

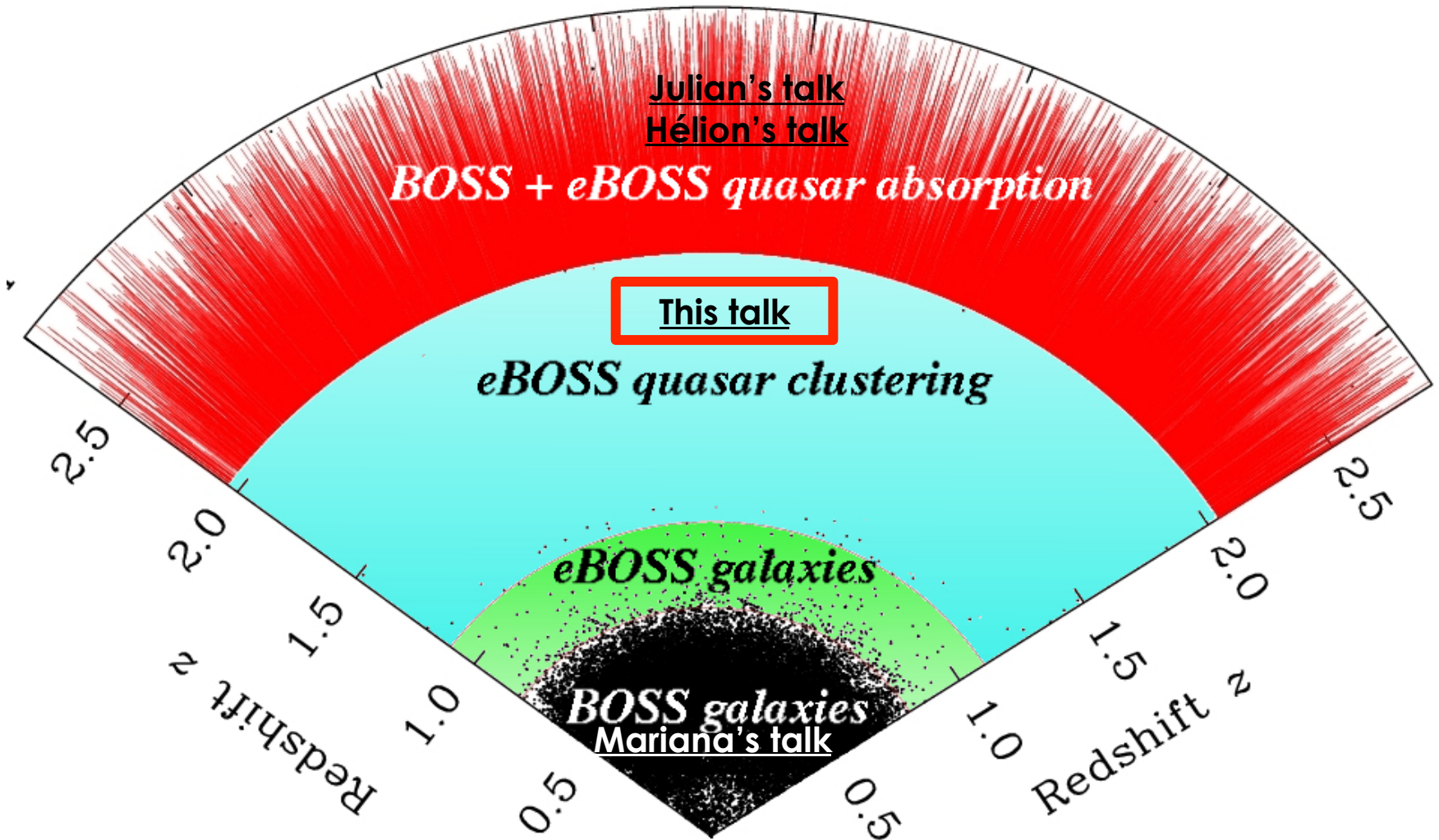


Pierre Laurent,  
CEA Saclay

# MEASURING BAO SCALE WITH QUASAR CLUSTERING IN EBOSS

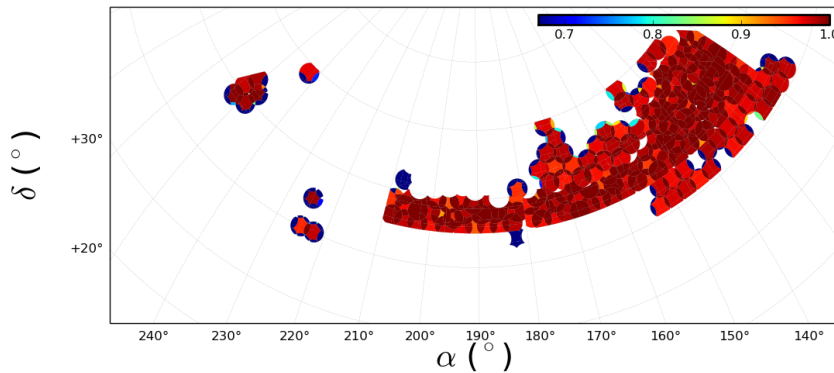
On behalf of the EBOSS clustering working group

# Measuring BAO at a new scale

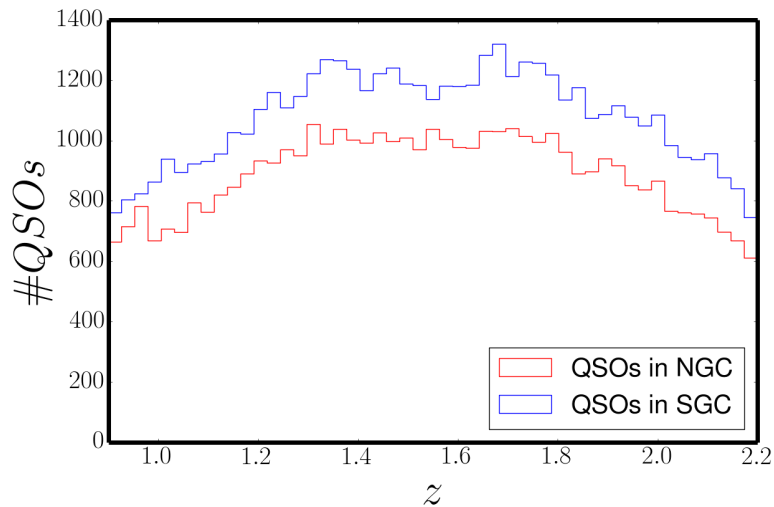
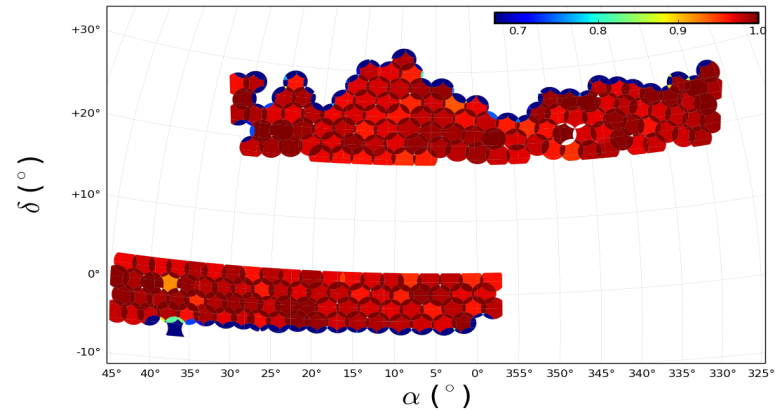


# The EBOSS QSO data sample

NGC



SGC



44,570 QSOs in NGC, (9,472 known)  
52,729 QSOs in SGC, (7,281 known)

