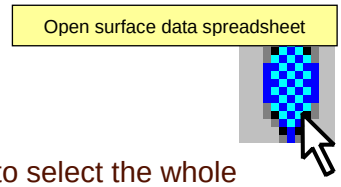
DESIGNING A SCHMIDT CAMERA OBJECTIVE

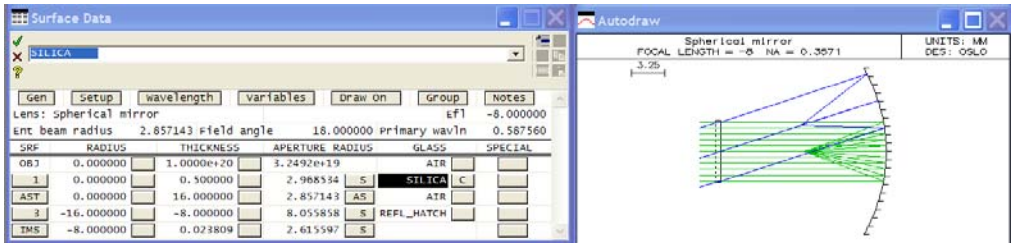
This exercise commences with the concluding design of the section headed “Your first OSLO session”. This consists of a concave mirror with the stop at its centre of curvature, and a curved image. The task is to design a Schmidt camera with aperture f/1.4 and semi-field of view 18º.

1. Adding a silica plate

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



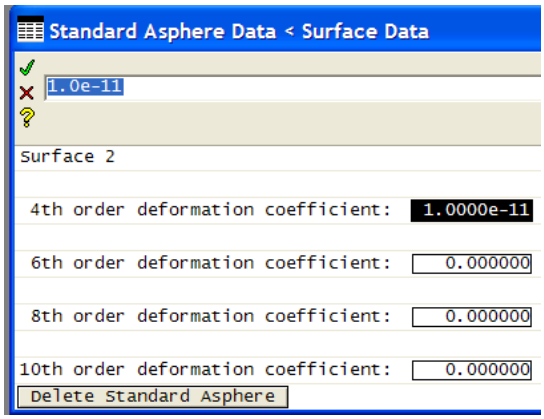
- ☐ Open the surface data spreadsheet.
- ☐ Change the entrance beam radius to **`8/2/1.4`**
- ☐ Click on the grey button labelled **AST** (surface 1) to select the whole row.
- ☐ Right click.
- ☐ From the list, select **Insert before.**
- ☐ In the new surface 1, change the THICKNESS to **`0.5`** mm and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



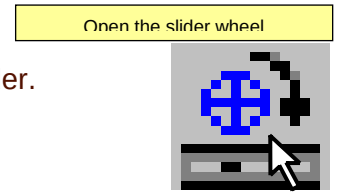
- ☐ Change the title to **`Schmidt camera f/1.4`**

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.

