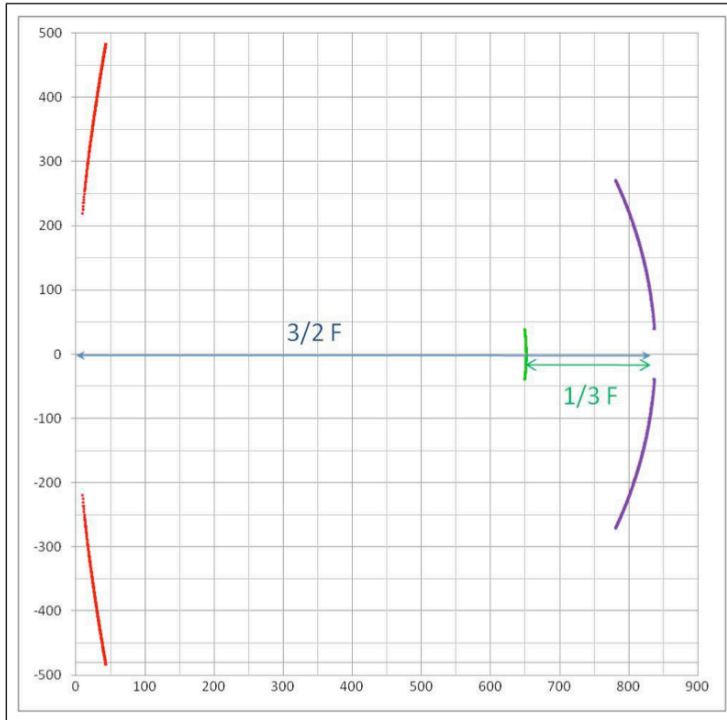


SCT optical system segmentation schemes

Julien Rousselle, UCLA
Vladimir Vassiliev, UCLA

- Overview of the SCT optical system
- Optimization of the segmentation
- Primary and secondary mirrors
- Alternative segmentation schemes
- Study of spherical segments



OS focal length of 5.6 m

Diameters of primary mirror

intern : 2.2 m

extern : 4.8 m

Diameters of secondary mirror

intern : 0.4 m

extern : 2.7 m

Mirror areas

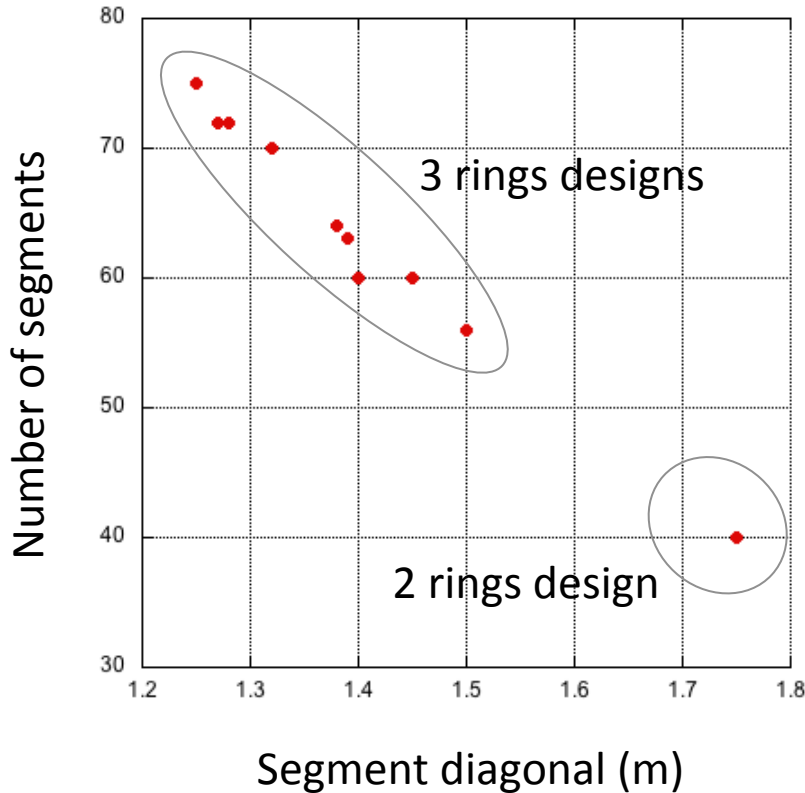
primary : $\sim 57 \text{ m}^2$

secondary : $\sim 22 \text{ m}^2$

Optimization of the “Petal” segmentation Schemes by :

