



**OPERATIONAL CONCEPTS DEFINITION**

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# RSS-NIR



- Duplicate all modes of RSS-VIS in the NIR
- Differences arise due to the detector
- HgCdTe detector instead of CCD
  - No charge shuffling or drift mode capabilities
  - Possibly some high speed capability
    - Read out sub-windows of the HgCdTe array
    - 12-bit instead of 16-bit



# 10 RSS-NIR OPERATING MODES



Optics configuration			Detector Configuration				
Config	Pol	Slit	Normal	Hi Spd ?	Shuffle	Drift	
Imaging	No	No	<b>X</b>	x		x	
	L,C,S	No	x				
		Multislit	<b>X</b>			x	
Spectroscopy	No	No	x				
		Longslit	<b>X</b>	X	x		
		Multislit	<b>X</b>			X	
	L,C,S	Longslit	<b>X</b>			x	
		Multislit	X				
Fabry- Perot	No	No	<b>X</b>		x		
	L,C,S	No	<b>X</b>				

**X – tested**

**x – team commissioned**

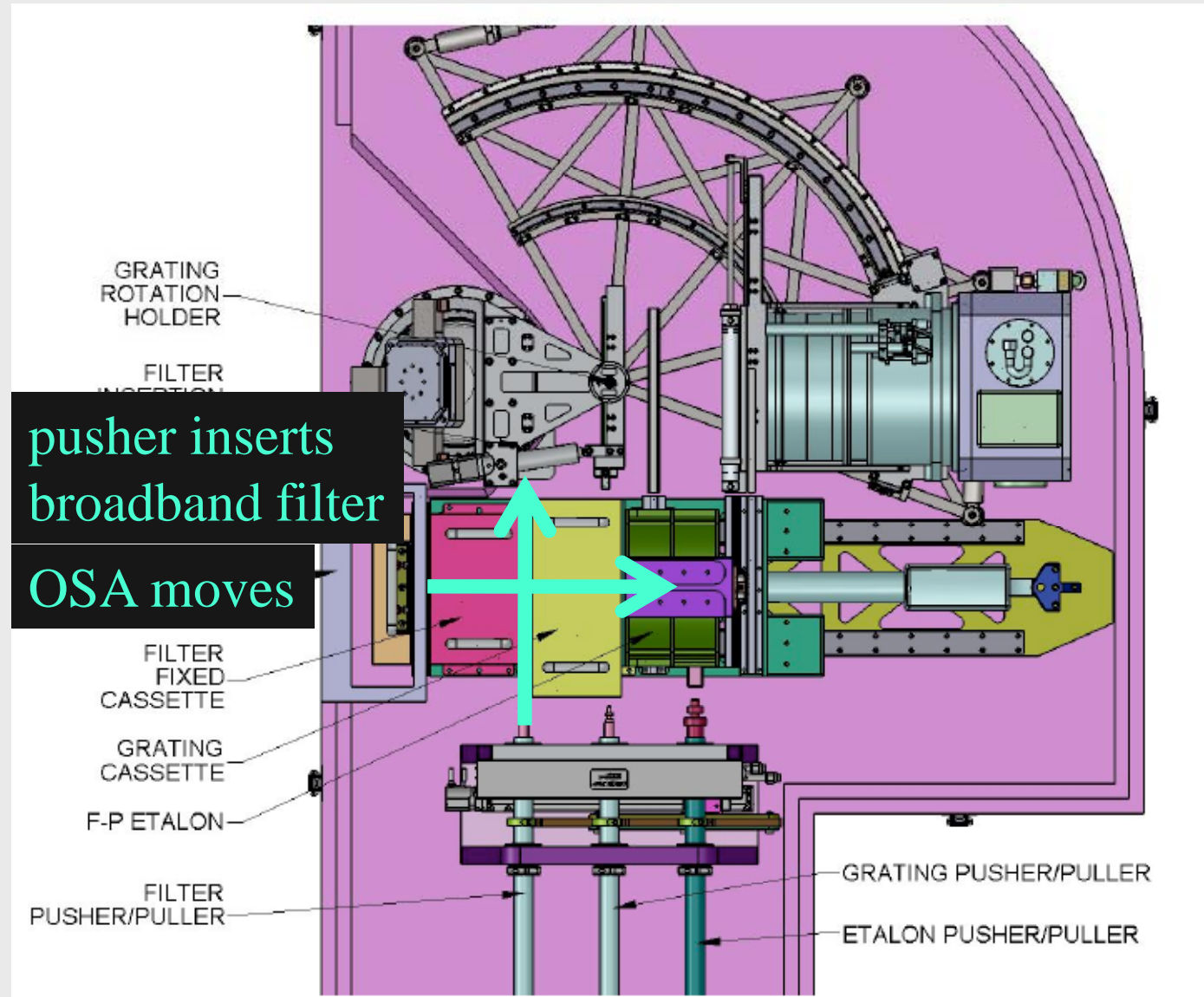
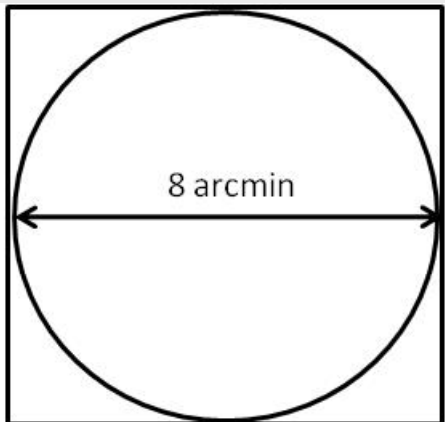
**x – user commissioned**