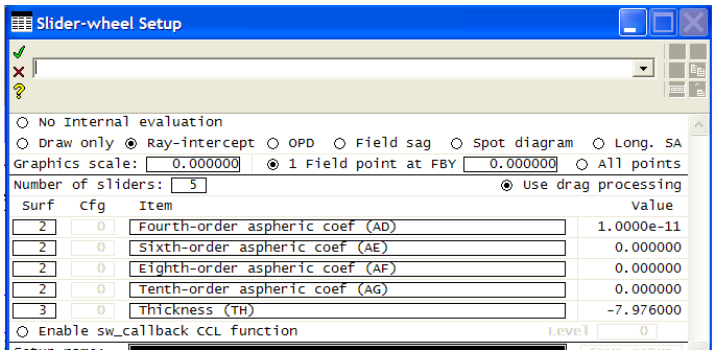


3. Adjusting the aspheric coefficients

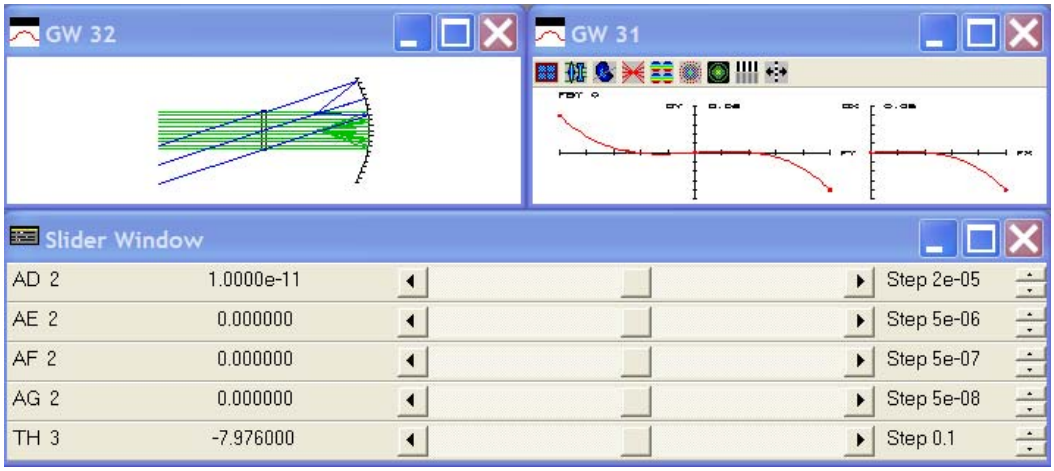


- Open the **Slider-wheel Setup spreadsheet**, by clicking on the icon on the main window header.

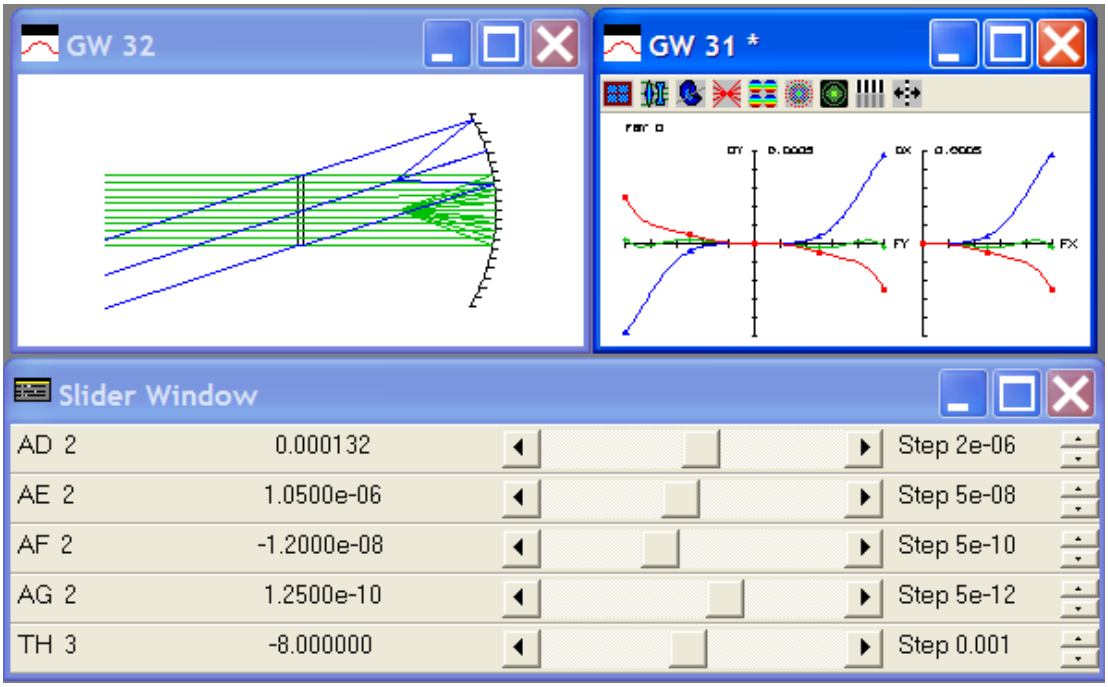
In the dialog box which opens,



- On the second row select **Ray-intercept**
- On the third row select **1 field point at FBY 0.000000**
- 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.



