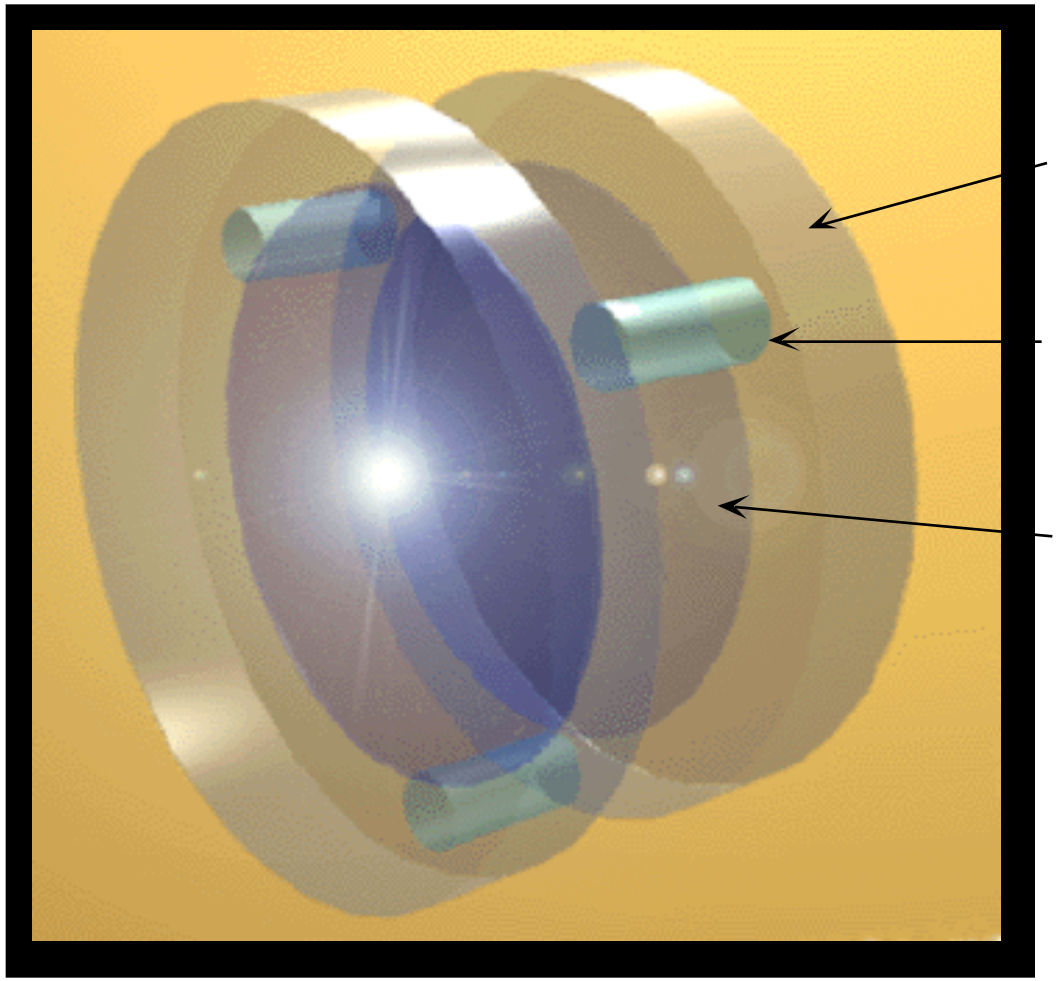
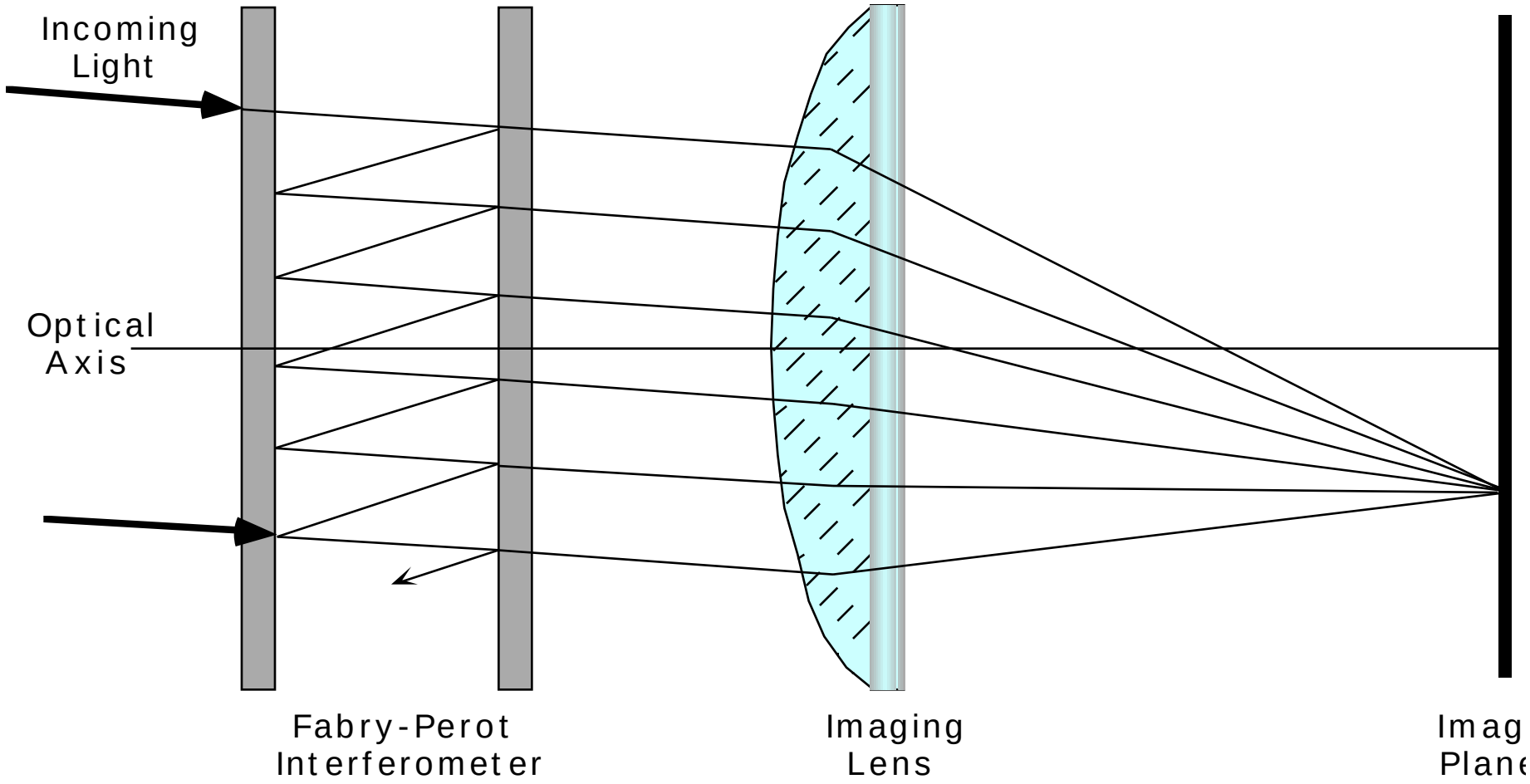
TIDI Profiler Features