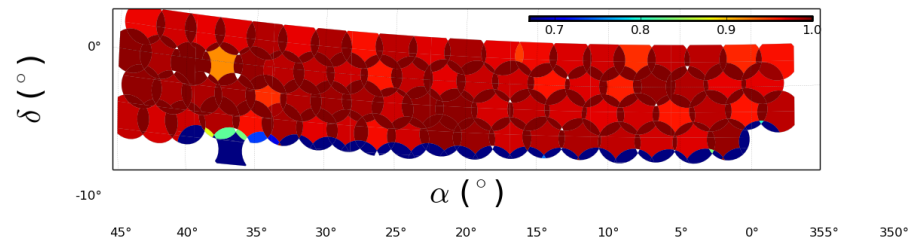
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Total (02/2016) = 97,299 QSOs (1,623 deg<sup>2</sup>)  
Expect  $\approx$  500,000 QSOs ( $\approx$  7,500 deg<sup>2</sup>)

# Computing $\xi(r)$ (naively)

- Completeness in each polygon :

$$C = \frac{N_{obs}}{N_{targets}}$$



- Generate random catalog with  $n_{randoms} \propto Area \times C$

- Compute :  $\xi(r) = \frac{DD(r)}{RR(r)} - 1$

# Computing $\xi(r)$

- Completeness defined as :

$$C = \frac{N_{obs} + N_{collisions}}{N_{targets} - N_{known}}$$

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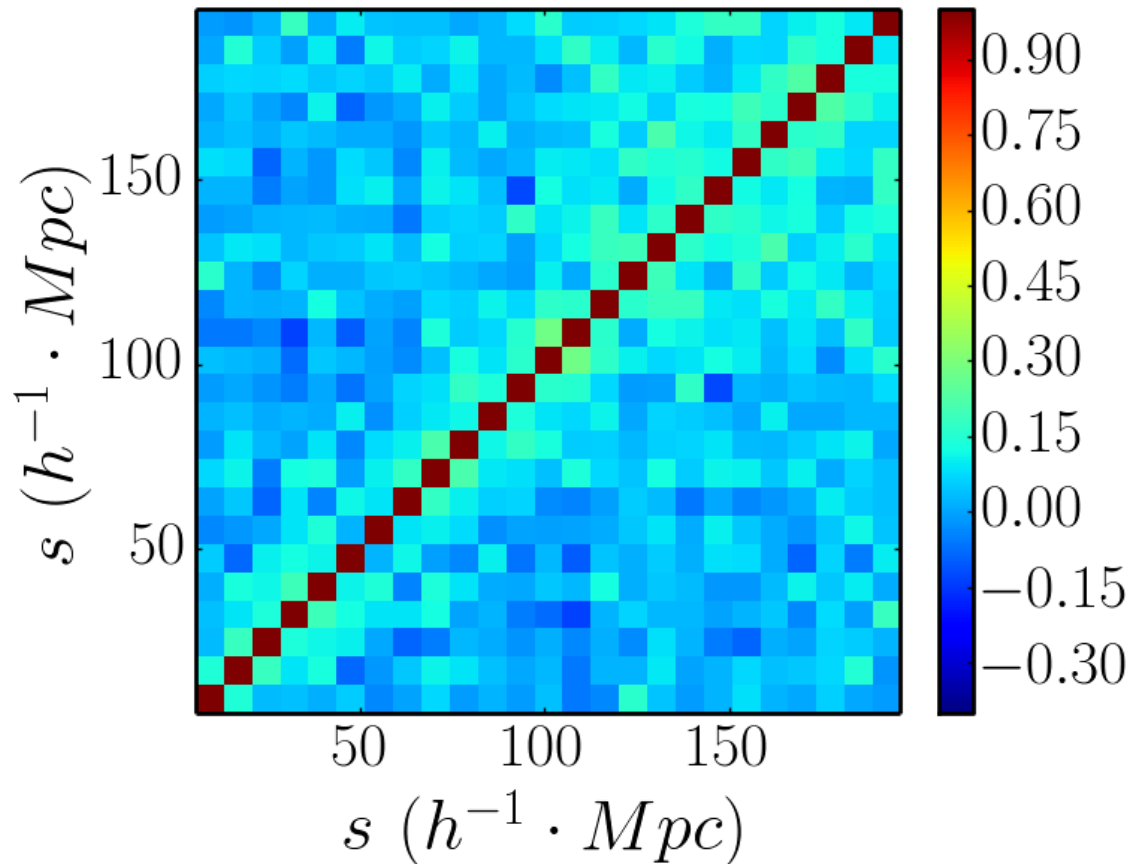
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- Use Landy-Szalay estimator :  $\xi_{LS}(r) = \frac{DD(r) - 2DR(r) + RR(r)}{RR(r)}$

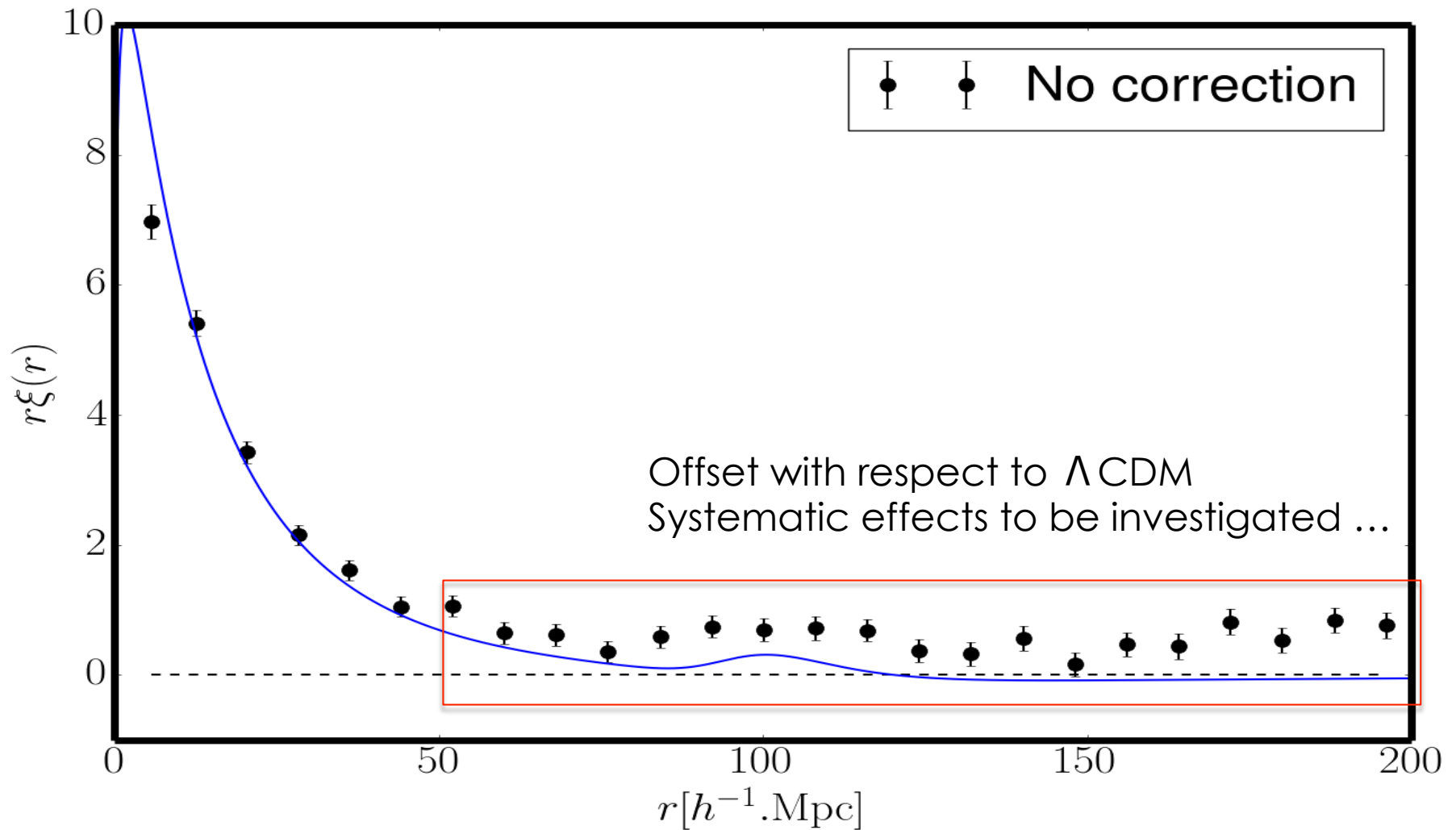


# Covariance matrices

- Computed from Bootstrap realizations (mocks ongoing)
- This neglects cosmic variance, but survey shot-noise limited

