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	SEGMENTATION SCHEME FOR PRIMARY AND SECONDARY MIRRORS OF SCT	Version : 0.1 Date: 11/06/2012 Page : 1/6

Segmentation schemes for primary and secondary mirrors of the Schwarzschild-Couder telescope for CTA

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List of Abbreviations			
SCT	Schwarzschild-Couder Telescope		
SC	Schwarzschild-Couder		
OS	Optical System		
FoV	Field of View		

History		
Version	Date	Observation

Distribution	CTA-US collaboration, MRI consortium, MLT Inc.
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1. INTRODUCTION

This memo provides the baseline designs for the primary and secondary mirror segmentations of the Schwarzschild-Couder telescope (SCT). These designs are the result of an optimization to reduce the size and the number of mirror segments. Optimization is performed with additional constraints imposed by the mirror fabrication technologies.

The segmentation schemes described were developed for the baseline SCT design for CTA with a field of view (FoV) of 8 deg and a focal length of 5.58630 m as described in the memo "Optical system of 9.5m Schwarzschild-Couder Telescope for CTA" [1].

2. DEFINITION

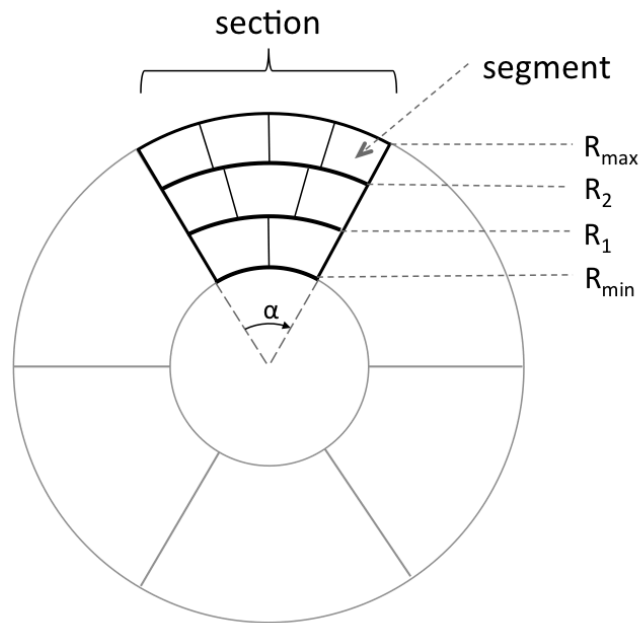



Figure 1: Explanation of the terms used in this memo with an example of segmentation.

The SCT primary and secondary mirrors are made by the repetition of identical sections (Fig. 1) composed of "petal" segments on 2 or 3 rings. The section is defined by the angle $\alpha = 360^\circ/n$ with n an integer and the segments are defined by the ring radii, e.g. (R_1, R_2) , and the number of segments on each ring.

3. PRIMARY MIRROR SEGMENTATION

The baseline segmentation scheme (F) for hybrid glass mirrors is made of 2 rings and 16 sections for a total of 48 segments. In order to reduce the stress on the glass sheets, they are cut along straight line prior to the glass slumping.

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3.1 Segmentation scheme for primary mirror

The Figures 2 and 3 show the F segmentation scheme described in Table 1.

