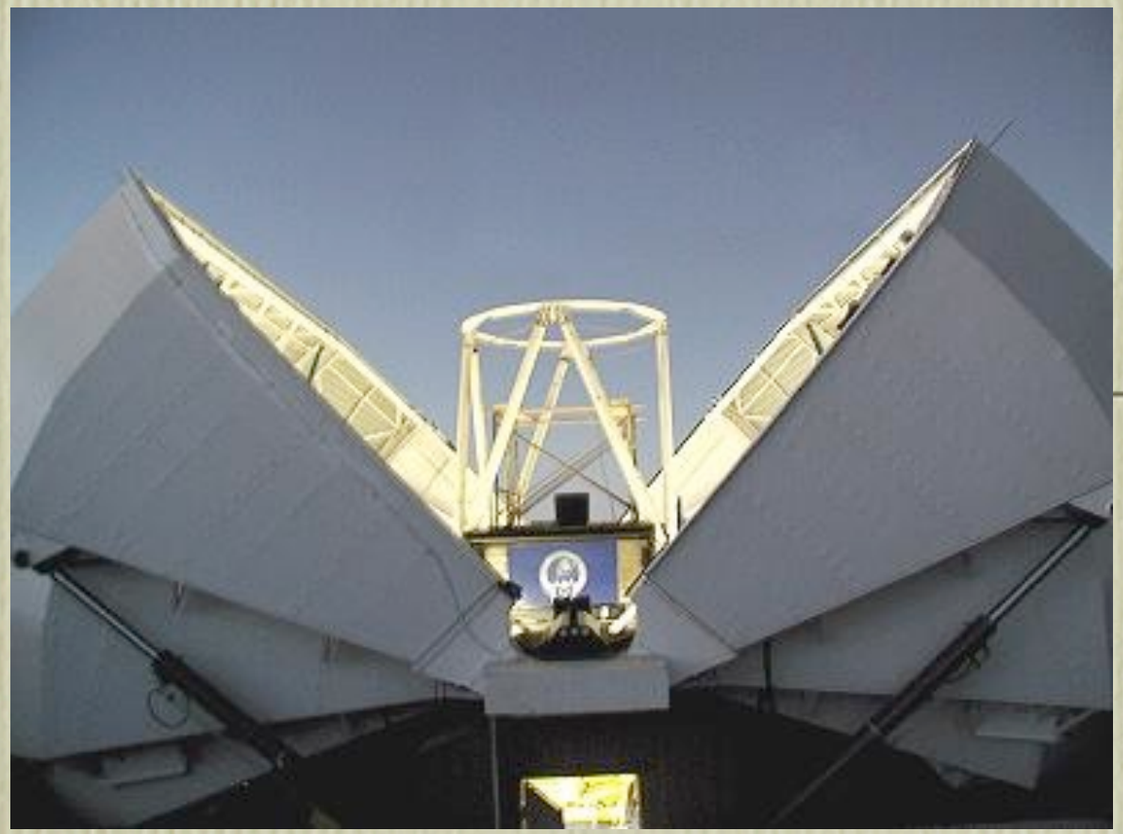
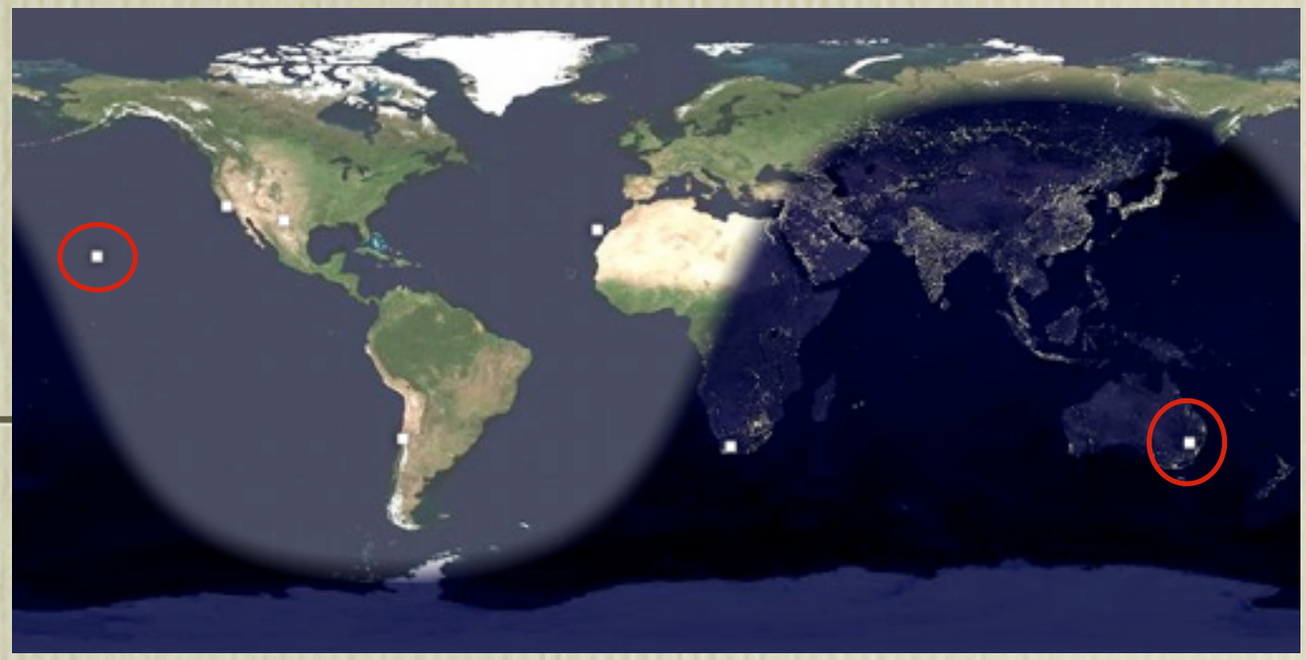
FLOYDS

D. Sand (Texas Tech University), T. Brown, R. Haynes, M. Dubberley, D. Mullins,
M. Norbury, E. H Hawkins, S. Valenti + others (mostly LCOGT)

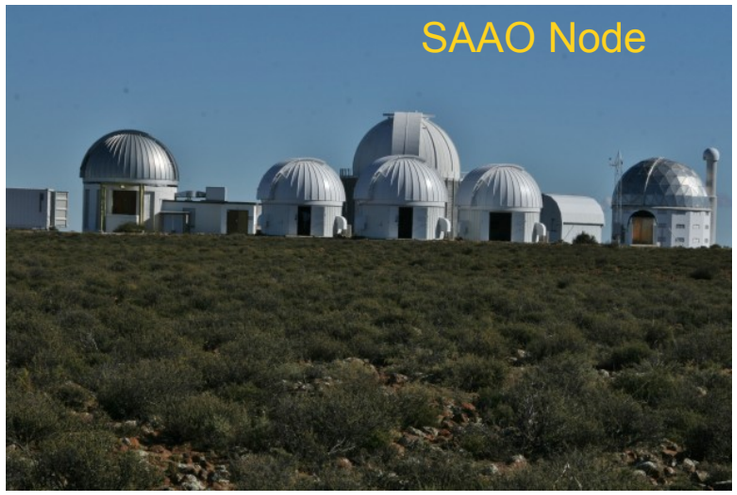




LCOGT in one slide -- global, robotic telescope network

Sites: Deployment

SAAO installation



- 1x1m at MacDonald Observatory - deployed Apr. 2012
- 3x1m at CTIO - deployed Sep. 2012
- 3x1m at SAAO - deployed Feb. 2013
- 1m site in Siding Spring under construction
- Sites in Teide and China under investigation

Yiannis Tsapras slide

The Faulkes telescopes

- LCOGT is operating the two Faulkes telescopes (2m) in Haleakala and Siding Springs. A robotic spectrograph would be great for SN typing/study, reverberation mapping, GRBs....