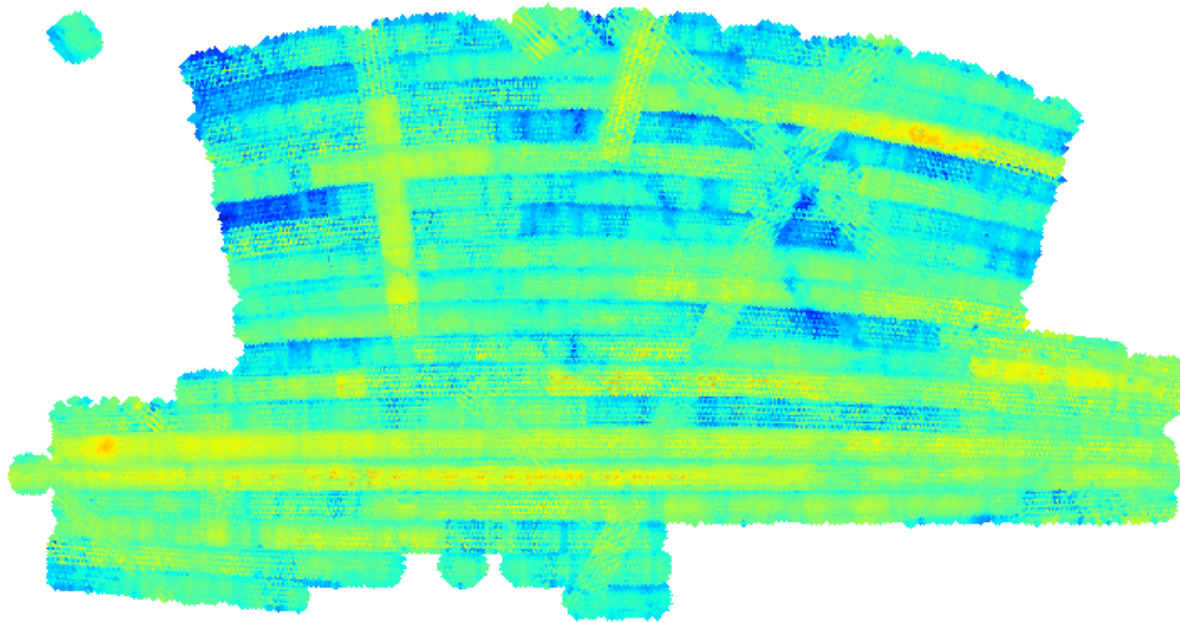


# 'Raw' results for $\xi(r)$



# What systematic effects ?

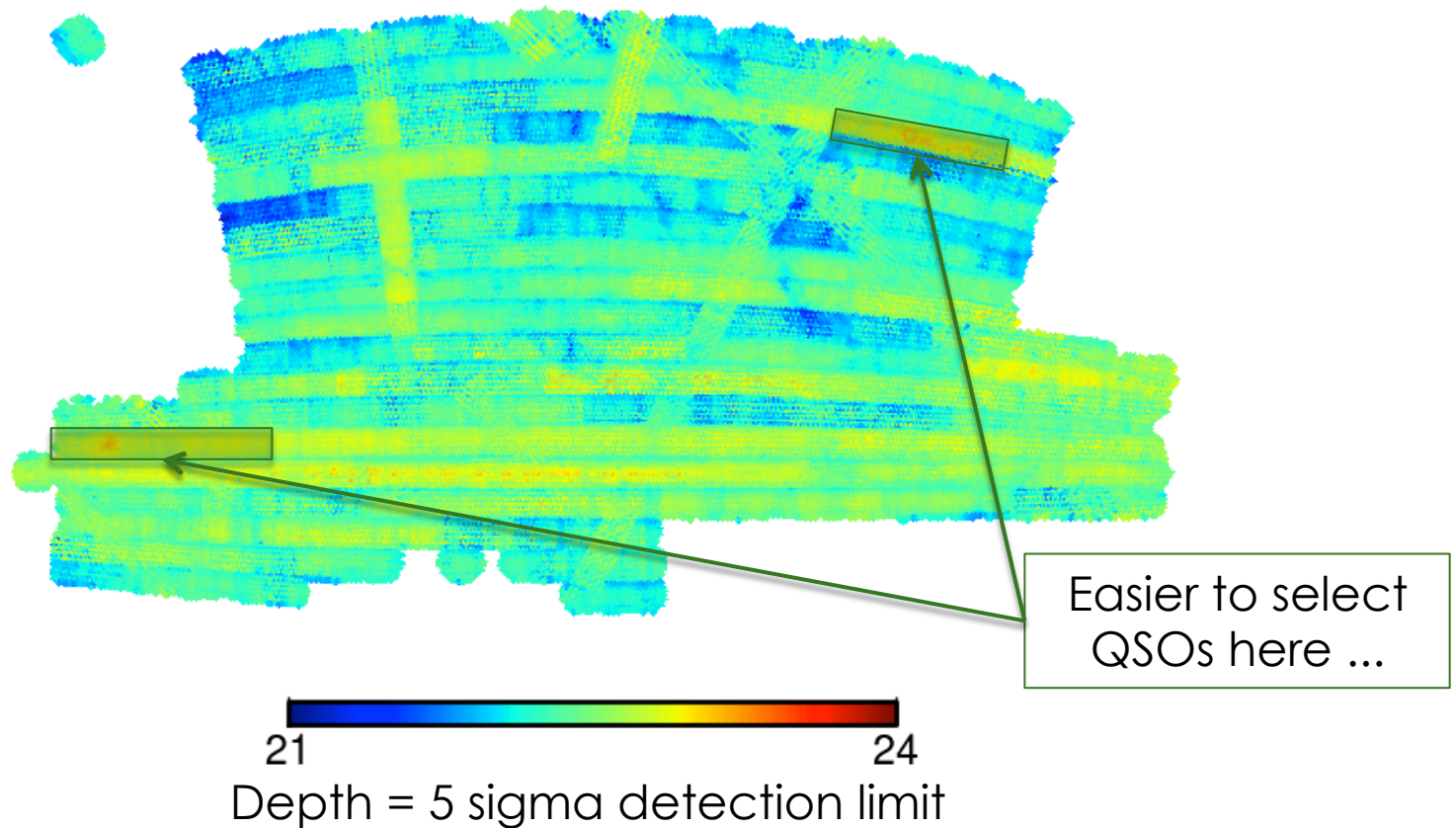
1) Inhomogeneity in target selection (TS)