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



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

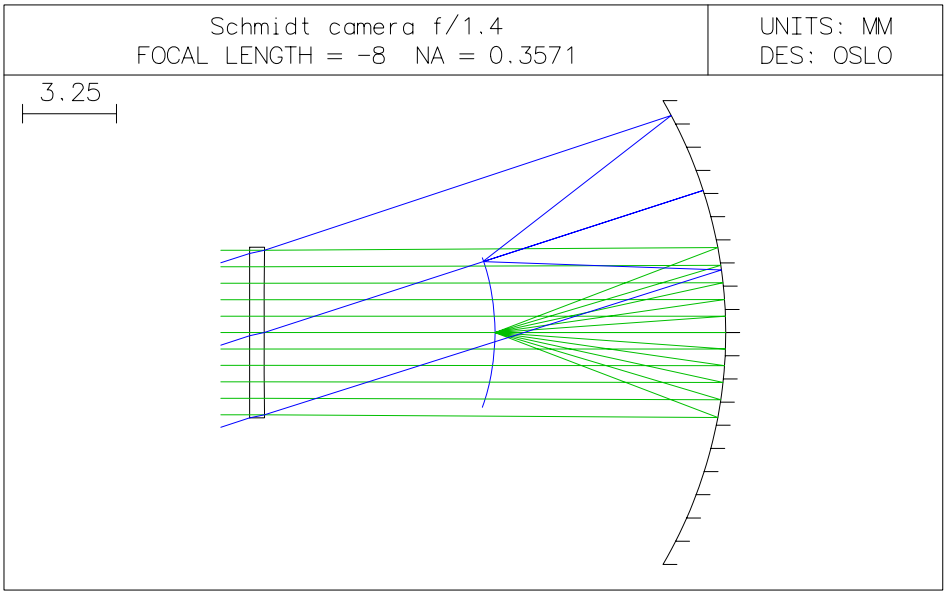
4. Drawing and listing the final design

- 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 view)** 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.

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*LENS DATA
Schmidt camera f/1.4
 SRF      RADIUS      THICKNESS   APERTURE RADIUS      GLASS  SPE  NOTE
 OBJ        --       1.0000e+20    3.2492e+19            AIR

  1         --         0.500000      2.968534 S        SILICA C
 AST        --        16.000000      2.857143 AS          AIR   *

  3    -16.000000     -8.000000      8.055858 S    REFL_HATCH

 IMS     -8.000000        --          2.599358 S

*CONIC AND POLYNOMIAL ASPHERIC DATA
 SRF        CC          AD          AE          AF          AG
  2         --      1.3200e-04  1.0500e-06 -1.2000e-08  1.2500e-10

*PARAXIAL SETUP OF LENS

 APERTURE
   Entrance beam radius: *    2.857143    Image axial ray slope:     0.357143
   Object num. aperture:    2.8571e-20    F-number:                 -1.400000
   Image num. aperture:       0.357143    Working F-number:          1.400000
 FIELD
   Field angle:          *   18.000000    Object height:          -3.2492e+19
   Gaussian image height:     2.599358    Chief ray ims height:      2.599358
 CONJUGATES
   Object distance:         1.0000e+20    Srf 1 to prin. pt. 1:     16.342826
   Gaussian image dist.:     -8.000000    Srf 3 to prin. pt. 2:        --
   Overall lens length:      16.500000    Total track length:      1.0000e+20
   Paraxial magnification: -8.0000e-20    Srf 3 to image srf:       -8.000000
 OTHER DATA
   Entrance pupil radius:     2.857143    Srf 1 to entrance pup.:    0.342826
   Exit pupil radius:         2.857143    Srf 3 to exit pupil:     -16.000000
   Lagrange invariant:       -0.928342    Petzval radius:           -8.000000
   Effective focal length:   -8.000000
 SPOT DIAGRAMS
   Aperture divisions:       17.030000    Gaussian apod. spec.:    Spot size
   X 1/e^2 entr. irrad.:      0.500000    Y 1/e^2 entr. irrad.:      0.500000
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This concludes the design.