# IMAGING



Field of view



May 20 & 21, 2009

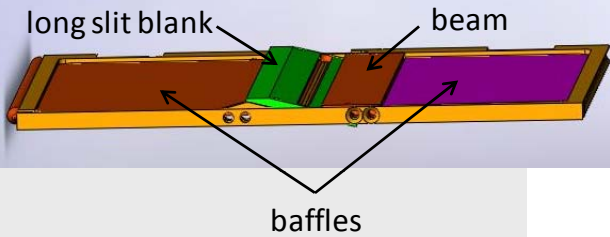
RSS-NIR MTR





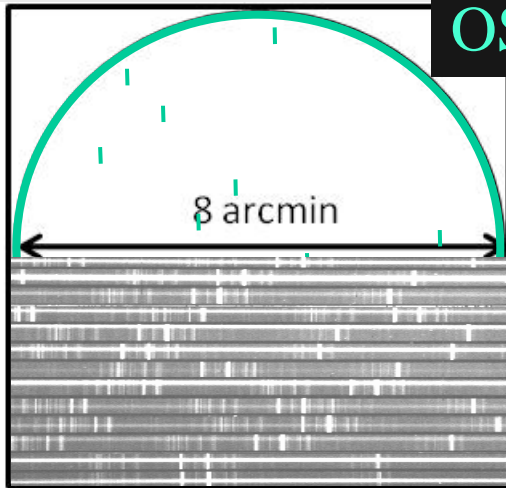
# SPECTROSCOPY

longslit or multi-object mask in focal plane



grating rotates  
camera articulates

