VST ATLAS: Science Goals and Status

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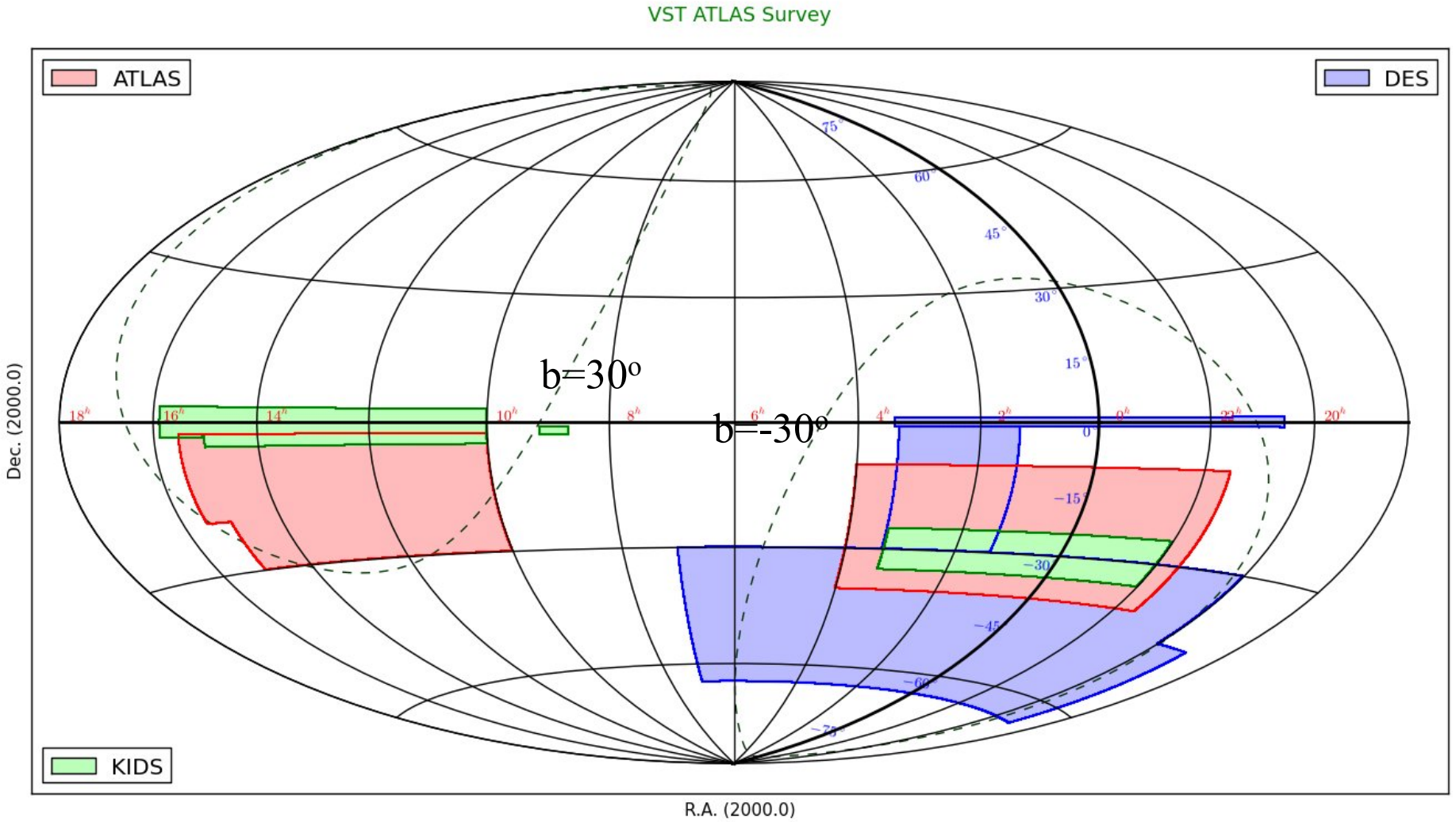
ATLAS Science Summary

- VST ATLAS – "Southern Sloan" – SDSS depth + ~1."2 resolution in ugriz over ~4000-5000deg^2
- Cosmology Package to rival WFIRST!
  - 2QDES survey of up to ~500000 UVX QSOs
    - BAO at z~1.6 via ATLAS+2dF UVX QSO clustering
    - Gravitational Growth rate at z~1.6 via QSOs
    - QSO Lensing + galaxy ugrizYJHK photo-z
    - Probe of primordial large-scale Non-Gaussianity
  - ISW and BAO via Luminous Red Galaxy clustering
  - Galaxy counts – study extent of "Local Hole"
- Other Science
  - Stellar Streams + Galactic Archaeology
  - Z~7 QSOs via ATLAS+VHS z dropouts
  - Beyond the Great Attractor + Fornax etc

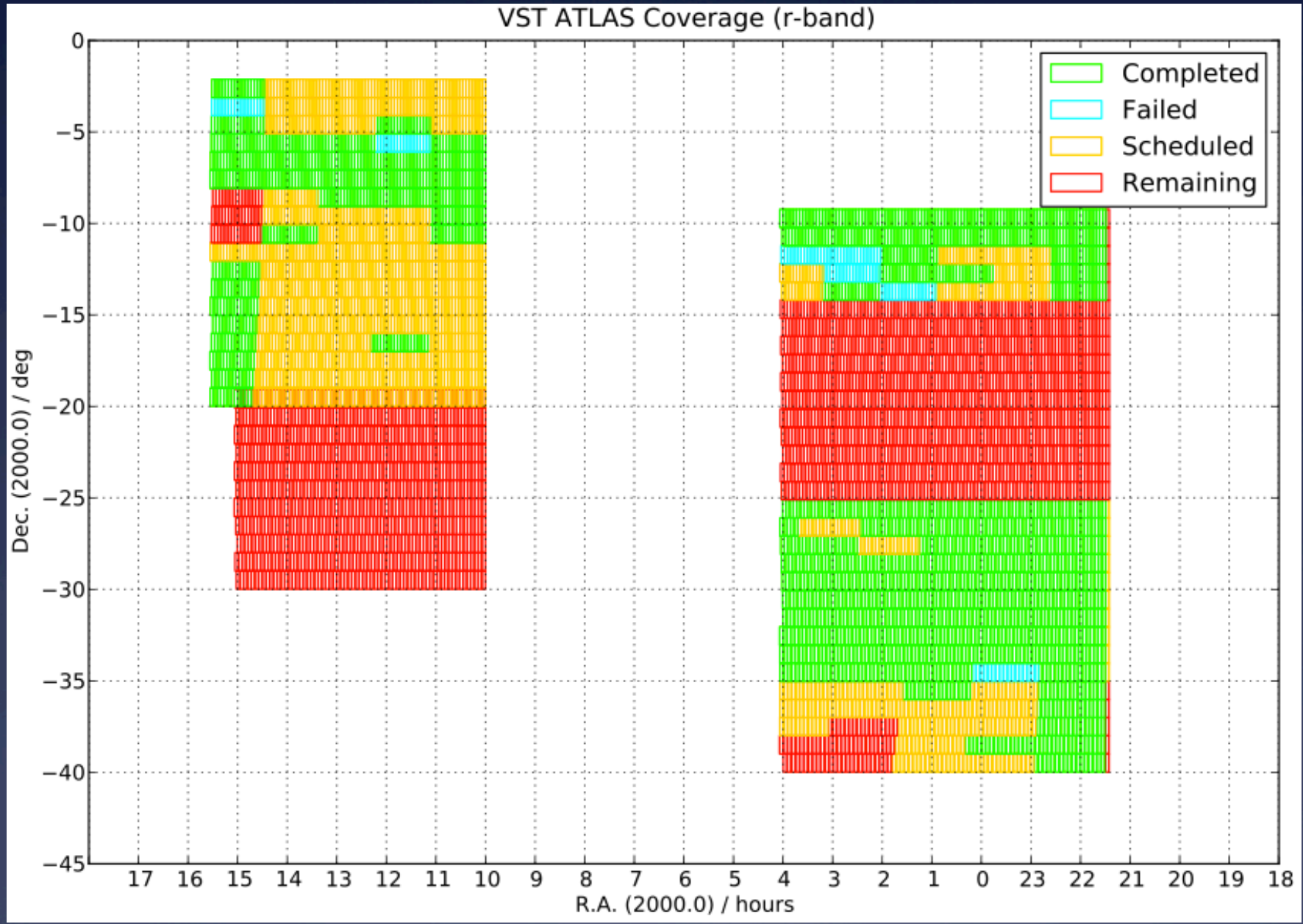
VST ATLAS Survey

- VST ATLAS (+VHS) → Southern SDSS in ugriz(+YJHK)!
- Exposures u: 2x60s, g: 2x50s, riz: 2x45s – one filter per hourly concatenation – ugr (dark), iz (gray/bright)
- Chilean u extension (PI L. Infante) → takes u to 4x60s
- 2-tile dither – 84" in Dec, 24" in RA
- Offsets 58' in RA and Dec – 2' overlap
- 1"-1."4 seeing – better than SDSS median 1."4 – complements KIDS
- No guide star needed so no overhead!
- Footprint ~2500deg^2 in SGC and ~2000deg^2 in NGC (tbc)
- Equivalent of ~1500deg^2 ugriz observed since September 2011

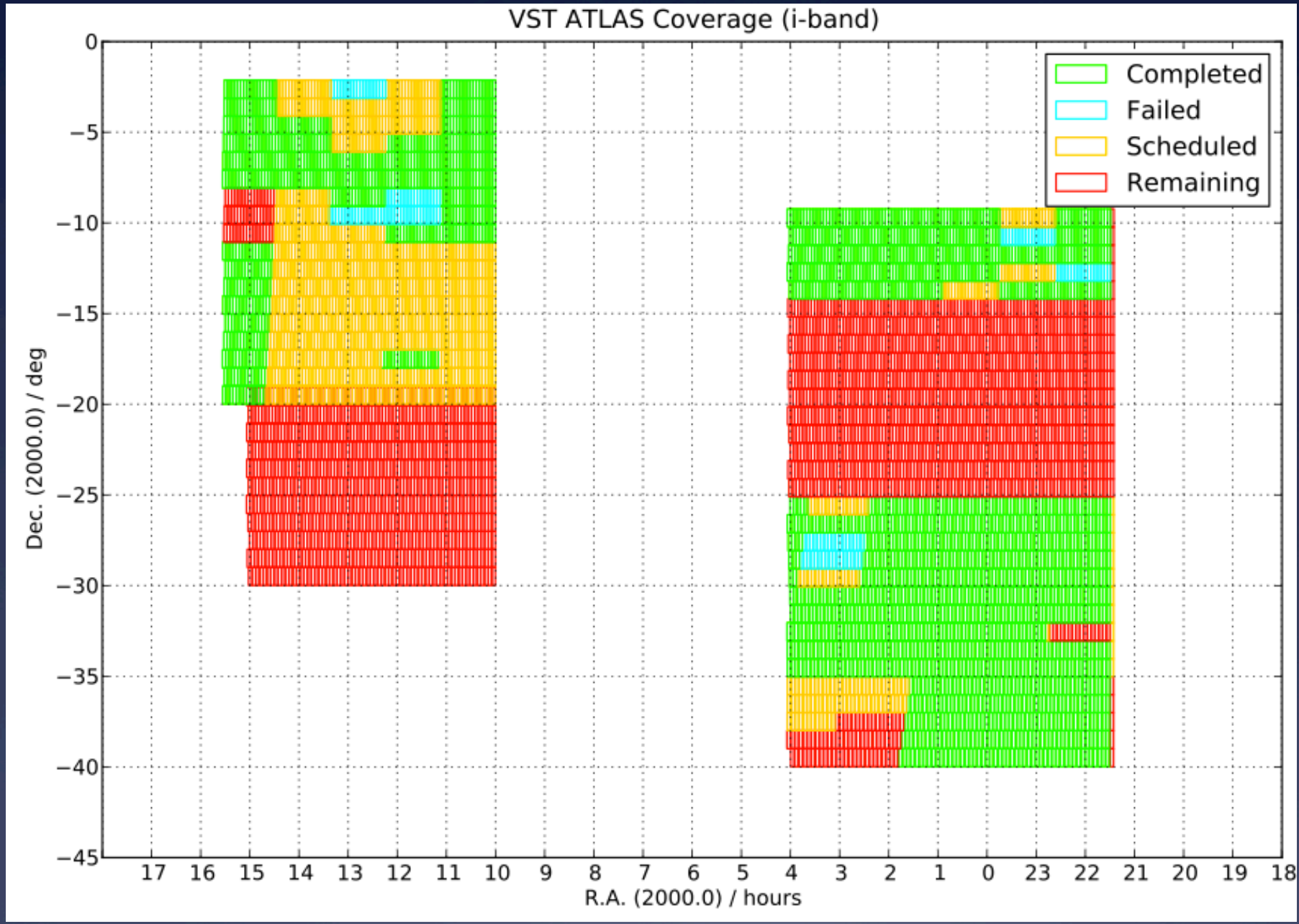
VST ATLAS Survey Area



ATLAS Status r



ATLAS Status i



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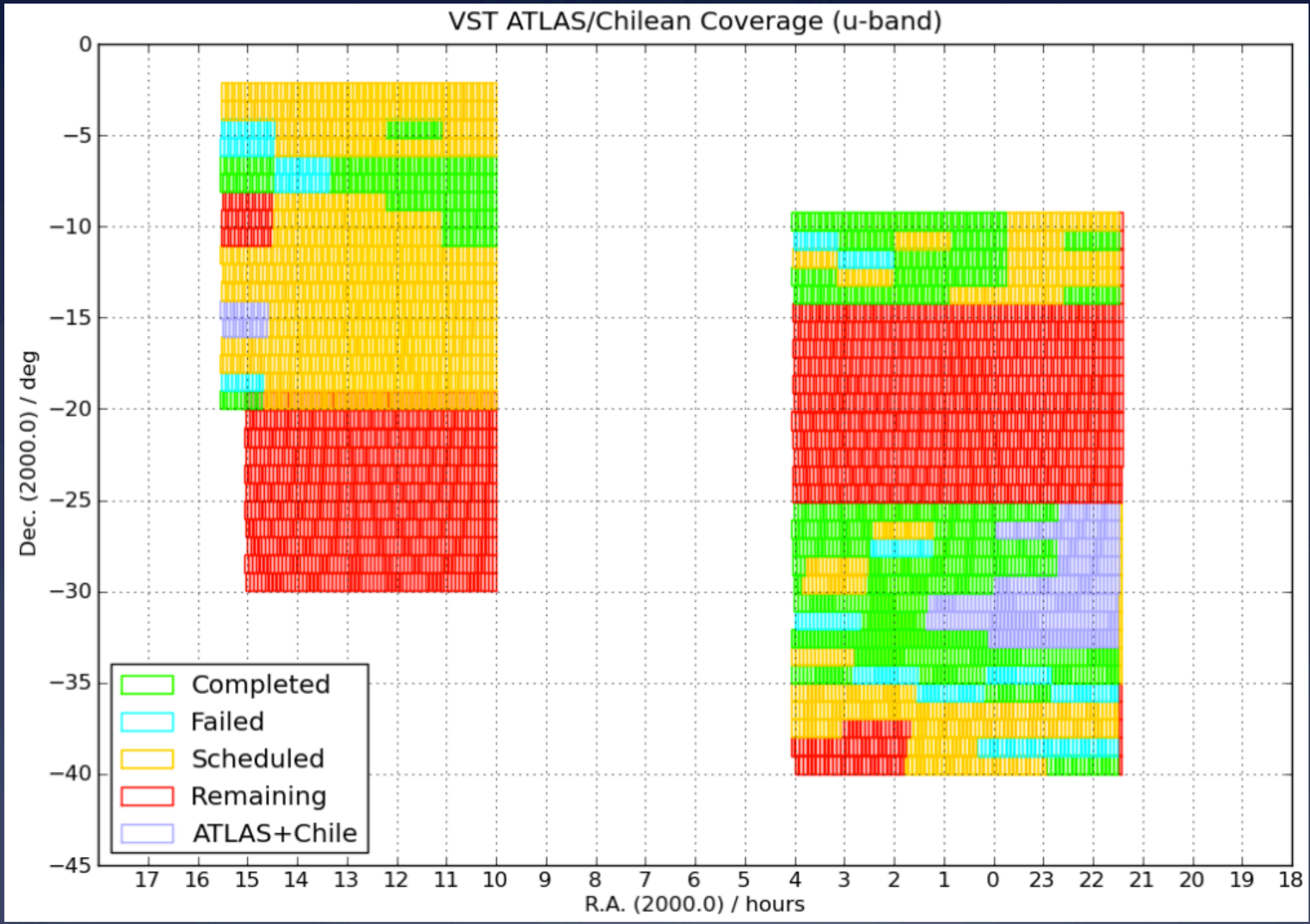
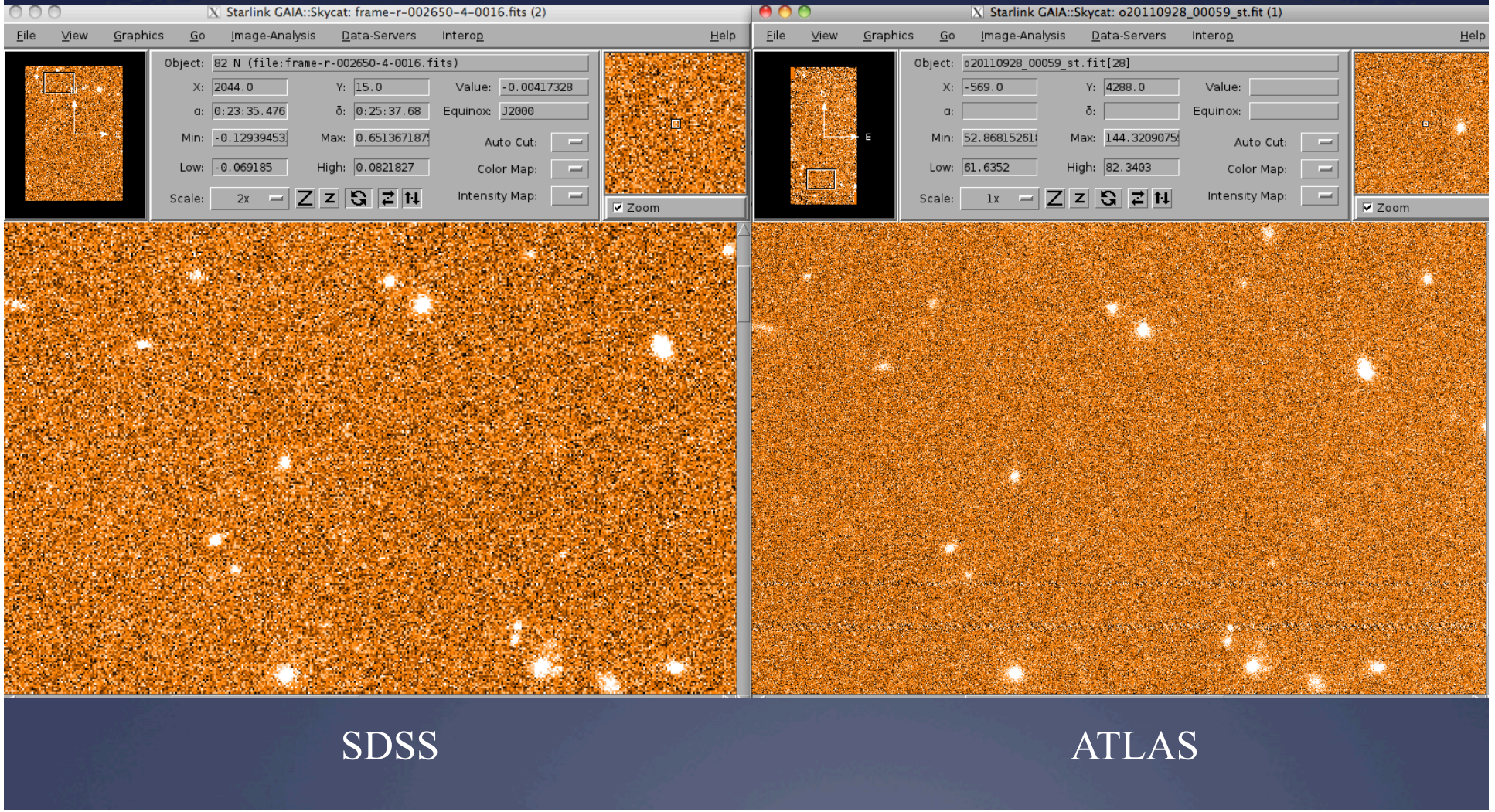


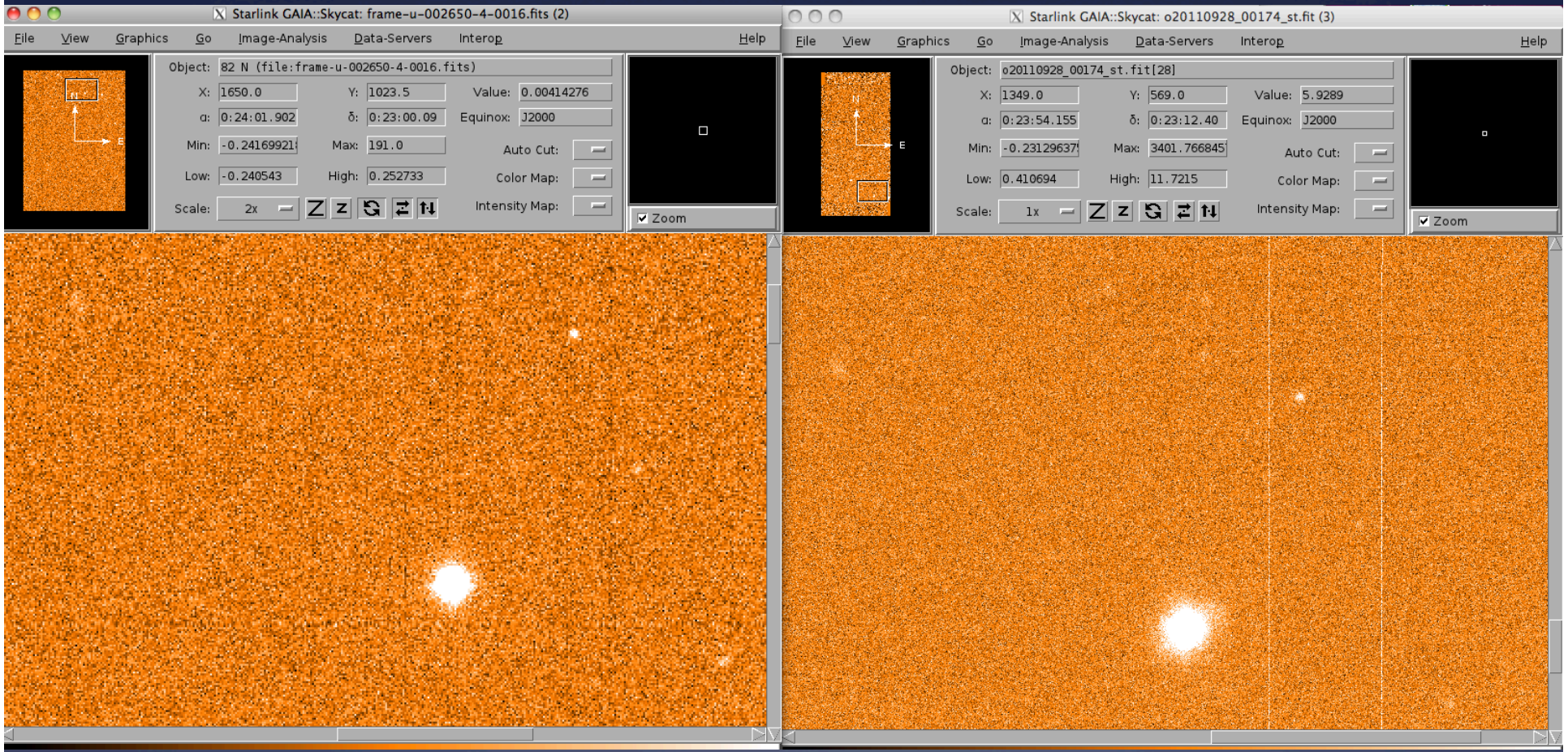
SDSS-ATLAS - r



SDSS

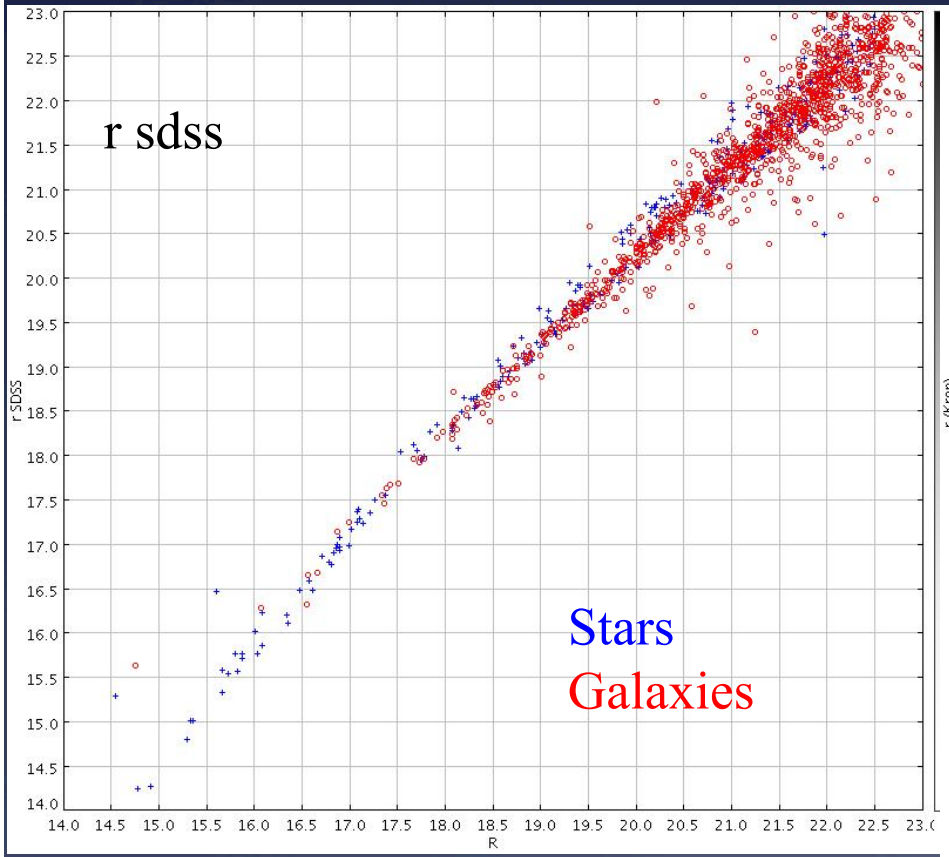
ATLAS

SDSS-ATLAS - u

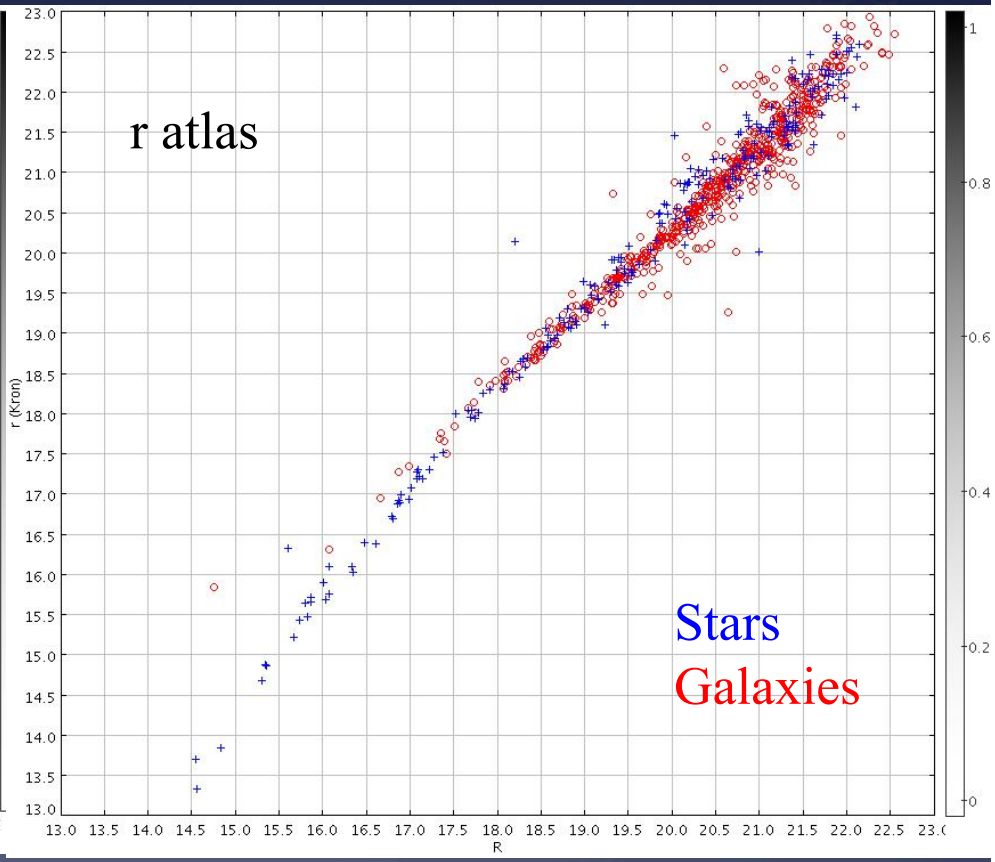


SDSS ATLAS

WHDF v SDSS+ATLAS – r

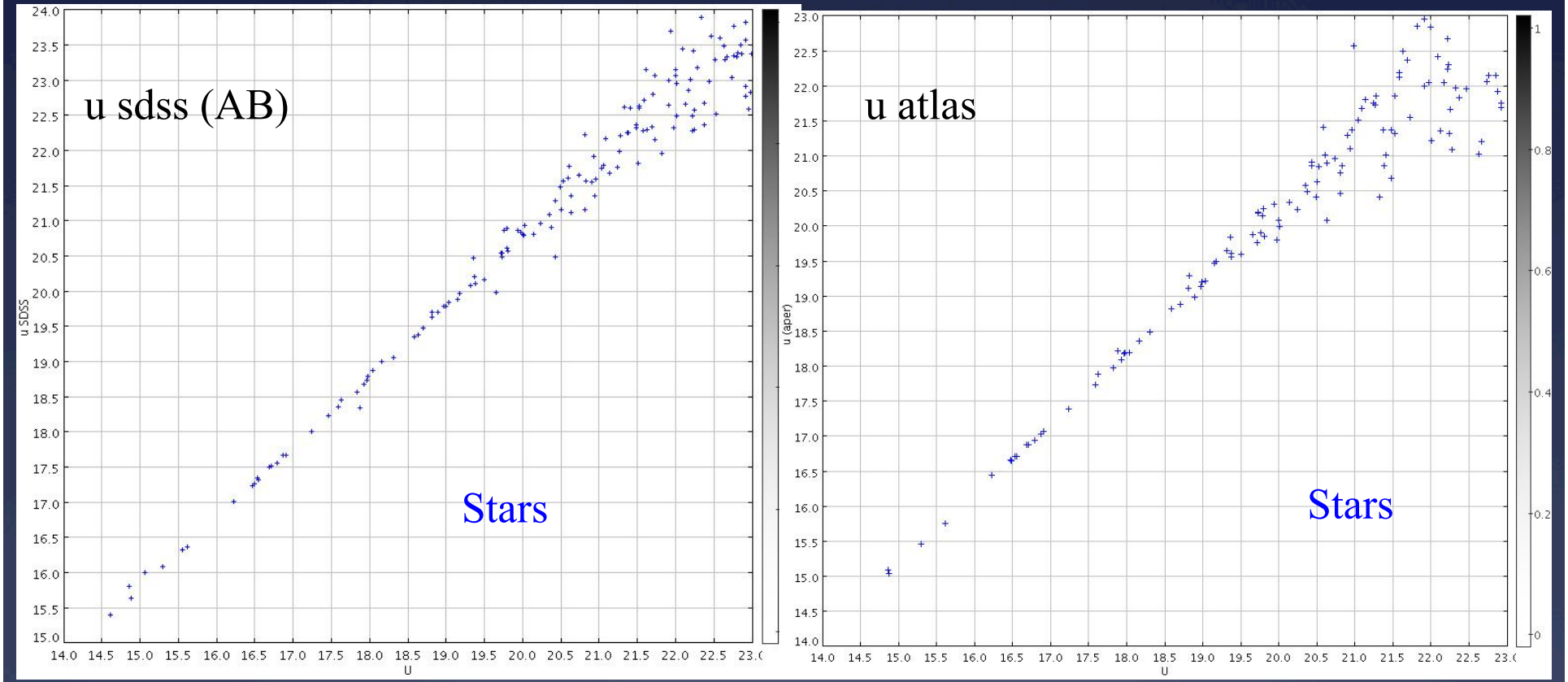


r WHDF



r WHDF

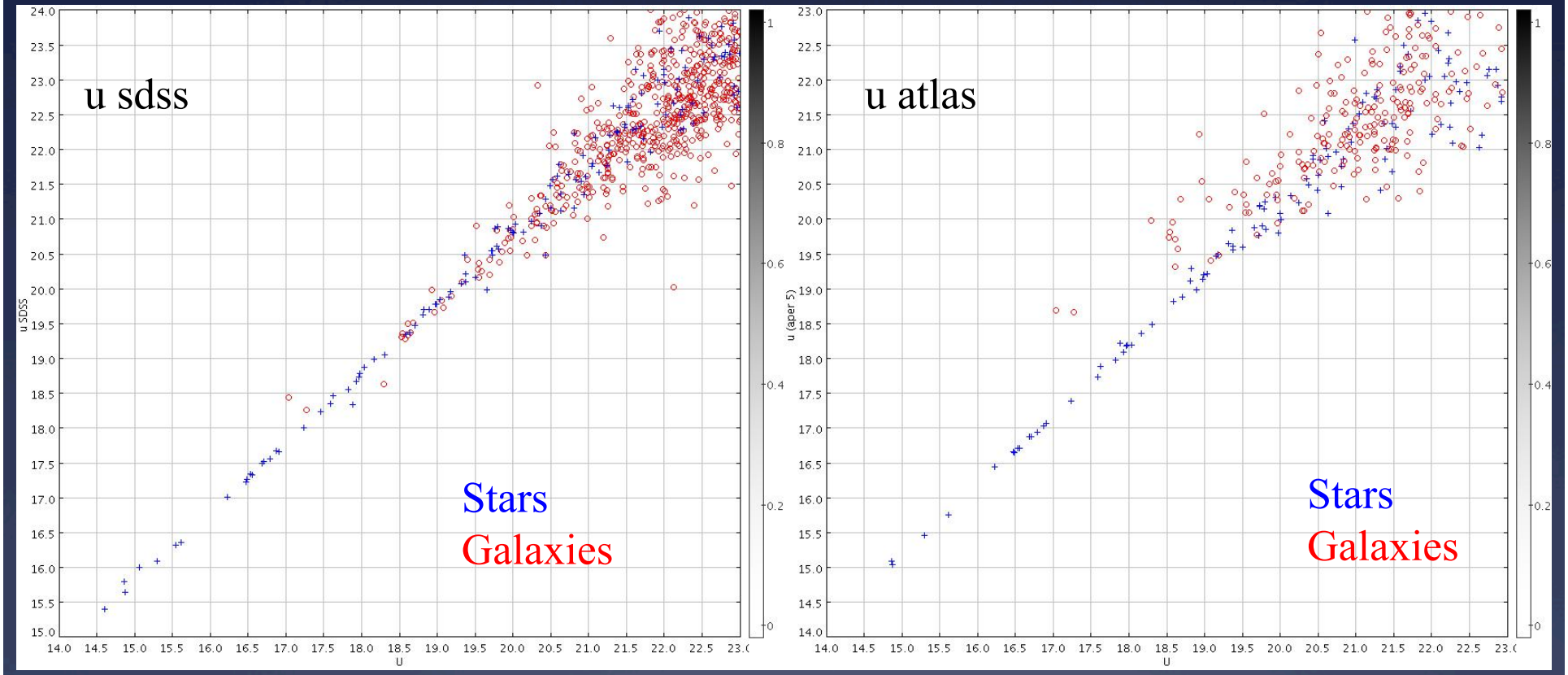
WHDF v ATLAS + SDSS - u - stars



u WHDF

u WHDF

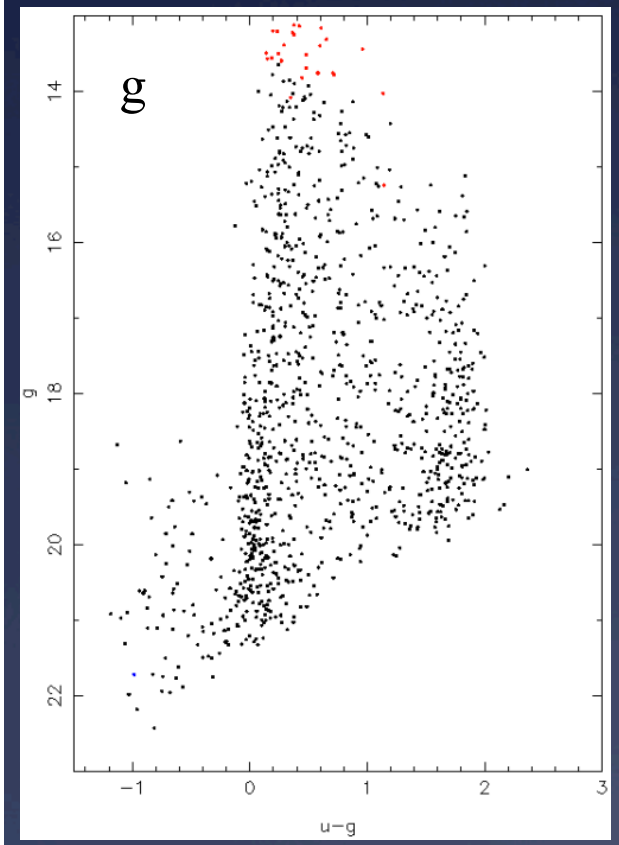
WHDF v SDSS+ATLAS - u



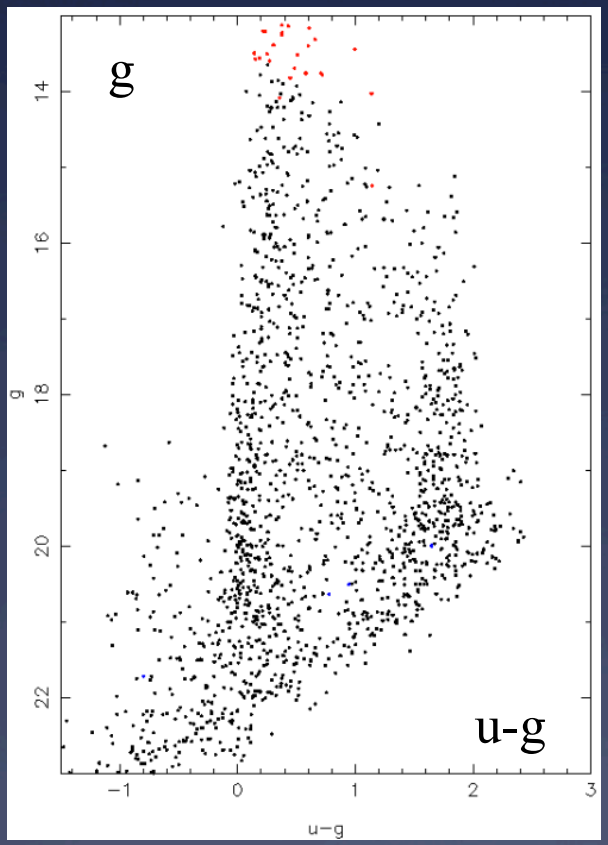
u WHDF

u WHDF

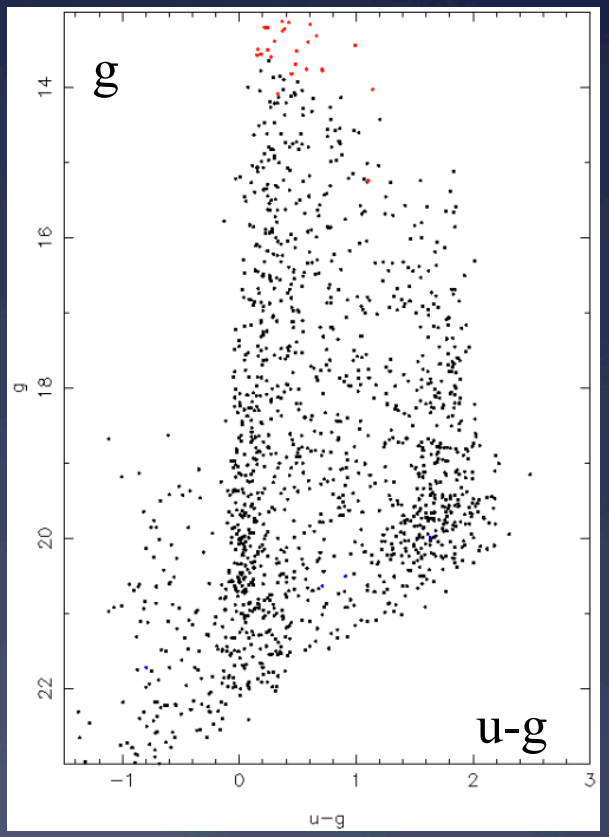
ATLAS u + list +Chile u - stars



ATLAS

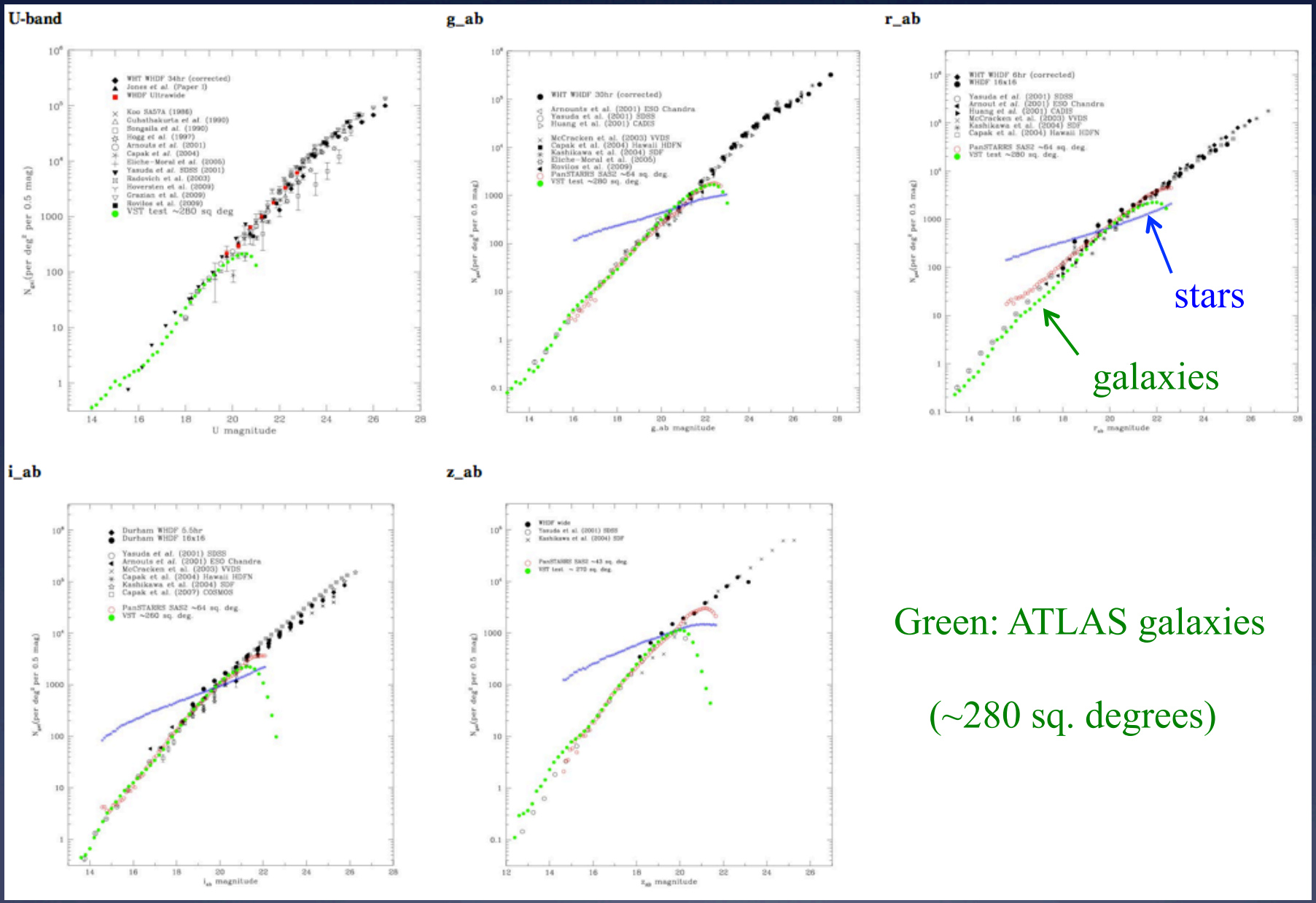


ATLAS list driven



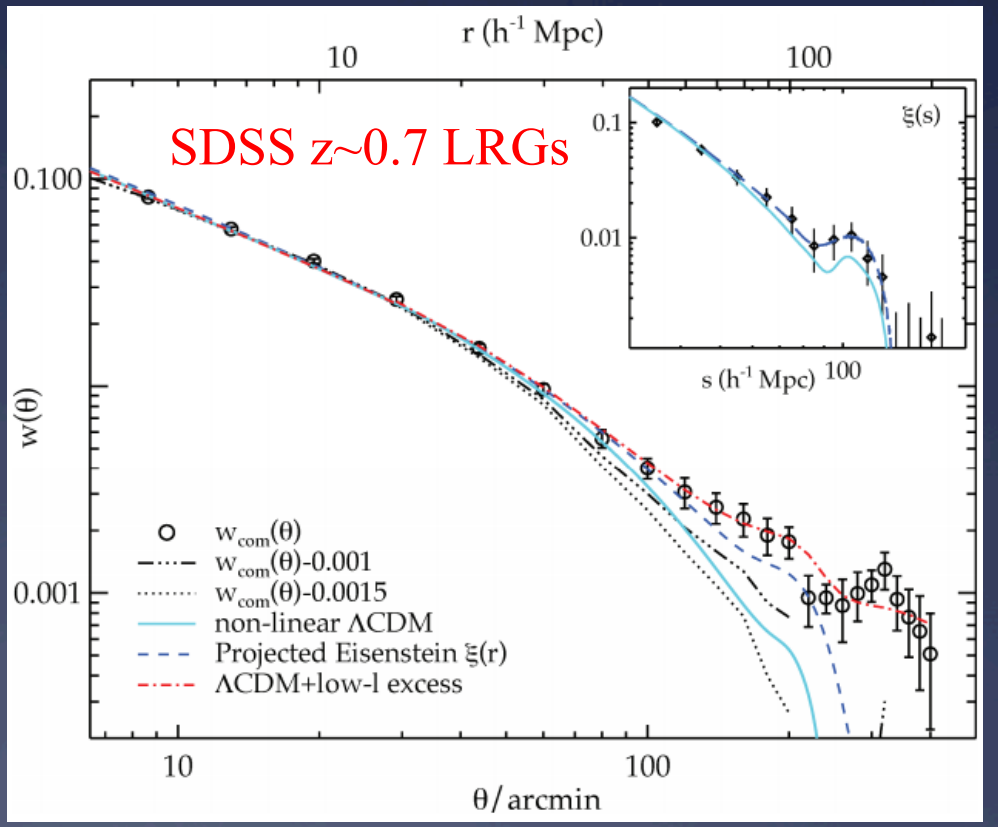
ATLAS+Chile list driven

Science Goal – Galaxy Counts



Science Goal - Galaxy Clustering

* ±10% variation in galaxy number density
* ⇒0.01 amplitude in angular correlation, w(θ)
* Significant when looking for BAO at w~ 0.001
* w(θ)~0.001 needs ±0.03 mag global calibration



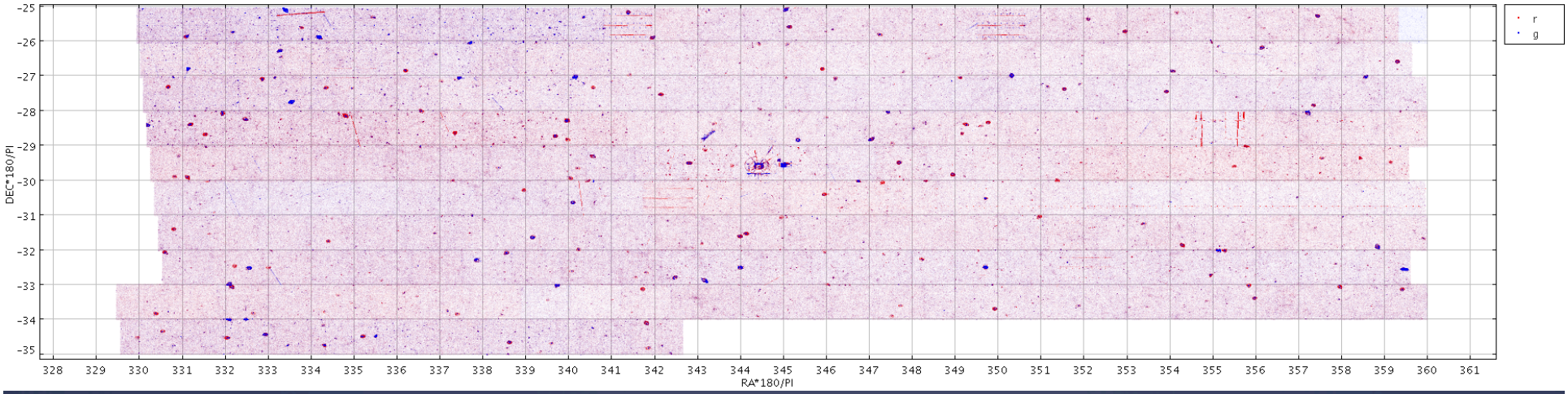
Sawangwit et al. (2011)

ATLAS Calibration

- Flat-field/Illumination correction problem – particularly affects global calibration
  - Affects galaxy counts (but not colours?)
  - CASU has now applied illumination correction
- Next step - global calibration
- Calibration currently based on nightly standards → ±0.1mag
- Improve to ±0.03mag via:
  - 2rcmin overlaps
  - + anchor sequences from photometric VST images, FNAL/CTIO photometry
  - +APASS 16 mag photometry?

ATLAS in the GAMA area

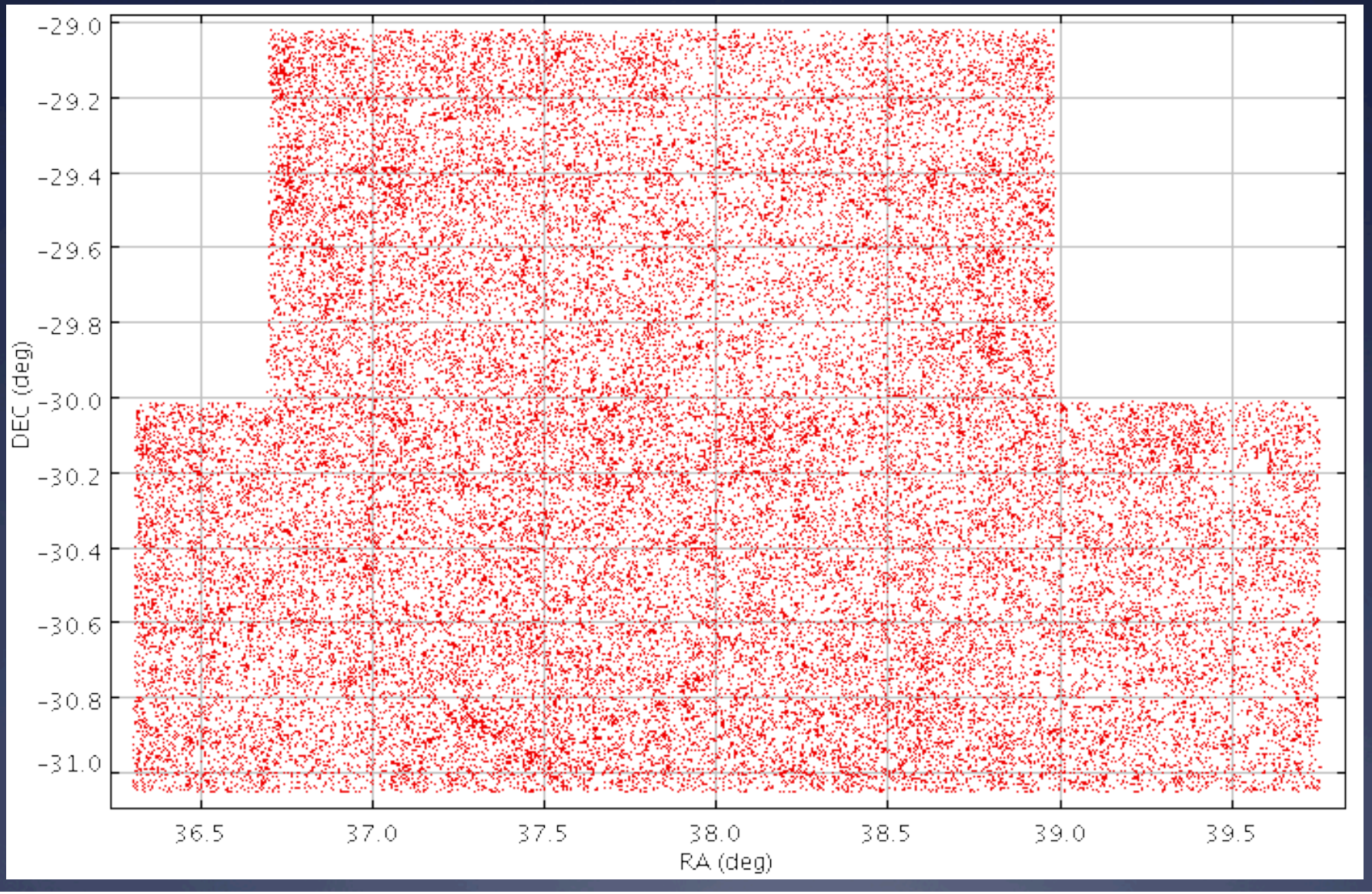
(picture from P. Norberg)

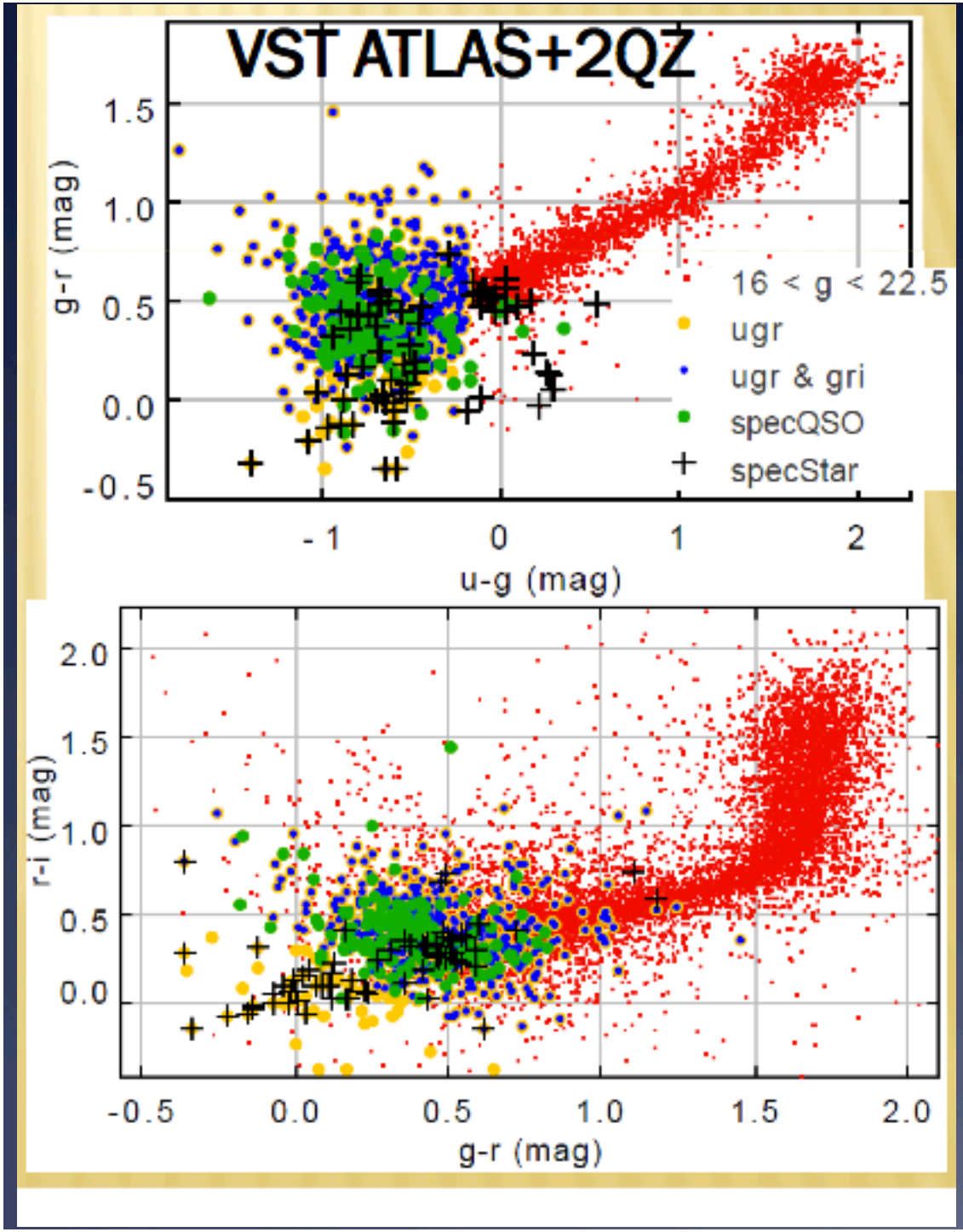


Still before global calibration ⇒ ±0.1mag

ATLAS successfully used at 2dF…

2QDES Pilot: 5 ATLAS fields → 2dF

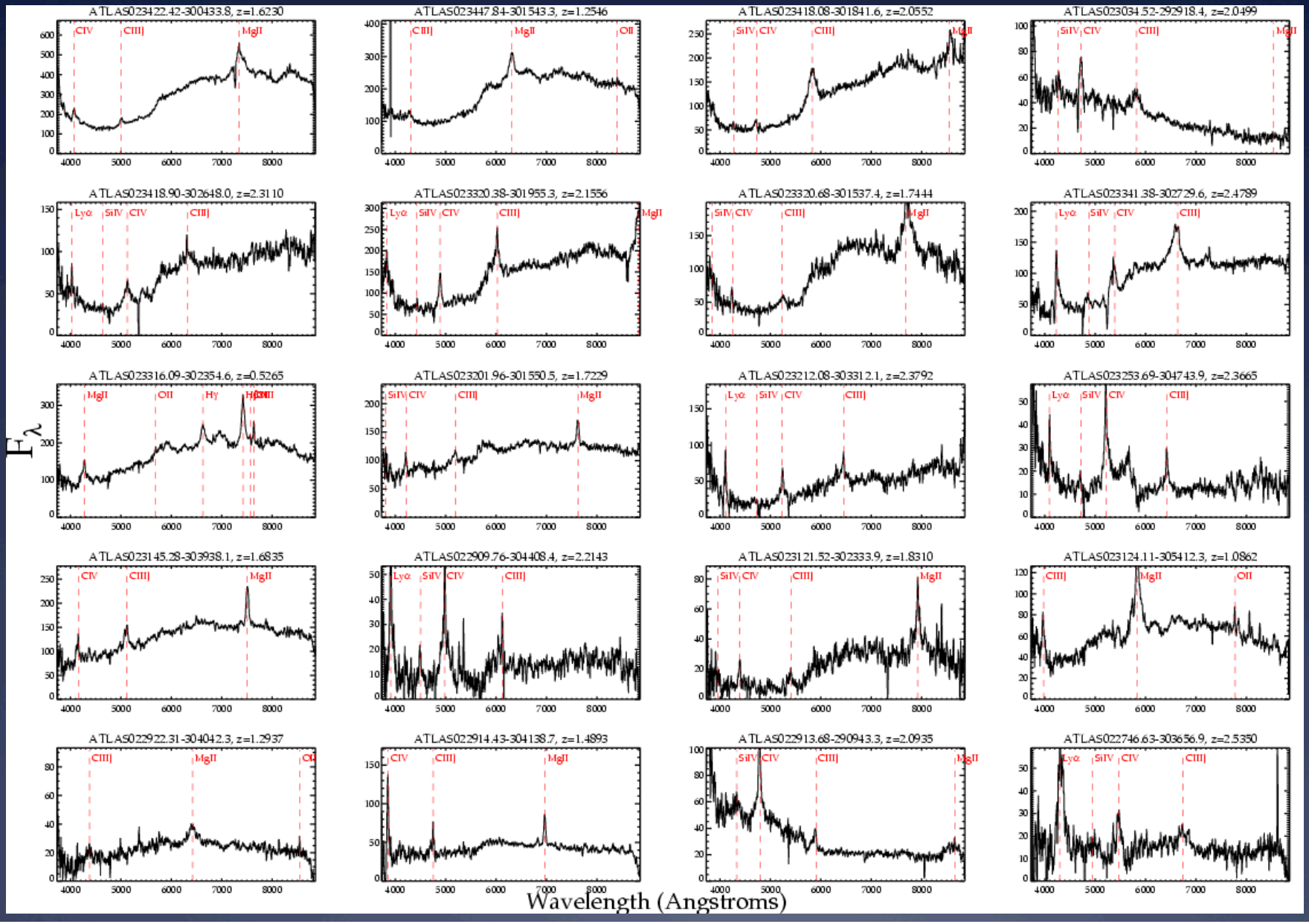




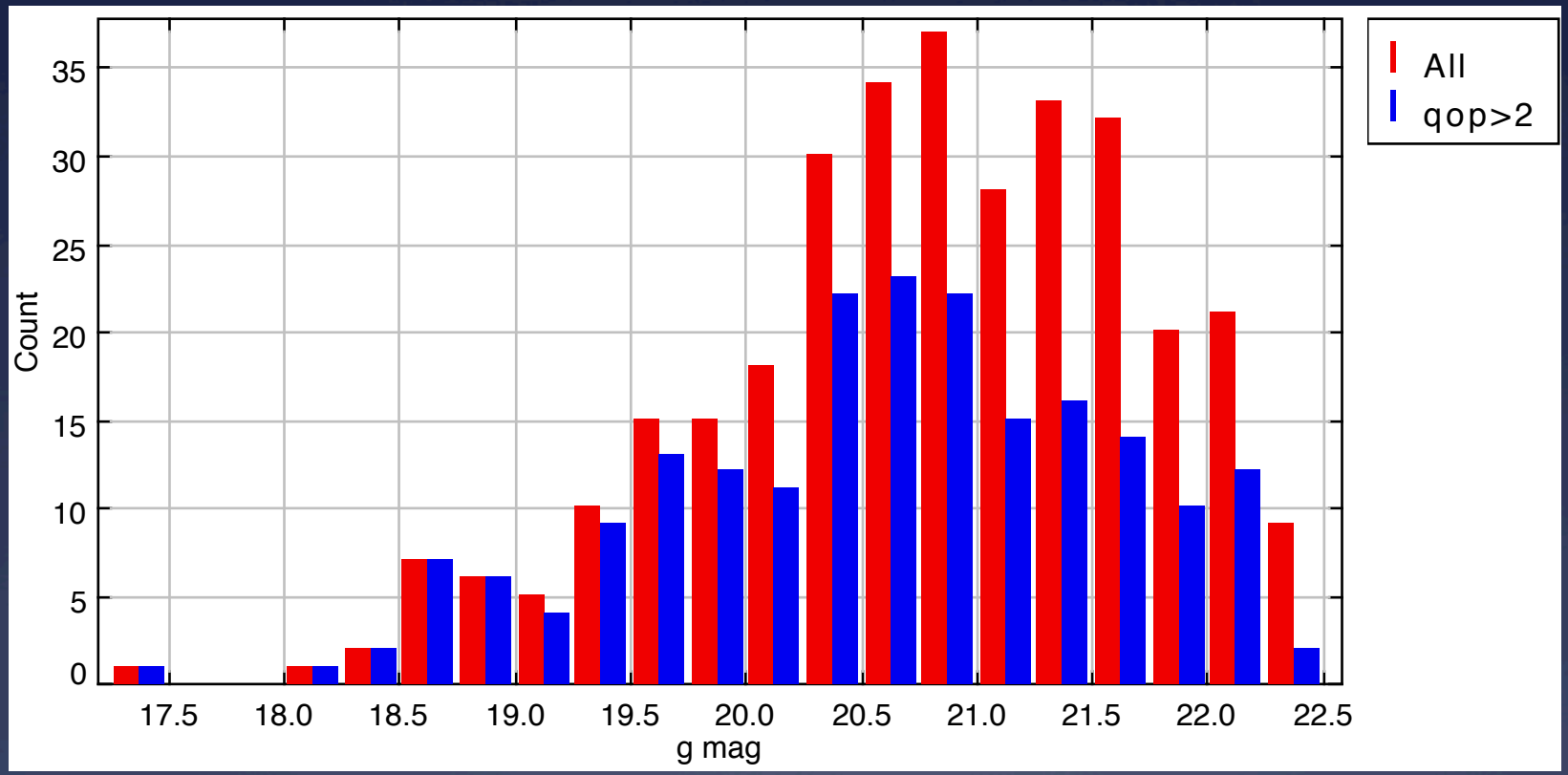
ATLAS 2QDES ugri QSO selection

* Simple selection in ugr and gri
* + KDE selection of Bovy et al
* Limit g<22.5
* Then 50min 2dF exposure on 20/12/11.....

Pilot Sample QSO Spectra

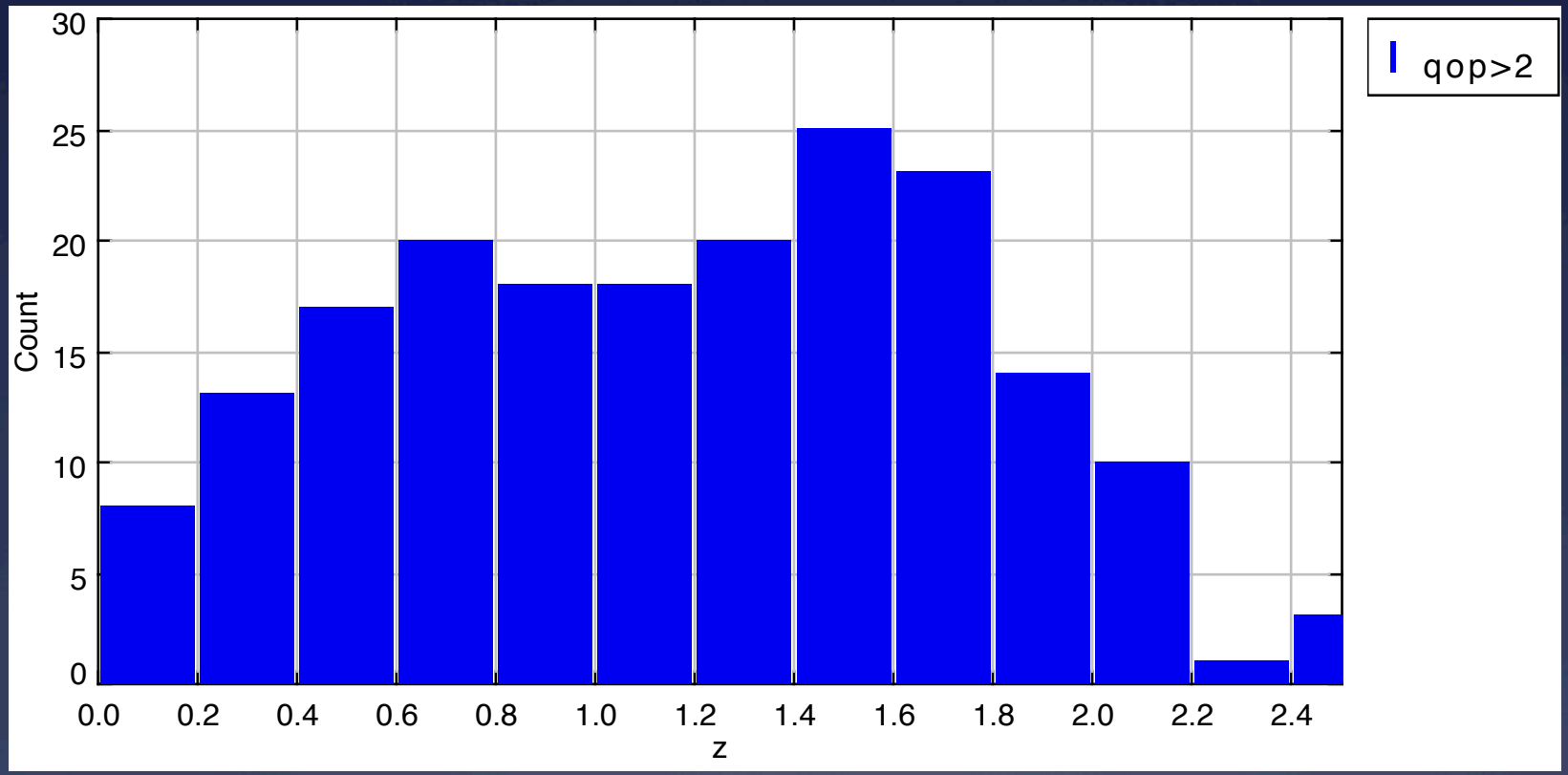


AAOmega Pilot QSO n(g)



~50% success rate being maintained at g~22 in only 50 min exposure

AAOmega Pilot QSO n(z)



~50% success rate being maintained at g~22 in only 50 min exposure

Summary

- ~1500deg^2 surveyed by ATLAS in 1year - achieving ~SDSS depth in ugriz
- Chilean u extension on-going
- Goals of ±0.02mag global photometry plus ±100mas astrometry
- Main problem is flat-fielding – CASU now implemented illum corr^n
- 2QDES 2dF pilot already hitting QSO sky density of ~70deg^{-2} to g~22 in 50min exposure – deeper than previous QSO surveys!
- 2QDES survey of ~0.5million QSOs still a possibility…
- … for z~1.6 6σ BAO, RSD, QSO Lensing + f_{NL} + QSO BH-halo mass relation