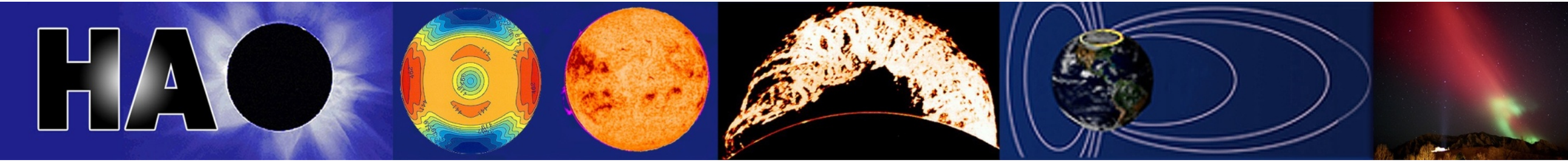

Introduction to ViSP and the ViSP IPC

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NCAR

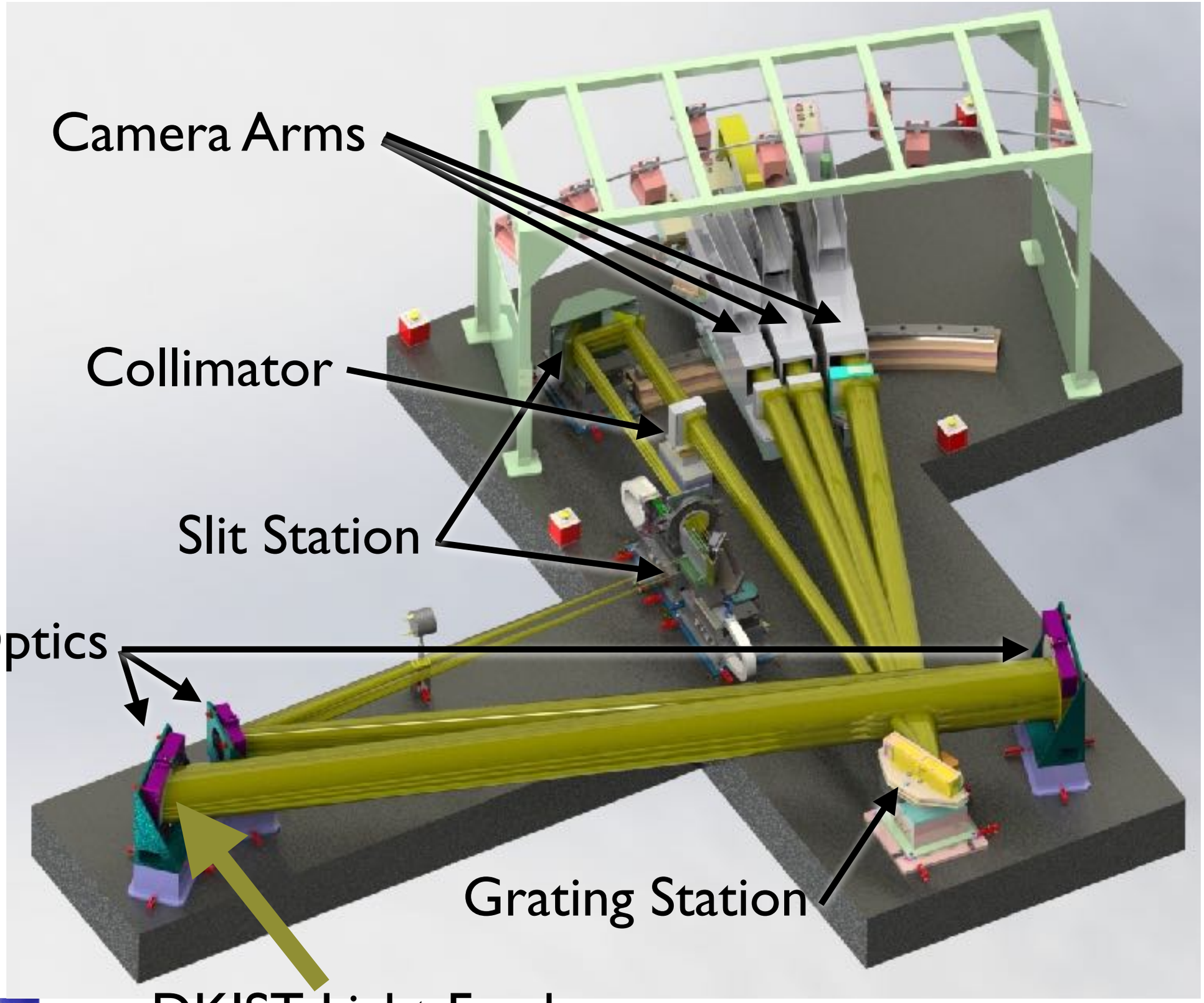
Science Requirements

Provide the DKIST with a research spectro-polarimeter offering high resolution and continuous tuning capability over its spectral range

