# DESIGNING A SCHMIDT CAMERA OBJECTIVE

This exercise commences with the concluding design of the section headed "Your first OSLO session". This consists of a concave mirror with the stop at its centre of curvature, and a curved image. The task is to design a Schmidt camera with aperture f/1.4 and semi-field of view 18°.

# 1. Adding a silica plate

Silica is chosen for this application as it transmits a wide range of wavelengths.

- □ Open the surface data spreadsheet.
- □ Change the entrance beam radius to 8/2/1.4
- □ Click on the grey button labelled **AST** (surface 1) to select the whole row.
- □ Right click.
- □ From the list, select **Insert before.**
- In the new surface 1, change the THICKNESS to 0.5 mm and the GLASS to silica.

III Surface Data	🔄 📃 🐹 🔼 Autodraw	
× SILICA	FOGAL LENGTH = -8 NA = 0.387	1 UNITS: MM DES: OSLO
8		A
Gen Setup Wavelength Variables Draw on Gr	Notes	E
Ent beam radius 2.857143 Field angle 18.000000 Primary w	In 0.587560	t
SRF RADIUS THICKNESS APERTURE RADIUS GLAS	SPECIAL	
OBJ 0.000000 1.0000e+20 3.2492e+19 AI		
1 0.000000 0.500000 2.968534 5 STLTC		
AST 0.000000 16.000000 2.857143 AS AI		F
3 -16.000000 -8.000000 8.055858 5 REFL_HATC		F
TMS -8.000000 0.023809 2.615597 S		£

□ Change the title to schmidt camera f/1.4

#### 2. Making the plate aspheric

- Under SPECIAL for surface 2 (AST) select Polynomial asphere (A)> Standard asphere
- In the dialog box which opens, enter a small nominal value say, 1E-11 as the value of the 4th order deformation coefficient. This tags surface 2 as being aspheric.
- □ Close the dialog box with the green tick.
- Note that the letter A now appears on the grey button under SPECIAL for surface 2.
- Close the surface data spreadsheet.

🌐 Standard Asphere Data < Surface Data				
✓ × 1.0e-11 ?				
Surface 2				
4th order deformation coefficient: 1.0000e-11				
6th order deformation coefficient: 0.000000				
8th order deformation coefficient: 0.000000				
10th order deformation coefficient: 0.000000 Delete Standard Asphere				



### 3. Adjusting the aspheric coefficients

#### Open the Slider-wheel Setup spreadsheet, by clicking on the icon on the main window header.

E Slider-wheel Setup



In the dialog box which opens,

- On the second row select Rayintercept
- On the third row select 1 field point at FBY 0.000000
- × ? • E E ○ No Internal evaluation ○ Draw only ④ Ray-intercept ○ OPD ○ Field sag ○ Spot diagram ○ Long. SA Graphics scale: 0.000000 © 1 Field point at FBY 0.000000 All points Number of sliders: 5 © Use drag processing Surf Cfg Item Value 2 2 2 Fourth-order aspheric coef (AD) 1.0000e-11 0.000000 Sixth-order aspheric coef (AE) Eighth-order aspheric coef (AF 0.000000 2 Tenth-order aspheric coef (AG) 0.000000 3 Thickness (TH) -7.976000 O Enable sw\_callback CCL function
- For Number of sliders enter 5
  Enter the four
- variables AD AE AF AG all for surface 2.
- □ Enter the variable **TH** for surface **3**.
- □ Close the window with the green tick.
- □ Locate the slider wheel bar, the lens drawing window (GW32) and the ray intercept curves window (GW31) and arrange as shown below.

🗖 GW 32			🗖 GW 31	
				<b></b>
🔤 Slider W	indow			
AD 2	1.0000e-11			🛾 Step 2e-05 🛛 🛨
AE 2	0.000000			Step 5e-06 🚊
AF 2	0.000000	•		Step 5e-07 🚊
AG 2	0.000000			Step 5e-08 🚊
TH 3	-7.976000			Step 0.1

Adjust the step sizes of the slider bars to the values shown below.

