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THE USE OF ANNULAR LENSES IN WIDE ANGLE OPTICAL SYSTEMS

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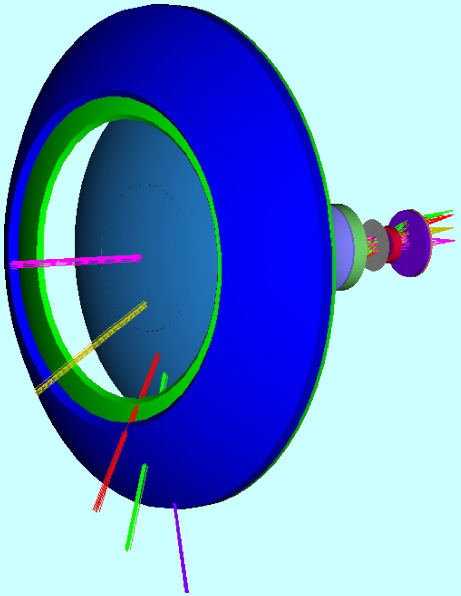


Outline

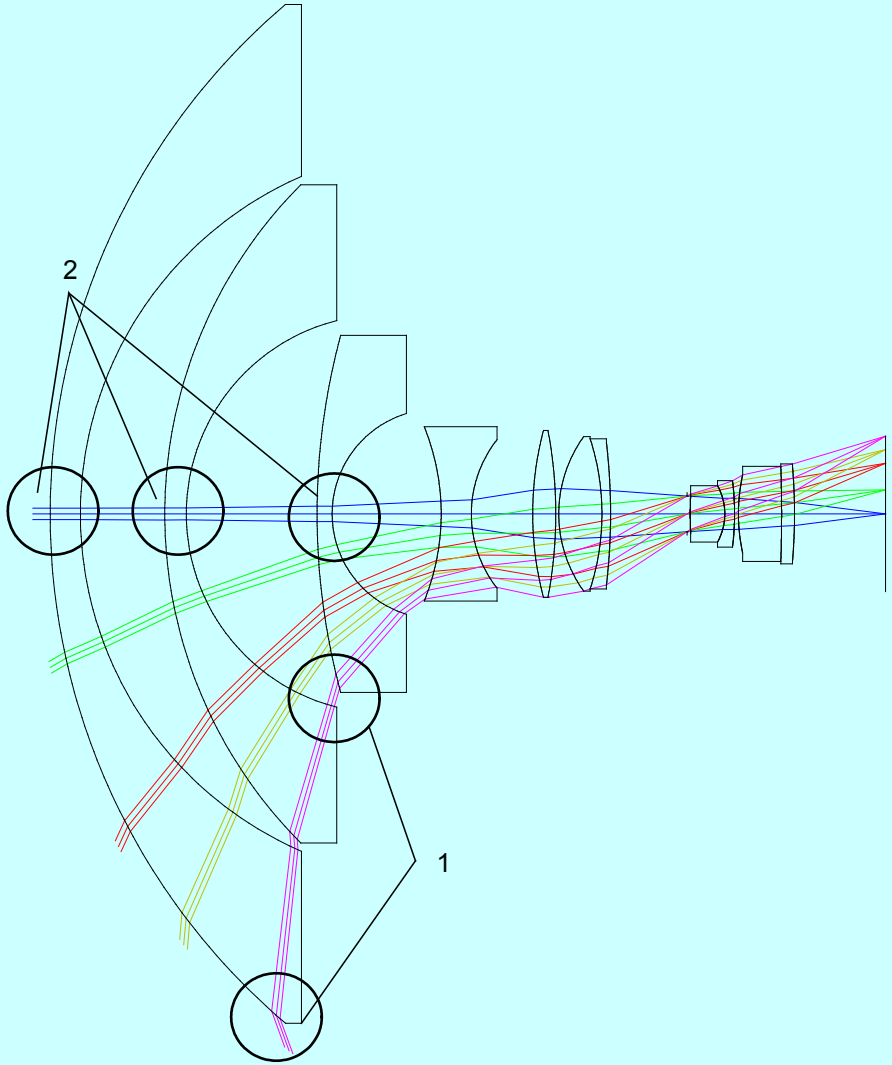
- Problems in wide angle optical systems design and a way to solve them
- Design results
- Merit function design
- The technological effectiveness

