Solution to: Simplified study of a research microscope

A- First design of the microscope

1. f'_{obj}=20mm
2. PE at infinity. NA=0.25.
3. G_{ey}=10
4. P_{mic}=400δ. G_{mic}=100
5. 2mrad
6. λ/2NA=1µm
7. $2'/P_{mic}$=1.5µm
8. 25µm
9. PS in the plane of F'_{ey}. Dia PS=1.25mm
10. See drawing 1.
11. See drawing 1.

Study of the field of view :

12. See drawing 1.
13. objective: 12mm ; Tube lens: 30mm; Eyepiece: 21.25mm
14. Angular diameter of BF: 0.8rad (45.8°).

Second part of the problem : new design for the tube lens

15. 120mm from the objective lens, 100mm from D
16. *Only the exit pupil position* has changed. Now it is at 1.56mm to the left of F'_{ey}
17. No. Depth of field due to accommodation depends only on the power of the microscope.
18. See drawing 2.
19. See drawing 2.
20. Eyepiece diameter: 22.5mm
21. Same as first design (same object field, same microscope power)

Third part: observation on a CCD camera

22. 2µm (limited by the pixel size)
23. The extra lens should increase the size of the image on the CCD by at least of factor of 2. A negative lens with focal length –20mm, located at 190mm from the tube lens would do the job. The detector would then be at 20mm to the right of the extra lens. A positive lens with focal length +20mm located at 230mm from the tube lens works also, the detector being at 60mm to the right of that extra lens. The field of view would be limited by the detector; at best: 512*resolution limit=512µm.