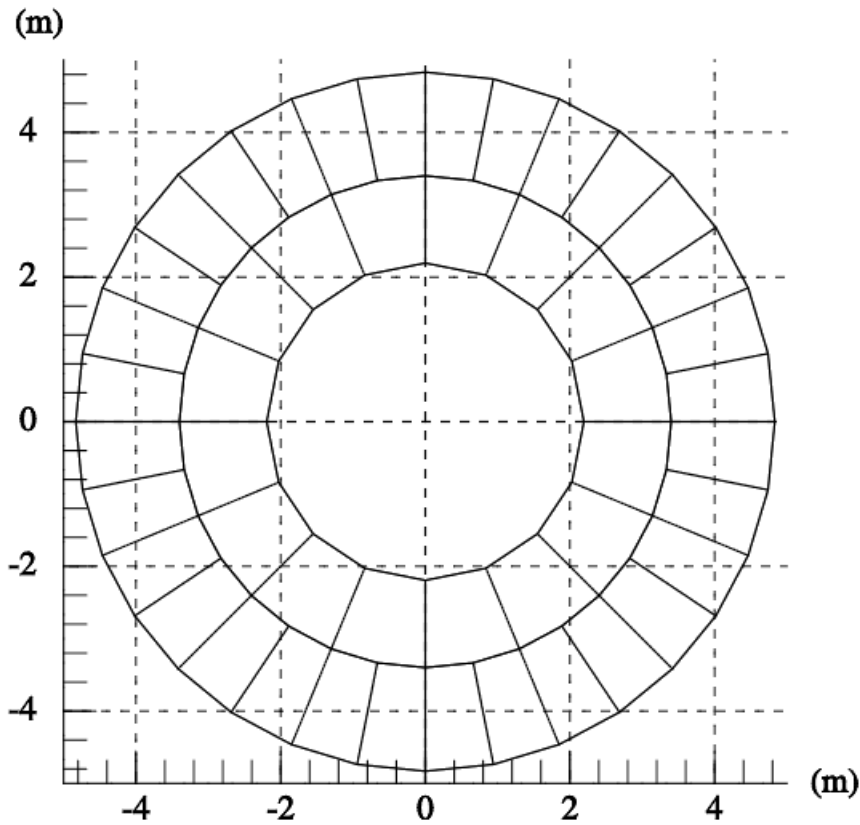


Figure 2: Representations of the F design of the primary mirror, made of hybrid glass substrate with 48 segments distributed on 2 rings.

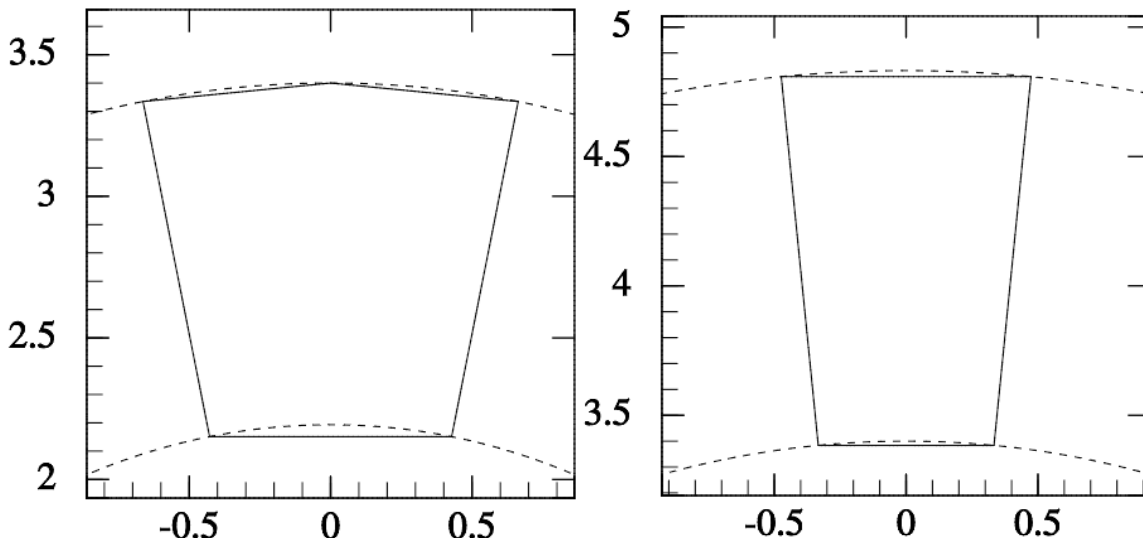



Figure 3: Inner, P1, (left) and outer, P2, (right) segments of the baseline F segmentation design. The dashed lines represent the ring radii.

3.2 Segment parameters for F design

The Tables 1 describes the segment parameters from the F favorite segmentation schemes, presented in Figure 2 and 3. The parameters φ and τ are used in the parametric equations of the mirror surfaces and described in the CTA Memo SCT-OPTMO/121108 [1].

Mirror ring	P1	P2
Number of segments	16	32
φ_{min} (deg)	-11.25	-5.625
φ_{max} (deg)	11.25	5.625
R_{min} (m)	2.19350	3.40000
R_{max} (m)	3.40000	4.831875
τ_{min}	0.154180	0.370433
τ_{max}	0.370433	0.748140
Diagonal (m)	1.61	1.64
Width max. (m)	1.3259	0.9472
Height (m)	1.2471	1.4500
Segment area (m^2)	1.33	1.16

Table 1: Parameters of the mirror segments using the segmentation scheme F for the primary mirror. φ and τ are the two parameters used in the parametric equation of the mirrors. P1, P2 are respectively the inner and outer rings.

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4. SECONDARY MIRROR SEGMENTATION SCHEME

The baseline J segmentation scheme of the secondary mirror is shown Figures 4 and 5 to illustrate the segment distribution and the fold symmetry. It is made of 24 segments distributed on 2 rings.