- Wavelength range: 380–900 nm, 3 lines simultaneously
  - Half as many as the DST spectrograph from the ‘70s!
- Spatial resolution: 2× DKIST resolution, 0.07” at 630 nm
- Spatial FOV: 2’×2’
- Spectral resolution: ≤3.5 pm at 630 nm or R≥180 000
- Polarimetric capability: 10^{-3} I_{cont} polarimetric signal in 10 s
- Simultaneous operation with other instruments

ViSP Design

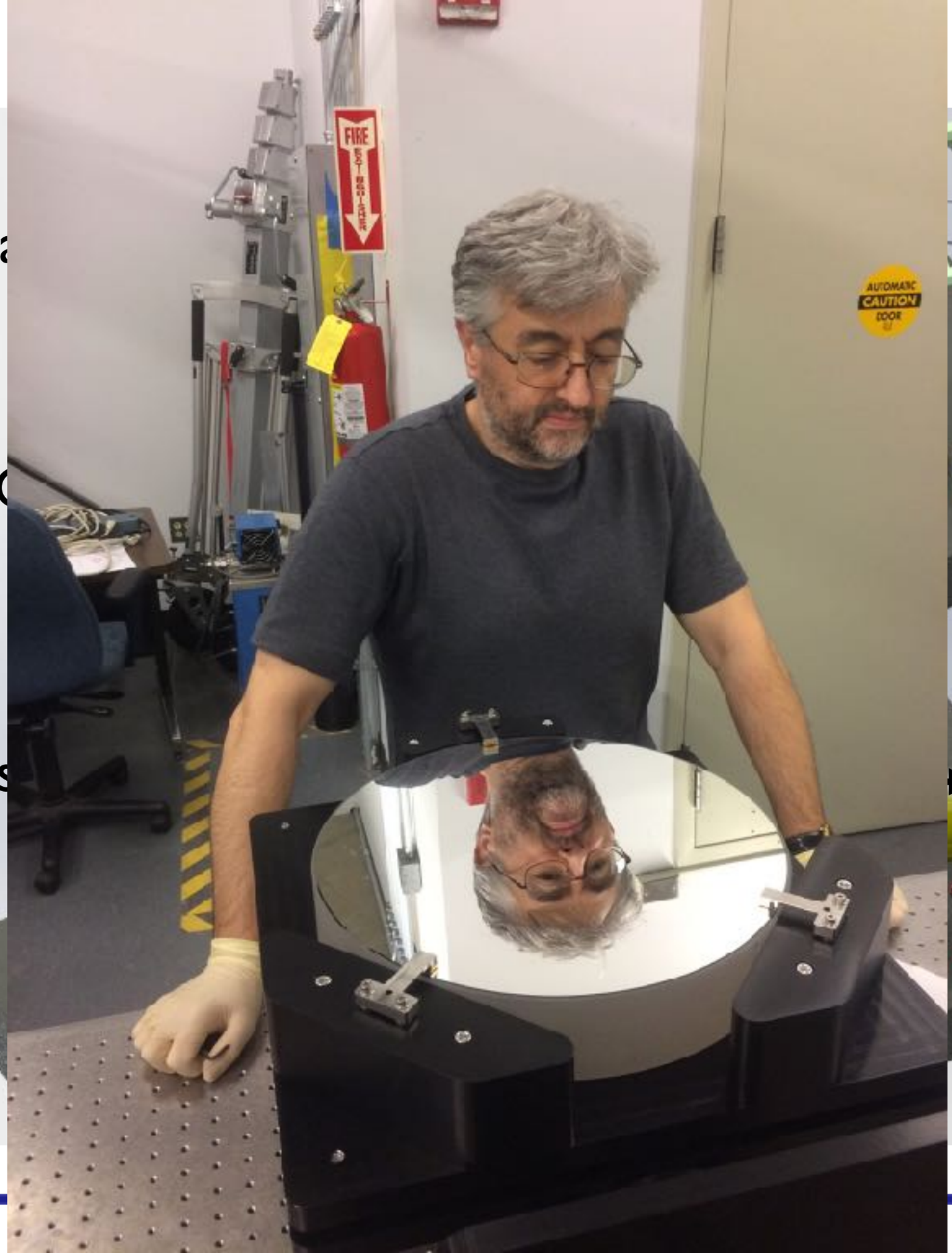
- Spectrograph design is highly constrained
- Refractive optical system with spectral coverage from 380 to 900 nm
- Automated re-configuration
- 5 photo-etched slits with widths matching telescope resolution at 450, 650, 850, 2×850, and 4×850 nm
- Low-order gratings for large free spectral range


