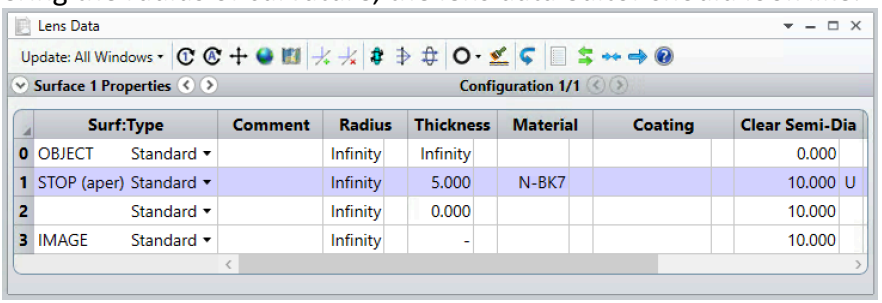
What are the effective focal length (in mm), the working f-number, the total track (in mm) and the distance (in mm) from the last surface of the lens to the focal plane?

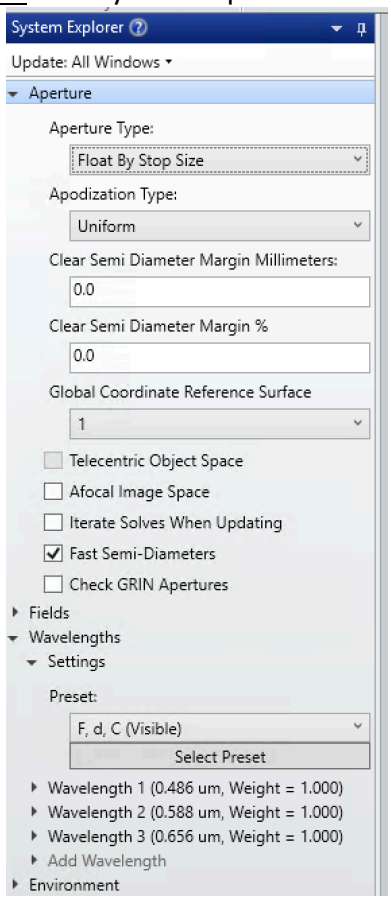
To find the requested quantities:

1. Open OpticStudio and create a new lens with the File/New command.
2. The lens data editor will have three rows with surface types 0: OBJECT, 1: STOP, and 2: IMAGE. Right (or on a Mac trackpad, two-finger) click on the row 1:STOP in any column except the Surf:Type to bring up a menu that begins with Copy Cell. Select Insert Surface After so that the surfaces are now 0: OBJECT, 1: STOP, 2: and 3: IMAGE.
3. On surface 1: STOP, enter the radius of curvature you calculated in 1.c (as a positive number), a thickness of 5 mm, material of N-BK7 and clear semi diameter of 10 mm. Before entering the radius of curvature, the lens data editor should look like:

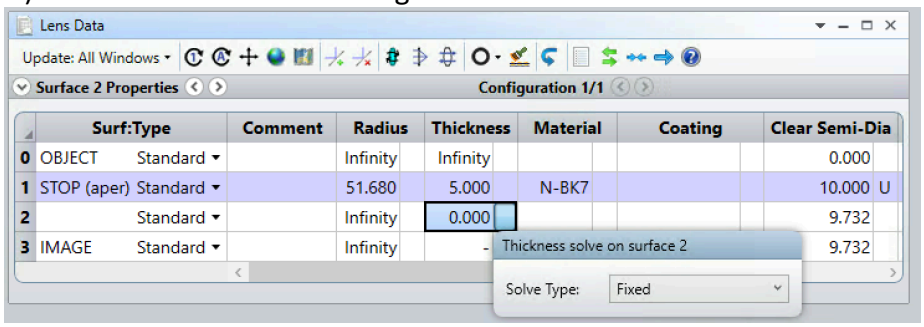


	Surf:Type	Comment	Radius	Thickness	Material	Coating	Clear Semi-Dia
0	OBJECT Standard		Infinity	Infinity			0.000
1	STOP (aper) Standard		Infinity	5.000	N-BK7		10.000 U
2	Standard		Infinity	0.000			10.000
3	IMAGE Standard		Infinity	-			10.000

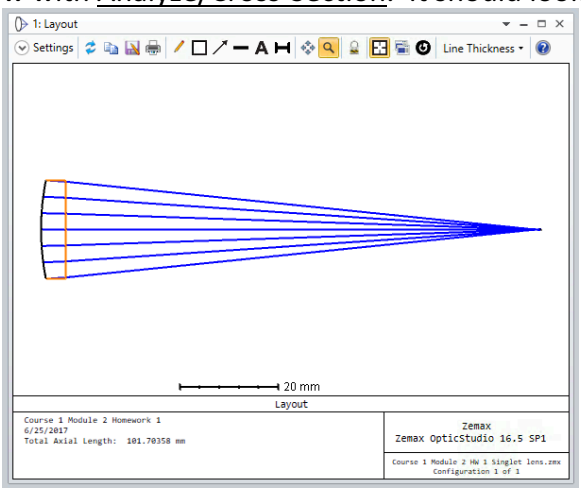
4. Using the Setup/System Explorer, enter the aperture as Float by Stop Size and the wavelengths as (F, d, C) Visible. The System Explorer window should look like:



5. On surface 2, click on the small column just to the right of thickness to bring up a menu labeled “Thickness solve on surface 2” as shown below. From the Solve Type menu, select Marginal Ray Height and hit return. This is a “solve” – a calculation done by OpticStudio to solve for a property of the lens. In this case, you are setting the thickness from the back surface of the lens (#2) to the image (#3) such that the *marginal ray* which just hits the outer edge of the stop is forced to have a height of zero at the next surface. In other words, the program will choose the distance from surface 2 (the back of the lens) to surface 3 such that the light comes to a focus at surface 3.



6. To understand the function of this “solve” and see how your lens is performing, bring up a layout window with Analyze/Cross-Section. It should look like:



Since the object (surface 0) is at infinity, no rays are draws before surface 1 (the curved glass surface). Note that the rays come to a focus at surface 3.

7. The first three quantities requested are reported at the bottom of the window. Note that the *effective focal length* and the *back focal distance* (the thickness of surface 2) are not the same, for reasons we will understand later in the course. The *working f-number* is close to your design goal but differs due to the finite thickness of the lens. The *total track* is the length of the lens on the axis from the surface 1 to the focal point.