# Spectrograph Options

# Common Requirements

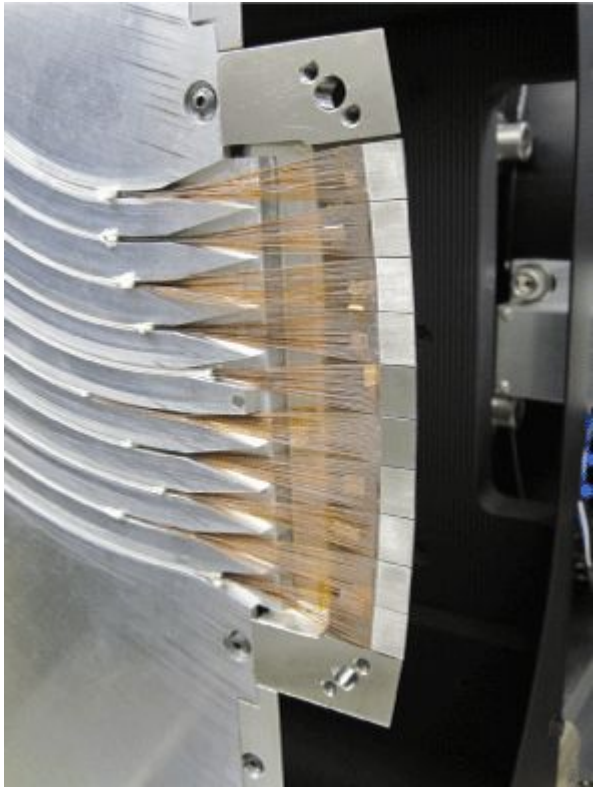
Interface with fiber slit

Number of fibers

Fiber diameter/sky sampling

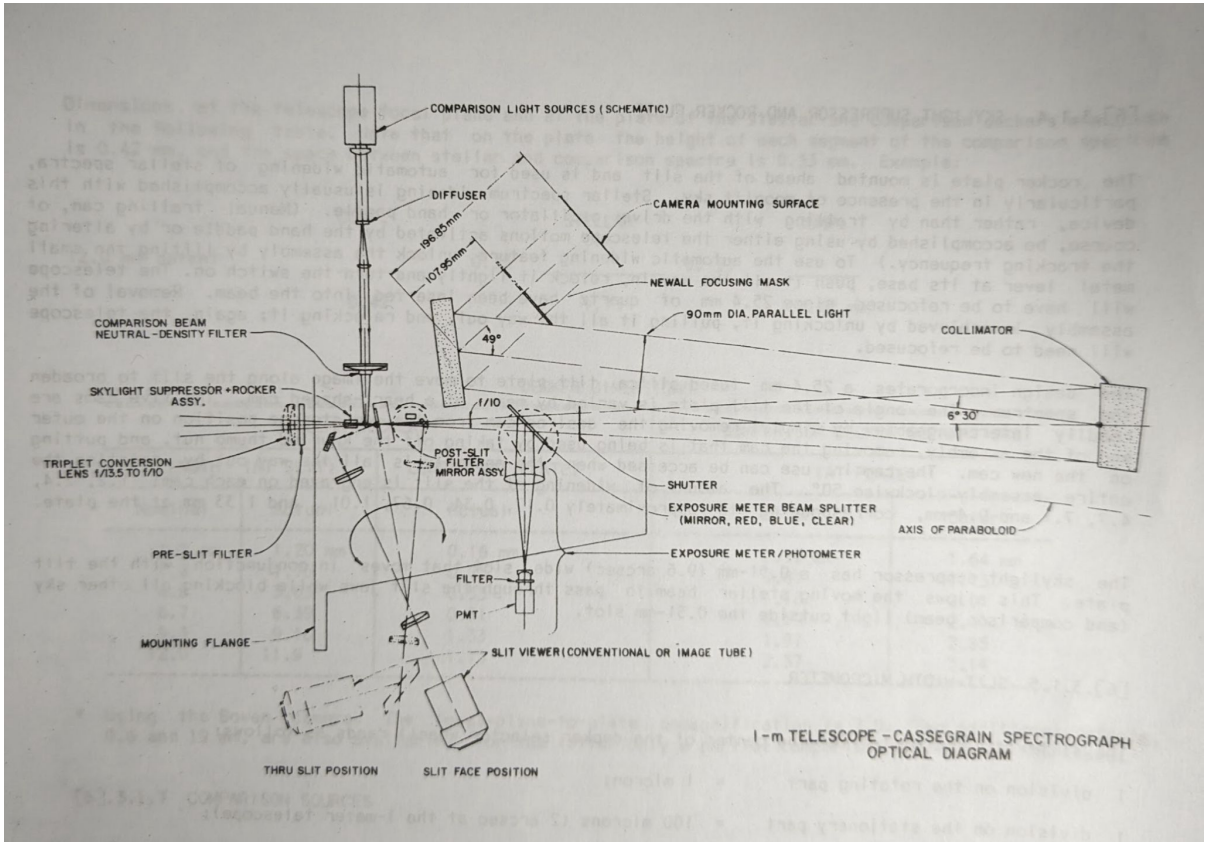
Wavelength Coverage (total/simultaneous)

