Optimized Multi-element Lens Design

The convex doublet lens focal length is 25 cm, the diameter is 1.95 cm, the principle plane position is 0.2390383 cm (Fig. 1). The concave doublet lens focal length is -15 cm, the diameter is 1.2 cm, the principle plane is 0.1125710 cm (Fig. 2). The focal length is same as my initial singlet lens design, the diameter is larger than the singlet lens design (convex: 1.5 cm; concave: 0.4319 cm).

The doublet lens distance = initial design distance – convex principle plane position – concave principle plane position.

Design EFL	30 cm	35 cm	40 cm
Initial design distance	22.5 cm	20.73 cm	19.37 cm
Doublet lens distance	22.1484 cm	20.3784 cm	19.0184 cm
Initial double lens EFL	29.9228 cm	34.8439 cm	39.8837 cm
Initial double lens throw	26.7489 cm	27.9316 cm	29.5955 cm

The double lens intial EFL is within +/- 0.25 cm of initial design. The initial throws are all under 30 cm. (Fig. 3-Fig. 5) The initial merit function value is 0.423473470 (Fig. 6).

After optimization of the separations, the merit function drop to 0.047088201 (Fig. 7). After lens shape optimzation, the merit function drop to 0.000117041(Fig. 8).

The final design parameter are list as below (Fig. 9 – Fig. 11), same as the initial double lens parameters.

Final double lens EFL	30 cm	35 cm	40 cm
Final double lens Throw	26.7489 cm	27.9316 cm	29.5955 cm

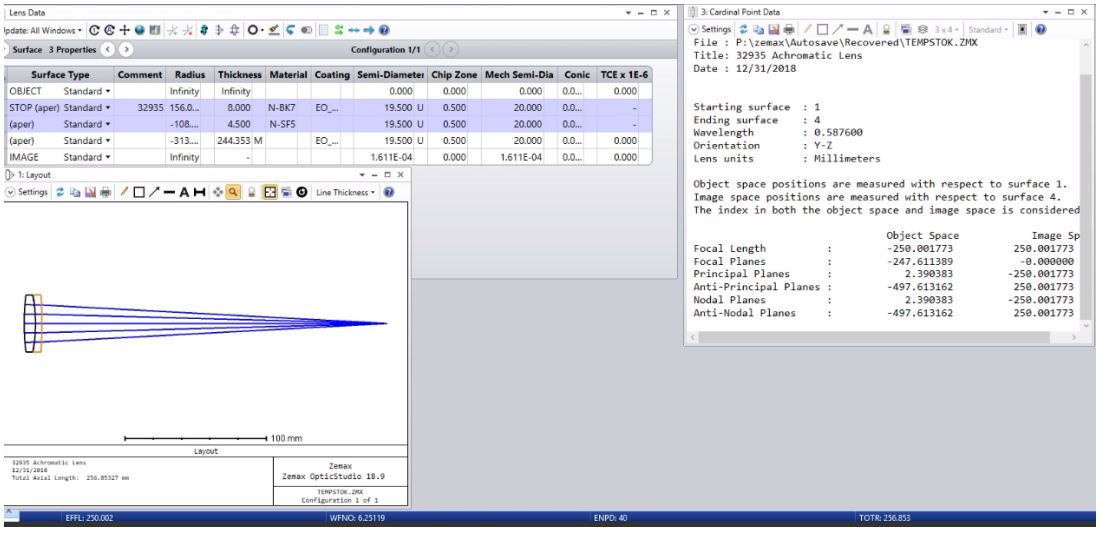

Fig. 1 The focal length, diameter and principle planes position of initial convex doublet lens.