Lag between SN discovery & typing

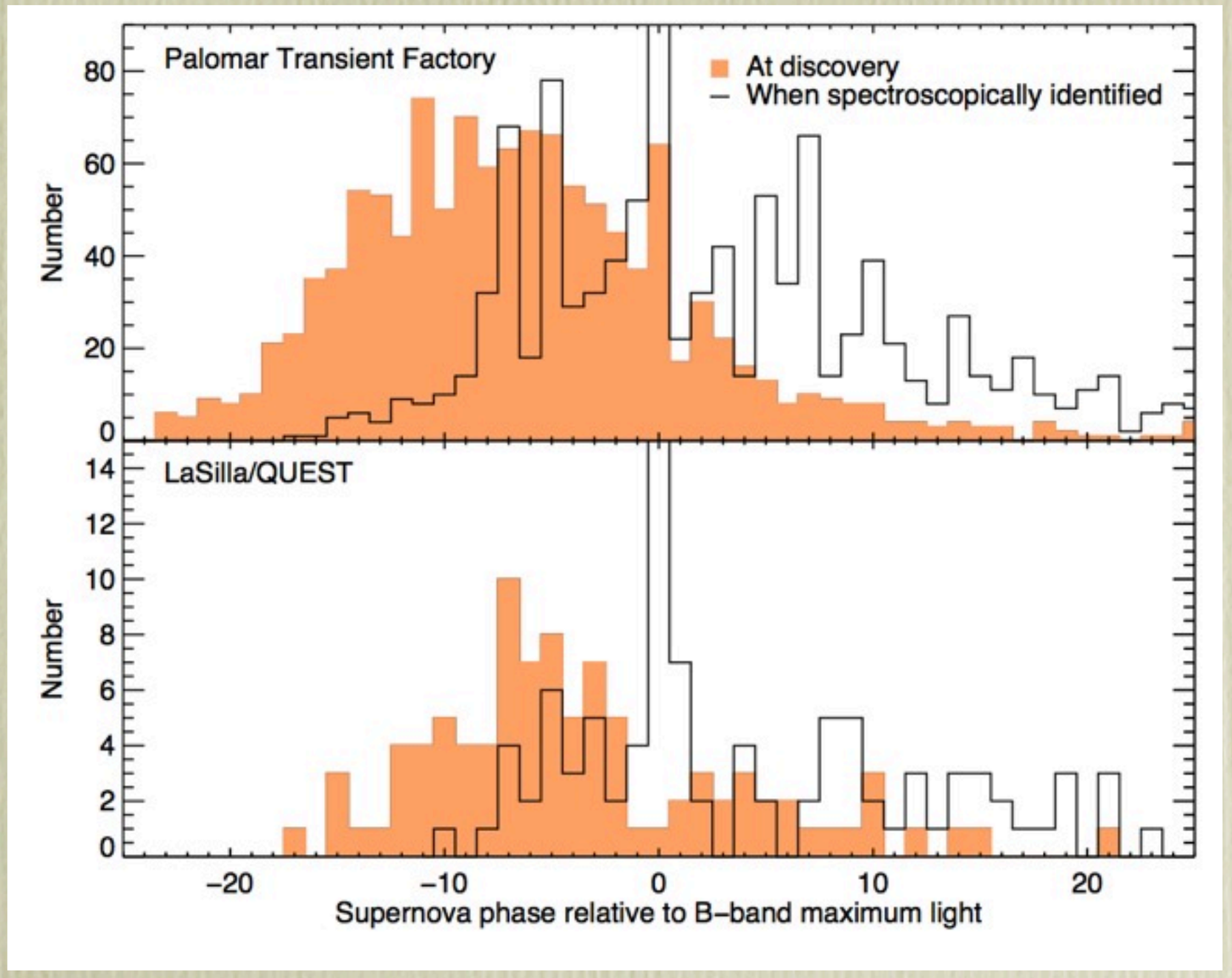
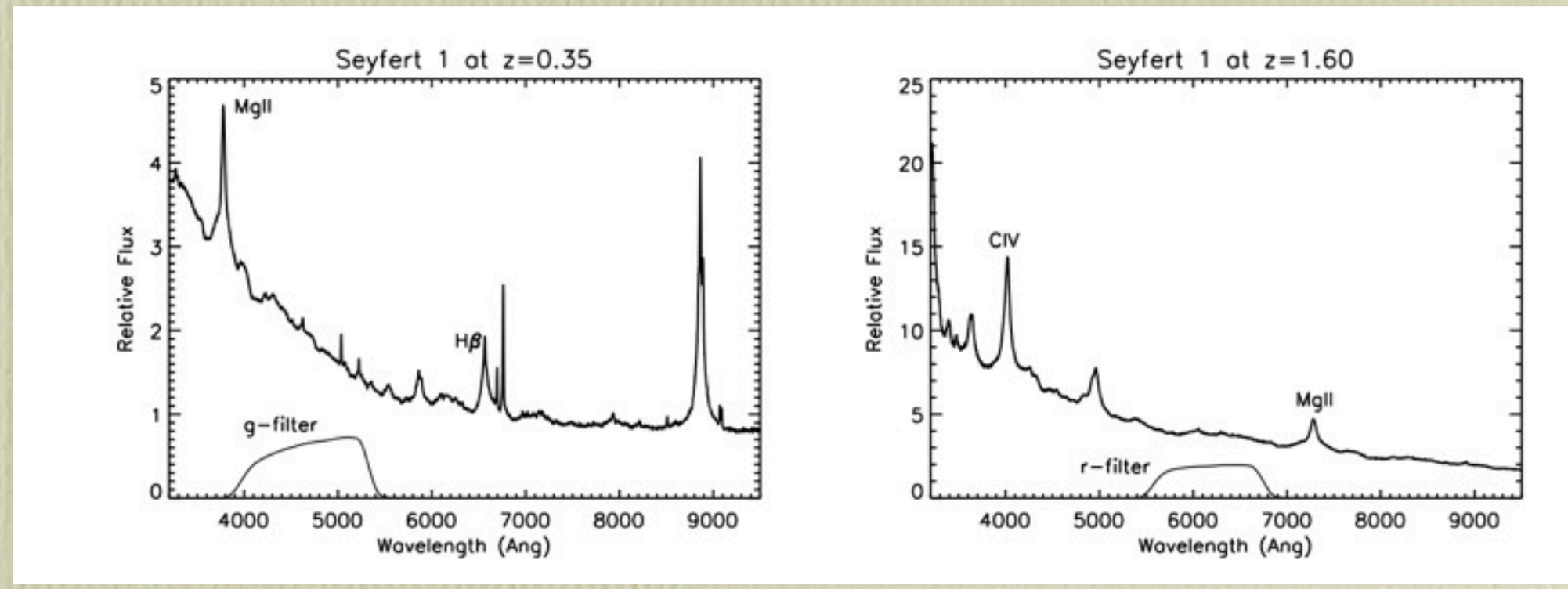


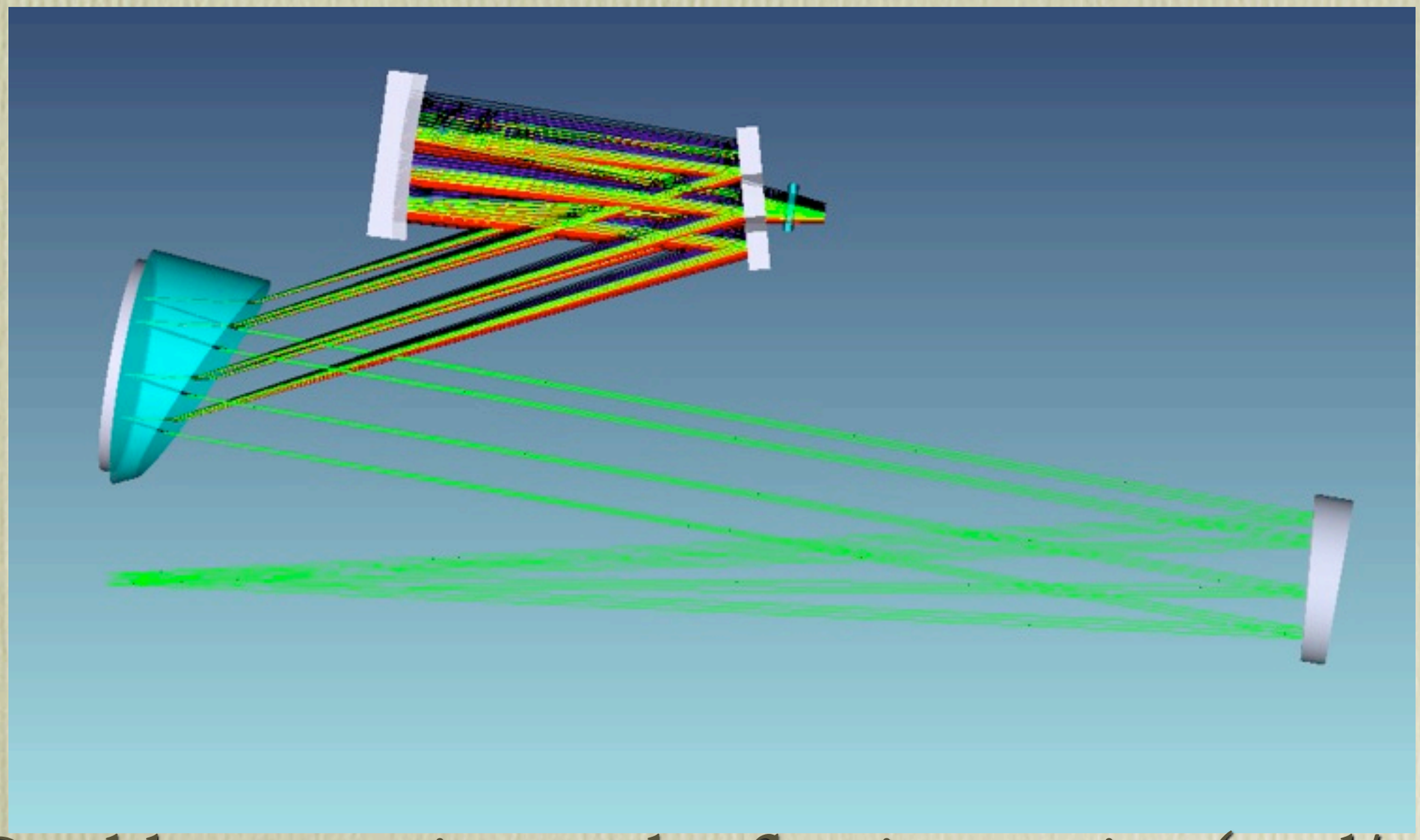
Figure by A. Howell

Reverberation mapping (at z>0)