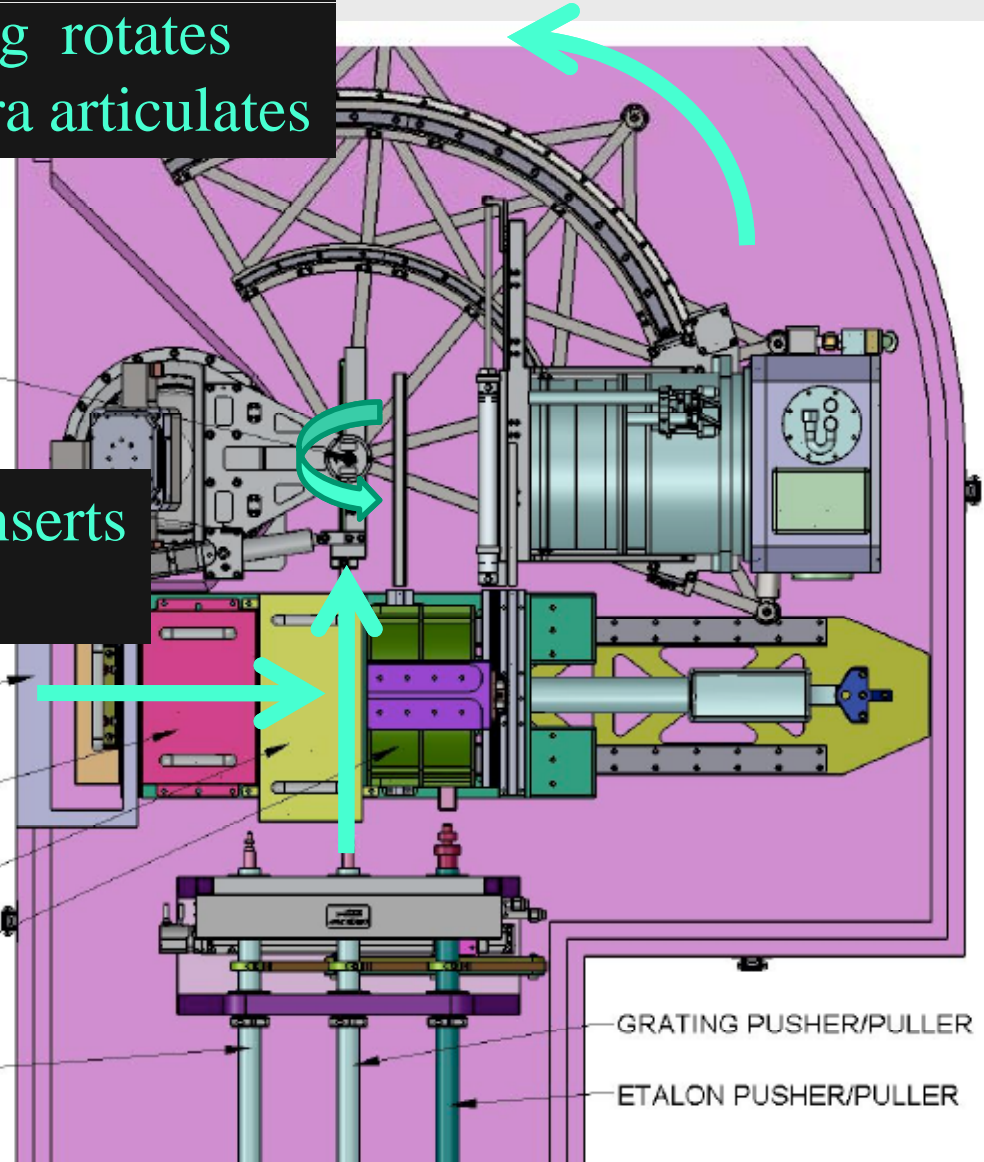
Multi-object spectroscopy



OSA moves

pusher inserts  
grating

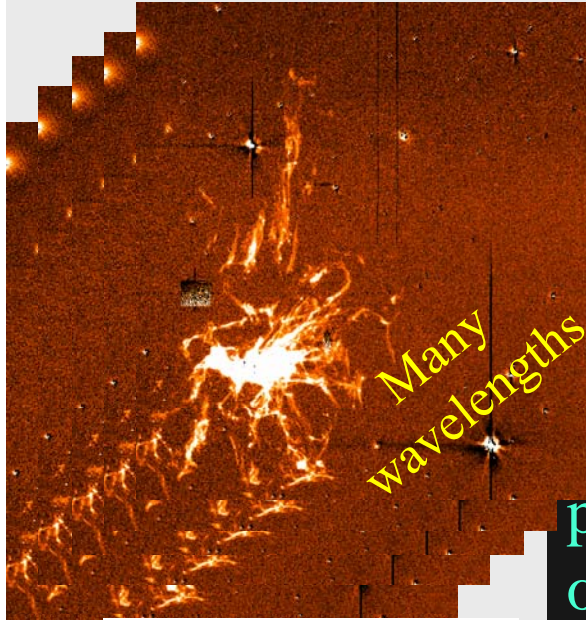
- GRATING ROTATION HOLDER
- FILTER INSERTION
- FILTER FIXED CASSETTE
- GRATING CASSETTE
- F-P ETALON
- FILTER PUSHER/PULLER



