Remote sensing device

Chatterjee Consulting Services

Mistic – Optical Design

MISTiC™ Key Instrument Performance Characteristics		
Characteristic	**Value**	**Comments**
Minimum Spectral Frequency	1750 cm^{-1}	5.72 µm
Maximum Spectral Frequency	2450 cm^{-1}	4.082 µm
Spectral Sampling	~ 2:1	<590 spectral samples
Spectral Resolution @ minimum	>700 :1	ν/δν ((comparable to CrIS-Apodized)
Spectral Calibration Knowledge	1/100,000	δλ/λ
Angular Sampling	1.6 mr (cross-dispersed)	1.38 km (@ Nadir)
Orbital Altitude and Orbit	705.3 km	Polar/Sun-Synchronous
Angular Range (cross-track)	1570 radians	90 Degrees—Same as AIRS
Spatial Resolution	<3.0 km (geometric mean)	@ Nadir
Radiometric Sensitivity	<200 mK (max)	(<150 mK @ 2380 cm^{-1})
Radiometric Accuracy	<1%	@ 300K Scene Background
Key Sounding Data Product Characteristics		
Vertical Resolution—Temperature	~ 1 km	In Lower Troposphere
Layer Accuracy	~ 1.25 K	In Lower Troposphere
Vertical Resolution—Humidity	~ 1-2 km	In Lower Troposphere
Layer Accuracy—Humidity	~ 15 %	In Lower Troposphere

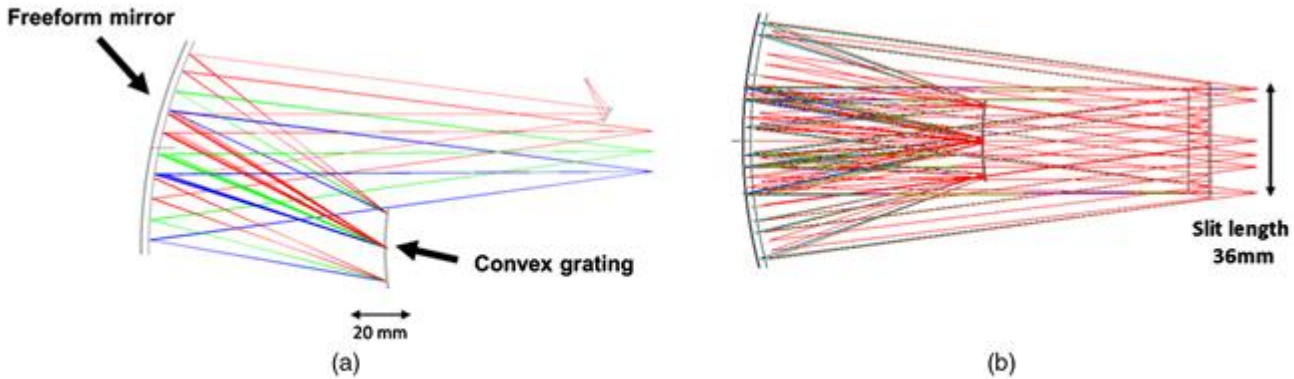


Fig. 17 A high-resolution Littrow-Offner design with long slit and freeform mirror.

Model an offner and Littrow-offner design based on Image above (Target Model)

Key parameters

Design = 1:1 magnification for field extension.

Assume detector has 640x480 pixel

IR sensor pixel size of 0.03mm

Derived effective focal length P/AS = 18.75mm = The angular range (cross track)

