

The Tri-Schiefspiegler:

Origins of and developments from a telescope design by Anton Kutter.

Guntram Lampert

Presentation for the International Kutter and ATM days at Biberach

June 16, 2018

The Tri-Schiefspiegler:

Around the mid-1960s, Kutter had already published his major works:

- **1953: Der Schiefspiegler**
- **1958: Bulletin A (in English)**
- **1964: Bauanleitung für den Kosmos-Schiefspiegler**

The Tri-Schiefspiegler:

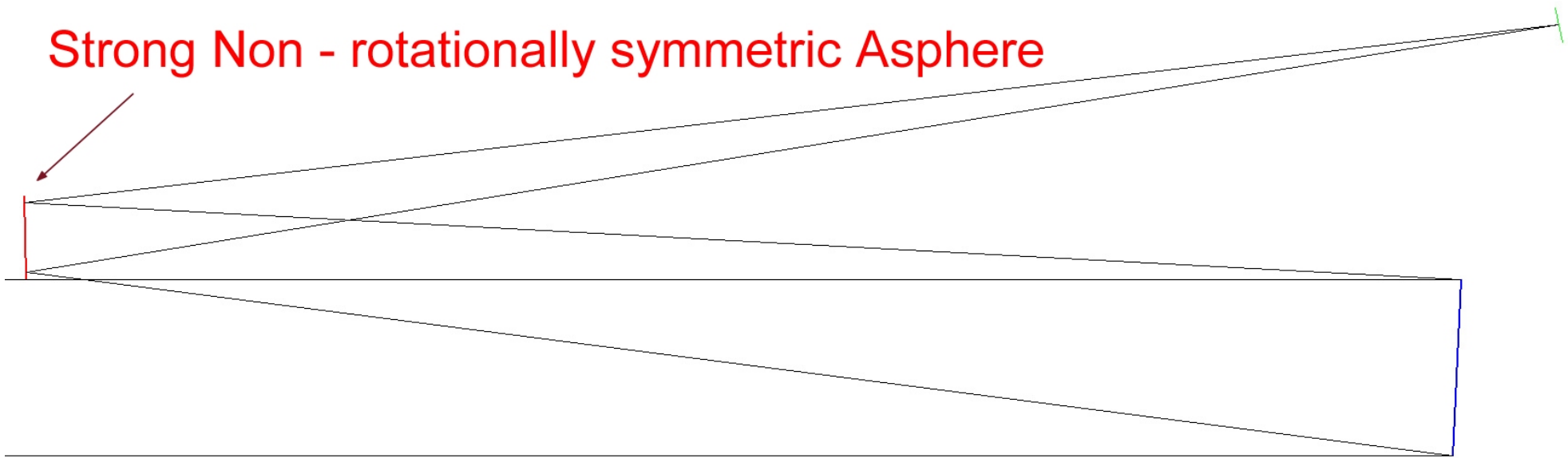
June 13, 1967: New Task

- **Aperture: 600mm**
- **Extreme wavelength range: Visual → 20 μ m Infrared**
- **Comparatively fast: $f/15$**
- **Compact: Must fit into pre-existing dome**

The Tri-Schiefspiegler:

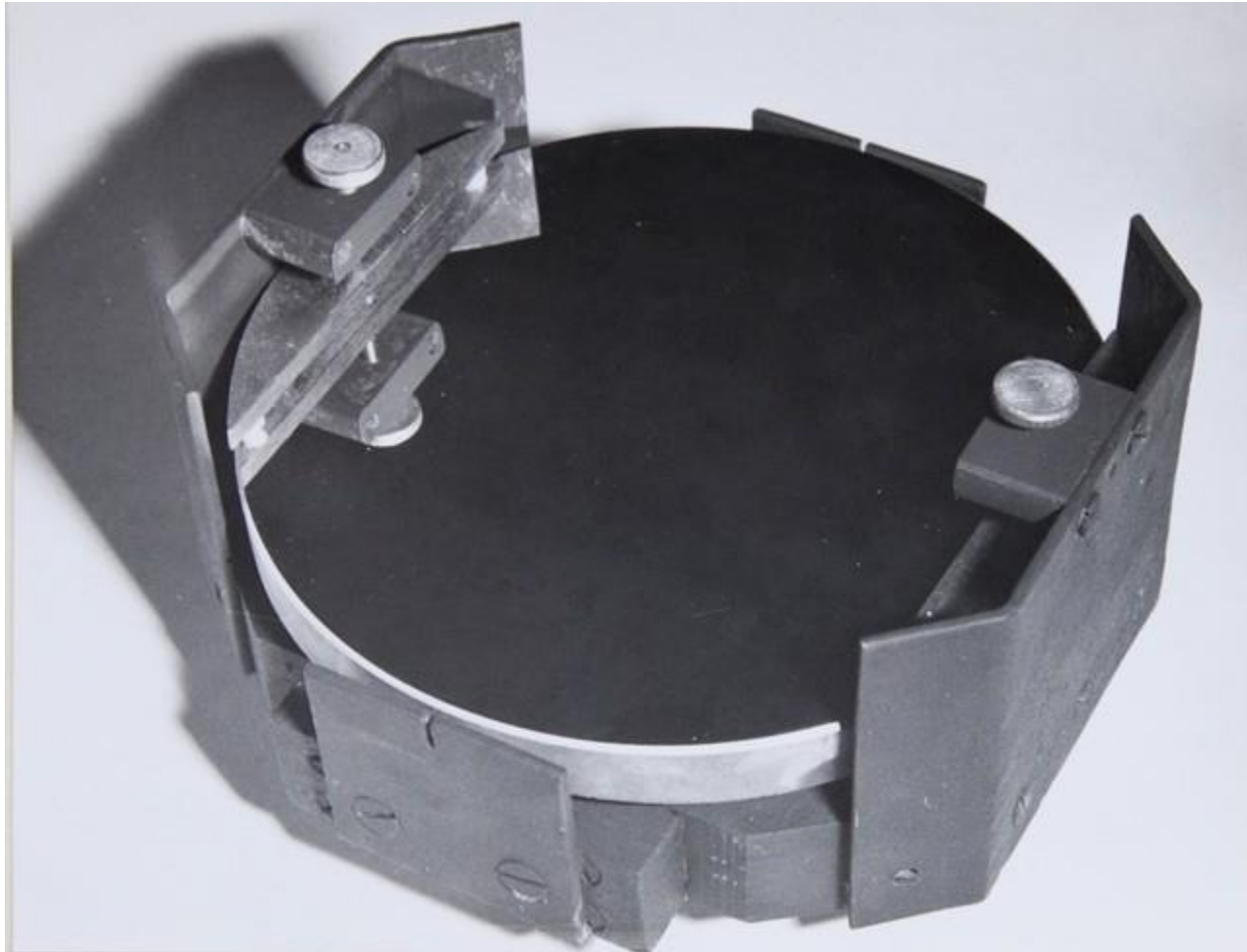
Idea #1:

Strong Non - rotationally symmetric Asphere



The Tri-Schiefspiegler:

Idea #2:

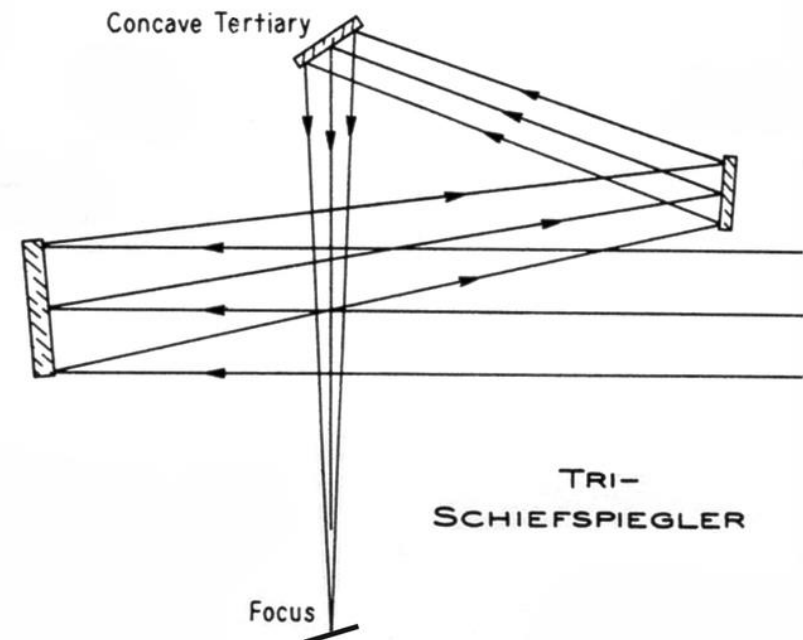
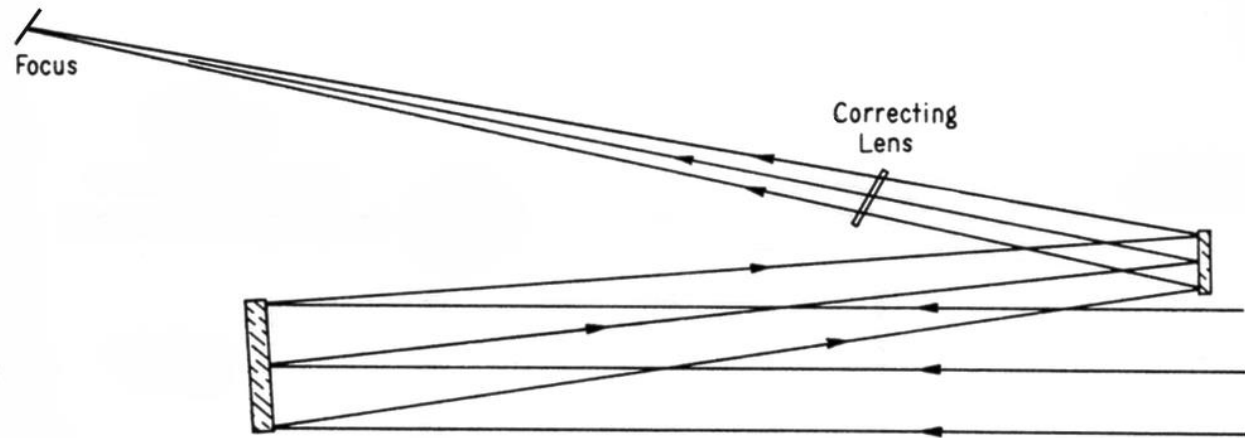


Secondary with cylindrical deformation.

