

# Task 4

## Optical design software - How did the figuring error of the HST primary affect the imaging performance of the telescope?

This exercise should be fun and gives you a feeling of the "real thing". You will work with a professional-grade optical design program, and you will understand how the problem with the Hubble Space Telescope primary affects the performance of the telescope.

The Hubble Space Telescope is an f/4 Ritchey-Chrétien telescope with a 2.4m primary mirror. Due to a manufacturing error, the primary was given the wrong shape. The optical design called for a conic constant of -1.002299, but the primary was manufactured with a conic constant of -1.0133. (See the books by Wilson and by Schröder for details about the Ritchey-Chrétien design, and about the definition of mirror conic constants.)

Download the OSLO-EDU optical design program from <https://www.lambdares.com/edu/> and install it your computer (or get the program on a memory stick). Work your way through the documentation of the package on the WEB (or given). When you understand how the program works, look at the file "hubble.len" that comes with OSLO-EDU. It contains the optical description of of HST "as designed". Make plots of spot diagrams and of the point spread function (psf). Now change the conic constant to -1.0133 for the HST "as built". Make new plots of spot diagrams and of the psf. It is possible to improve a bit by refocusing the telescope (click "Evaluate/Autofocus" on OSLO-EDU). What does the spot diagram and the psf look like now?