

FGS optical design

General remarks

Reflective and refractive optical systems were considered.

As a baseline reflective system was selected

advantages : two elements system, simple alignment
and simpler technology compare to refractive systems

Analyzed systems of telescope

- off axis system
- on axis Gregorian configuration
- on axis Cassegrain/Ritchey – Chretien configuration

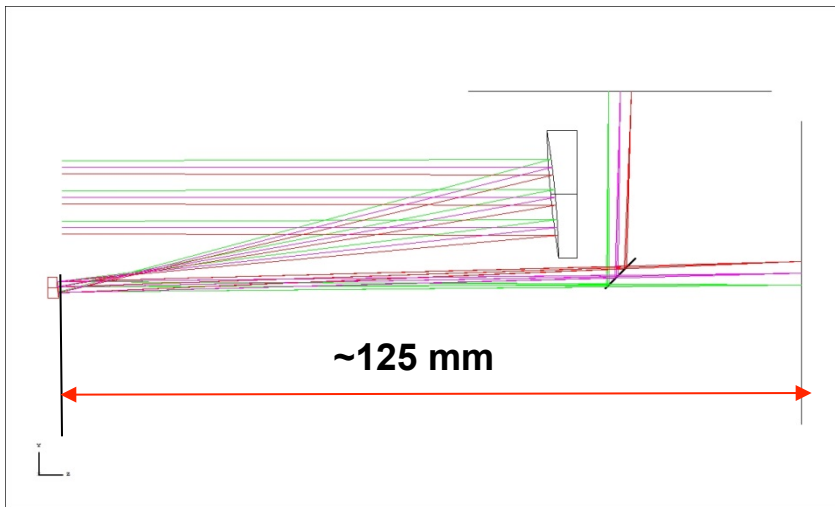
the base for a selection of solution

technology of element production, physical properties of
materials , simplicity of alignment and thermal aspect

FGS optical design

Requirements:

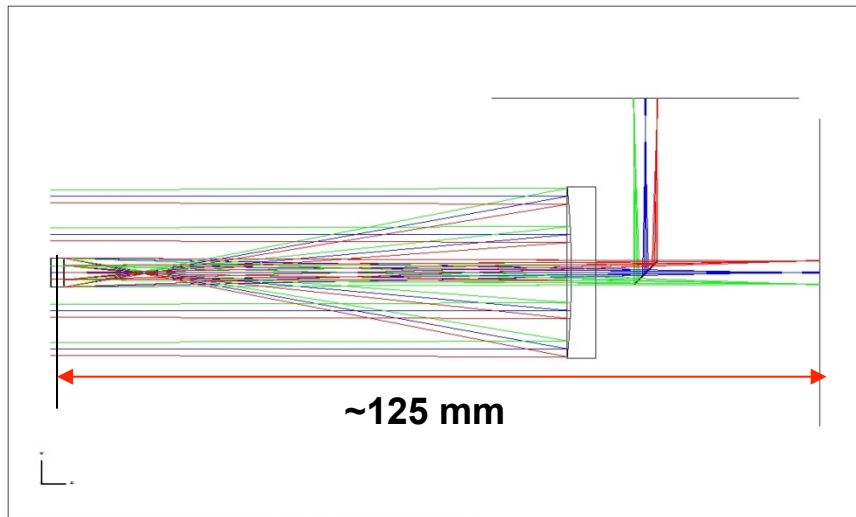
- Detector MCT 512x512 px 15 μ m
- FOV $\sim 0.33\text{deg} \times 0.33\text{deg}$ internal field
- Minimum bin/star image spread FWHM: 2x2 or 3x3 pixels
- centroiding to 1/10th of a pixel level
- Acquisition rate $> 1\text{Hz}$
- Redundancy at detector level
- System Diffraction Limited



- Focal length: 667mm,
- F-number: 25.8,
- First mirror off-axis parabolic,
- Second mirror off-axis elliptical,
- Flat folding mirror,
- No obscuration,

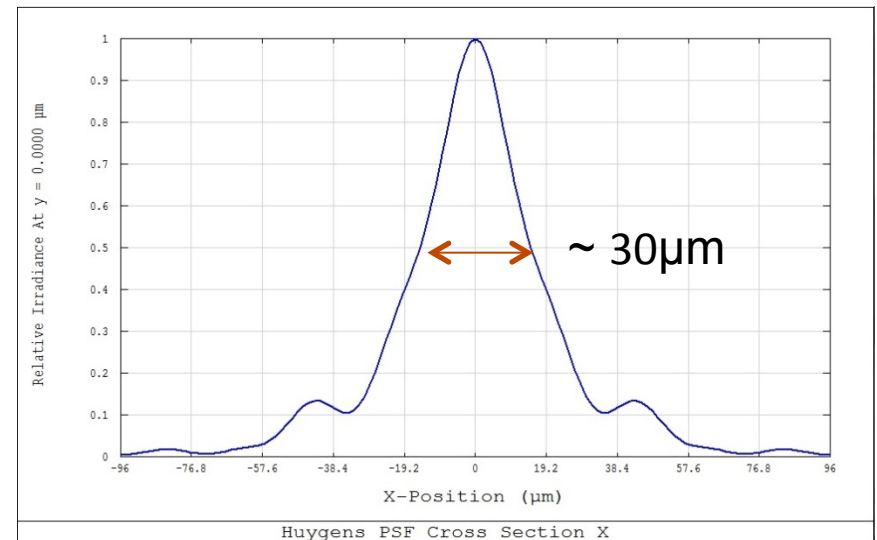
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Telescope in Gregorian configuration