- GRATING PUSHER/PULLER
- ETALON PUSHER/PULLER



# FABRY-PEROT NARROW BAND IMAGING



Many wavelengths

Perseus A in Hydrogen Light



Perseus Cluster of Galaxies

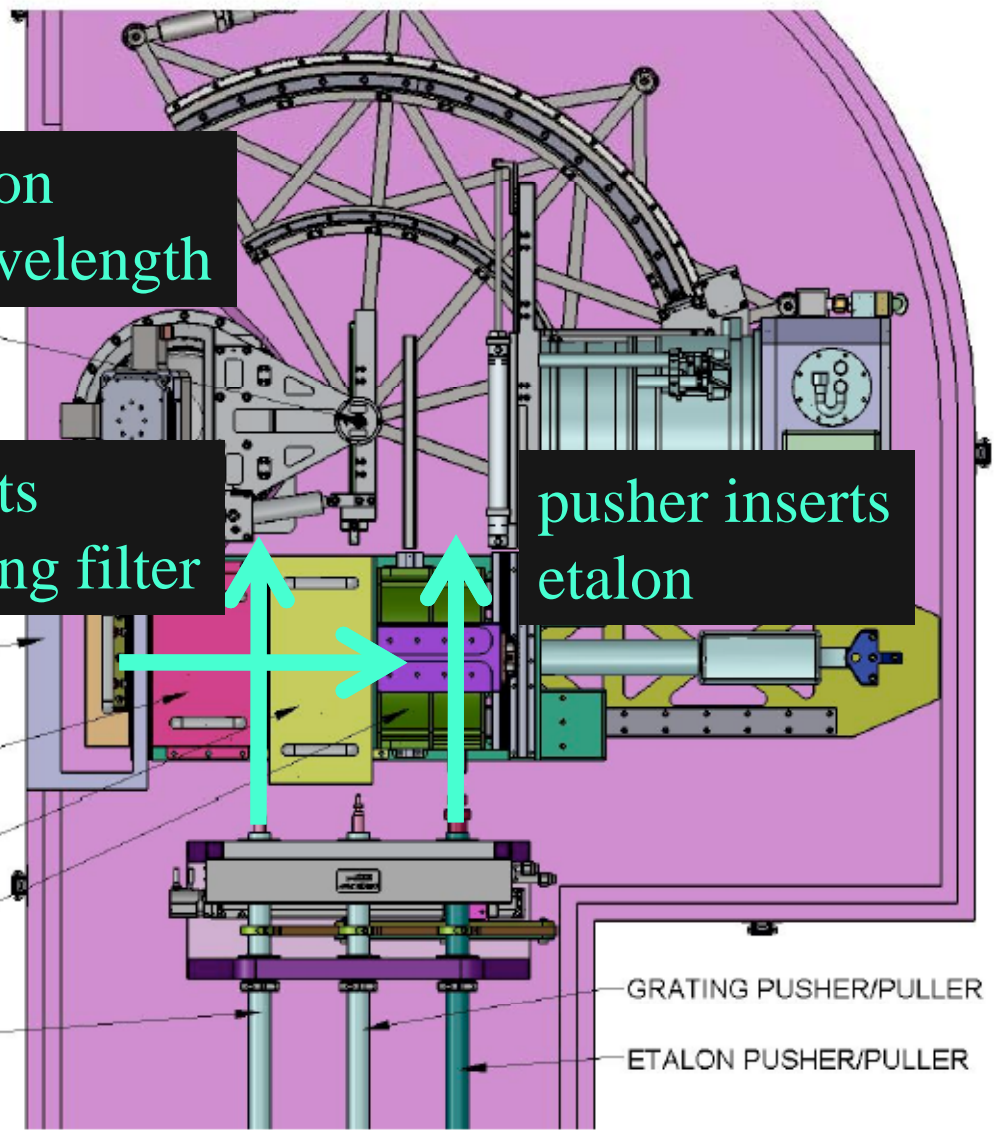
adjust etalon to new wavelength

pusher inserts order blocking filter

pusher inserts etalon

OSA moves

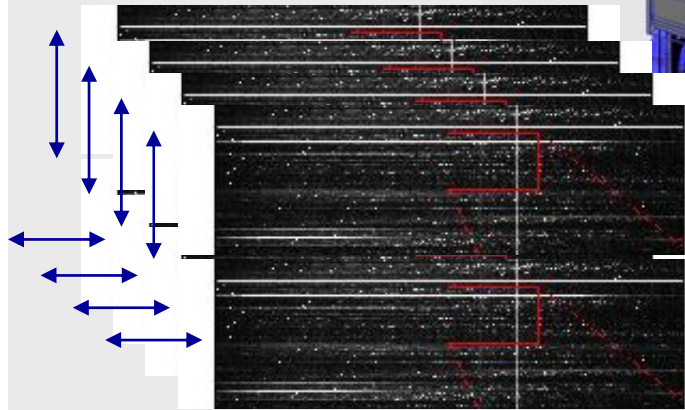
- ROTATION HOLDER
- FILTER INSERTION
- FILTER
- FILTER FIXED CASSETTE
- GRATING CASSETTE
- F-P ETALON
- ER
- ER



