Statut/Résultats

# Roadmap BOSS, eBOSS Resampling & cosmic voids

**zSURVEY meeting**

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CPPM - December 8-9, 2015

# Covariance matrix with mocks

# Computation of the error

Under the joint work of combining lensing and clustering data with LAM (cf. Eric's talk and Sylvain's talk):

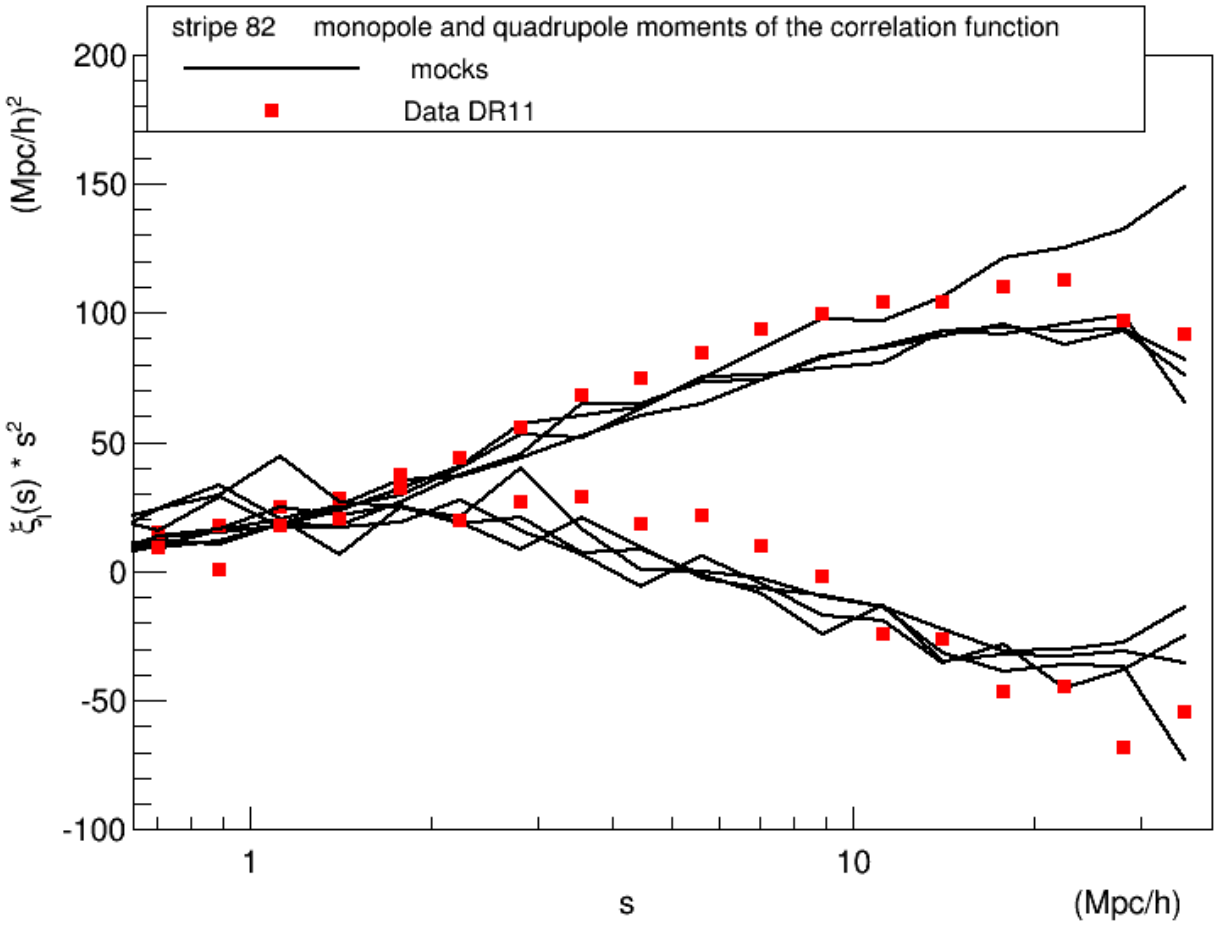
- Clustering variables $\varepsilon_0$ (monopole) and $\varepsilon_2$ (quadrupole), as a function of R
  = 11 bins x 2

- Lensing variable $\Delta\Sigma$, as a function of R
  = 15 bins

Errors computed from the inverse covariance matrix
➔ Necessity to have at least 37 independent galaxy mocks

And we have only 4 mocks lightcone for the Stripe 82 region

# Correlation function on S82



# Jackknife method

Usually used on data sample, jackknife is a resampling technique.