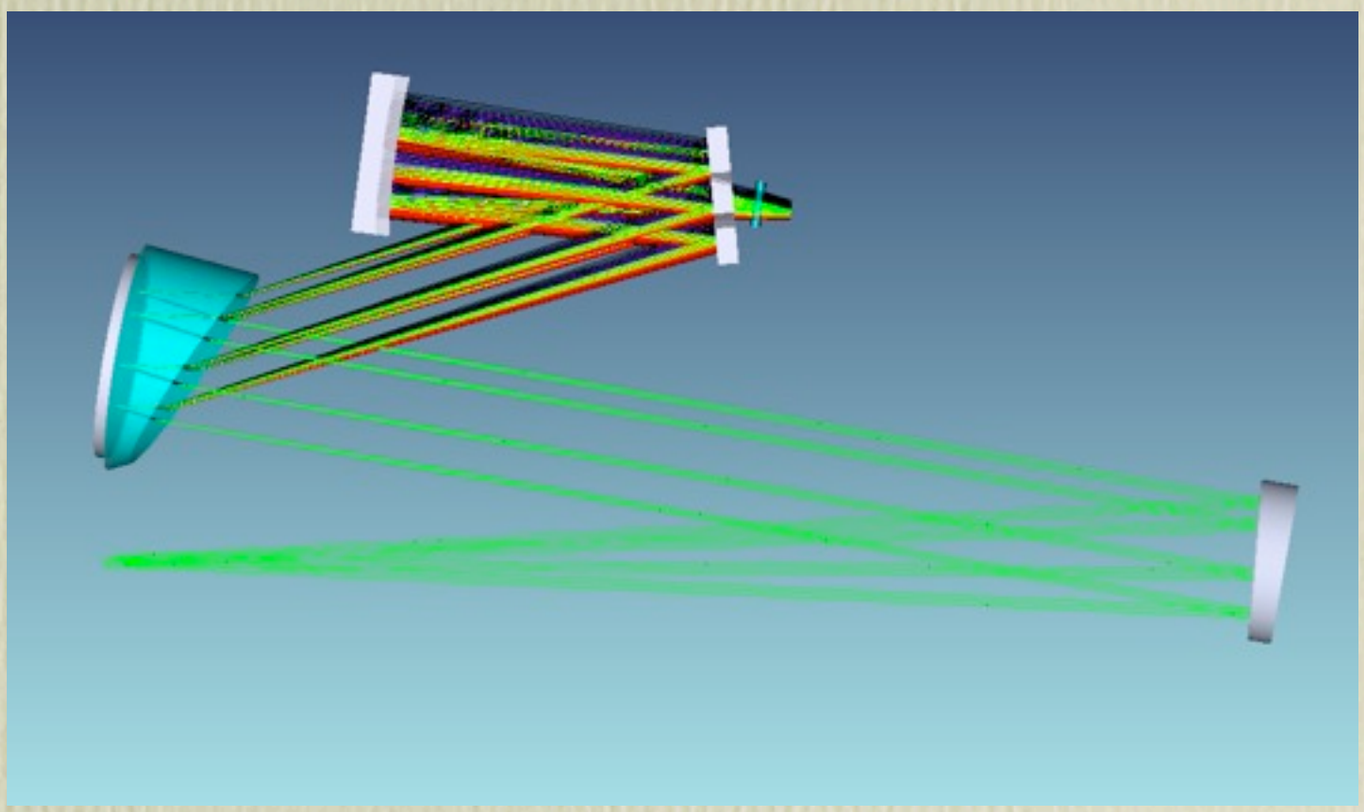
Need to establish a R_BLR vs. L relationship for MgII & CIV to bolster 'single epoch' black hole mass measurements. Extremely difficult for classically scheduled spectrographs. FLOYDS key project.

Optical Layout



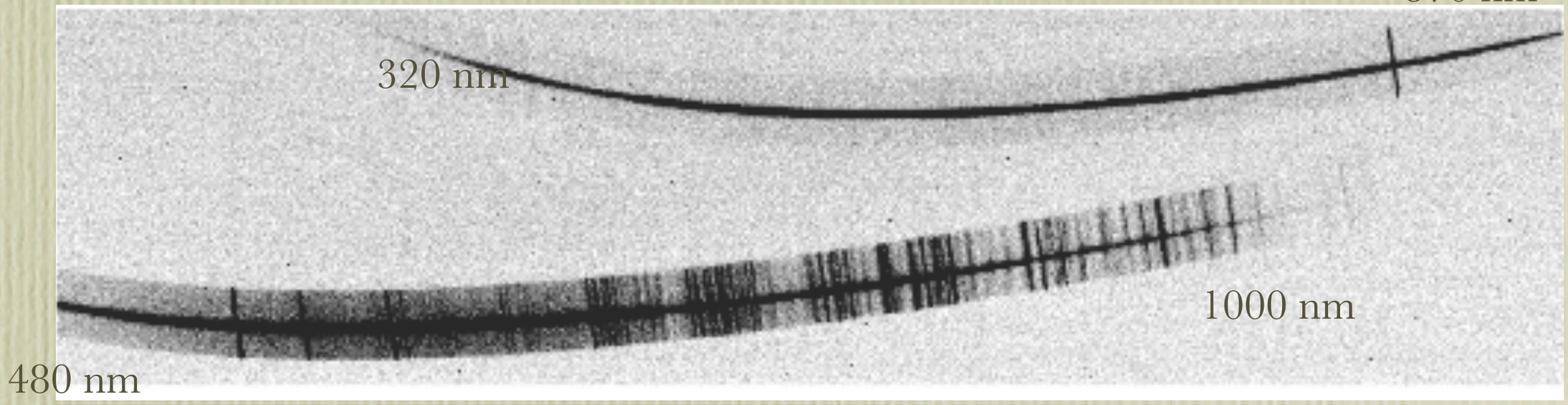
Double-pass prism and reflective grating (235 l/mm). Simple folded Schmidt camera. Broad wavelength coverage with one CCD in one shot.

In real life



Invar truss with all elements supported on a hexapod. Excellent thermal control -- basically never changes focus.

On the CCD



E2V chip; 512 x 2048; 13.5 micron pixels; 1.2x30 arcsec slit

$R = \lambda / d\lambda$

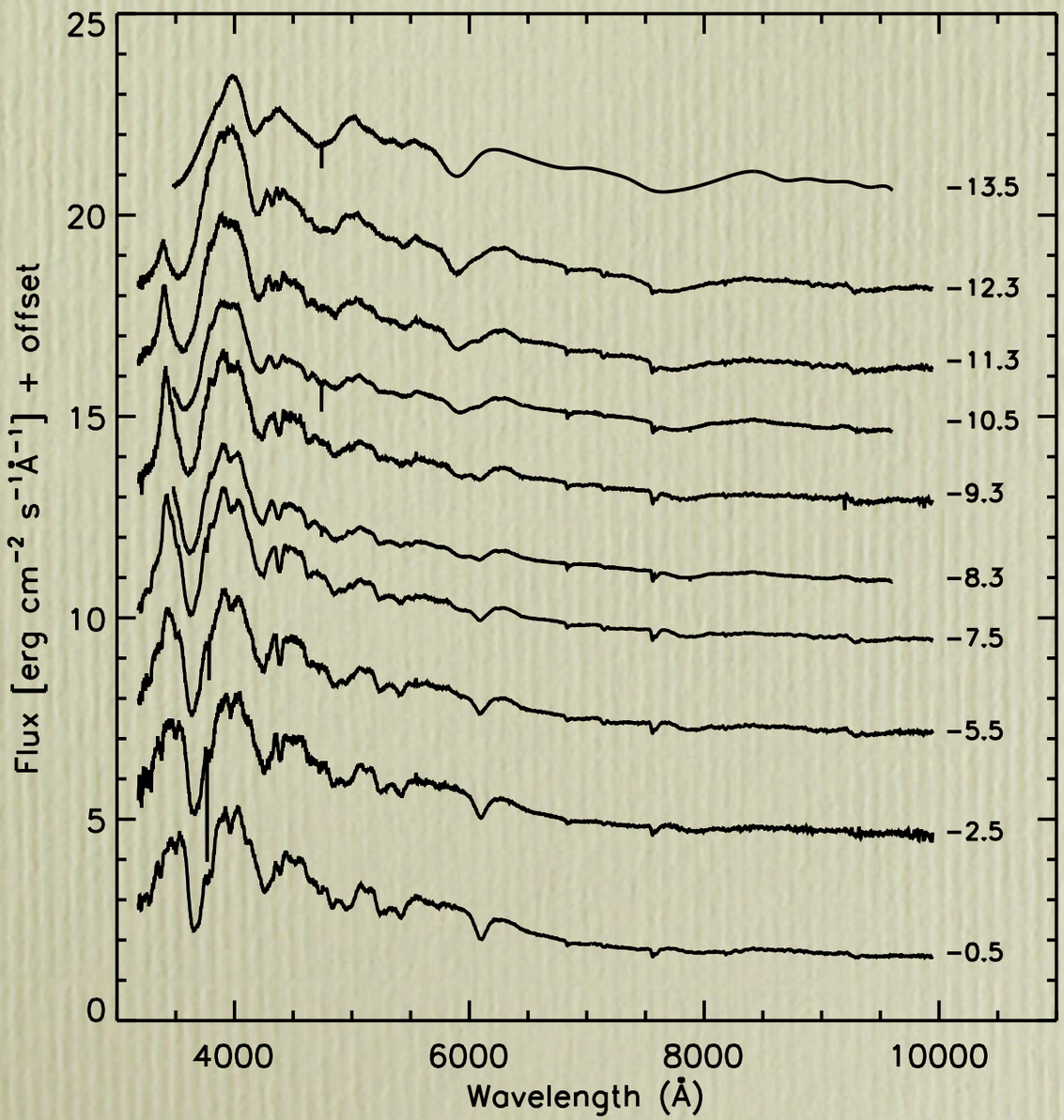
R-420 at 350nm (2nd order)
R-690 at 570nm (2nd order)
R-315 at 520 nm (1st order)
R-540 at 900 nm (1st order)

