The FMOS-COSMOS Survey: Clustering analysis of star-forming galaxies at z~1.6

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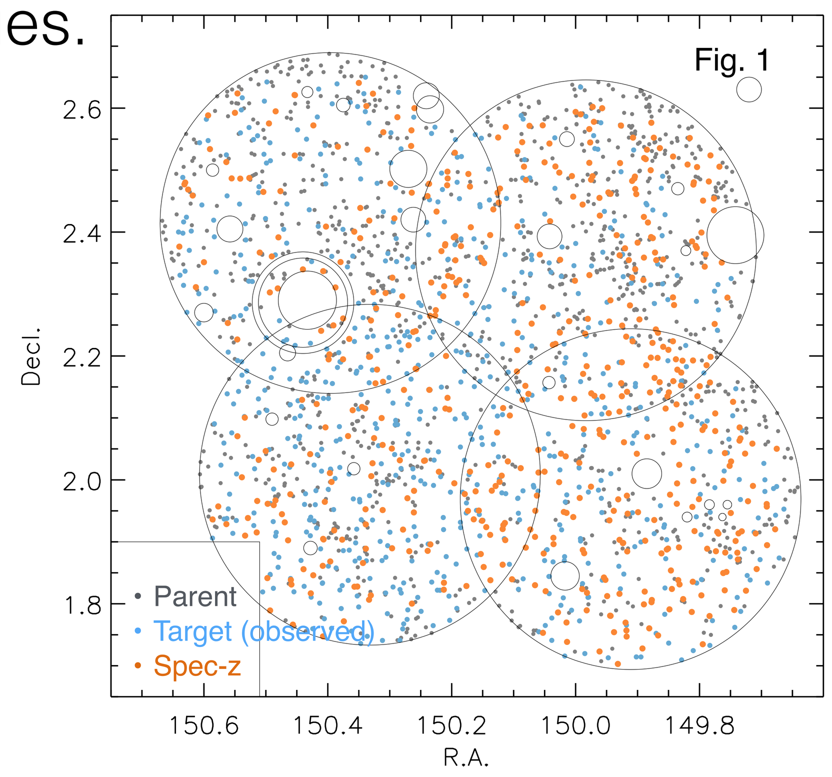
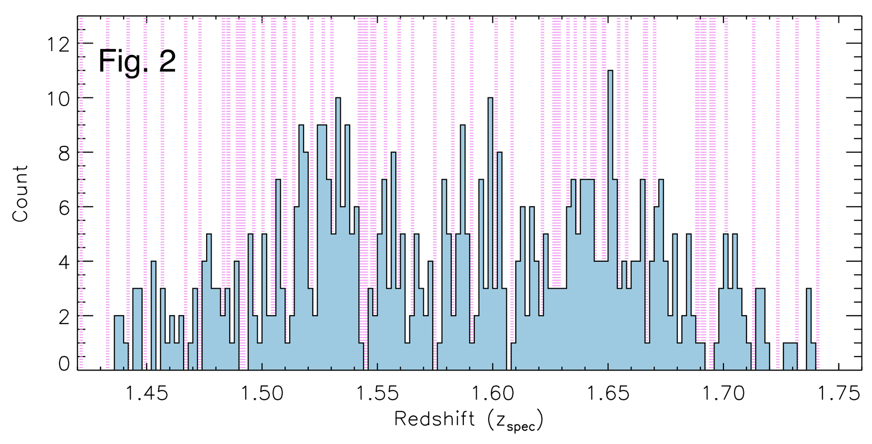
Abstract: We present an clustering analysis of a star-forming galaxy sample at $1.4 \lesssim z \lesssim 1.7$ from the FMOS-COSMOS survey. Using 516 galaxies for which Hα is identified, we measure a two-point correlation function, and then detect a significant clustering at r_p~0.1-20 h^{-1}Mpc with r_0=5.01±0.43 h^{-1}Mpc. We also fit an HOD model to the data to constrain typical properties of host halos. In the analysis, we carefully treated artificial biases specific to fiber spectroscopy in NIR window.