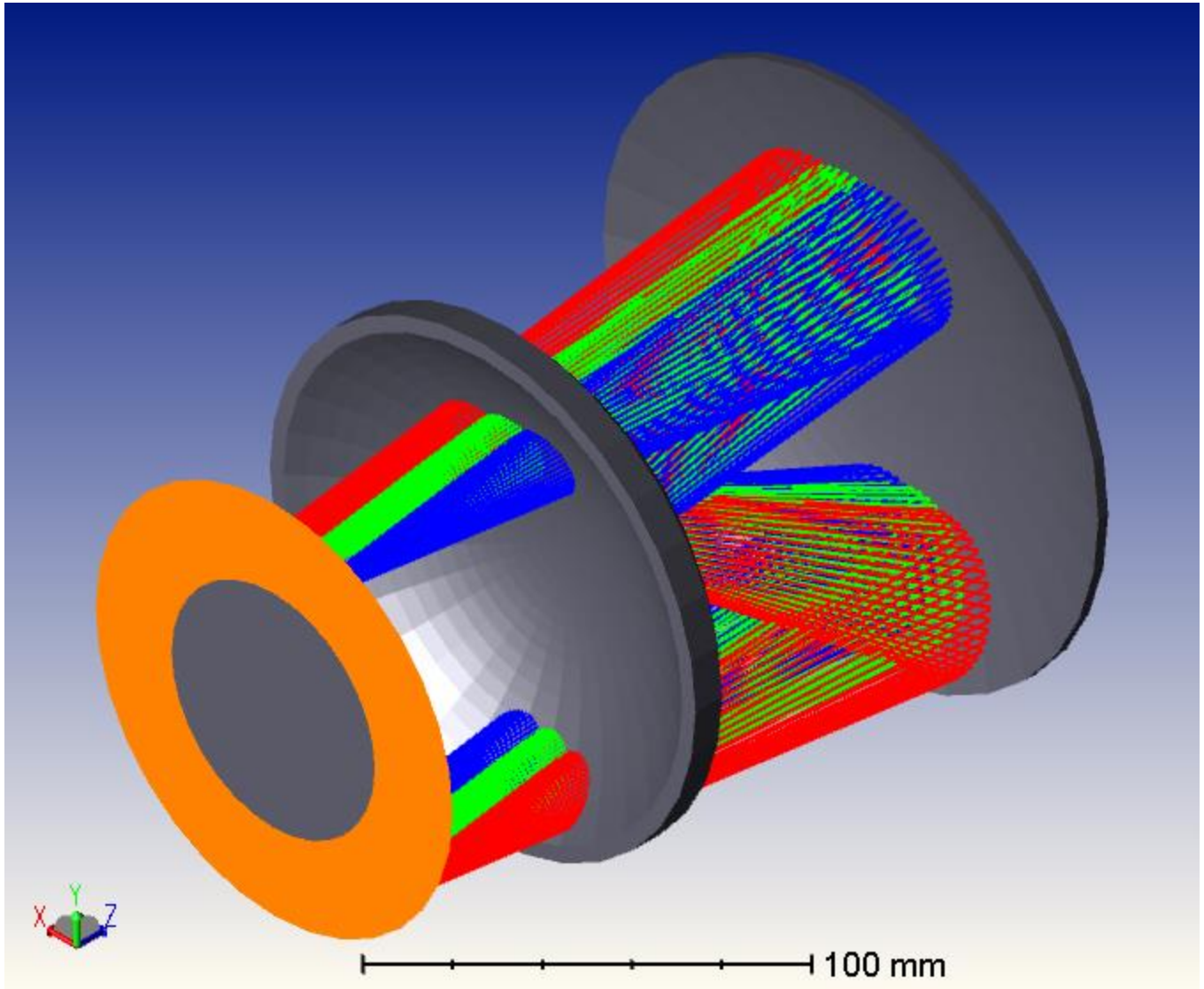
Which gives the field extension = 37.5 mm.

