

VST ATLAS: Requirements, Operations and Products

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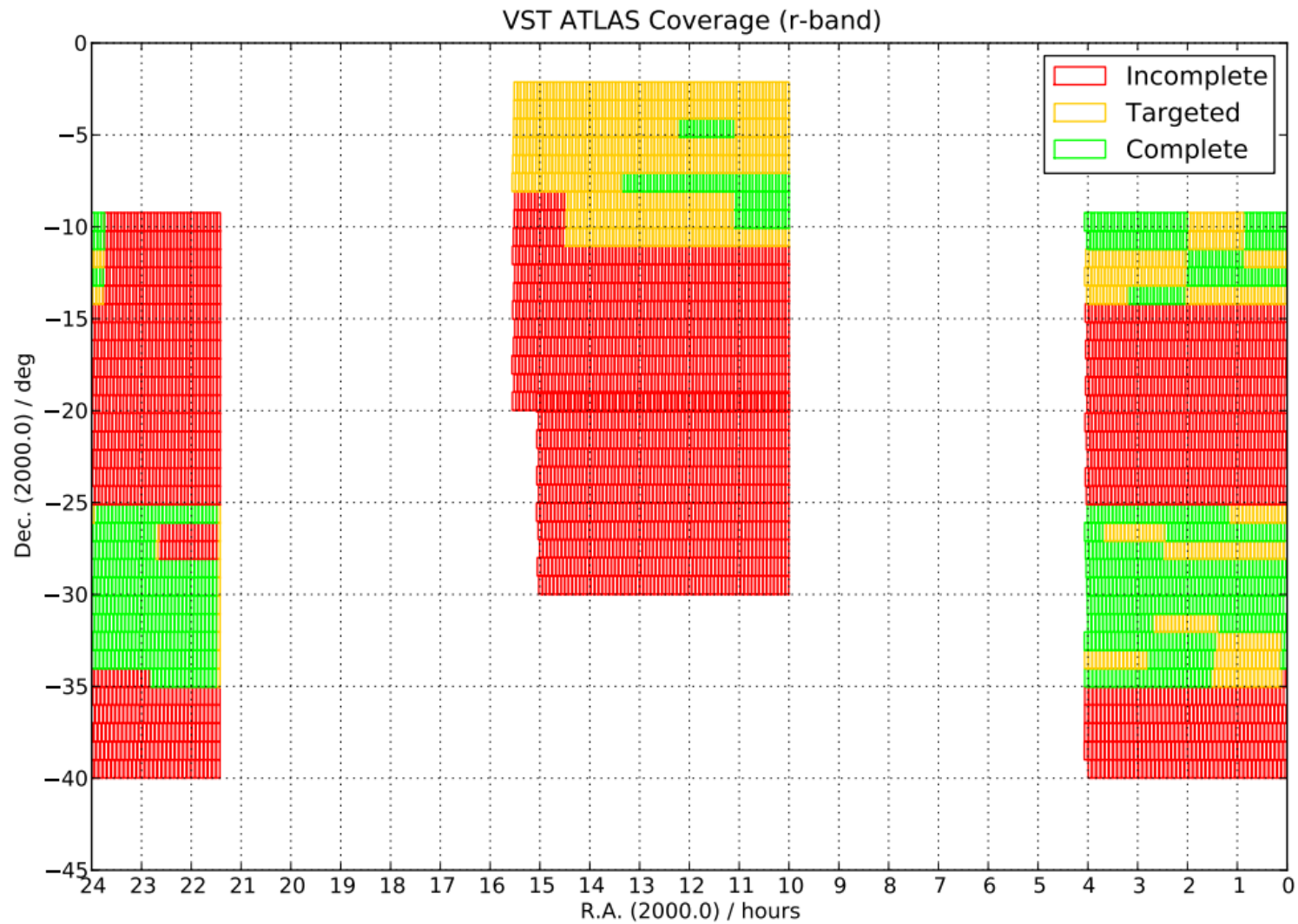
ATLAS Science Summary

- * VST ATLAS – "Southern Sloan" – SDSS depth + $\sim 1.''2$ resolution in ugriz over $\sim 4500 \text{deg}^2$
- * Cosmology Package to rival WFIRST!
 - * 2QDES survey of up to ~ 500000 QSOs
 - * BAO at $z \sim 1.6$ via ATLAS+2dF UVX QSO clustering
 - * Gravitational Growth rate at $z \sim 1.6$ via QSOs
 - * QSO Lensing vs galaxy ugrizYJHK photo-z
 - * Probe of primordial large-scale Non-Gaussianity
 - * ISW via LRGs
- * Other Science
 - * Stellar Streams + Galactic Archaeology
 - * $Z \sim 7$ QSOs via ATLAS+VHS z dropouts
 - * Beyond the Great Attractor + Fornax etc

ATLAS VST Operations

- * Offset Problem using 1hr OBs overcome
- * But now have to use concatenations which can't be grouped
- * So use Priorities to get contiguous areas
- * Airmass and Lunar sky distance – black art?
- * Chilean u reasonably integrated
- * Bad weather in Feb 12 means project delay

SDSS-ATLAS Overlap

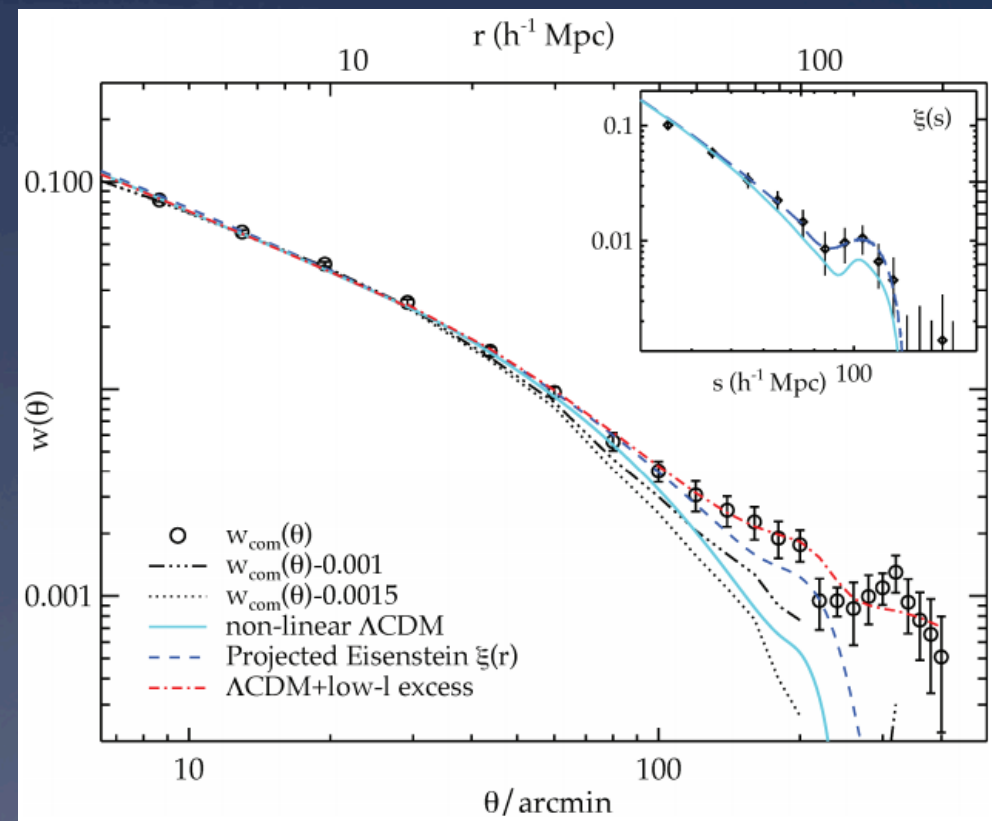


ATLAS Data Requirements

- * Science Requirement – reach SDSS depth in ugriz
- * Calibration – ± 0.05 mag required, ± 0.02 mag goal
- * Global Calibration – as above
- * Astrometric accuracy - ± 100 mas

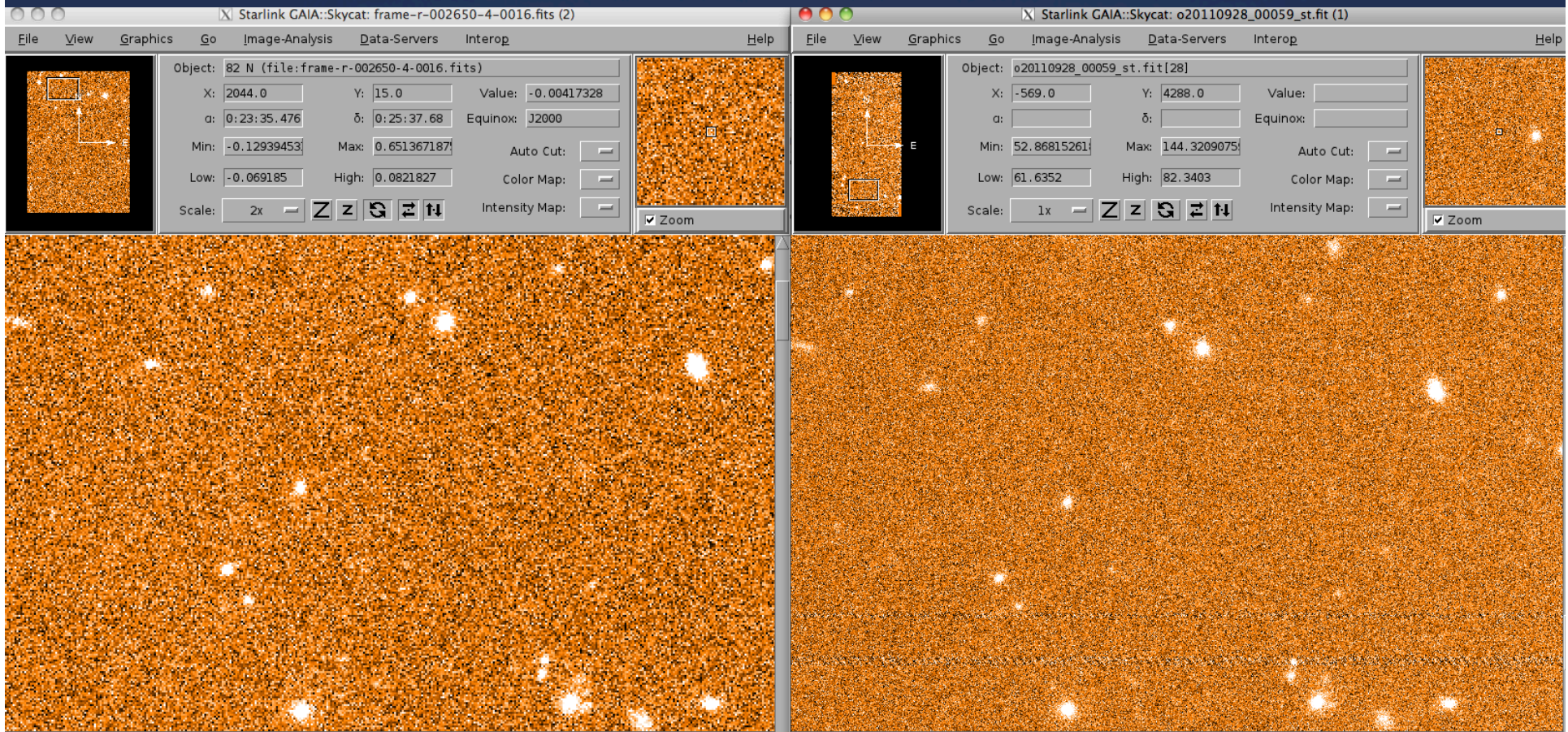
Galaxy Clustering

- * $\sim 10\%$ variation in number density
- * 0.01 variation in angular correlation, $w(\theta)$
- * Significant when looking for BAO
- * $w(\theta) \sim 0.001$ needs ± 0.03 mag



Sawangwit et al. (2011)

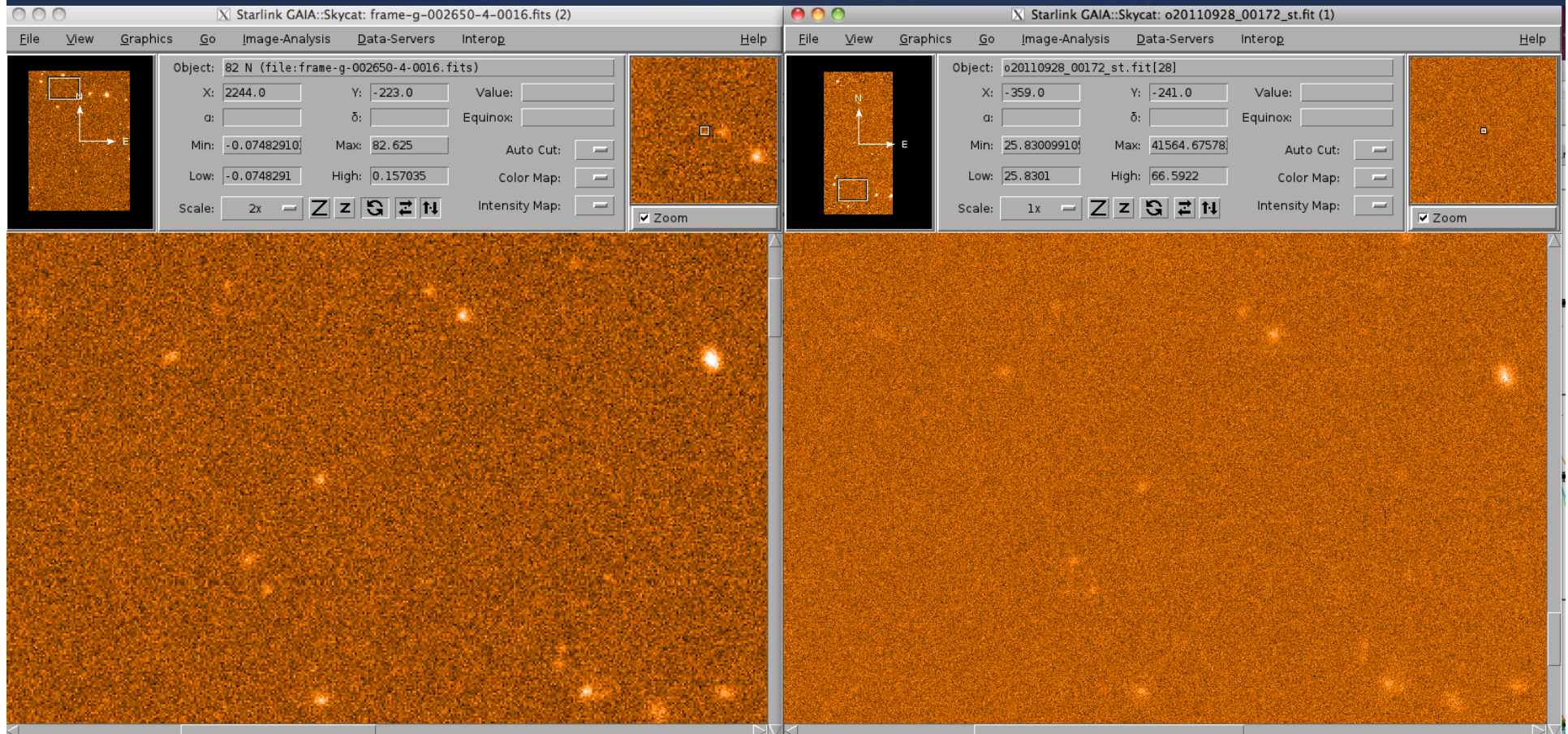
SDSS-ATLAS zoom - r



SDSS

ATLAS

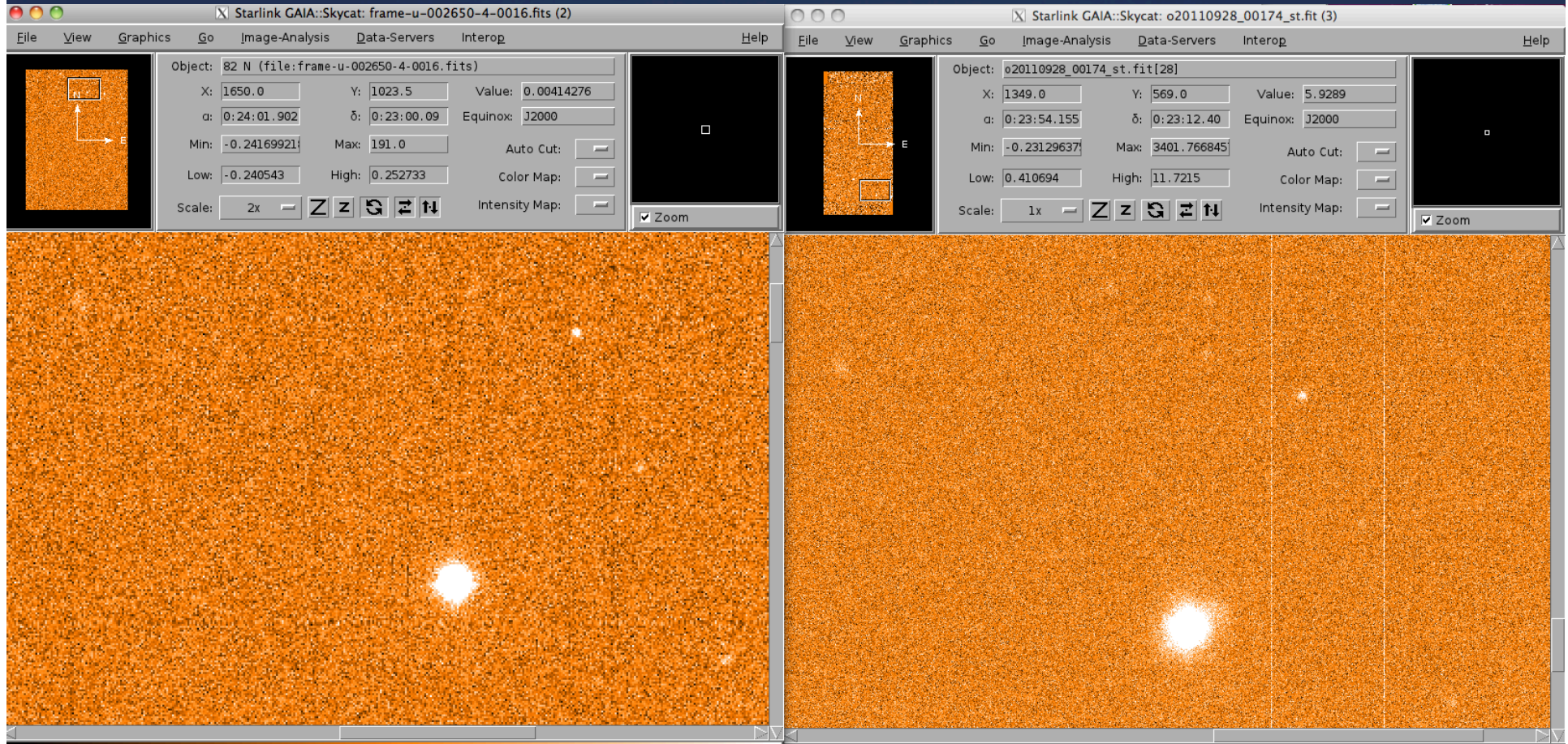
SDSS-ATLAS zoom - g



SDSS

ATLAS

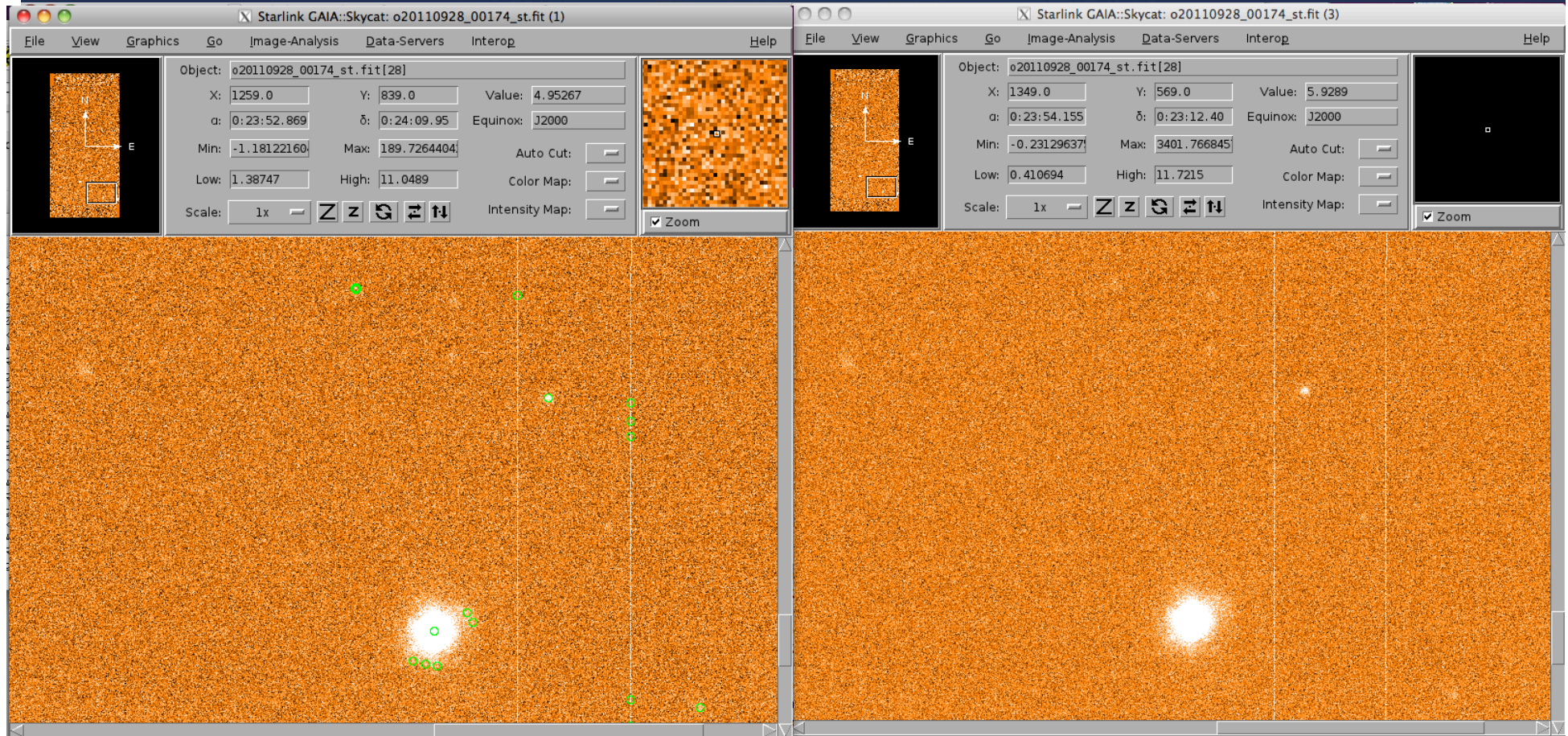
SDSS-ATLAS zoom - U



SDSS

ATLAS

ATLAS CASU ids – improve!



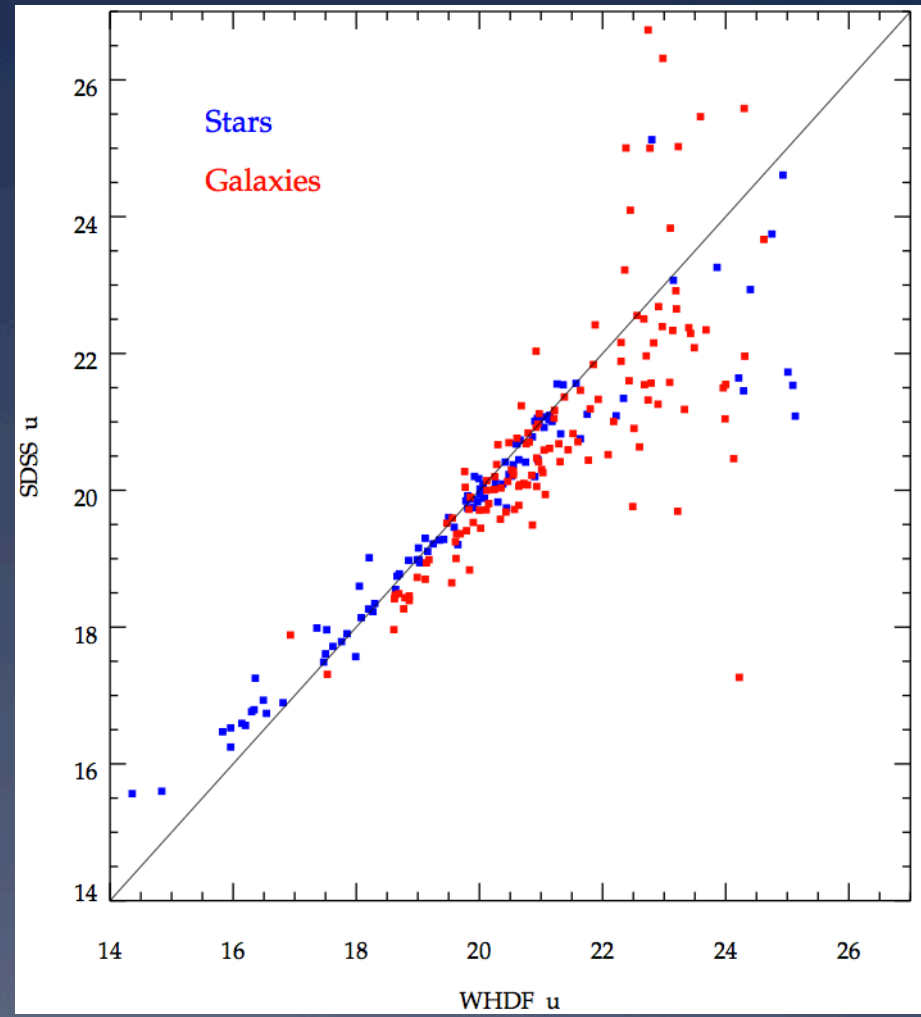
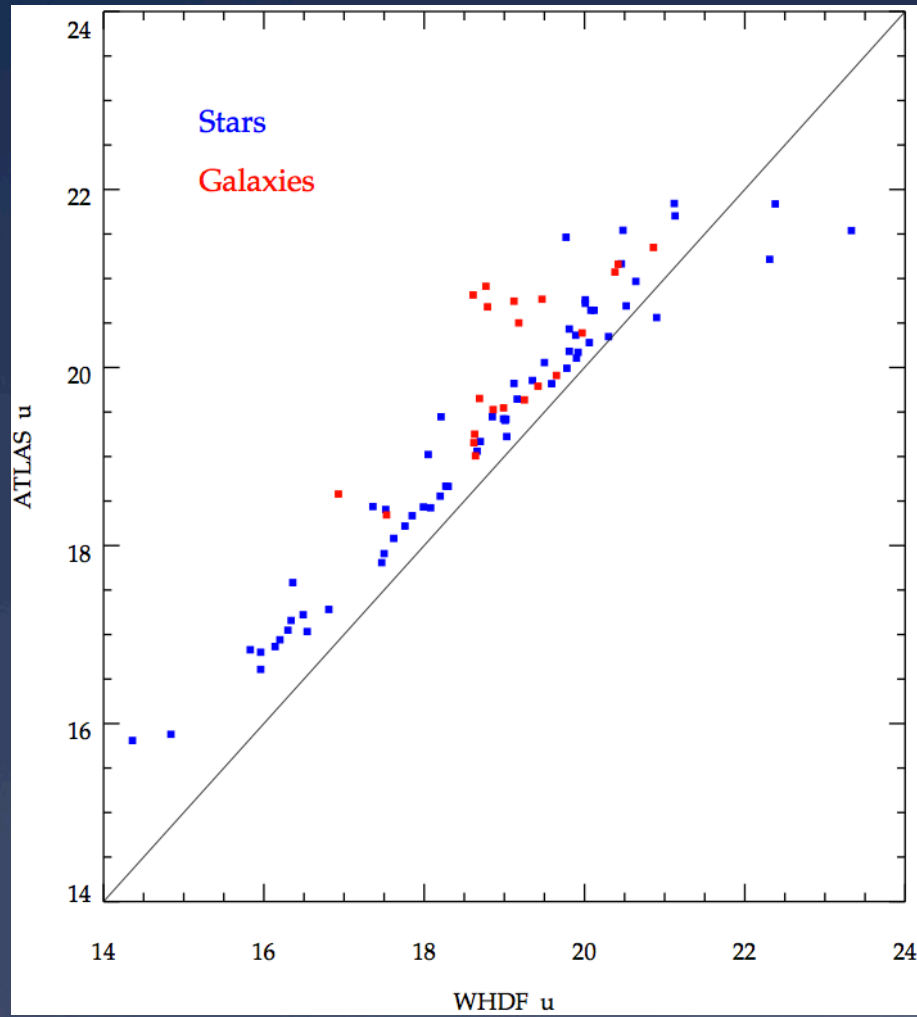
ATLAS ids

ATLAS

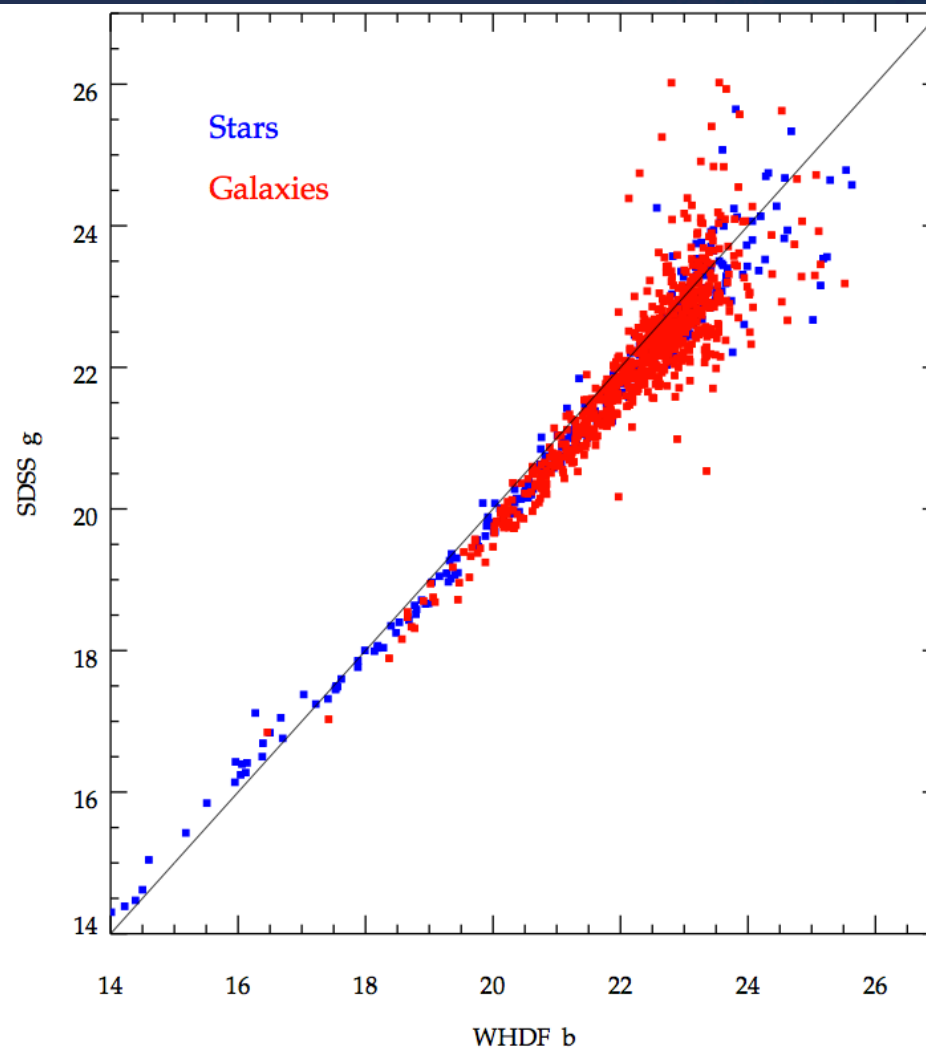
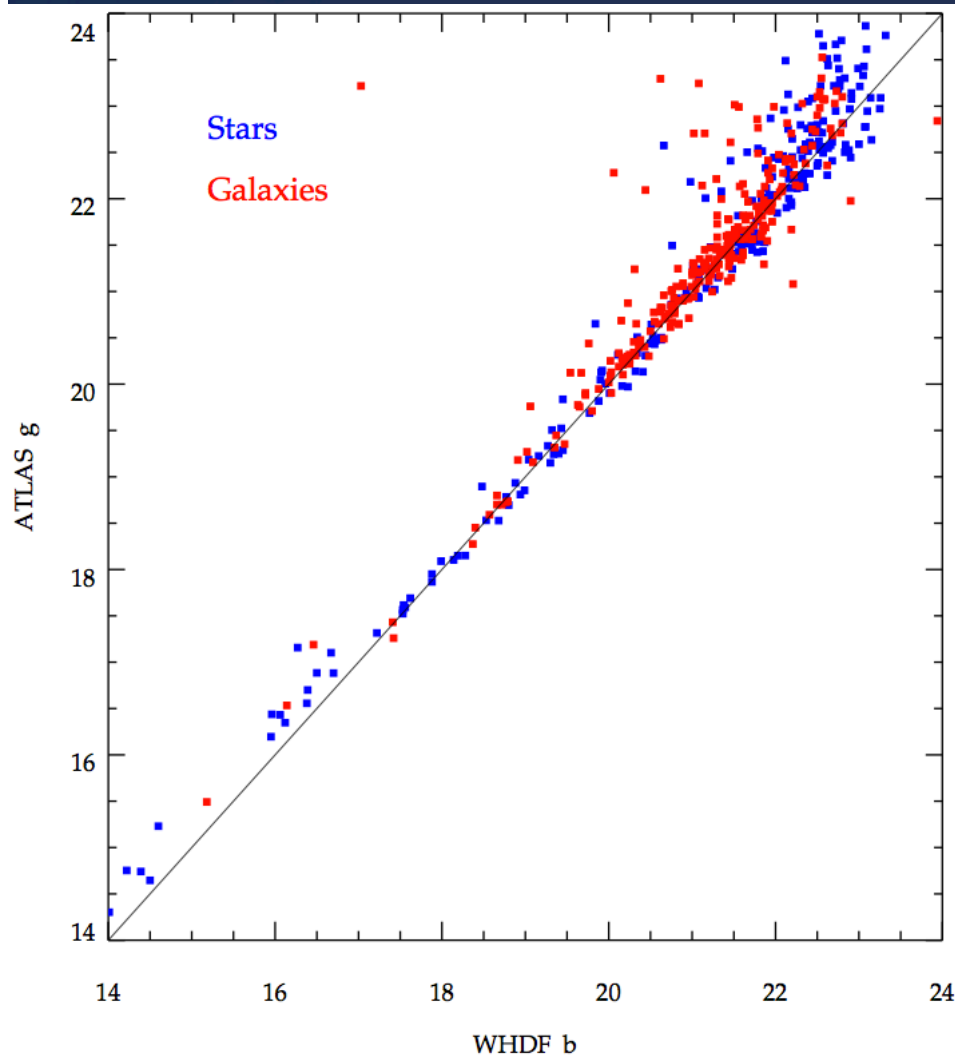
ATLAS Data Products

- * Instrumentally corrected frames along with header descriptors propagated from the instrument and processing steps
- * Stacked data for dithered observations of single targets
- * Statistical confidence maps for all image products
- * Object catalogues based on a standard VDFS set of object descriptors including astrometric and photometric measures and morphologies
- * Data Quality Control database including measurements of seeing, average stellar shape, aperture corrections, sky background noise levels and limiting magnitudes
- * Homogeneous band-merged catalogues (ugriz from single pointing).

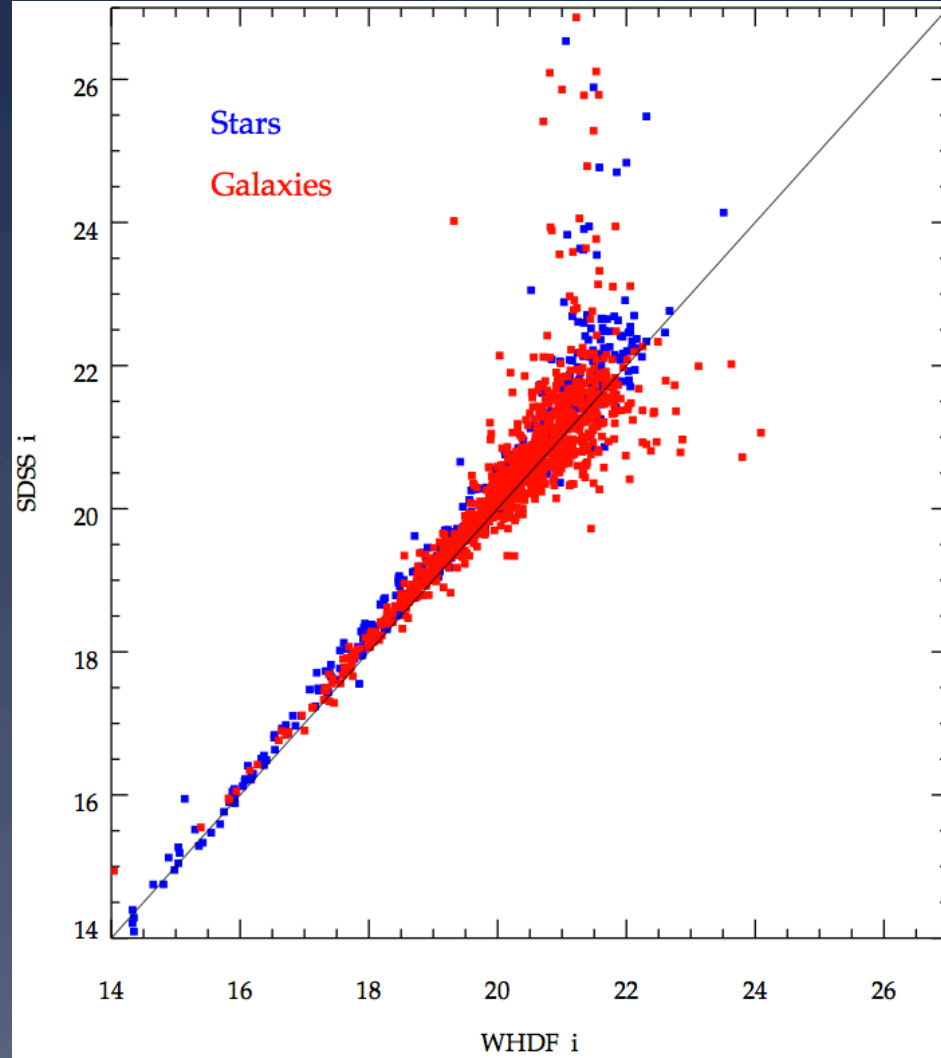
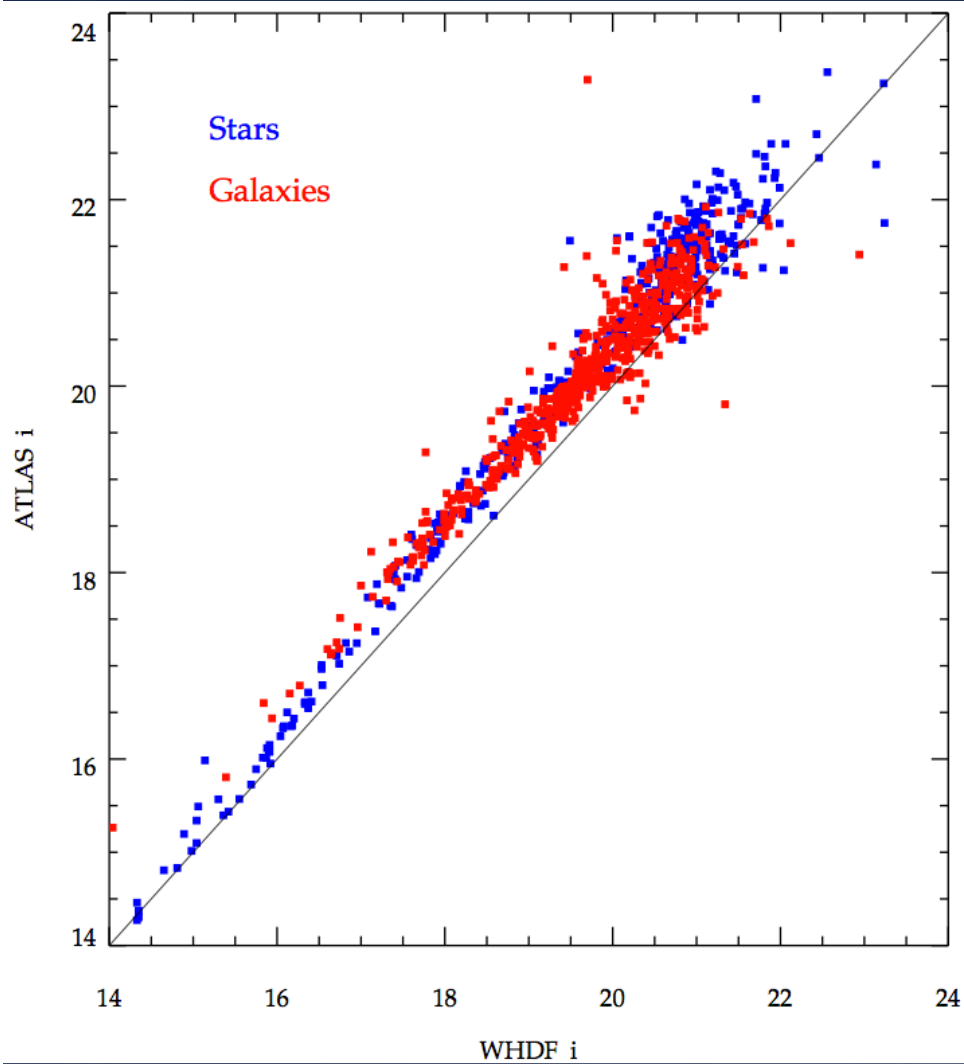
WHDF ν ATLAS + SDSS - U



WHDF ν ATLAS + SDSS – b vs g



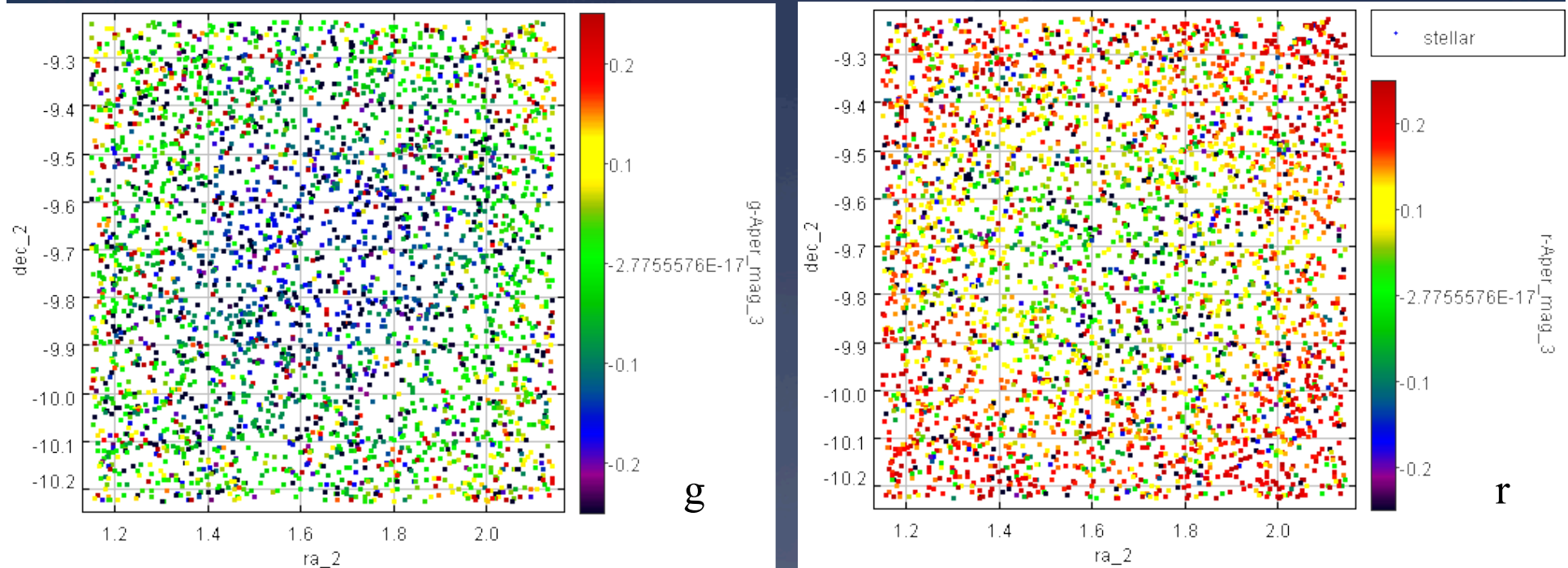
WHDF vs ATLAS+SDSS - i



ATLAS Data Issues

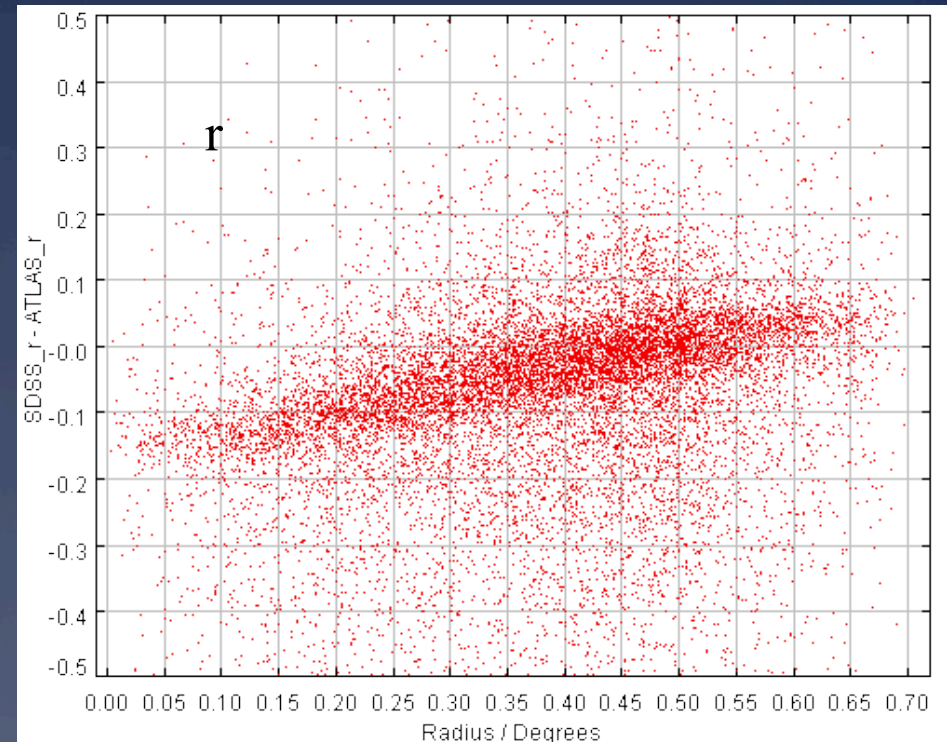
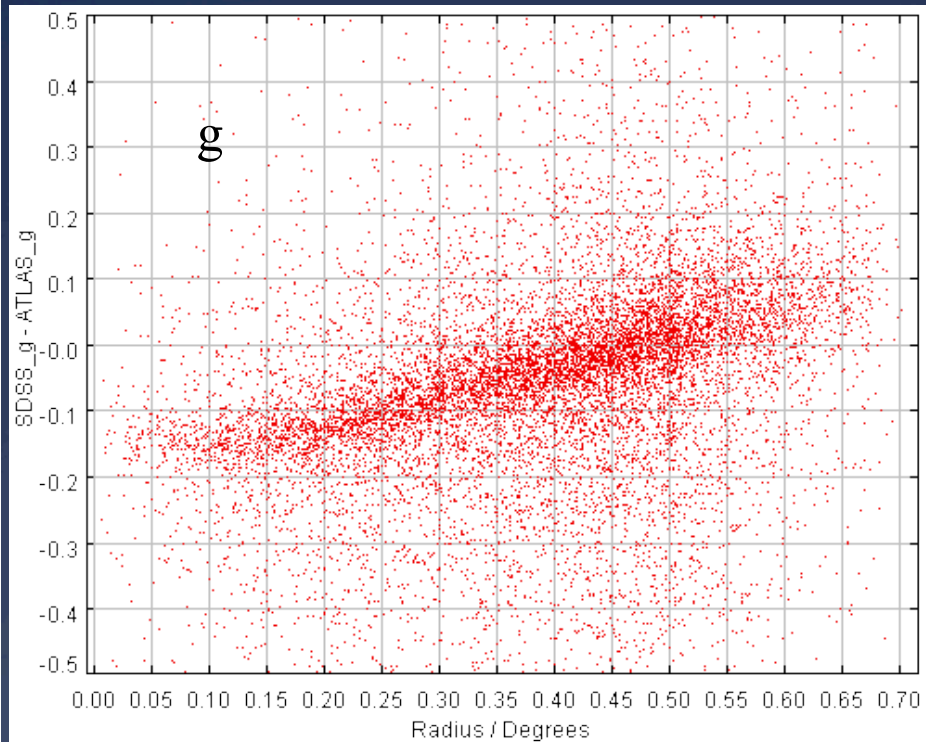
- * Flat-field/Illumination correction problem – particularly affects global calibration
- * Affects galaxy counts (but not colours?)
- * Depth of extracted photometry in some bands (u)
- * Some artefacts in extracted catalogues
- * Background maps sometimes show CCD pattern

SDSS-ATLAS mag Residuals

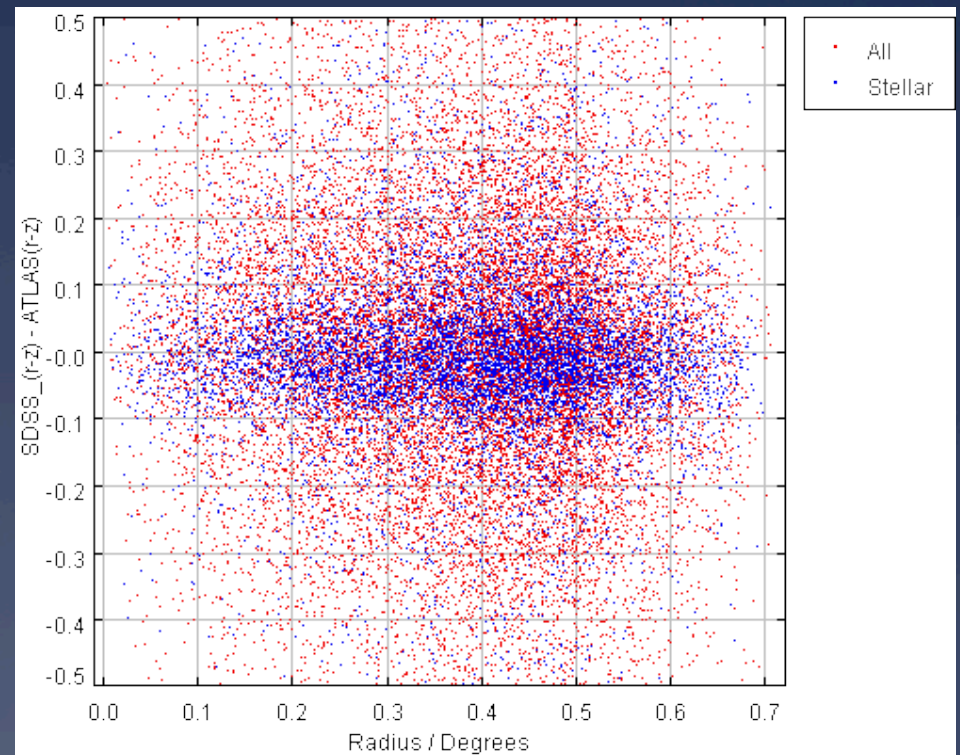
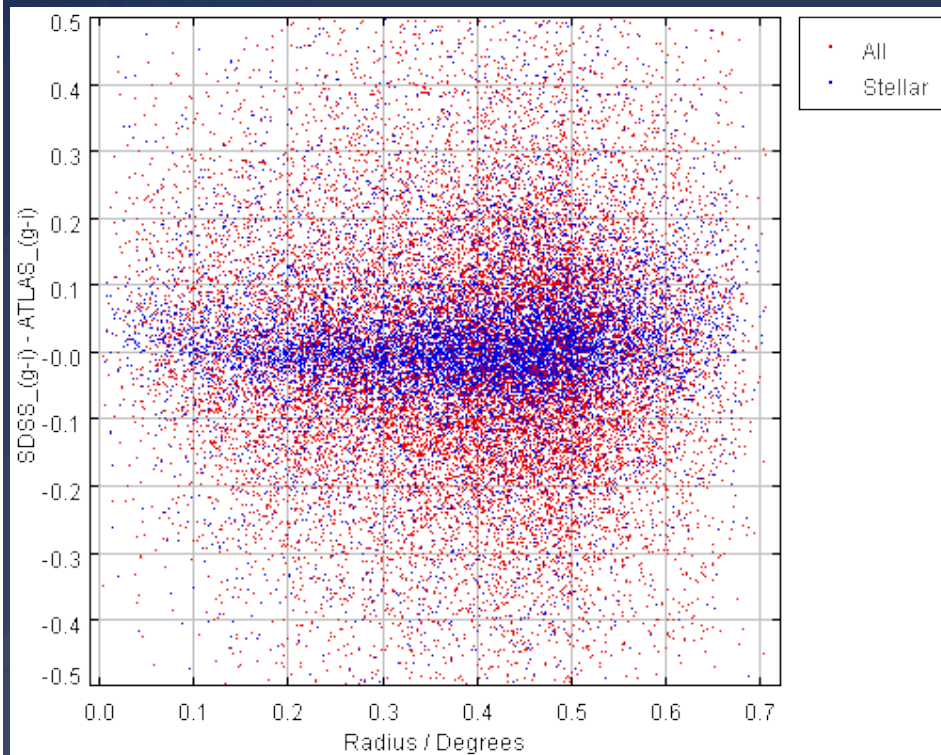


ATLAS too bright at edge

SDSS-ATLAS mag residual v Radius

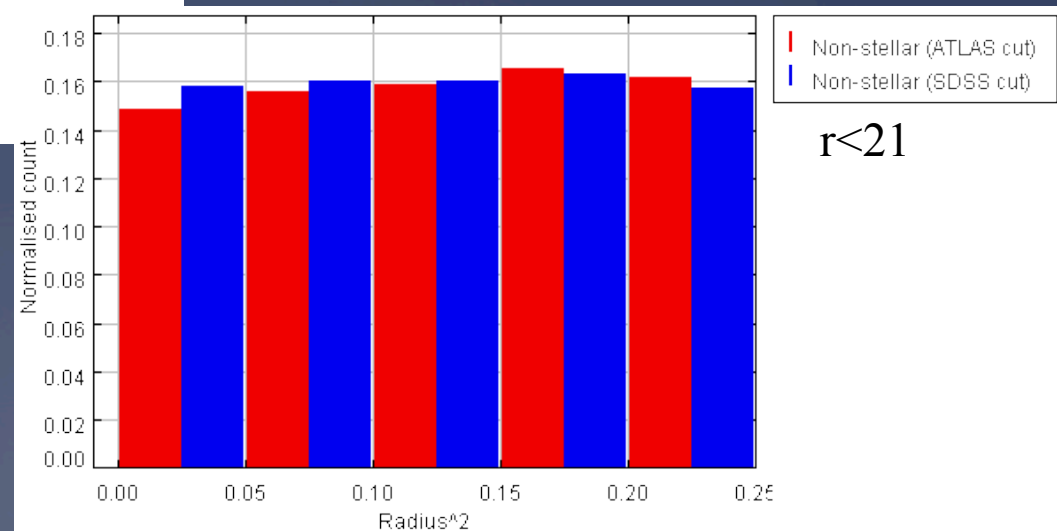
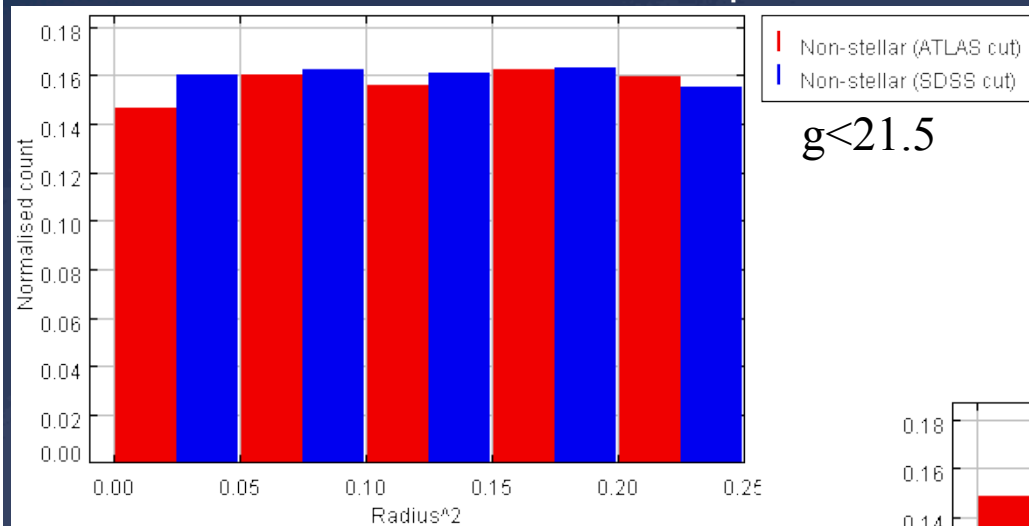


Colours unaffected?



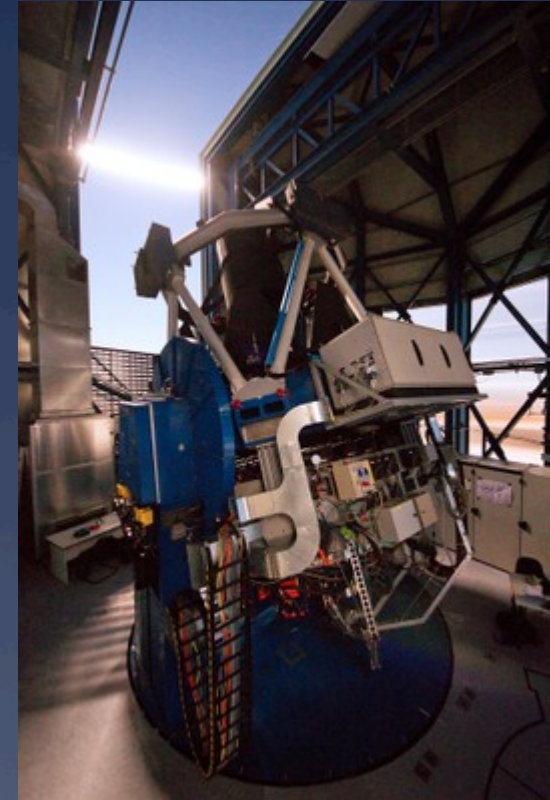
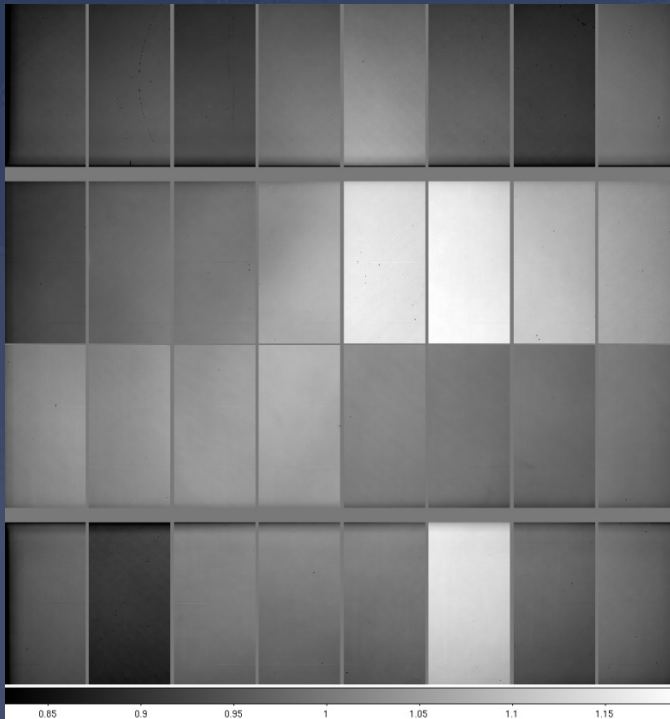
Galaxy Number Counts

* Show radial dependence, unlike colours



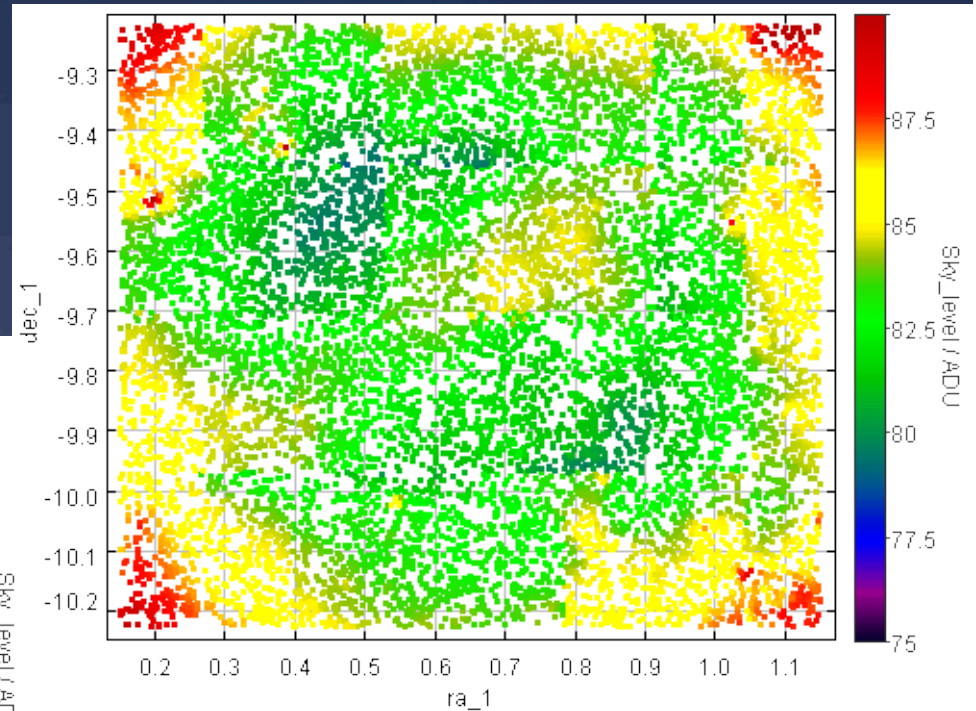
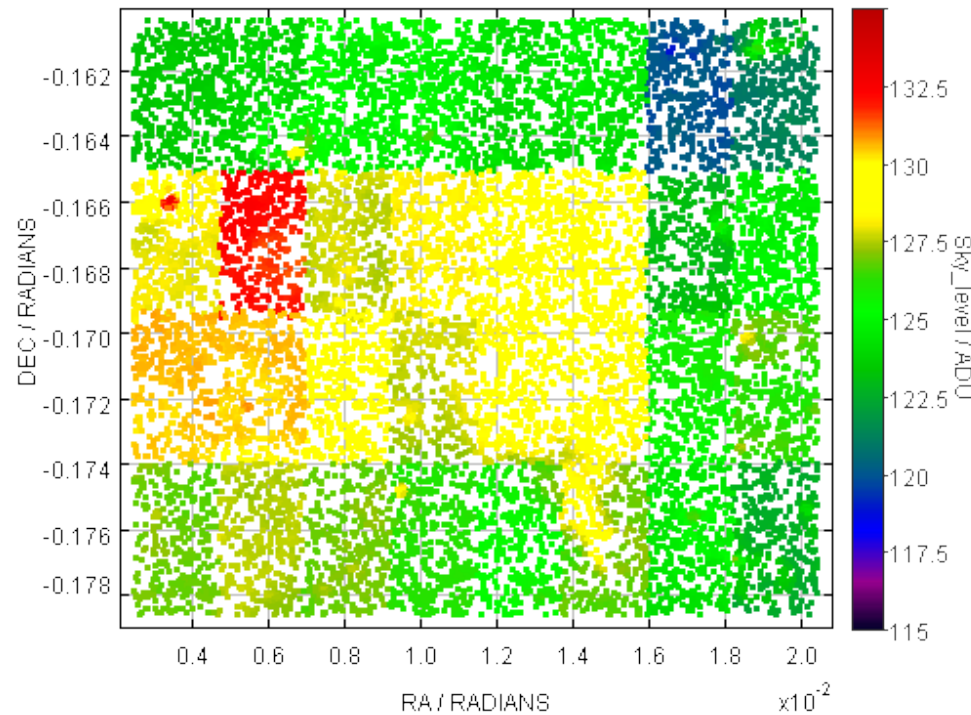
Possible Explanation

- * Scattered light
- * \Rightarrow Flat fielding problem
- * Needs Illumination correction



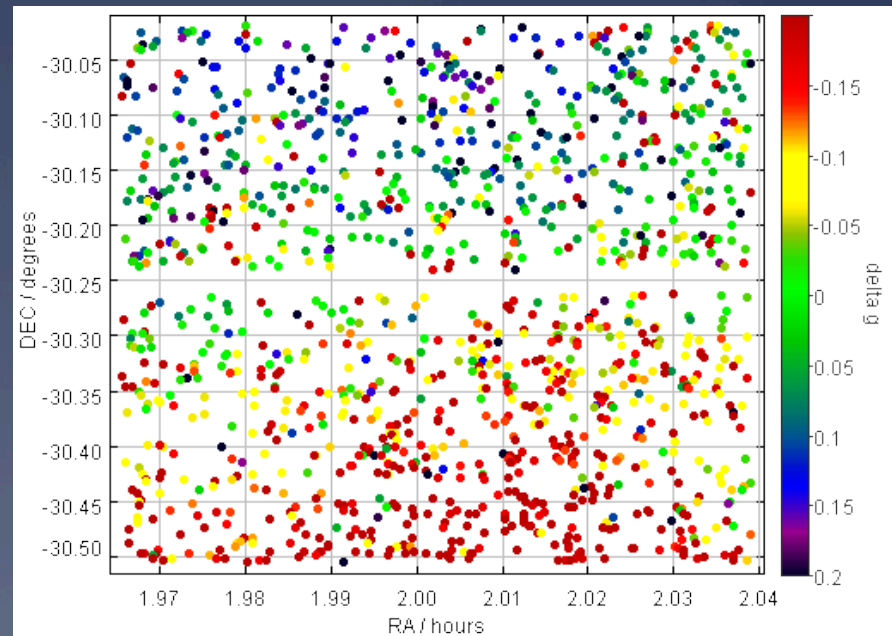
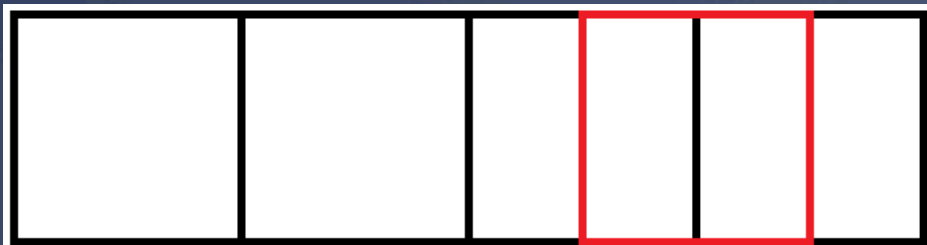
Local Sky Intensity

- * Looks radial in r-band
- * but only in r-band



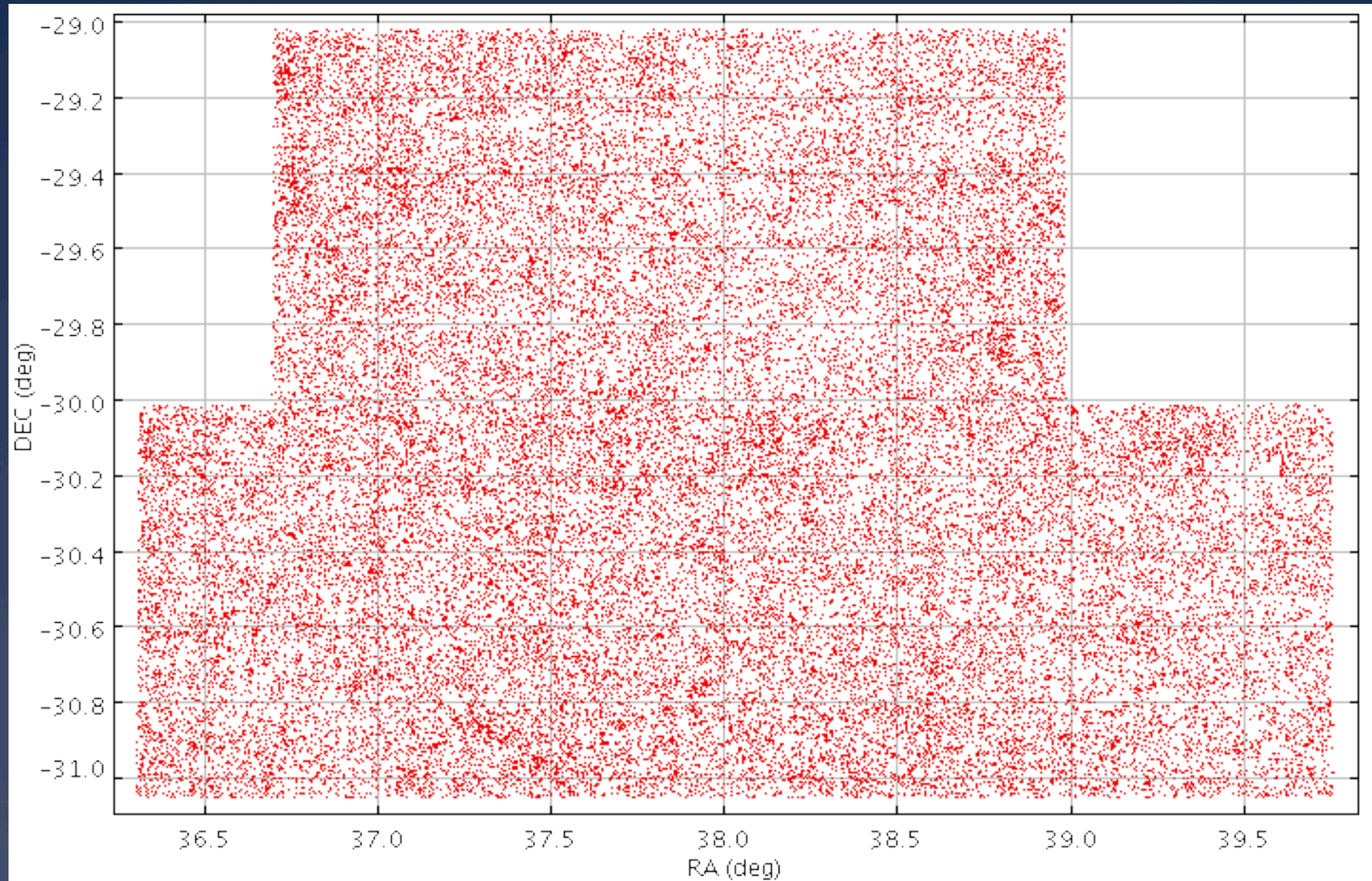
Potential Solutions

- * Baffling the telescope
- * Correcting catalogues via SDSS overlaps – SA113 etc
- * Can monitor over whole survey area via half overlap fields – even when no SDSS



But data already used at 2dF...