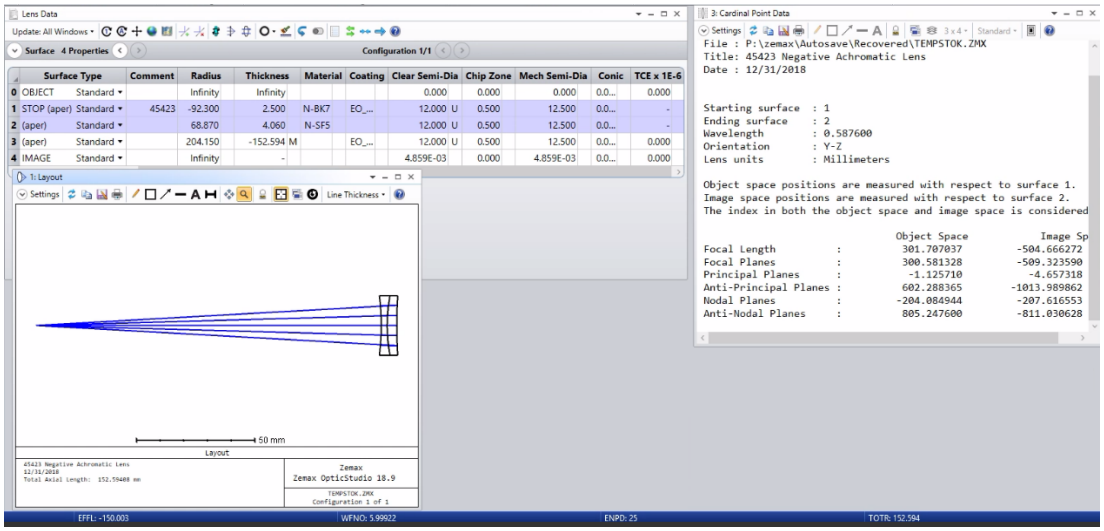

Fig. 2 The focal length, diameter and principle planes position of initial concave doublet lens.

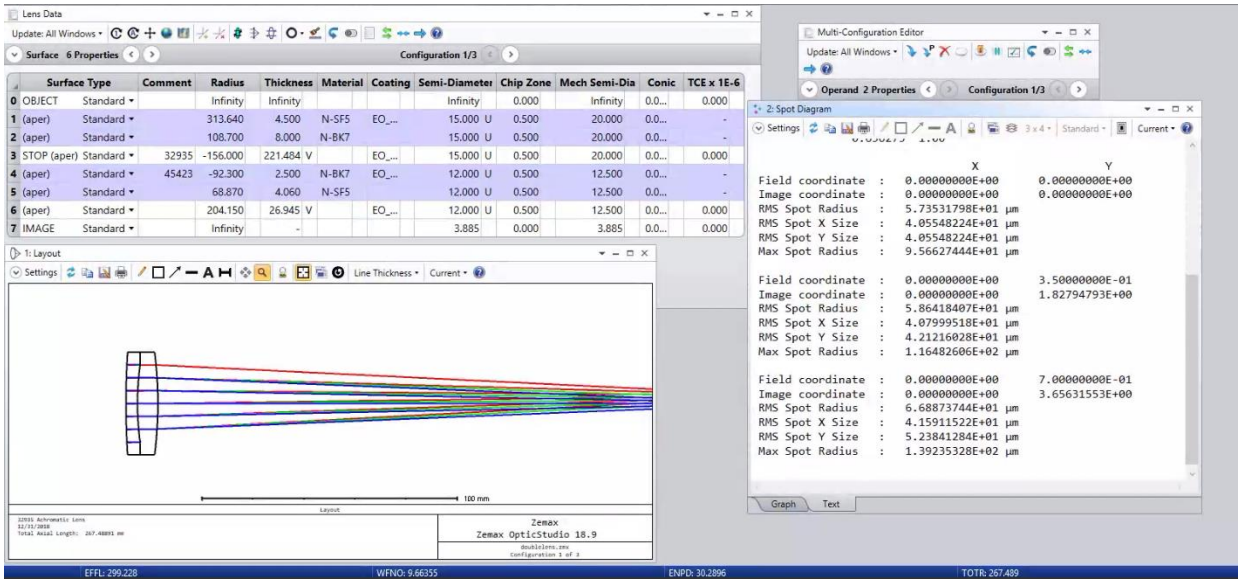

Fig. 3 Initial OpticStudio lens data, layout and spot radius of planed EFL = 30 cm.