- reducing the number of segments to reduce the complexity and cost of the mechanical structure
- keeping the segment diagonal $<$ industrial limit
- Constant segment area \rightarrow same Contribution to the collection area



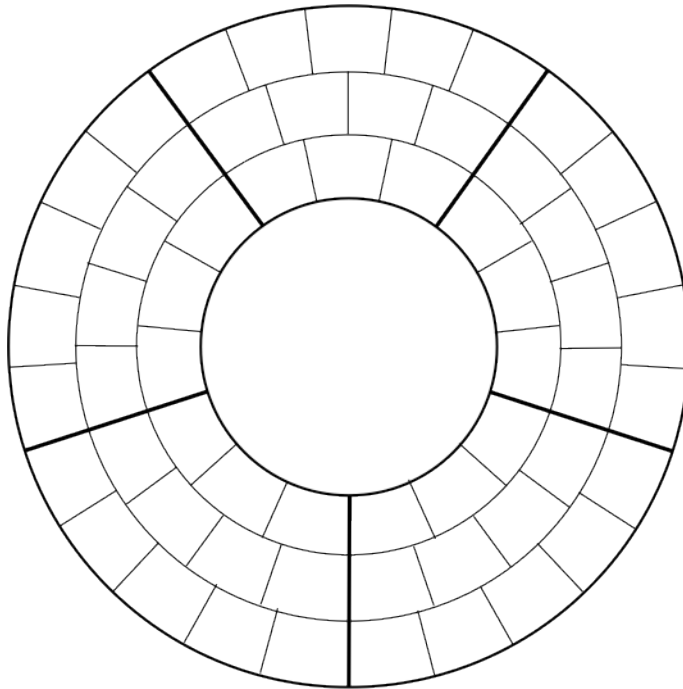


Linearity between segment number and diagonal

Except for 1 design which is more compact

(60 segments with a diagonal of 1.4 m)

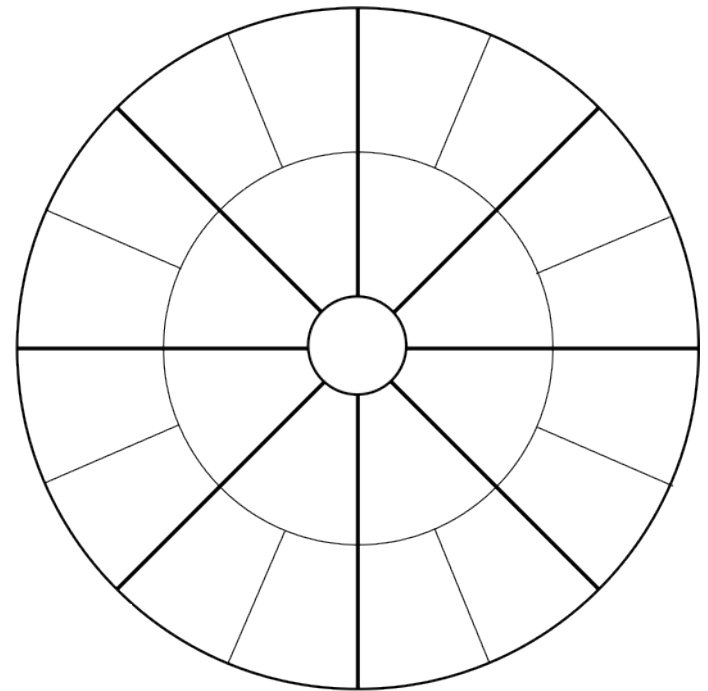
Favorite segmentation for the primary mirror



- **3 rings** design
- **60 segments** (15+20+25)
- Segment **diagonal of 1.4 m**
- 5 fold symmetry
- Segment area of 0.97 m²

Favorite segmentation for the secondary mirror

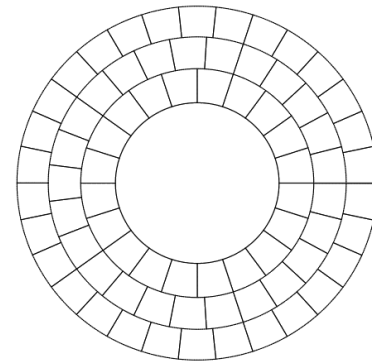
- **2 rings** design
- **24 segments** (8+16)
- Segment **diagonal of 1.35 m**
- 8 fold symmetry
- Segment area of 0.94 m^2