- **High-resolution Fabry-Perot interferometer**
  - well established technique to measure wind, temperature, VER from weak emissions (ground systems, DE-FPI, HRDI)
- **High-quantum-efficiency CCD detector**
  - about a factor of 10 better than old detectors
- **Four telescopes for viewing atmosphere**
  - permits two tracks on either side of the spacecraft viewing different local times
- **A novel set of input optics**
  - allows all four telescopes to be sampled simultaneously
- **The circle to line interferometer optic (CLIO)**
  - allows the CCD to be used to minimize read noise and readout time

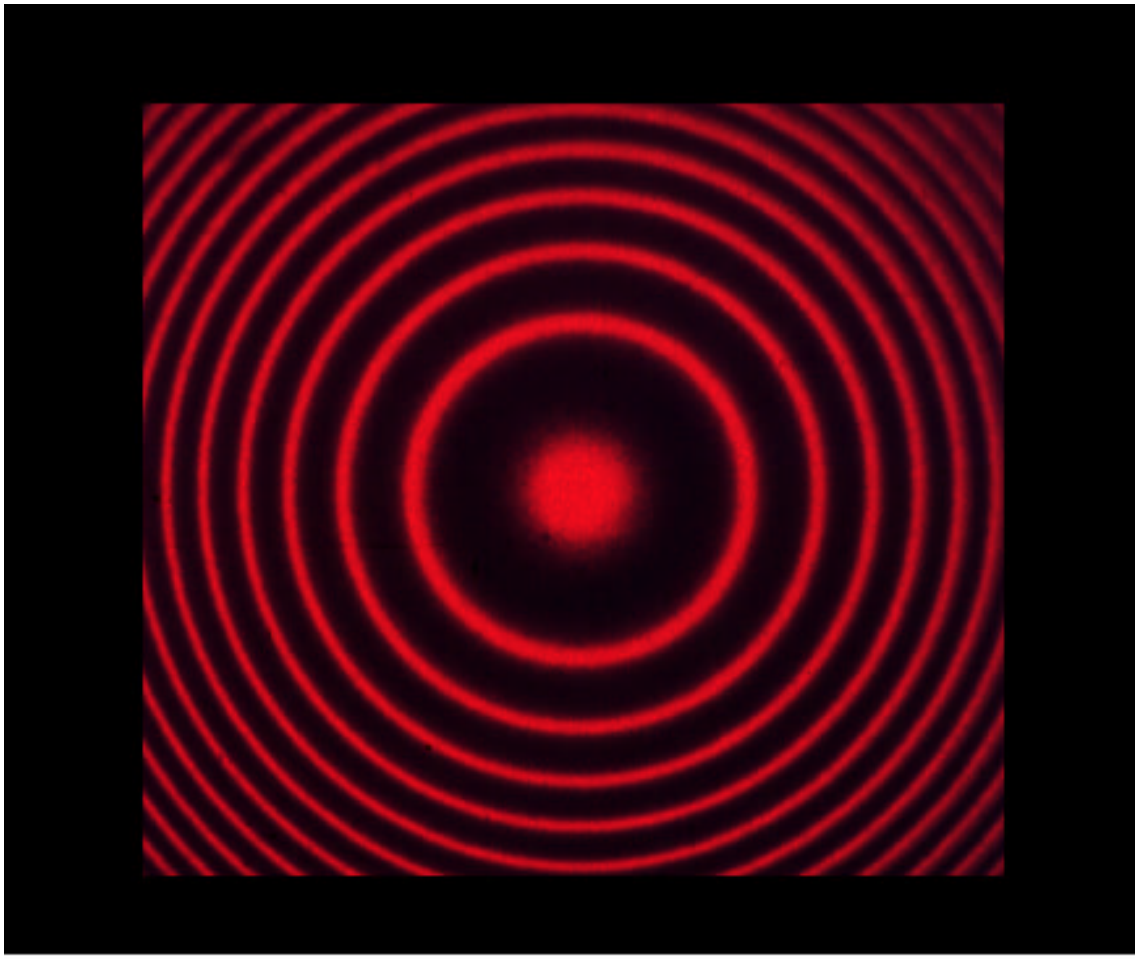
Fabry-Perot Interferometer



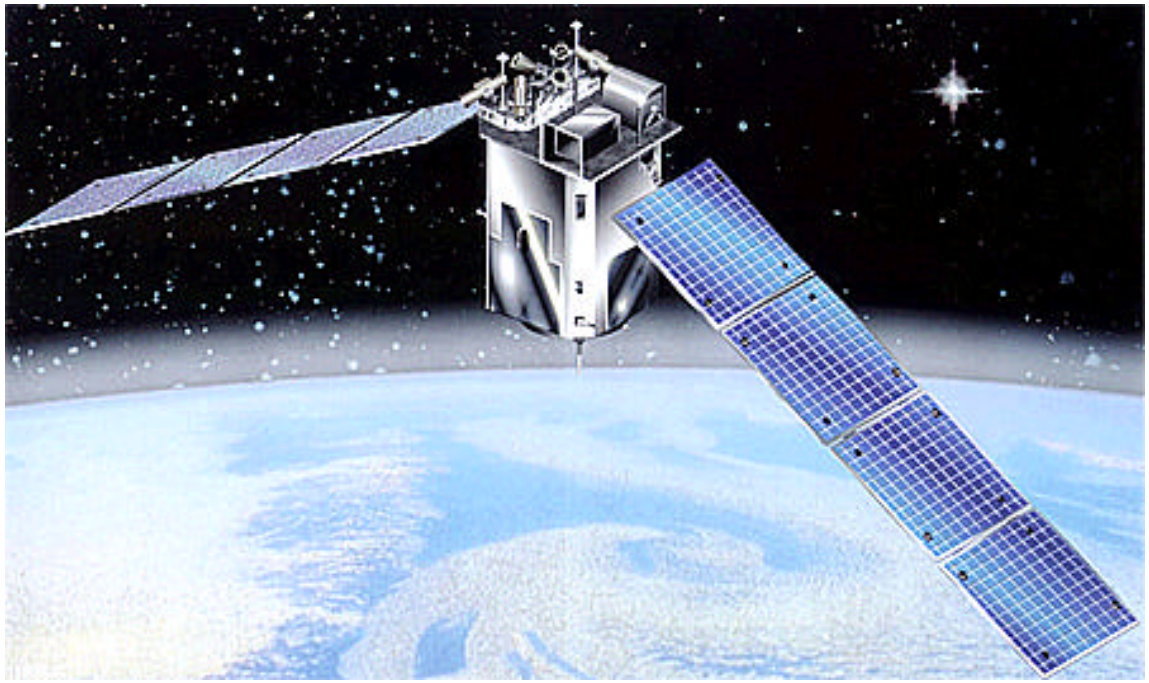