The Tri-Schiefspiegler:

Idea #3:

**Transform the Two-Mirror
Catadioptric Schiefspiegler
into an
All-reflective Tri-Schiefspiegler!**

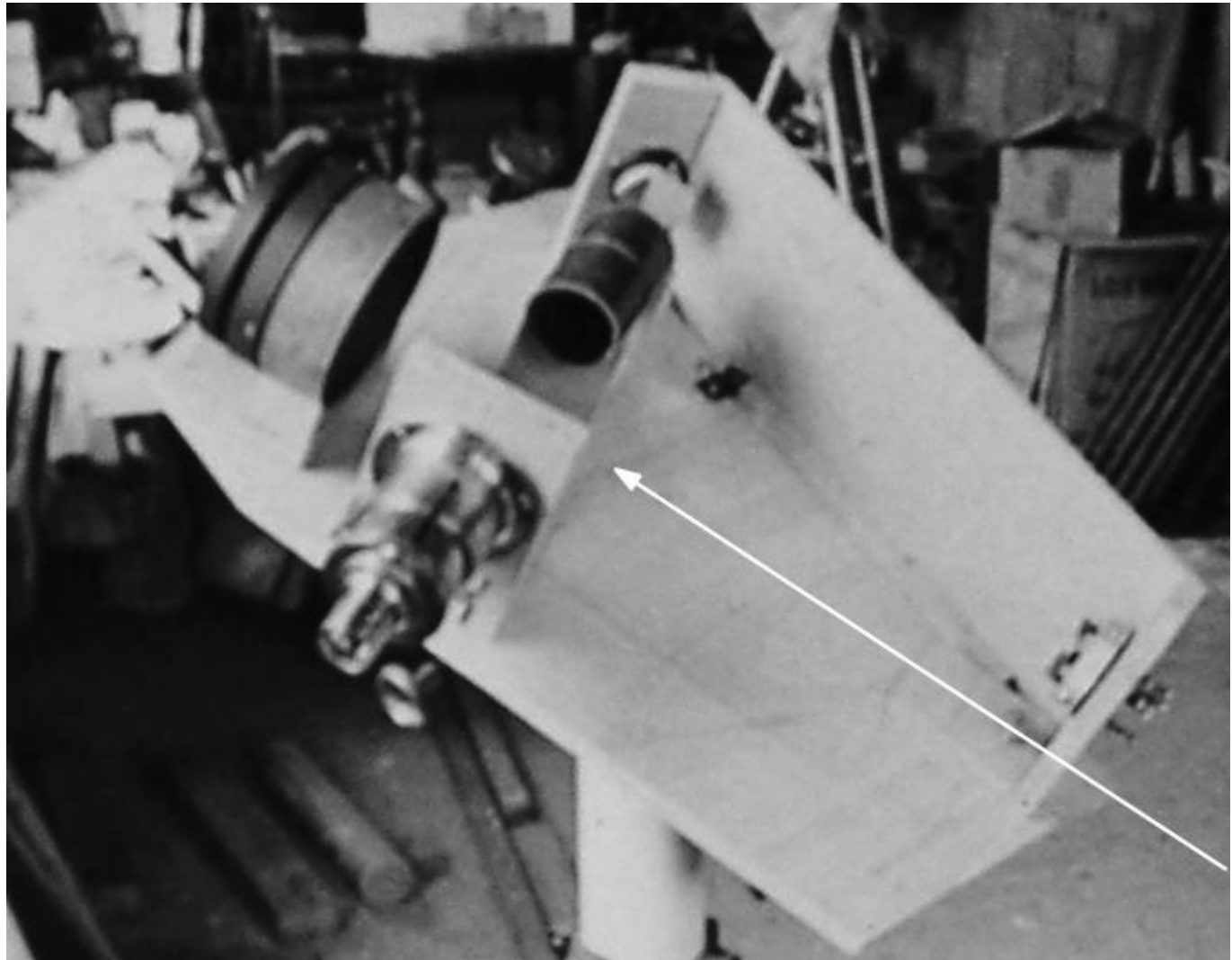


The Tri-Schiefspiegler:

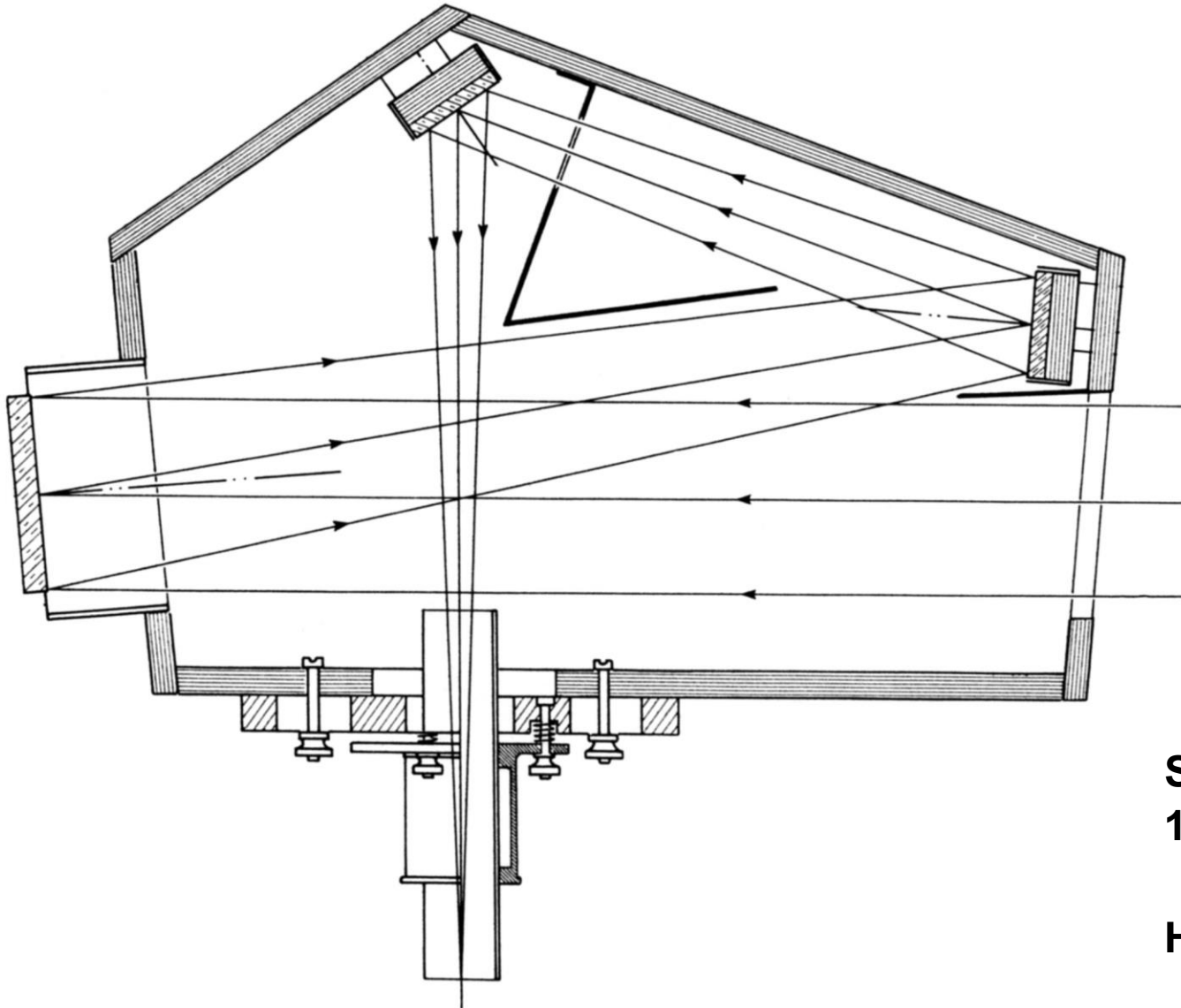
First known photo
of a Tri-Schiefspiegler.

Test-Setup
August 1967

*Beam from tertiary
to focus not yet
perpendicular.
8° off.*



The Tri-Schiefspiegler:

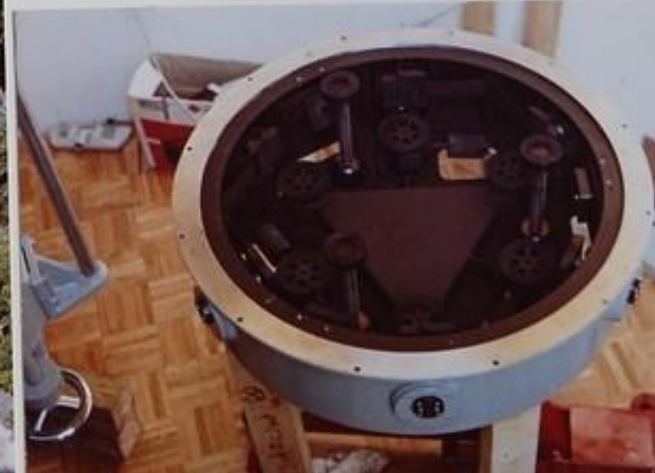


**Scale drawing of the final
110 mm Tri-Schiefspiegler.**

Highly efficient baffles.

The Tri-Schiefspiegler:

Installation of the
600 mm Tri-Schiefspiegler
in Glücksburg in 1969.

