SWG-Galaxy Clustering status report

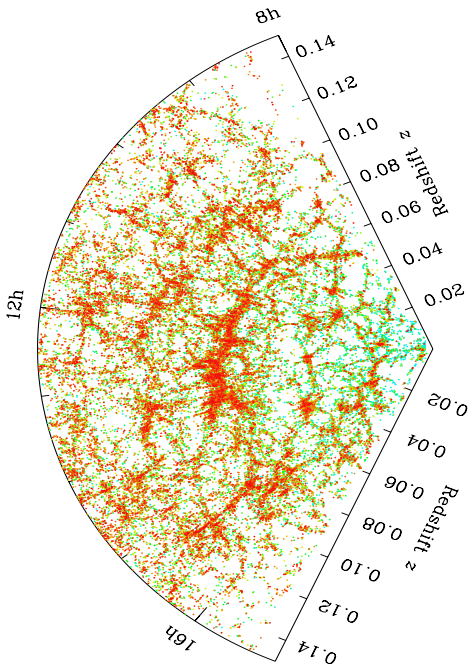
SWG leads: Luigi Guzzo & Will Percival

Euclid-France meeting
Lyon 5/12/2014

Sylvain de la Torre

Galaxy clustering and Euclid key questions

Euclid Consortium



1. Is cosmic acceleration produced by a cosmological constant or by an evolving scalar field?

- Measure expansion history H(z) to unprecedented accuracy to detect percent variations of w(z)

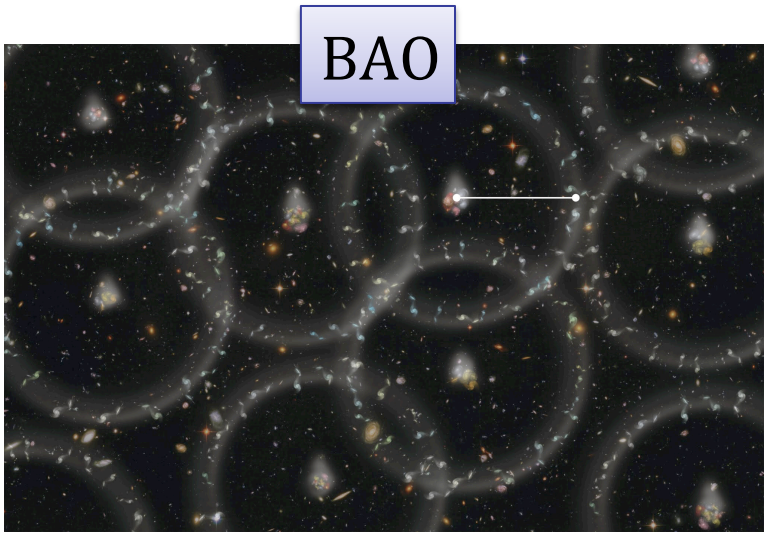
➔ Using Baryonic Acoustic Oscillations (BAO) in the galaxy clustering pattern