Camera Arms
Collimator
Slit Station
Feed Optics
Grating Station
DKIST Light Feed

Ca

C

Feed Optics



Spectral Diversity

1.	Ca II K	393.37 nm	(photo/chromosphere)
2.	Ca II H	396.85 nm	(photo/chromosphere)
3.	Fe I	404.58 nm	(photosphere)
4.	H δ	410.17 nm	(E-field diagnostics)
5.	Ca I	422.67 nm	(PRD)
6.	H γ	434.05 nm	(E-field diagnostics)
7.	Ti I	453.60 nm	(second solar spectrum)
8.	Ba II	455.40 nm	(second solar spectrum)
9.	Sr I	460.73 nm	(Hanle effect)
10.	H β	486.13 nm	(chromosphere)
11.	Mg I b1	517.27 nm	(photo/chromosphere)
12.	Mg I b2	518.36 nm	(photo/chromosphere)
13.	Fe I	525.04 nm	(photosphere)
14.	Mn I	553.78 nm	(HFS)
15.	He I	587.59 nm	(prominences; spicules)
16.	Na I D2	589.00 nm	(photo/chromosphere; PRD)
17.	Na I D1	589.59 nm	(photo/chromosphere; PRD)
18.	Fe I	617.33 nm	(HMI)
19.	Fe I	630.20 nm	(Hinode/SP)
20.	H α	656.28 nm	(chromosphere)
21.	Ni I	676.78 nm	(photosphere)
22.	Ca I	714.82 nm	(photosphere)
23.	Fe I	751.15 nm	(photosphere)
24.	K I	769.90 nm	(photosphere)
25.	Na I	818.33 nm	(photo/chromosphere)
26.	Na I	819.48 nm	(photo/chromosphere)
27.	Ca II	849.81 nm	(photo/chromosphere)
28.	Ca II	854.21 nm	(photo/chromosphere)
29.	Ca II	866.22 nm	(photo/chromosphere)
30.	Mn I	874.10 nm	(HFS)

Assumptions:

- Scalar theory of grating efficiency
- Grating losses to reproduce "shadow cast" model
- 316 l/mm grating, 63° blaze
- $-30.0° < \beta - \alpha < -3.4°$