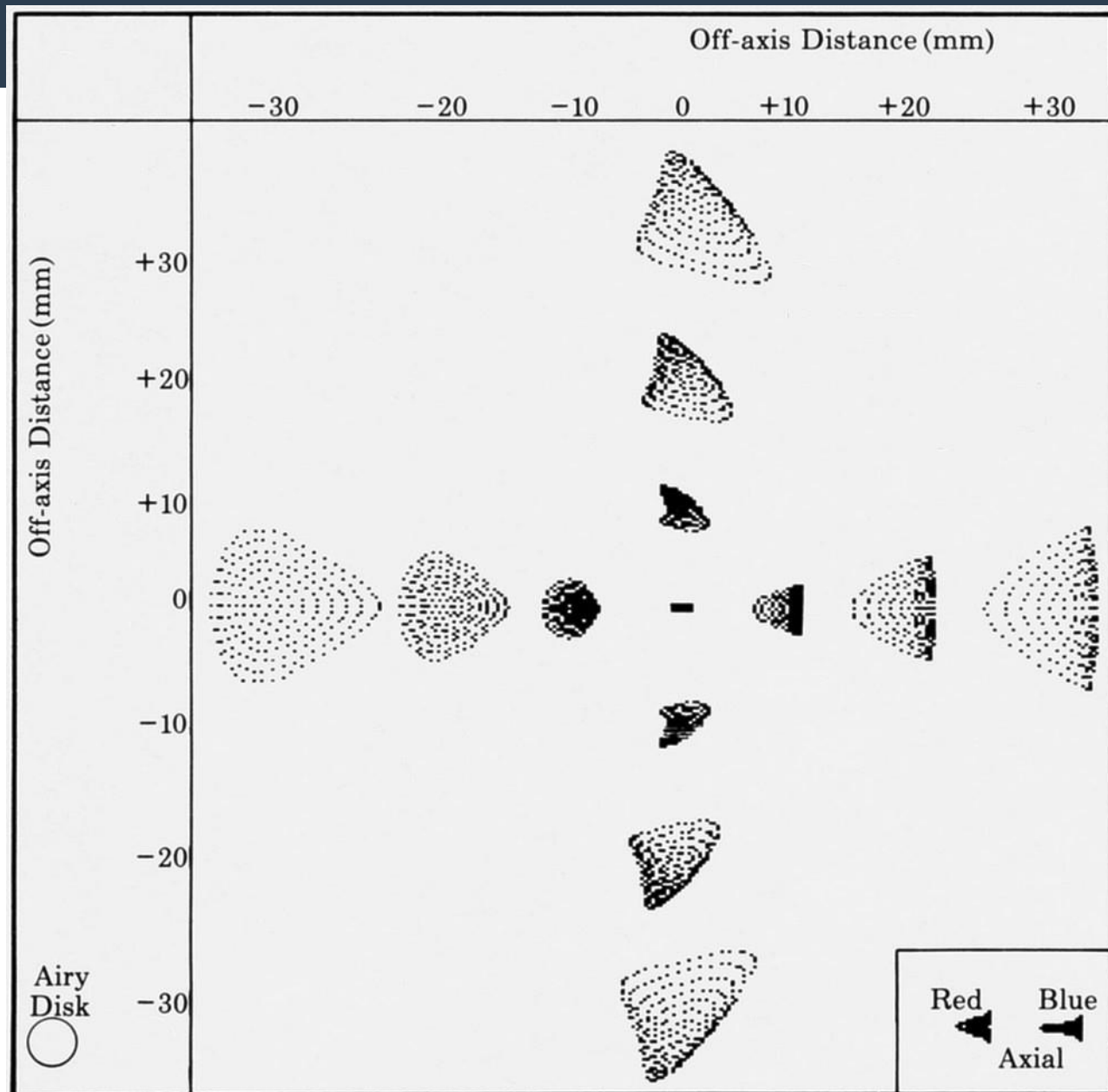


The Tri-Schiefspiegler:

- **1975: Two – part article in *Sky and Telescope*.**
- **Cal-Astro produces complete optics sets of 4.25, 6, and 8 inches aperture.**
- **At least a dozen Tri-Schiefspiegler were made, mostly in the United States.**
- **1988: The book *Telescope Optics* appears and discusses the Kutter Schiefspiegler.**

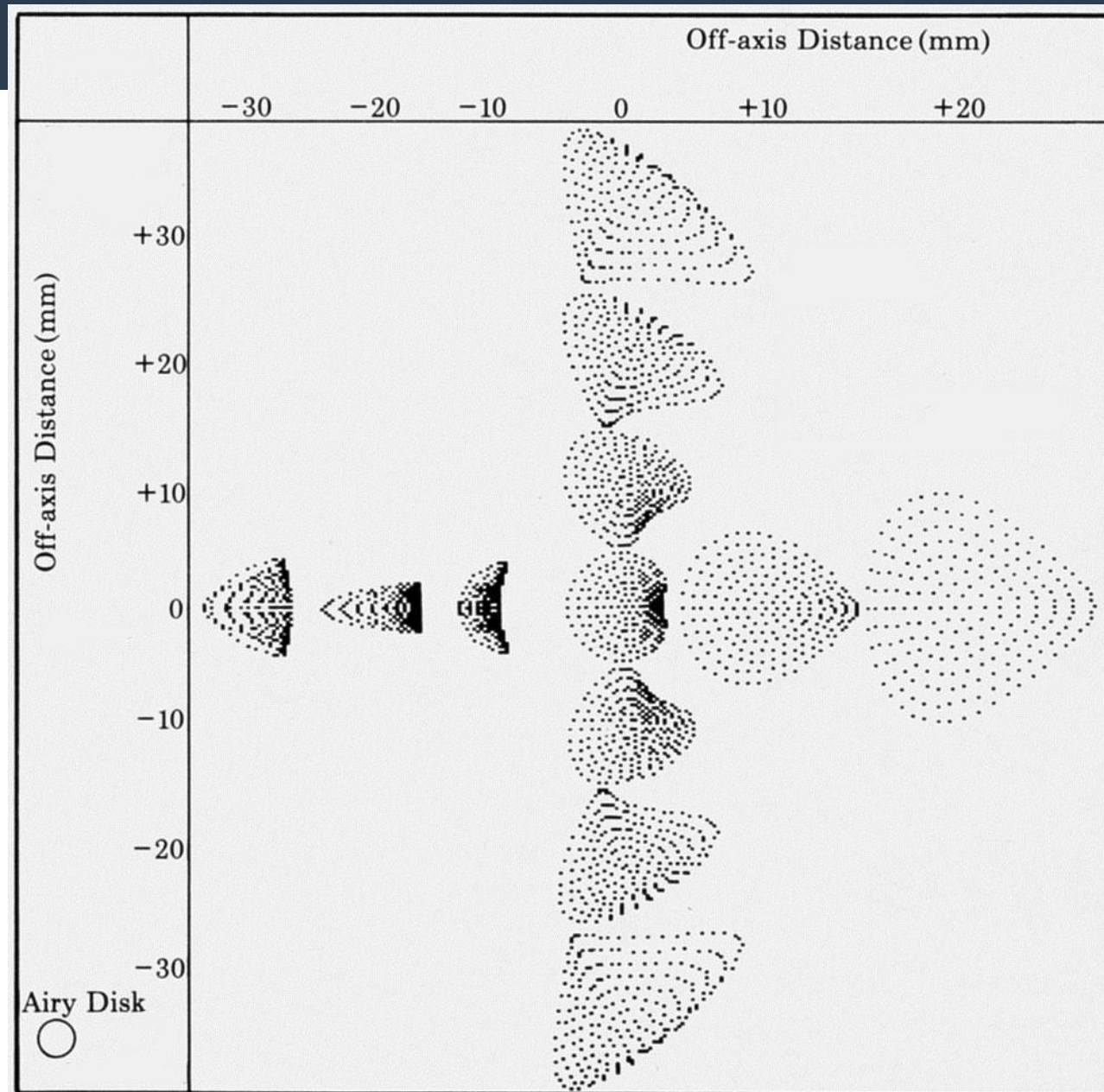
The Tri-Schiefspiegler:

200 mm
Catadioptric
Schiefspiegler:



The Tri-Schiefspiegler:

200 mm Tri-Schiefspiegler

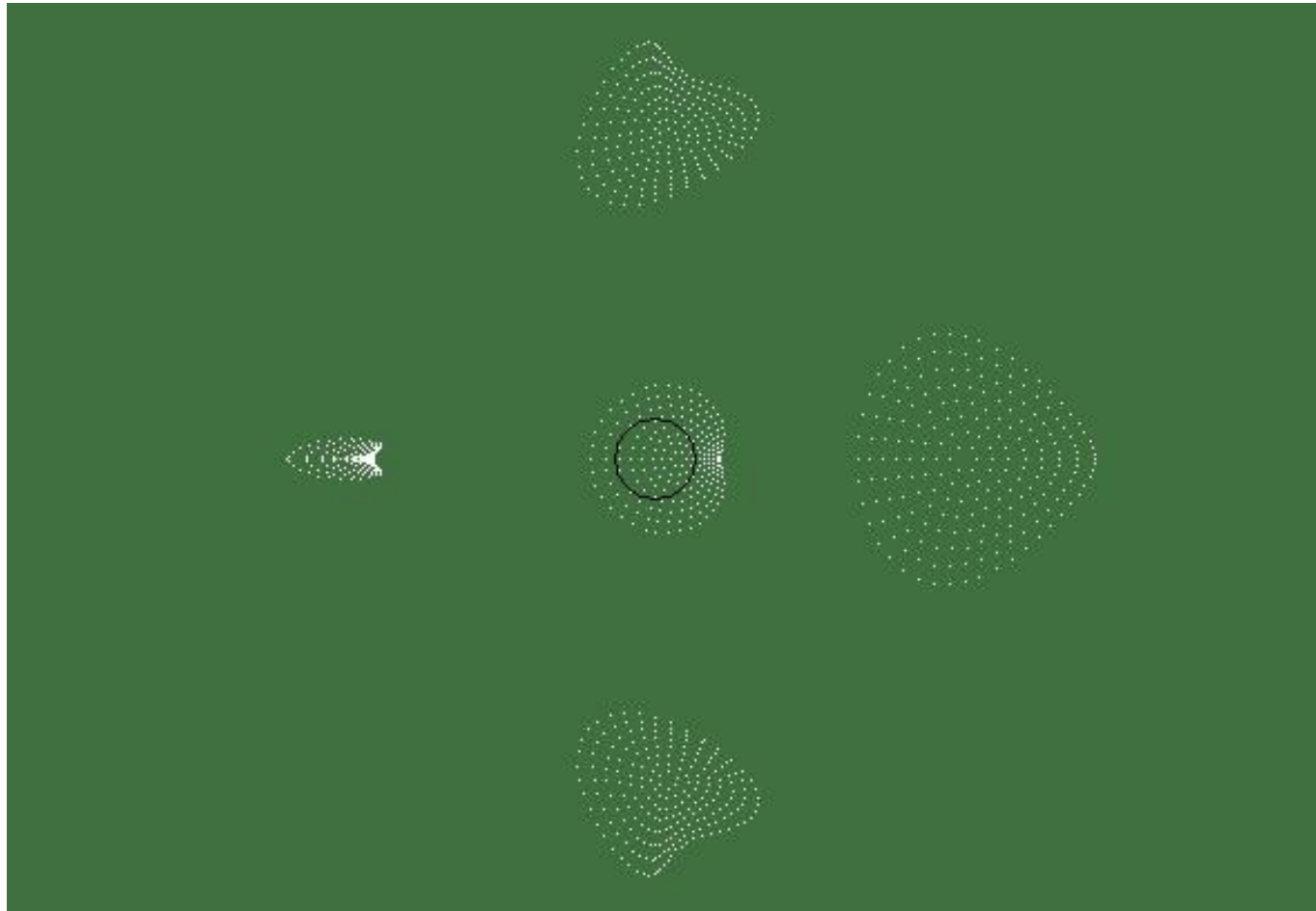


The Tri-Schiefspiegler:

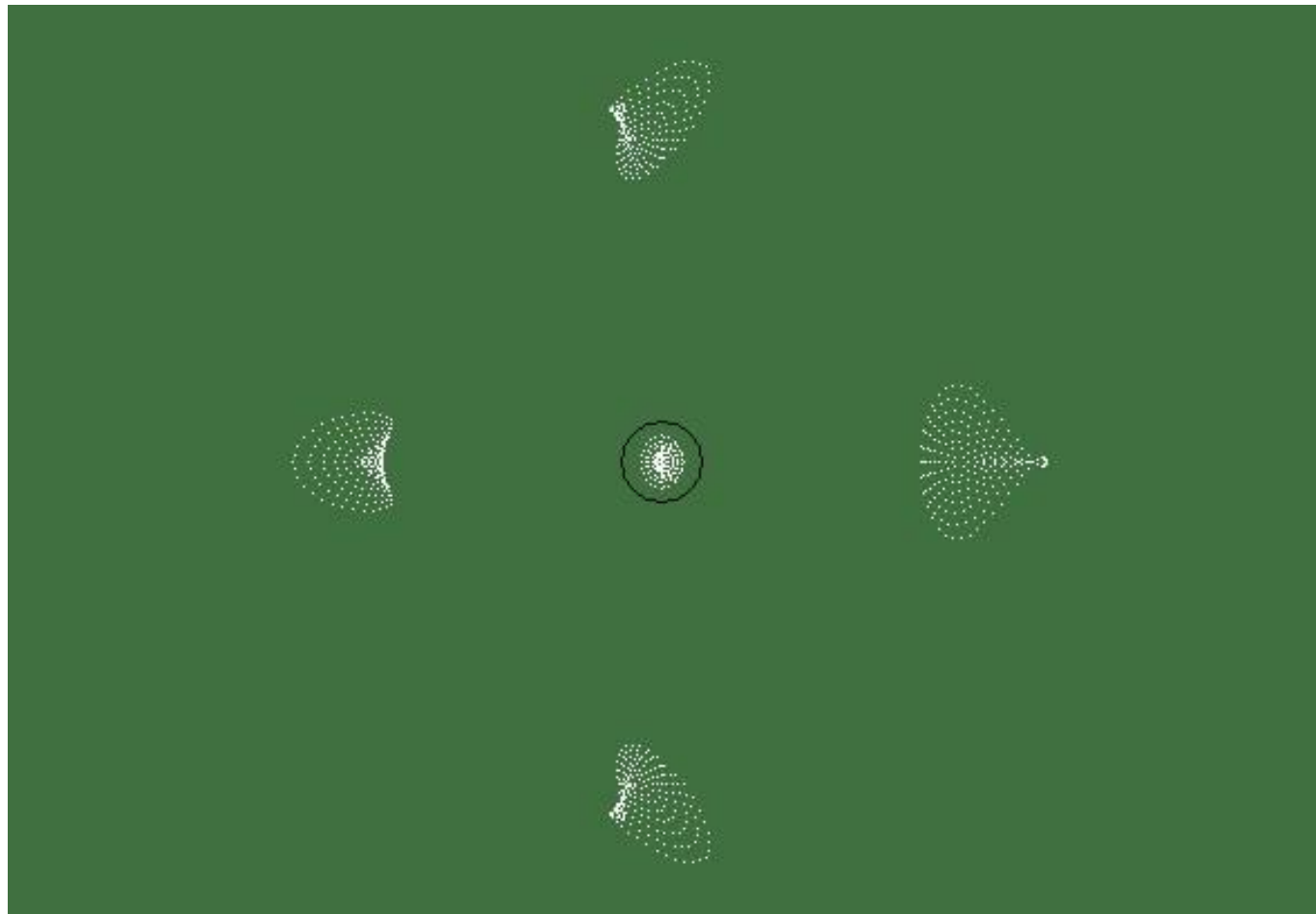
- „The instrument's contrast and definition are finer than with any other telescope of 110 mm aperture I have built.“ - *Oscar Knab*
- „For a 110 mm aperture, seeing such detail [craterlets on the Kies and Milichius dome] speaks for itself.“ - *Robert Feuardent*
- „... the small Tri-Schiefspiegler turned out to be, I'm inclined to say, the culmination of of my second vocation.“ - *Anton Kutter*

?

The Tri-Schiefspiegler:



The Tri-Schiefspiegler:

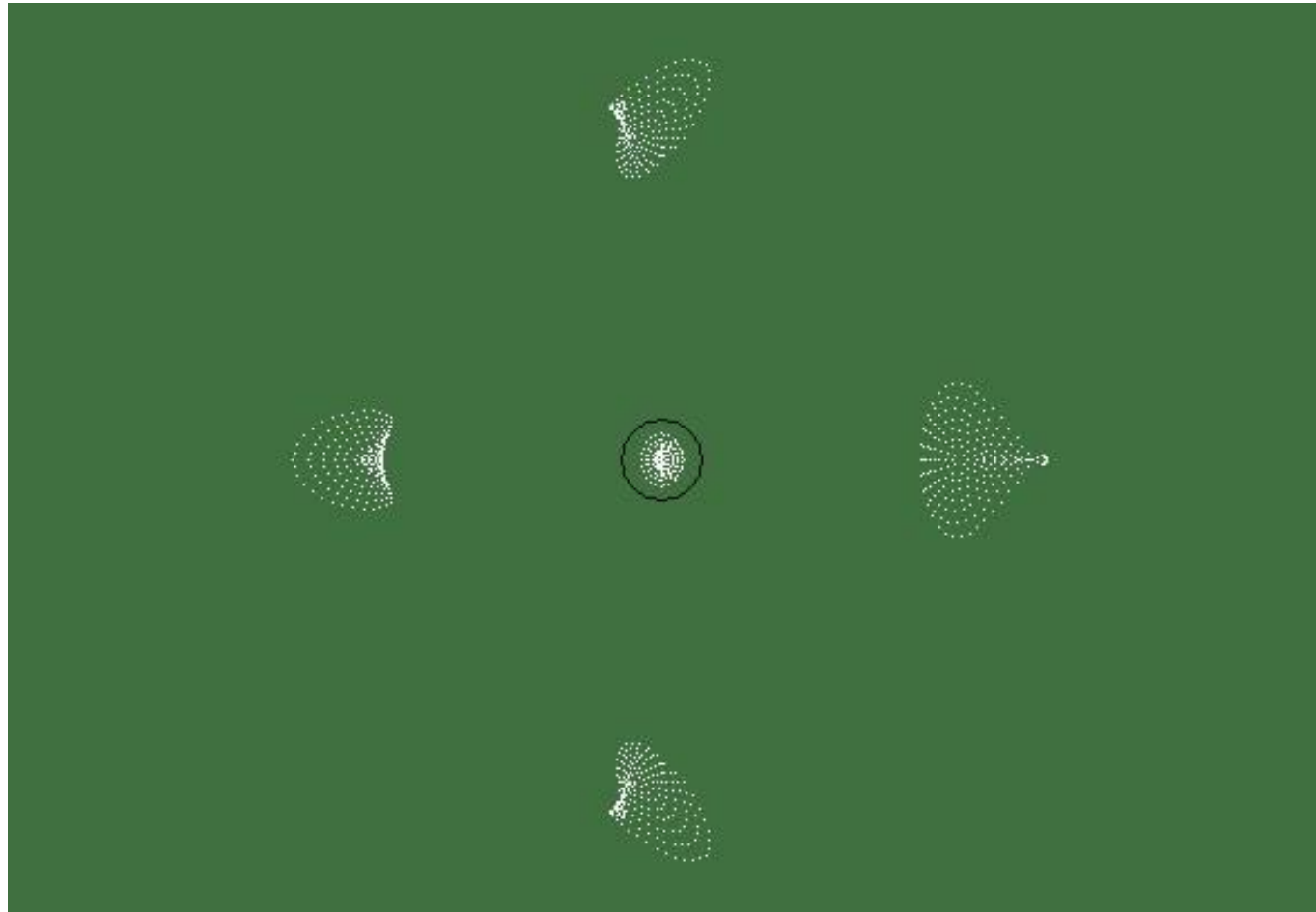


The Tri-Schiefspiegler:

In 1990, David Stevick proposed enlarging the spacing between secondary and tertiary by just 22,5 mm.