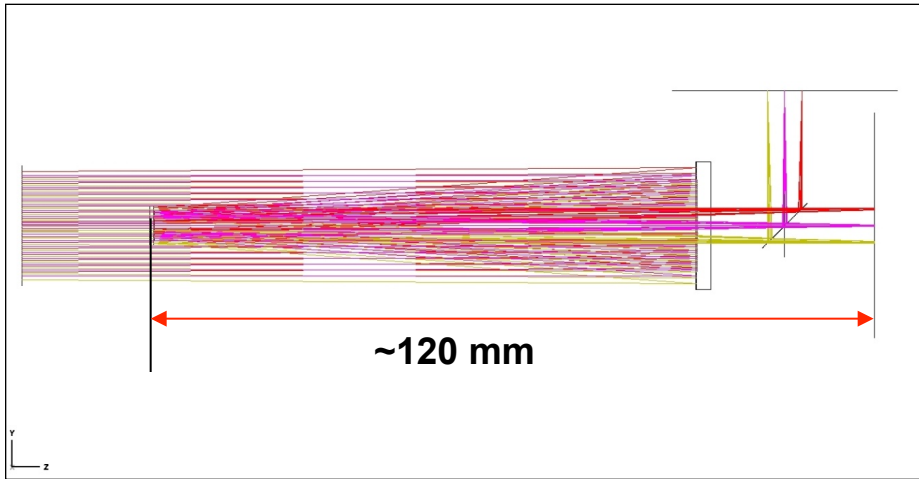
- Simple yet flexible design,
- With aperture stop placed at second mirror, entrance pupil located several 100s of mm in front of lens,
- PSF well suited to the requirements for 15 μ m pixel

- Focal length: 667mm,
- F-number: 25.8,
- First mirror parabolic,
- Second mirror spherical,
- Flat folding mirror,
- Central obscuration: ~3%,



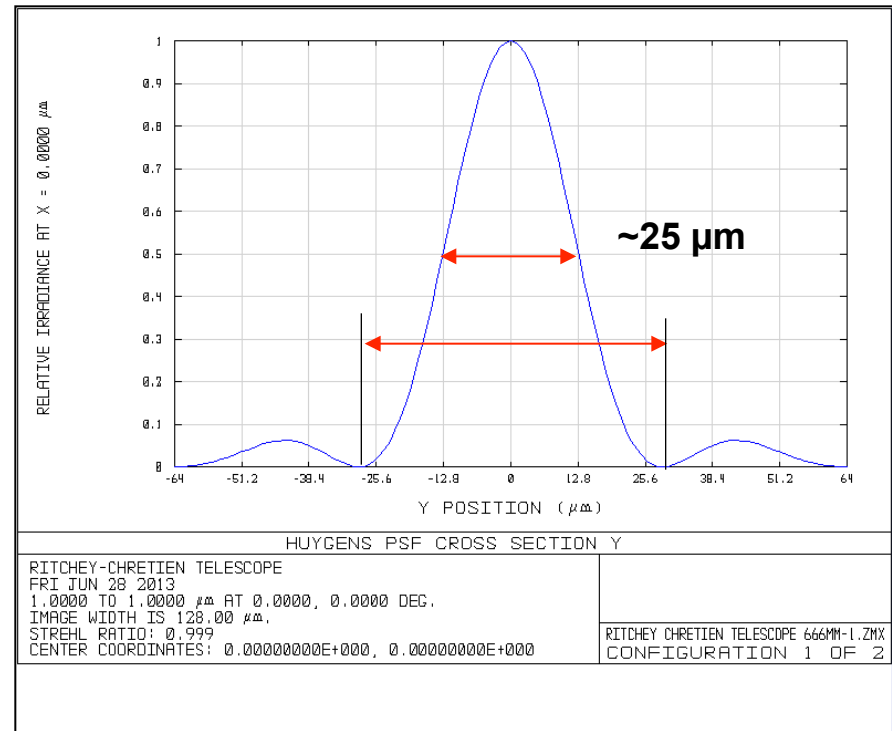
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Telescope in Cassegrain/Ritchey – Chretien



- Two aspherical mirrors and one flat mirror:
Conic constant: -0.822 and -1.844
- Diameter: $\Phi 30$, $\Phi 9$
- Central obscuration: $\sim 15\%$

- Diameter of the Airy disc (for $\lambda=1\mu\text{m}$):
 $65.04\mu\text{m}$ – close to the assumption
of the minimum star image
- spread FWHM: 2x2 or 3x3 pixels.



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Dimensions of the FGS housing 350x100x250mm (LxWxH).

Approximately system dimensions: 180x50x50 mm (detector unit assumed 50x50mm)