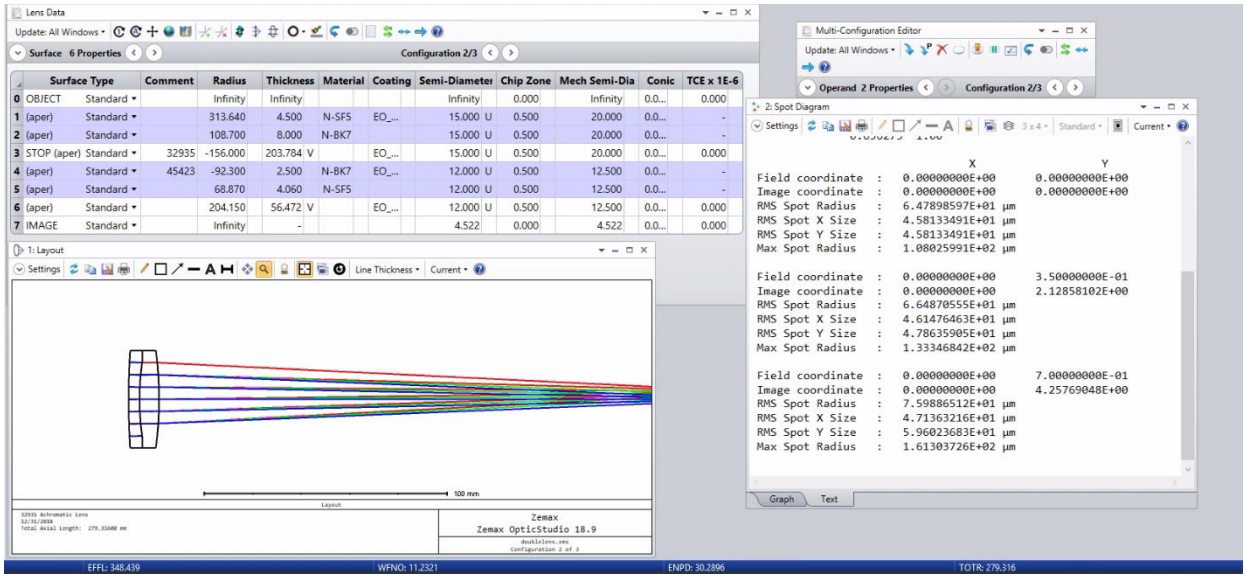

Fig. 4 Initial OpticStudio lens data, layout and spot radius of planed EFL = 35 cm.