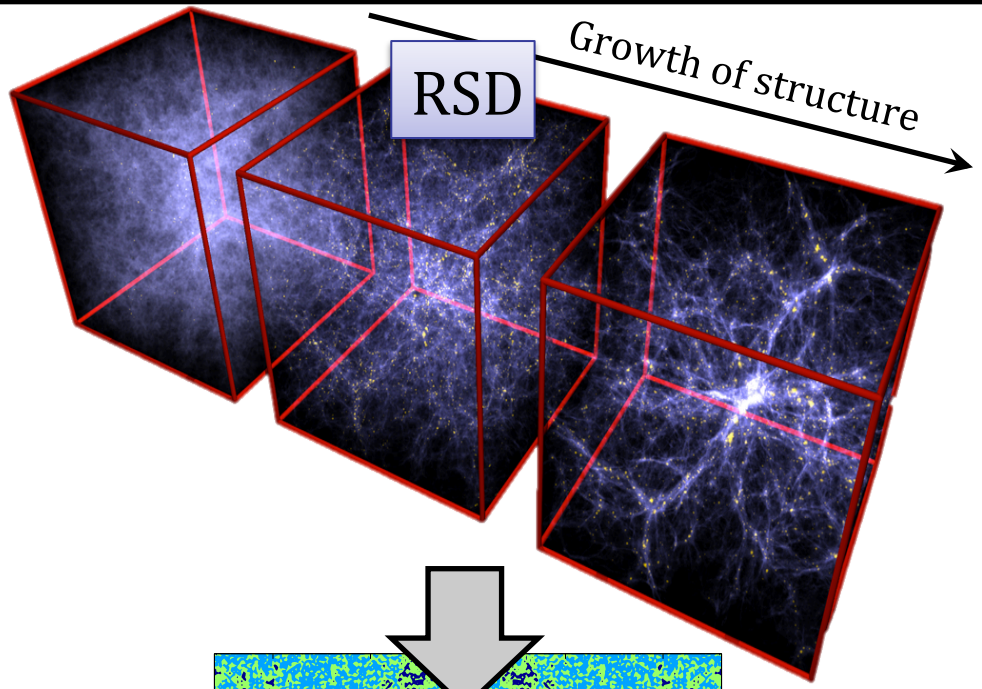
2. Does General Relativity need to be modified on cosmological scales?

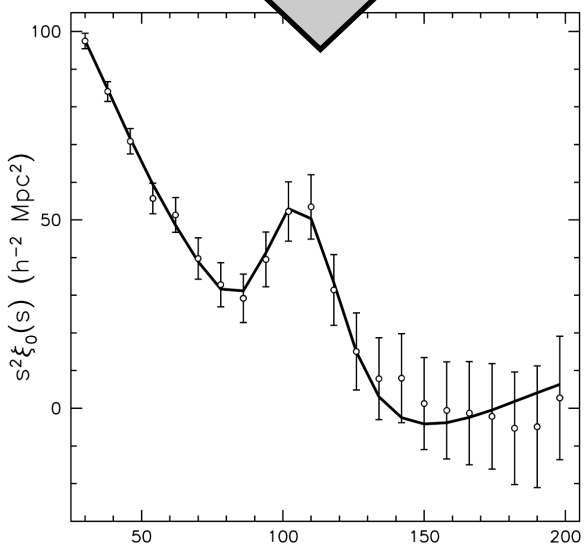
- Measure structure growth history of structure to unprecedented accuracy

➔ Using anisotropy of galaxy clustering in redshift-space (Redshift-Space Distortions, RSD)

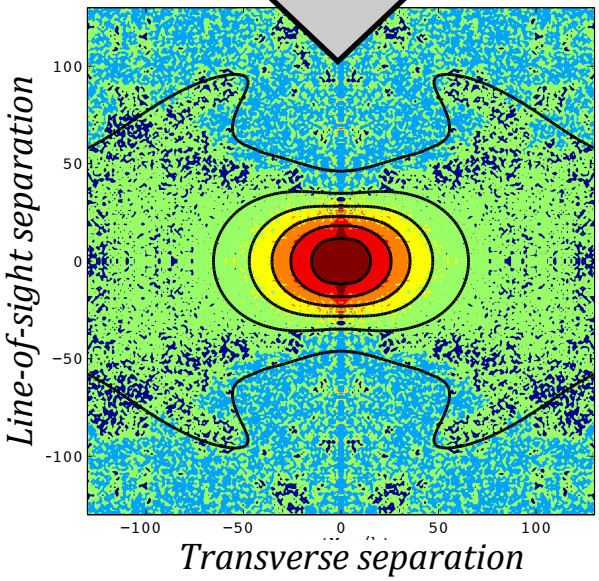
BAO and RSD







Galaxy clustering in z-space (2PCF)



(BOSS, Anderson et al. 2013)