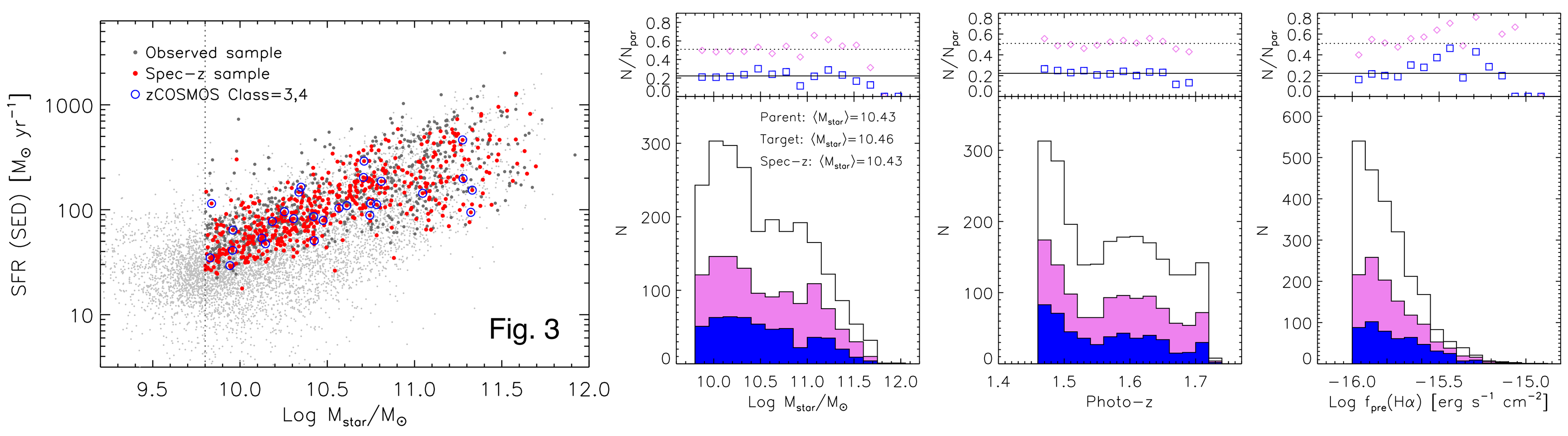
Motivation: It is important to investigate the connection between galaxies and their host haloes. Especially, z~1-3 is an exciting era, when galaxies grow the bulk of their stellar mass with high SFRs, and the question in what environ-ments and/or haloes did such rapid mass assemblies occur is essential in galaxy formation. For such studies, use of a sample repre-sentative of general star-forming population is important. The sample in this study maps a wide range of star-forming main sequence at z~1.6 (Fig.3).

FMOS-COSMOS sample: Samples in this study is const-ructed from a data set of the FMOS-COSMOS survey, a large near-IR spectroscopic survey using Subaru/FMOS. The survey is designed to detect Hα in H-long (1.6-1.7μm; $1.4 \lesssim z \lesssim 1.7$) grating and to provide ~3000 spectra of star forming galaxies in the COSMOS field (Silverman+15 in prep). Samples in this study are selected based on SED-fitting (K_{AB}<23.5; M>$10^{9.8}M_\odot$; Predicted f(Hα)>1e-16). We analyze sub-samples of 516 galaxies with S/N>3 emission lines, from 1182 observed galaxies.

Mass-limited $M_* > 10^{9.8}\,M_\odot$	Parent $+f(\mathrm{H}\alpha) > 10^{-16}$	Target	Spec-z $1.43 \le z_{\rm spec} \le 1.74$
6453	2319	1182	516





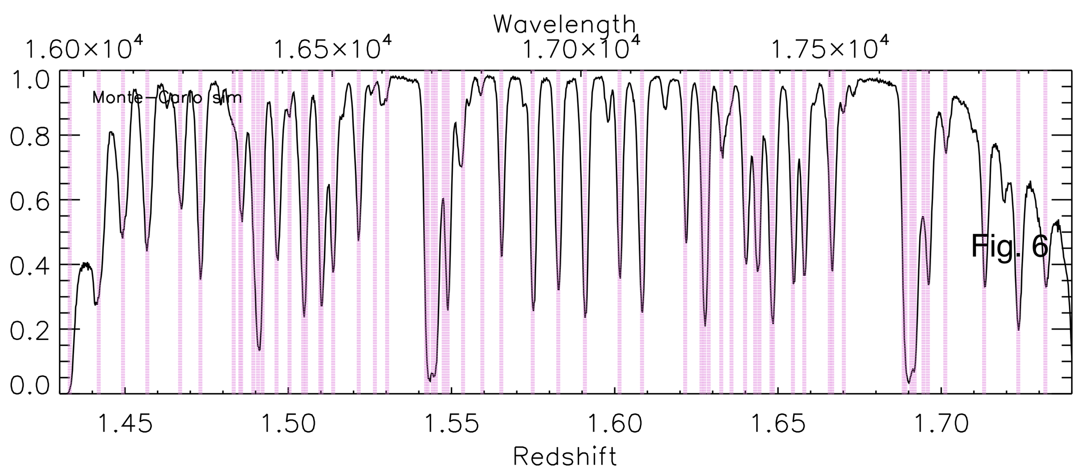


Clustering analysis: Two-point correlation function is a powerful tool to quantify the galaxy clustering. To minimize the effects of the peculiar motions of galaxies, we employ the projected correlation function:

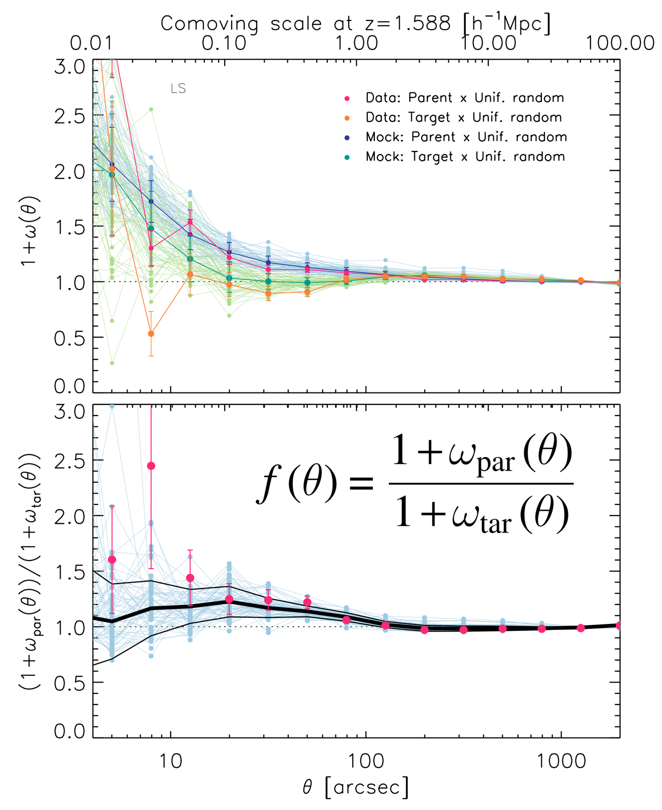
$$w_p(r_p) = \int_0^{\pi_{\max}} \xi(r_p, \pi)\, d\pi = 2\int_0^{\pi_{\max}} \xi\left[(r_p^2 + y^2)^{1/2}\right] dy$$

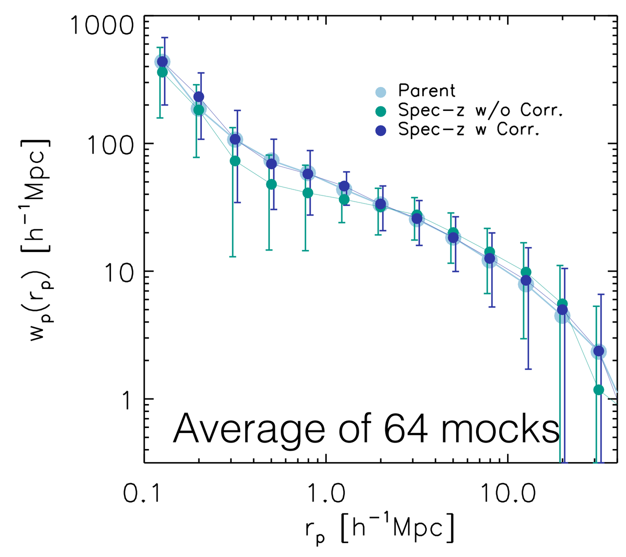
ξ (r_p, π) is estimated with Landy & Szalay (1983) estimator using a random sample.

Radial weight function: An OH airglow suppression system equipped on FMOS masks out strong atmospheric emission lines (Fig. 2) and also the light from galaxies. The detection rates decrease around the masks. We include such effects to construct the random sample, by evaluating the detection rate at each redshifts with a set of Monte Carlo simulations.

