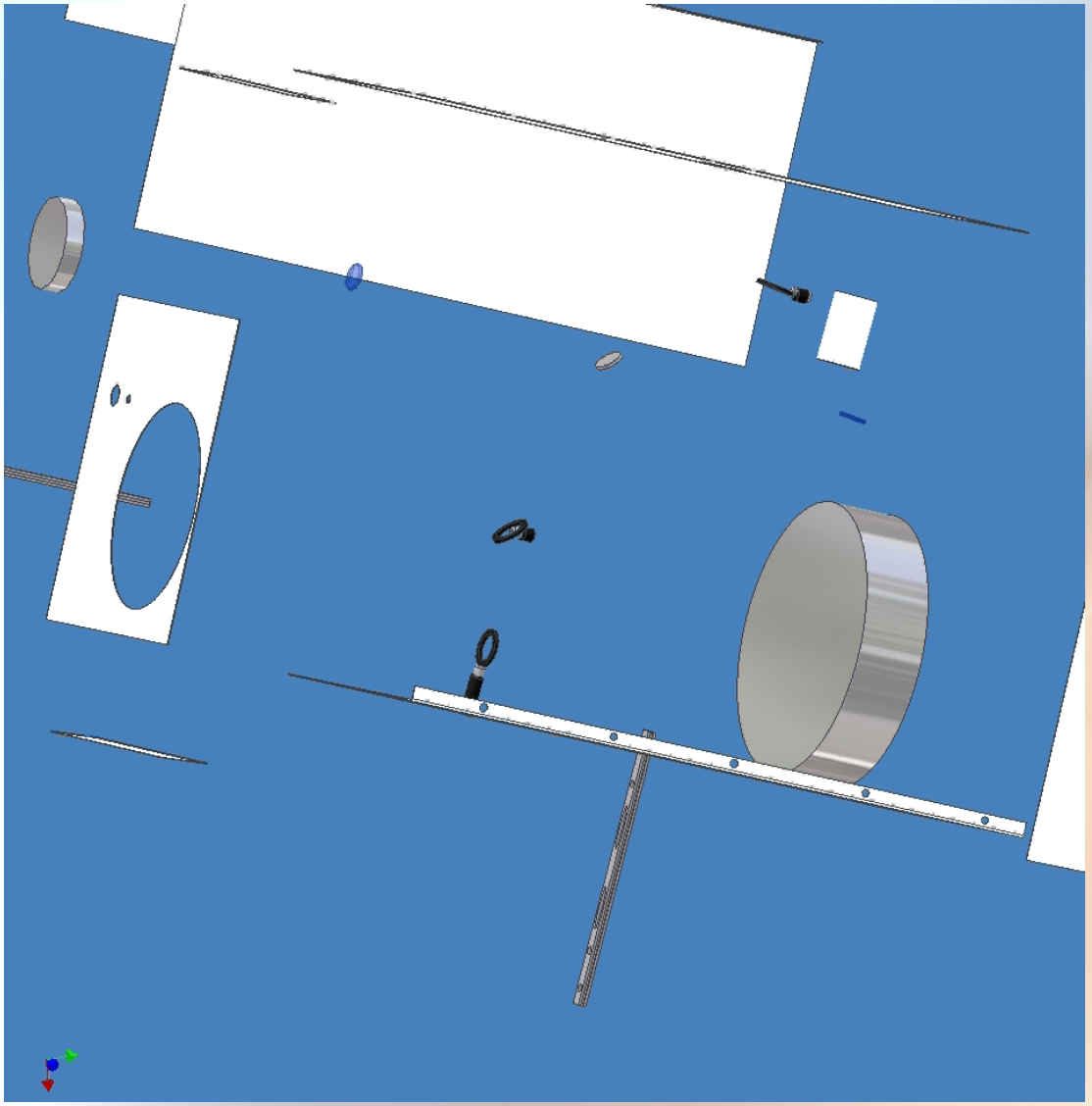
Center Frequency of 1000 nm







Final Design



Acknowledgements

- The Institute for Astronomy
  - J.D. Armstrong
  - Jeff Kuhn
- Center for Adaptive Optics
  - Malika Bell
  - Lisa Hunter
  - Hilary O'Bryan
- Maui Economic Development Board
  - Isla Yap
- Maui Community College
  - Mark Hoffman
- Funding provided through the Center for Adaptive Optics, a National Science Foundation Science and Technology Center (STC), AST-987683
- Mom and Dad

Questions

Sunrise on top Haleakala