The 6dF Galaxy Redshift Survey:
First Data Release

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The 6dF Galaxy Survey

- The 6dFGS is designed to be the first of a new generation of combined *z*+*v*-surveys, combining…
  - → NIR-selected redshift survey of the local universe
  - → Peculiar velocity survey using D_n-σ distances
  - → Additional redshift surveys of other 'interesting' source samples.

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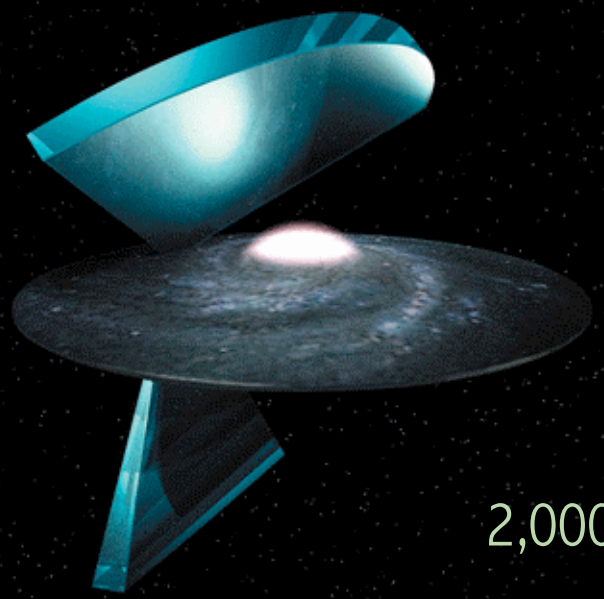
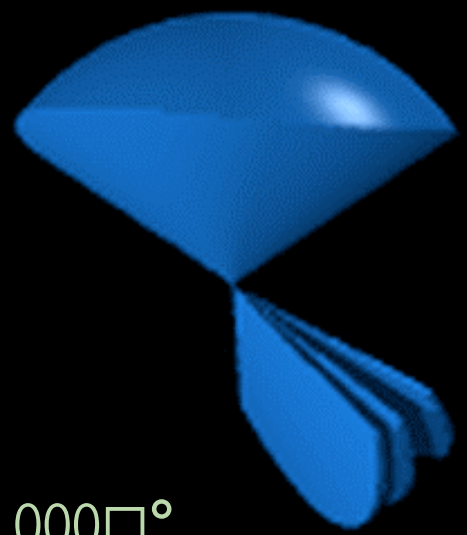
- Survey strategy…
  - survey whole southern sky with |b|>10°
  - primary *z*-survey: 2MASS galaxies to K_{tot}<12.75
  - secondary samples: H<13, J<13.75, r<15.7, b<17
  - 11 additional samples: radio, X-ray, IRAS…
  - *v*-survey: ~15,000 brightest early-type galaxies