  - Special requirements

  - Comparison

- Conclusions

Problems in wide angle optical systems design



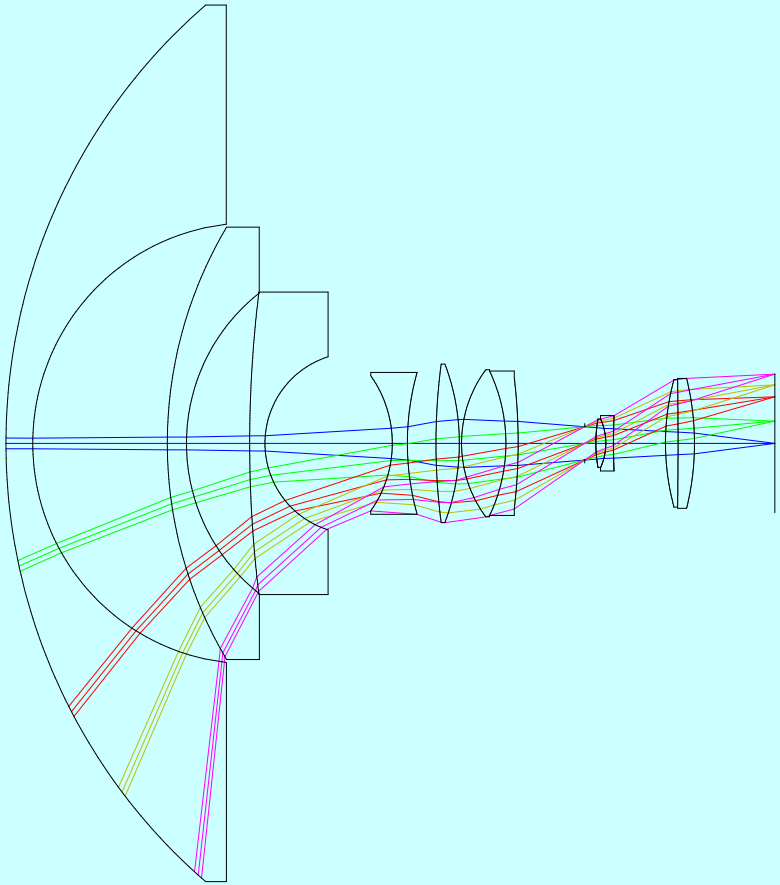
1 - large angles of incidence on the surface,

2 - the thickness of the lens on the axis.

Expensive materials to improve quality.