If requested by the industry, the segment diagonals can be reduced using alternative segmentation schemes

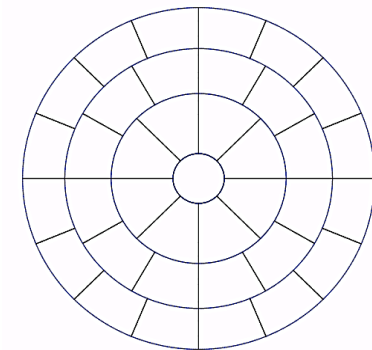
Primary mirror made of 3 rings

1.4 m -> 1.25 m
60 -> 75 segments

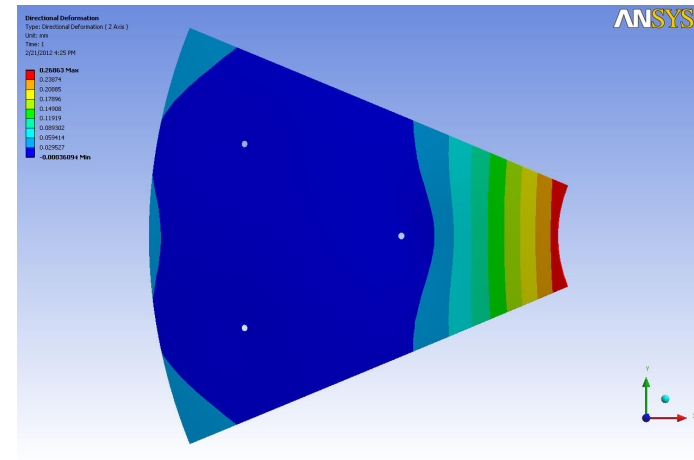
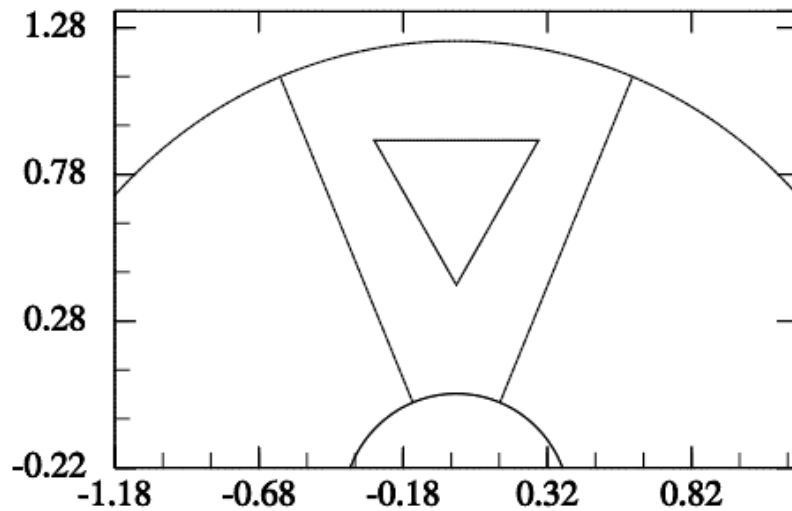