-Slits are site dependent, but 0.9 - 6.0 arcsec

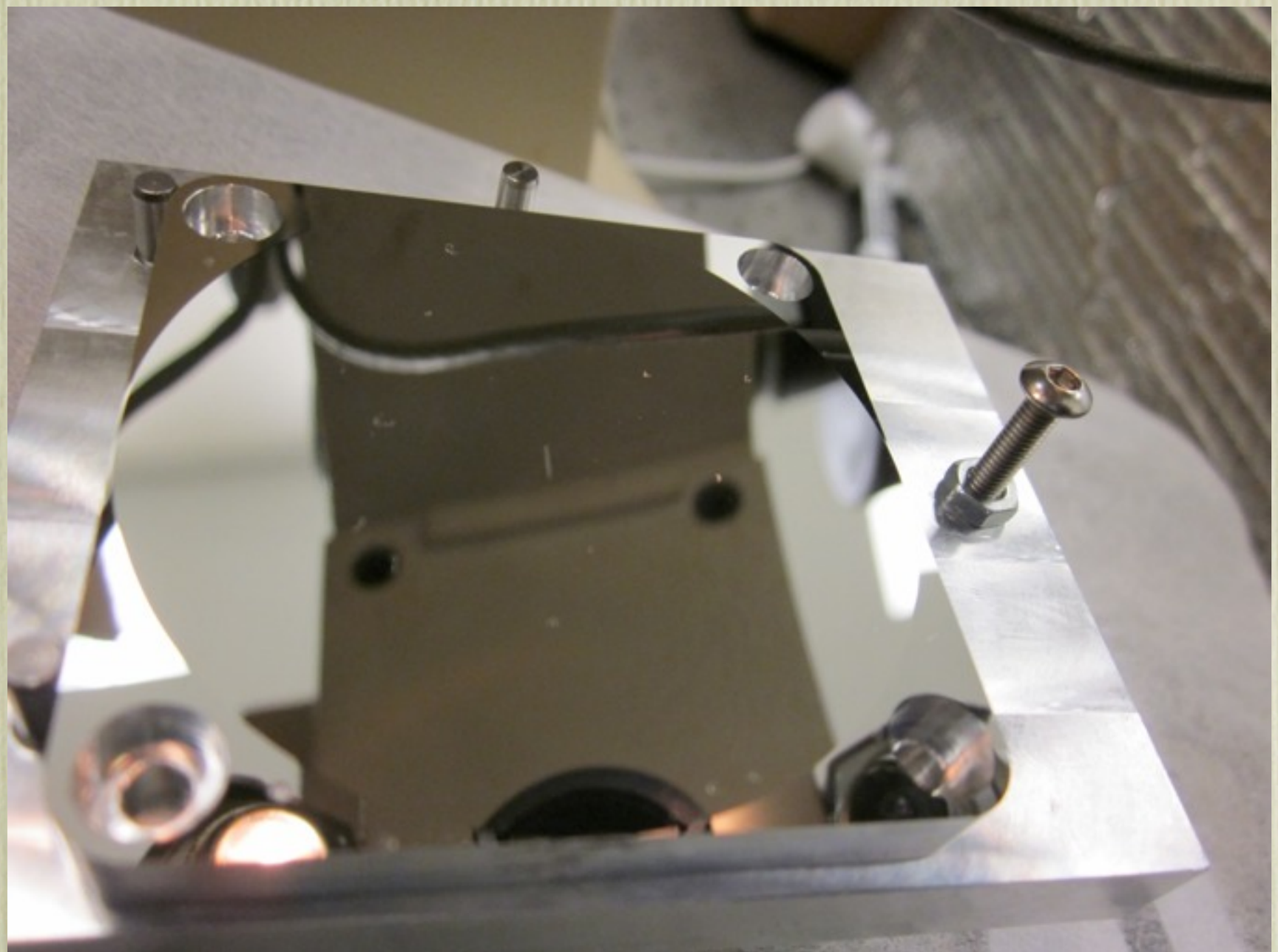
-Calibration unit sits in adjacent room; pneumatic arm with optics delivers F/10 beam into spectrograph

Starting to get sequences of spectra....

(not just SN, but AGN reverberation mapping too)



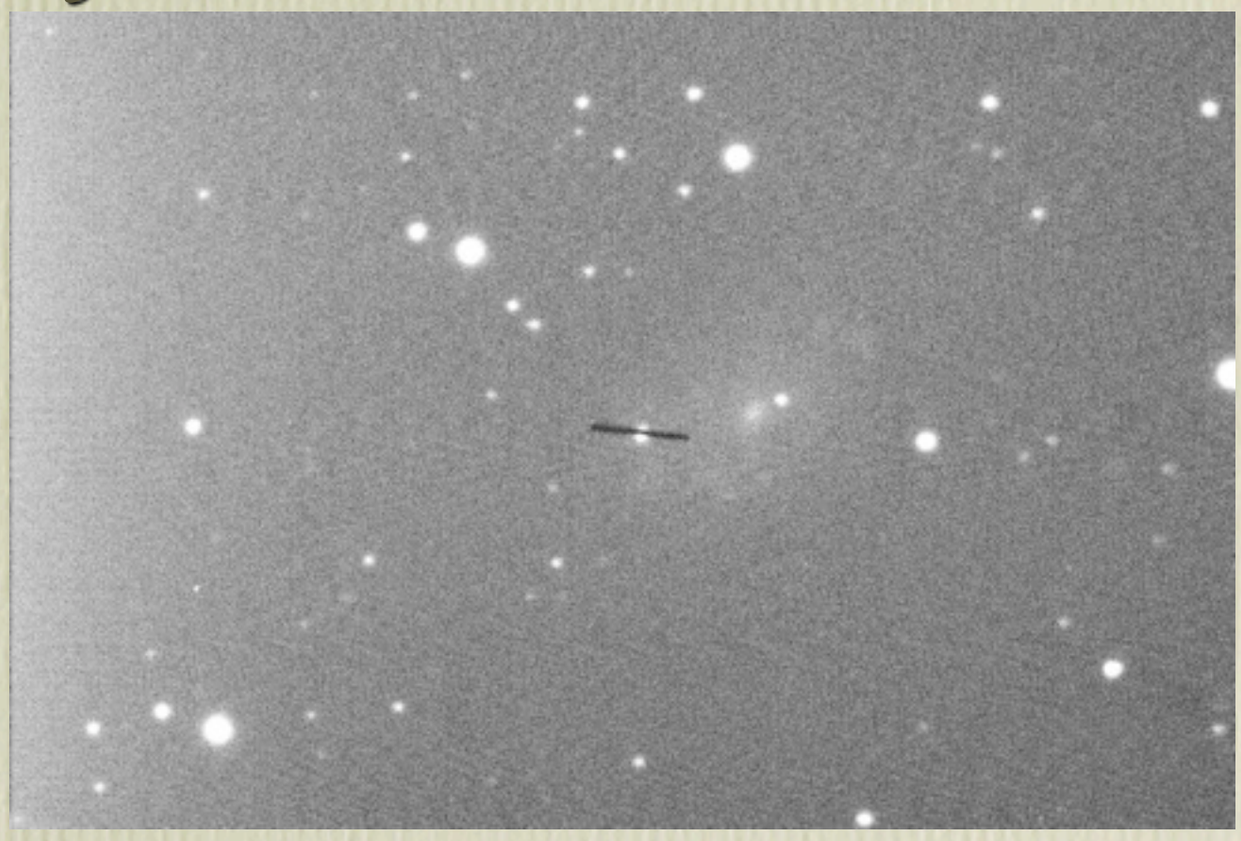
The slit -- light from supernova goes through slit while nearby regions get imaged by another CCD



