

## Exercise on RAY TRACING assigned on August 28, 2023

1. By using Beam Four verify that the lensmaker's formula is correct: use a bi-convex lens, the lens' dielectric has a refractive index equal to 2.2 and the focal length must have a value between 4 and 10 cm. At least two figures of the report must clearly show how the traced rays identify the focal position on both sides of the lens.
2. By using Beam Four verify that in the case of a compound lens made of 2 bi-convex lenses  $L_1$  (having focal length  $f_1$ ) and  $L_2$  (having focal length  $f_2$ ) the distance  $s_i$  between  $L_2$  and the image is given by the following formula:

$$s_i = \frac{f_2 d - \frac{f_1 f_2 s_o}{s_o - f_1}}{d - f_2 - \frac{f_1 s_o}{s_o - f_1}}$$

where  $s_o$  is the separation between the object and the first lens  $L_1$  and  $d$  is the separation between the two lenses. The dielectric refractive index is 2.2 and the two lenses must have different focal lengths (in any case, between 4 and 10 cm). The distance  $d$  must be chosen by the student and more than one value can be considered during the analysis.

The report must include at least two figures showing the formation of an image and a brief description of the procedure to check the proposed formula.

The deadline for submitting the report (which must be a pdf file NO longer than 3 pages) and the Beam Four files (separate files for point 1 and 2) is September 15, 2023. Report and files must be sent to [daniele.modotto@unibs.it](mailto:daniele.modotto@unibs.it) and the email subject must be: solution exercise August 28.