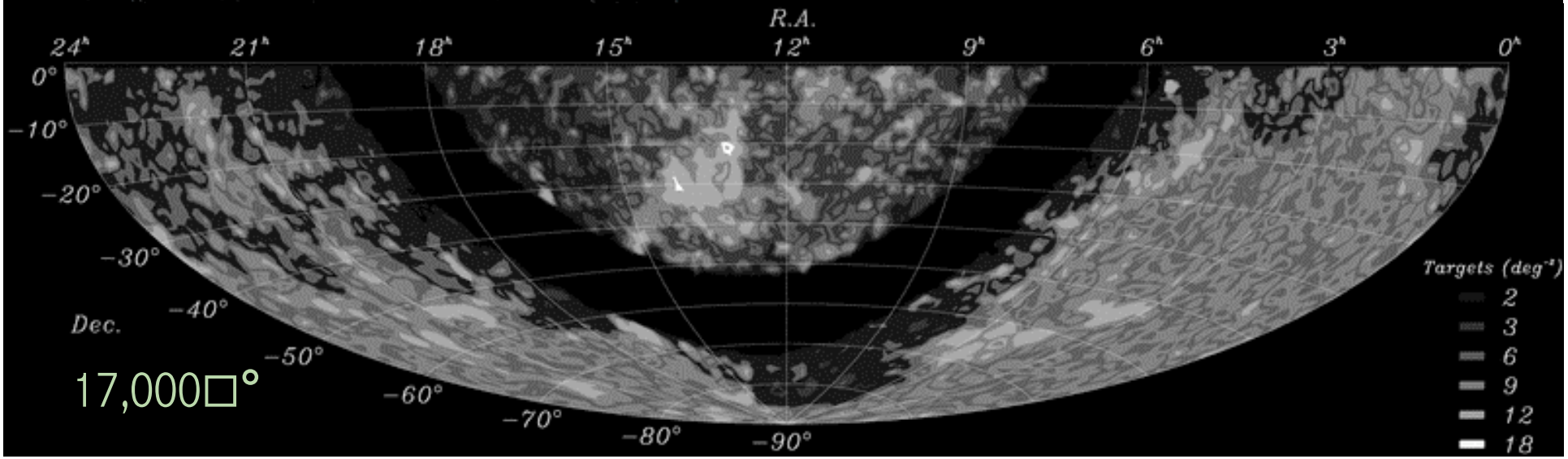
Advantages *- sky coverage*



2,000□°

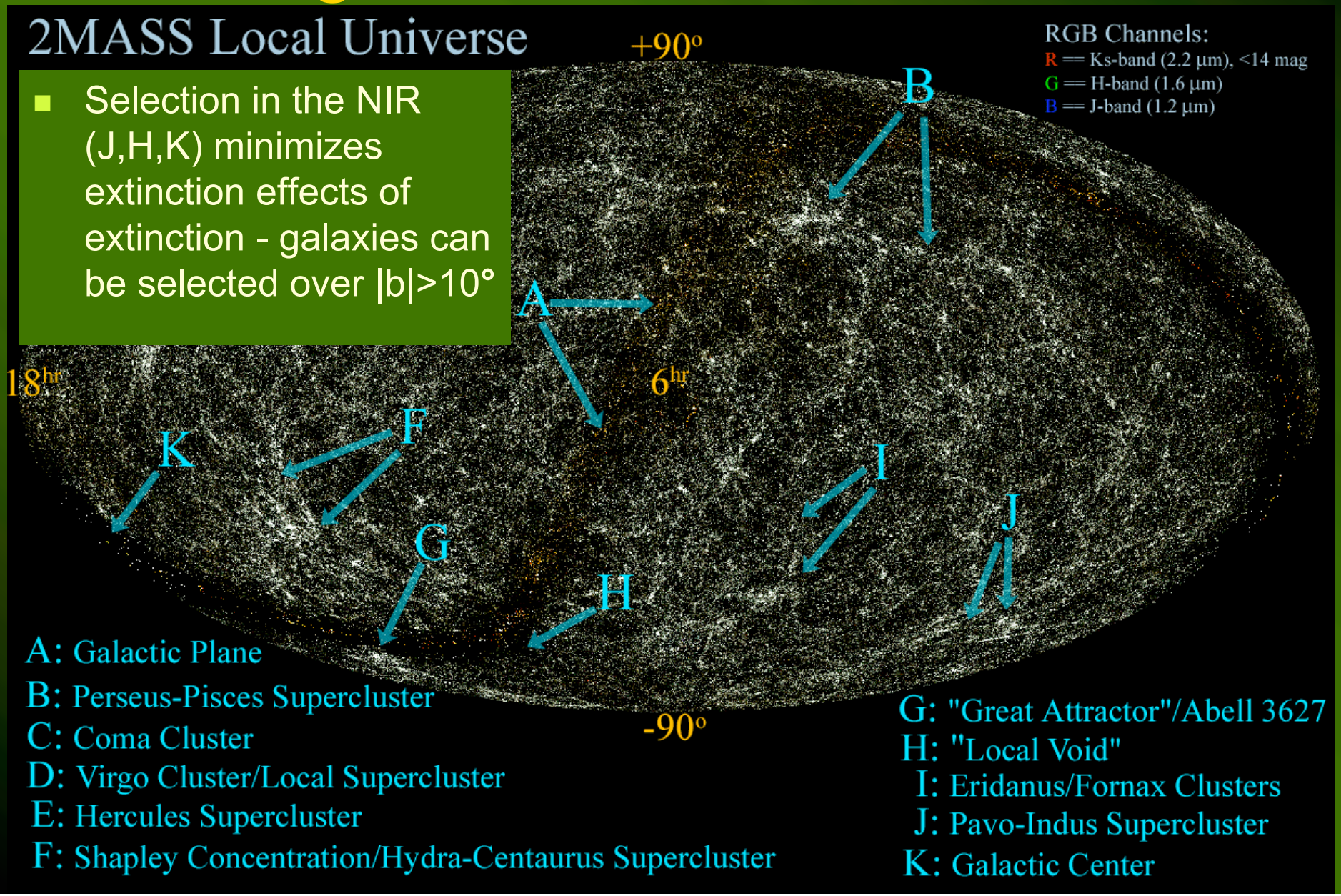


10,000□°



17,000□°

Advantages - NIR selection



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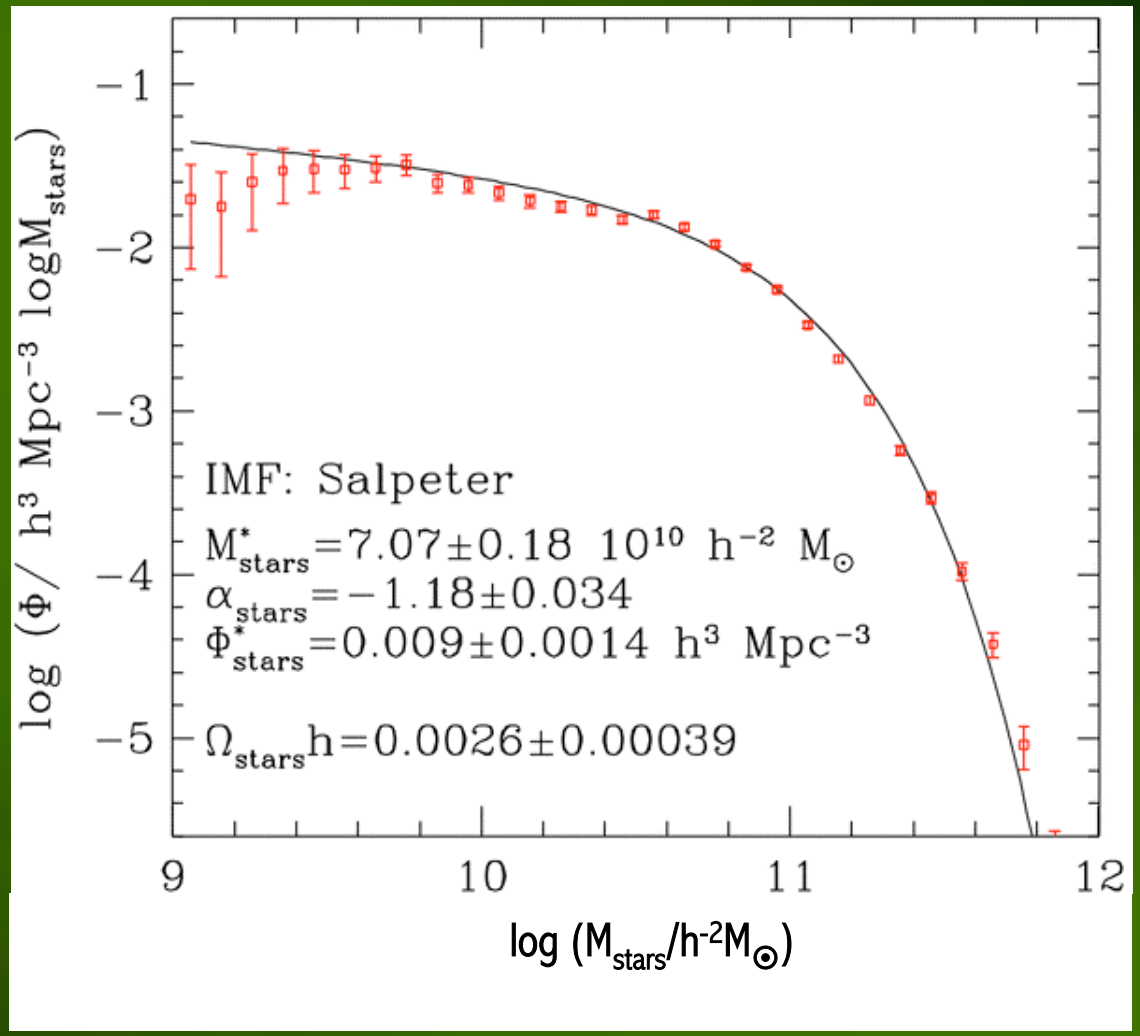
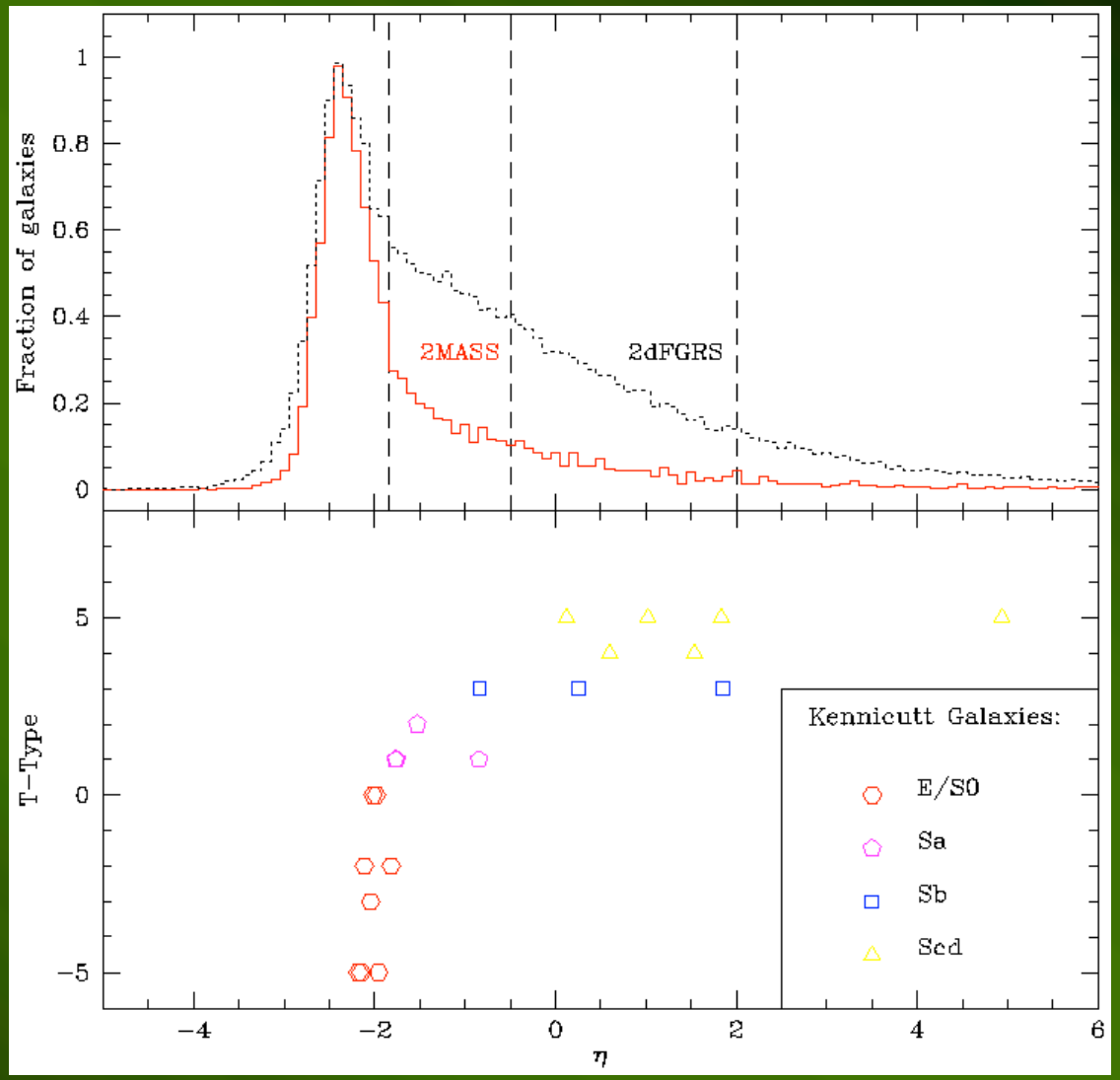
- NIR luminosity is very closely correlated with total stellar mass, and so yields the stellar mass function.

