Multidark Patchy Mocks for BOSS DR12 Documentation

M&M Patchy Team

Mocks version 6S and 6C

Version 6S and 6C of M&M Patchy for BOSS data release 12 provide mocks for the analyse of different samples and regions, reproducing the following features:

- 1-point, 2-point and 3-point statistics,
- Evolution of the clustering (redshift dependency),
- Clustering at different stellar mass bins,
- Bias weighting,
- Veto Mask,
- Fiber Collision weights.

Version 6S aims to reproduce the clustering of the "**S**"imulation catalog, the BigMultiDark light-cones, Rodriguez-Torrez et al. in prep. This set of mocks is ideal for testing the methodology of extracting the cosmological parameters from the galaxy sample since the true cosmology is the same as the BigMultiDark simulation.

Version 6C is for constructing the "**C**"ovariance matrix of the clustering measurements. We have done some tuning so that the clustering agrees with observed data in terms of 1-point, 2-point, and 3-point clustering statistics in redshift space. We have also included the evolution measured from the observed data in both monopole and quadrupole (configuration space and Furious-space). Therefore, this set of mocks is ideal for the covariance matrix estimation.

Codes and tools

The necessary periodic Boxes were made using PATCHY code, which is based on Augmented Lagrangian Perturbation Theory and a non-linear bias stochastic scheme (Kitaura, Yepes, Prada 2014, arXiv:1307.3285), where the bias parameters are fitted to the proper clustering of the BigMultiDark Planck simulation for each redshift snapshot (Klypin et al. 2014, www.multidark.org). More information:

- https://trac.sdss3.org/wiki/BOSS/clustering/PATCHY/

The HADRON code was used for mass assignment to halos (Zhao et al. arXiv:1501.05520)

Light-cone mocks are built using the SUGAR code (Rodriguez-Torres et al. in preparation) and the MockFactory products: https://github.com/mockFactory

These mocks were designed to reproduce the observed evolution of clustering, and its dependency with stellar mass.

Cosmology

All quantities in these catalogs (stellar mass, nbar, etc) use Planck1 cosmology

- Ω_M = 0.307115
- Ω_L = 0.692885
- Ω_b = 0.048
- σ_8 = 0.8288
- h = 0.6777

DATA info

M&M Patchy Version 6S and 6C reproduce the dependency of the clustering with stellar mass observed in the BOSS DR12 data. We use the Portsmouth stellar mass catalogs with a Kroupa IMF.

Weighted areas, including veto Mask, are:

- CMASS NGC (SGC): 6851.4 deg^2 (2524.7 deg^2)
- LOWZ NGC (SGC): 5836.2 deg^2 (2501.3 deg^2)
- CMASSLOWZTOT NGC (SGC): 6826.9 deg^2 (2517.6 deg^2)

Columns mocks

Mocks contain 8 columns: RA, DEC, Z, MSTAR, NBAR, BIAS, VETO FLAG, FIBER COLLISION

- (RA, DEC) are in degrees,
- MSTAR, stellar mass in $M_\odot$ units,
- NBAR comes from nbar Reid dr12v4 and dr12v5 files, re-scaled to Planck1 as the fiducial cosmology,
- BIAS: Compute from the clustering in different bins of stellar mass,
- VETO FLAG: 0 = object excluded by veto mask, 1 = otherwise,
- FIBER COLLISION: Fiber collision weights. We use flag_collided.cpp included in the mockFactory product.

Randoms

Random are generated using shuffle method.

- Columns: RA, DEC, Z, NBAR, BIAS, VETO FLAG,FIBER COLLISION

We provide randoms 10, 20, 50 and 100 times larger than data. These randoms are not independent between them. Random x10, x20 and x50 are subsamples of x100.

Guidelines for weights

Weights (FKP+veto+fiber collision) should be computed using:

$$\text{Data: } w_{tot} = \frac{Col_7^D \times Col_8^D}{1 + 10000 \times Col_5^D},$$

$$\text{Random: } w_{tot} = \frac{Col_6^R \times Col_7^R}{1 + 10000 \times Col_4^R},$$

where, $Col_5^D(Col_4^R)$, $Col_7^D(Col_6^R)$ and $Col_8^D(Col_7^R)$ correspond to the number density, the veto flag and the fiber collision weight for mock (random) catalogs.

These are the default weights; however, other combination can be done depending on the user's wish.