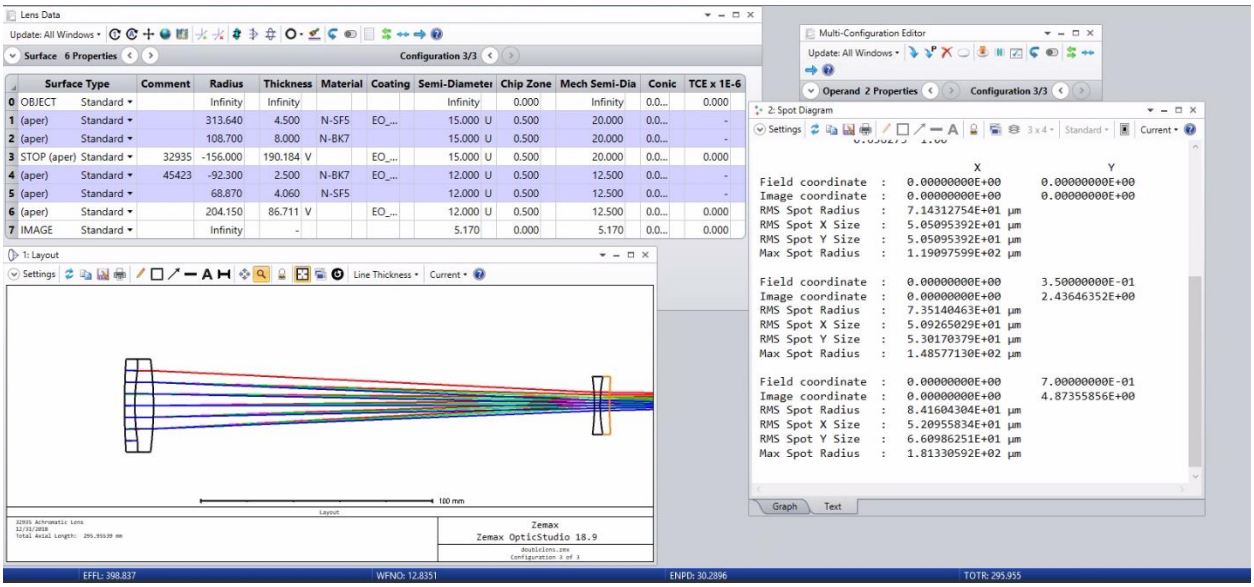

Fig. 5 Initial OpticStudio lens data, layout and spot radius of planed EFL = 40 cm.

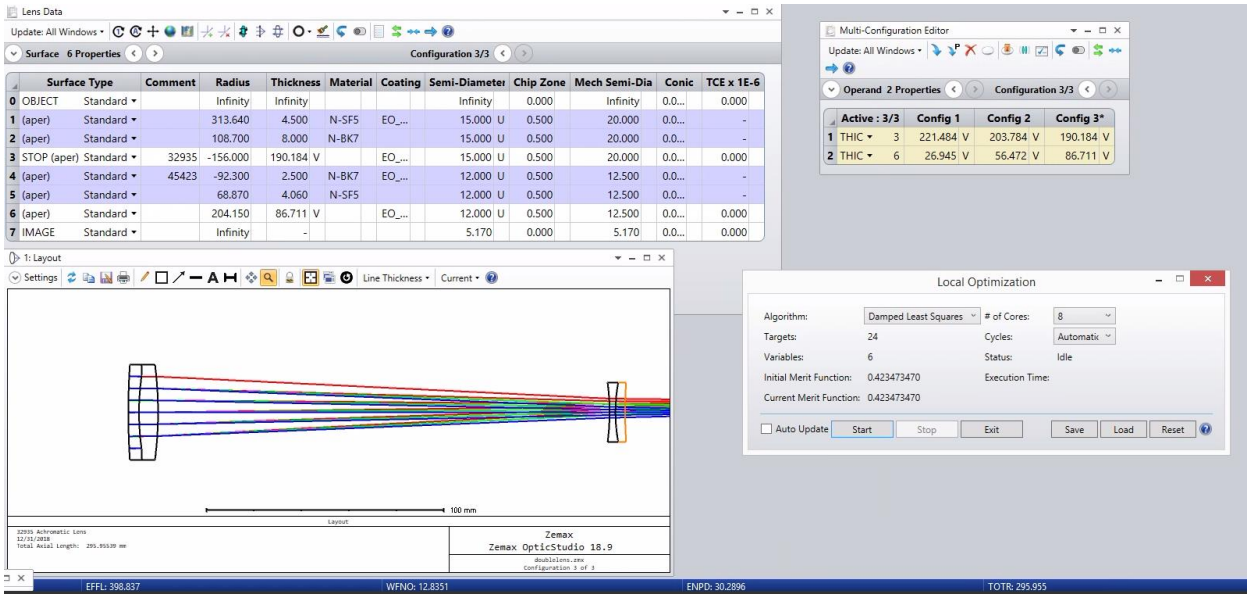

Fig. 6 Initial Merit Function of doublet lens zoom lens design.