Cole et al (2001)



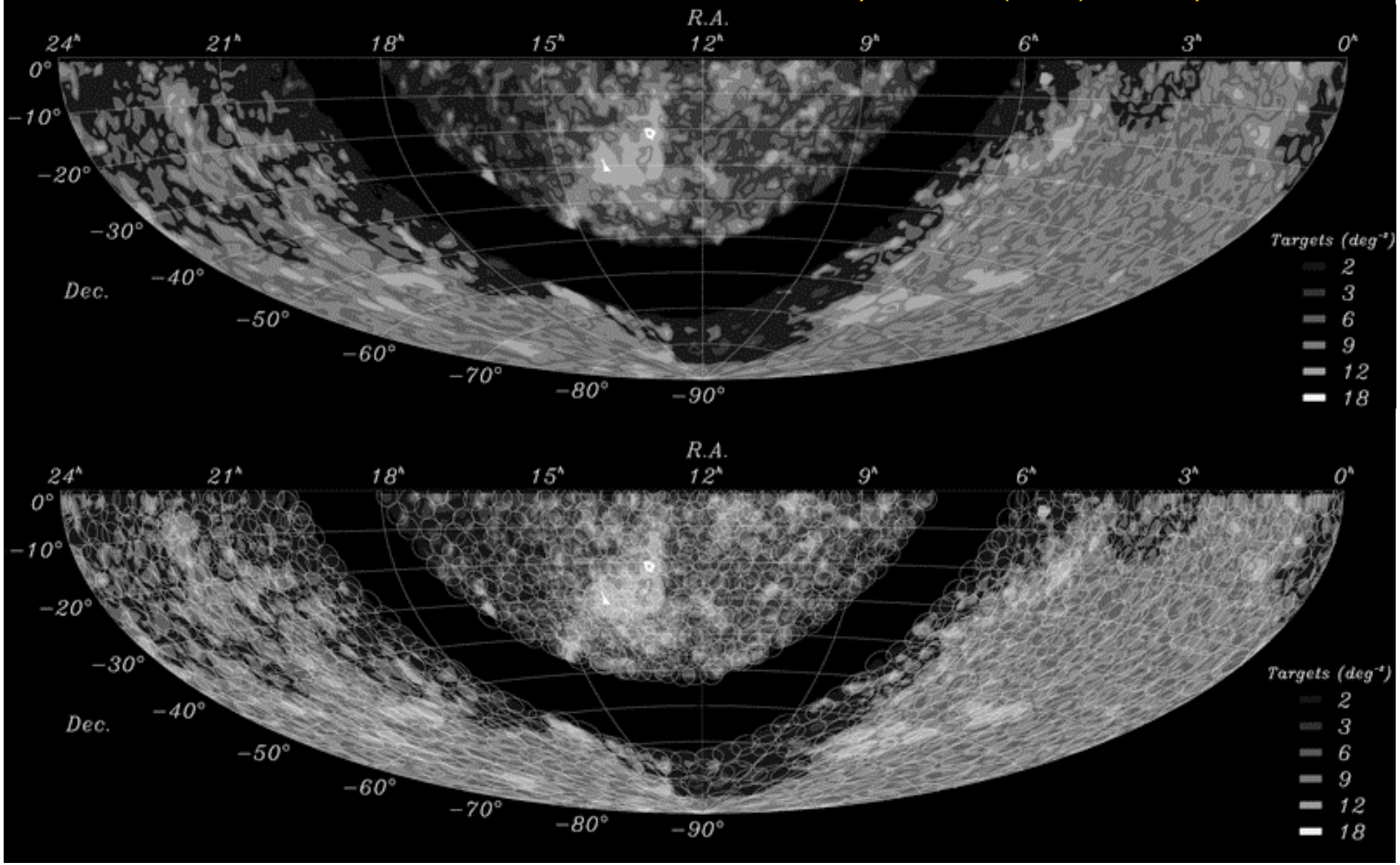
Advantages - NIR selection

- Selection in the NIR (J,H,K) minimizes extinction effects of extinction - galaxies can be selected over |b|>10°.
- NIR luminosity is very closely correlated with total stellar mass, and so yields the stellar mass function.
- Optical selection is biased towards late-type, star-forming galaxies - NIR selection is thus better for the D_n-σ sample.



Target density and Survey Tiling

Campbell et al (2004), astro-ph/0403502



Tiling the Sample

Sample	Priority
2MASS Ks < 12.75	8
2MASS H < 13.05	6
2MASS J < 13.75	6
SuperCOSMOS r_F < 15.7	6
SuperCOSMOS b_J < 17.0	6
Shapley	6
ROSAT All-Sky Survey	6
HIPASS (> 4-sigma)	6
IRAF Faint Source Catalogue	6
Denis J < 14	5
Denis I < 15	5
2MASS AGN	4
Hamburg-ESO Survey	4
NOAO-VLA Sky Survey	4

- Additional target samples extend science grasp and fully exploit whole-hemisphere redshift survey.
- AT programs include targets from:
  - 2MASS NIR sky survey
  - DENIS NIR sky survey
  - SuperCosmos galaxy catalogs
  - ROSAT All-Sky Survey (RASS)
  - HI Parkes Sky Survey (HIPASS)
  - IRAS Faint Source Catalog (FSC)
  - NVSS and SUMSS radio surveys
  - Hamburg-ESO QSO survey

Tiling the Sample

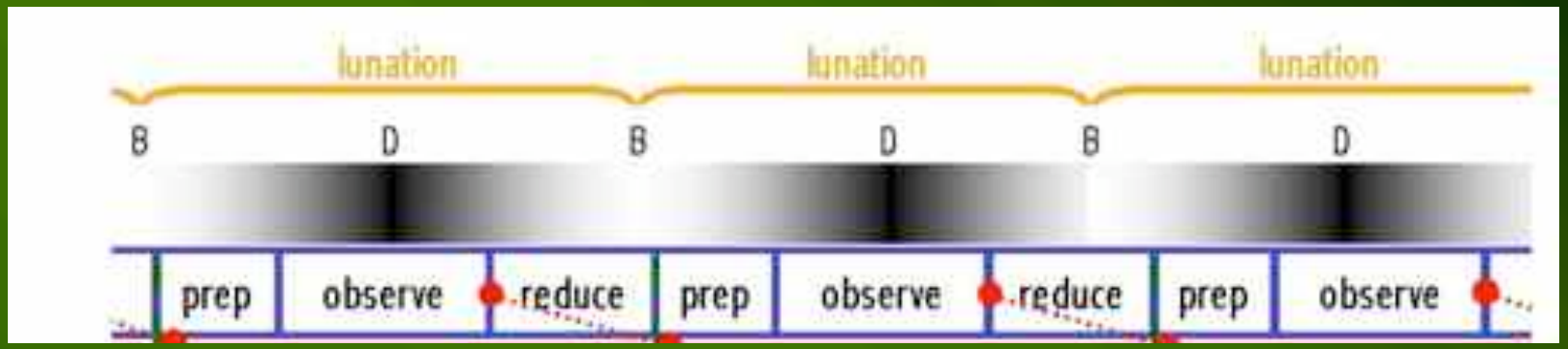
$$\frac{\text{Number of Tiled Sources}}{\text{Number of Sources on Sky}}$$

Sample	Priority	Total	Tiling Completeness
2MASS Ks < 12.75	8	113988	94.1 %
2MASS H < 13.05	6	3283	91.8
2MASS J < 13.75	6	2008	92.7
SuperCOSMOS r_F < 15.7	6	9199	94.9
SuperCOSMOS b_J < 17.0	6	9749	93.8
Shapley	6	939	85.7
ROSAT All-Sky Survey	6	2913	91.7
HIPASS (> 4-sigma)	6	821	85.5
IRAF Faint Source Catalogue	6	10707	94.9
Denis J < 14	5	1505	93.2
Denis I < 15	5	2017	61.7
2MASS AGN	4	2132	91.7
Hamburg-ESO Survey	4	3539	90.6
NOAO-VLA Sky Survey	4	4334	87.6

Campbell et al (2004), astro-ph/0403502

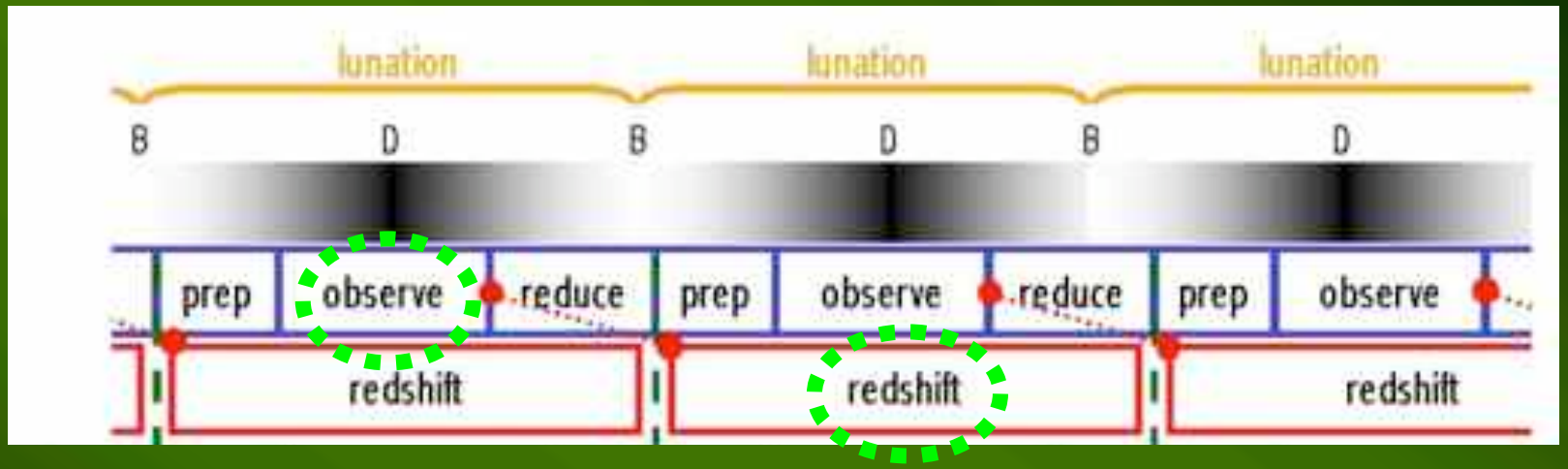
- 9 out of 14 samples with tiling completeness 92% or better