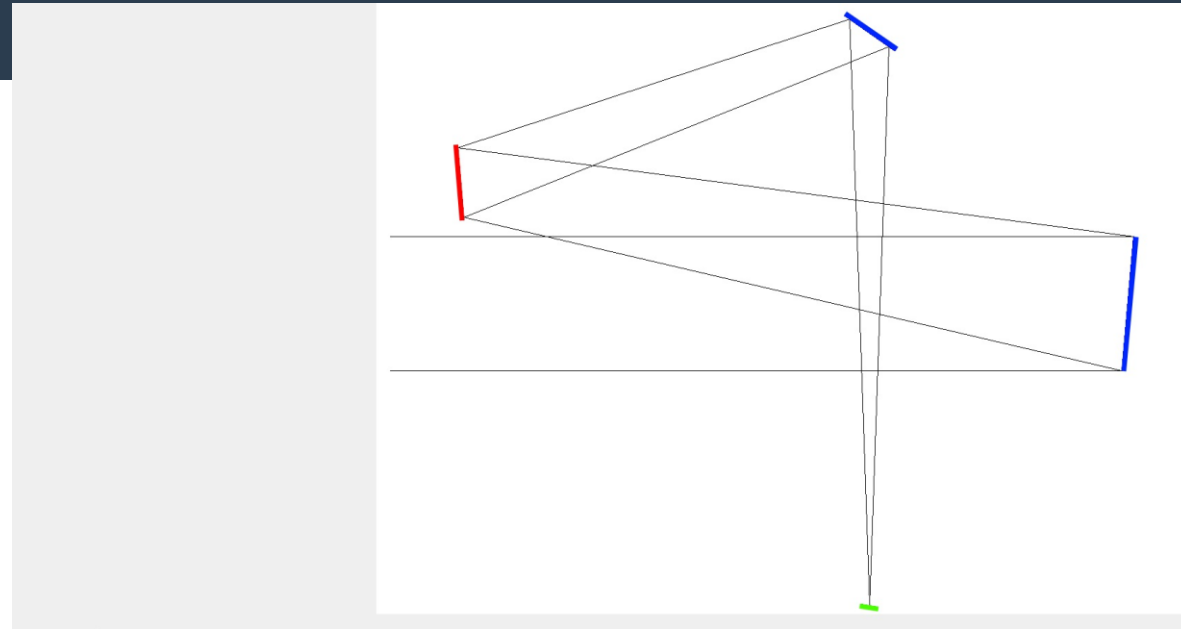
System optimal now!

Kutter mentioned „Distanz-änderungen“ in his experiments and articles.

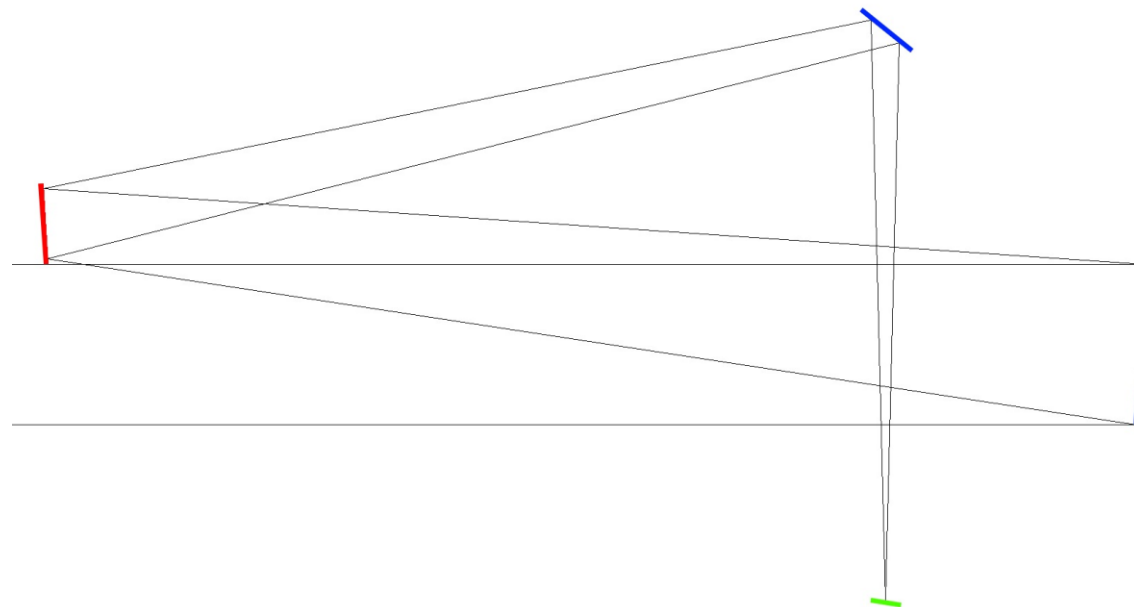


The Tri-Schiefspiegler:

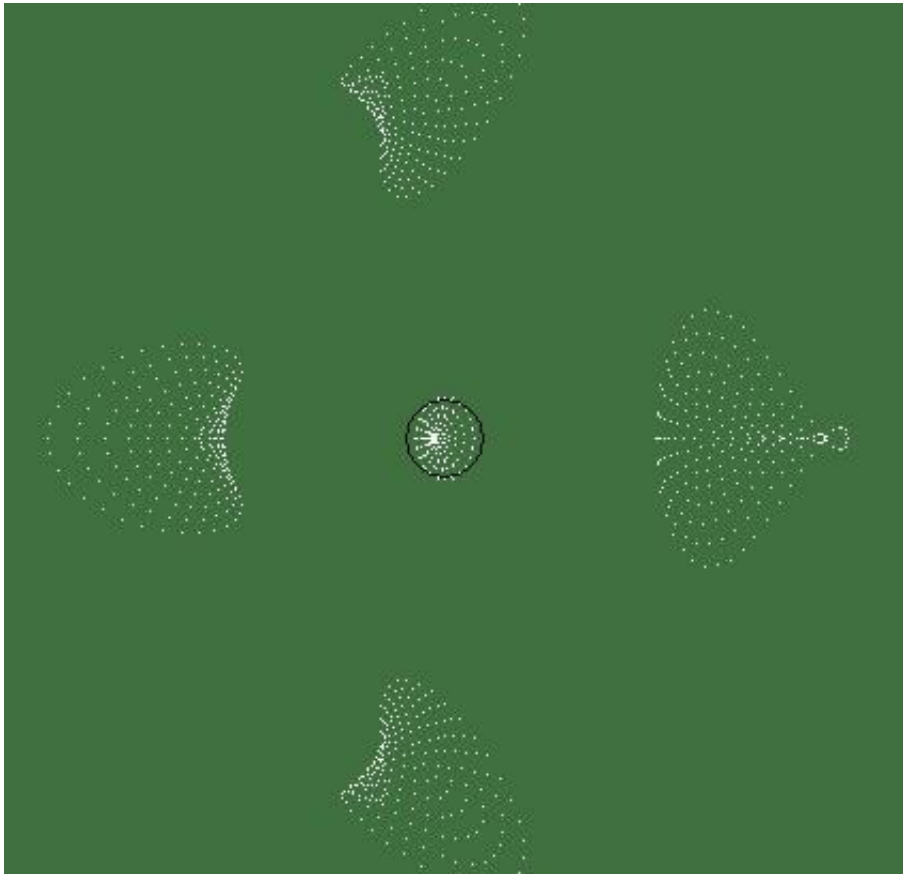
**Kutter Tri $f/14,7$
1967**



**Buchroeder Tri $f/20,2$
1971**



The Tri-Schiefspiegler:



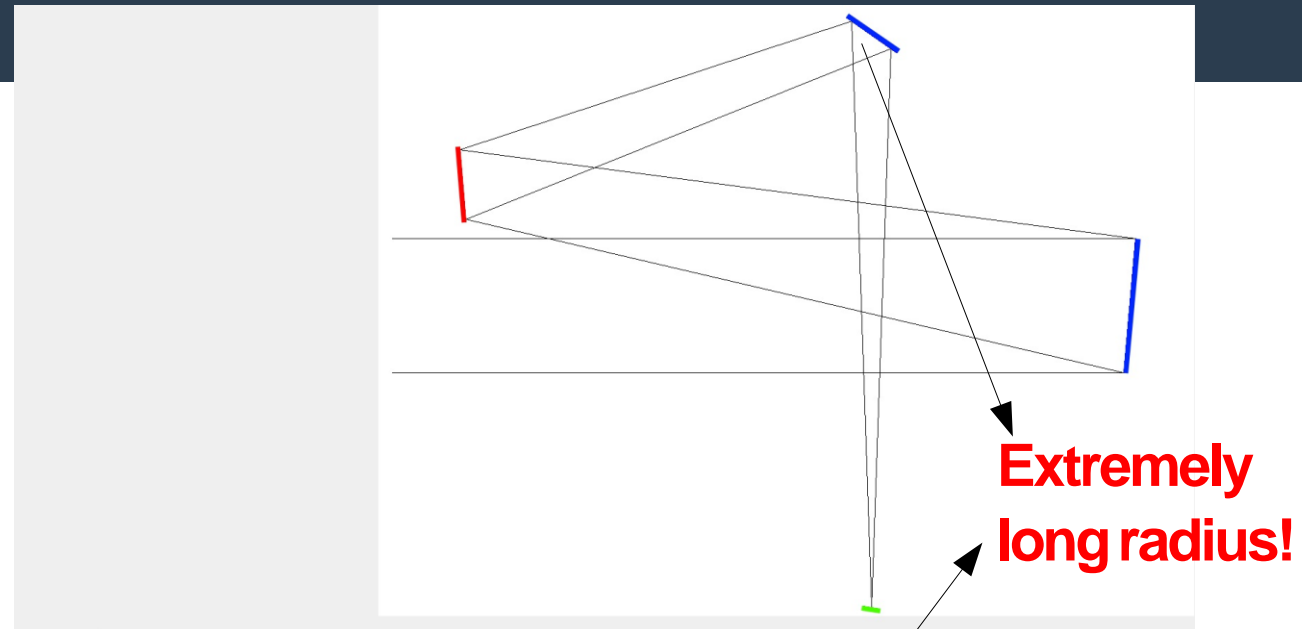
Optimized Kutter Tri 200 mm



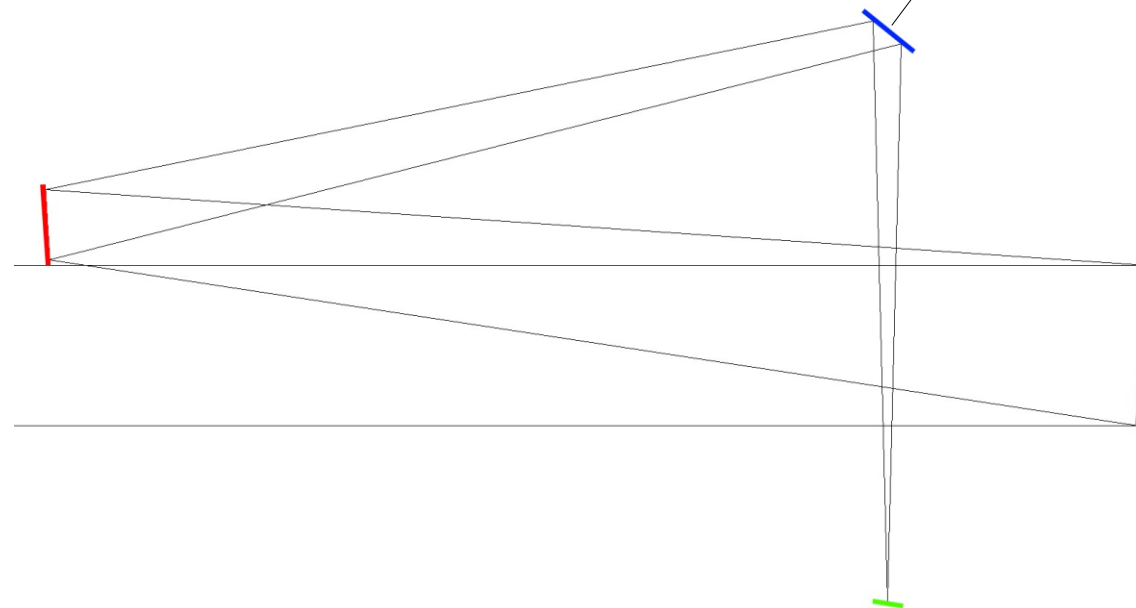
Buchroeder Tri 200 mm

The Tri-Schiefspiegler:

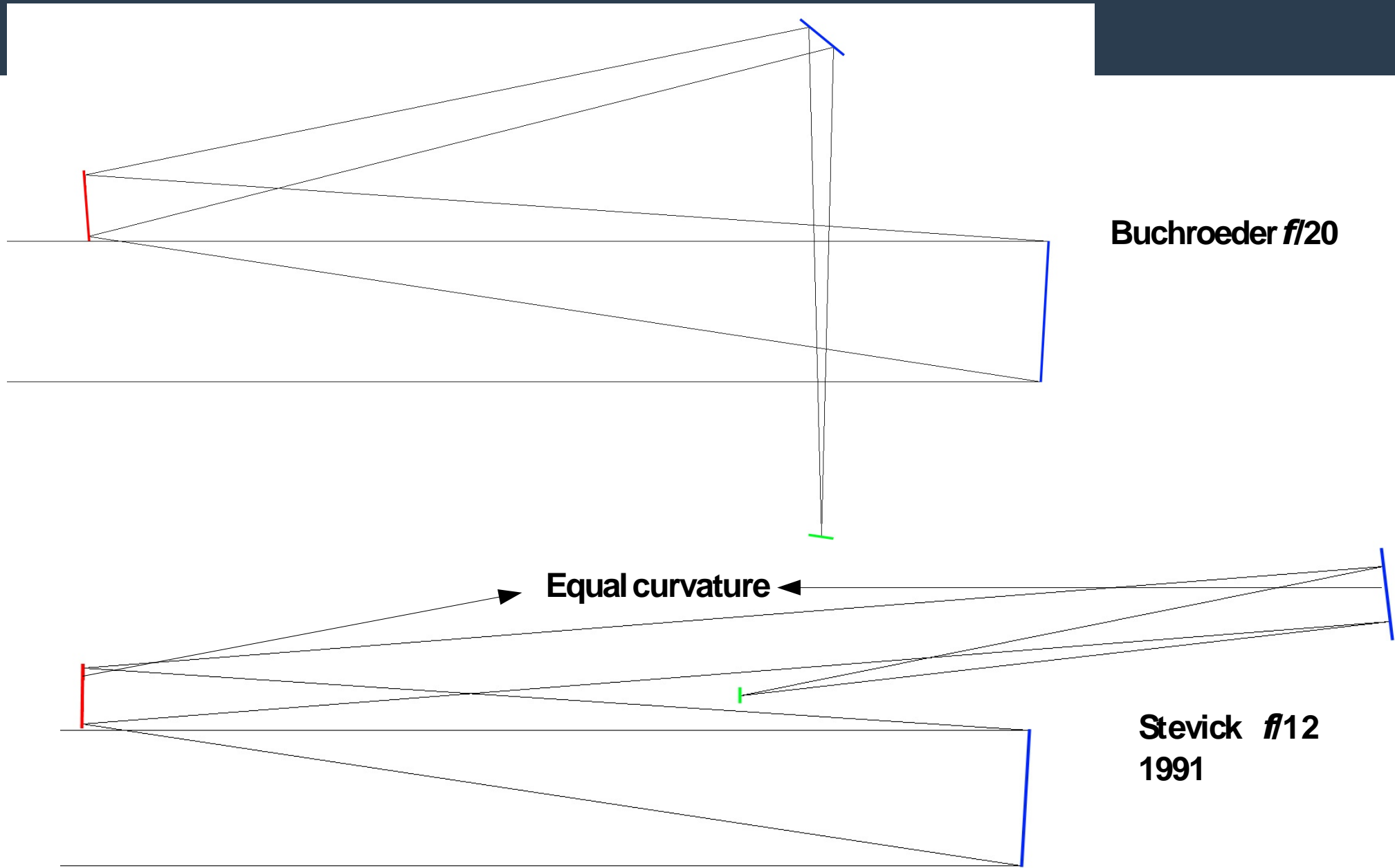
Kutter Tri $f/14,7$
1967



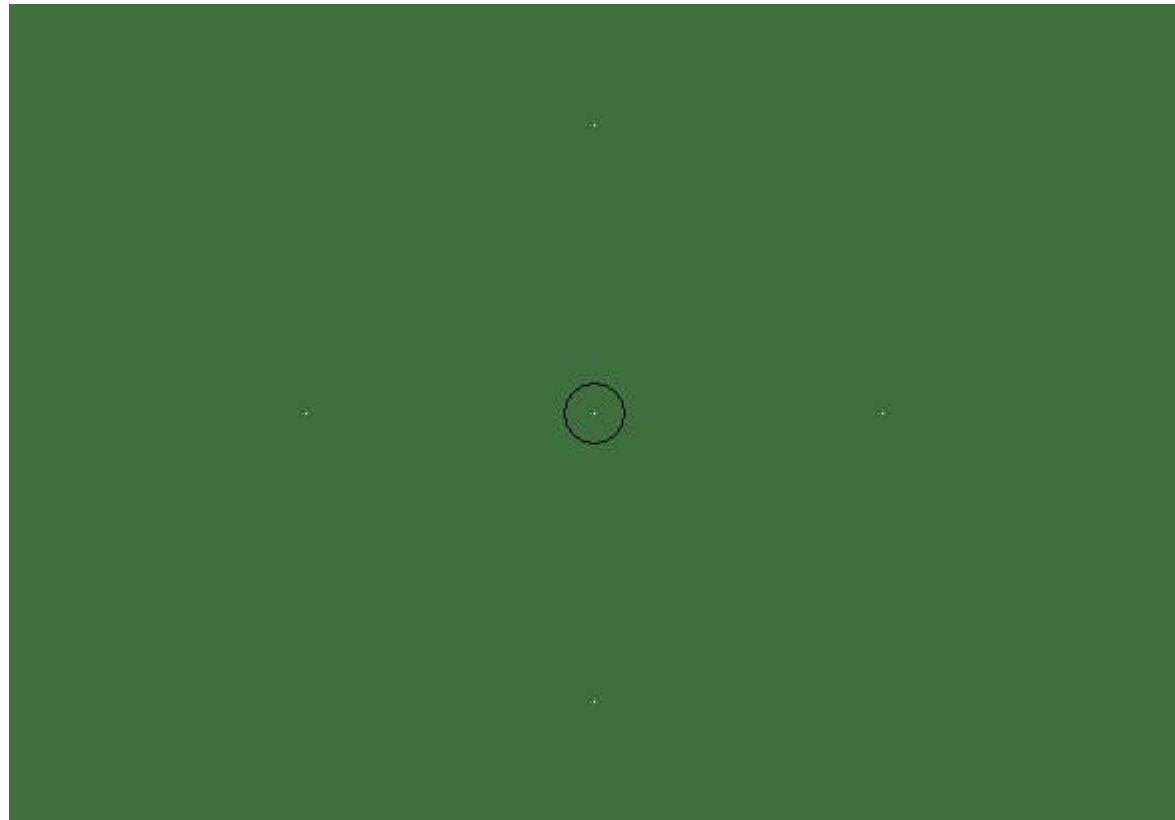
Buchroeder Tri $f/20,2$
1971



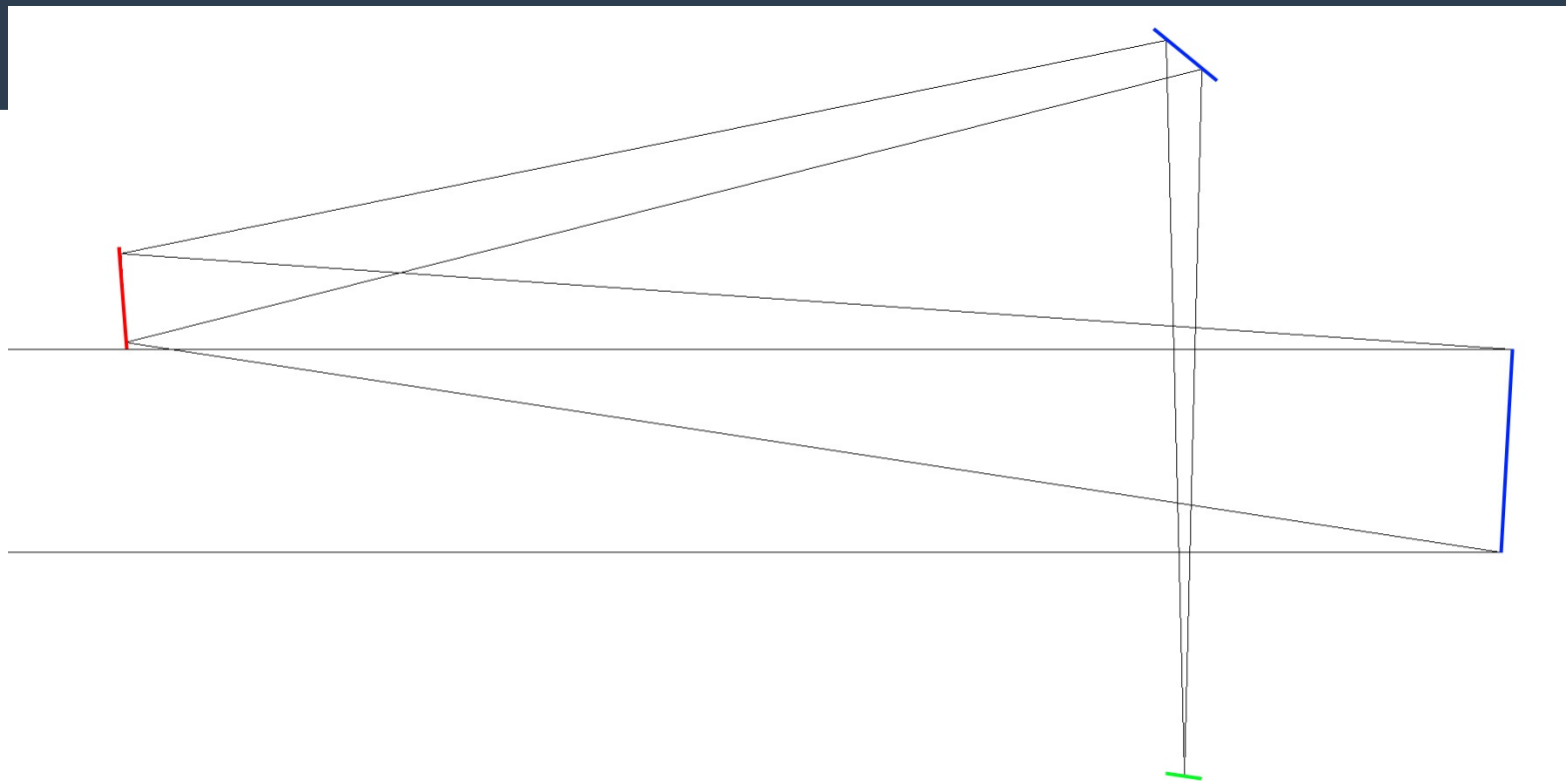
The Tri-Schiefspiegler:



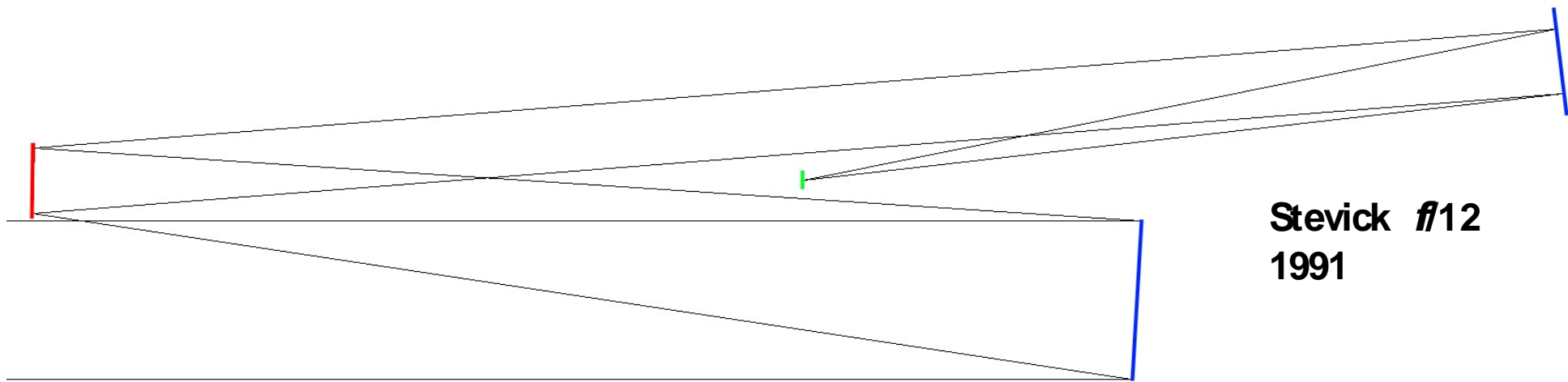
The Tri-Schiefspiegler:



The Tri-Schiefspiegler:



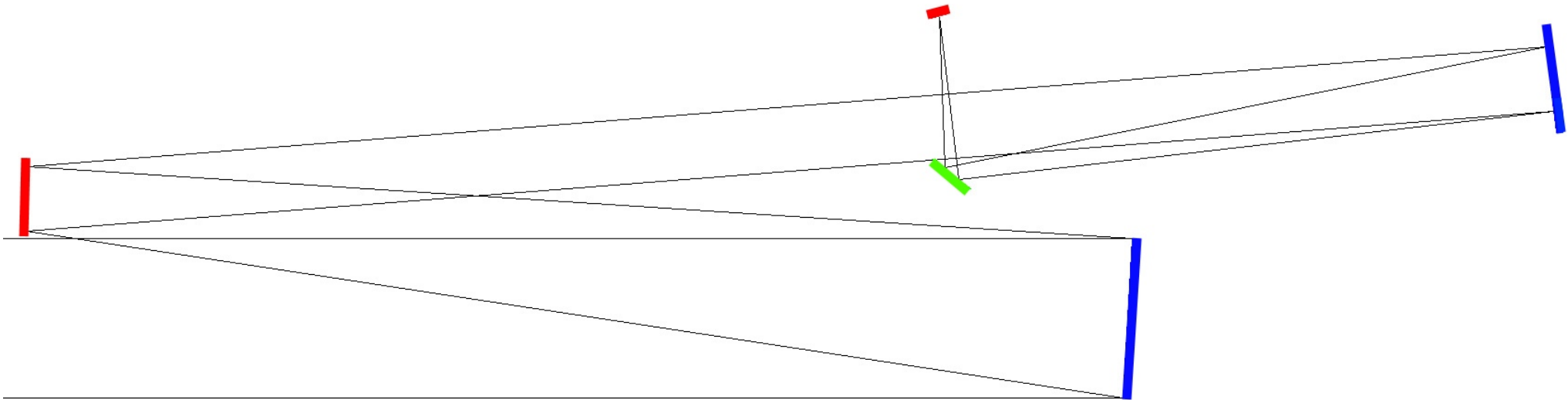
Buchroeder $f/20$



**Stevick $f/12$
1991**

The Tri-Schiefspiegler:

Stevick – Paul Telescope

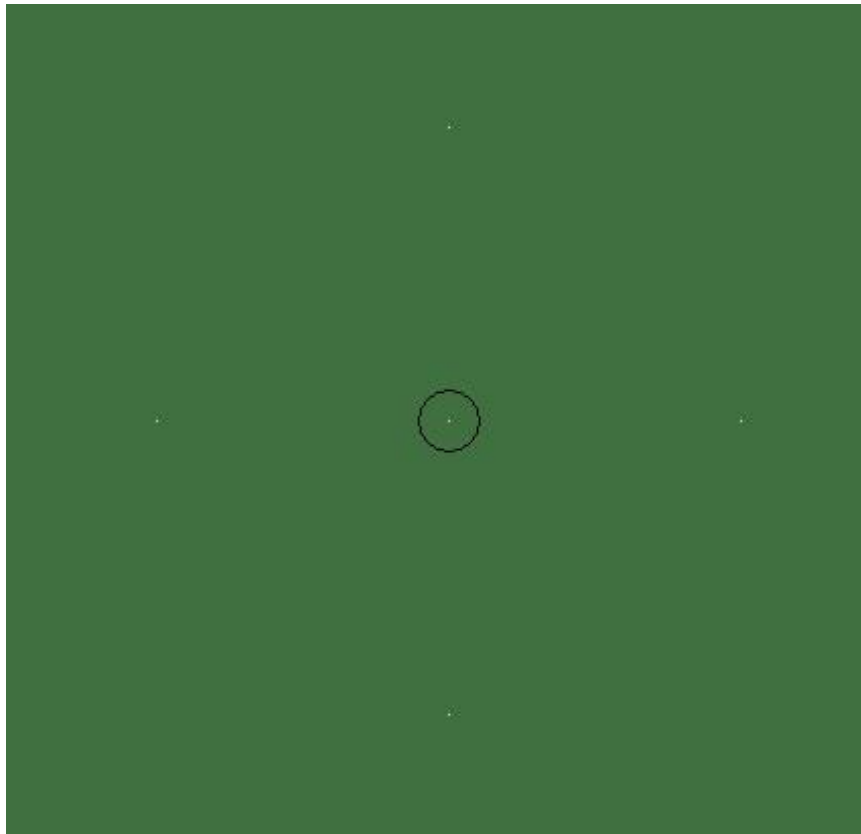


- **Primary: Paraboloid**
- **Spherical Aberration, Coma, and Astigmatism eliminated!**