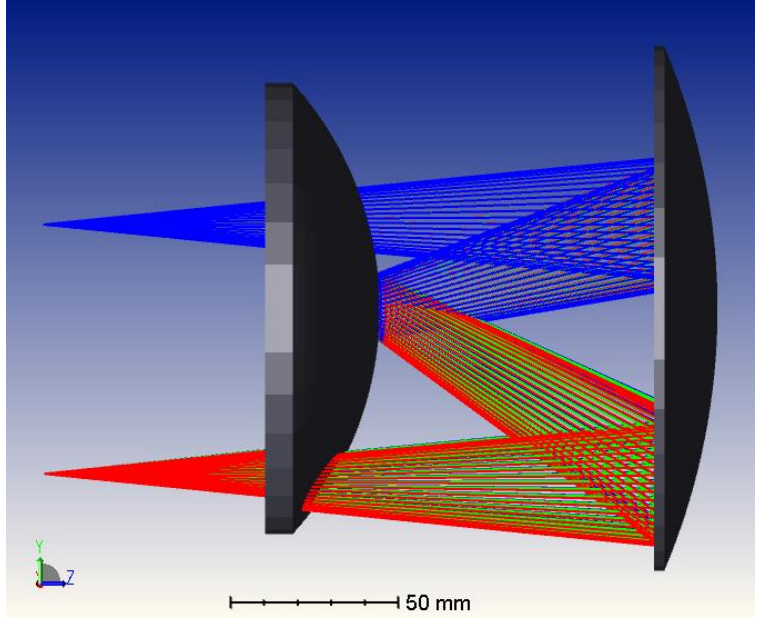
Spectral sample: TBD

0.05 Lines/micron

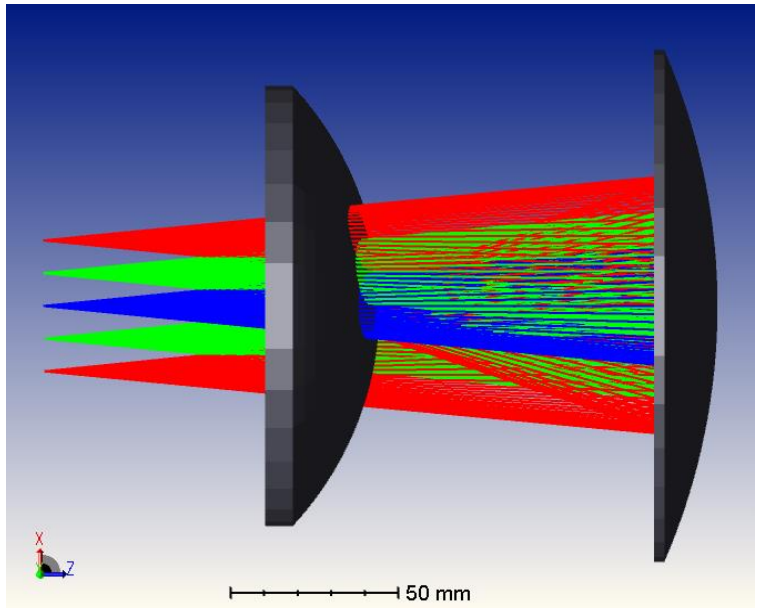
Order 0,-1,1

Lithrow Offner (order -1)