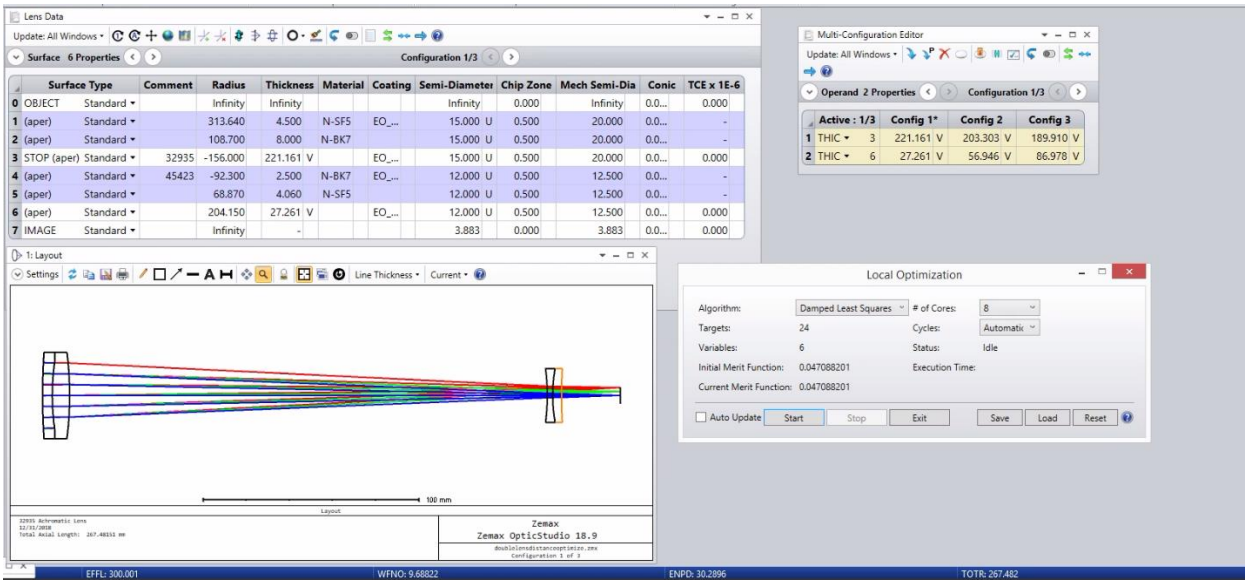

Fig. 7 Merit Function of doublet lens zoom lens design after separation optimization.

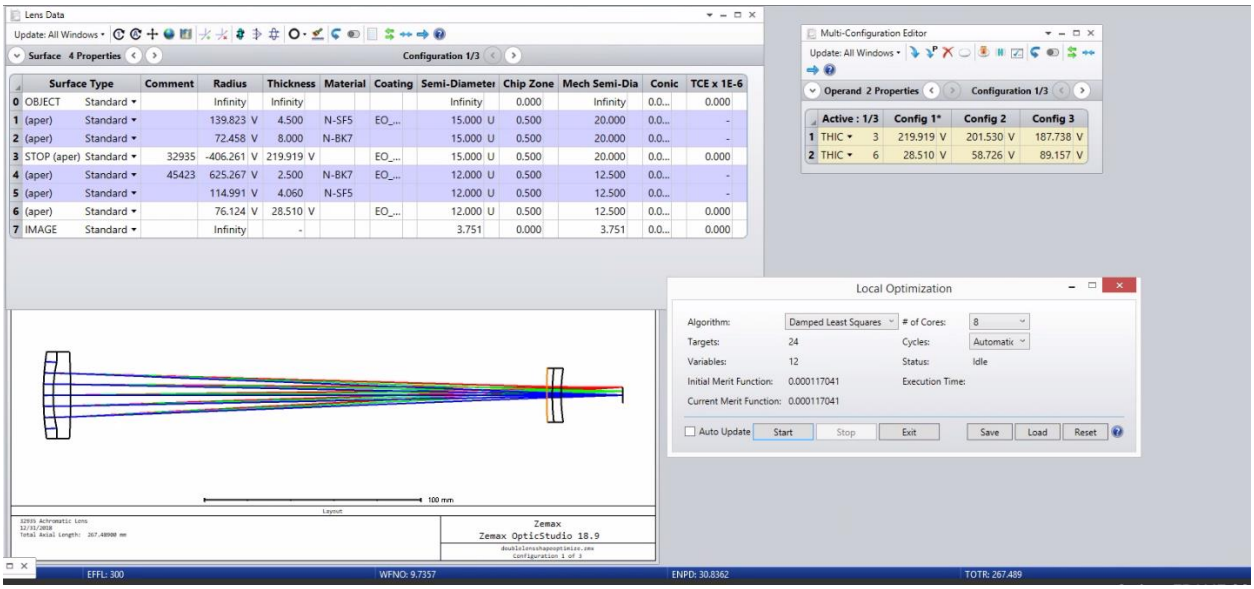

Fig. 8 Fig. 7 Merit Function of doublet lens zoom lens design after shape optimization.