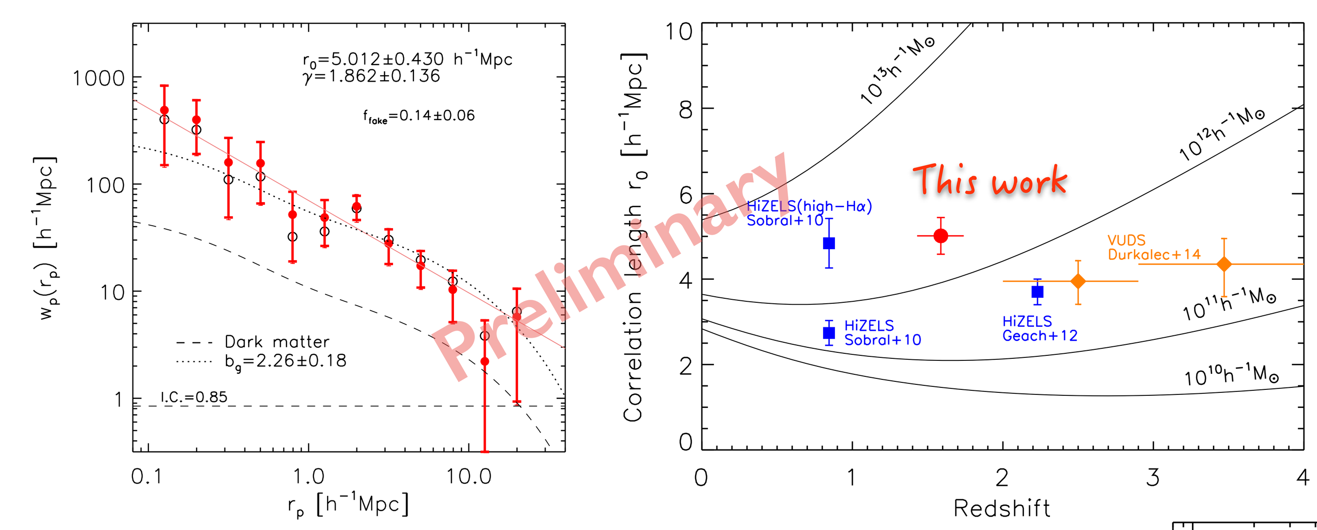


Effects of fiber-allocation: FMOS fibers are distributed uniformly in the FoV, thus the number of galaxy pairs having small angular separations is suppressed, which causes com-plicated biases in the 2D spatial dis-tribution of the targets. We correct such effect by weighting DD-term with the ratio between the mean number of pairs in parent and target samples responding to the angular separation. The weight can be ex-pressed with the angular correlation function. We define the weight and test robustness of the correction scheme using 64 mock sam-ples (v^2GC-M; Ishiyama+15).

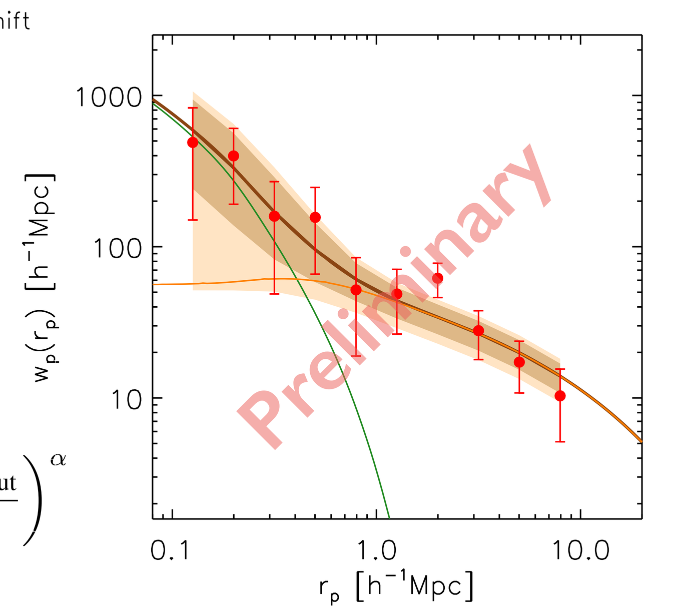


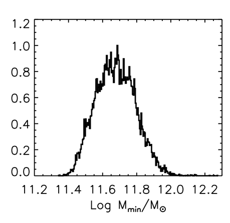


Results: Measured $w_p(r_p)$ shows a significant clustering signal at scales $0.1 \lesssim z \lesssim 20$ h^{-1}Mpc. By fitting a power-law, we find a correlation length r_0=5.0±0.4 h^{-1}Mpc.



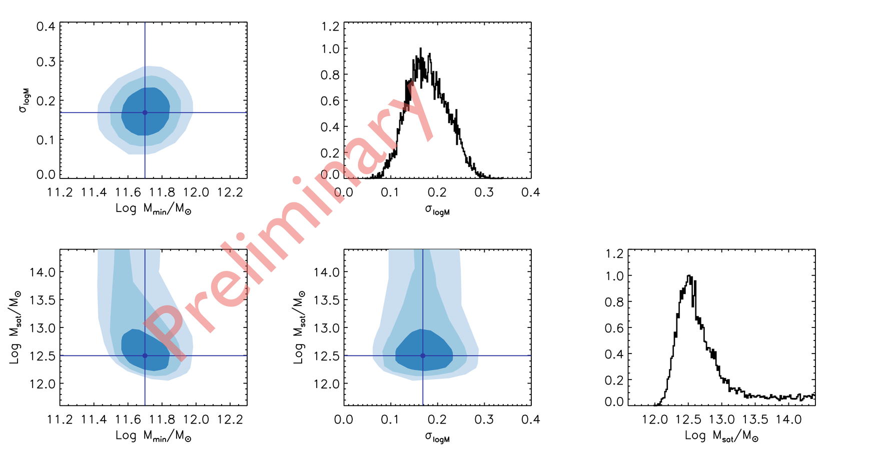
HOD modeling: We fit a simple HOD model to data to constrain typical halo properties.