4.1 Segmentation scheme for secondary mirror

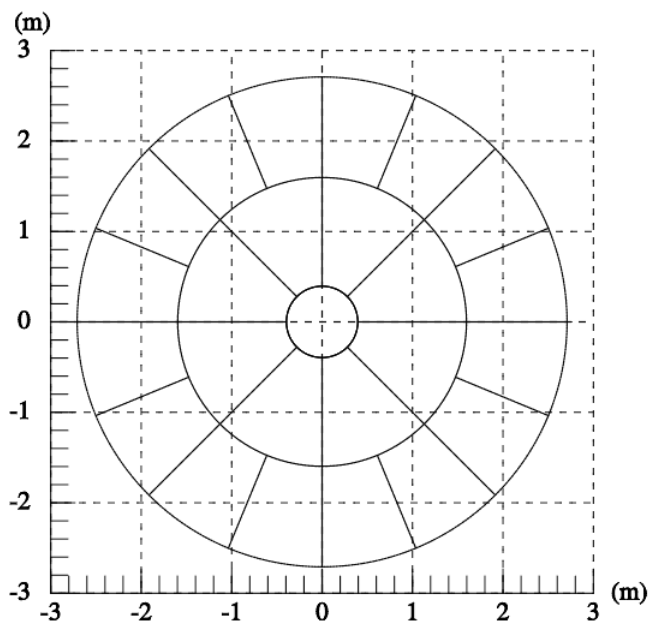


Figure 4: Representations of default J design of the secondary mirror. It uses 24 segments distributed on 2 rings.

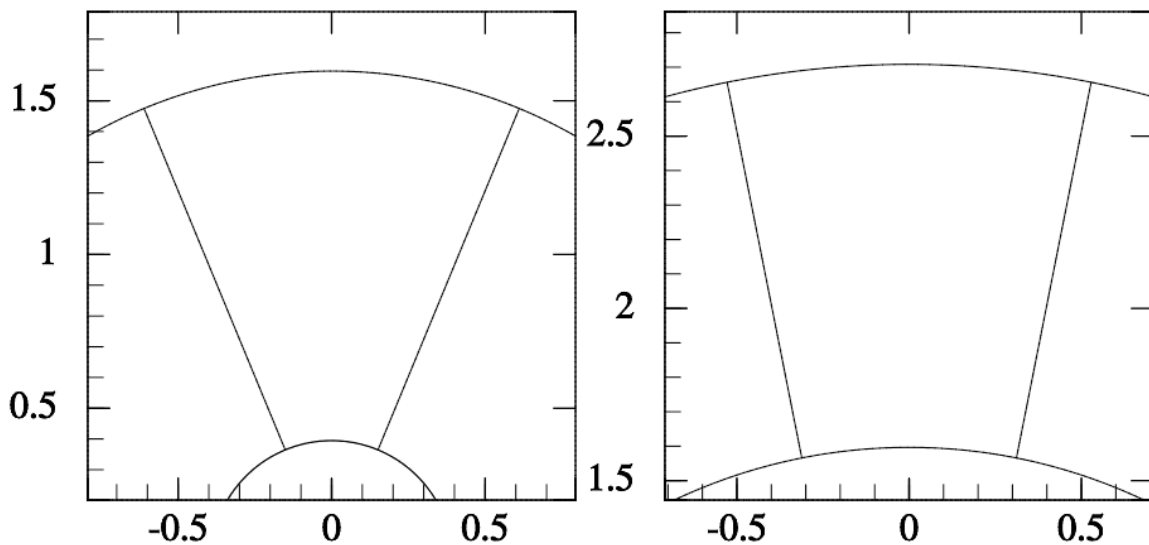


Figure 5: Inner (left) and outer (right) segments of the default J segmentation design of the secondary mirror.

4.2 Segment parameters for J design

The Table 2 describes the segment parameters for the baseline J segmentation scheme for the secondary mirror, presented in Figure 4 and 5. The parameters φ and τ are used in the parametric equations of the mirror surfaces and described in the memo [1].

Mirror ring	S1	S2
Number of segments	8	16
φ_{min} (deg)	-22.5	-11.25
φ_{max} (deg)	22.5	11.25
R_{min} (m)	0.3945	1.5965
R_{max} (m)	1.5965	2.7083
τ_{min}	0.0435	0.4781
τ_{max}	0.4781	0.8148
Diagonal (m)	1.3467	1.3764
Width max. (m)	1.2219	1.0567
Height (m)	1.2320	1.0444
Segment area (m^2)	0.9398	0.9398

Table 2: Parameters of the mirror segments using the segmentation scheme J, for the secondary mirror. φ and τ are the two parameters used in the parametric equation of the mirrors. S1 and S2 are respectively the inner and outer rings.

5. REFERENCES

- [1] CTA Memo SCT-OPTMO/121108, "Optical system of 9.5m Schwarzschild-Couder Telescope for CTA".