Etalon


Incoming
Light
Optical
Axis
Fabry-Perot
Interferometer
Imaging
Lens
Imag
Plane

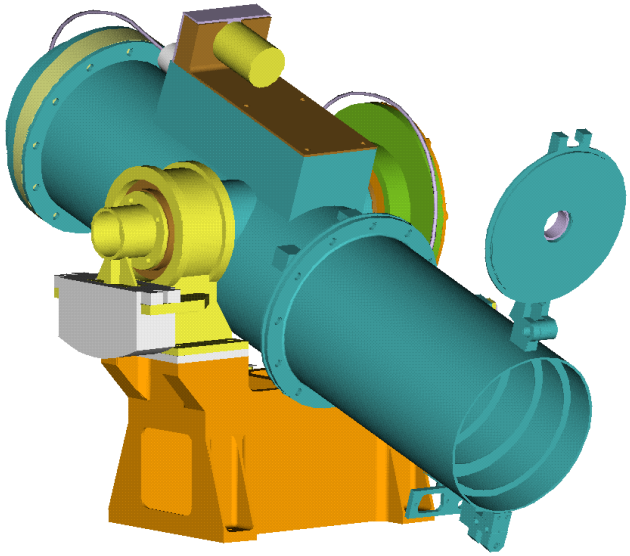
Fabry-Perot Fringe Pattern



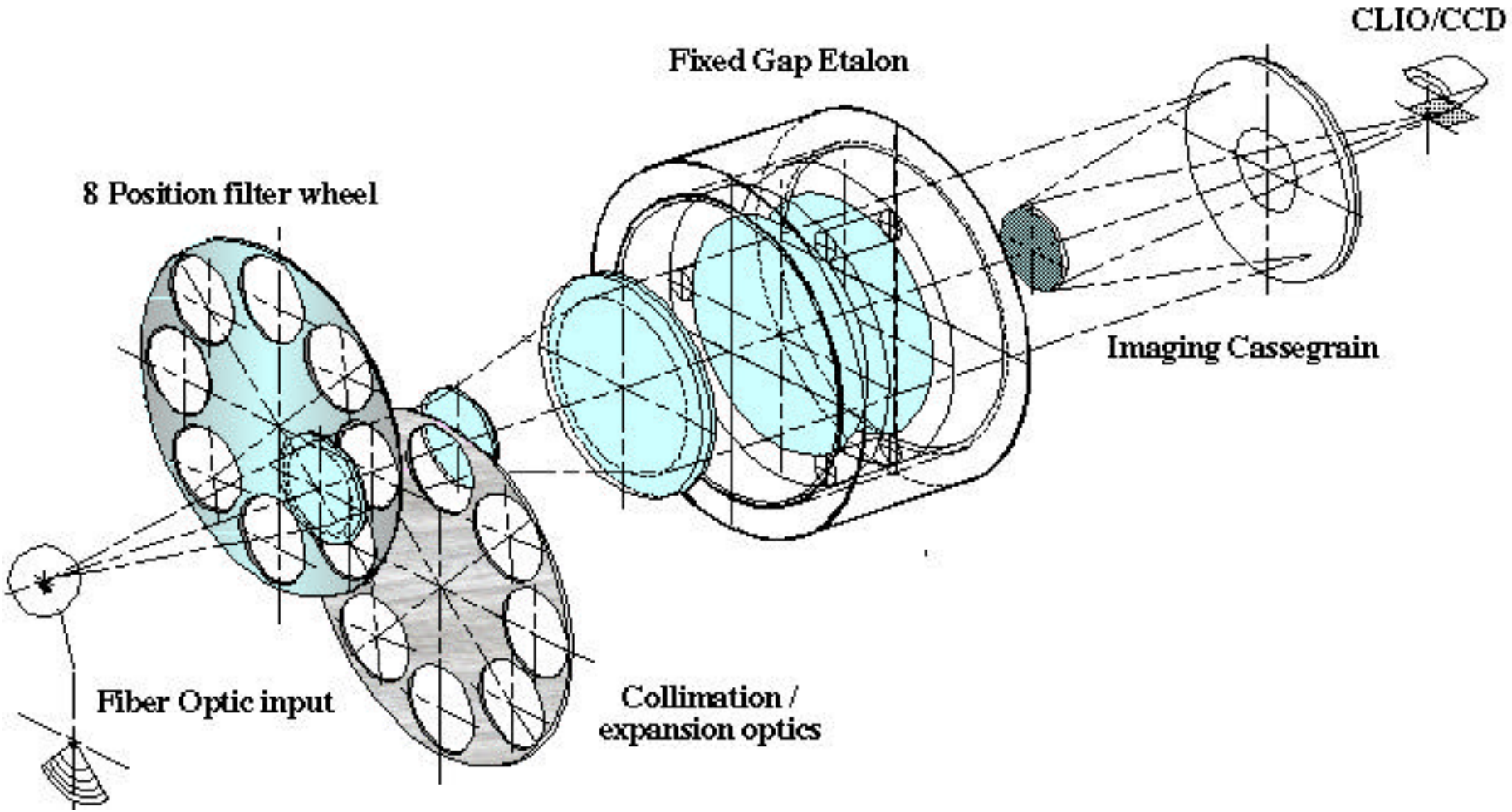
TIDI on TIMED