Spectral Resolution



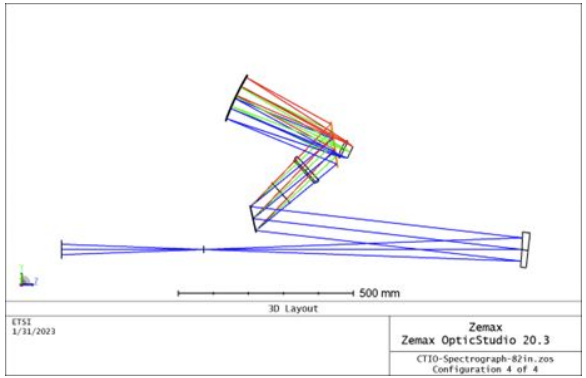
Apogee fiber slit, 30 fibers/block

# CTIO Spectrograph Refurbishment



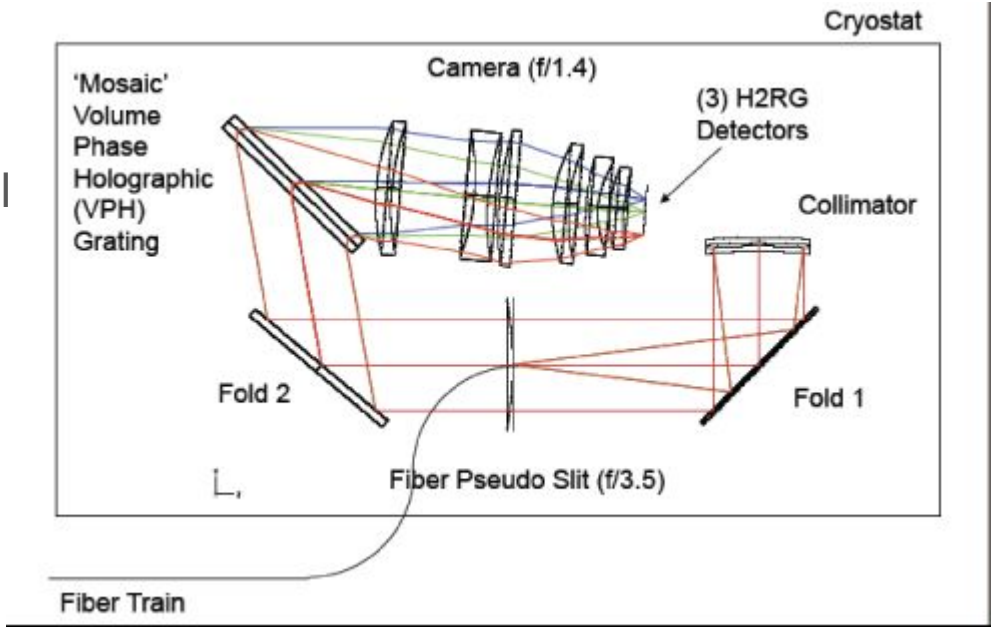

# CTIO Spectrograph


- 19mm long slit
- Needs camera and detector
  - COTS telescope - slower f/# than original camera f/4 vs f/1.4
  - COTS DSLR lens - slightly faster, f/2.8 for 300mm or 400mm fl
  - Folded Schmidt - customized to spectrograph, but may have significant vignetting
- Control electronics upgrades
- Possible mirror recoating



# From Scratch

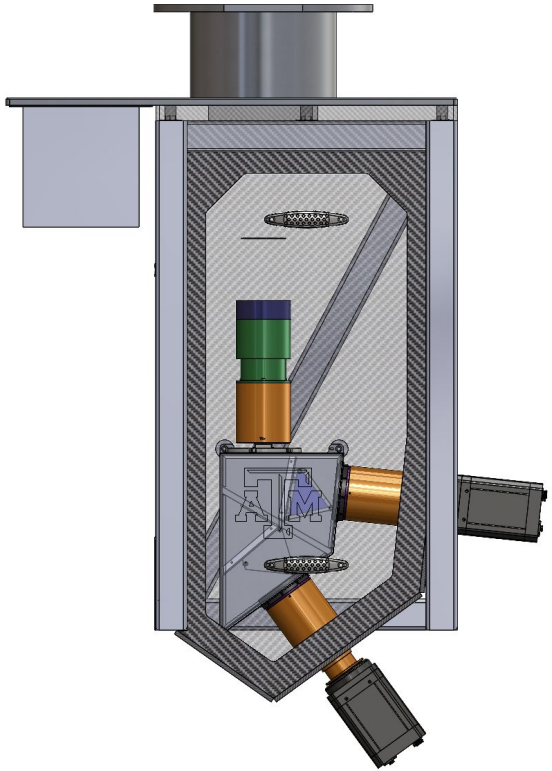
- Build to spec
- Most expensive
- Longer lead time for opto-mechanical design and optical manufacturing




APOGEE Spectrograph

# ETSI

- Optics and detector are complete
- Mounting of fiber slit
- Lower resolution (prism spectrograph)
- Must be reconfigured for continuous spectrum
- Availability is uncertain (will it be at McDonald or at another observatory?)