21  24  
Depth = 5 sigma detection limit

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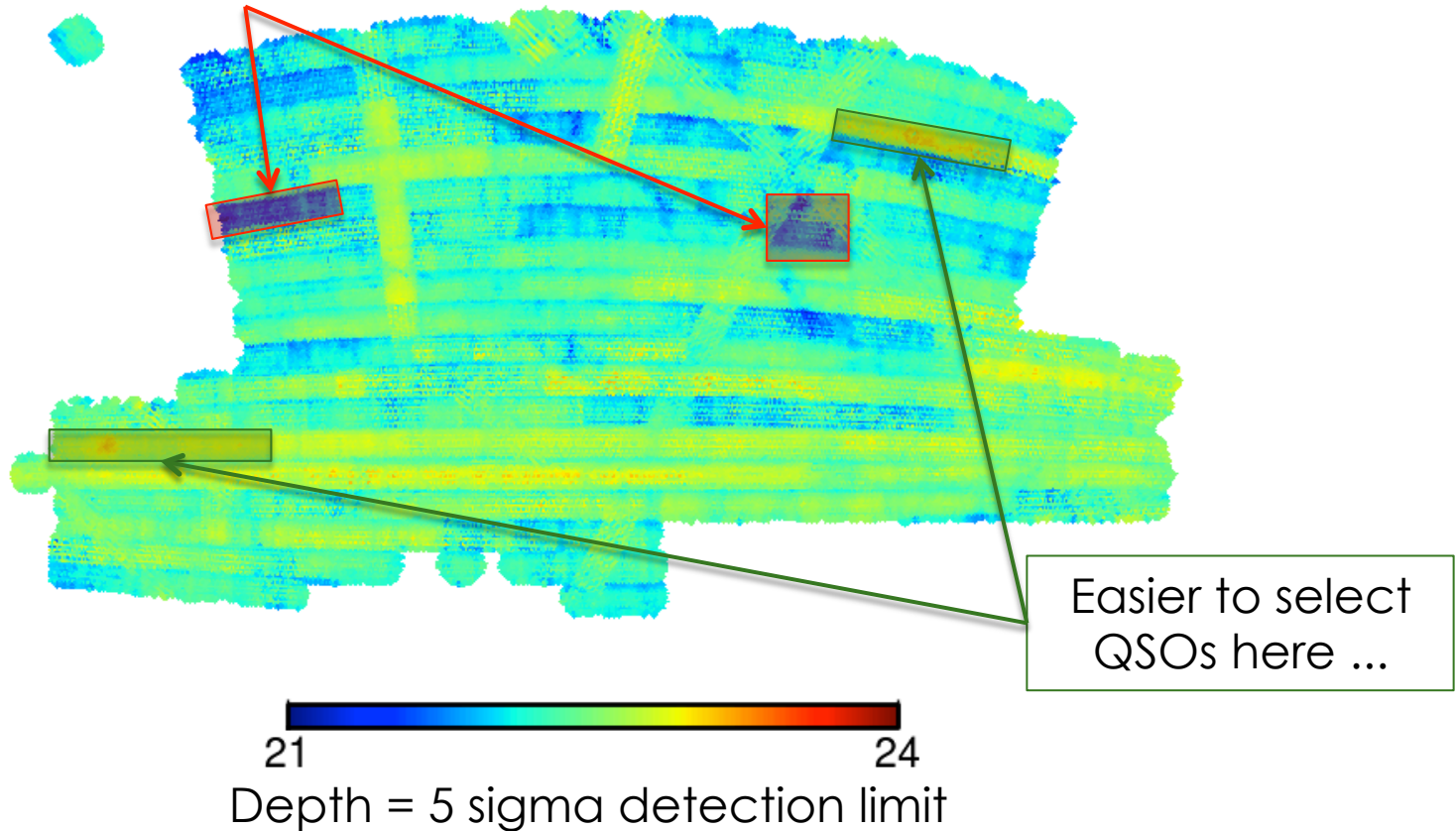
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# What systematic effects ?

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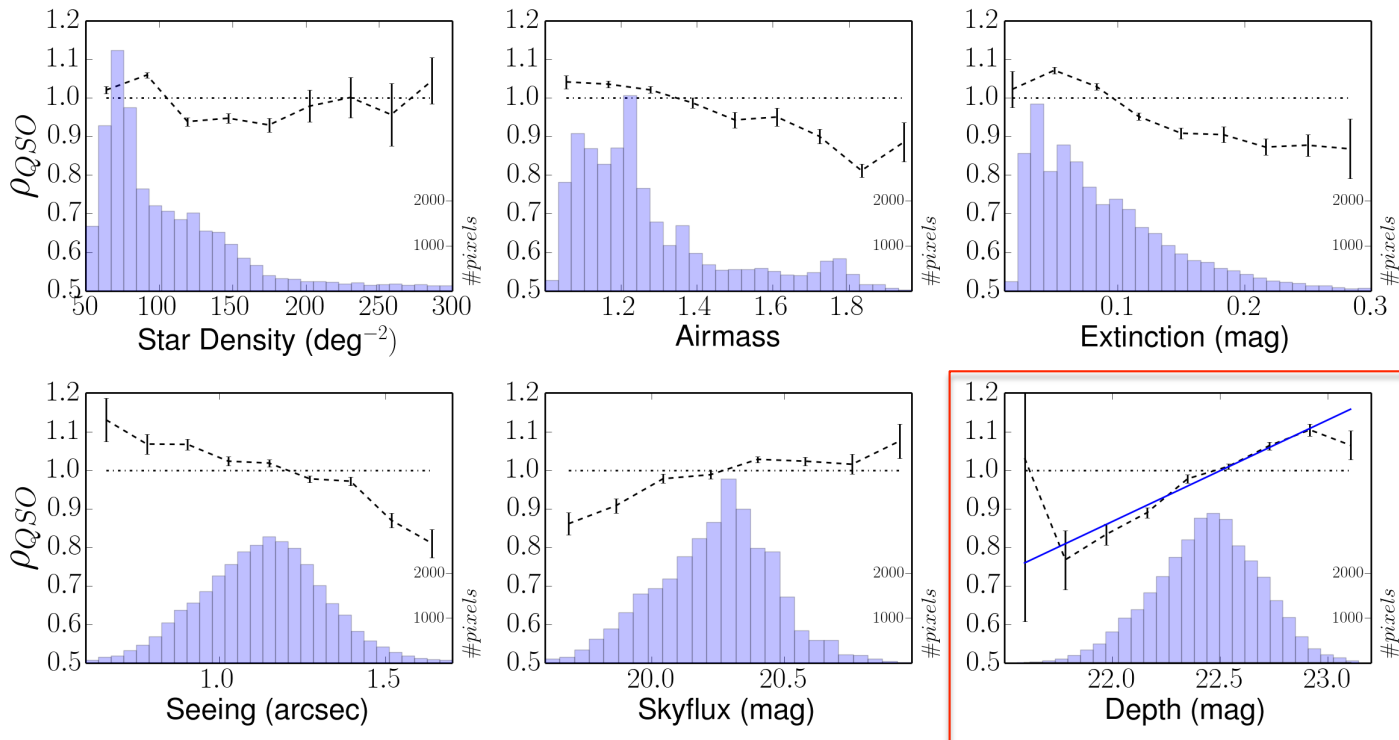
... than here !



# Sources of systematics

## 1) Inhomogeneity in target selection (TS)

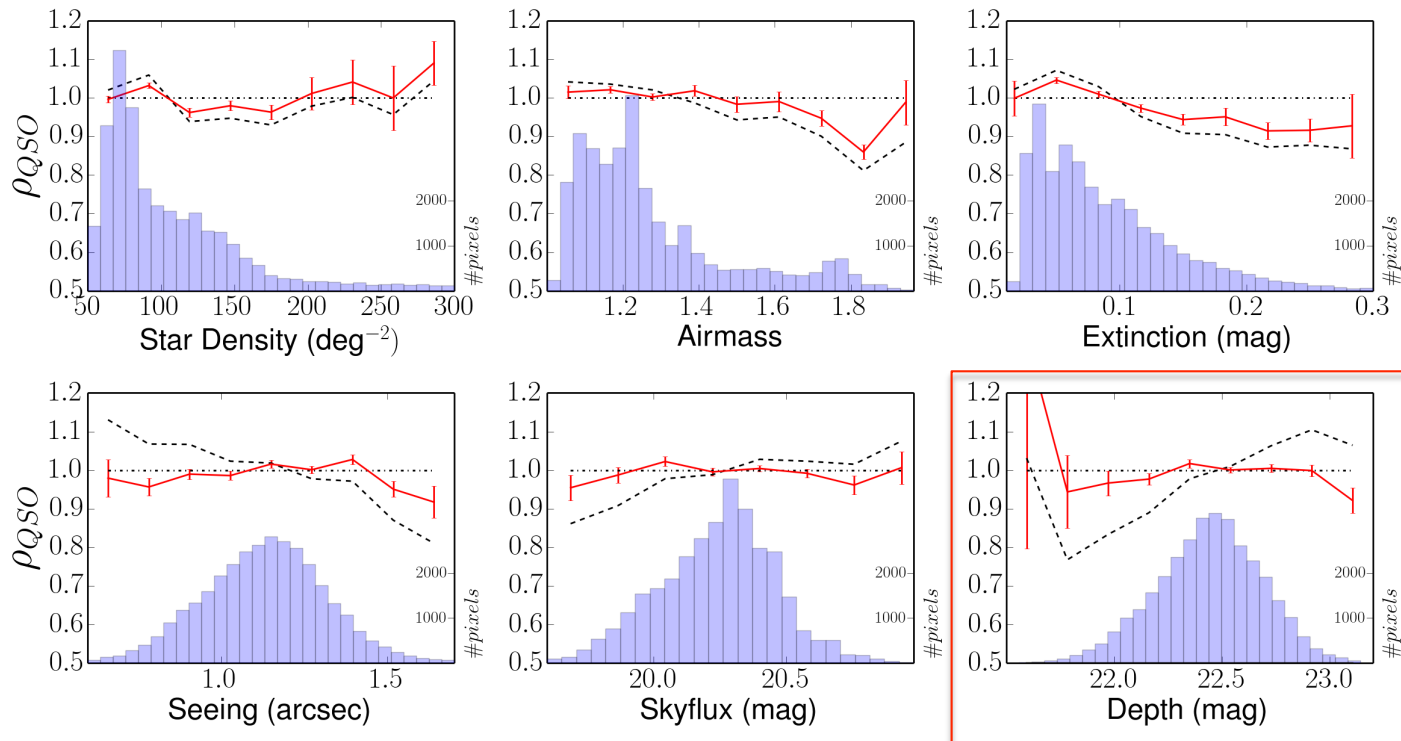
Quasars selected from inhomogeneous photometric survey  $\rightarrow \rho_{QSO}$  varies with photometry !