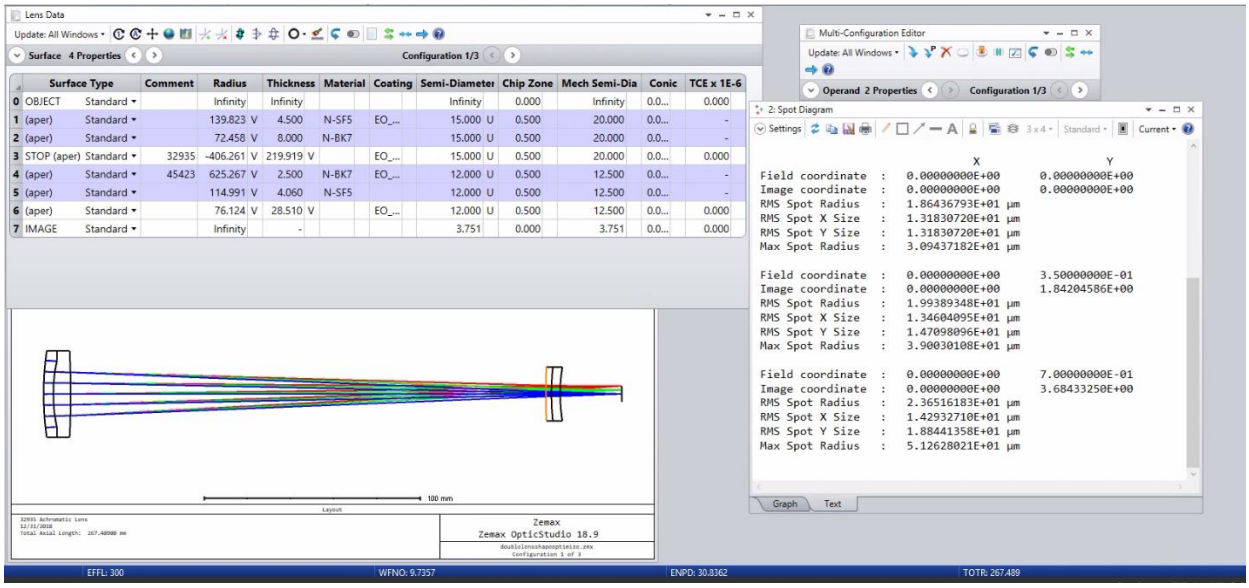

Fig. 9 OpticStudio lens data, layout and spot radius of planed EFL = 30 cm after optimization.