🖰 GW	32		🖰 GW 31 *	
📰 Slide	er Window			
AD 2	0.000132	•		Step 2e-06
AE 2	1.0500e-06	•		► Step 5e-08
AF 2	-1.2000e-08	•		Step 5e-10
AG 2	1.2500e-10	•		► Step 5e-12
TH 3	-8.000000	•		▶ Step 0.001

- □ Begin adjustment of AD 2 and TH 3.
- □ When the aberration curves become hard to distinguish from the axis, reopen the slider wheel spreadsheet to obtain aberration curves with better resolution.
- □ Find the balance which gives the optimum performance for the green (mid) wavelength.

## 4. Drawing and listing the final design

- □ Open the surface data spreadsheet.
- □ Click on the grey button under SPECIAL for surface 4 (IMS)
- □ Select Surface Control (F) > General.
- □ For Surface appearance in lens drawings change Automatic to Drawn.
- □ Change **Pen number for surface in lens drawings** from 0 to **3** (i.e. the surface will be drawn in blue).
- Draw the lens by clicking on the Draw system(2D plan v v) icon in the graphics window.

To list the lens:

- □ In the text window, click on the **Len** and **Spe** headers.
- □ From the **Evaluate** menu header, select **Paraxial Setup**, or click on the **Pxs** icon in the text window header.

Note that the parameters adjusted by slider wheel may not have quite the same values as those listed here.









*LENS	DATA						
Schmid	t camera f/1.	4					
SRF	RADIUS	THICKNES	S APERTUR	E RADIUS	GLASS	SPE	NOTE
OBJ		1.0000e+2	0 3.2492	e+19	AIR		
1		0.50000	0 2.96	8534 s	SILICA	С	
AST		16.00000	0 2.85	7143 AS	AIR	*	
3	-16.000000	-8.00000	0 8.05	5858 S	REFL_HATCH		
IMS	-8.000000		2.59	9358 S			
*CONIC	AND POLYNOMI	AL ASPHERIC	DATA			_	
SRF	ee	AD	AE	AF	AG	;	
2		1.3200e-04	1.0500e-0	6 -1.2000	e-08 1.2500	)e-10	
*PARAX	IAL SETUP OF	LENS					
ייסיסמא	יזסדי						
APERI Ent	TADGO DOAM TA	dive. *	2 9571/2	Tm290 27	ial raw alor		0 257142
Obi	eat num aner	ture	2.037143 8571a-20	E-number	.iai iay siop		-1 400000
UD ] Tm a	ge num apert	ure. 2.	0 357143	Working	• E-number•		1 400000
ETELD	ge num. aperc	ure.	0.337143	WOLKING	r-number.		1.400000
FIGDO	ld angle.	* 1	8 00000	Object h	eight.	_	3 24920+19
Gau	egian imaga h	eicht.	2 599358	Chief ra	v ime height		2 599358
CONJU	GATES	ergne.	2.333330	chier ru	y imp neight	••	2.333330
Obi	ect distance:	1.	0000e+20	Srf 1 to	prin. pt. 1	:	16.342826
Gau	ssian image d	ist.: -	8.000000	Srf 3 to	prin. pt. 2	2 •	
Ove	rall lens len	ath: 1	6.500000	Total tr	ack length:		1.0000e+20
Par	axial magnifi	cation: -8.	0000e-20	Srf 3 to	image srf:		-8.000000
OTHER	DATA						
Ent	rance pupil r	adius:	2.857143	Srf 1 to	entrance pu	ıp.:	0.342826
Exi	t pupil radiu	s:	2.857143	Srf 3 to	exit pupil:		-16.000000
Lag	range invaria	nt: -	0.928342	Petzval	radius:		-8.000000
Eff	ective focal	length: -	8.000000				
SPOT	DIAGRAMS	-					
Ape	rture divisio	ns: 1	7.030000	Gaussian	apod. spec.	:	Spot size
X 1	/e^2 entr. ir	rad.:	0.500000	Y 1/e^2	entr. irrad.	:	0.500000

This concludes the design.