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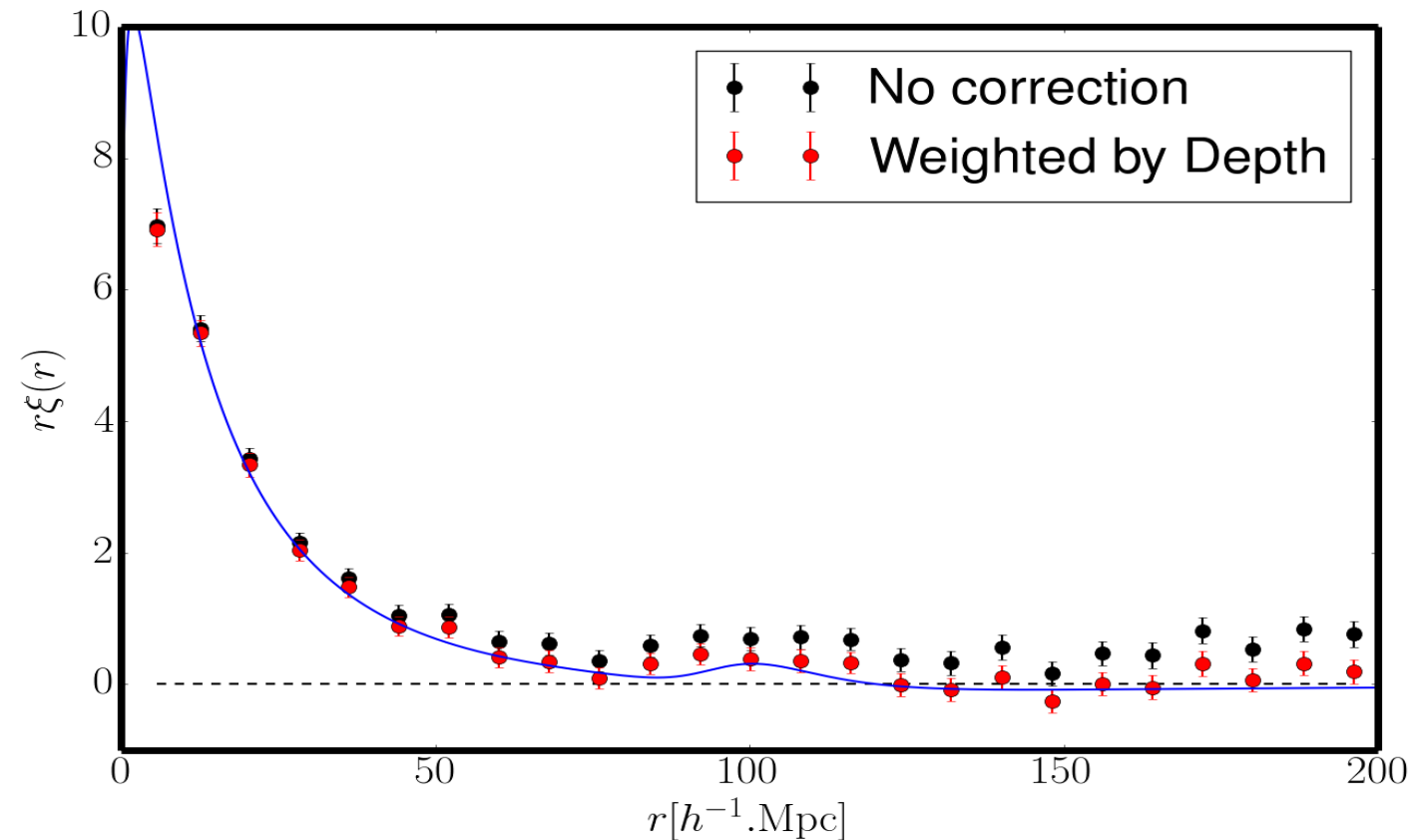
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QSO density corrected for TS inhomogeneity

# Sources of systematics

## 1) Inhomogeneity in target selection (TS) Compatible with $\Lambda$ CDM



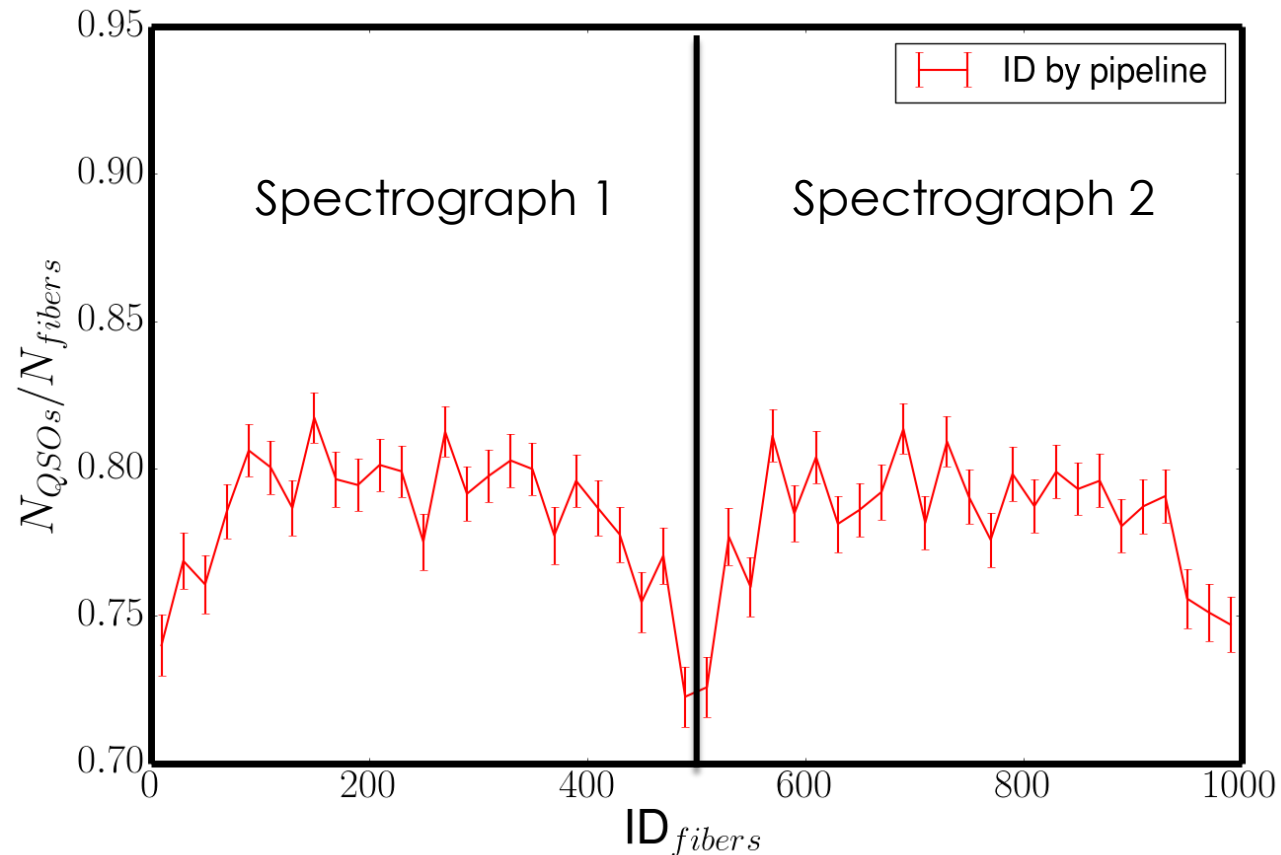
Corrected  $\xi(r)$  for  
TS inhomogeneity