Given *n* subsamples, we can compute :

An estimator of the mean value $$\bar{x} = \frac{1}{N}\sum_j x_j$$

and an estimator of the variance $$\hat{\sigma}^2 = \frac{1}{N-1}\sum_j \left(x_j - \bar{x}\right)^2$$

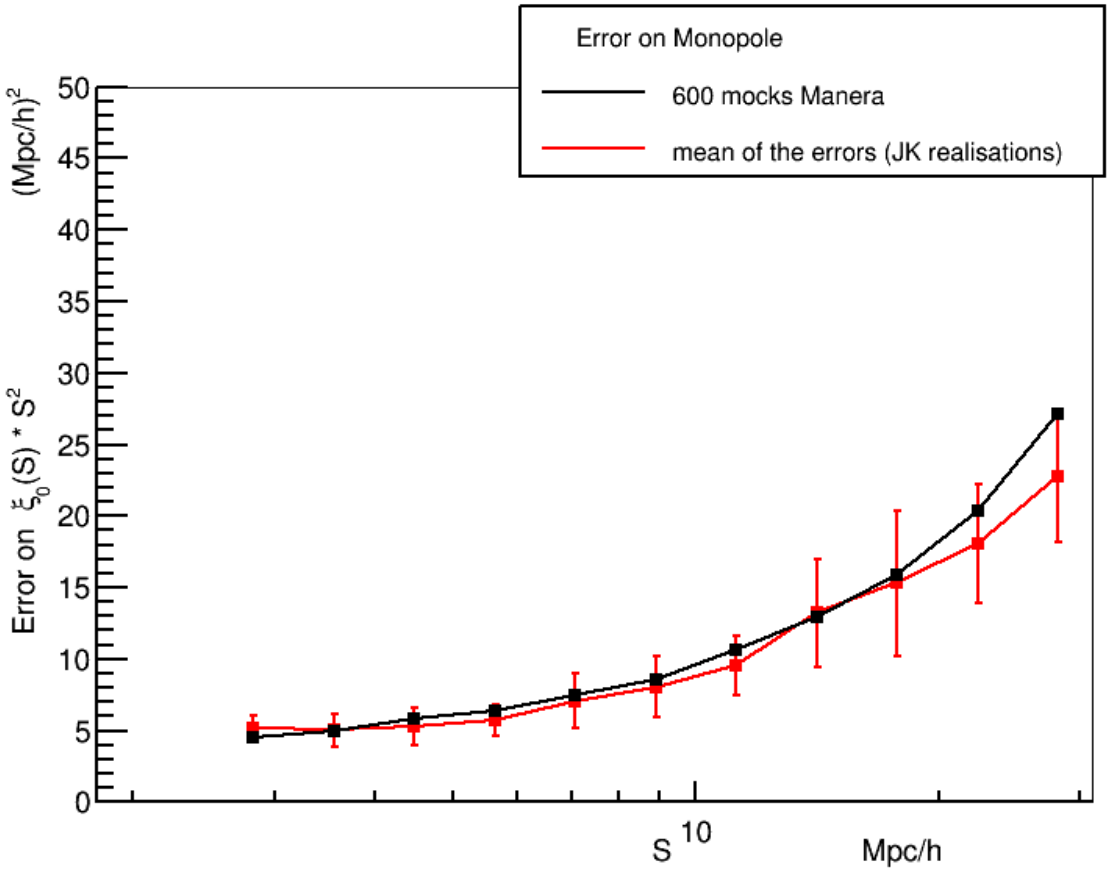
# Jackknife method

Idea is to applied jackknife resampling method on mocks.

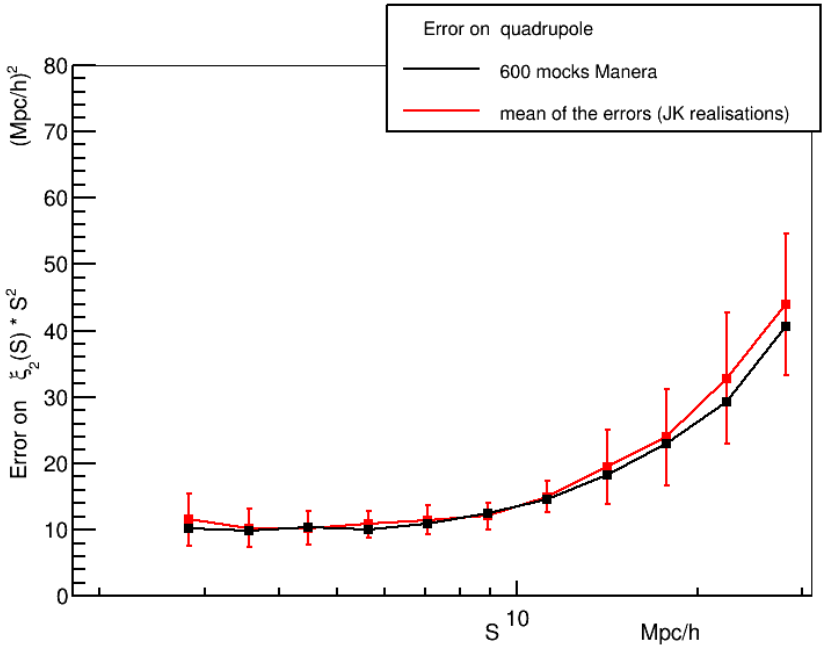
And to validate the method, we have used 600 BOSS mocks (public) from Manera (Manera et al. 2013):

- particle based 2LPT matter field
- halos identification using a friends-of-friends algorithm (FoF)
- Populate PT halos with galaxies using a halo occupation distribution (HOD) algorithm

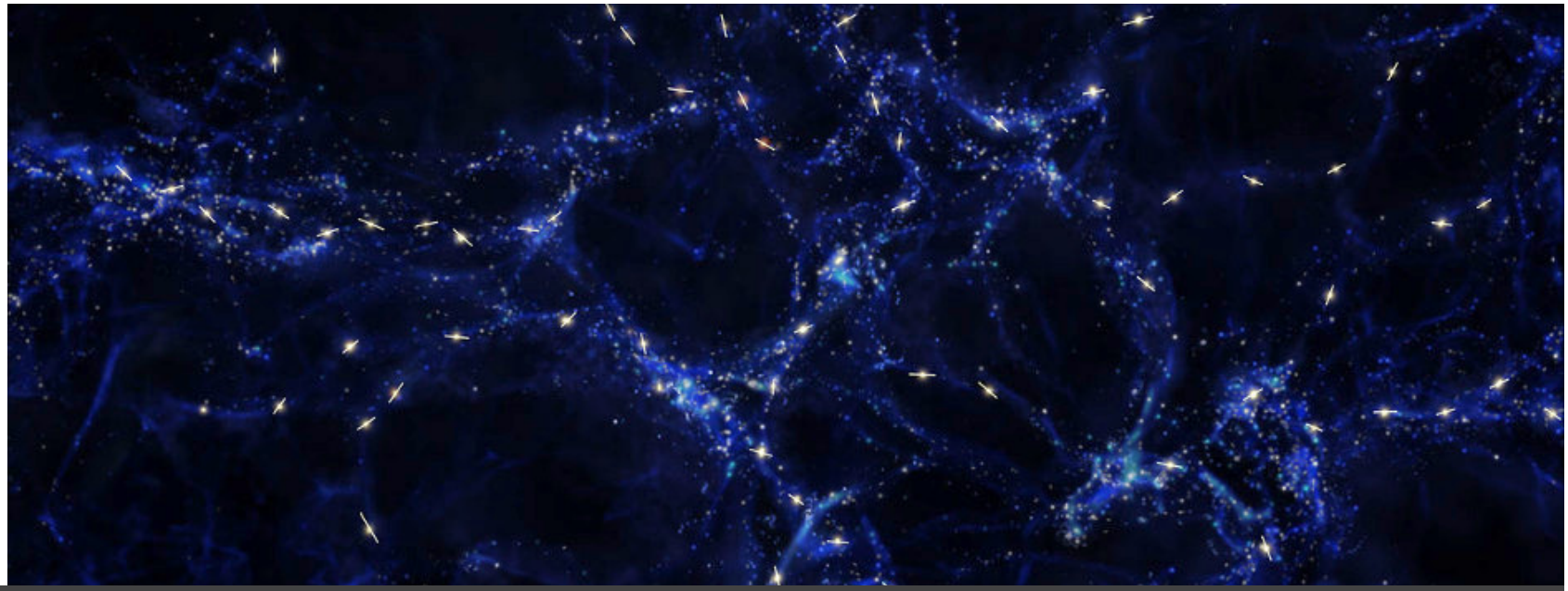
# Error on the monopole component



# Error on the quadrupole component




Work done in the framework of zsurvey, paper in preparation



# Cosmology with cosmic voids

On behalf of Alice Pisani

# Large-scale structure of the Universe and cosmic voids

Until very recently, due to the difficulty of extracting data from low density zones, the potential of voids has been under-explored.

Now, with new large galaxy surveys, sparse regions are well sampled.

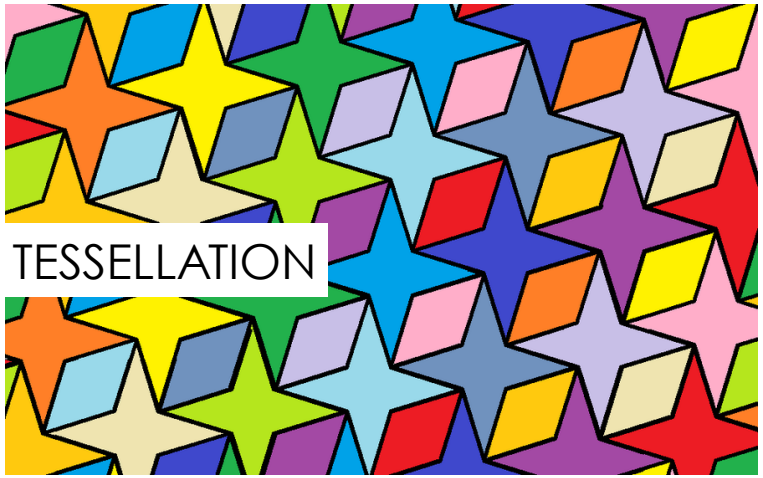
Being devoid of matter, cosmic voids might be mainly composed of dark energy.

So, they constitute a promising laboratory to test dark energy, constrain cosmic expansion and discriminate between cosmological models such as modified gravity models.

*Based on Zobov (Neyrinck 2008)*

# VIDE: a void finder algorithm

**galaxy survey or simulation** → **Voronoi tessellation**




**What is a tessellation?**

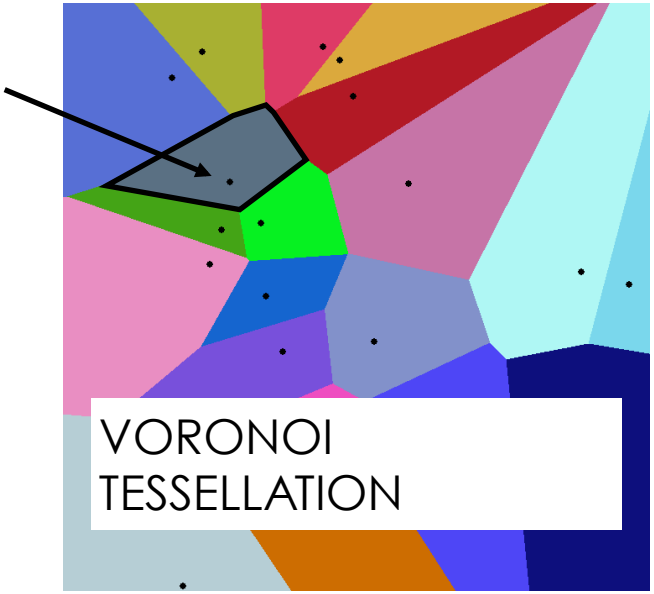
A tessellation of a flat surface is the tiling of a plane using one or more geometric shapes, called tiles, with no overlaps and no gaps.

*Based on Zobov (Neyrinck 2008)*

# VIDE: a void finder algorithm

**galaxy survey or simulation** → **Voronoi tessellation**

Tracer




**What is a Voronoi tessellation?**

Voronoi tilings are tessellations where each tile is defined as the set of points closest to one of the points in a discrete set of defining points.

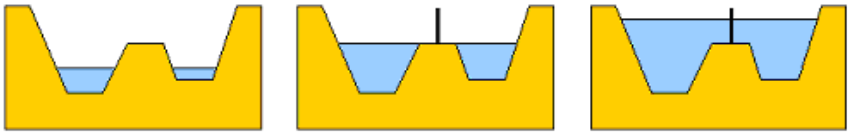
➔ density can be related to volume

$$\rho_{local} = \frac{1}{V_{cell}}$$

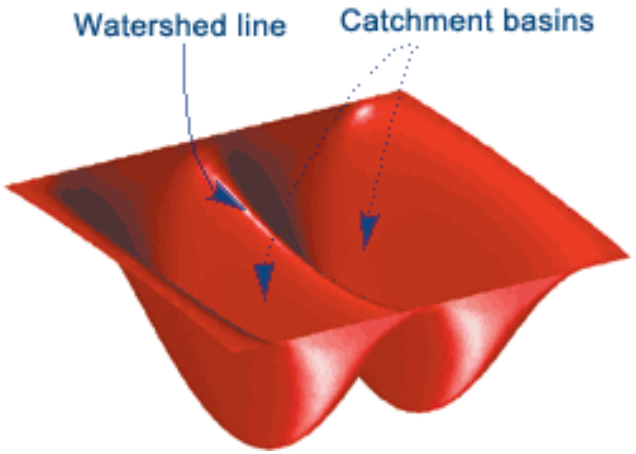
*Based on Zobov (Neyrinck 2008)*

# VIDE: a void finder algorithm

**galaxy survey or simulation** → **Voronoi tessellation** → **Watershed transform** → **Voids**



Basins are merged in one void if the border of lower density is common.