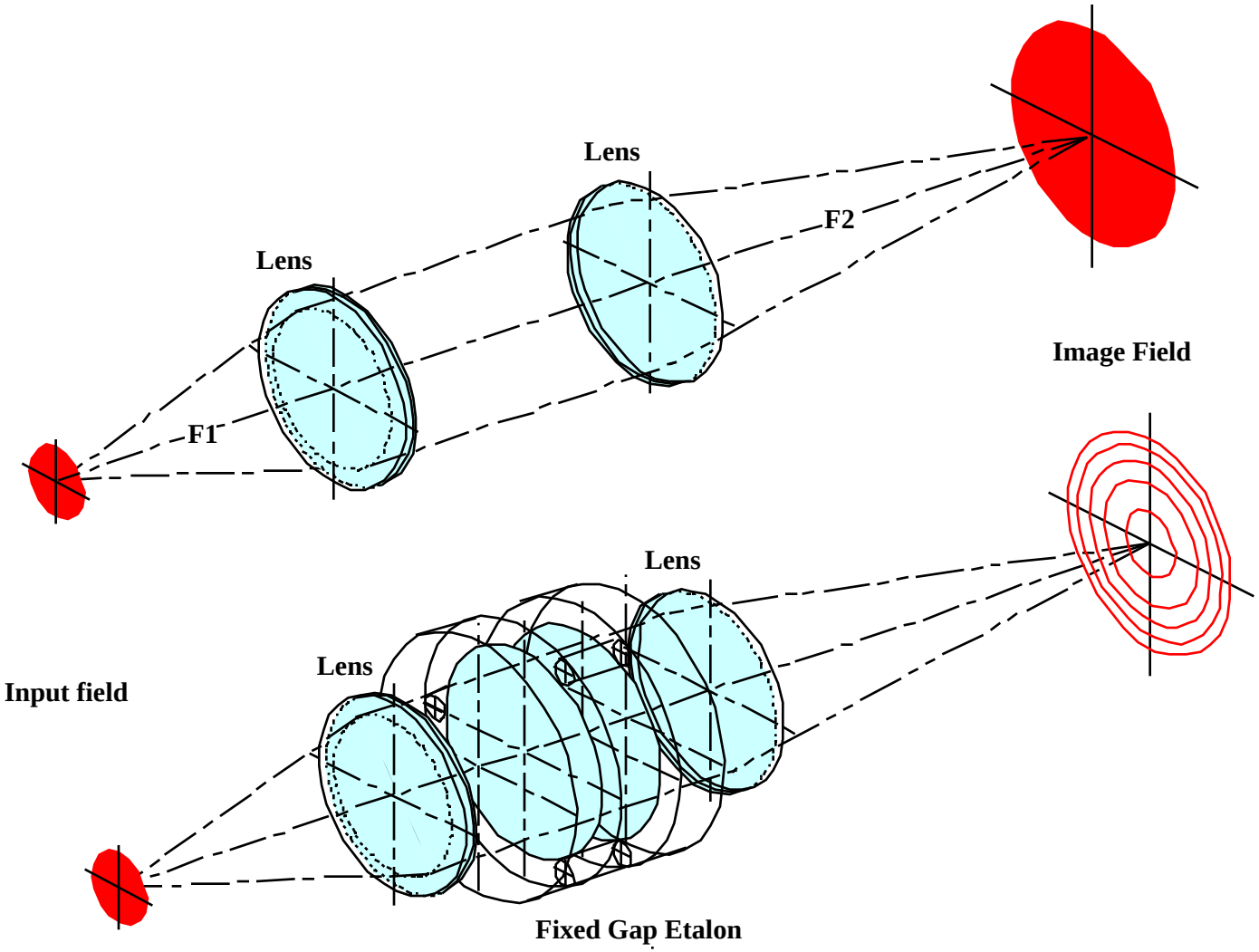
TIDI Telescope



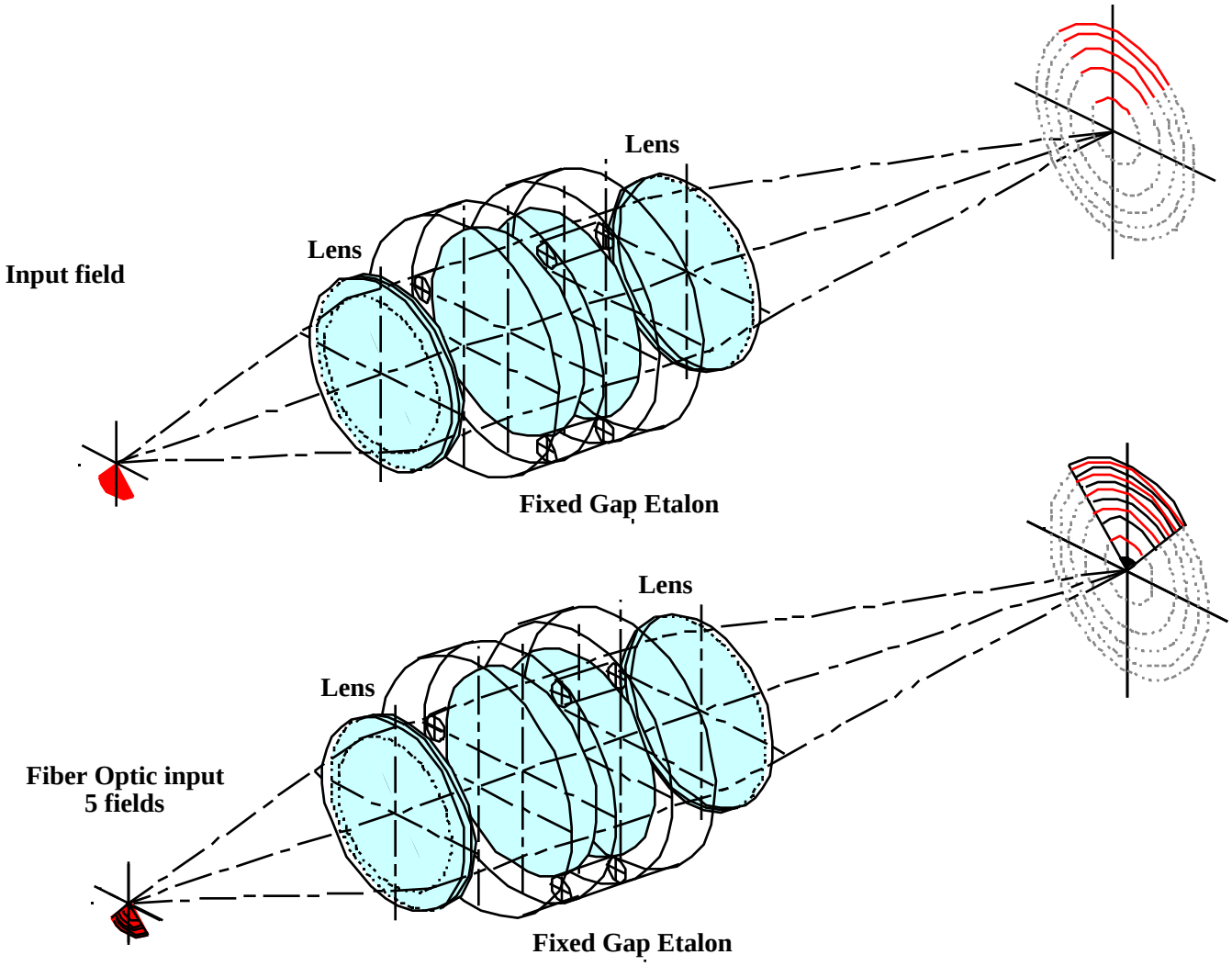
TIDI Profiler Optics Overview



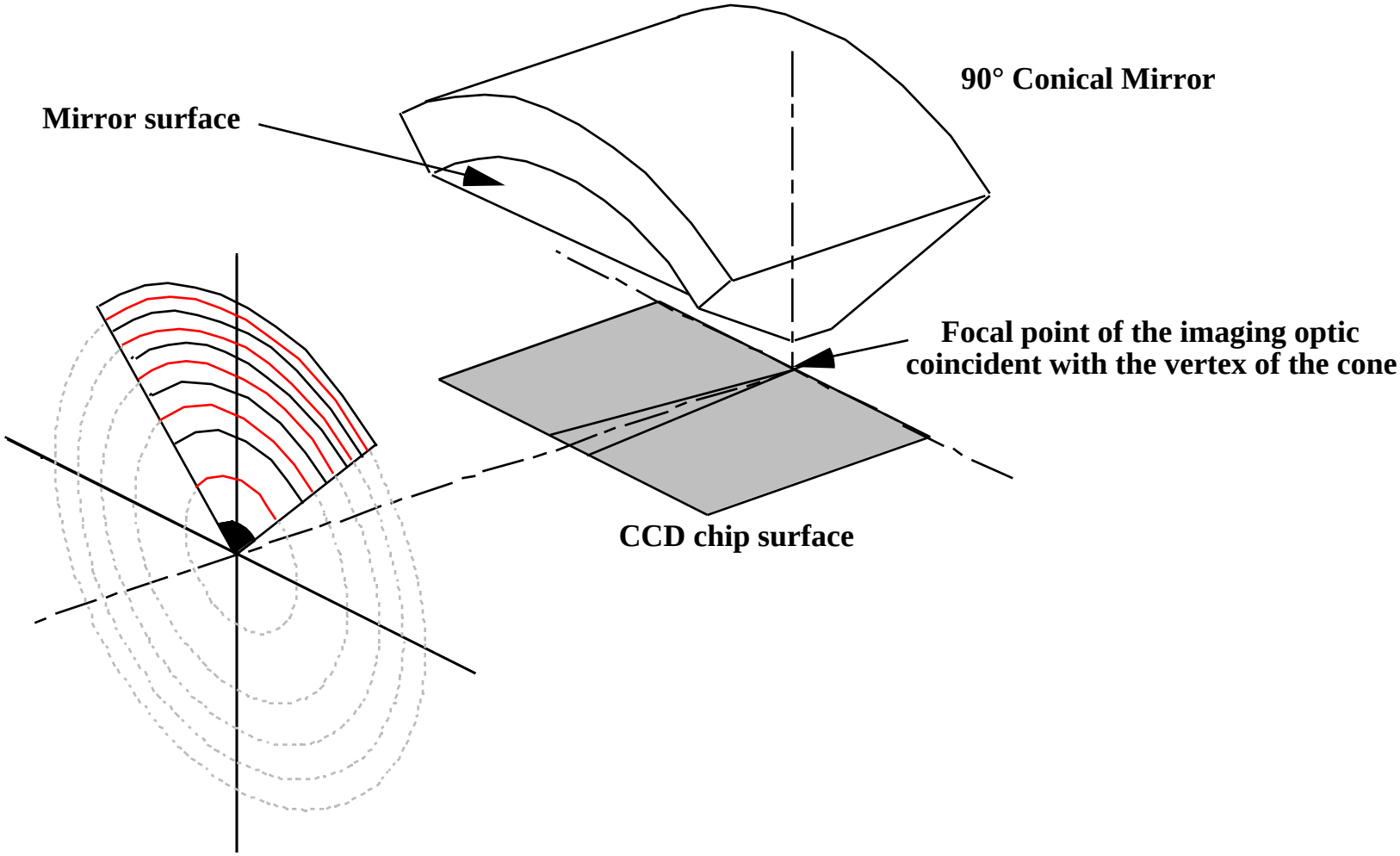
Optical Transformation



Optical Transformation (continued)