# Sources of systematics

## 2) Inhomogeneity in target identification

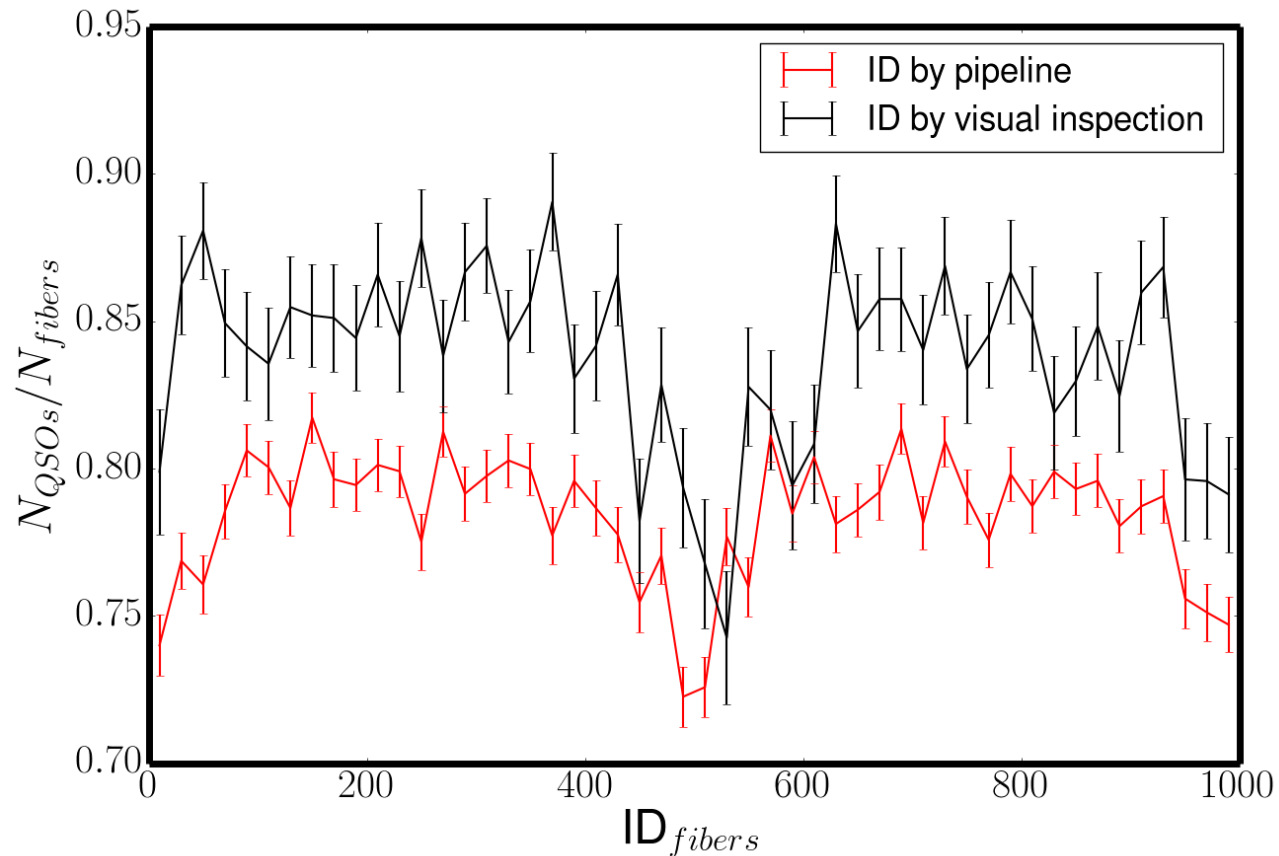
- Depend on the position of the fiber in the 2 spectrographs