Acquisition images

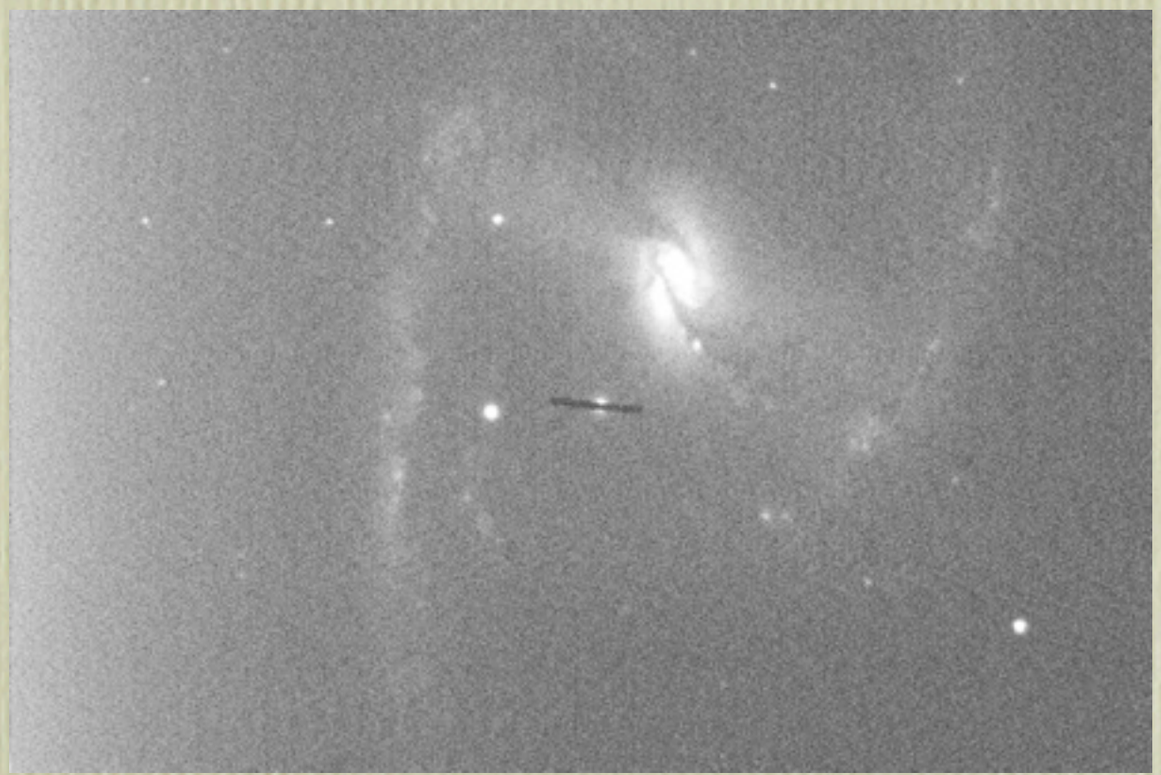
- Autoguider FOV is ~4x6 arcmin.
- Use astrometry.net for initial WCS solution. Or just put brightest target within pointing error circle into slit. Or do a blind offset.

Easy --- 3 sec.

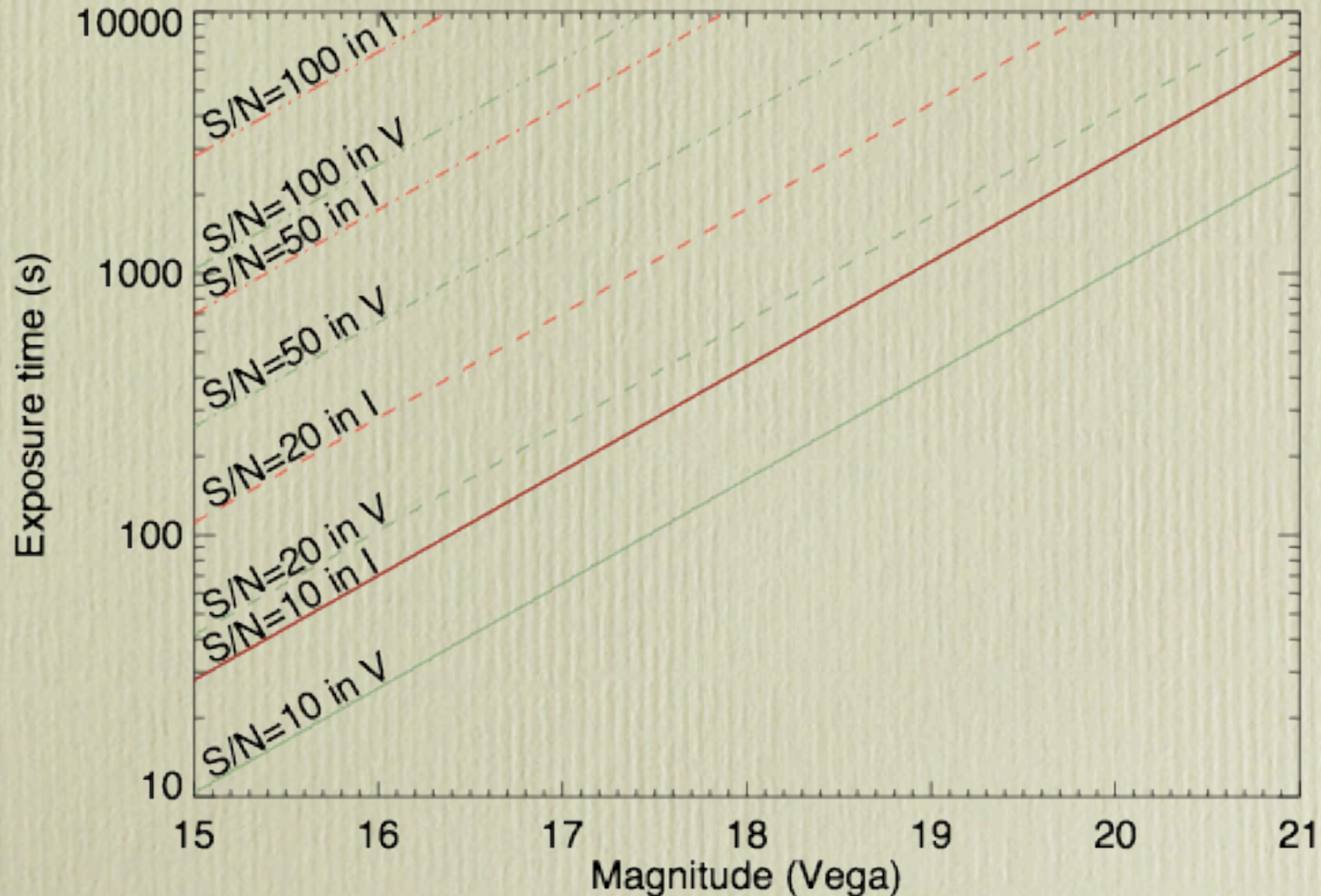


Standard Star field -- Just slam it into the slit.

Conditions change



Some sensitivity numbers

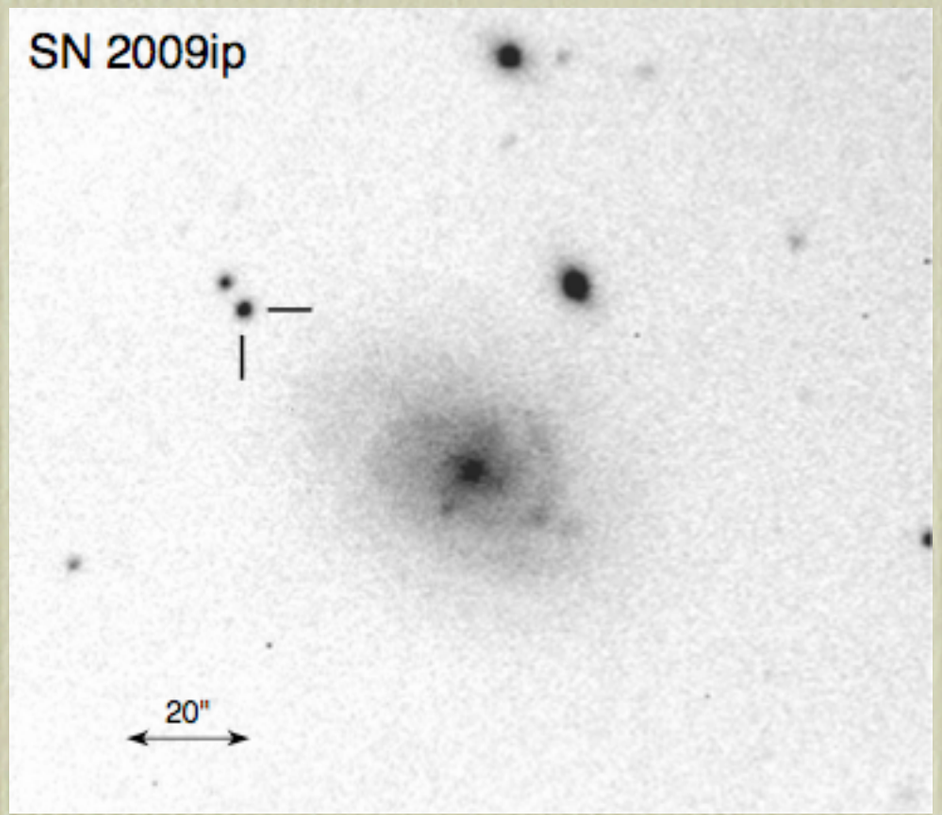


Numbers from standard star observations; thanks to Andy Howell for making plot.

What's next?