Download Catalogs

For NERSC users:

- /global/project/projectdirs/boss/galaxy/PATCHY/PATCHY-V5C/
- /global/project/projectdirs/boss/galaxy/PATCHY/PATCHY-V5S/

For non-NERSC users:

- http://portal.nersc.gov/project/boss/galaxy/PATCHY/Patchy-V5C/ (username:sdss3)
- http://portal.nersc.gov/project/boss/galaxy/PATCHY/Patchy-V5S/

CMASS mocks (4096 mocks NGC+SGC)

Mocks cover redshift range z=0.43 to z=0.75. Geometry was applied using mksample results for CMASS DR12V4 NGC and SGC.

Stellar mass and bias included

LOWZ mocks (4096 mocks NGC+SGC)

Mocks cover redshift range z=0.15 to z=0.43. Geometry was applied using mksample results for LOWZ DR12V4 NGC and SGC.

Sellar mass and bias included

CMASSLOWZ mocks (10240 mocks NGC+SGC)

Mocks for CMASS+LOWZ sample. These mocks reproduce the combined number density between z=0.2 and z=0.75 and use CMASS DR12V5 masks.

Stellar mass and bias included.

We provide mocks for different areas. We use the same nomenclature as the mksample products.

- CMASSLOWZ: chunk >7 (4096 NGC+SGC).
- CMASSLOWZEARLY2trimmed: chunk2 region (2048 NGC).
- CMASSLOWZEARLY3-6trimmed: chunk3-6 region (2048 NGC).
- CMASSLOWZTOT: chunk2 + chunk3-6+chunk>7 (2048 NGC).

We also provide a few mocks chunk2+chunk>7 with chunk2 number density (CMASSLOWZEARLY2) and chunk3-6+chunk>7 with chunk3-6 number density (CMASSLOWZEARLY3-6) to produce randoms. Shuffling to construct randoms must be done for the different region separately, because each of them has different number density, the final random for CMASSLOWZTOT is the addition of randoms for the three different areas.

One-point, two-point, three-point statistics and evolution

We present results for one point (number density, total number of objects), the two point function in redshift space for LOWZ, CMASS and CMASSLOWZ sample for different redshift bin, and the three point function for LOWZ and CMASS.

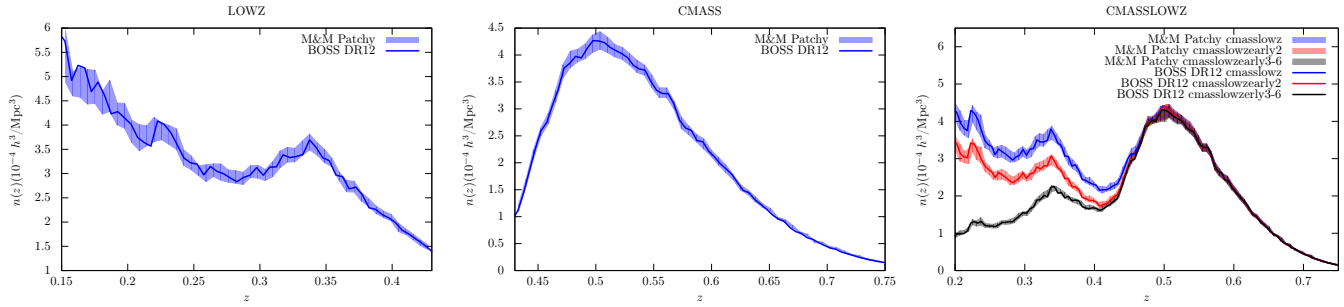

Figure 1: Number density from 20 mock realisation compared to data.