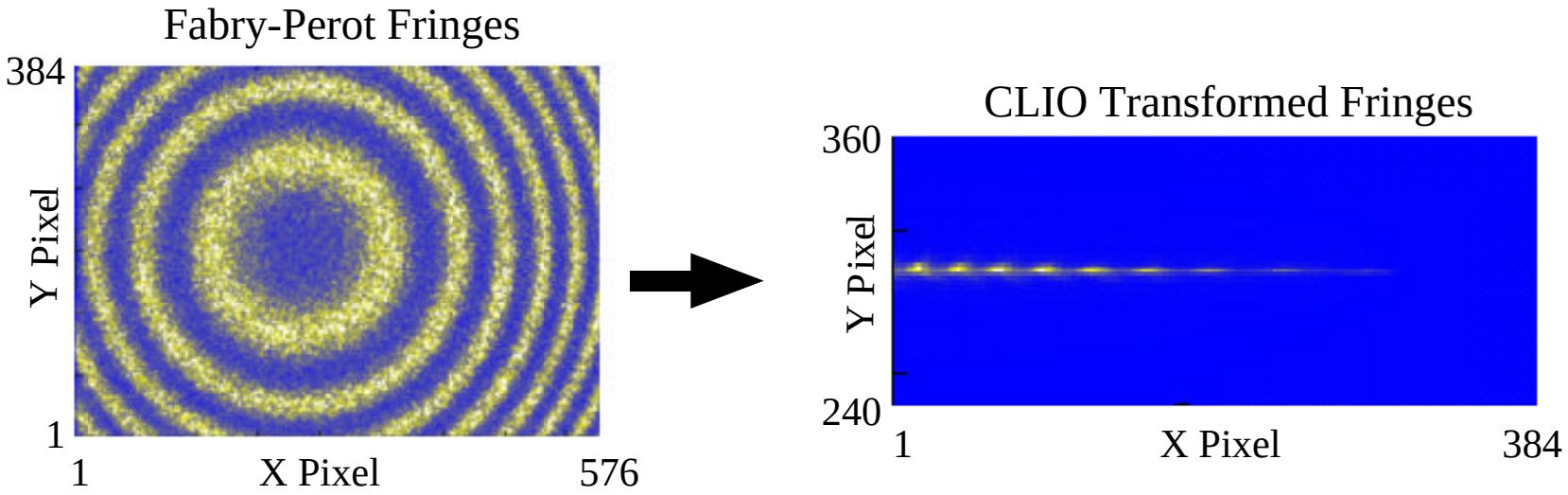


CLIO: Circle-to-Line Imaging Optics

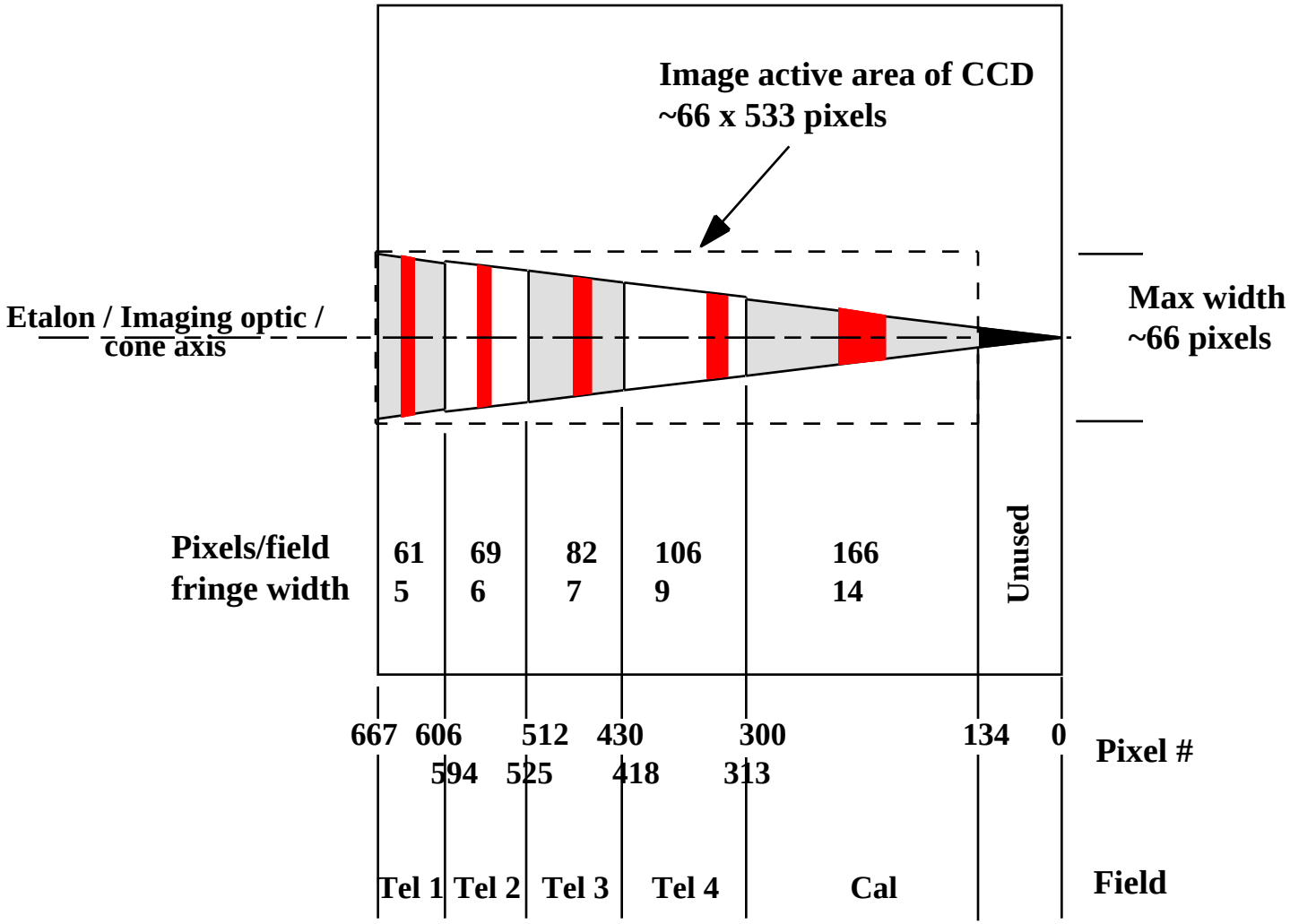


Demonstration of CLIO in a Lidar System

- **Transforms FPI rings into linear pattern**
- **Allows use of linear array detector (e.g. CCD)**