Big frontal lenses need large blanks

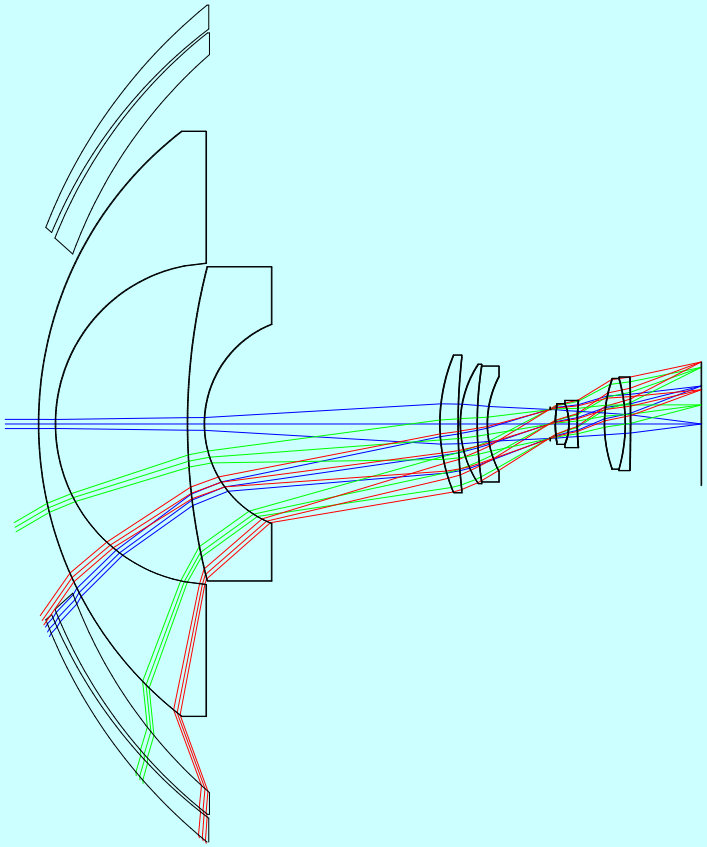
“Classical” optical systems



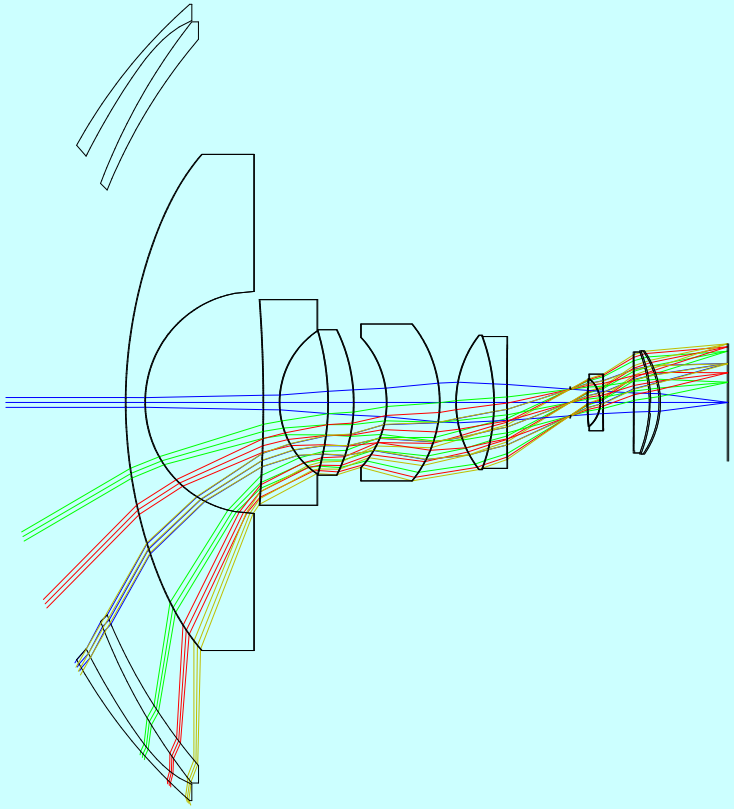
Optical systems characteristics:

- field of view of 220°;
- focal plane array size of 36x36 mm;
- f-number is 1:4;
- working spectral range of 440-680 nm;
- front lens diameter of less than 240 mm;
- MTF ≥0.6 at 35 cycles/mm

Optical systems with annular lenses



Field of view with a blind zone of 2.4°



Continuous field variant with aspherical lenses

Weight decrease of more than 30%.

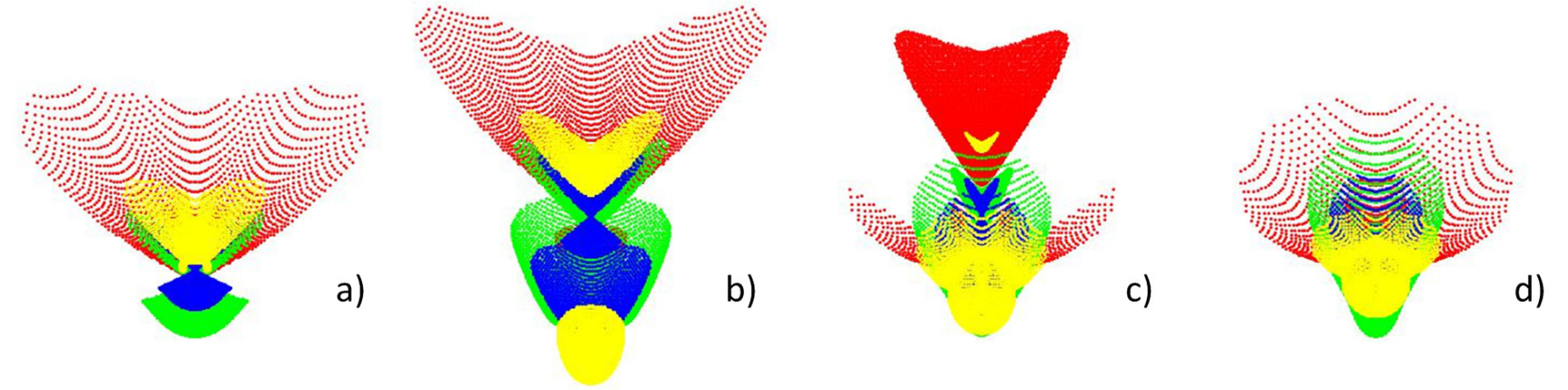
The requirements for merit function in optical systems with annular lenses