Secondary mirror made of 3 rings

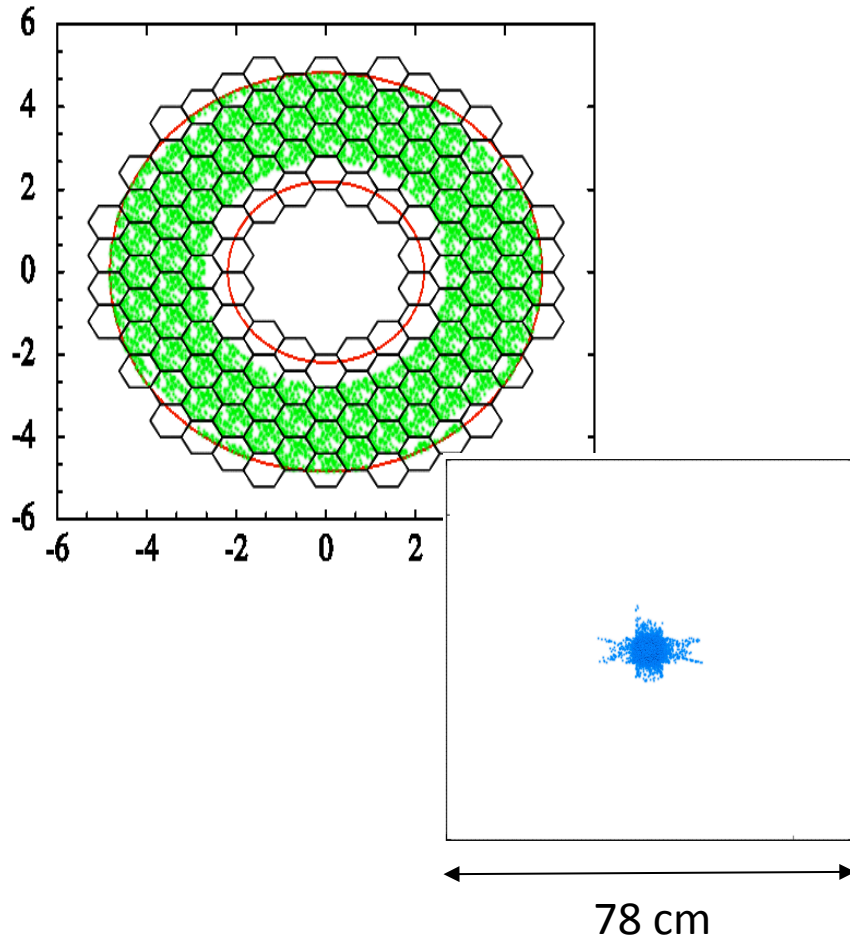
1.4 m -> 1.15 m
24 -> 36 segments



- Optimized to reduce the torque on the segment nodes due to the wind.
- Currently starting an iteration process in collaboration with Victor



Primary mirror made of spherical segments



Primary mirror made of hexagonal spherical segments

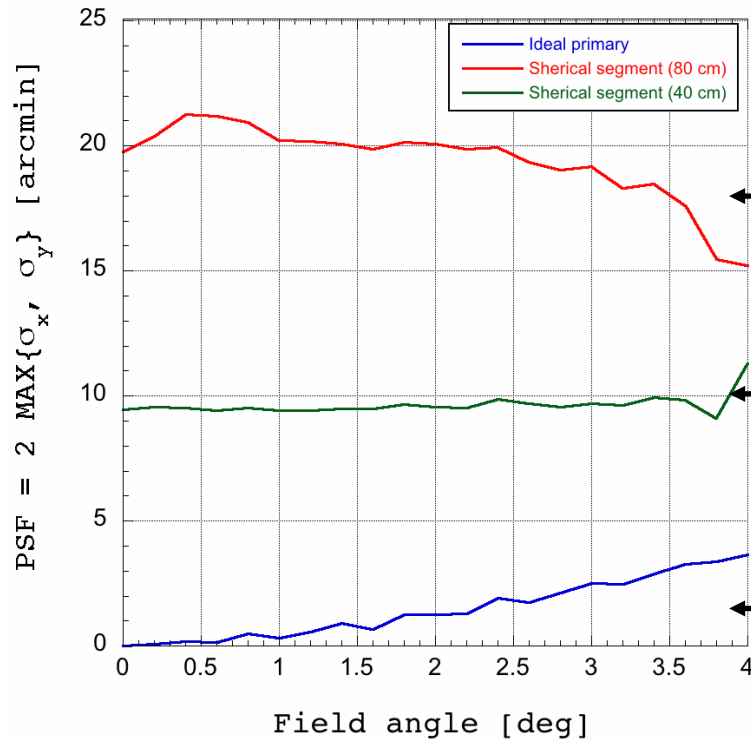
Optimization of segment

- position
- curvature
- orientation
- size

Ideal secondary

What impact on the PSF ?

PSF comparison with ideal primary mirror



Hexagonal segment
80 cm diameter

Hexagonal segment
40 cm diameter

Ideal primary mirror
surface

Large degradation of the PSF using spherical segments whatever the size.

- Spherical segment not usable for the SCT (9 m).
- “Petal” segmentation schemes optimized for the primary (60 segments) and secondary mirrors (24 segments).
- Possible backup to alternative designs if needed for the industrialization.