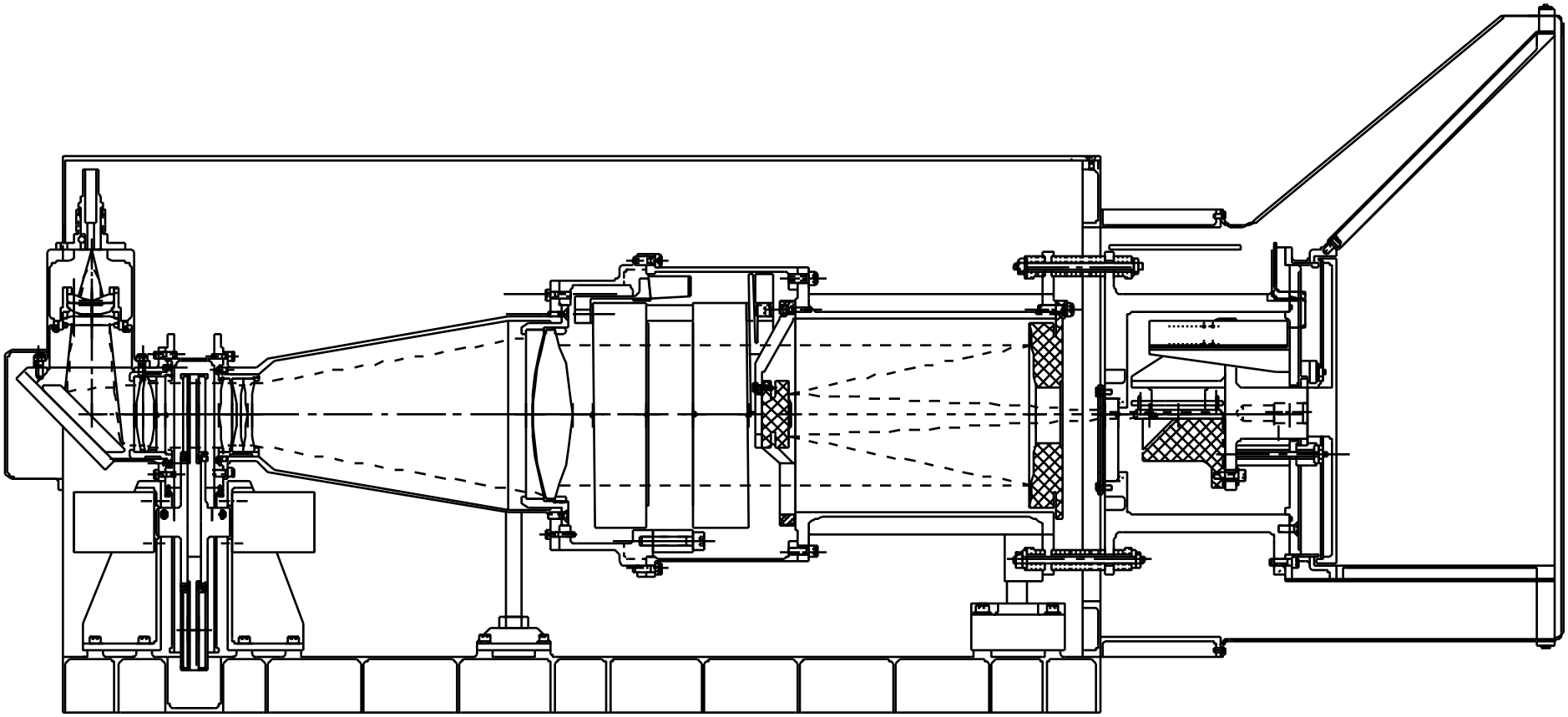


CCD Image Field



TIDI

TIDI CROSS SECTION



TIDI Sensitivity

White light sensitivity: $S_{white} = \frac{A\Omega 10^6}{4\pi} T_{op} T_{tele} T_{fil} Q \Delta\bar{\nu} \Delta t$ where $\Delta\bar{\nu} = \Delta\nu_{Fil} \left(\frac{1-R}{1+R}\right)$ $\Delta\nu_{Fil} = \int_0^\infty T_{Fil}(\nu) d\nu$

Parameter	Units	Symbol	Value
Telescope diameter	cm		7.5
Telescope effective area (each)	cm^2	A	44.2
Field of view	degrees		0.05 x 2.5
Field of view	sr	Ω	3.8×10^{-5}
AΩ (Each telescope)	cm^2 sr	AΩ	1.7×10^{-3}
Photometric sensitivity	photons/s/R	$A\Omega 10^6/4\pi$	133.7
Optical Transmittance (excluding telescope and filters)		T_{op}	0.22
Peak filter transmittance		T_{fil}	0.4-0.6 (use 0.5)
Area under filter curve	cm^{-1}	$\Delta\nu_{Fil}$	2.5-40 (use 5)
Reflectivity		R	0.80
Number of channels per field			30
Integration time	s	Δt	variable (use 1)

Parameter	Units	Symbol	Value @ 550nm	Value @ 650nm	Value @ 750nm	Value @ 850nm
Quantum efficiency[1]	e^-/photon	Q	0.59	0.63	0.59	0.45
Telescope effective transmittance[2]		T_{tele}	0.33	0.58	0.83	0.60
Sensitivity (per field)	e^-/s/R/cm^{-1}	S	14.3	26.9	36.0	19.9
Sensitivity (per channel)	e^-/s/R/cm^{-1}	S	0.48	0.90	1.20	0.66

Notes: 1. Estimate from SITe for T=-80°C; 2. From K. Peacock, APL