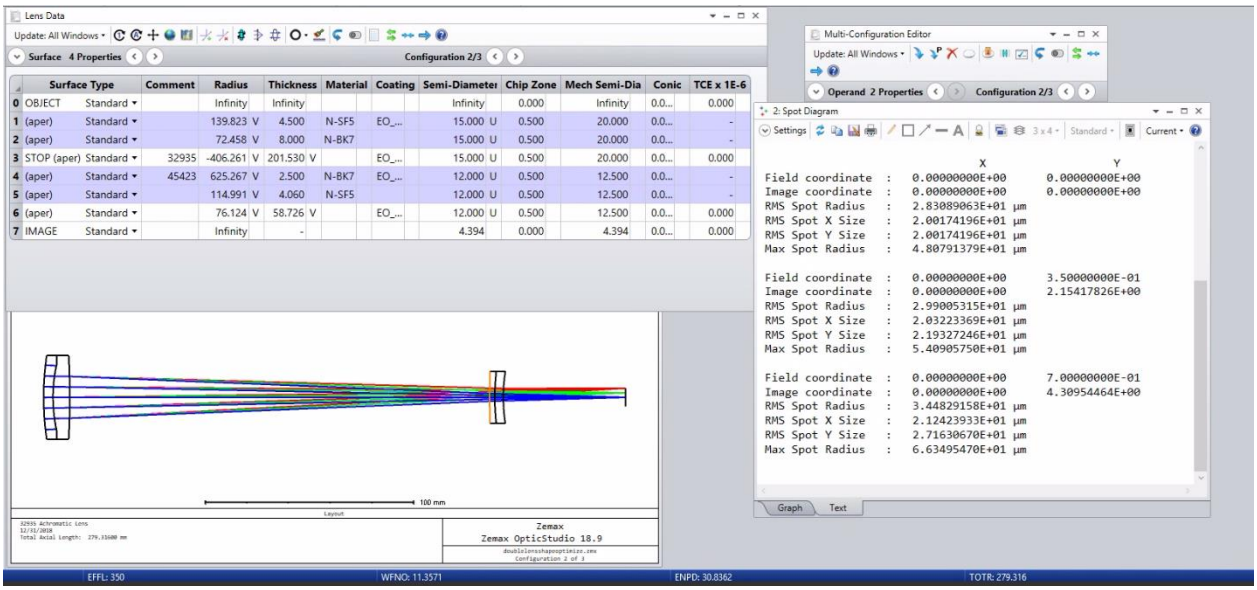

Fig. 10 OpticStudio lens data, layout and spot radius of planed EFL = 35 cm after optimization.

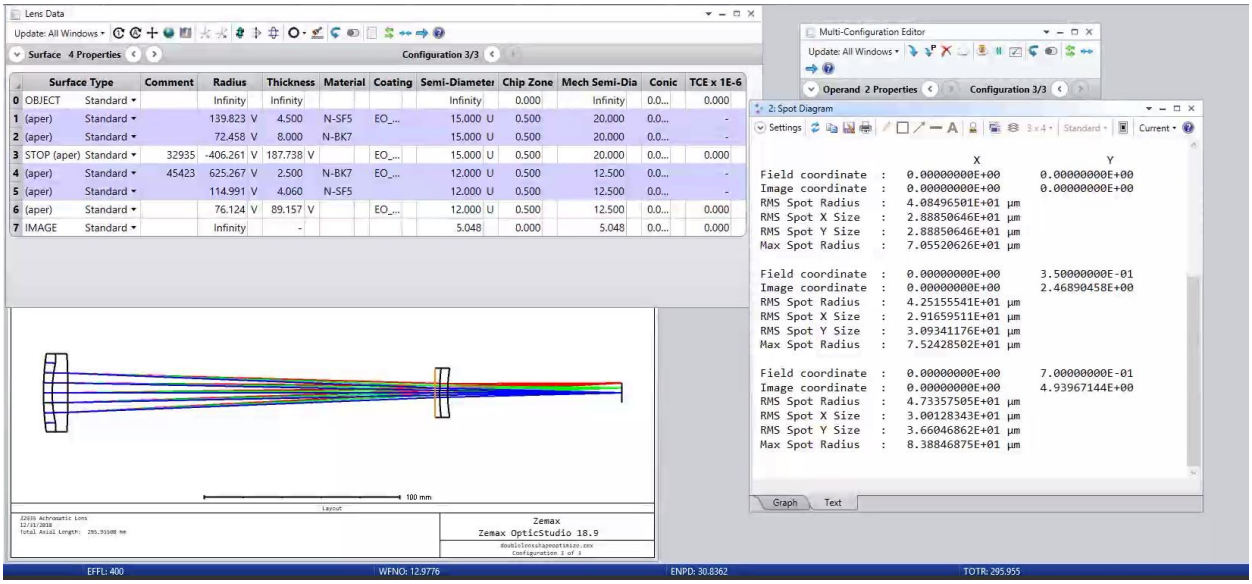

Fig. 11 OpticStudio lens data, layout and spot radius of planed EFL = 40 cm after optimization.