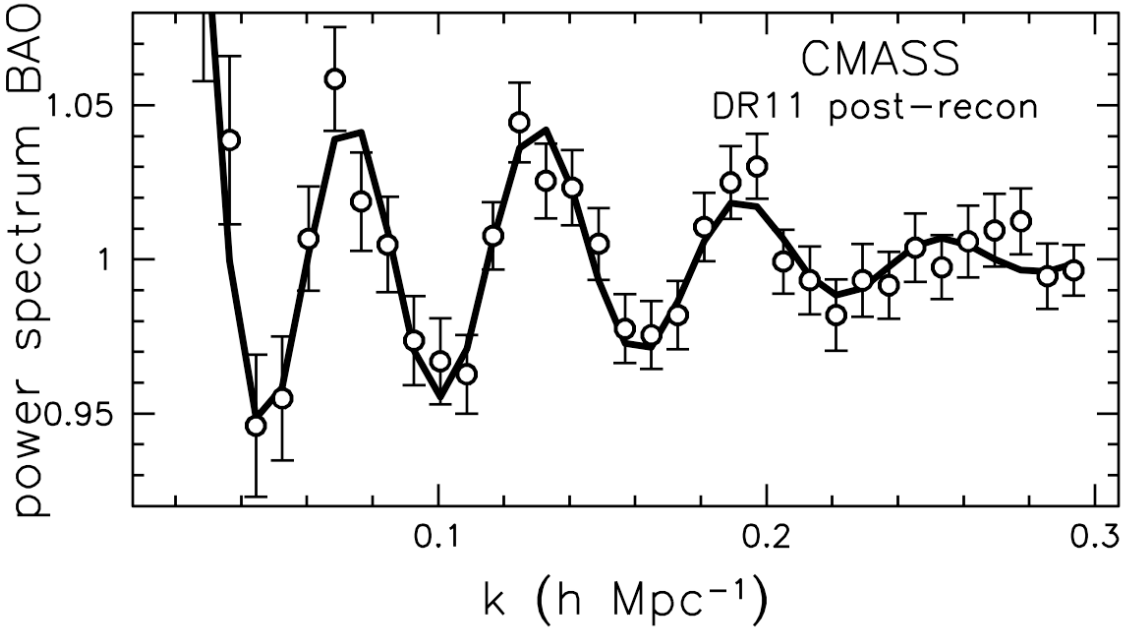
(BOSS, Reid et al. 2012)

Baryonic Acoustic Oscillations

BOSS DR11

Largest volume of the Universe currently mapped

(Anderson et al. 2014)