1. The same distortion near the overlapping area

2. Fields alignment is based on ray height of spot centroid on image plane

3. Similar PSF in overlapping area

The influence on the image quality



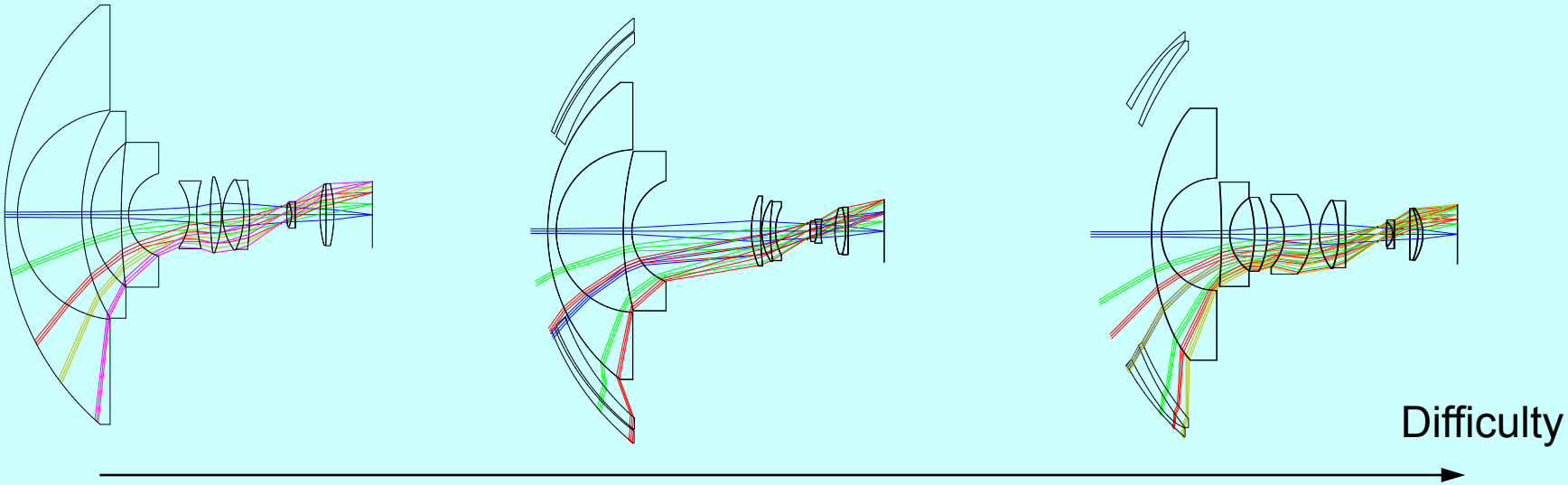
Spot diagrams of a lens with continuous field (not full correction).

Errors in design:

1)Increase RMS spot size in overlapped area.

2)Different PSF in inner and outer parts distort bokeh and problems for identification algorithm.

Technological effectiveness of the systems (manufacturing and assembly)



Annular lenses increase the requirements for the rear part of the lenses (manufacture, assembly and glass quality).

Additional requirements to remove the field asymmetry.

Error in manufacturing and assembly:

1. Field of view with a gap or double image.

2. Asymmetric field of view (manufacture and assembly errors).

Conclusions

1. Annular lenses allow to solve the discussed problems in wide angle optical system
2. Merit function for continuous field variant was discussed
3. Technological problems:
    1. Lens manufacturing
    2. The system alignment
4. Despite some challenges, the solution can be useful in certain applications

Thank you for your attention!

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