

## **Development of a Customized Super Wide Angle Camera Lens**

### **Topics:**

- Specifications
- Technical Aspects
- Economical Aspects
- Comparison
- Next Steps
- Questions to the Chip Manufacturer

### **Specifications:**

- Low Cost
- Low Working Distance
- Super Wide Angle
- Low Distortion, High Resolution

## Development of a Customized Super Wide Angle Camera Lens

### Technical Aspects:

Classical Optical Design - "Theory"-Approach: (*Cooke Triplet*)

Three lenses (positive, negative, positive) sufficient to compensate for:

- Petzval (field) curvature
- spherical aberration, coma, astigmatism
- distortion

Does not work: Wide Angle requires starting with a negative lens!

Classical Optical Design: - "Practical" Approach: (*e.g. Topogon Lens*)

Symmetrical lenses reduce field curvature and distortion problems.

Does not work: Either too large, or too slow (typical f:30, Hypergon).

Experimental Approach:

Starting with the Reverse Telephoto Approach (1st lens: "big" negative meniscus reducing coverage angle) and optimizing for Petzval sum and distortion, neglecting aberrations.

Restriction: Small number of elements (price!), short length of the lens.

**Literature:** W. J. Smith, Modern Optical Engineering, New York 1966

## **Development of a Customized Super Wide Angle Camera Lens**

### **Economical Aspects:**

- small number of elements
- spherical surfaces
- non-critical design: larger tolerances allowed
- design suitable for mass production

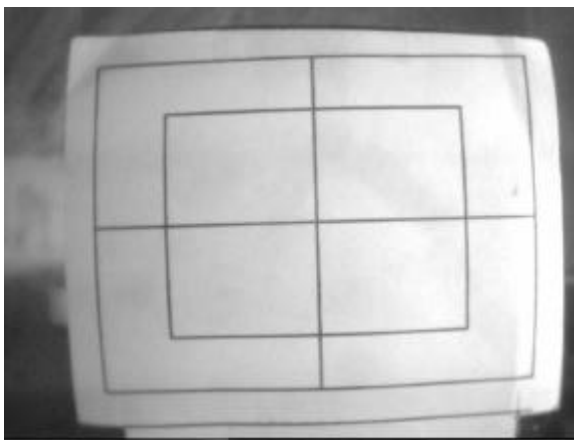
### **Glass Lenses: Comparison**

- standard lens: one element
- commercial wide angle lens: 6 elements
- custom lens NT5a: 3 elements

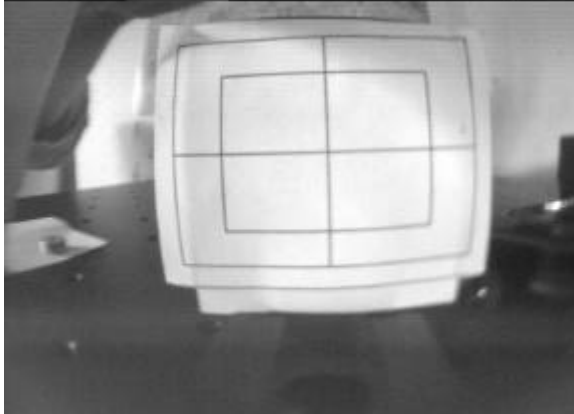


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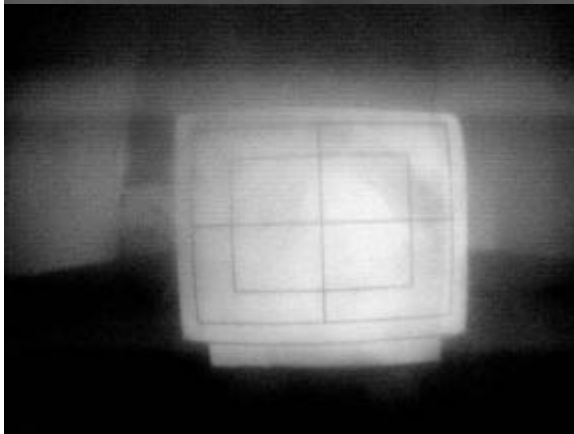
**Lens Comparison** (*at 40 mm object distance*)