The Observing/Reducing Cycle



- Preparation, observing, reducing follows the lunar cycle

The Observing/Reducing Cycle



- Preparation, observing, reducing follows the lunar cycle
- Redshifting takes place in the following lunation
- Survey results are updated/reported ~6 weeks after observation

Observing Progress of 6dFGS

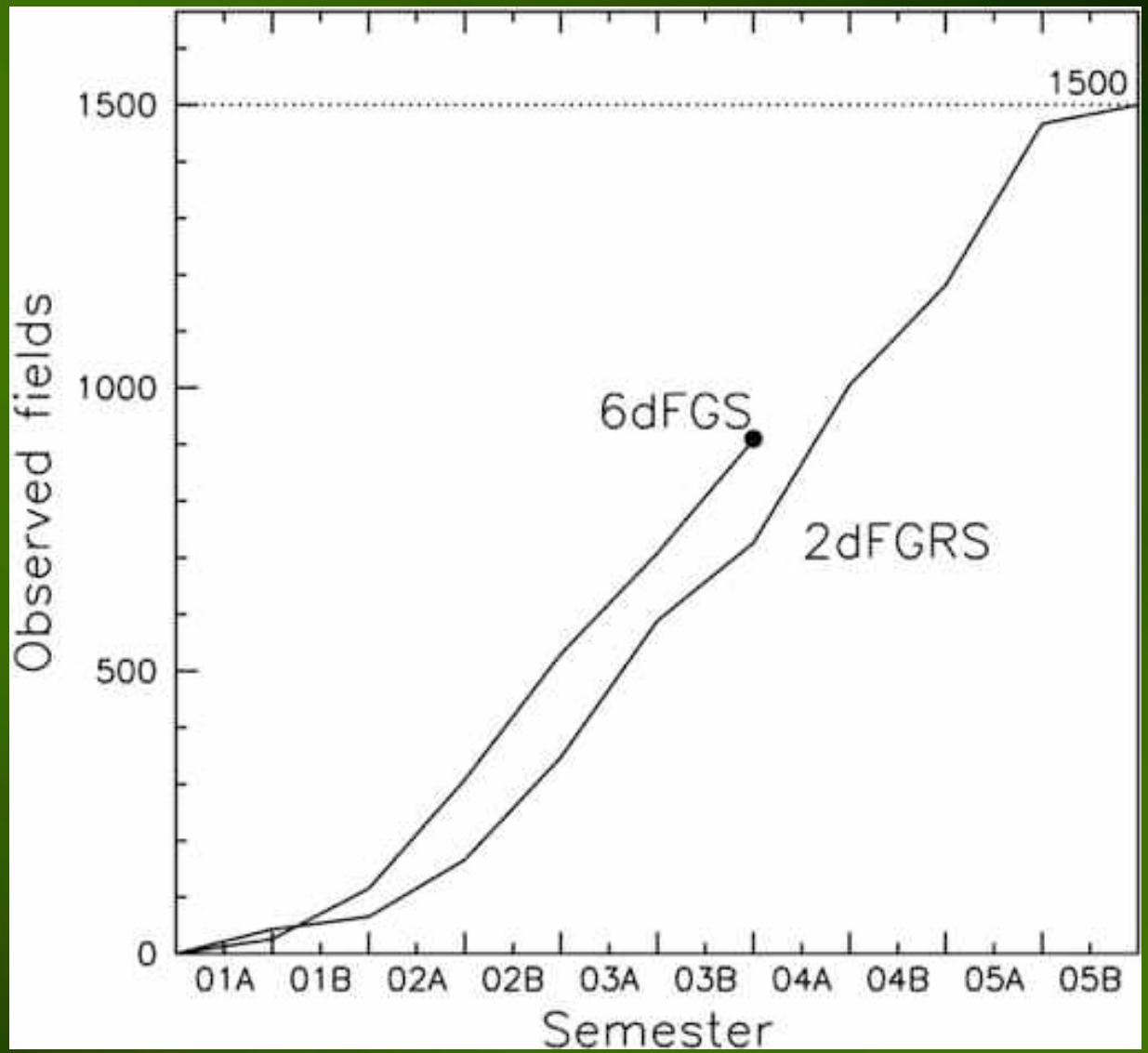
- 881 fields have been observed to end-2003.

  (86517 spectra)

Year	Observed # of fields	Cumulate fields
2001	98	98
2002	387	485
2003	396	881

- 524 fields have contributed to 1st Data Release

  (52048 spectra)

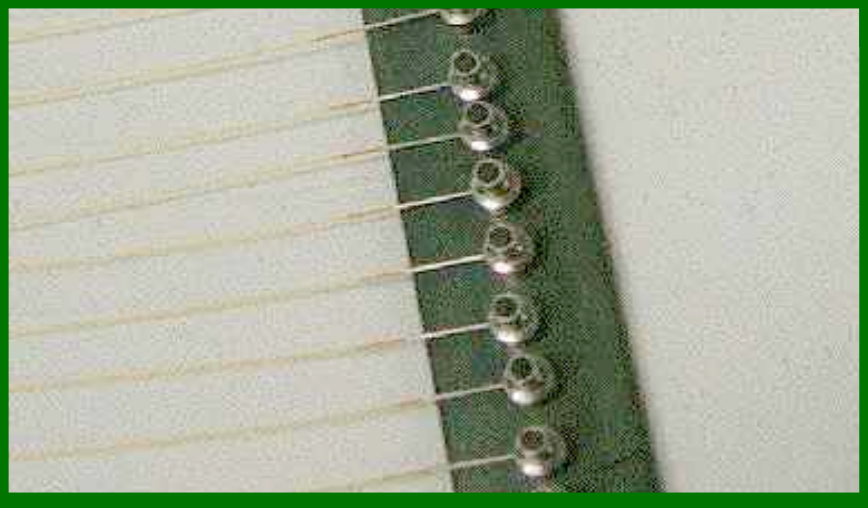


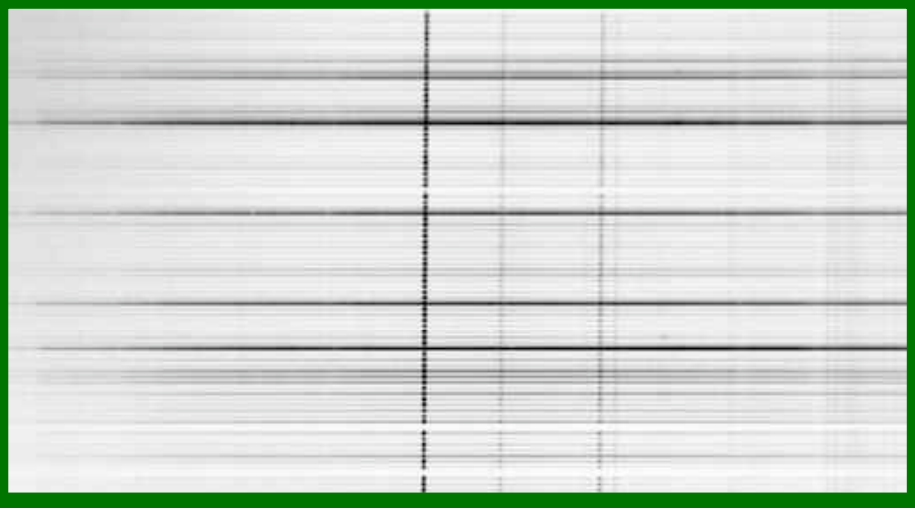
Schmidt Telescope at Siding Spring Observatory