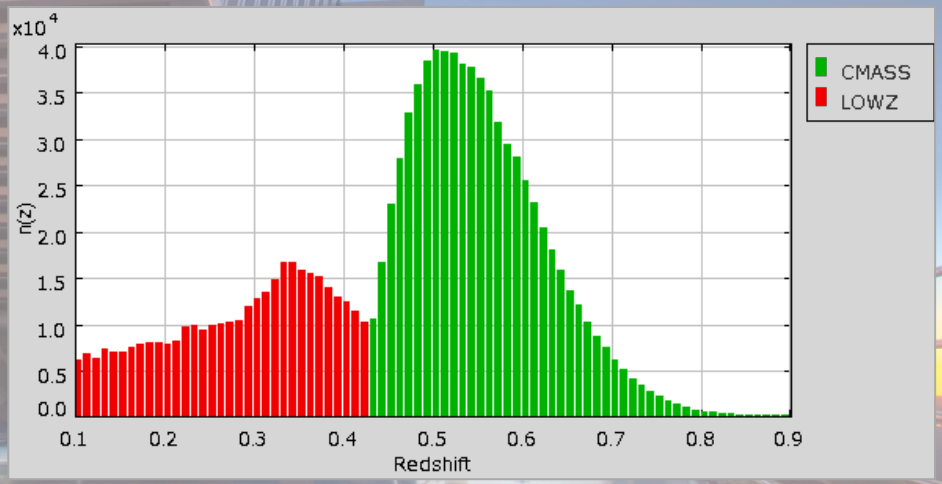



The algorithm takes into account survey boundaries and masks

# The DR11 BOSS galaxy catalog

BOSS galaxy survey, on the 2.5 m Sloan telescope

- Spectroscopic data from 2009 to 2014
- The total footprint is about 10,400 deg2
- Two galaxy samples:
  - Low redshift sample LOWZ (0.1<z<0.43)
  - Volume-limited sample CMASS (0.43<z<0.7)