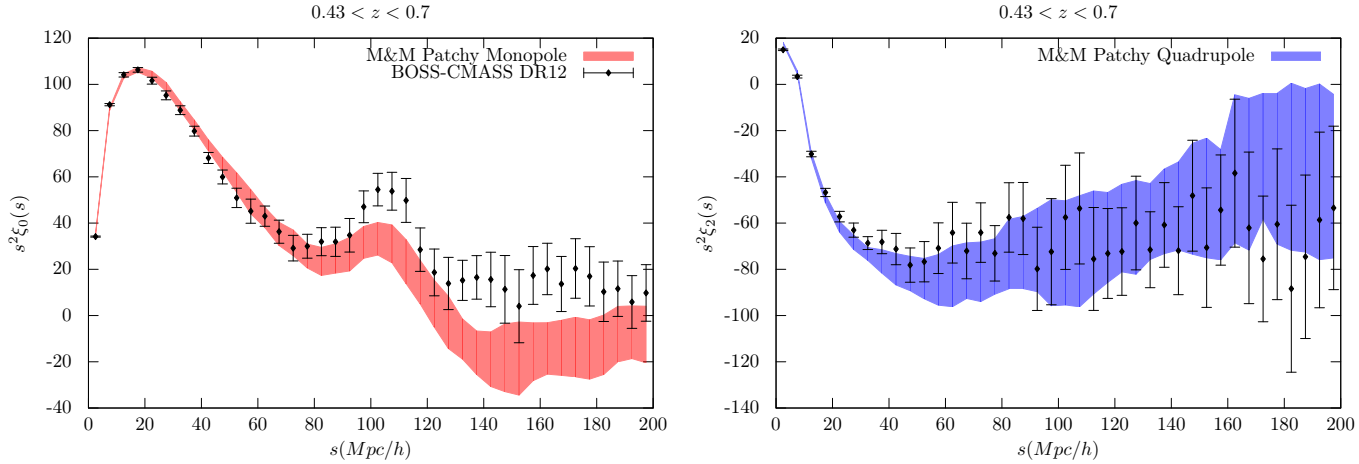

Figure 2: Correlation function CMASS NGC, 0.43$< z <$0.7. Error bars come from 20 mock realisation.

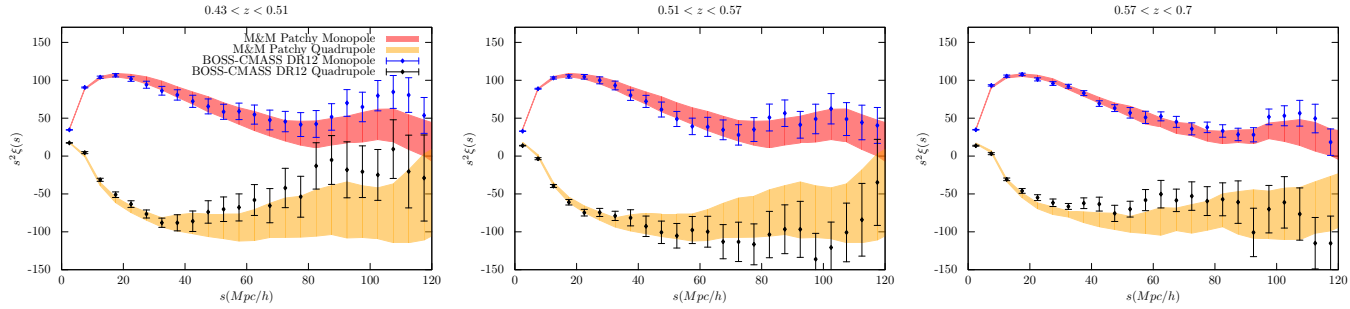

Figure 3: Correlation function for three different redshift bins for CMASS NGC mocks. Error bars come from 20 mock realisation.

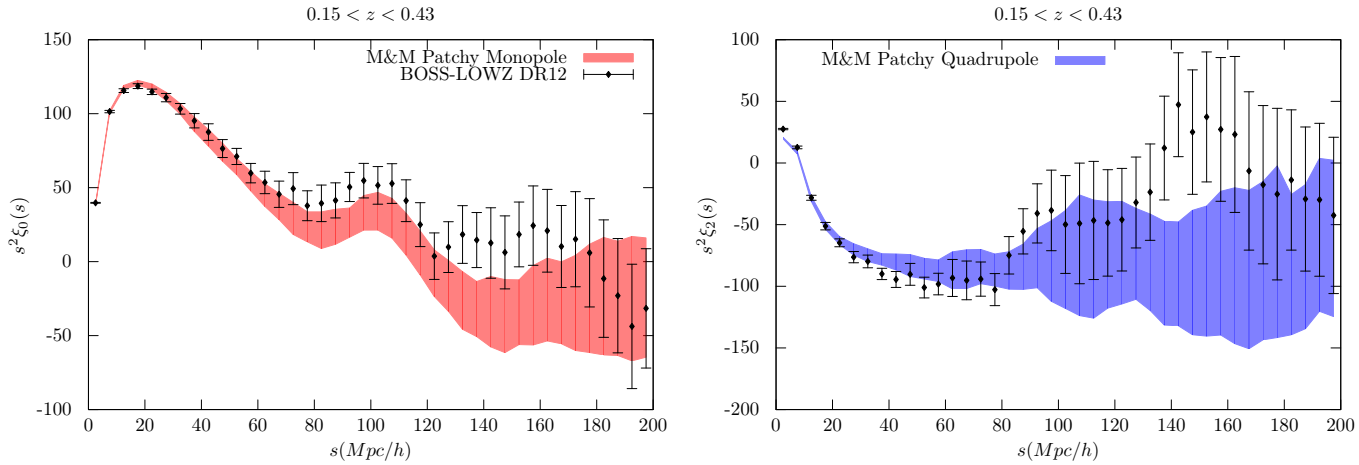

Figure 4: Correlation function LOWZ NGC 0.15< z <0.43. Error bars come from 20 mock realisation.

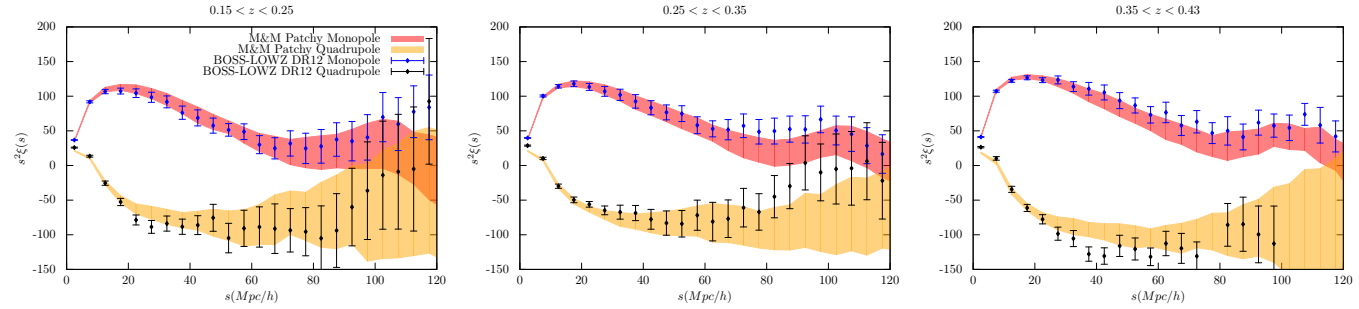

Figure 5: Correlation function for three different redshift bins for LOWZ NGC. Error bars come from 20 mock realisation.

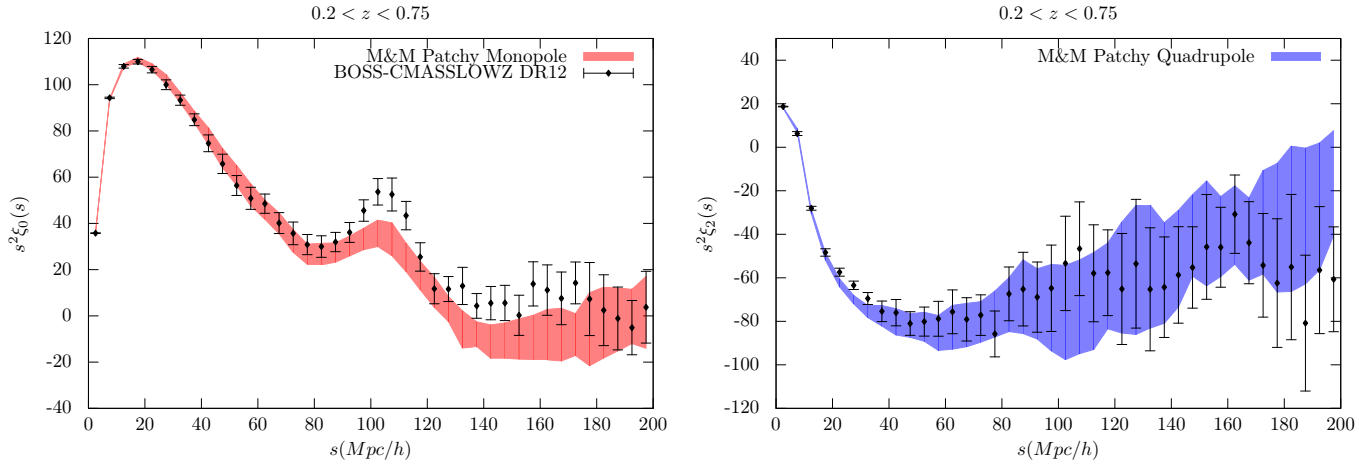

Figure 6: Correlation function CMASSLOWZ sample NGC (chunk2+chunk3-6+chunk>7) 0.2< z <0.75. Error bars come from 10 mock realisation.