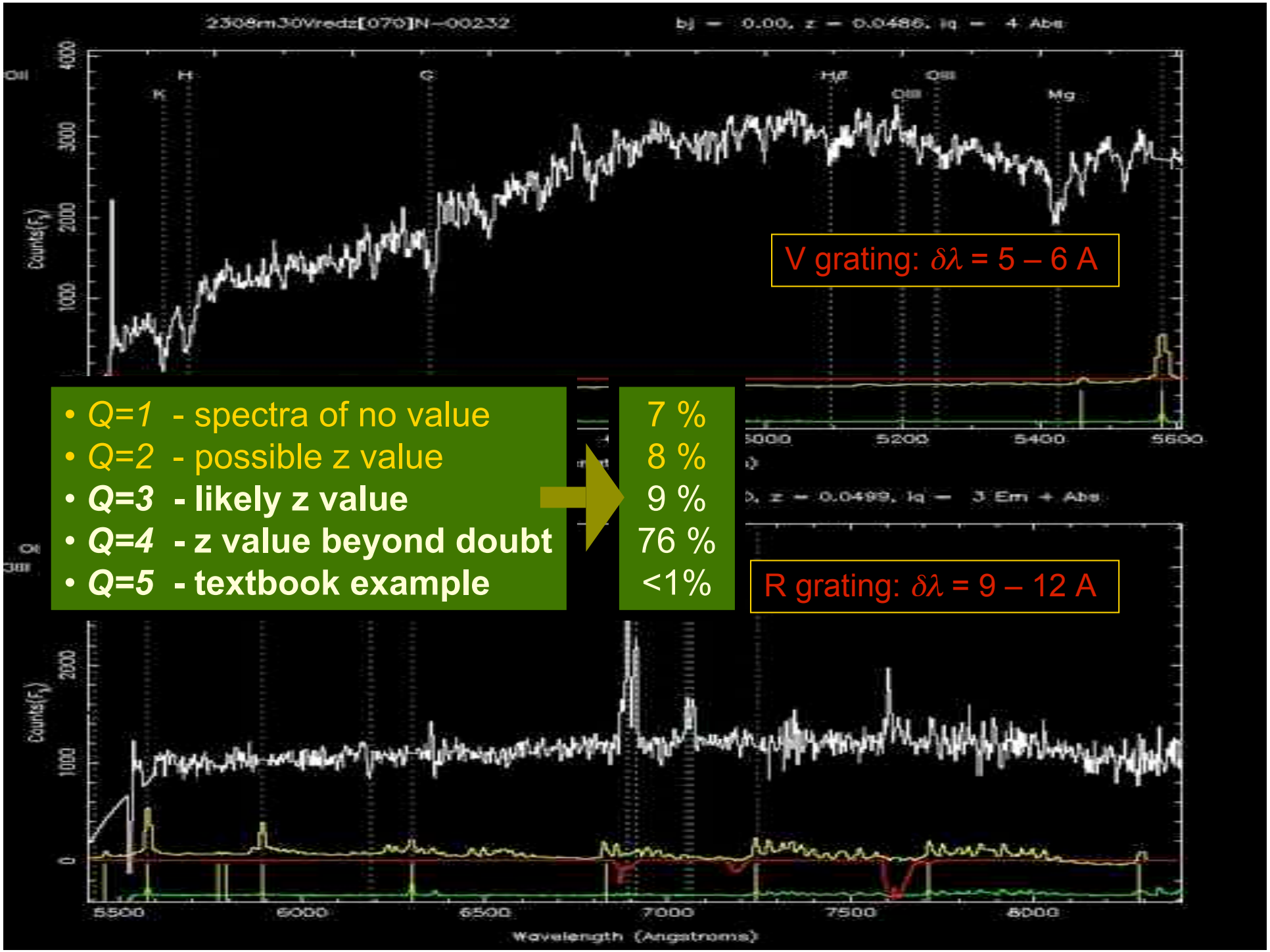
- 6dFGS gets 175 nights/year on the 1.2m UKST (75% of dark/grey time)

6dF Fibre Spectrograph

- 6dF has 150 6.7” fibres covering a 6 diameter field of view.







• *Q=1* - spectra of no value	7 %
• *Q=2* - possible z value	8 %
• ***Q=3* - likely z value**	9 %
• ***Q=4* - z value beyond doubt**	76 %
• ***Q=5* - textbook example**	<1%

Things to Watch in Some 6dF Data

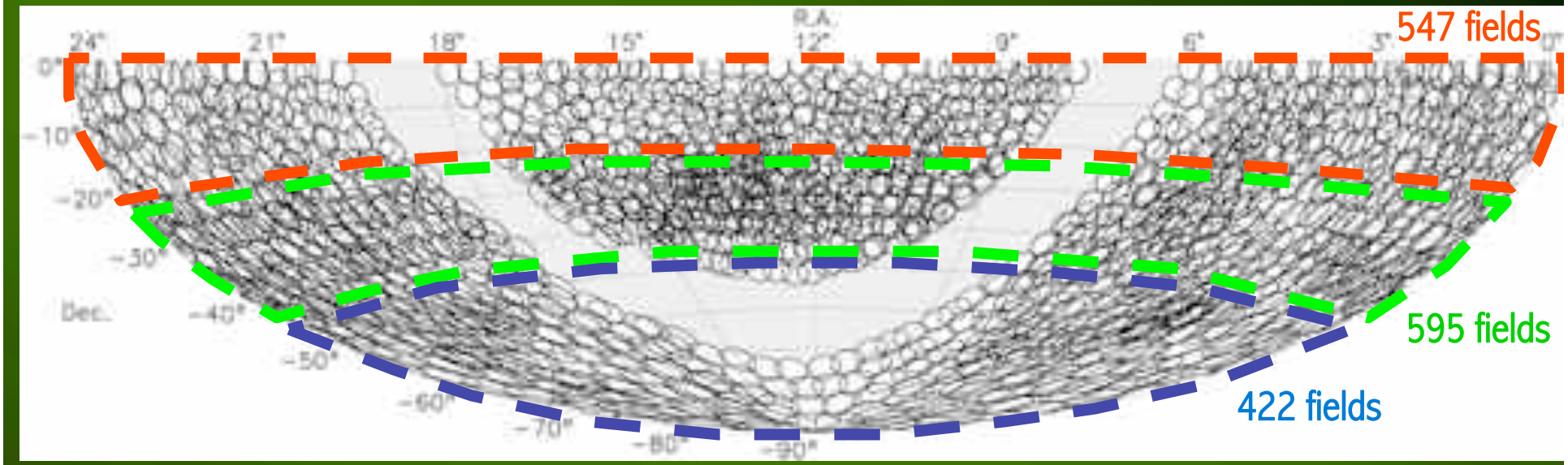
- Low S/N fields due to (1) poor conditions; (2) fewer-than-normal guide fibres; (3) misaligned buttons and fibres. Any worthless fields re-observed.

- Fringing present due to internal cracks/damage within some fibres, and also in the red (due to CCD).

- Scattered light present in some cases towards blue end

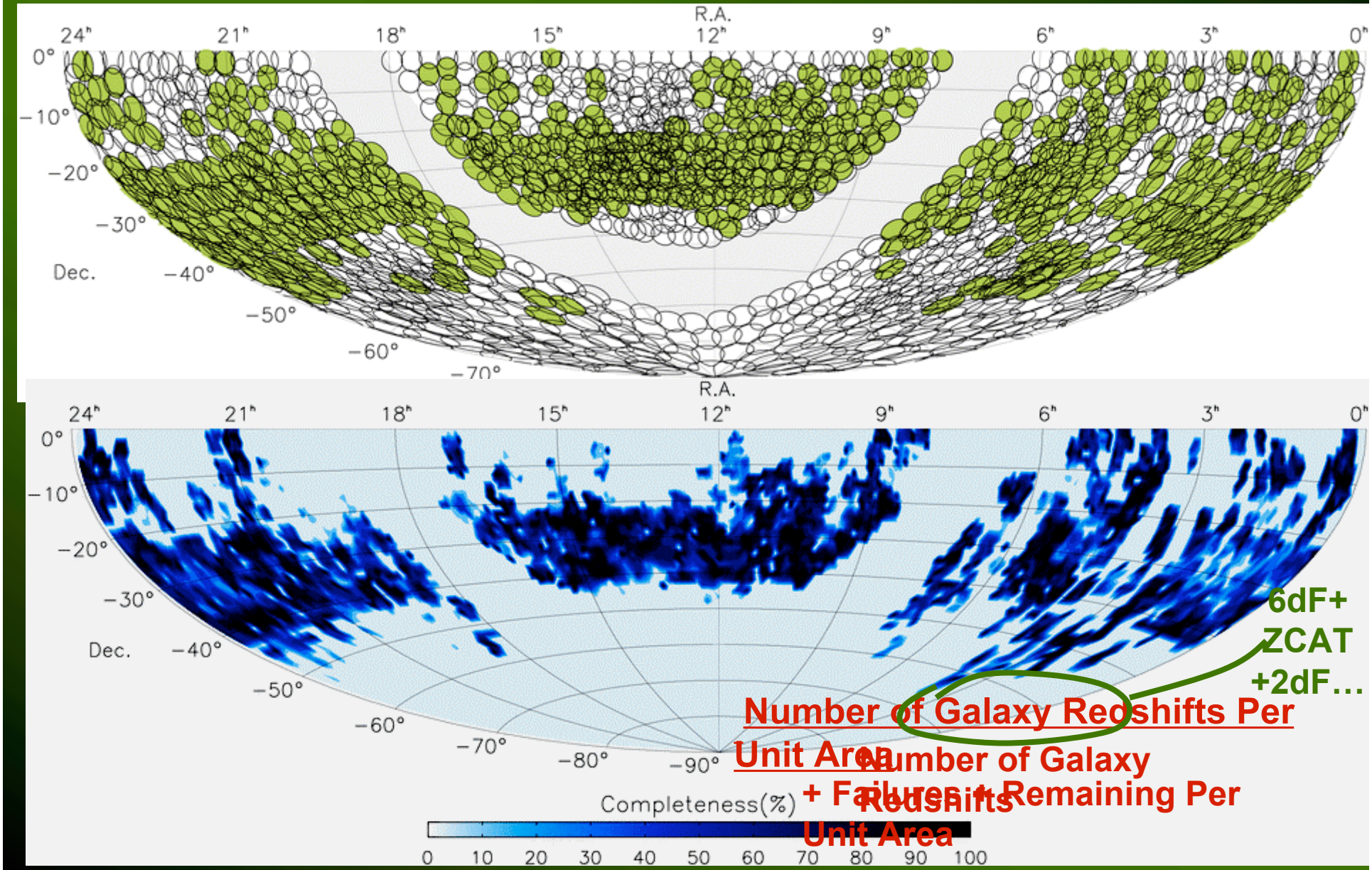
- Spurious features in VPH data around 4440 A (V grating) and 6430/6470 A (R grating) due to ghosting

Survey Sky Coverage

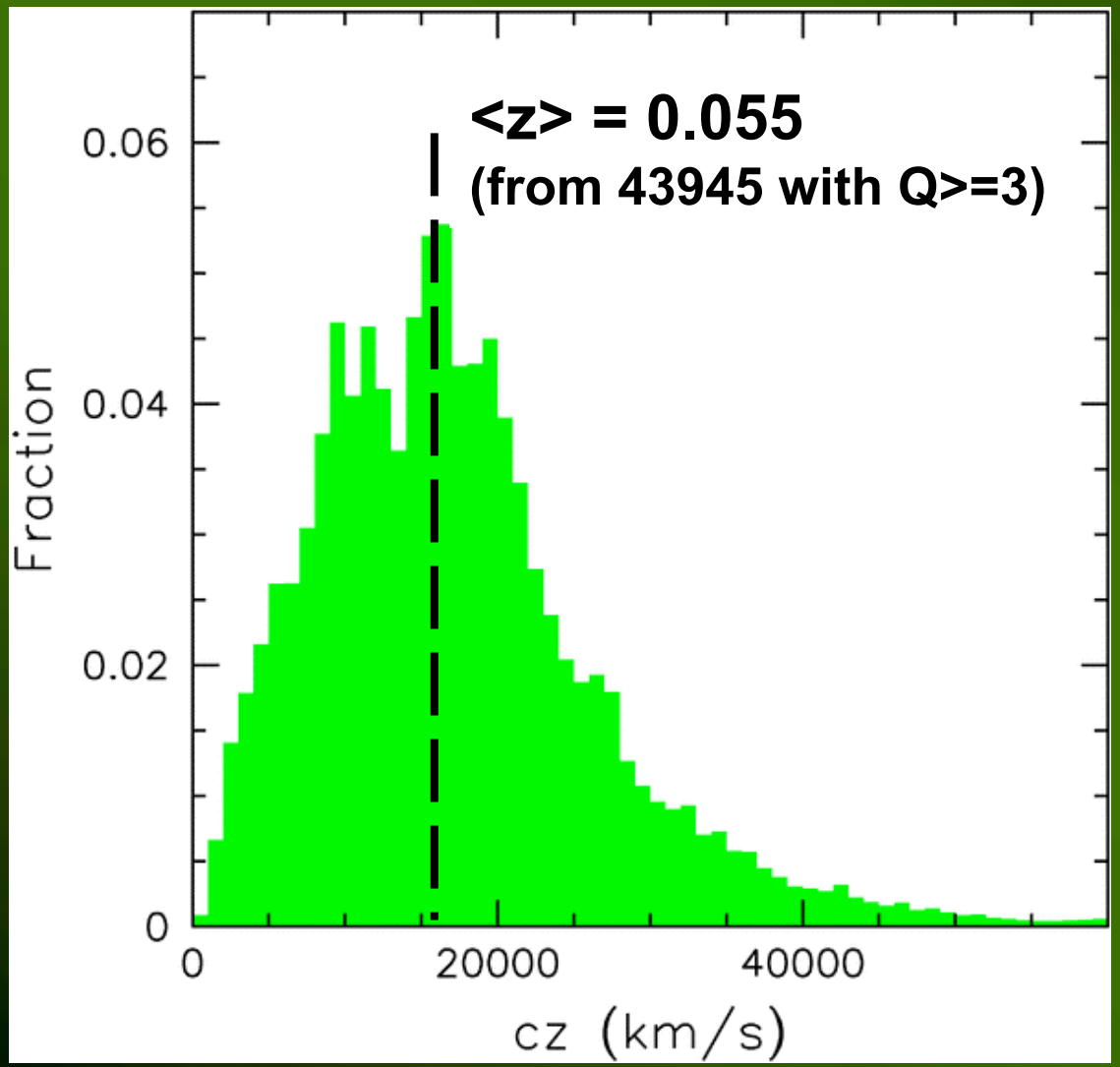


- 1500 fields over southern sky with |b| >10° = 17000□°
- Observing strategy is to cover the sky in thirds: (1) central strip; (2) equatorial strip; (3) southern polar cap.

Survey Sky Coverage



The redshift-space distribution



- First Data Release: 52048 spectra yielding 46474 unique redshifts
- Breakdown of spectra
  - galaxy redshifts (85 %)
  - stellar (3 %)
  - HII regions, PNe (1 %)
  - failures (11 %)

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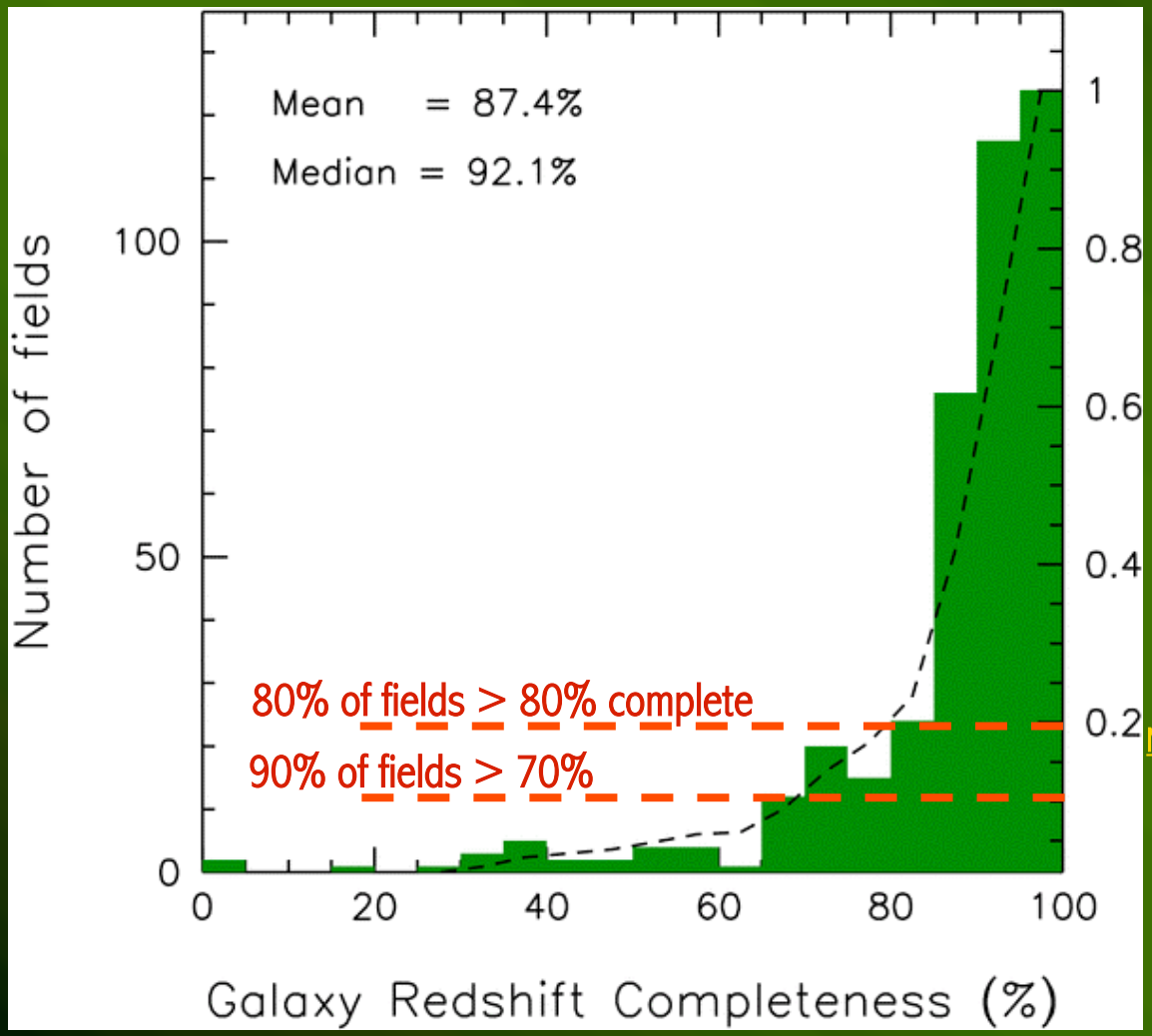