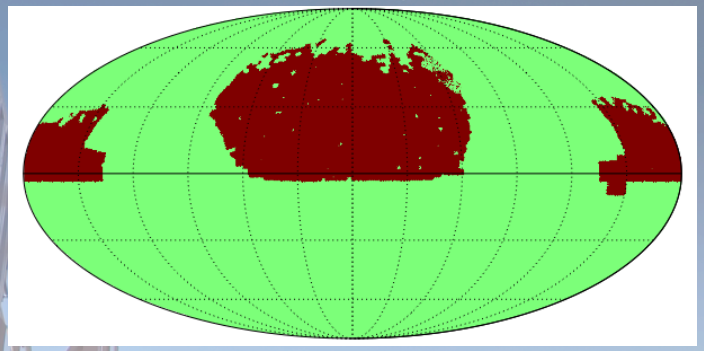


# The DR11 void catalog

LOWZ : 0.1<z<0.43

| DR11 NGC | SGC | total |
|---|---|---|
| 156,569 | 108,800 | 265,369 |

LOWZ : 666 voids

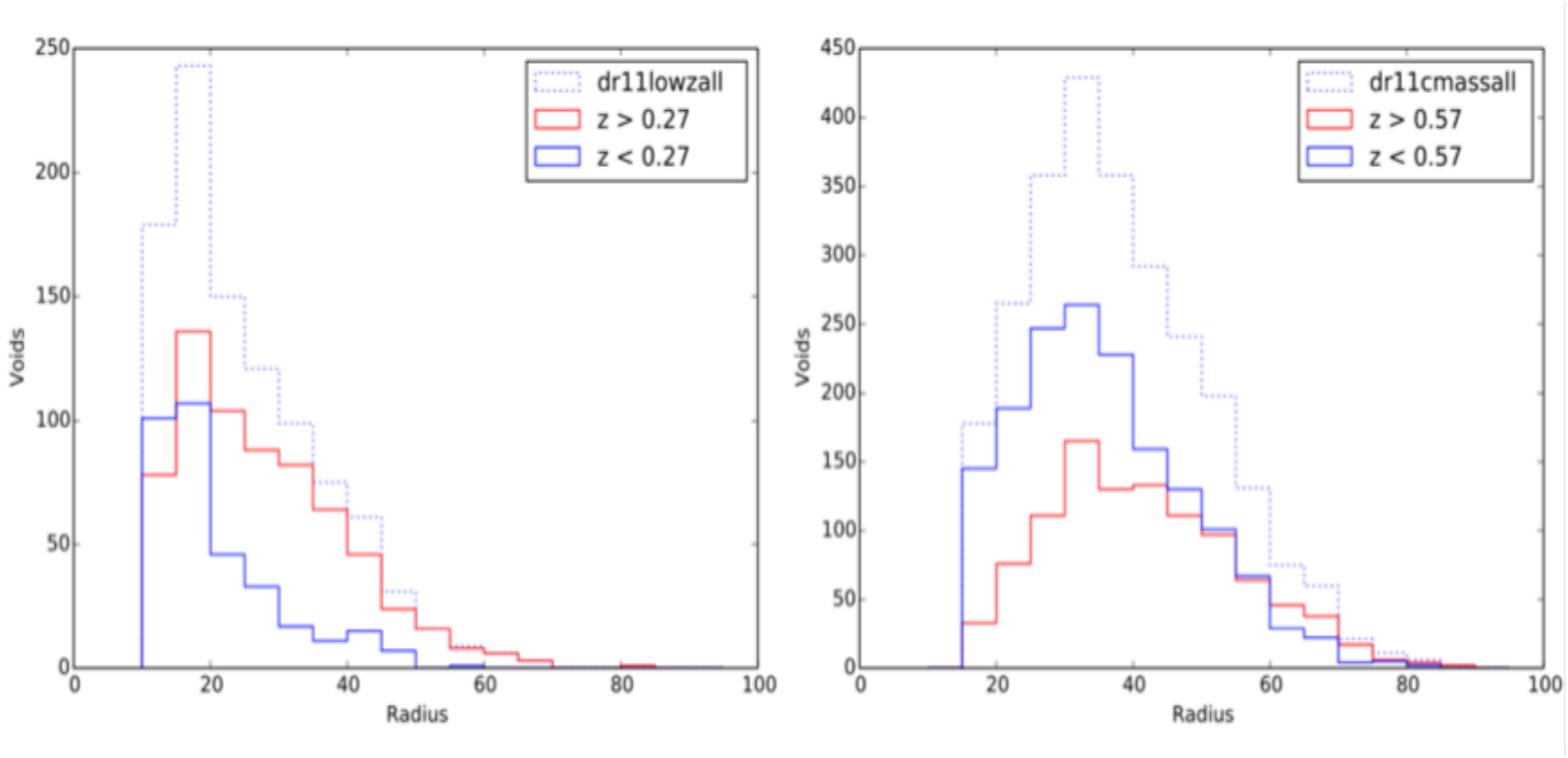


CMASS : 0.43<z<0.7

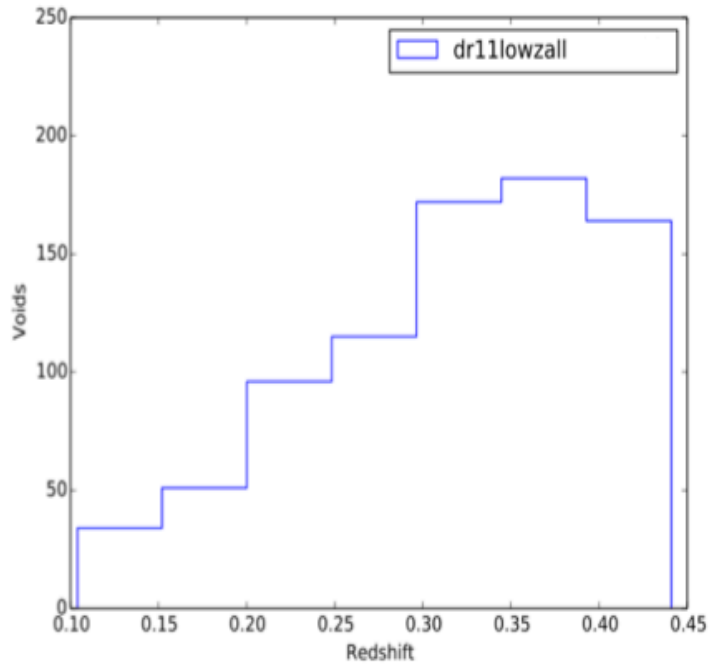
| DR11 NGC | SGC | total |
|---|---|---|
| 556,896 | 186,907 | 743,803 |