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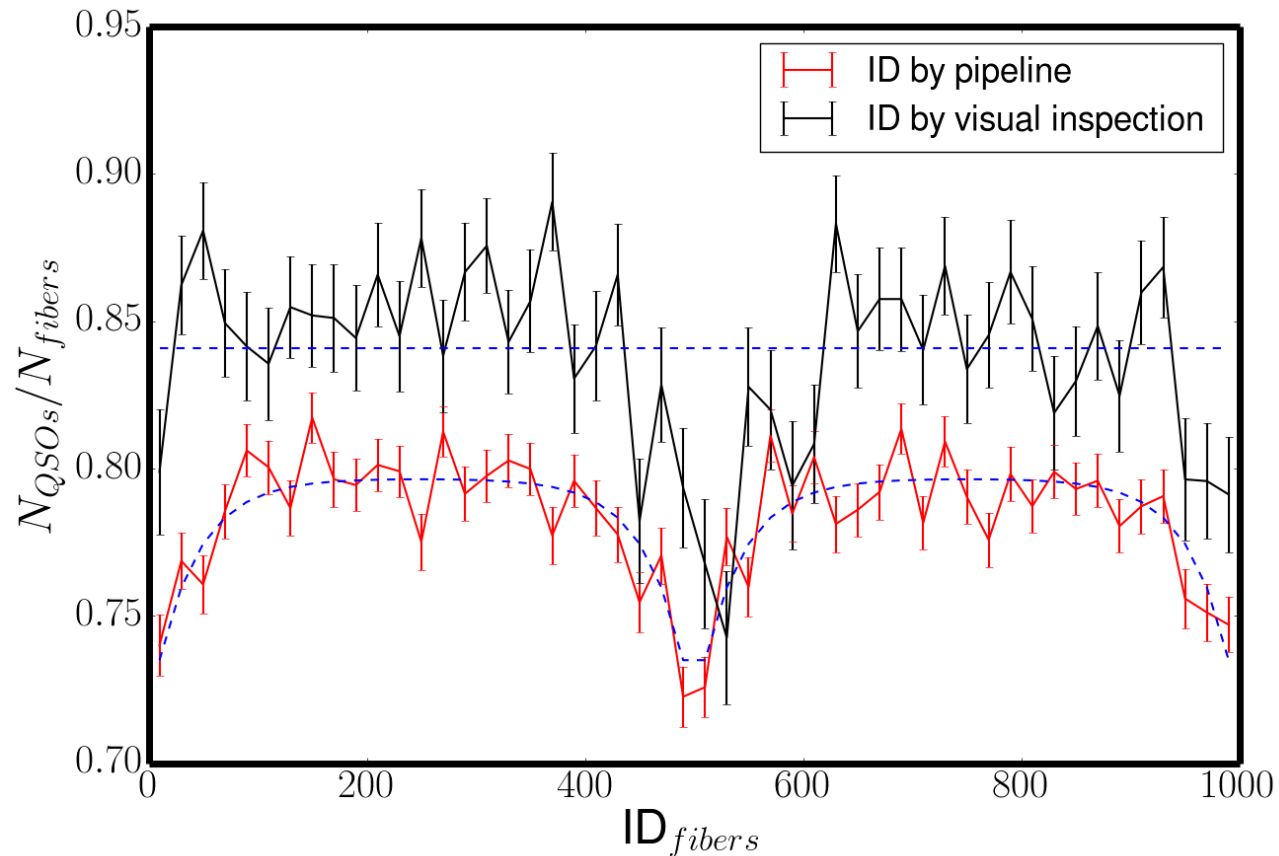
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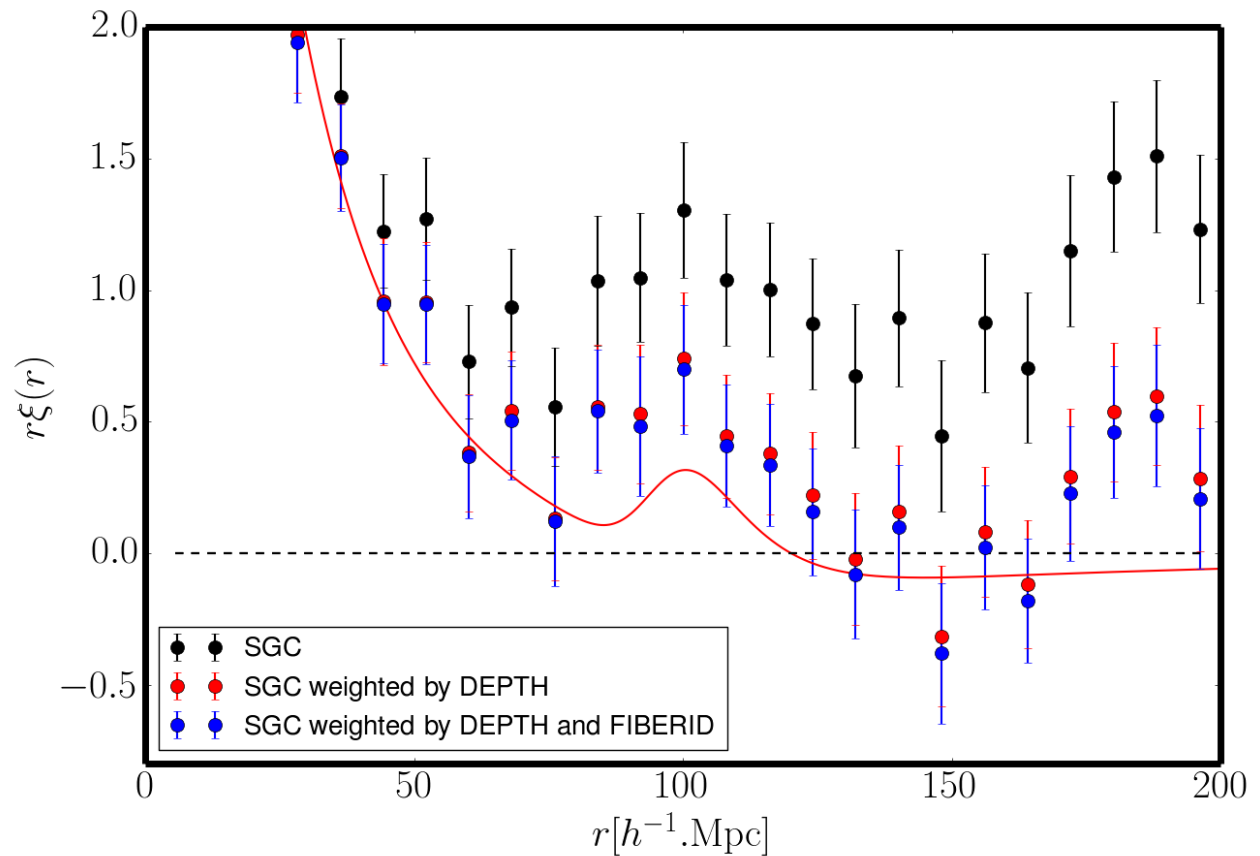
- Depend on the position of the fiber in the 2 spectrographs
- Known targets were visually inspected : higher efficiency of identification
- Apply different weightings for known and data ...



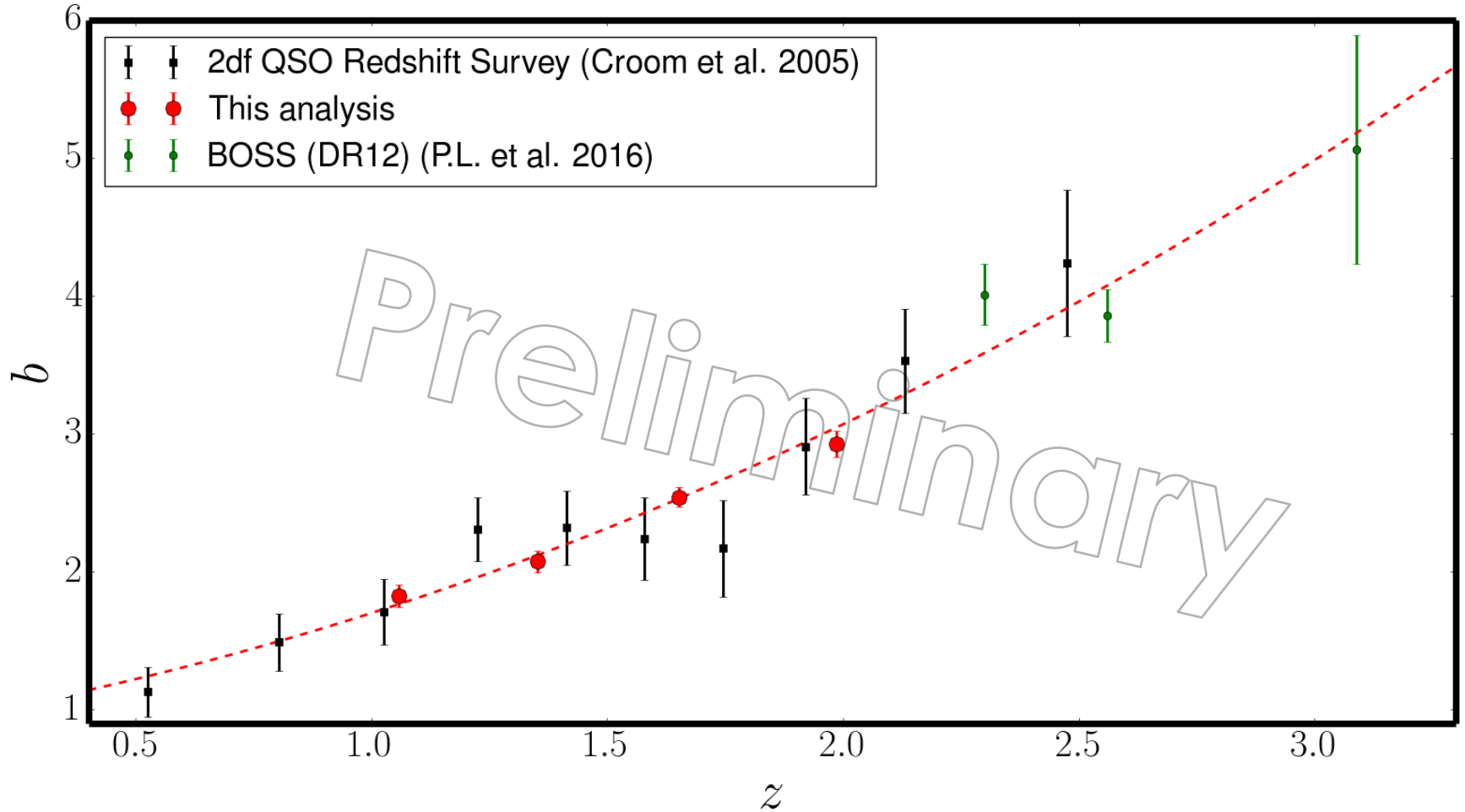
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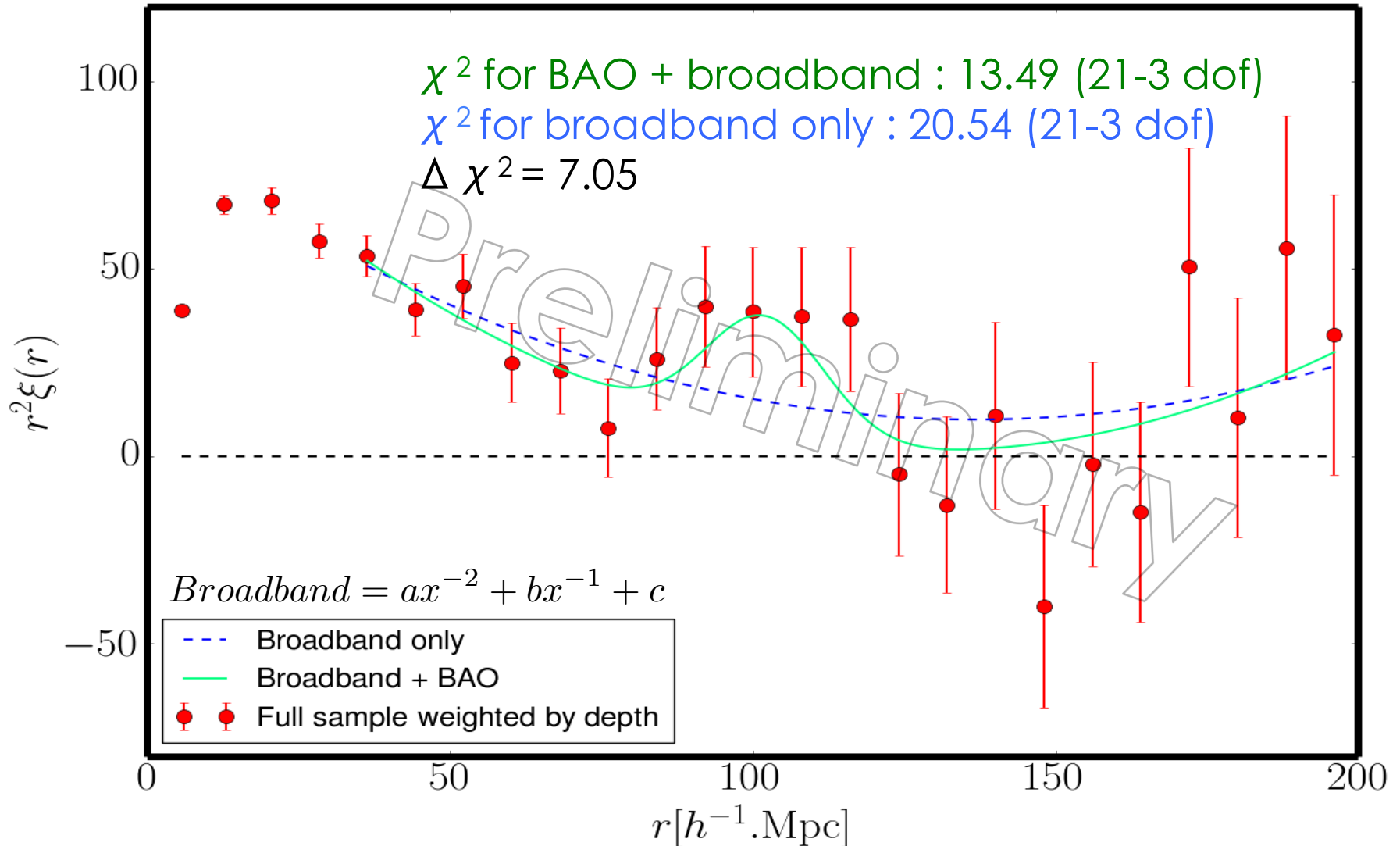
- Correlation function after weighting :