1 element lens



6 elements commercial  
wide angle lens

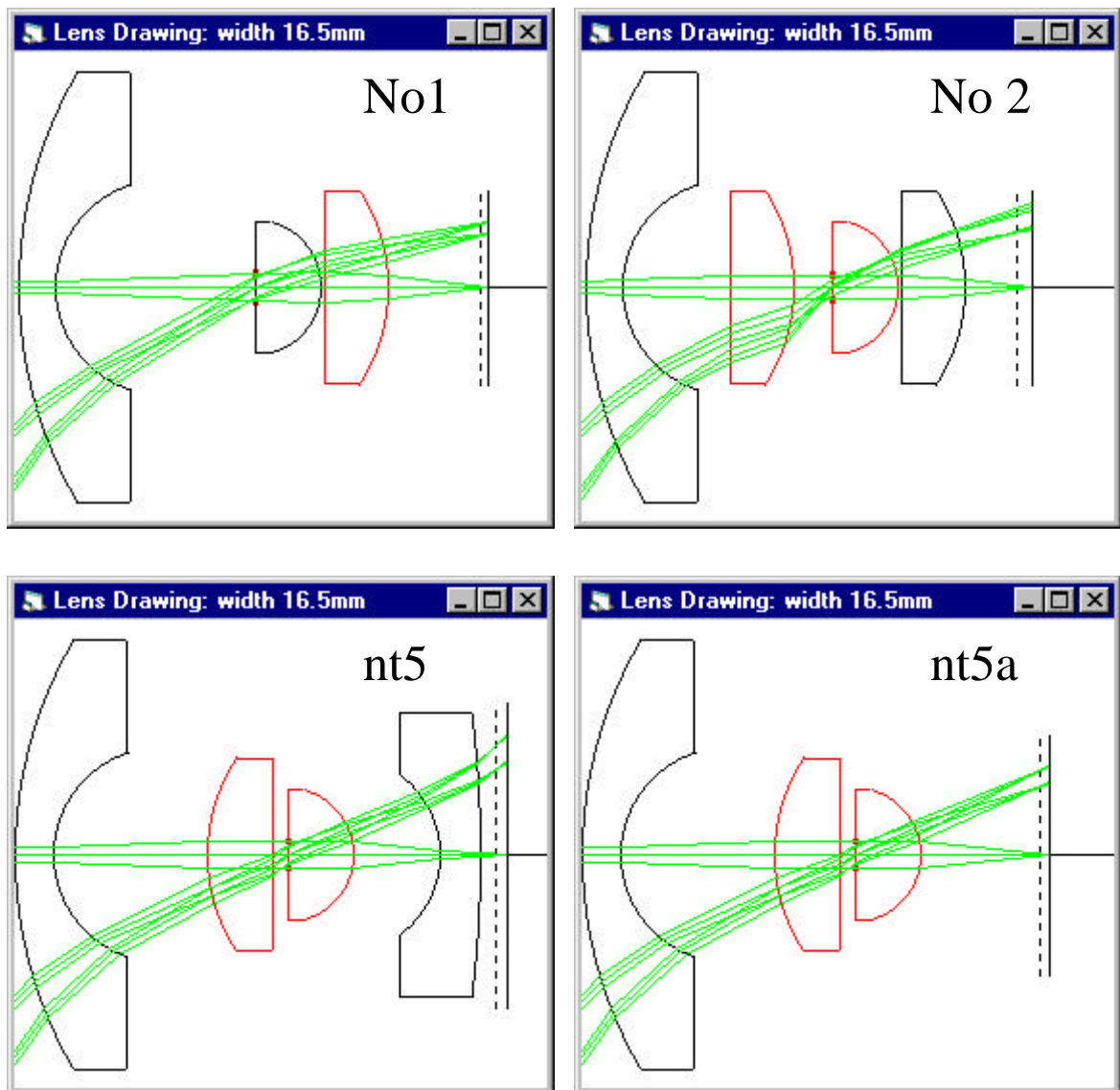


3 elements customized  
wide angle lens

*model NT5a*

reduced contrast due to stray  
light (barrel not yet black  
anodized)

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Development progress: January to April 1999

NT6 is on its way!

## **Development of a Customized Super Wide Angle Camera Lens**

### **Questions about the camera chip:**

- size, geometry
- tolerances
- glass cover: thickness, index of refraction
- lens mount ?
- product cycle time (design changes?)

### **Next steps:**

- further improvement of specs (distortion, field)
- barrel optimization
- "mass production" specs for lenses
- continuous testing

### **Requests, Comments:**

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