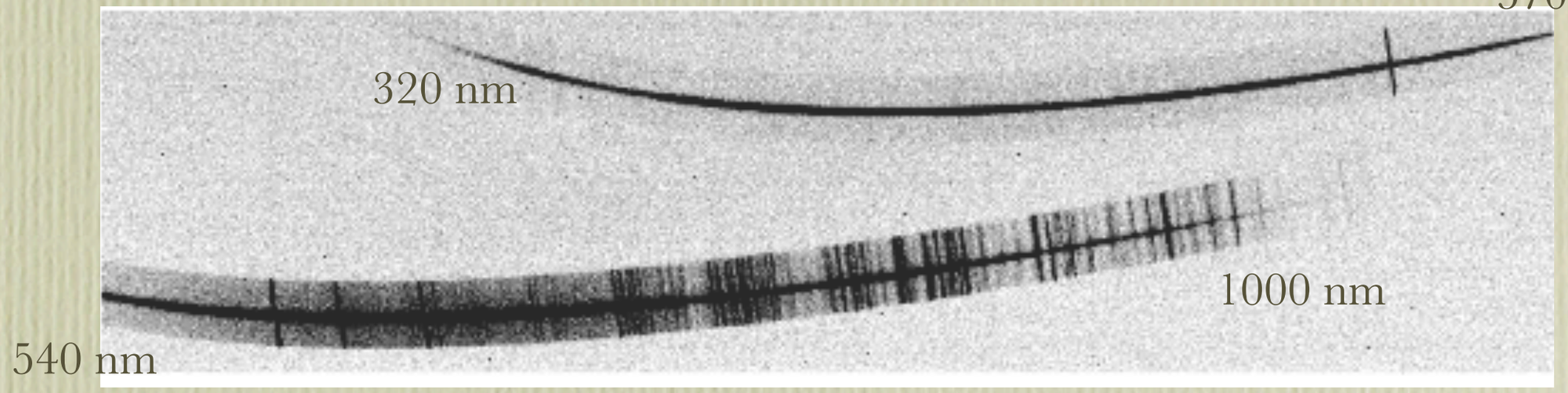
- Software (some guider issues, data reduction pipeline version 2) and establishment of 'normal' operations in the next couple of months. A all-electronic ToO mode. Mostly SCIENCE.

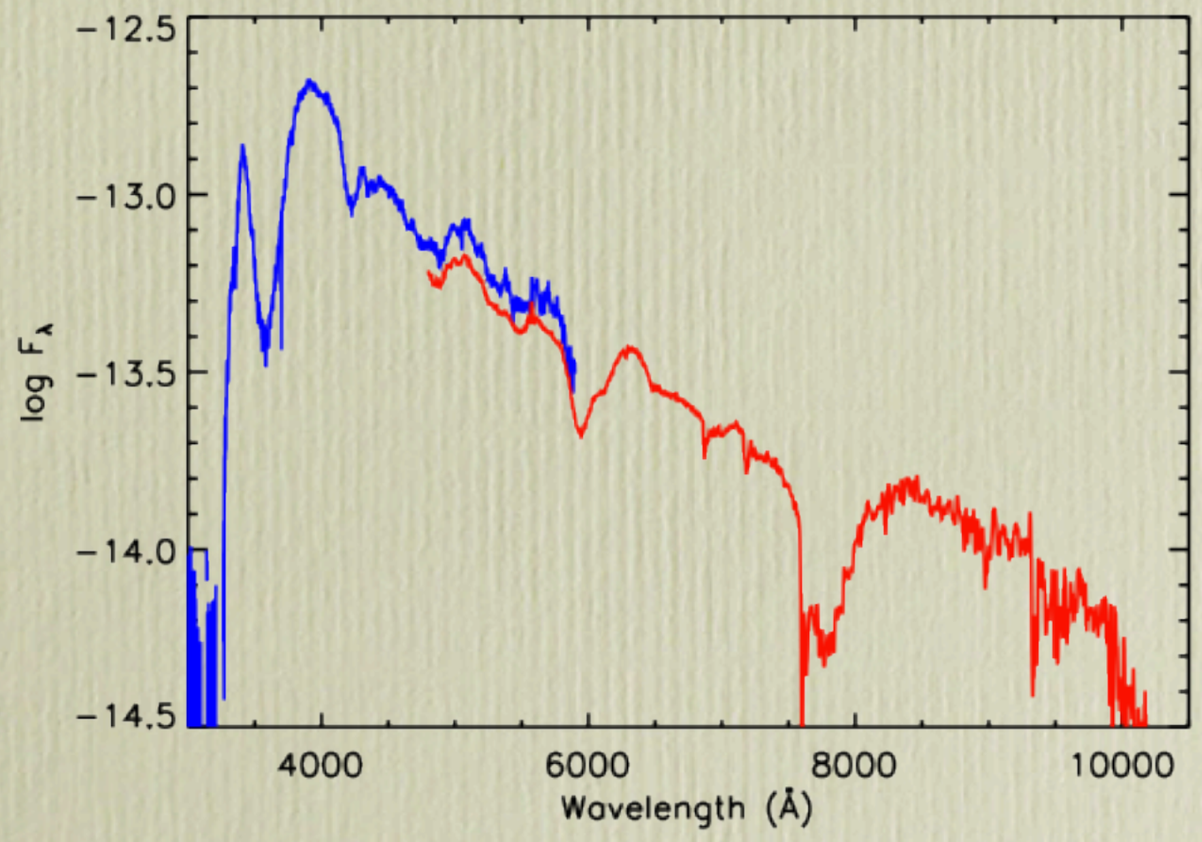
Nearby and Bright SNe



- FLOYDS can provide high cadence, low-res spectroscopy for all nearby and peculiar SNe. Large campaign beginning now in coordination with photometry from ELP 1-m.

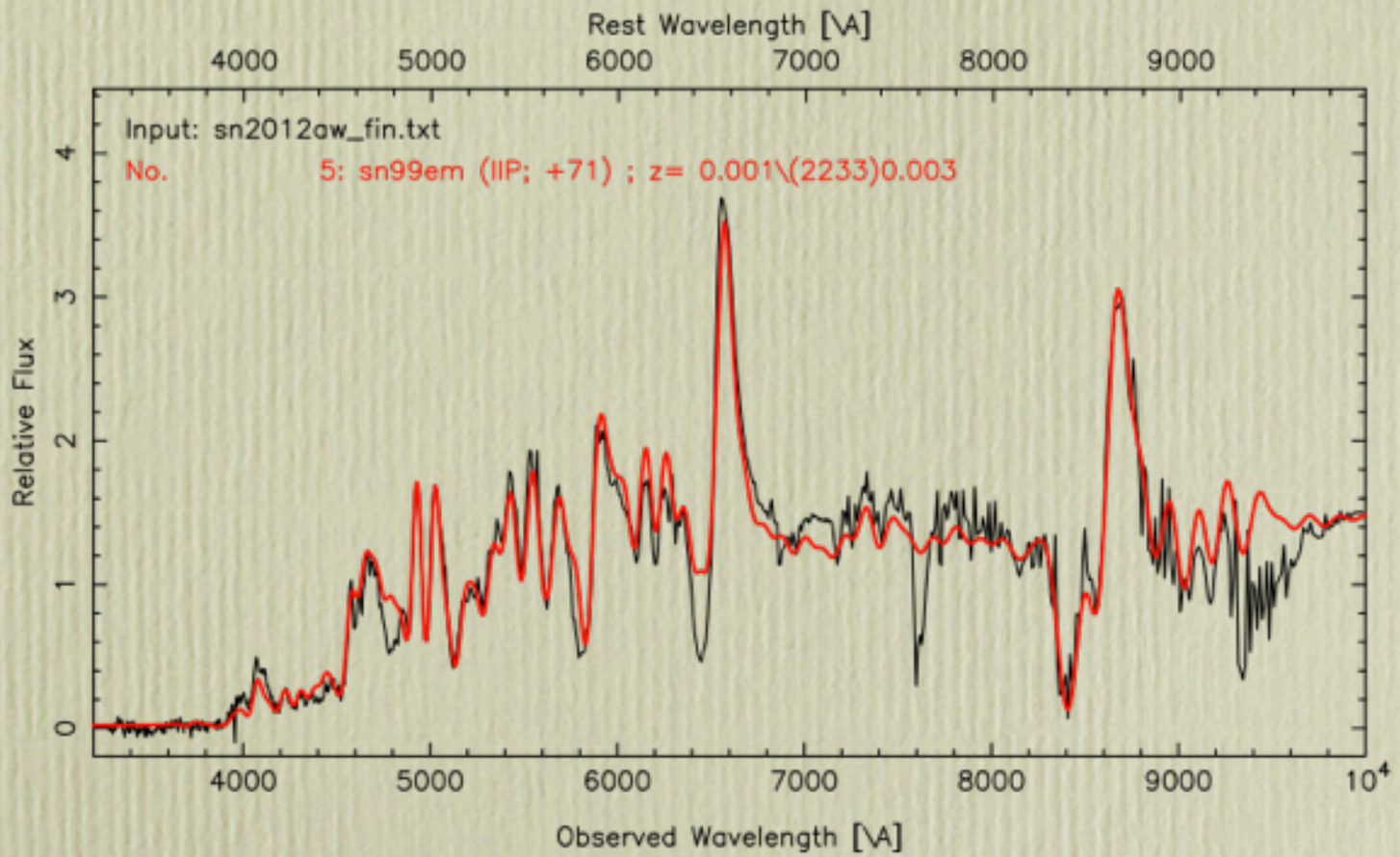
2D and 1D





SN12fr at roughly -10 days before max.