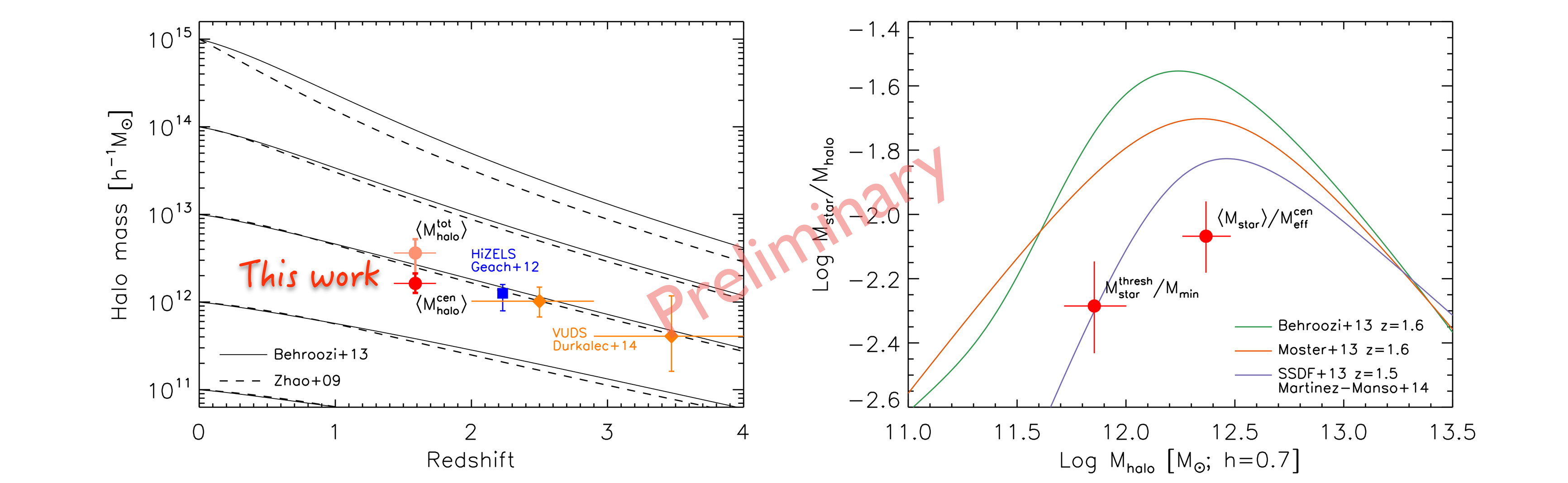
$$\langle N_{\rm cen}|M\rangle = \frac{1}{2}\left[1+{\rm erf}\left(\frac{\log M - \log M_{\rm min}}{\sigma_{\log M}}\right)\right]$$

$$\langle N_{\rm sat}|M\rangle = \frac{1}{2}\left[1+{\rm erf}\left(\frac{\log (M/M_{\rm min})}{\sigma_{\log M}}\right)\right]\left(\frac{M-M_{\rm cut}}{M_1}\right)^{\alpha}$$



$$n_{\rm tot} = 8.51^{+2.74}_{-2.66} \times 10^{-3} / \left(h^{-1}{\rm Mpc}\right)^3$$
$$f_{\rm sat} = 0.34^{+0.21}_{-0.18}$$
$$\langle M^{\rm tot}_{\rm halo}\rangle = 3.63^{+1.59}_{-1.50} \times 10^{12}\, h^{-1}\, M_\odot$$
$$\langle M^{\rm cen}_{\rm halo}\rangle = 1.63^{+0.49}_{-0.36} \times 10^{12}\, h^{-1}\, M_\odot$$
$$b_{\rm eff} = 2.06^{+0.24}_{-0.23}$$

The HOD params are well-determined by MCMC, and we find a typical mass of the host haloes of our sample galaxies of M_h~$10^{12}h^{-1}M_\odot$, consistent to commonly believed pictures for star-forming galaxies.



More careful comparisons with other observations and theories and interpretations are needed.