

1. Cassegrain Objective Raytrace (Legacy HW 11)

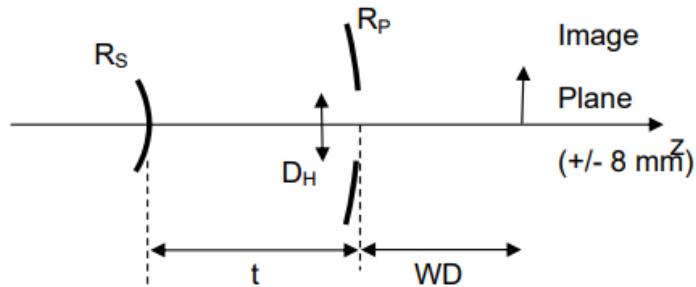
A Cassegrain Objective consists of a concave primary mirror and a convex secondary mirror.

The system stop is located at the primary mirror. The working distance is defined from the vertex of the primary mirror to the image plane. For the purposes of this problem, assume that the mirrors have zero thickness.

The object is at infinity. The maximum image size is $\pm 8\text{mm}$. The system operates at an f-number of $f/4$.

The system specification is (only the magnitudes of the quantities are provided):

$$R_p = 500 \text{ mm} \quad R_s = 125 \text{ mm} \quad t = 200 \text{ mm}$$



Determine the following:

- System focal length and the working distance
- Diameter of the Primary Mirror D_p
- The location and diameter of the Exit Pupil

- The required diameter of the Secondary Mirror D_S and required diameter of the Hole in the Primary Mirror D_H the system to be unvignetted over the specified Image Size
- The angular Field of View of the system in Object Space

Note: This problem is to be worked using raytrace methods only.

2. Eyepieces (Legacy HW 11)

Design three different eyepieces for an optical system. All three eyepieces have a Magnifying Power of 10, and are used with a relaxed eye (the image presented to the eye is at infinity). The system objective presents an intermediate image to the eyepiece, and the intermediate pupil of the system is 200mm to the left of this intermediate image plane. This intermediate pupil is the image of the stop through any optical elements between the stop and the eyepiece.

- a. A simple eyepiece consisting of just an eye lens. Determine the focal length and the eye relief.
- b. A compound eyepiece with a field lens located at the intermediate image plane. The field lens has a focal length of 40mm. Determine the eye relief.
- c. A Ramsden-style eyepiece with the same eye relief as found with compound eyepiece of part (b). The field lens is located 12mm to the right of the intermediate image plane.

Determine the focal lengths of the two lenses and their separation. Hint: Three conditions must be met by the design—the eyepiece must have the proper magnifying power, the final image presented to the eye must be at infinity, and the required eye relief must be obtained.