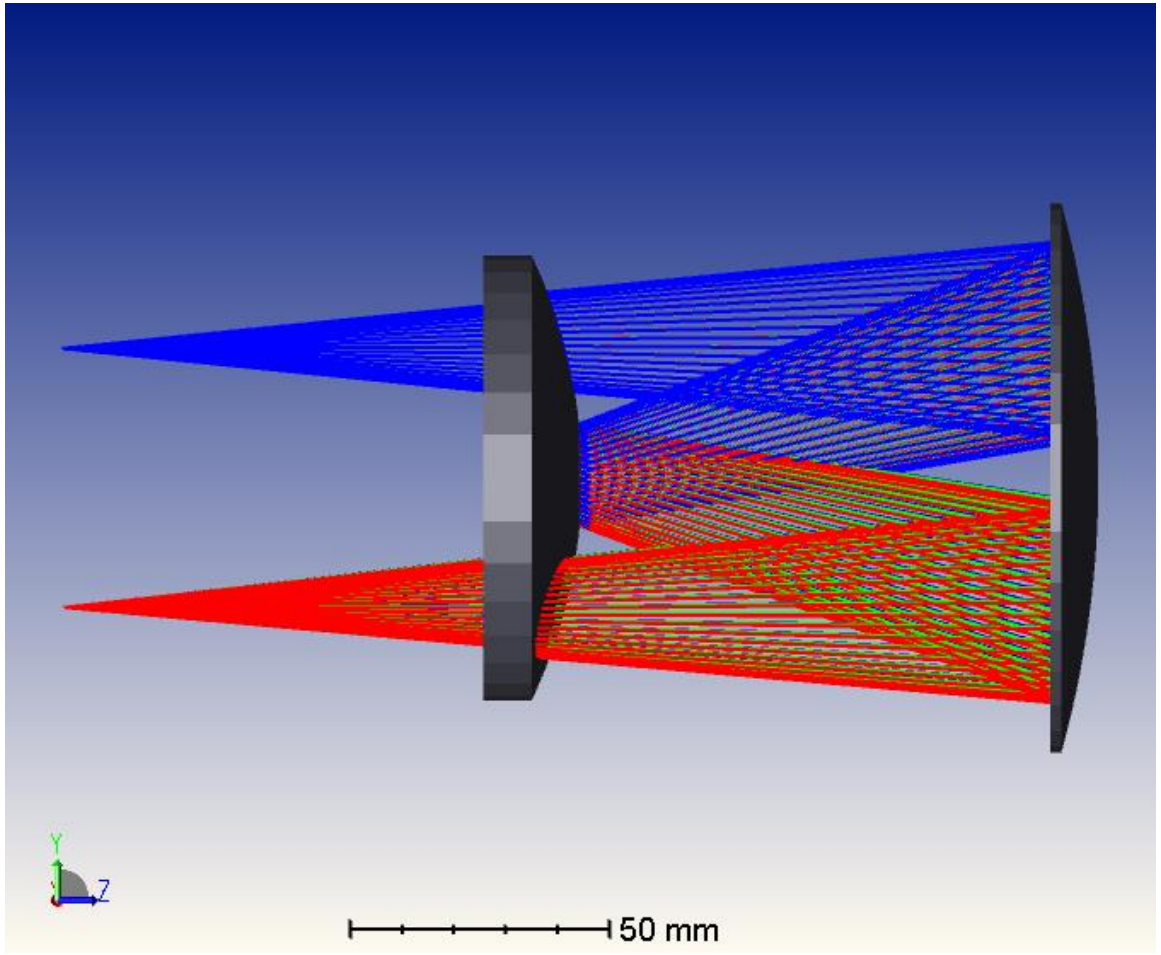


Y-Z



X-Z

Lithrow Offner (order 0)