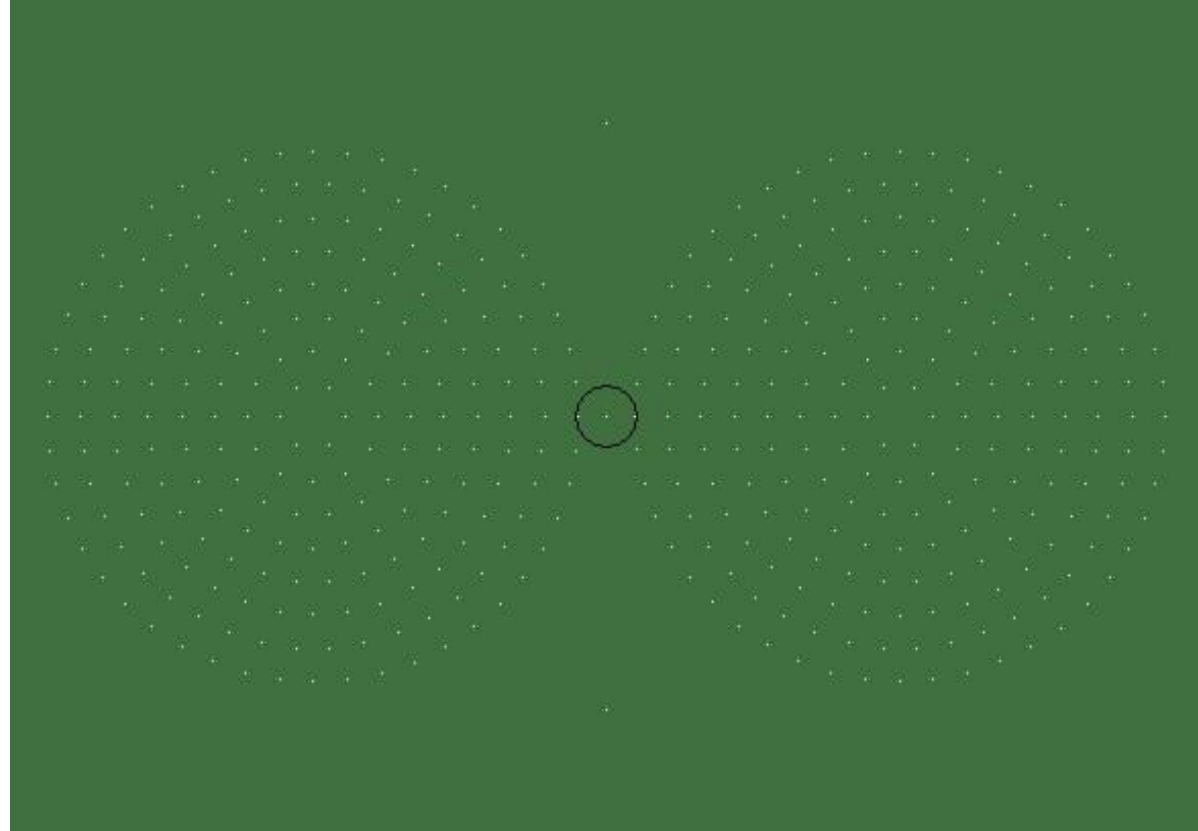
The Tri-Schiefspiegler:

BUT:

Focal plane tilt remains, as in ALL Tri-Schiefspiegler telescopes!



**Spot diagrams for
Tilted focal plane**



**Spot diagrams for
UNtilted focal plane**

The Tri-Schiefspiegler:



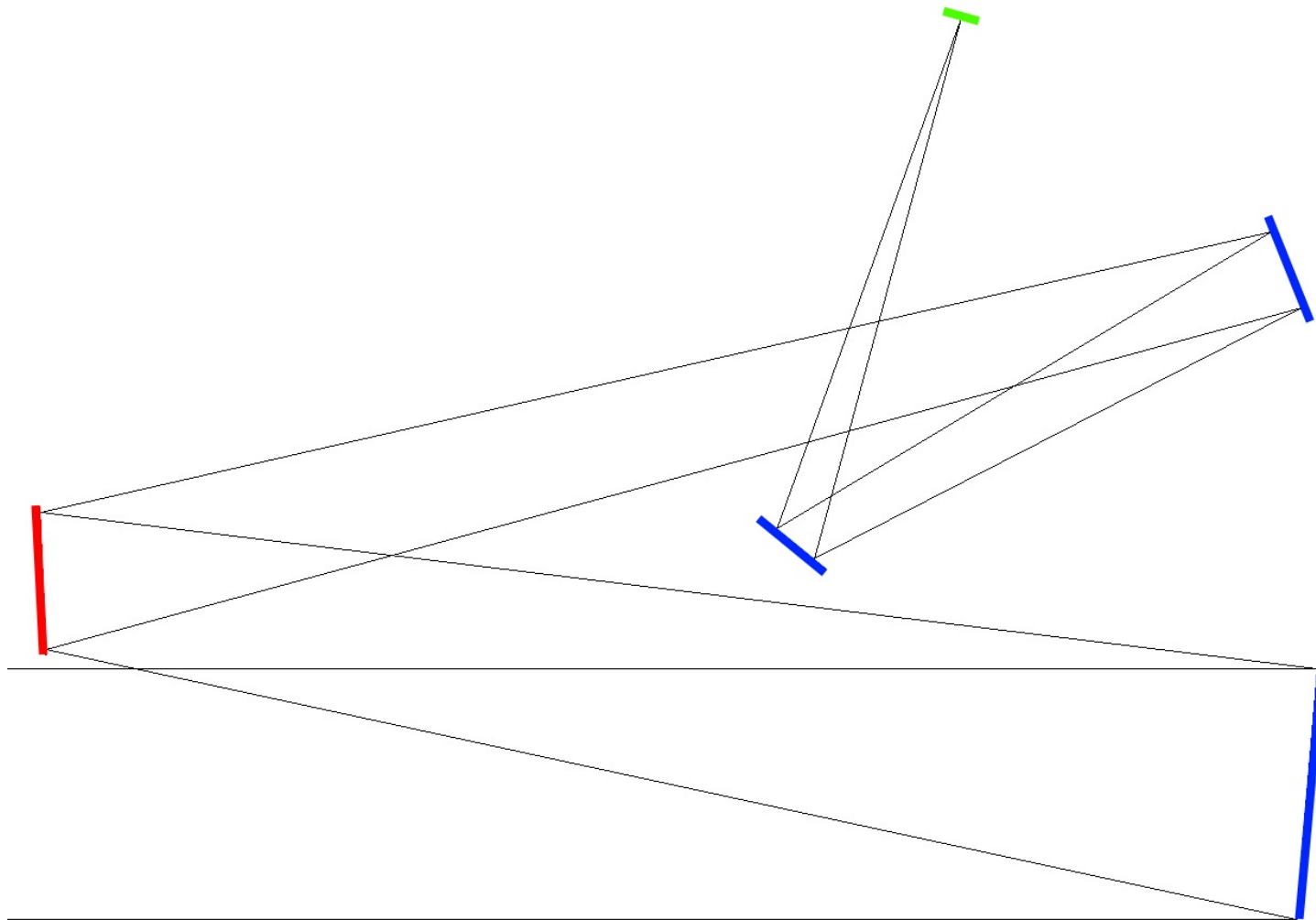
Adrian Kutter showing the plate adapter for the tilted field of the 300 mm Kutter telescope.

The Tri-Schiefspiegler:

Solution:

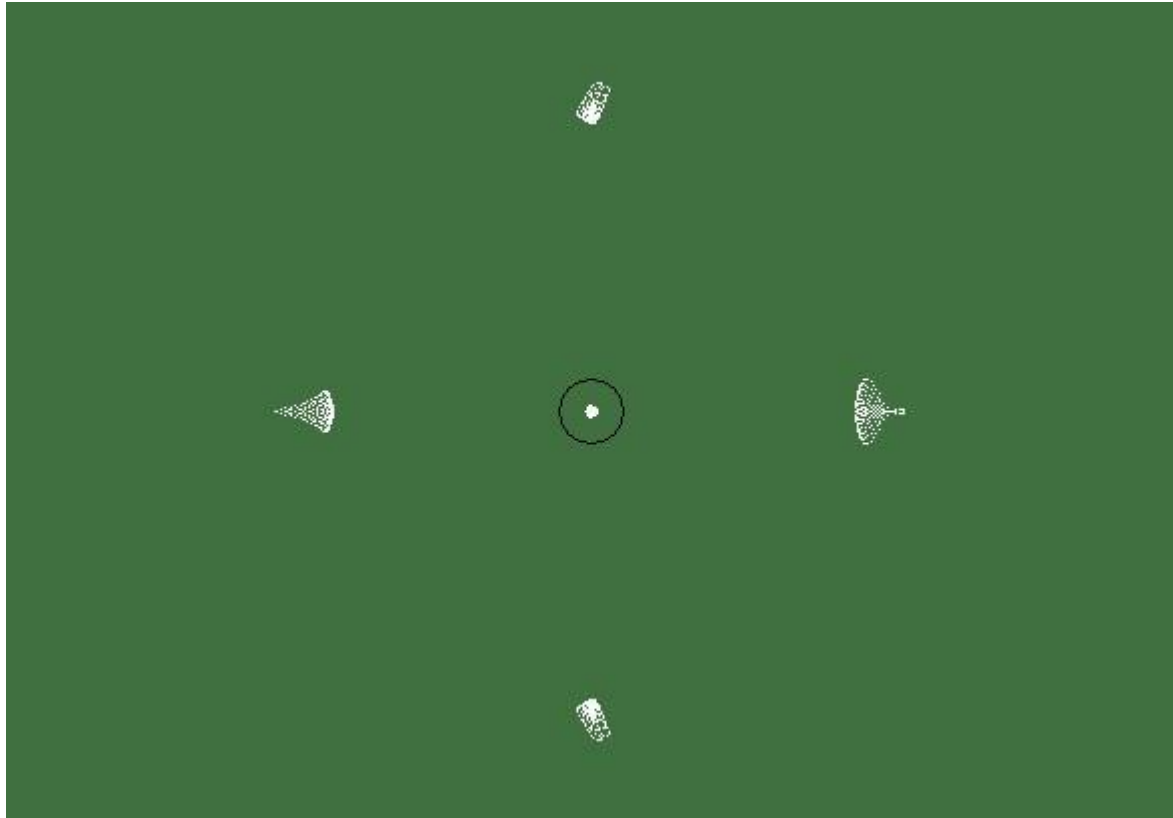
Make the fourth mirror concave!

The Tri-Schiefspiegler:



Michael Brunn 1989: 200 mm Tetra-Schiefspiegler $f/12.6$

The Tri-Schiefspiegler:



- **Good image quality**
- **Flat, untilted field**
- **Good speed**
- **Simple surfaces. Easy to make & test.**
- **Compact**
- **Excellent stray light suppression**
- **Enough back focus for accesories**

- **Many variants possible**

The Tri-Schiefspiegler:

Thank you for your attention!

Any questions?

The Tri-Schiefspiegler: