Redshift survey of 10 000 QSOs from VST ATLAS, WISE & 2dF

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Ph301

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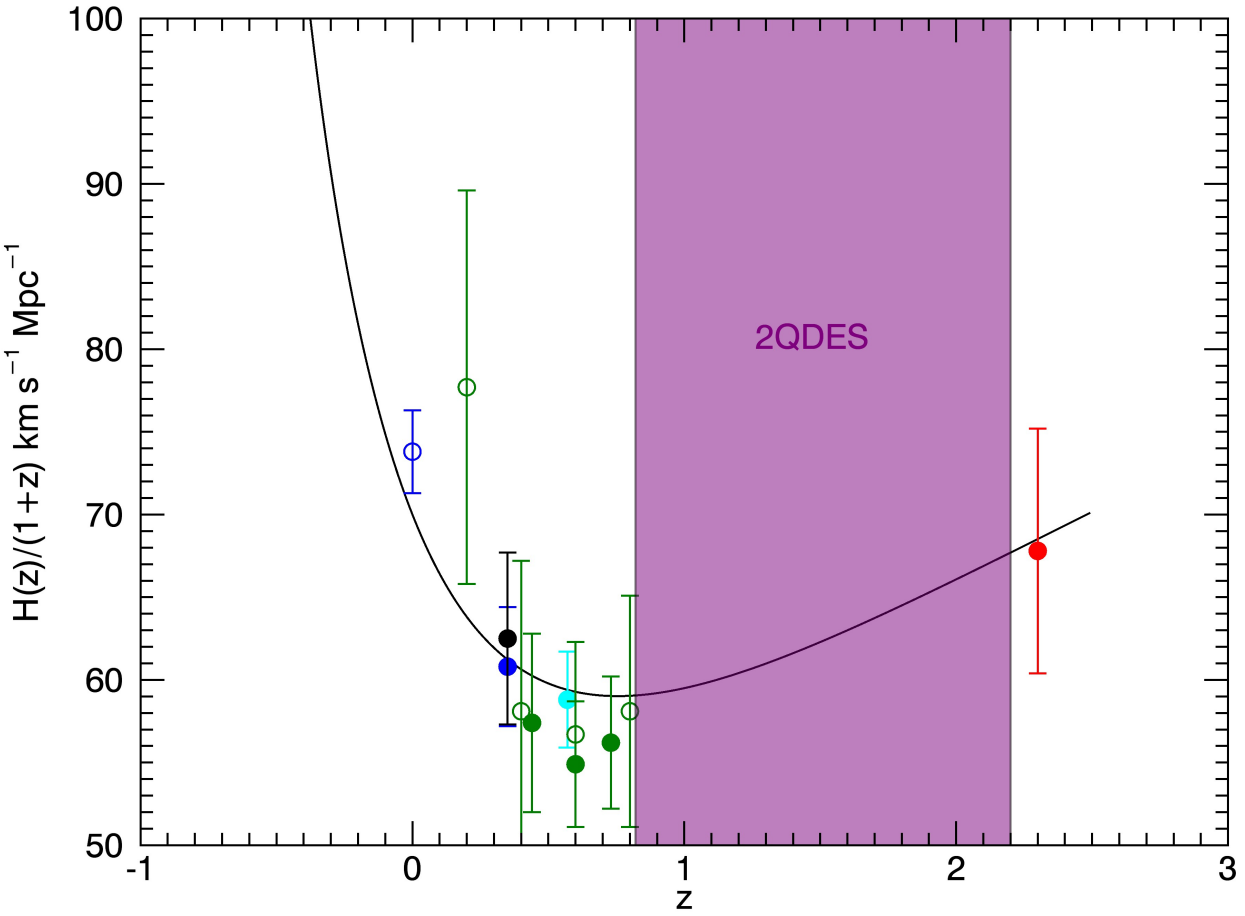
2QDES pilot survey

- Pilot goal
- Survey instruments
- Selection techniques
- Pilot results
- Science goals
- Summary

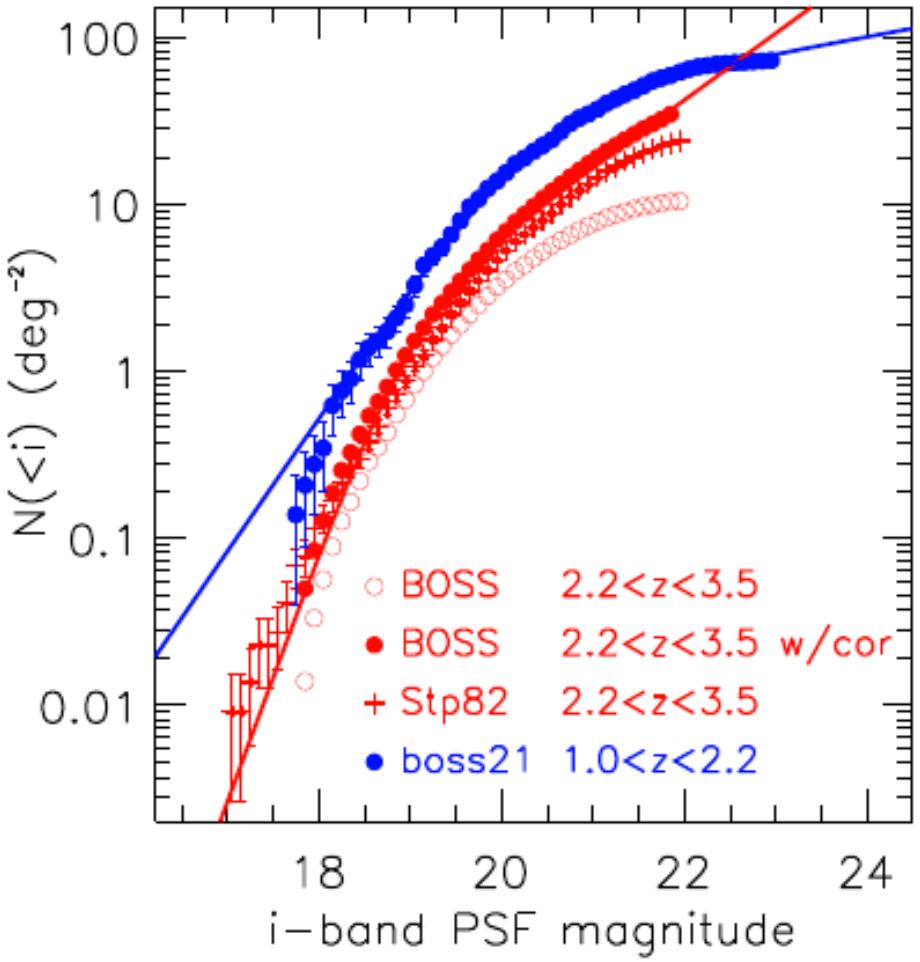
Science goal of 2QDES survey

- measure the BAO peak at z~1.5
- test Dark Energy equation of state



Pilot requirements

- 80+ quasars per square degree
- In range 0.8 < z < 2.5



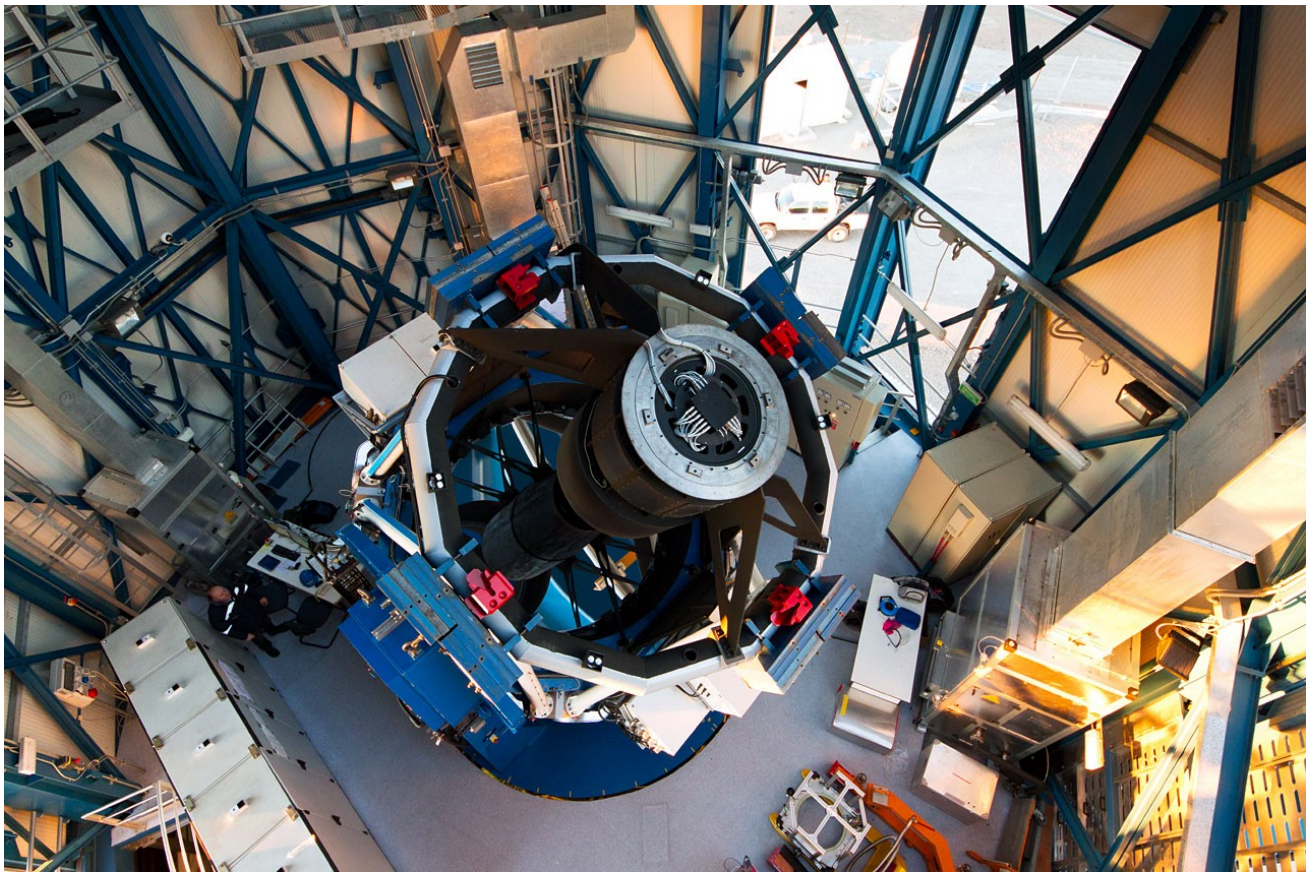
Science case verified in simulation

Sawangwit et al. MNRAS 2011

Quasar density achieved

Palanque-Delabrouille et al., A & A2013

VST ATLAS

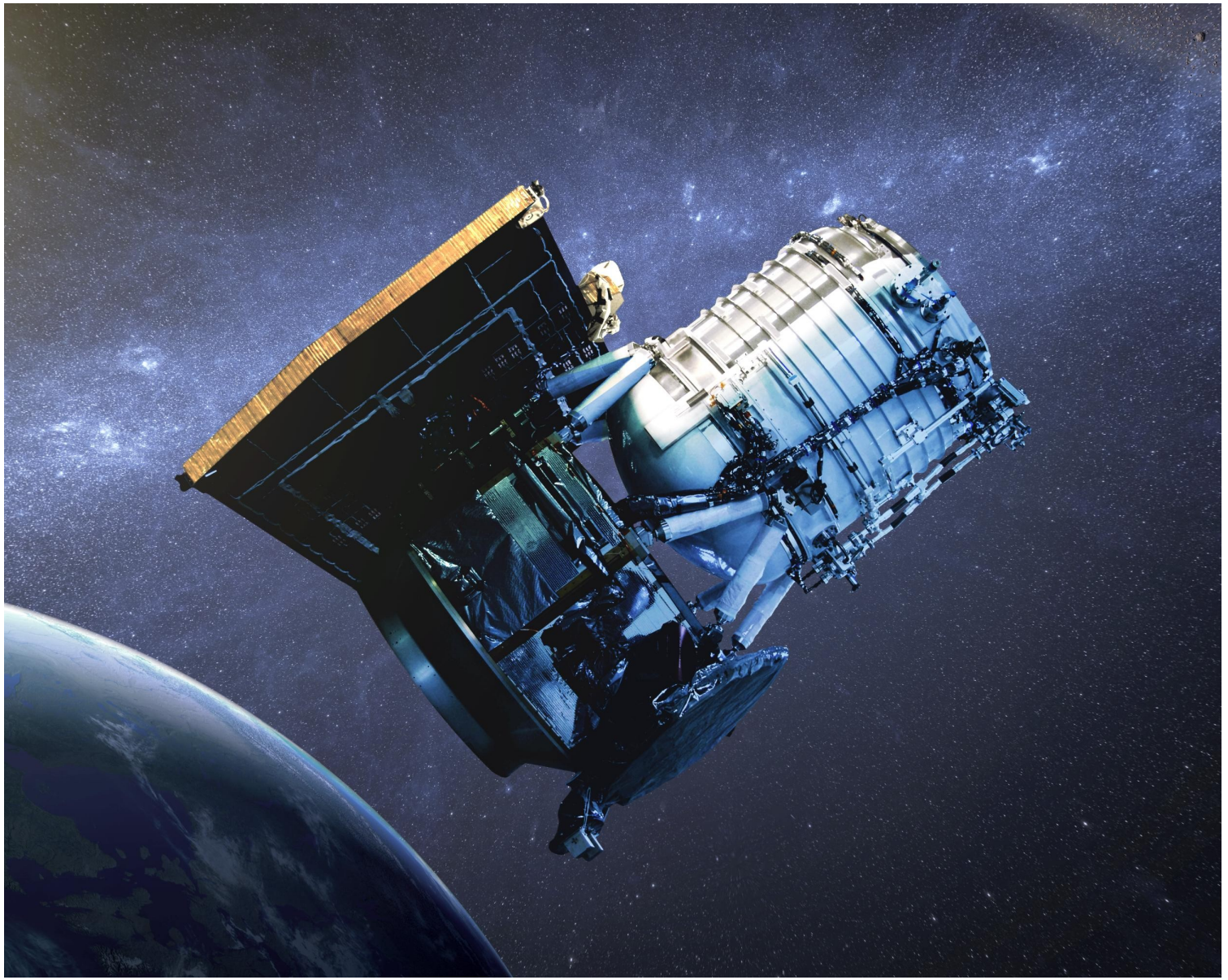


u – 21.1 [Vega]
g – 23.2
r – 22.6
i – 21.6
z – 20.3

Sub arcsecond seeing

4k square degrees

WISE

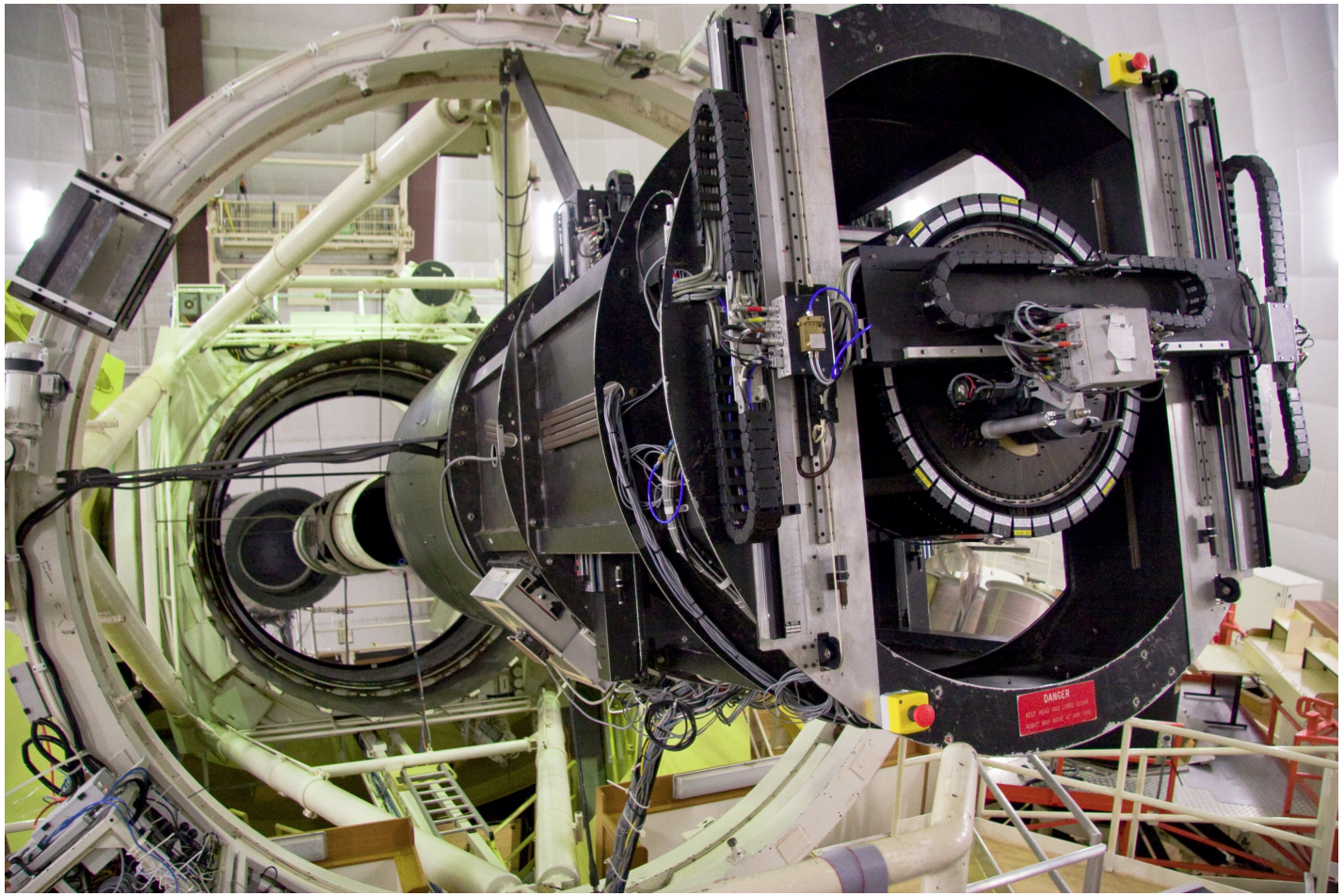


W1 – 17.7 [Vega]
W2 – 17.2
W3 – 12.5
W4 – 9

6 arcsecond psf

All sky

AAT 2dF



AAT 4m telescope

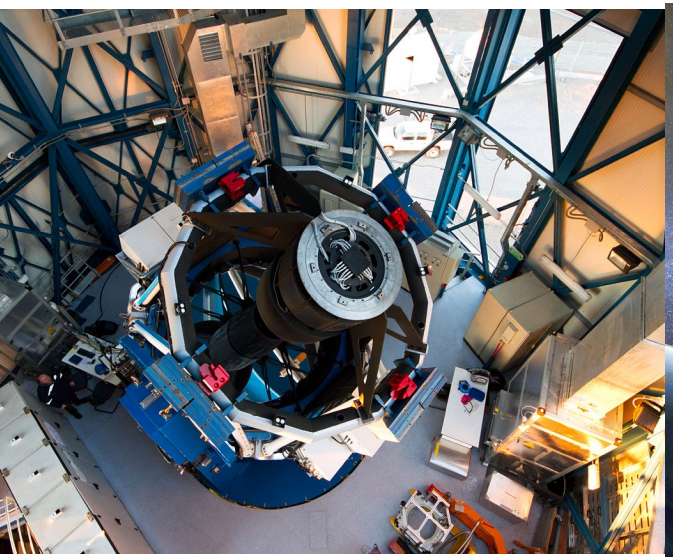
360 science fibres

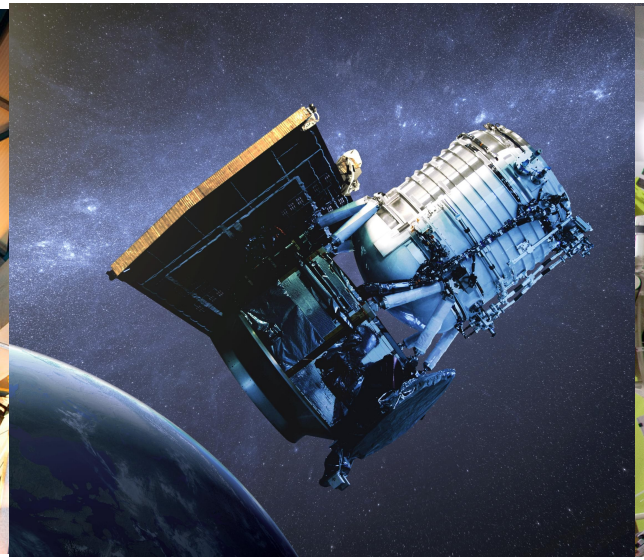
π square degrees FOV

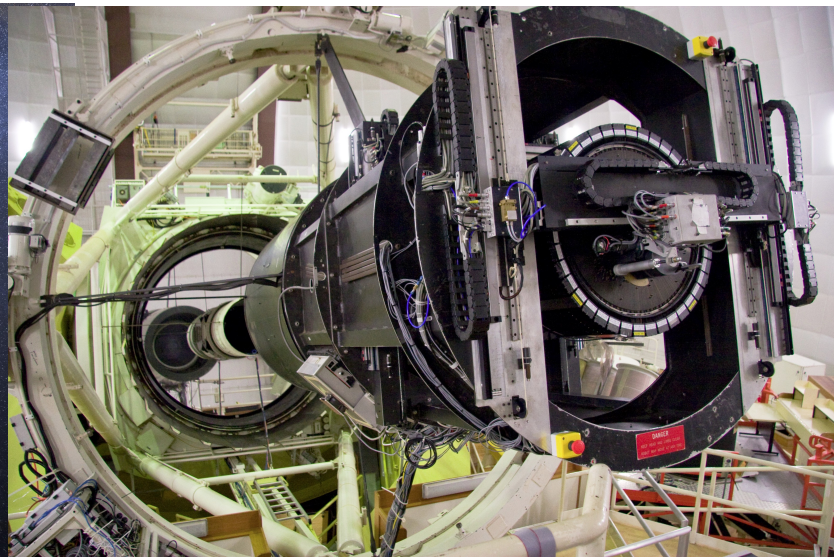
Wavelength range ~370-880nm

Survey instruments

➔ VST ATLAS + WISE + AAT 2dF

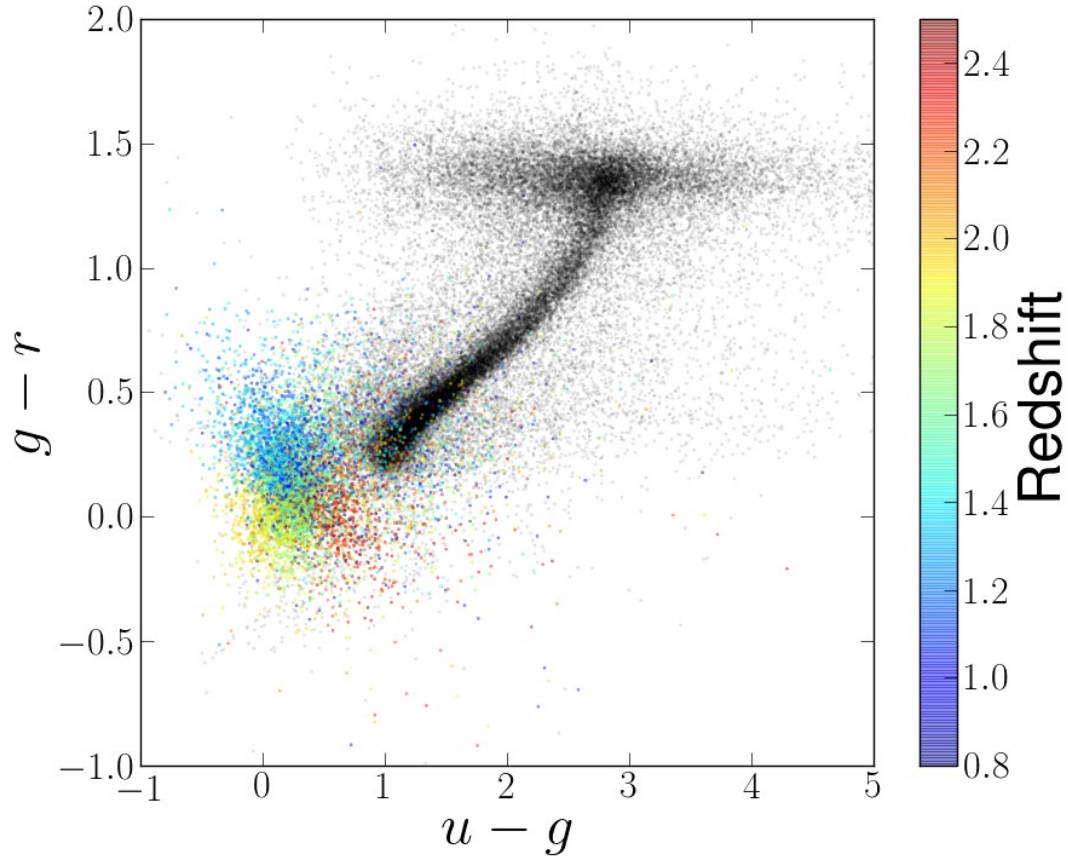






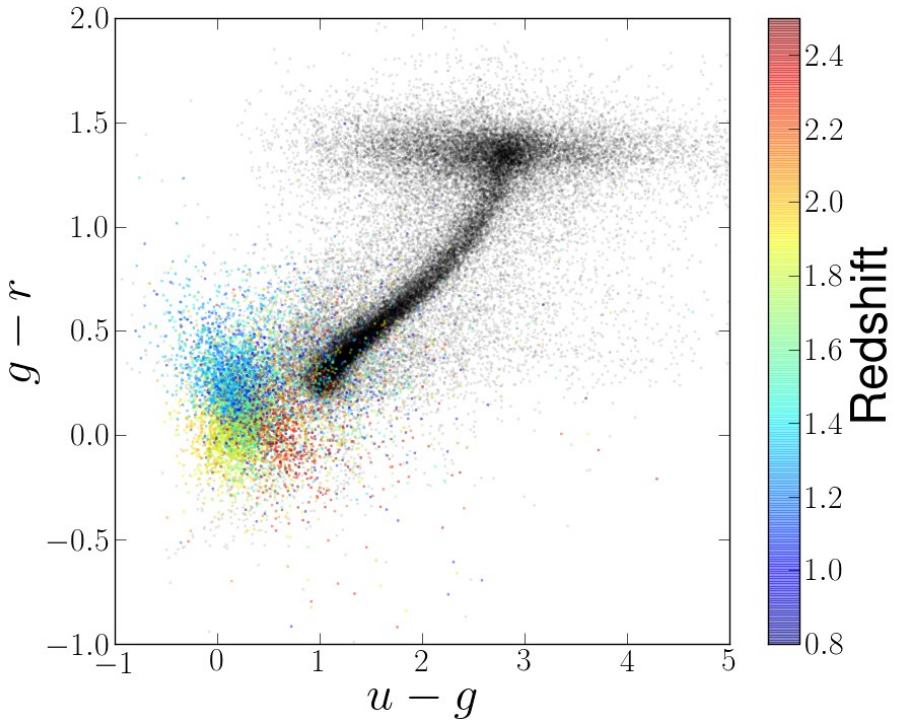
Selection techniques

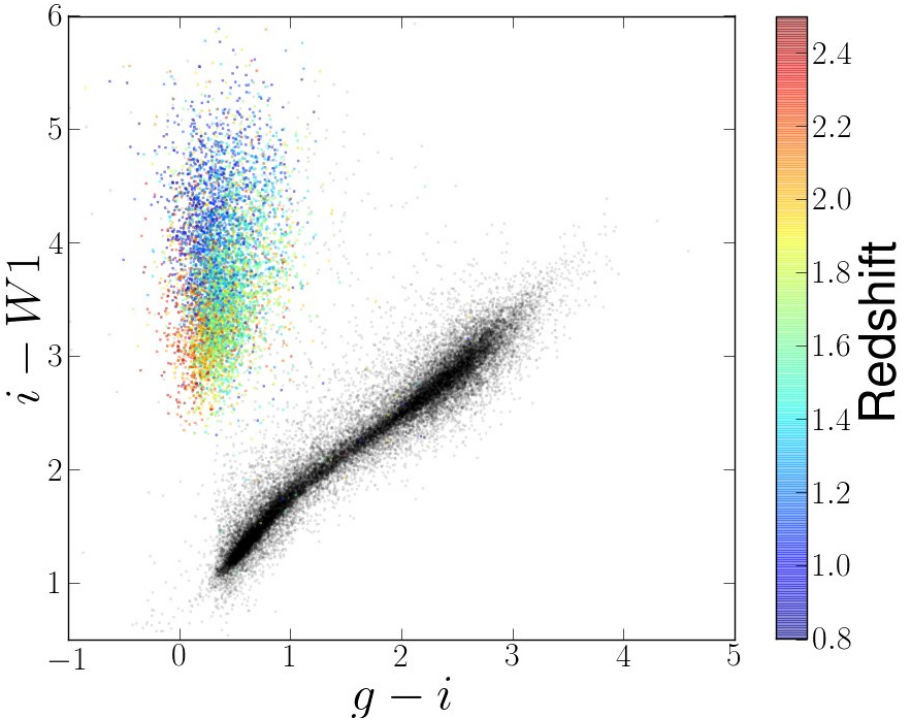
- 2QZ,2SLAQ, SDSS rely on optical photometry
  - ugr and gri colour cuts (UVX)
- 2QDES utilises ugriz → Xtreme Deconvolution



Selection techniques

- 2QDES
  - XD combined with IR photometry
  - 80+ quasars per sq deg





2QDES Pilot

17 nights

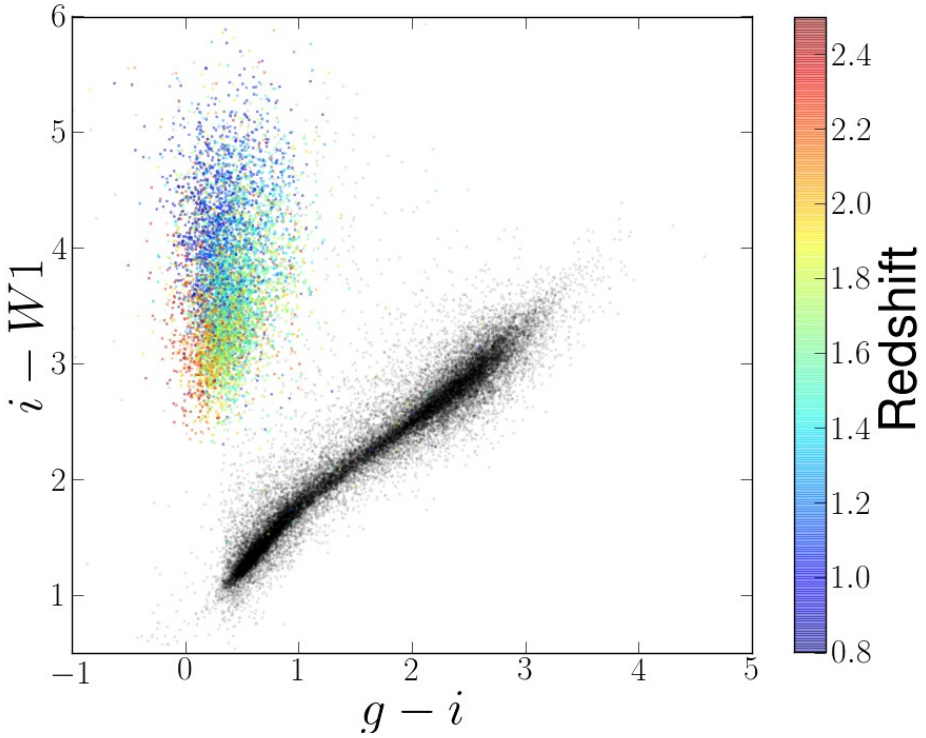
- ➔ dark and grey time
- ➔ observing throughout the year

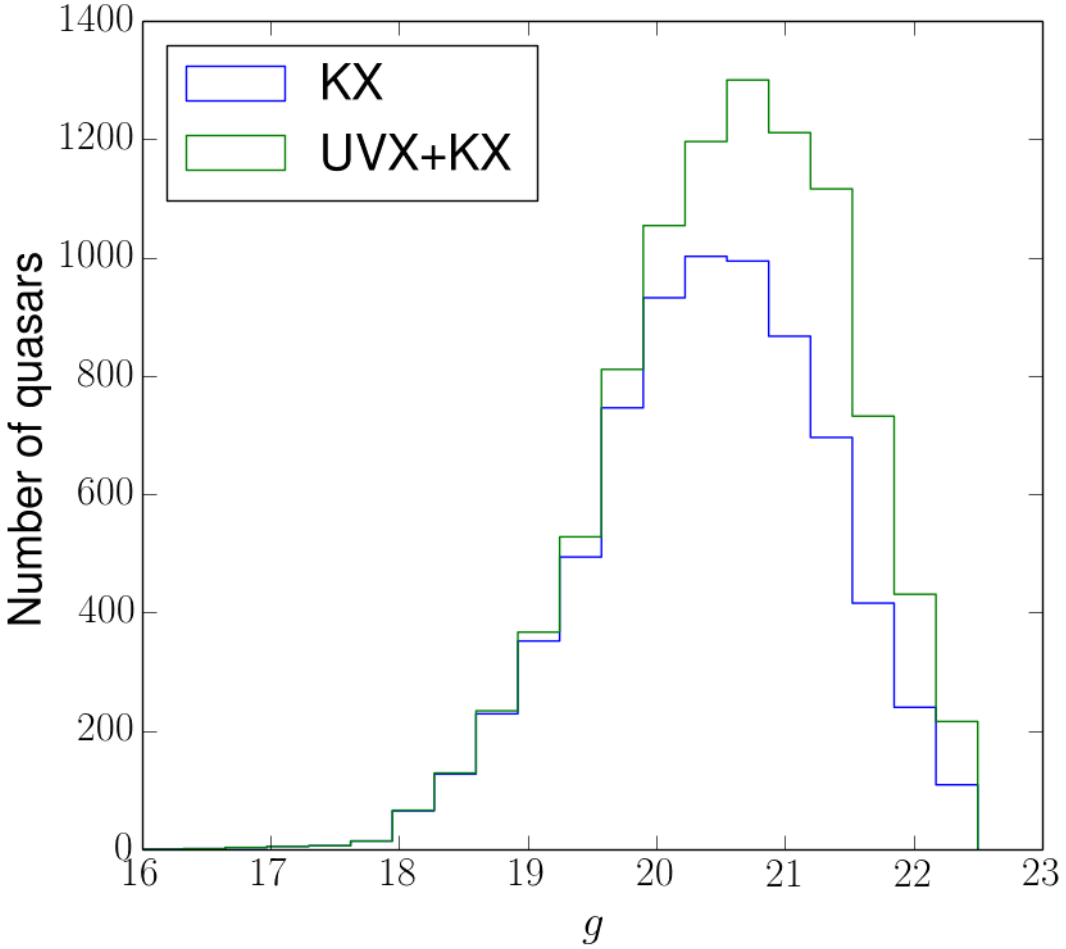
Observing at Siding Spring

FIRE at Siding Spring

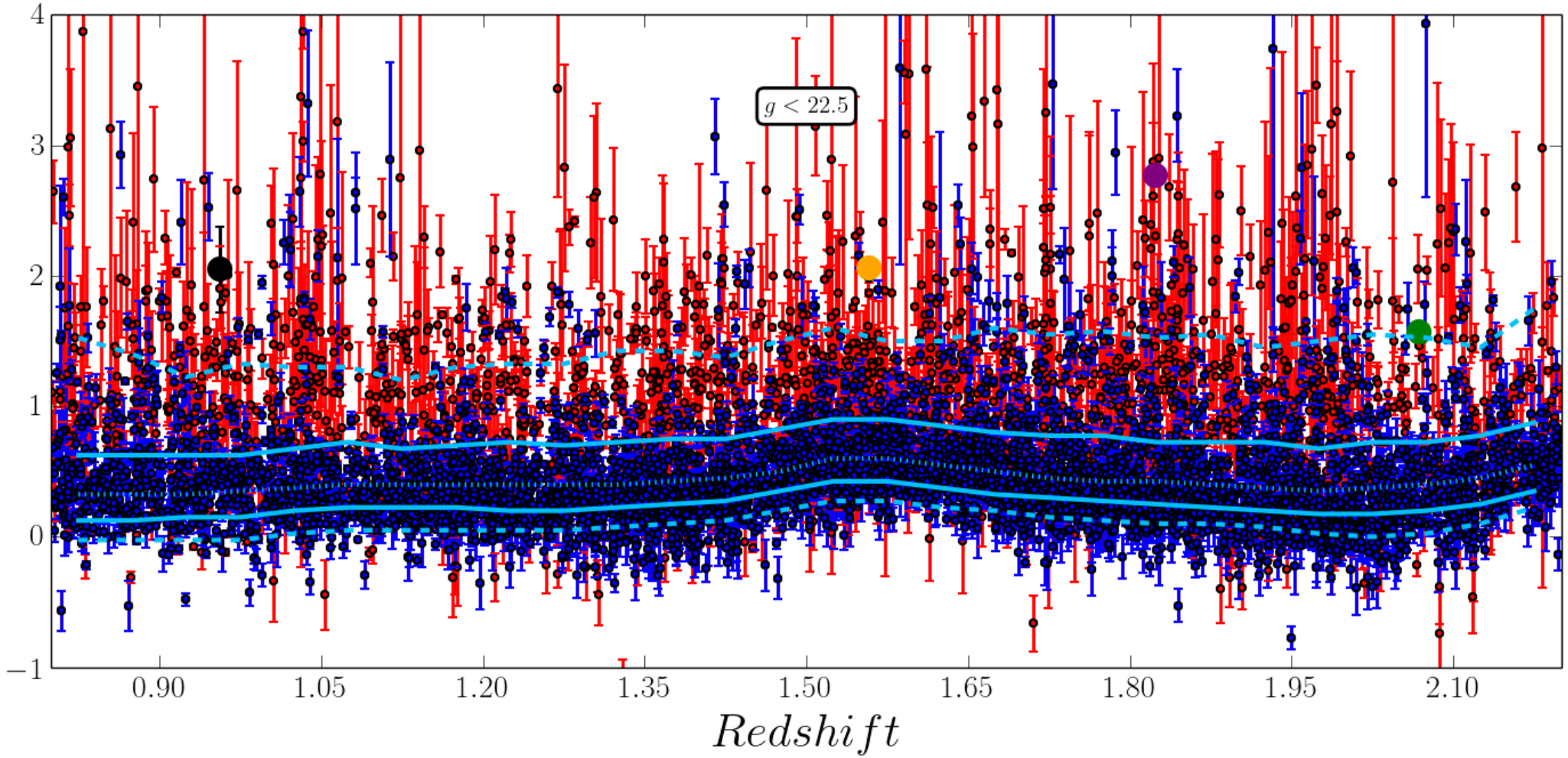
KX selection with WISE

- WISE identifies over 60 QSO per sq deg
- Optical selection increasingly important at faint end

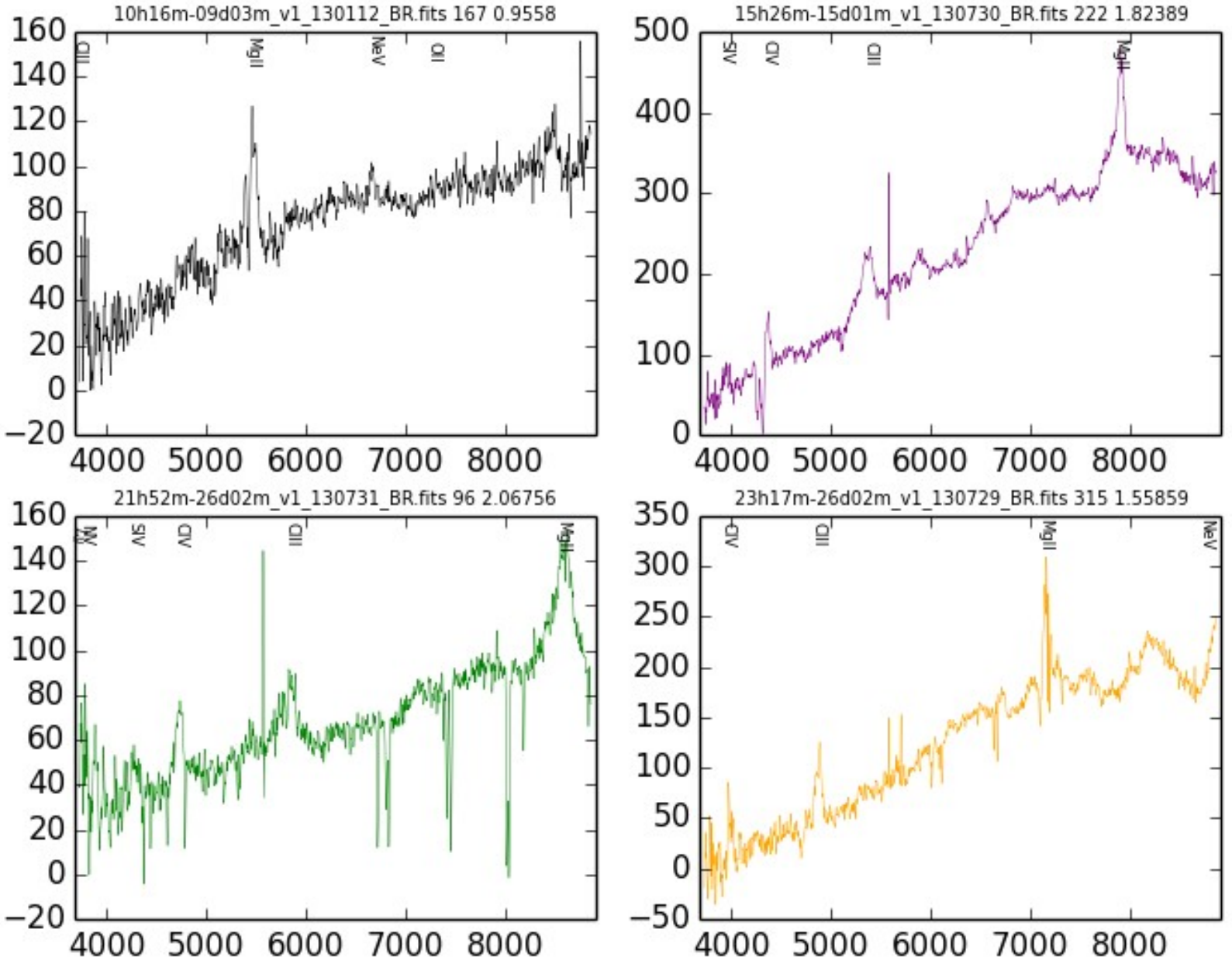




KX vs UVX Selection



'RED' quasars


10h16m-09d03m_v1_130112_BR.fits 167 0.9558
CIII
MgII
NeV
OI
15h26m-15d01m_v1_130730_BR.fits 222 1.82389
SiV
CIV
CIII
MgII
21h52m-26d02m_v1_130731_BR.fits 96 2.06756
MgII
23h17m-26d02m_v1_130729_BR.fits 315 1.55859
CIV
CIII
MgII
NeV

2QDES Pilot summary

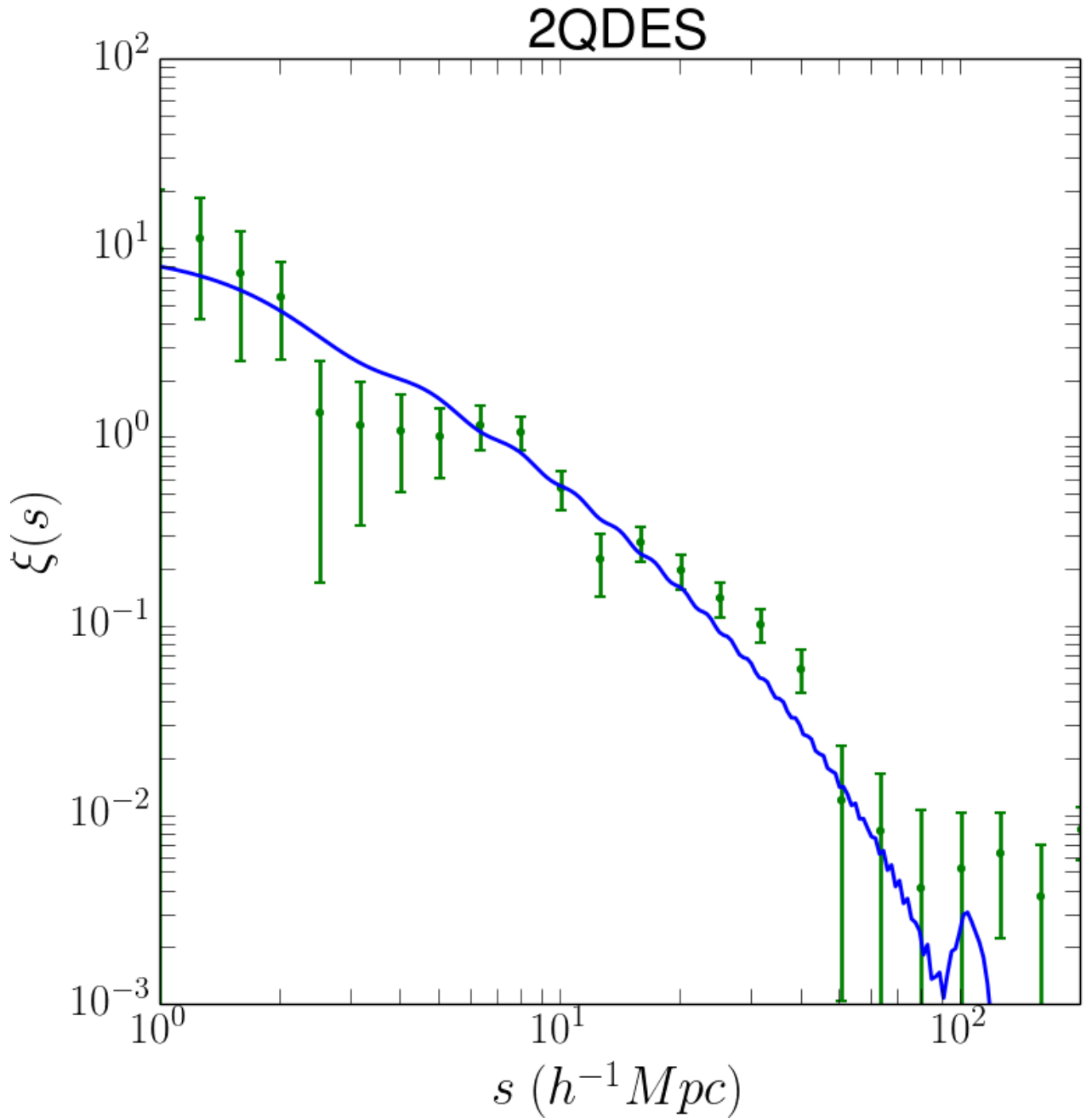
- Review
  - 17 nights
    - 10 000 quasar redshifts
  - 0.8 < z < 2.5 (1.55)
  - Optical-IR selection

  - Achieved desired QSO density
    - Not in every field

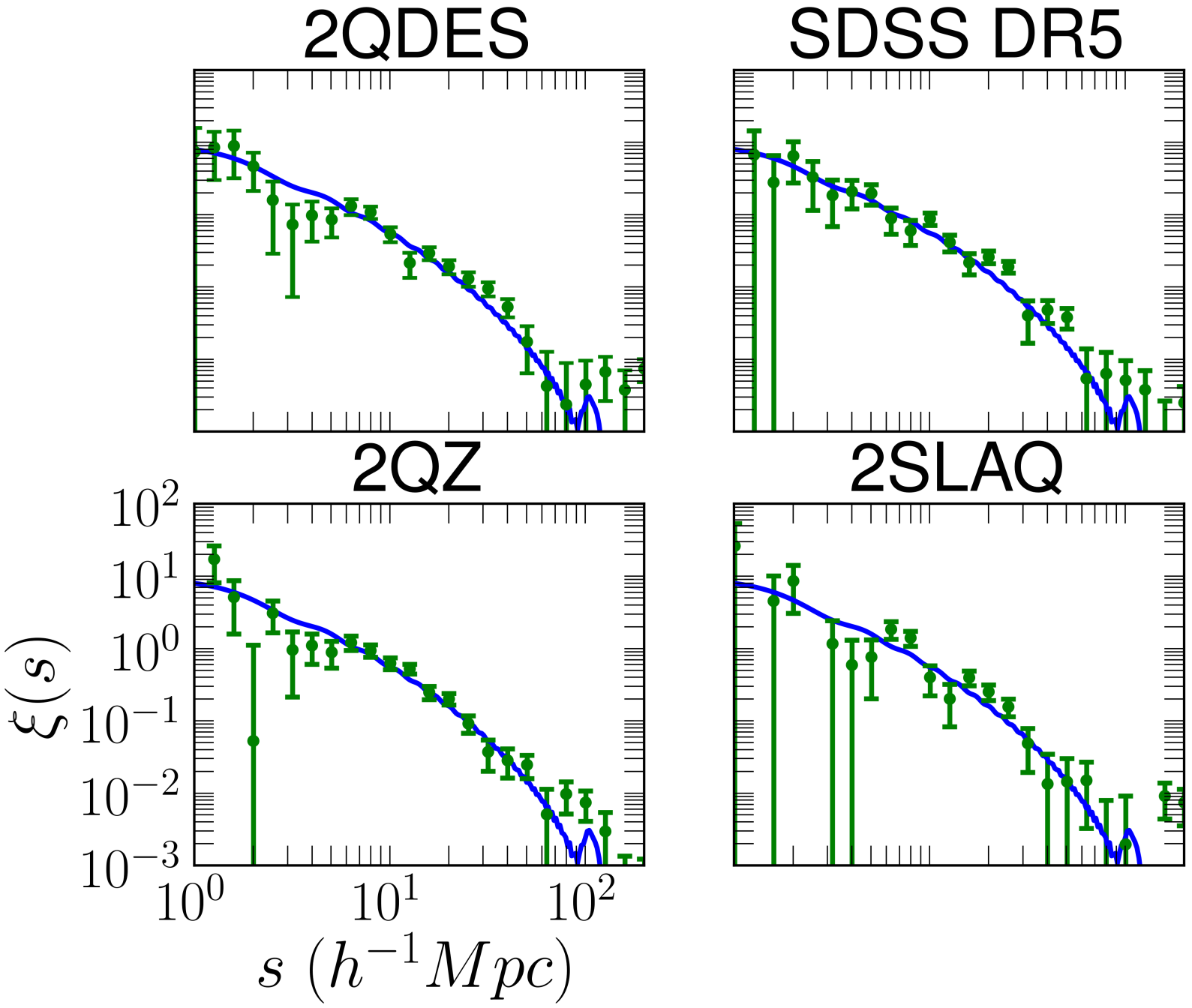
Conclusions of Pilot survey

- Very low contamination below g ~ 21
- Optical selection is markedly less efficient below this depth
    - Efficiencies come with caveat
- Combining XD technique and IR photometry
    - 85+ QSO per sq deg

Science results – Quasar autocorrelation

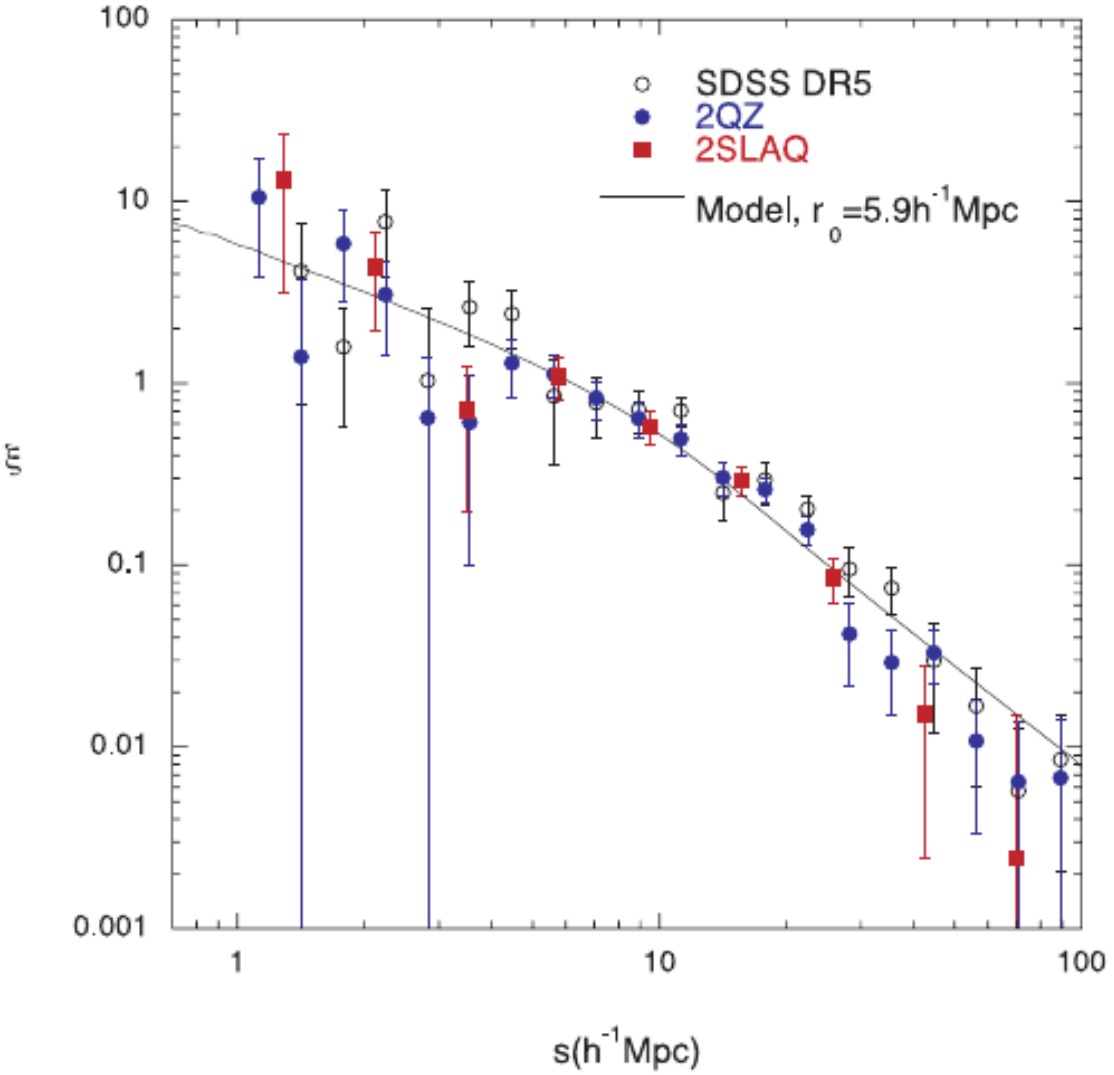


Comparison of clustering signal



Results from QSO clustering measurements

- Little or no luminosity dependence of clustering
  - Shanks et al., MNRAS 2011
  - Shen et al., ApJ 2013



2QDES 0.7mag fainter than 2SLAQ

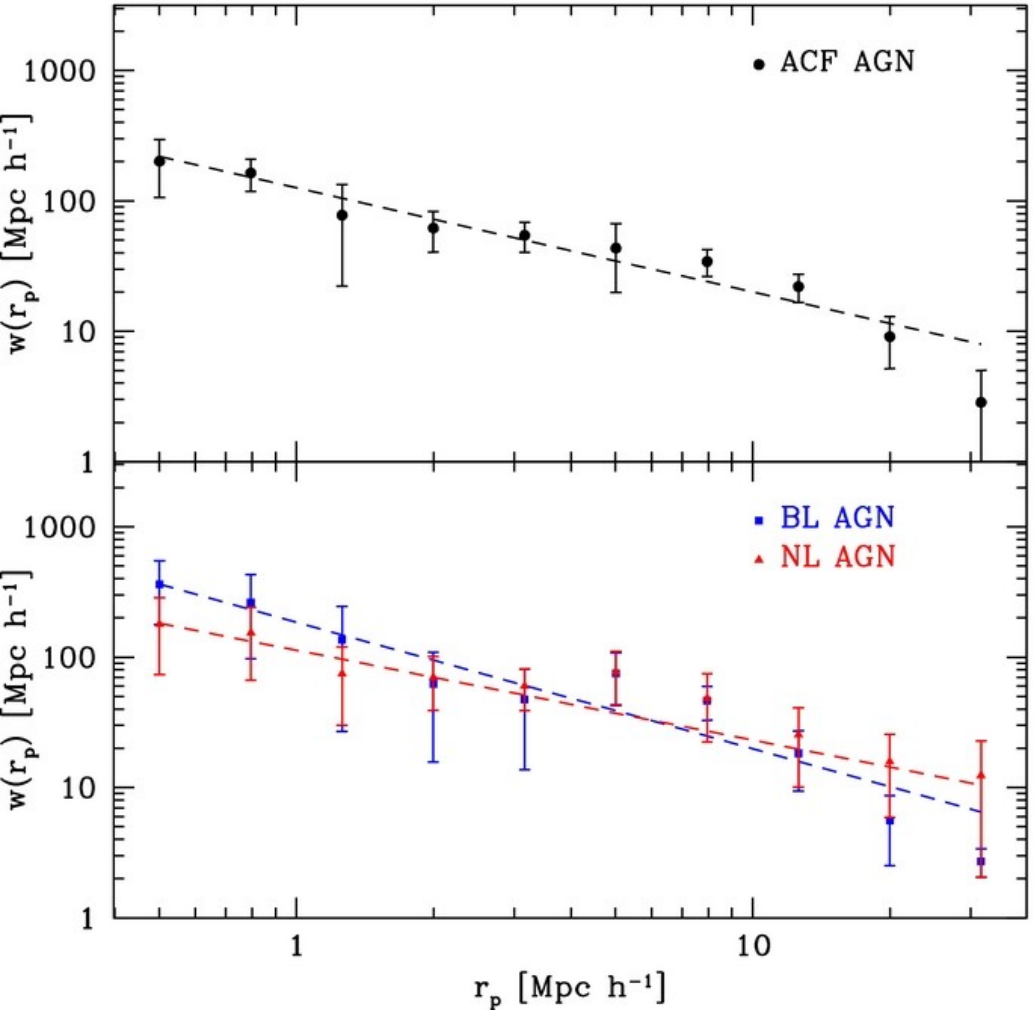
-23 < Mi < -28 (z=1.5)

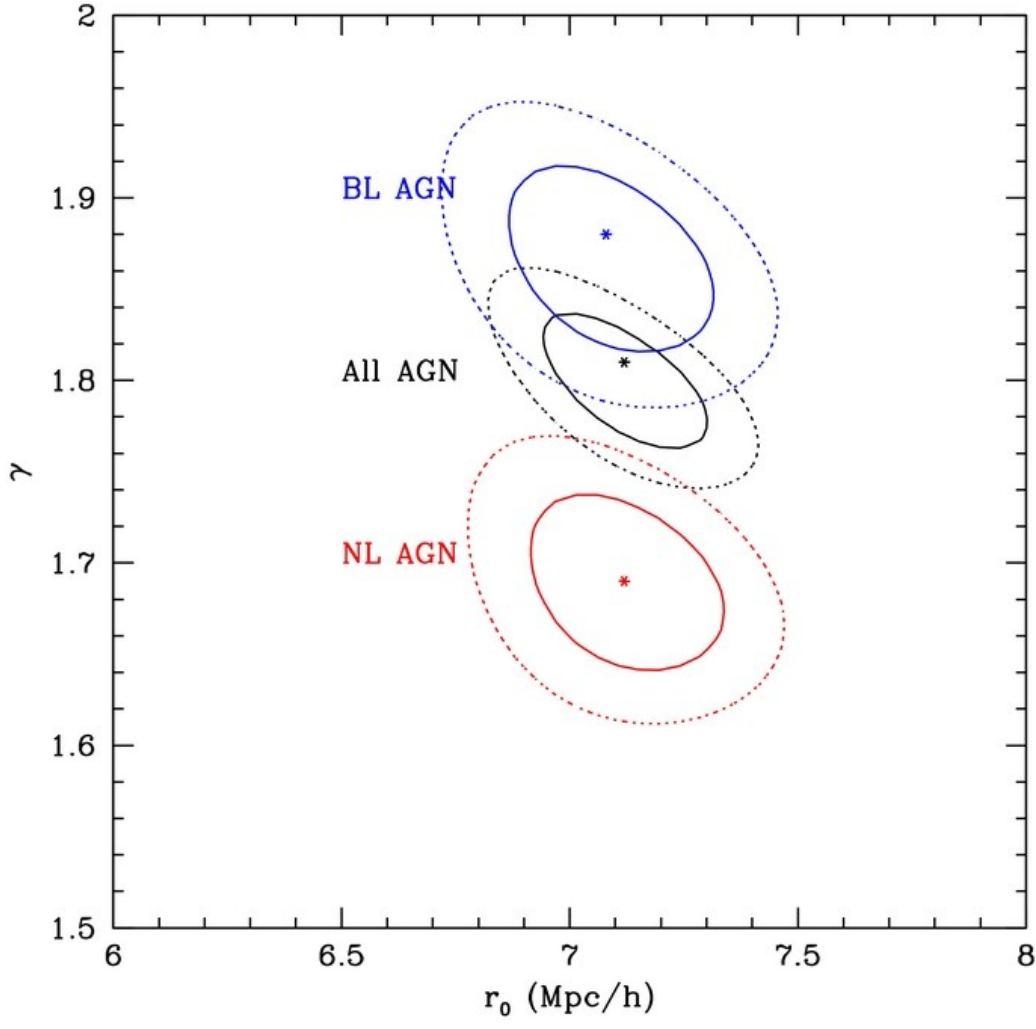
~double the number of faint g>21 QSOs

da Angela et al. MNRAS 2009

Results from QSO clustering measurements

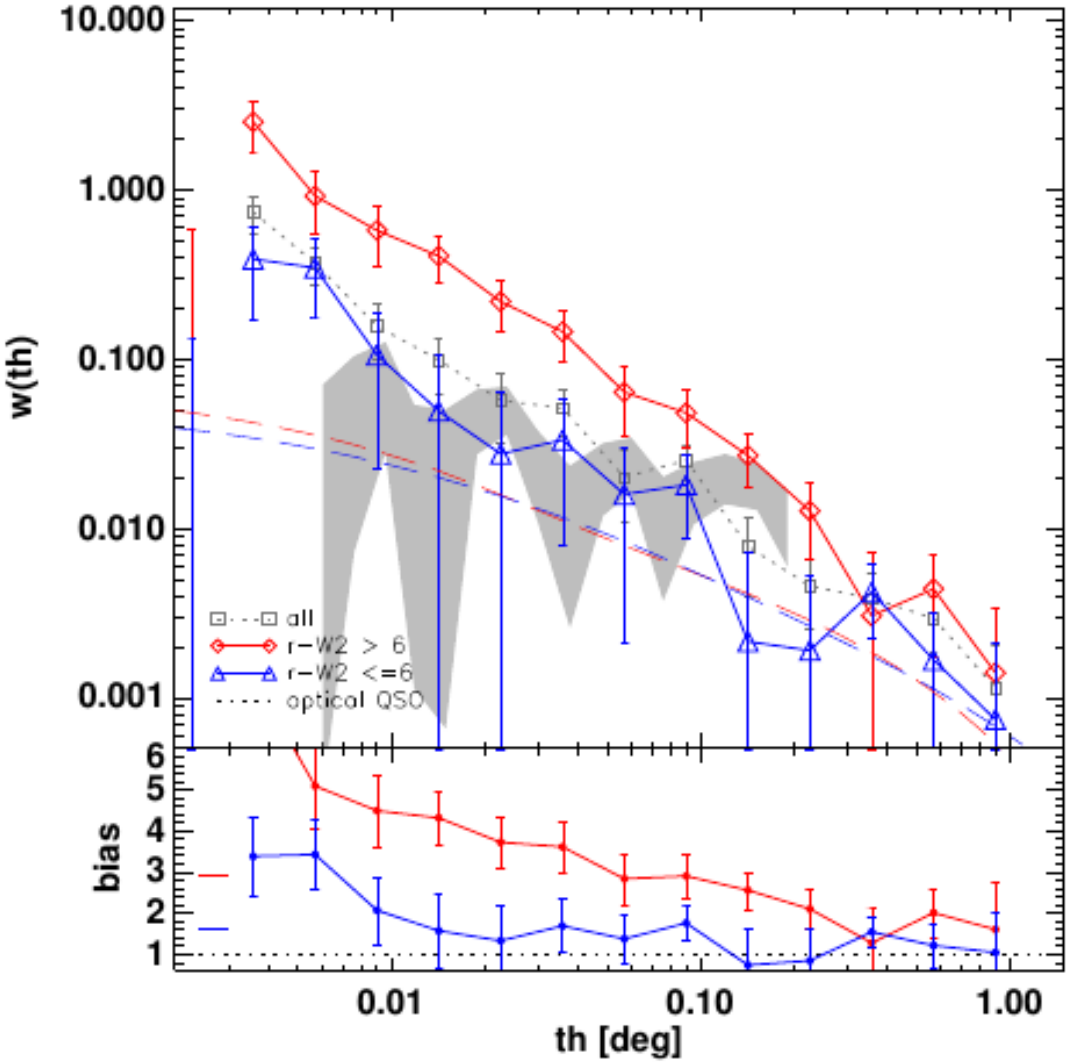
- Clustering scale (r0) (in)consistent between optical and X-ray surveys
  - Gilli et al., A&A 2009 & Allevato et al., ApJ 2011

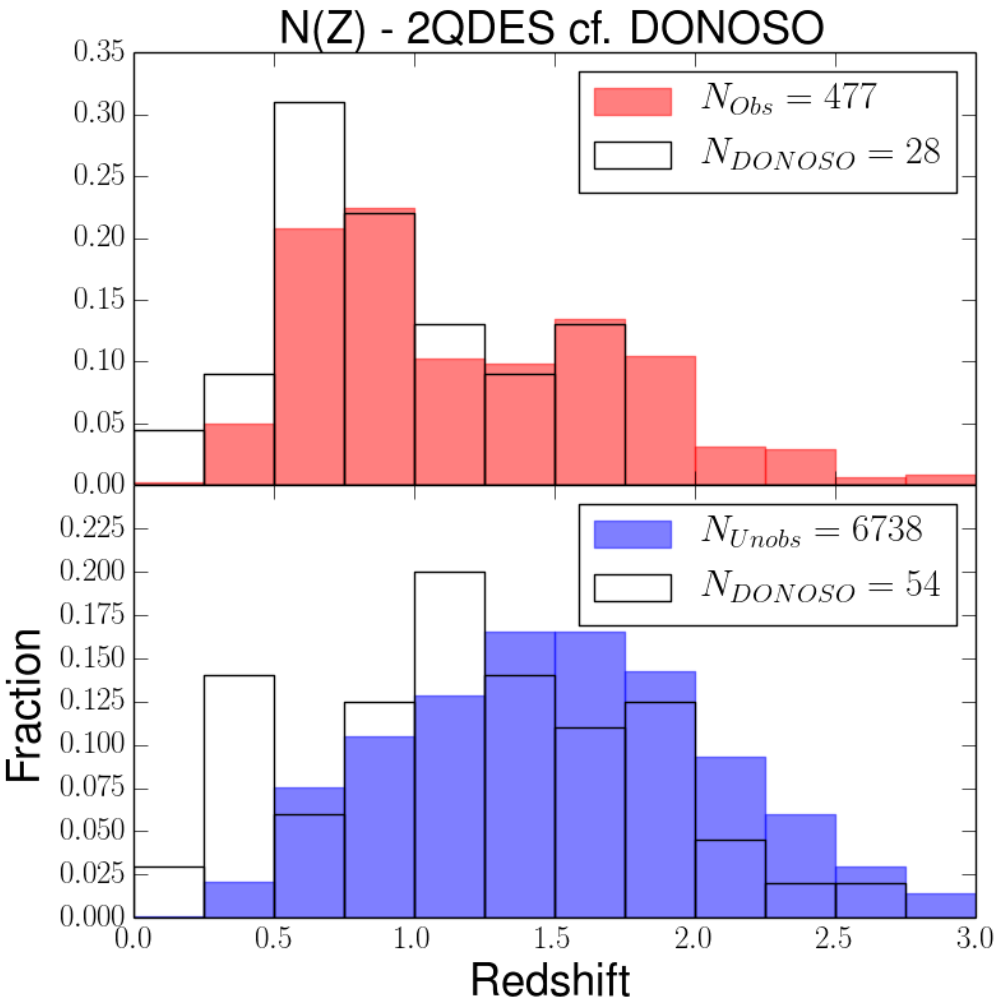




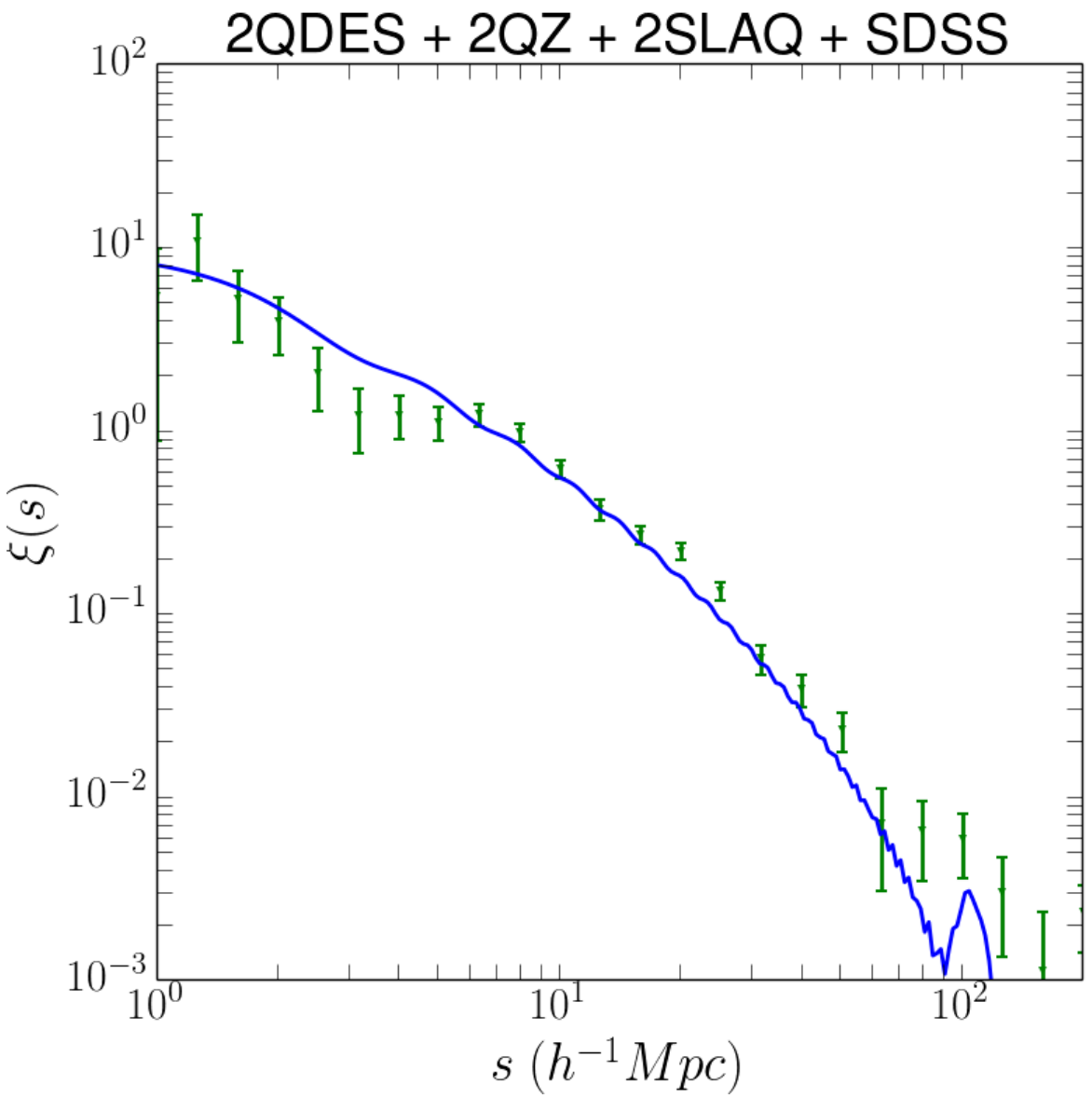
QSO Clustering

- Different clustering scale for Obscured vs Unobscured AGN
  - Donoso et al. 2013arXiv1309.2277D





QSO clustering at large scales



~85 000 Quasars
0.5 < z < 2.5

Low clustering amplitude at large scales

BAO peak undetected in QSO clustering

Summary

- Original aim measure BAO at z=1.5
- VST ATLAS + WISE
- UVX + KX selection -> 80 QSO per square degree

Ongoing work:

- QSO clustering
  - Luminosity dependence
  - Colour dependence
  - BAO

Tom Shanks

Joe Findlay

Nigel Metcalfe