# Results



# Hints for BAO

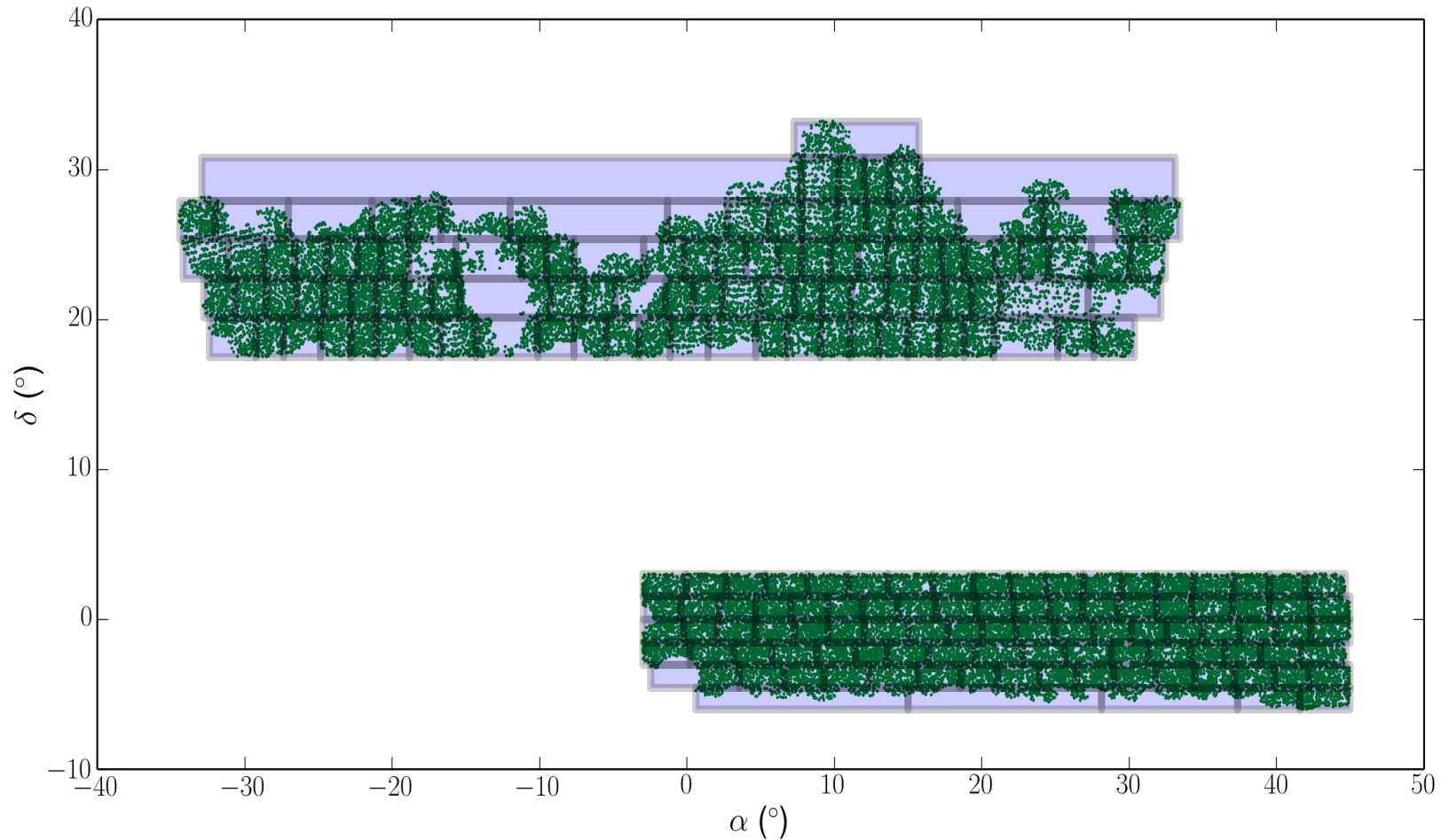


# Conclusion

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- ◆ Good mitigation of systematic effects (P.L. et al., to be published)
- ◆ BAO scale in agreement with  $\Lambda$ CDM model
- ◆ Only 20% of the full QSO sample

# More about bootstraps





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- Take 1 cell, compute all pairs distances within this cell, and do the same with half of the remaining cells → this is 1 subsample
- Do the same with all cells, avoiding double-counting → N subsamples
- Draw randomly (with repetition) N subsamples, then compute  $\xi(r)$  → 1 realization

# More about bootstraps