2QDES Pilot: 5 ATLAS fields \rightarrow 2dF



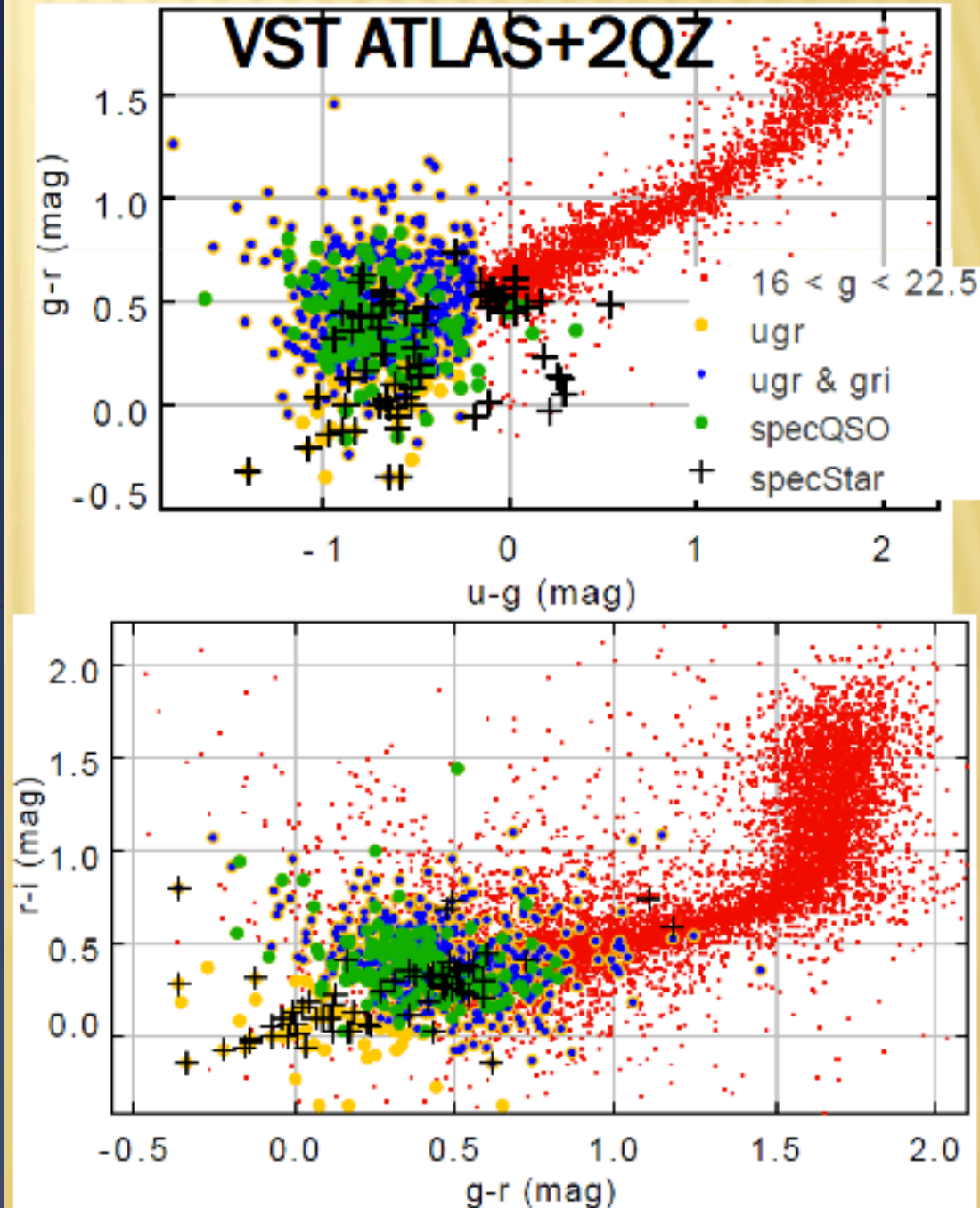
ATLAS 2QDES ugri QSO selection

- * Simple selection in
ugr and gri

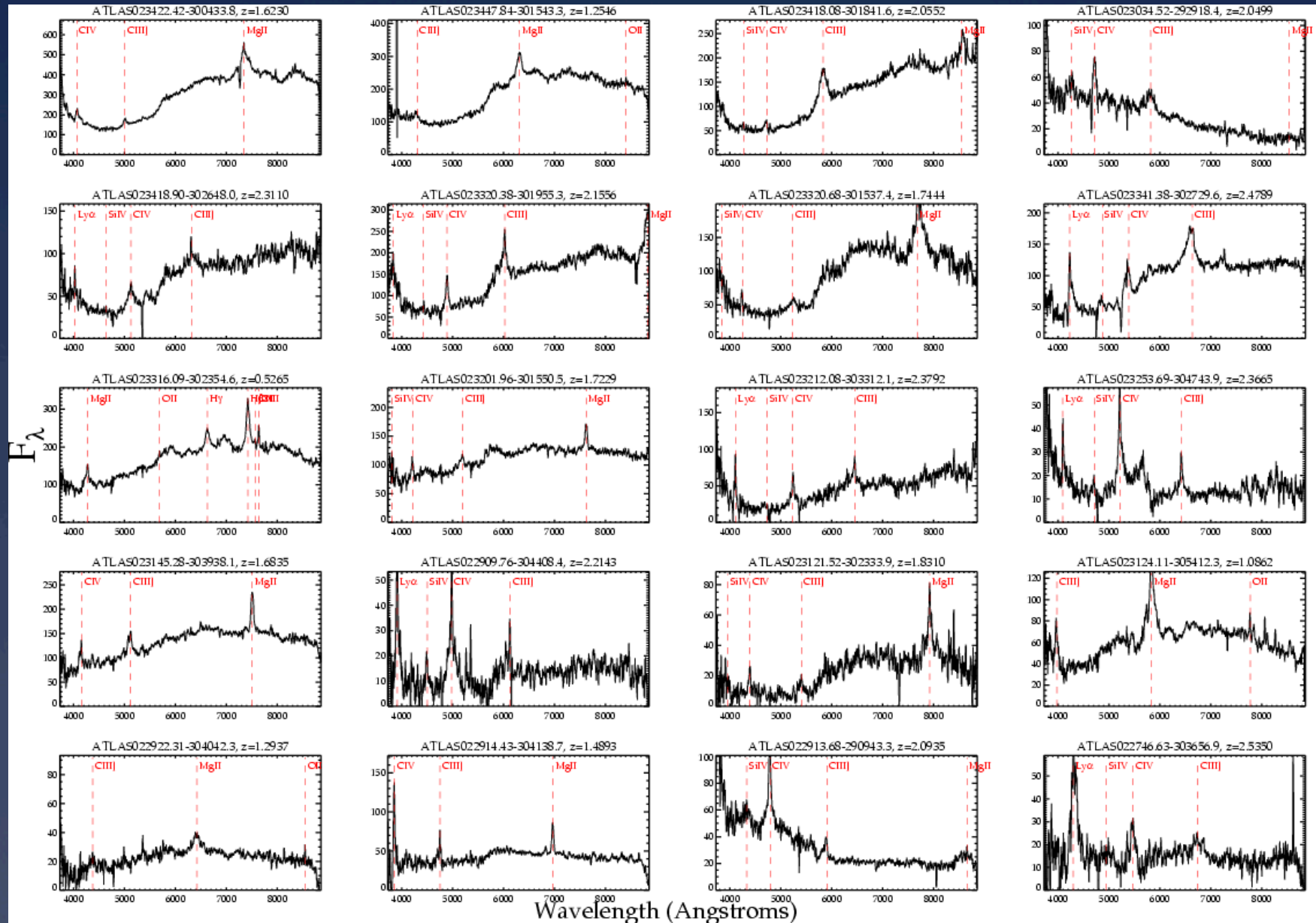
- * + KDE selection of
Bovy et al

- * Limit $g < 22.5$

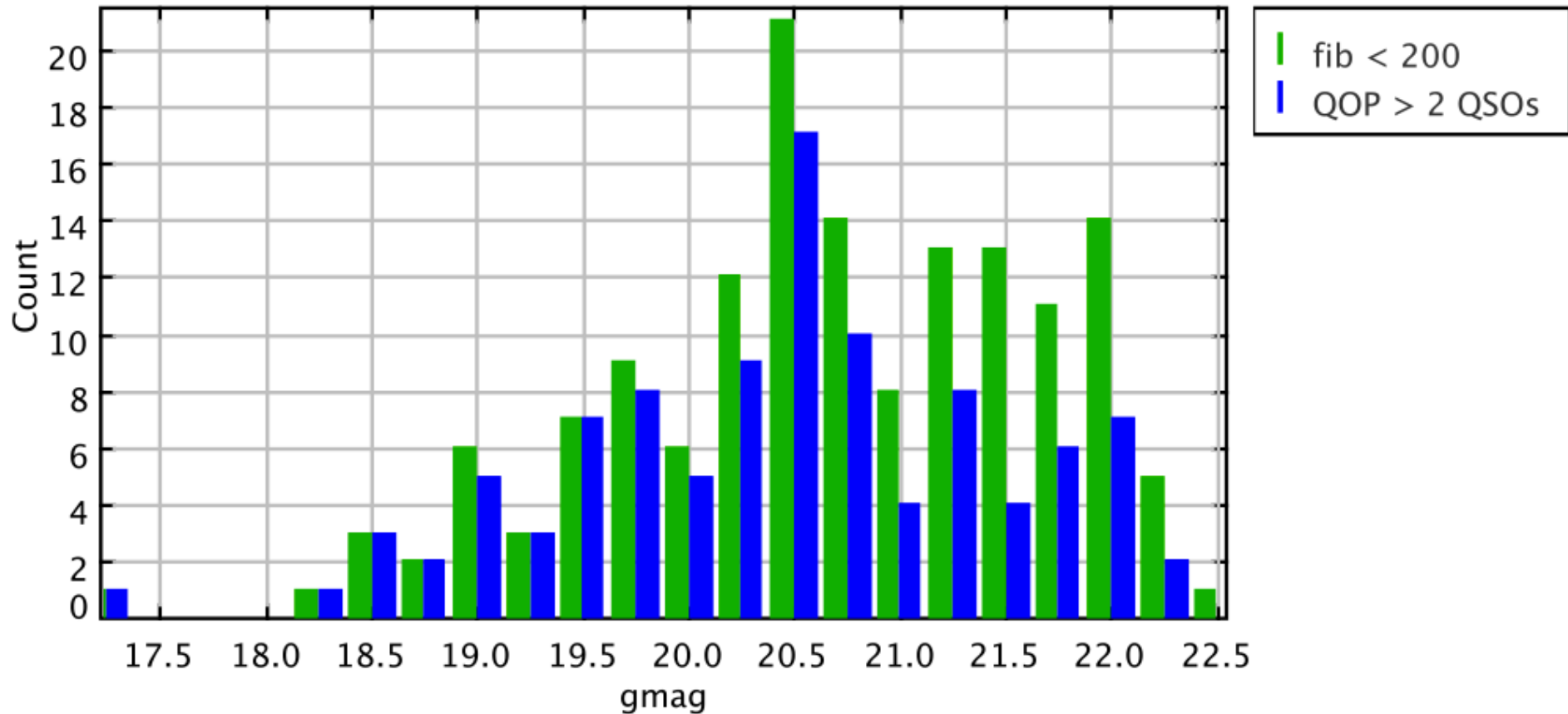
- * Then 50min 2dF
exposure on
20/12/11.....



Pilot Sample QSO Spectra



AAOmega Pilot QSO n(g)



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

Summary

- * $\sim 750\text{deg}^2$ surveyed by ATLAS already - achieving SDSS depth in ugriz
- * Chilean proposal to double u exposure time accepted
- * ATLAS ops+OB submission working well
- * Goals of $\pm 0.02\text{mag}$ global photometry plus $\pm 100\text{mas}$ astrometry
- * Main problem is flat-fielding – VST baffle? Calibrate via SDSS overlaps?
- * Other issues – artefacts, sky background, optimise extraction depth
- * But 2QDES 2dF pilot already hitting QSO sky density of 80deg^{-2} to $g\sim 22$ in 50min exposure – deeper than previous QSO surveys!
- * 2QDES survey of $\sim 0.5\text{million}$ QSOs still a possibility...
- * ... for $z\sim 1.6$ 6σ BAO, RSD, QSO Lensing + f_{NL} + QSO BH-halo mass relation

Checking profile vs radius