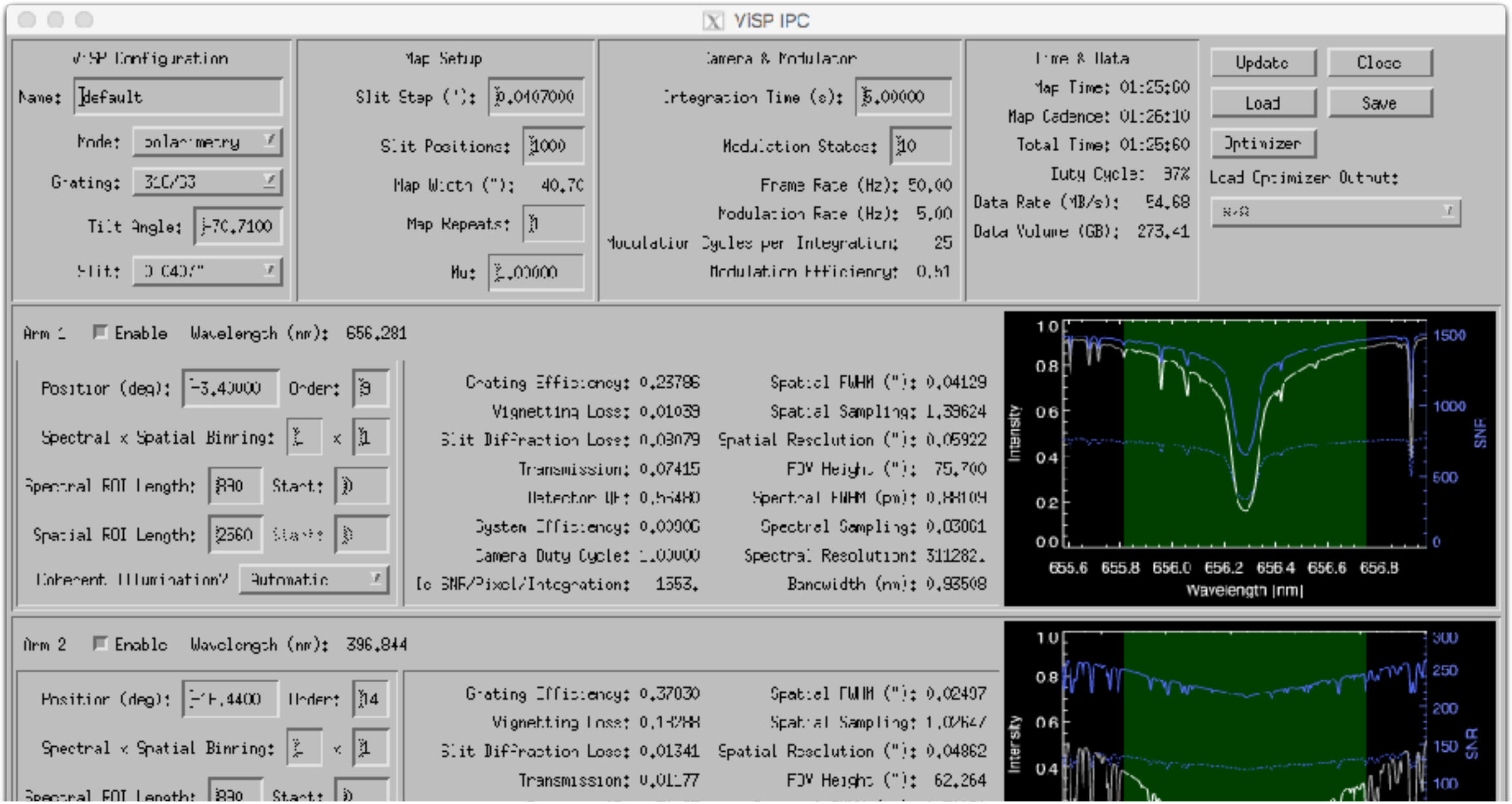
> 5%	#	63° < α < 73°	
singlets	30	30	100%
doublets	435	431	99.1%
triplets	4060	3748	92.3%

> 15%	#	63° < α < 73°	
singlets	30	30	100%
doublets	435	397	91.3%
triplets	4060	3223	79.4%