- GRATING PUSHER/PULLER
- ETALON PUSHER/PULLER



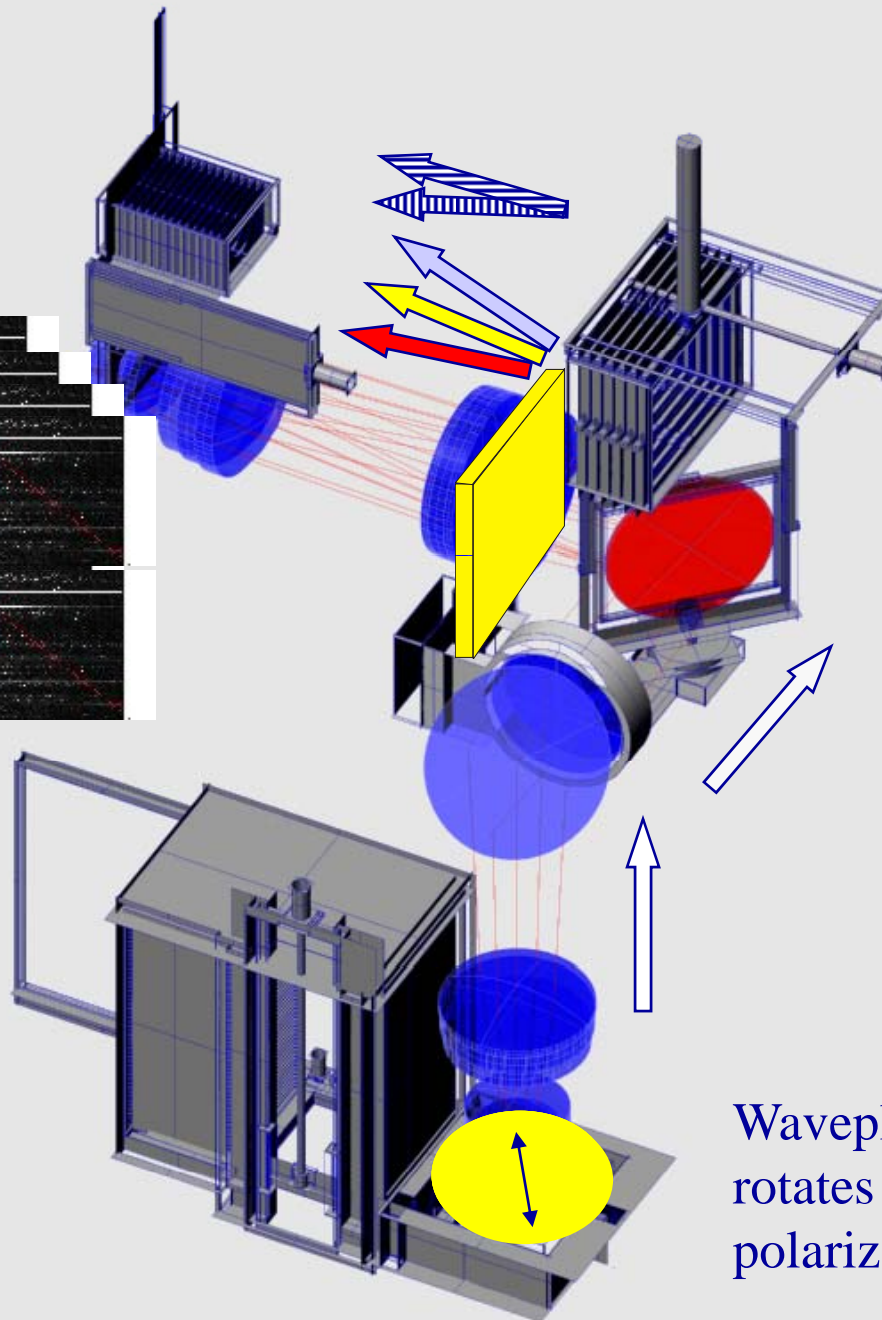




### Polarization of 20 Spectra

Also works in Imaging/  
Fabry-Perot  
Modes

May 20 & 21, 2009



Beamsplitter splits 2 polarizations

Hubble Deep Field (South)



Waveplate rotates polarization





# SIMULTANEOUS VIS-NIR OPERATION



- Sky very bright and changes rapidly in NIR
- NIR observations are usually relatively short and noded on the sky to obtain good background subtraction
  - ~ 60 sec for images
  - ~ 15-30 minutes for spectra } depends on site
- Imaging
  - Exposures short on 11 m telescope
    - If need longer exposure, could nod with telescope for both VIS and NIR
- Spectroscopy on bright objects
  - Exposures relatively short on both arms, so okay
- Spectroscopy on faint objects with small subtended angle on sky
  - Long exposures, so want simultaneous observations for efficiency
  - Use NIR fold mirror to nod along slit by up to 23 arcsec on NIR side during longer exposure on VIS side
    - Time to sky limit on NIR side ~8 minutes at R=7000, assuming  $6 e^- RN$
  - Will work for long slits or multi-object masks if the slits cut are long enough
- Spectroscopy on faint extended objects
  - Nod with telescope
    - Sky-subtract and co-add visible images in the same way as the NIR images



# SUMMARY OF RSS-NIR MODES



- Imaging
- Longslit Spectroscopy
- Multi-object Spectroscopy
- Fabry-Perot Spectral Imaging
- Polarimetry
  - Imaging
  - Longslit spectroscopy
  - Multi-object spectroscopy
  - Fabry-Perot imaging
- Simultaneous VIS-NIR for all modes