References

[1] M&M PACHY: Kitaura et al., in prep.

[2] PACHY: Kitaura et al., MNRAS, 2014, 439, L21.

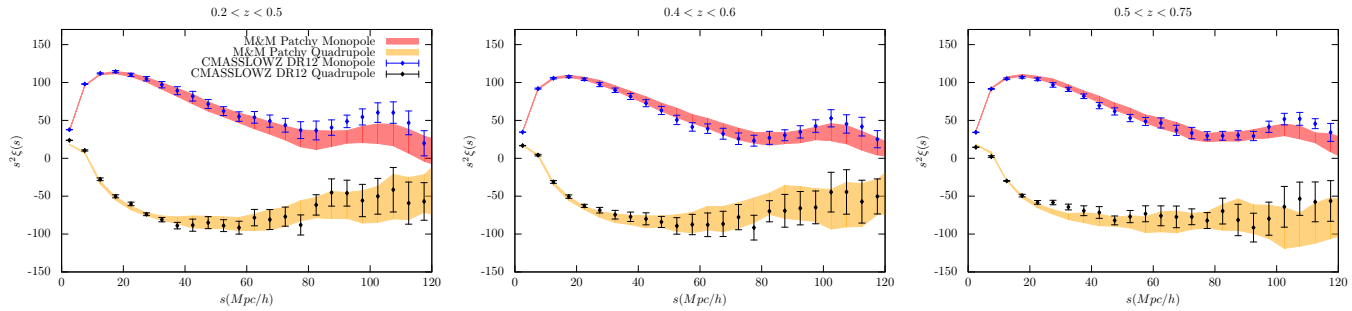

Figure 7: Correlation function for three different redshift bins for CMASSLOWZ sample NGC (chunk2+chunk3-6+chunk>7). Error bars come from 10 mock realisation.

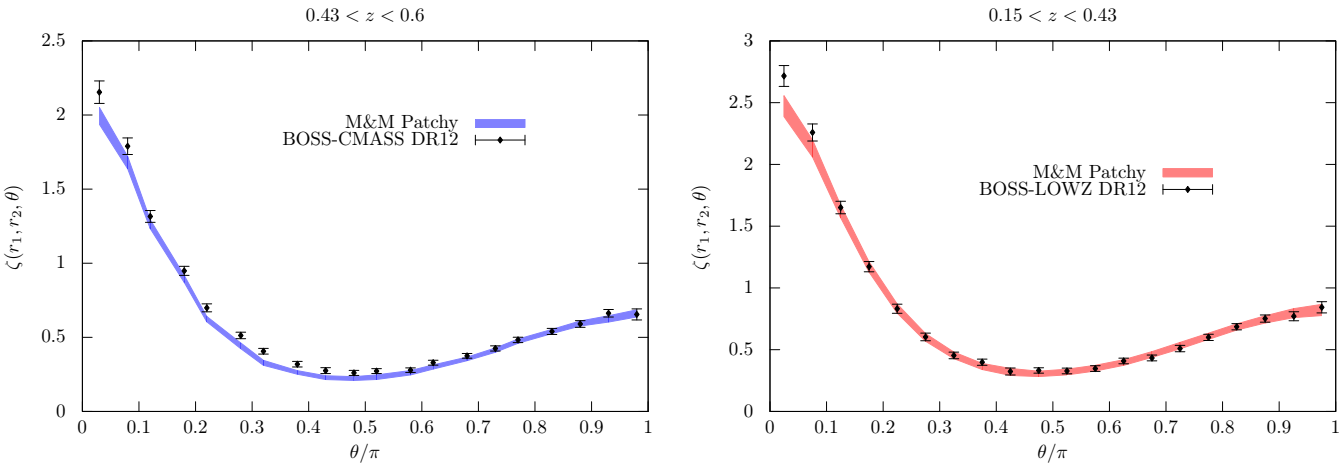

Figure 8: Three point function for LOWZ NGC (0.15< z <0.43) and CMASS (0.43< z <0.6). $r_1 = 10$Mpc/h and $r_2 = 20$Mpc/h. Error bars come from 20 mock realisation. Results provided by Hong Guo

[3] HADRON: Zhao, C. et al., arXiv:1501.05520.

[4] SUGAR: Rodríguez-Torres, S. et al., in prep.

[5] MOCKFACTORY: White, M. et al, MNRAS, 2014, 437,2594.