Conic surface

A system with an ellipsoidal mirror should be installed. For this task, the following steps should be performed:

a) A source with wavelength λ = 1.064 μm and numerical aperture NA = 0.1 is imaged by a spherical mirror in a 1:1 setup with a mirror radius of 20 mm

b) The image distance is enlarged to 40 mm. The radius of the mirror and the conical constant are optimized for this geometry. According to the theory, an ellipsoidal mirror images one point perfect into another point.

c) The coordinate system is rotated by 60° directly after the object. For a proper layout, the subaperture of the mirror which is used should be explicitly defined. Make a shaded model layout with this setup. What is the bending angle of the central ray at the mirror ? Determine the shape and the approximate x/y-aspect ratio of the illuminated area on the mirror.

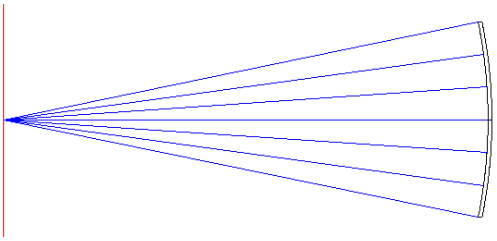
Solution:

a) spherical mirror with radius 20 mm

Lens Data Editor

Edit Solves View Help

	Surf:Type	Comment	Radius	Thickness	Glass	Semi-Diameter		Conic
*	Standard		Infinity	20.0000000		0.0000000		0.0000000
*	Standard		-20.0000000	-20.0000000	MIRROR	4.0000000		0.0000000
*	Standard		Infinity	-		6.0000000	U	0.0000000



b) Image distance doubled and a simple merit function (default) is used to optimize the radius r and conic constant κ

Lens Data Editor

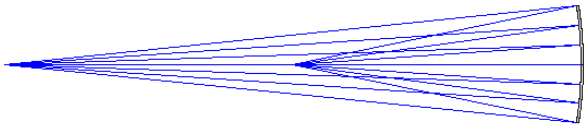
Edit Solves View Help

	Surf:Type	Comment	Radius		Thickness	Glass	Semi-Diameter	Conic	
*	Standard		Infinity		20.0000000		0.0000000	0.0000000	
*	Standard		-26.6666667	V	-40.0000000	MIRROR	4.0203067	-0.1111111	V
*	Standard		Infinity		-		6.705836E-011	0.0000000	

Merit Function Editor: 1.126763E-010

Edit Tools View Help

Oper #	Type					
1: DMFS	DMFS					
2: BLNK	BLNK	Default merit function: RMS spot radius centroid GQ 3 rings 6 arms				
3: BLNK	BLNK	No default air thickness boundary constraints.				
4: BLNK	BLNK	No default glass thickness boundary constraints.				
5: BLNK	BLNK	Operands for field 1.				
6: TRAC	TRAC		1	0.0000000	0.0000000	
7: TRAC	TRAC		1	0.0000000	0.0000000	
8: TRAC	TRAC		1	0.0000000	0.0000000	



c) An additional surface is introduced after the object and a coordinate break is defined with 60°tilt around the x-axis.

Lens Data Editor

Edit Solves View Help

	Surf:Type	Comment	Radius		Thickness		Glass		Semi-Diameter		Conic		Par 0(unused)	Par 1(unused)	Par 2(unused)	Par 3(unused)
*	Standard		Infinity		0.0000000				0.0000000		0.0000000					
1	Coordinate B..				20.0000000		-		0.0000000					0.0000000	0.0000000	60.0000000
*	Standard		-26.6666667	V	-40.0000000		MIRROR		25.0000000	U	-0.1111111	V				
*	Standard		Infinity		-				5.710001E-008		0.0000000					

A raytrace shows, that in the y-z-plane the y-values of the aperture cone are 16.3...19.8...22.9 mm. Therefore a rectangular aperture with y-shift 20 mm and half diameters of 4 and 5 mm are defined.

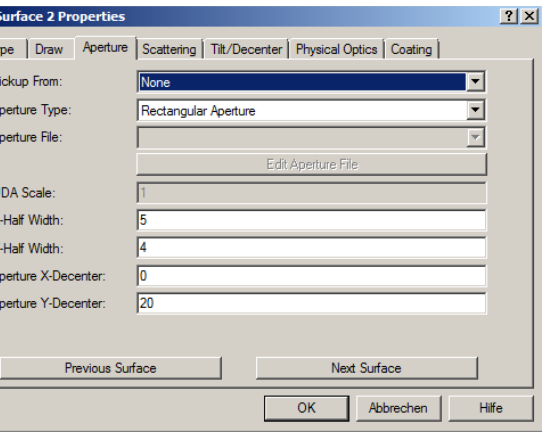
3: Ray Trace

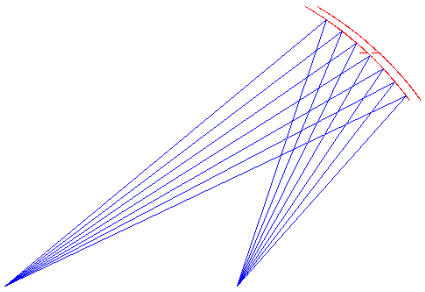
Update Settings Print Window

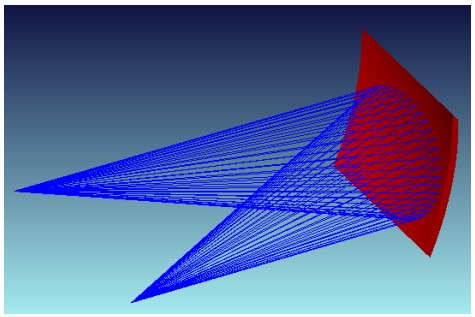
```
Normalized X Pupil Coord (Px) :      0.0000000000
Normalized Y Pupil Coord (Py) :      0.0000000000

Real Ray Trace Data:

Surf       X-coordinate       Y-coordinate       Z-coordinate
OBJ  -0.0000000000E+000 -0.0000000000E+000  0.0000000000E+000
  1    0.0000000000E+000  0.0000000000E+000  0.0000000000E+000
  2    0.0000000000E+000  1.9794866374E+001 -8.5714285703E+000
  3    0.0000000000E+000  3.2576998876E-008  0.0000000000E+000
```







If the ray trace is calculated for the central ray, we get the incidence angle 13.90°. Therefore the bending of the central ray is 27.8°.

A footprint on the mirror looks nearly elliptical with an aspect ratio of 0.712