SN 2012aw

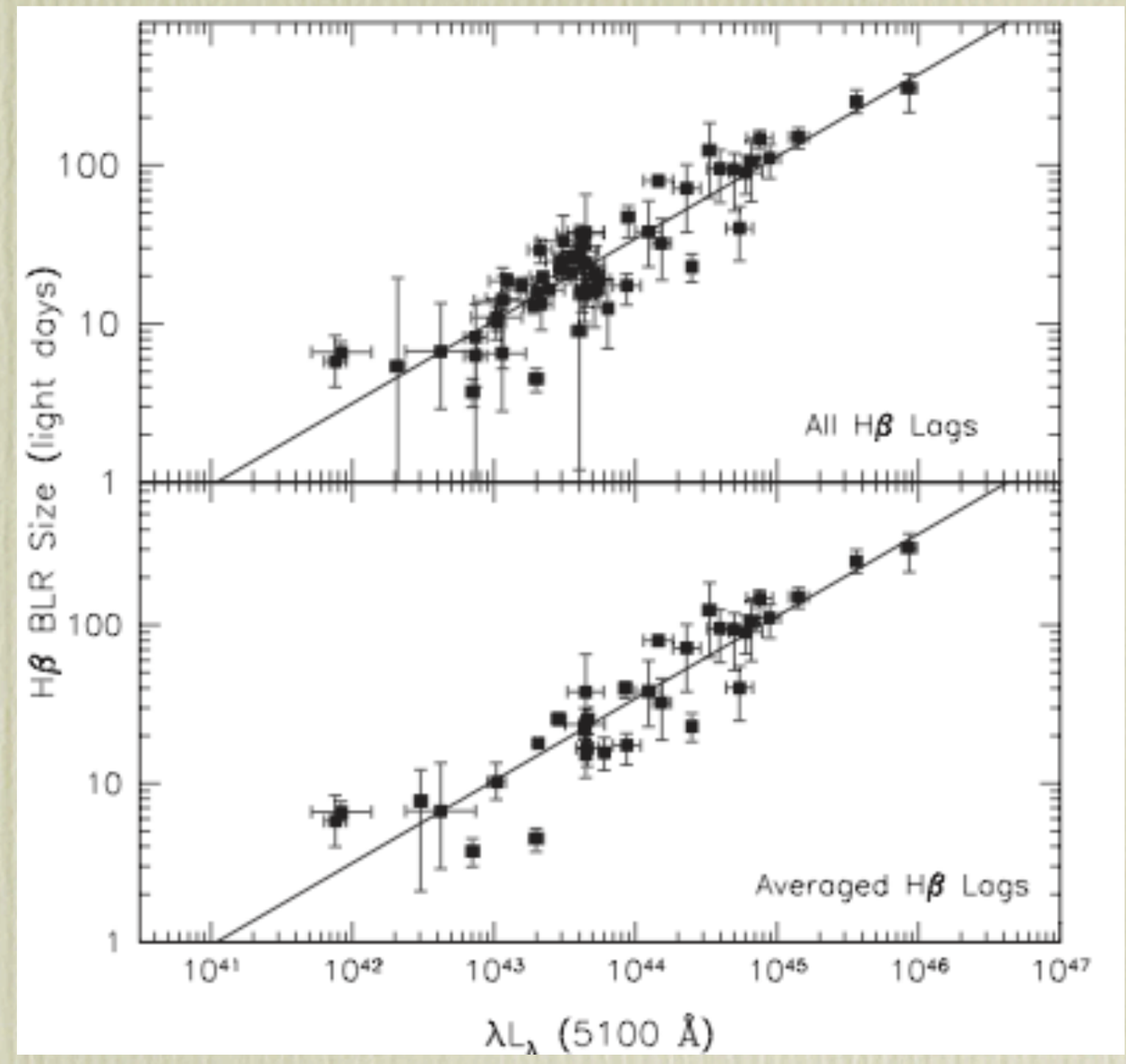

Rest Wavelength [\A]
4000
5000
6000
7000
8000
9000
Input: sn2012aw_fin.txt
No. 5: sn99em (IIP; +71) ; z= 0.001\(2233)0.003
Relative Flux
0
1
2
3
4
4000
5000
6000
7000
8000
9000
10^4
Observed Wavelength [\A]

Reverberation mapping of BHs -- pushing to high redshift

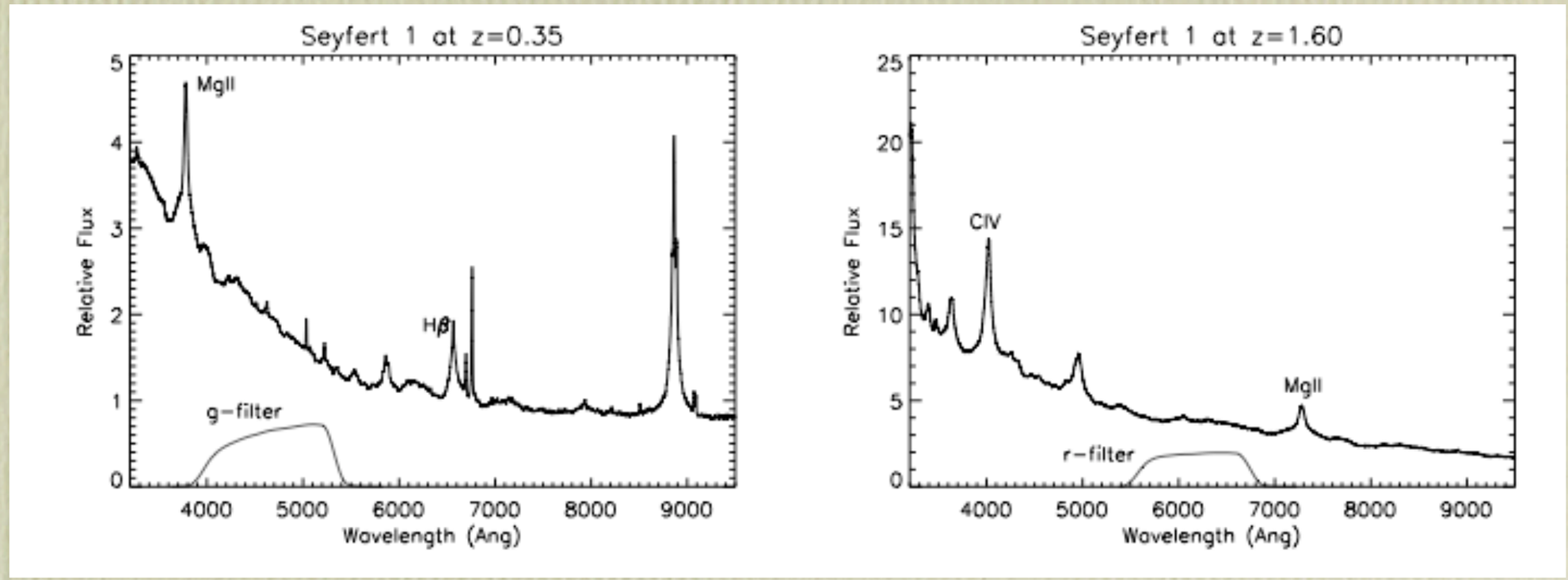
- M_{BH} vs σ relation -- how does it evolve with redshift? Uses 'single epoch' M_{BH} estimates based on local reverberation mapping results.

- Does the R_{BLR} vs. L_{AGN} relation evolve with redshift?

- Need direct R_{BLR} measurements via reverberation mapping at various z. Too hard to with classical observing, but is in LCOGT's wheelhouse