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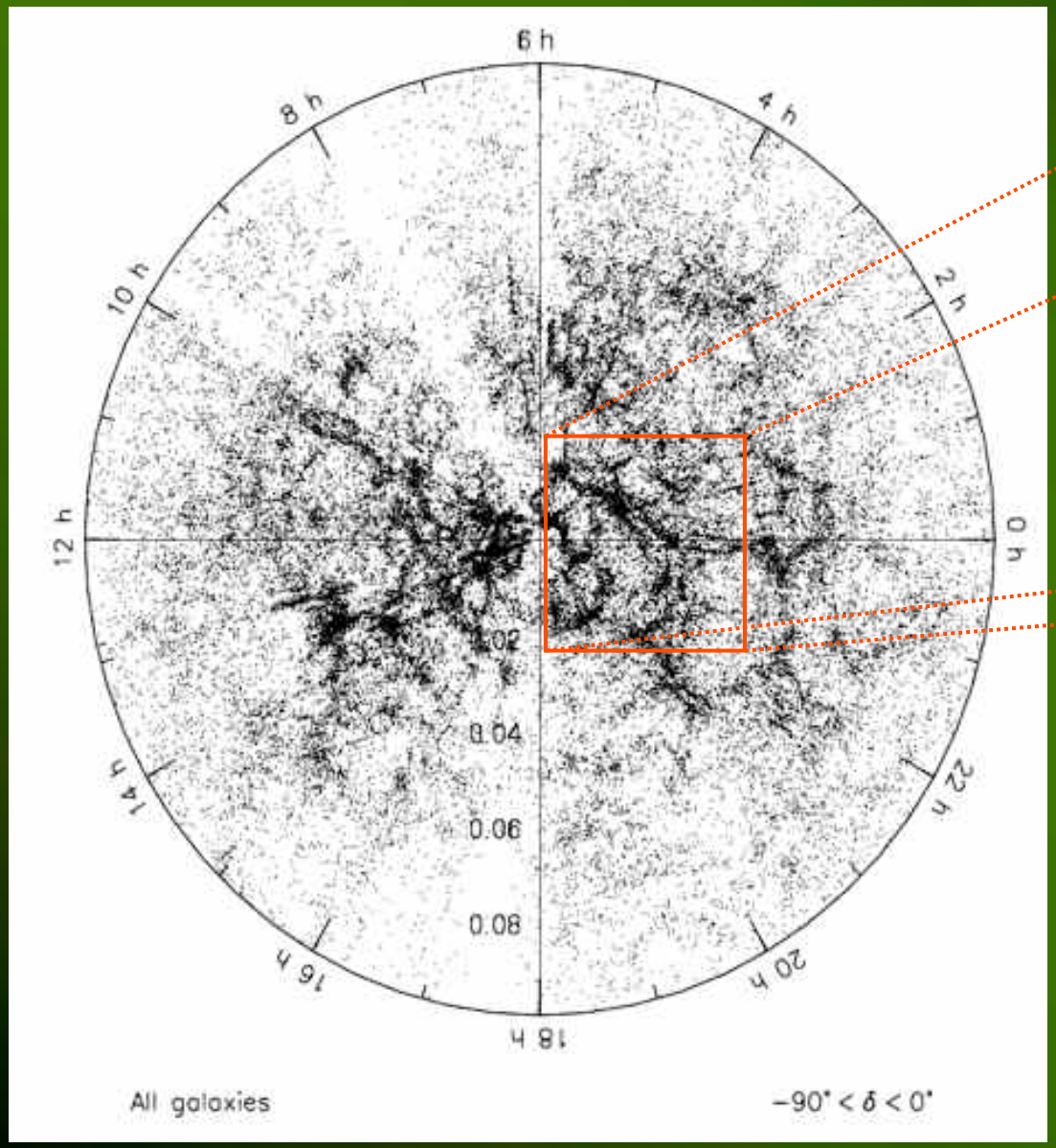
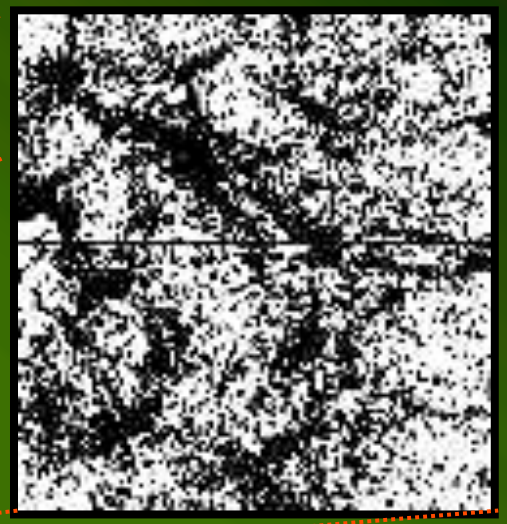
Number of 6dF Galaxy Redshifts per field