# Detectors

Various sCMOS models ranging in price from $8k-$80k

Pixel size from 3.7-11 microns

2k x 2k to 14k x 10k

Fast readout (<<1s)

Low read noise (1-2e-)

https://doi.org/10.1117/12.2562328

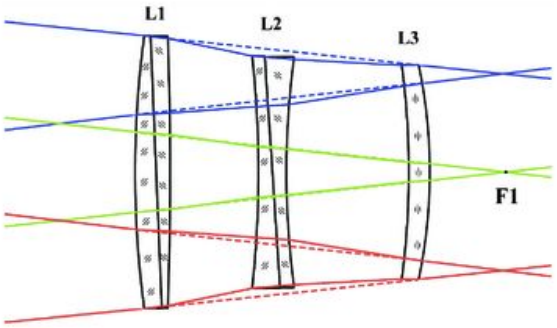
# Focal Reducer/ADC

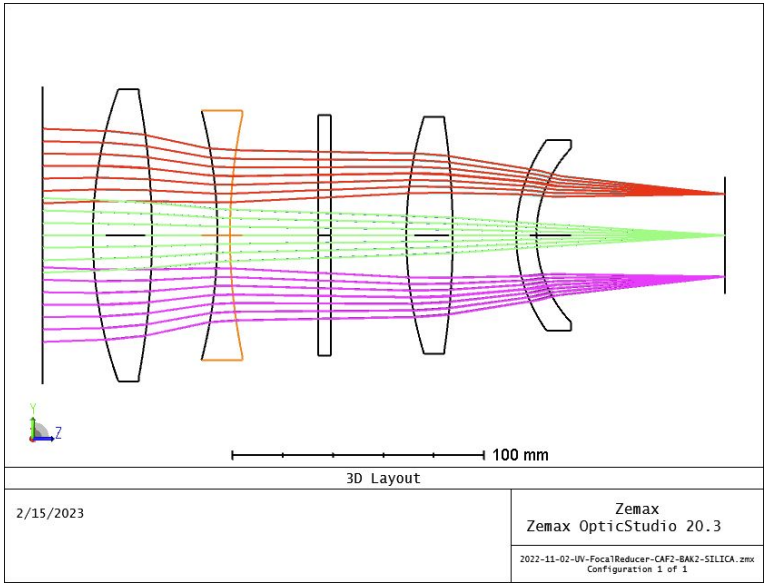
Focal reducer: better coupling to fibers, modifies plate scale, correct aberrations, etc.

Atmospheric Dispersion Compensator (ADC)

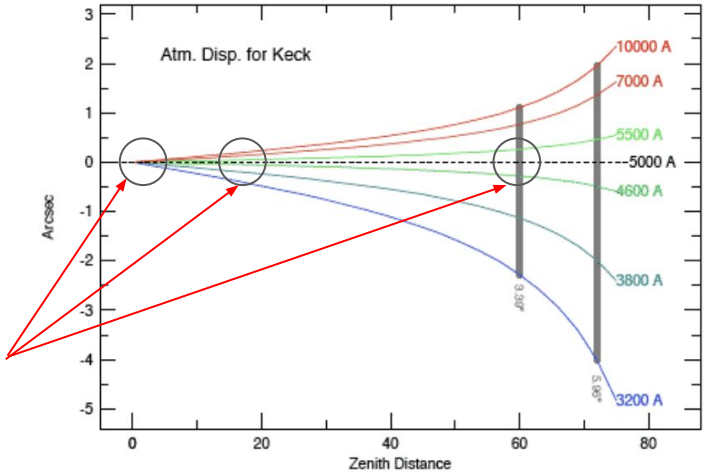
As you point away from Zenith, the atmosphere acts as a weak prism

More fibers, larger FoV, larger lenses, more $$$




1” fiber



# Design Trade

- Number and size of fibers required is critical
- Science goals and requirements must be determined before design
- Schedule constraints - custom optics have long design time and manufacturing lead times
- Plate scale vs precision requirements (0.1” -> 14 microns @ 2.1m )

Keep ADC/spectrograph optic size reasonable (<100mm)

Guide/acquisition sensors around FoV