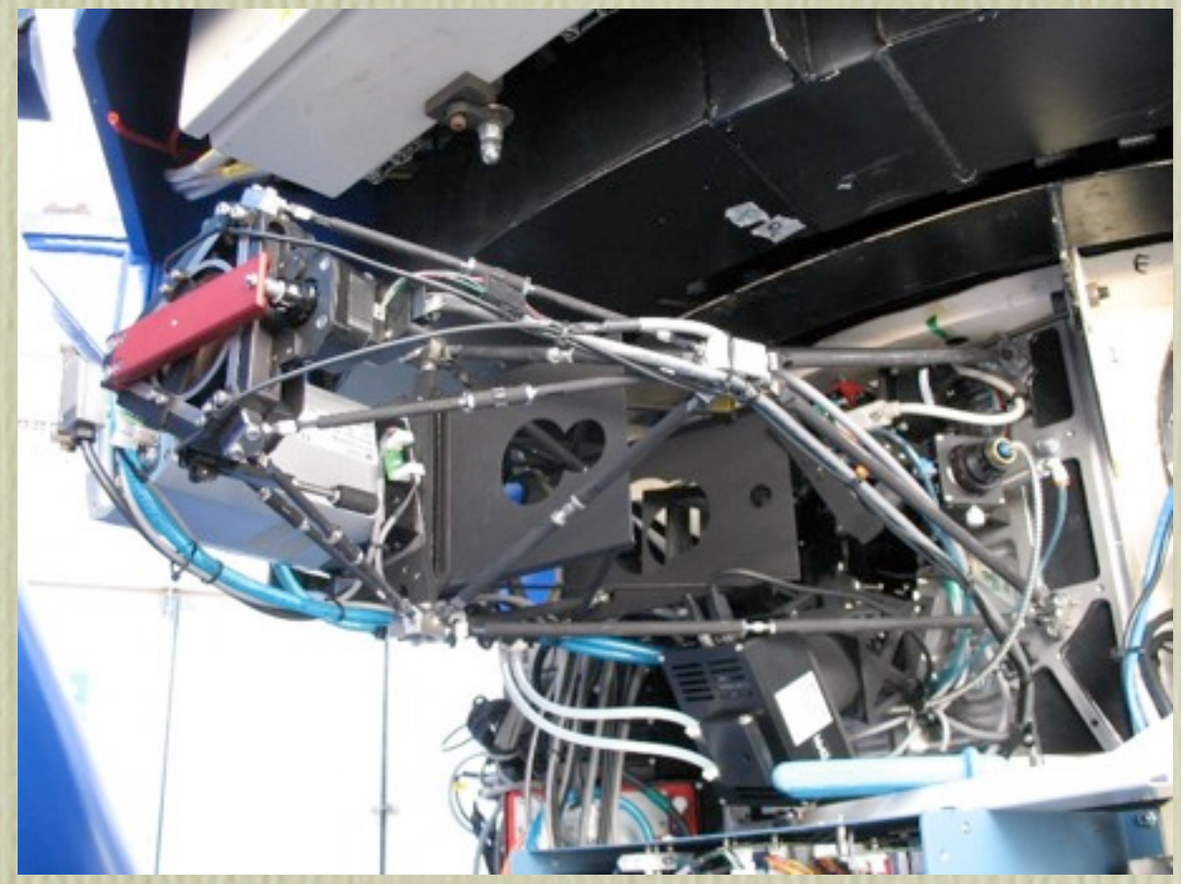


Reverberation mapping with FLOYDS: A three-pronged approach

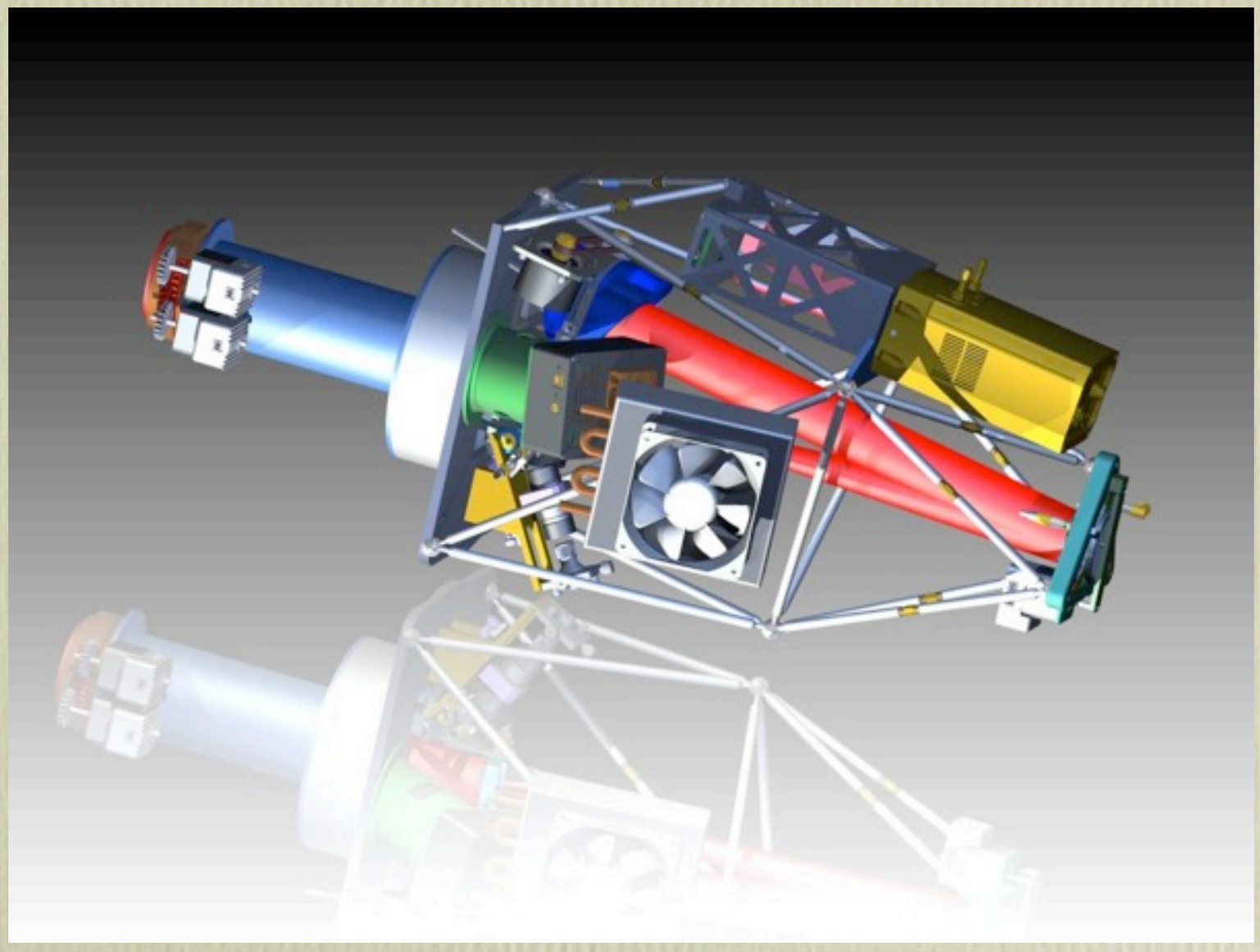


- Local sample to confirm utility of FLOYDS and obtain 1st robotic reverberation mapping result -- ~4-5 months.
- z~0.35 sample -- Measure RM signal in both MgII and Hbeta -- ~1 year
- z~1.6 sample -- Use CIV and MgII -- ~2 years.

Some pics



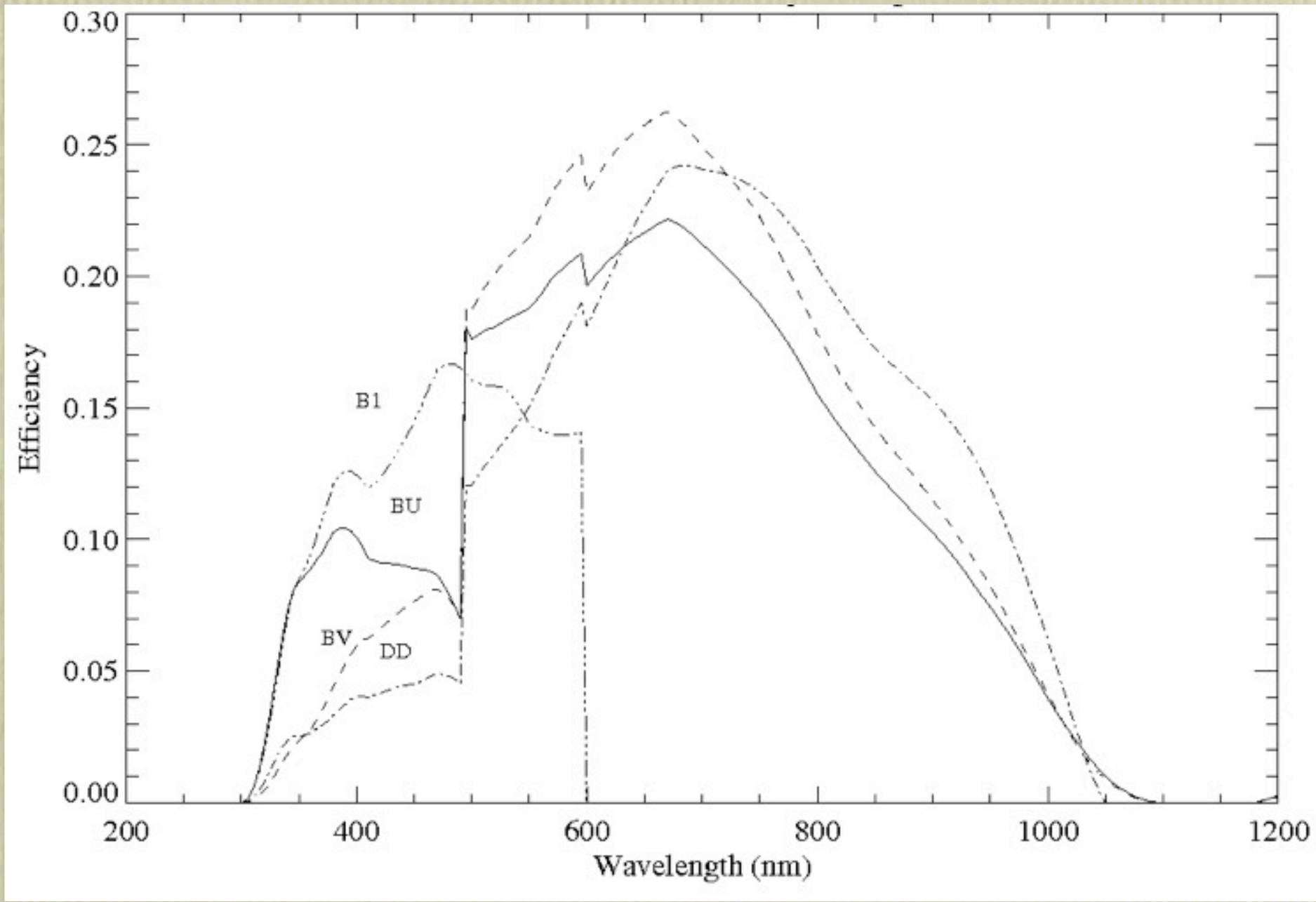
Mechanical Design/Enclosure



Invar truss with all elements supported on a hexapod.

The End

Estimated Throughput



Grating -- 235 l/mm