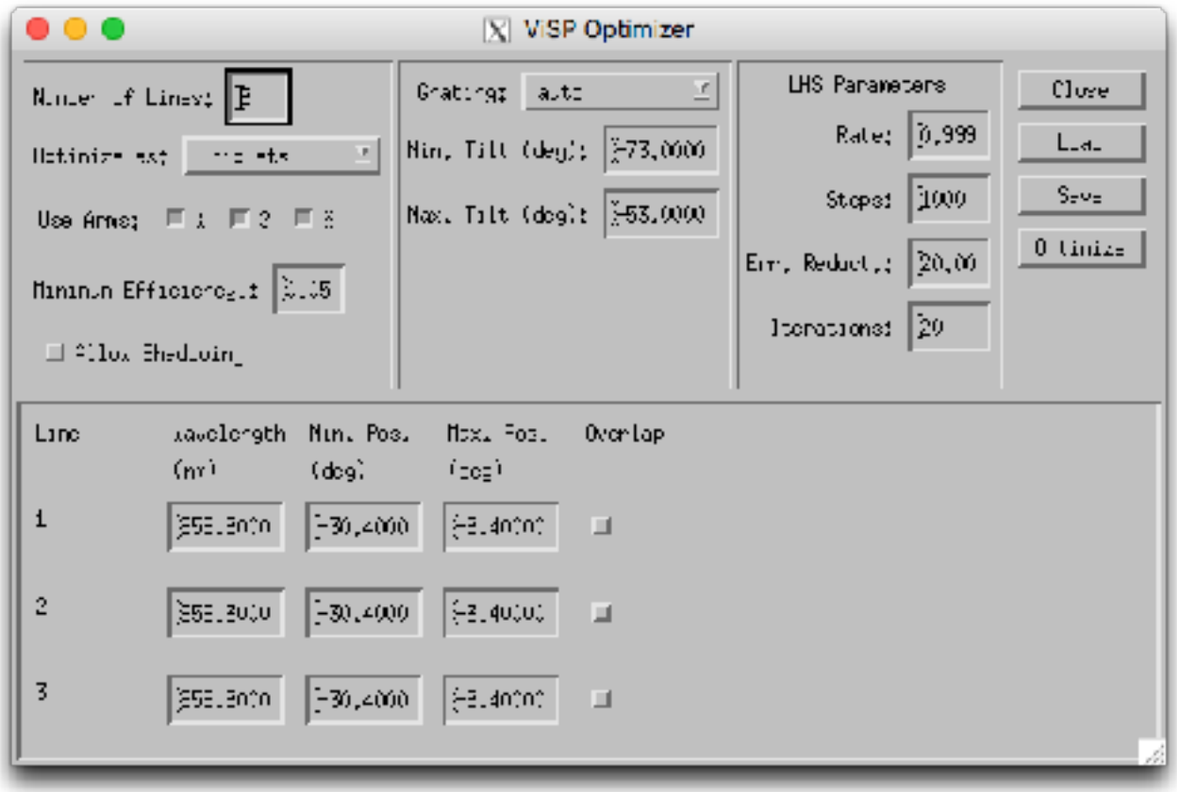
ViSP IPC

- I assume you've all read the manual?
- The IPC is a tool to explore the performance of ViSP configurations
- Includes the ViSP *Instrument Configuration Optimizer* that can be used to optimize ViSP configurations for finding configurations based on wavelengths selected by the user

ViSP IPC


ViSP IPC
ViSP Configuration
Name: default
Mode: polarimetry
Grating: 316/33
Tilt Angle: -70.7100
Slit: 0.040"
Map Setup
Slit Step ("): 0.0107000
Slit Positions: 1000
Map Width ("): 40.70
Map Repeats: 1
Mu: 1.00000
Camera & Modulator
Integration Time (s): 5.00000
Modulation States: 10
Frame Rate (Hz): 50.00
Modulation Rate (Hz): 5.00
Modulation Cycles per Integration: 25
Modulation Efficiency: 0.51
Time & Data
Map Time: 01:25:00
Map Cadence: 01:26:10
Total Time: 01:25:60
Duty Cycle: 97%
Data Rate (MB/s): 54.68
Data Volume (GB): 273.41
Update
Close
Load
Save
Optimizer
Load Optimizer Output:
Arm 1
Enable
Wavelength (nm): 656.281
Position (deg): -3.40000
Order: 9
Spectral x Spatial Binning: 1 x 1
Spectral ROI Length: 890
Start: 0
Spatial ROI Length: 2560
Start: 0
Coherent Illumination?
Automatic
Grating Efficiency: 0.23786
Vignetting Loss: 0.01039
Slit Diffraction Loss: 0.03079
Transmission: 0.07415
Detector QE: 0.9640
System Efficiency: 0.00900
Camera Duty Cycle: 1.00000
Sc SNR/Pixel/Integration: 1553.
Spatial FWHM ("): 0.04129
Spatial Sampling: 1.39624
Spatial Resolution ("): 0.05922
FOV Height ("): 75.700
Spectral FWHM (pm): 0.88104
Spectral Sampling: 0.03001
Spectral Resolution: 311282.
Bandwidth (nm): 0.93508
Intensity
SNR
Wavelength (nm)
Arm 2
Enable
Wavelength (nm): 396.844
Position (deg): -7.4400
Order: 14
Spectral x Spatial Binning: 1 x 1
Grating Efficiency: 0.37030
Vignetting Loss: 0.14788
Slit Diffraction Loss: 0.01341
Transmission: 0.01177
Spatial FWHM ("): 0.02497
Spatial Sampling: 1.02647
Spatial Resolution ("): 0.04862
FOV Height ("): 62.264

ViSP ICO



- Configurations found are loaded immediately into the IPC