Number of 6dF Galaxy Redshifts
+ Redshift Failures per field

Full Redshift Map

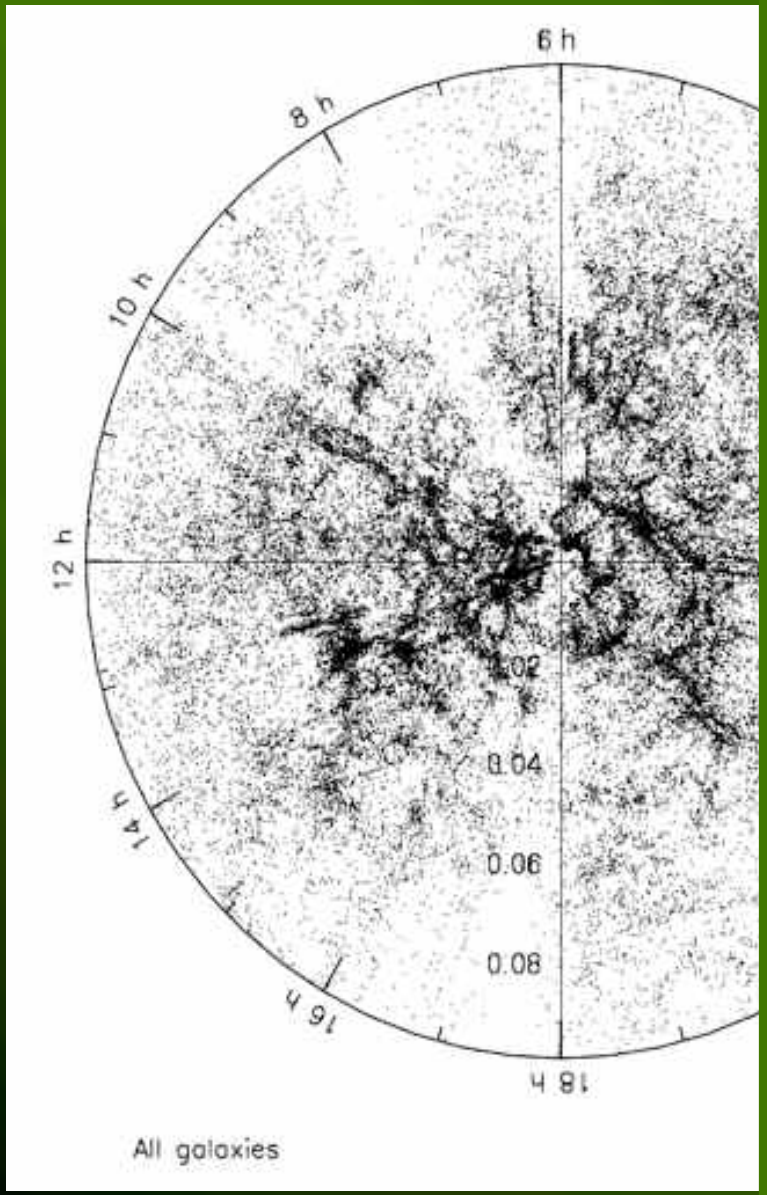


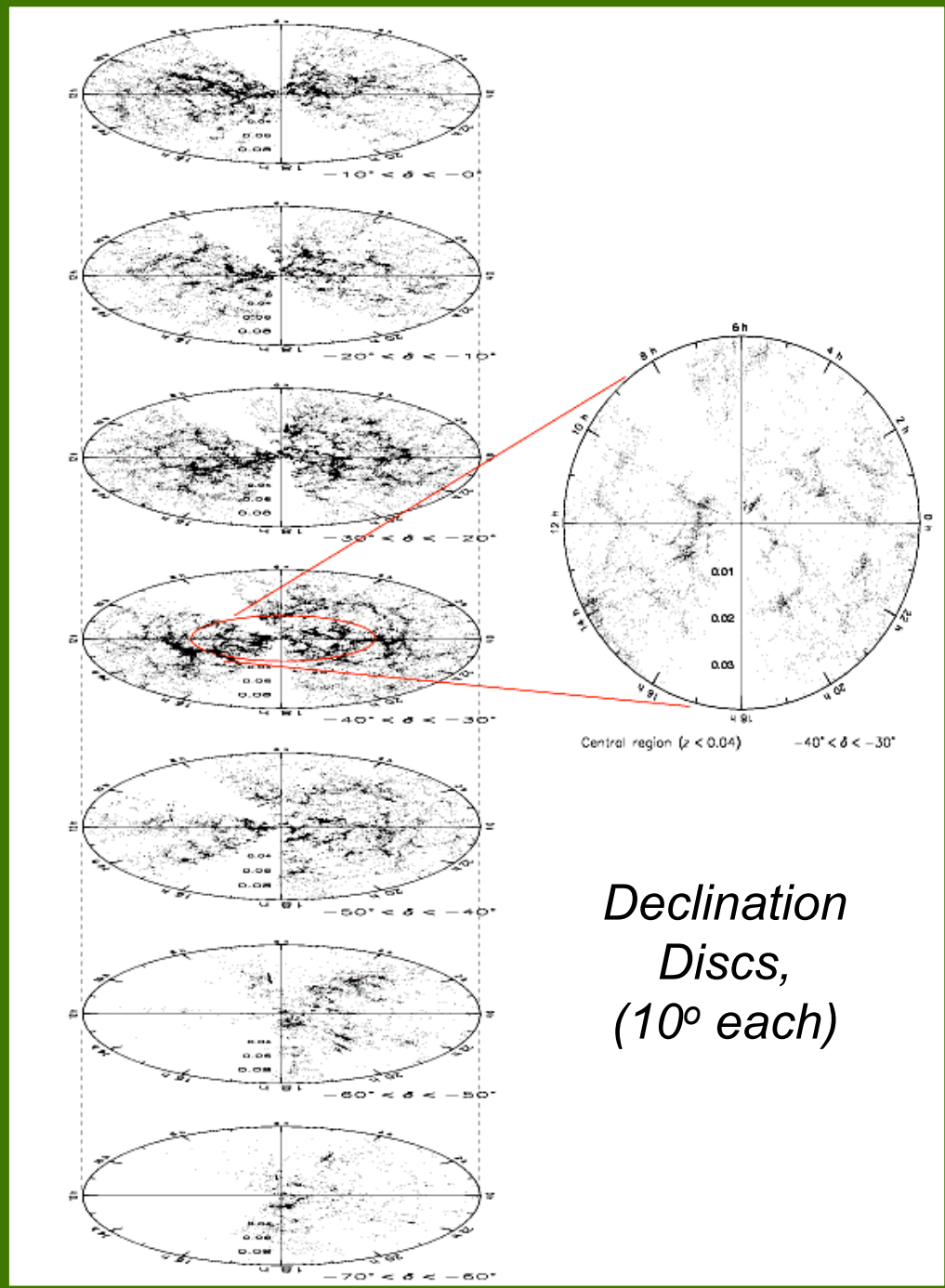


- *43945 6dFGS redshifts* (Q >= 3)
- *19570 ZCAT redshifts* (Huchra et al 1999)
- *8444 2dFGRS redshifts* (Colless et al 2001)

- ***TOTAL: 71959 redshifts***

Full Redshift Map





Declination Discs, (10º each)

Redshift Survey - Goals

- Measure the luminosity function of NIR-selected galaxies (i.e. the stellar mass function of collapsed structures) and its variation with local environment and spectral type. ***(Jones et al, in prep)***

- Map the local galaxy distribution (especially close to the Galactic equator).

- Quantify the small- and large-scale clustering of galaxies weighted by stellar mass, and so constrain the scale-dependence of the biasing of the galaxies with respect to the dark matter.

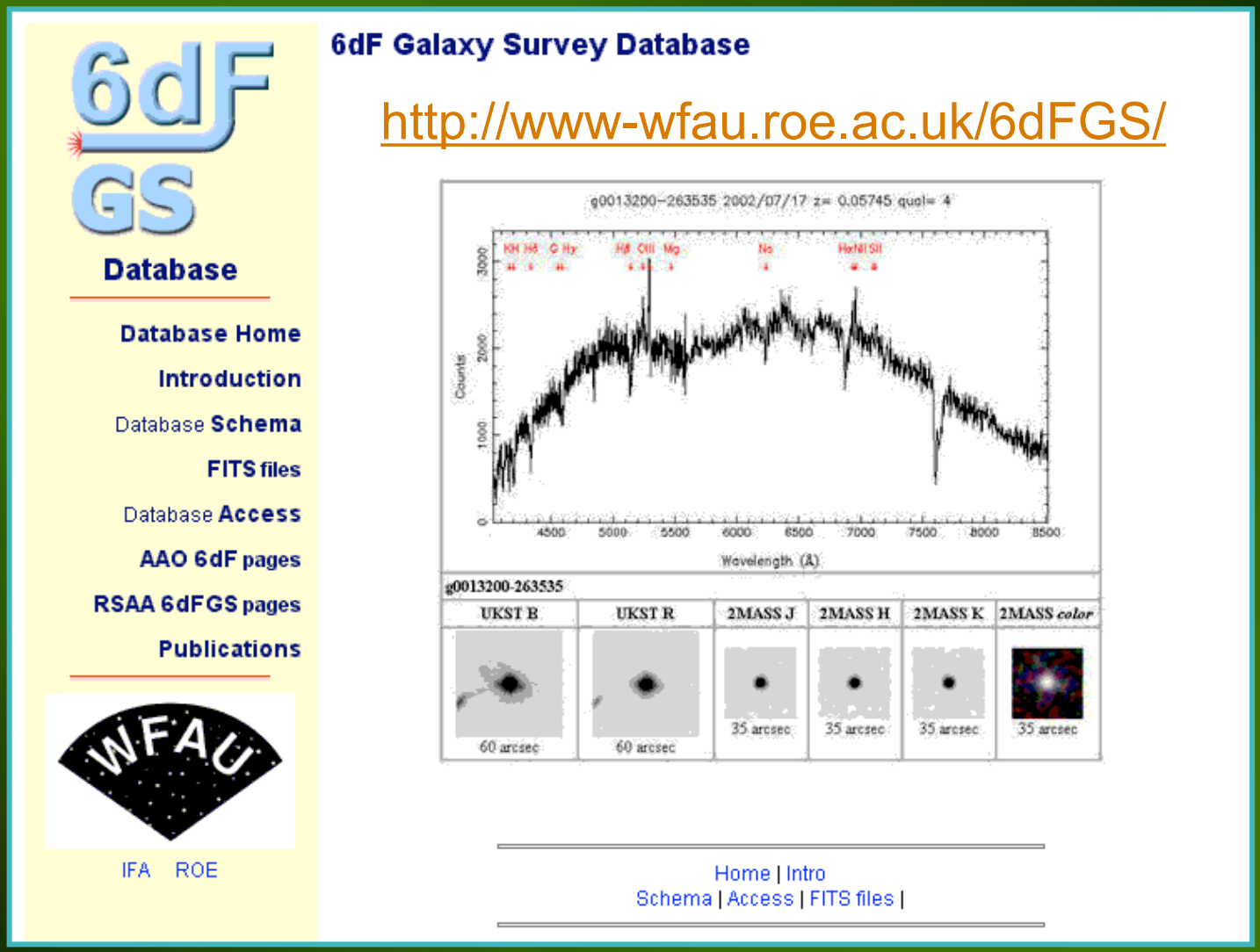
- Measure the power spectrum of galaxy clustering on very large scales, comparable to the scales achieved by the 2dFGRS and SDSS.

- Construct a large, all-sky, volume-limited sample of early-type galaxies as the basis for the peculiar velocity survey.

Peculiar Velocity Survey - Goals

- To map in detail the density and peculiar velocity fields over half the local volume to ~15,000 km/s.
- Provide additional constraints on cosmological models, and better measurements of fundamental parameters, from statistics of these fields. ***(see Burkey & Taylor 2004)***
- Study the ages, metallicities and star-formation histories of early-type galaxies over a wide range of masses and environments.

6dFGS Online Database



- Searchable through either SQL query commands or a WWW form

6dFGS First Data Release: Summary

- **Jan 2002 – July 2003** data made public → 52048 spectra; 46474 unique redshifts; 524 fields across central southern declinations
- **Survey Paper**: Jones et al (2004) → astro-ph/0403501
- **6dFGS Home** → http://www.mso.anu.edu.au/6dFGS
- **6dFGS Database** → http://www-wfau.roe.ac.uk/6dFGS/

6dF-DR1 Group

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