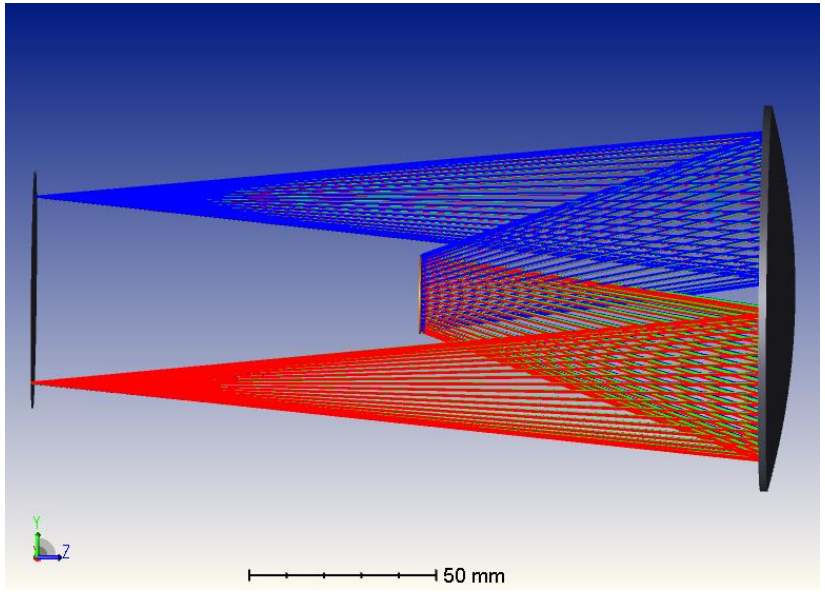


Zemax spec

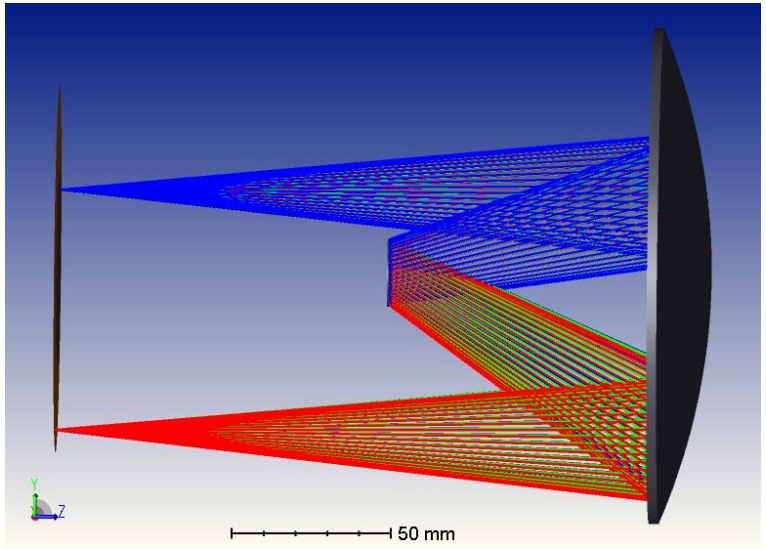
Surfaces	: 8		
Stop	: 1		
System Aperture	:	Object Space NA =	0.1
Fast Semi-Diameters	:	On	
Telecentric Object Space:		On	
Field Unpolarized	: On		
Convert thin film phase to ray equivalent	:	On	
J/E Conversion Method	:	X Axis Reference	
Glass Catalogs	: INFRARED		
Ray Aiming	: Off		
Apodization	: Uniform, factor =	0.00000E+000	
Reference OPD	: Exit Pupil		
Paraxial Rays Setting	:	Ignore Coordinate Breaks	
Method to Compute F/#	:	Tracing Rays	
Print Coordinate Breaks	:	On	
Multi-Threading	: On		
OPD Modulo 2 Pi	:	Off	
Temperature (C)	:	2.00000E+001	
Pressure (ATM)	: 1.00000E+000		
Adjust Index Data To Environment	:	Off	
Effective Focal Length	:	1383.269	(in air at system temperature and pressure)
Effective Focal Length	:	1383.269	(in image space)
Back Focal Length	:	1293.159	
Total Track	: 197.6671		
Image Space F/#	: 6.881674e-007		
Paraxial Working F/#	:	4.97418	
Working F/#	: 4.990323		
Image Space NA	:	0.1000151	
Object Space NA	: 0.1		
Stop Radius	: 9.077502		
Paraxial Image Height	:	32.01075	
Paraxial Magnification	:	-0.9998477	
Entrance Pupil Diameter	:	2.010076e+009	
Entrance Pupil Position	:	1e+010	
Exit Pupil Diameter	:	427.9027	
Exit Pupil Position	: 2122.789		
Field Type	: Object height in Millimeters		
Maximum Radial Field	:	32.01562	
Primary Wavelength [µm]	:	5	
Angular Magnification	:	-7229253	
Lens Units	: Millimeters		
Source Units	: Watts		
Analysis Units	: Watts/cm^2		
Afocal Mode Units	:	milliradians	
MTF Units	: cycles/millimeter		
Include Calculated Data in Session File	:	On	

offner

Diffraction order 0



Diffraction order -1



Zemax spec

urfaces : 4
Stop : 1
System Aperture : Object Space NA = 0.1
Fast Semi-Diameters : On
Telecentric Object Space: On
Field Unpolarized : On
Convert thin film phase to ray equivalent : On
J/E Conversion Method : X Axis Reference
Glass Catalogs :
Ray Aiming : Off
Apodization : Uniform, factor = 0.00000E+000
Reference OPD : Exit Pupil
Paraxial Rays Setting : Ignore Coordinate Breaks
Method to Compute F/# : Tracing Rays
Print Coordinate Breaks : On
Multi-Threading : On
OPD Modulo 2 Pi : Off
Temperature (C) : 2.00000E+001
Pressure (ATM) : 1.00000E+000
Adjust Index Data To Environment : Off
Effective Focal Length : 2205.579 (in air at system temperature and pressure)
Effective Focal Length : 2205.579 (in image space)
Back Focal Length : 2003.203
Total Track : 202.3227
Image Space F/# : 1.097262e-006
Paraxial Working F/# : 4.975785
Working F/# : 4.998697
Image Space NA : 0.09998312
Object Space NA : 0.1
Stop Radius : 20.30176
Paraxial Image Height : 32.02108
Paraxial Magnification : -1.00017
Entrance Pupil Diameter : 2.010076e+009
Entrance Pupil Position : 1e+010
Exit Pupil Diameter : 930.833
Exit Pupil Position : 4628.28
Field Type : Object height in Millimeters
Maximum Radial Field : 32.01562
Primary Wavelength [µm] : 5
Angular Magnification : -4533955
Lens Units : Millimeters
Source Units : Watts
Analysis Units : Watts/cm^2
Afocal Mode Units : milliradians
MTF Units : cycles/millimeter
Include Calculated Data in Session File : On

Fields : 3
Field Type : Object height in Millimeters

#	X-Value	Y-Value	Weight
1	0.000000	25.000000	1.000000
2	10.000000	25.000000	1.000000
3	20.000000	25.000000	1.000000