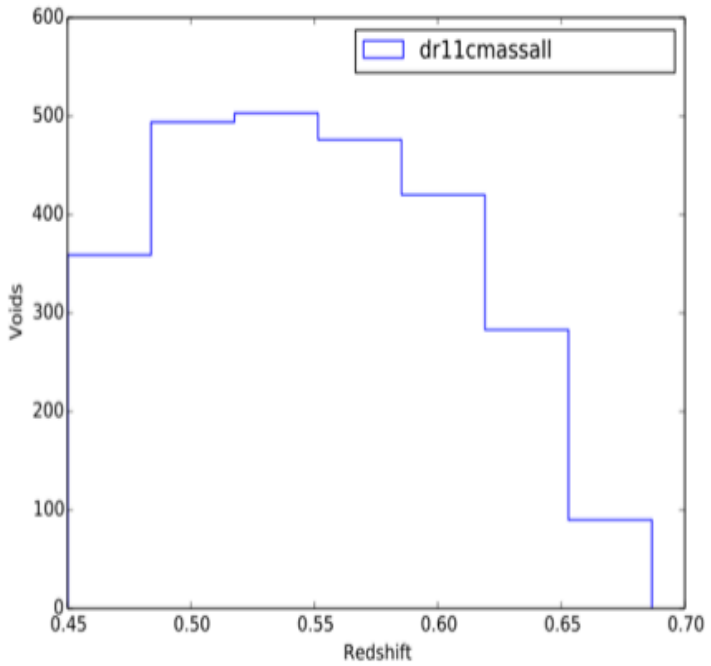
CMASS : 2355 voids

# Void distribution with size



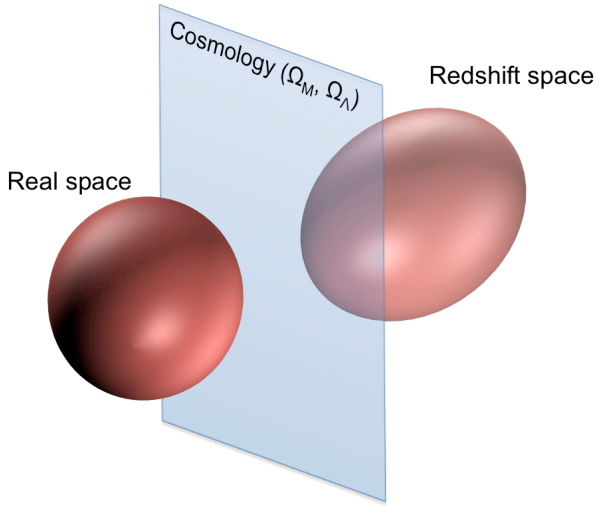
# Void distribution with redshift



# Alcock-Paczynski test with voids

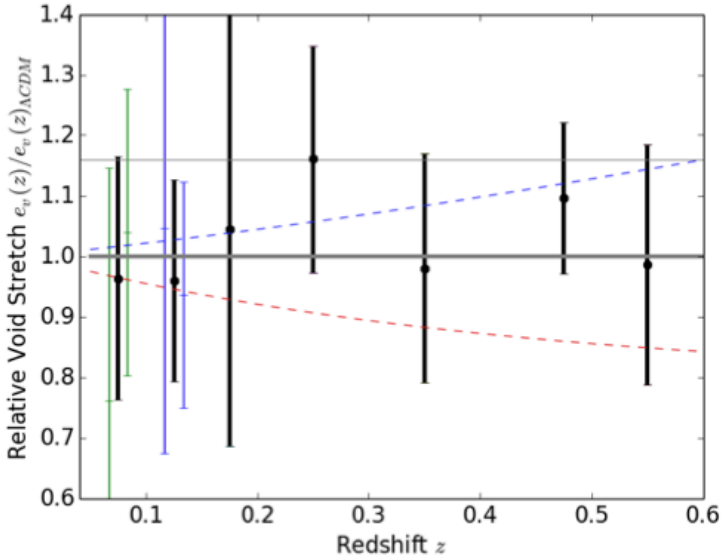
The principle of the AP test is to consider a perfect spherical system in real space, based on the assumption of uniformity and isotropy of the universe on large scale.




Cosmology is deduced from the deformation of the object in redshift space.

# Alcock-Paczynski test with voids

Previous work done by
Sutter et al., arXiv:1404.5618




Preliminary results already confirm that the AP test is a powerful and promising cosmological test.

The publication of the AP test on DR11 cosmic voids is in preparation (Pisani et al. 2016)