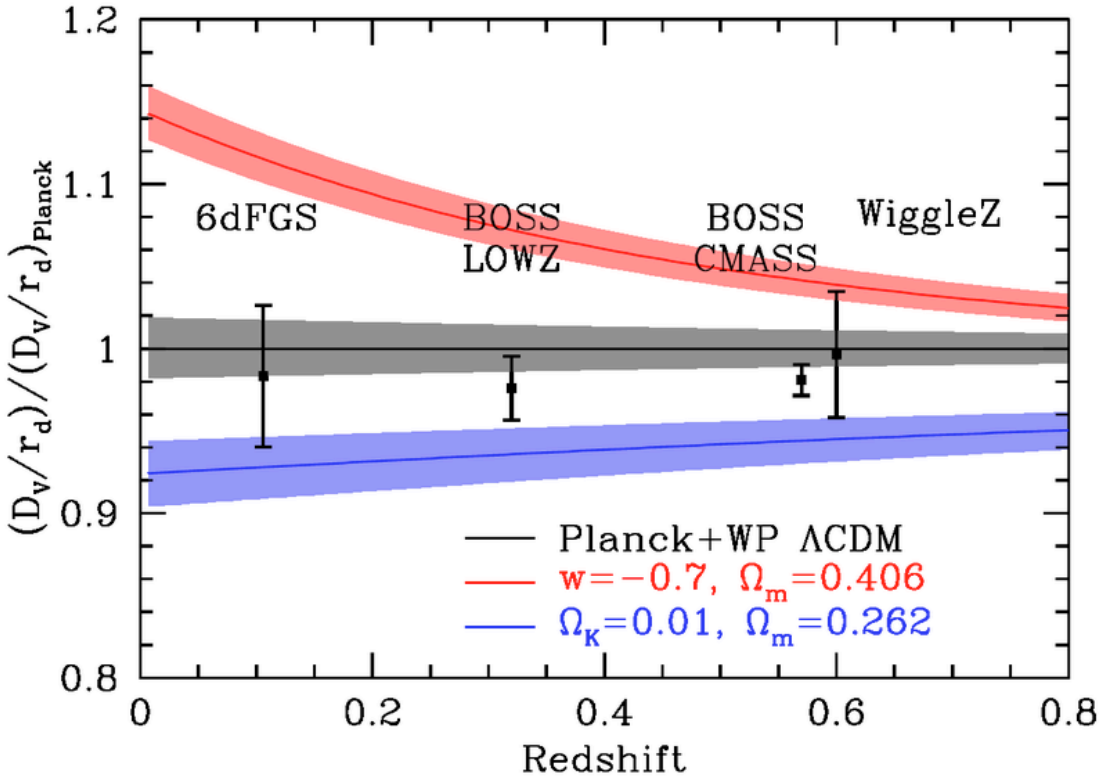
BAO in the galaxy power spectrum

Baryonic Acoustic Oscillations

BOSS DR11

Largest volume of the Universe currently mapped

(Anderson et al. 2014)



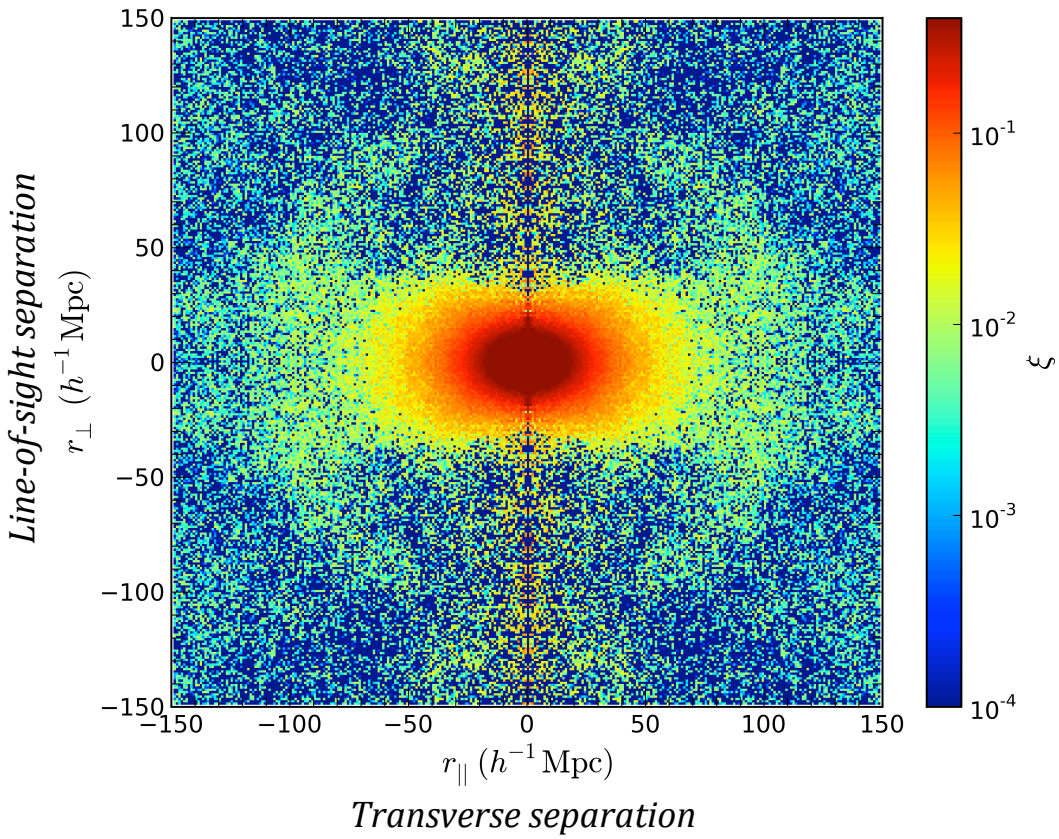
BAO Hubble diagram

Redshift-space distortions

BOSS DR11

Largest volume of the Universe currently mapped

(Samushia et al. 2014)



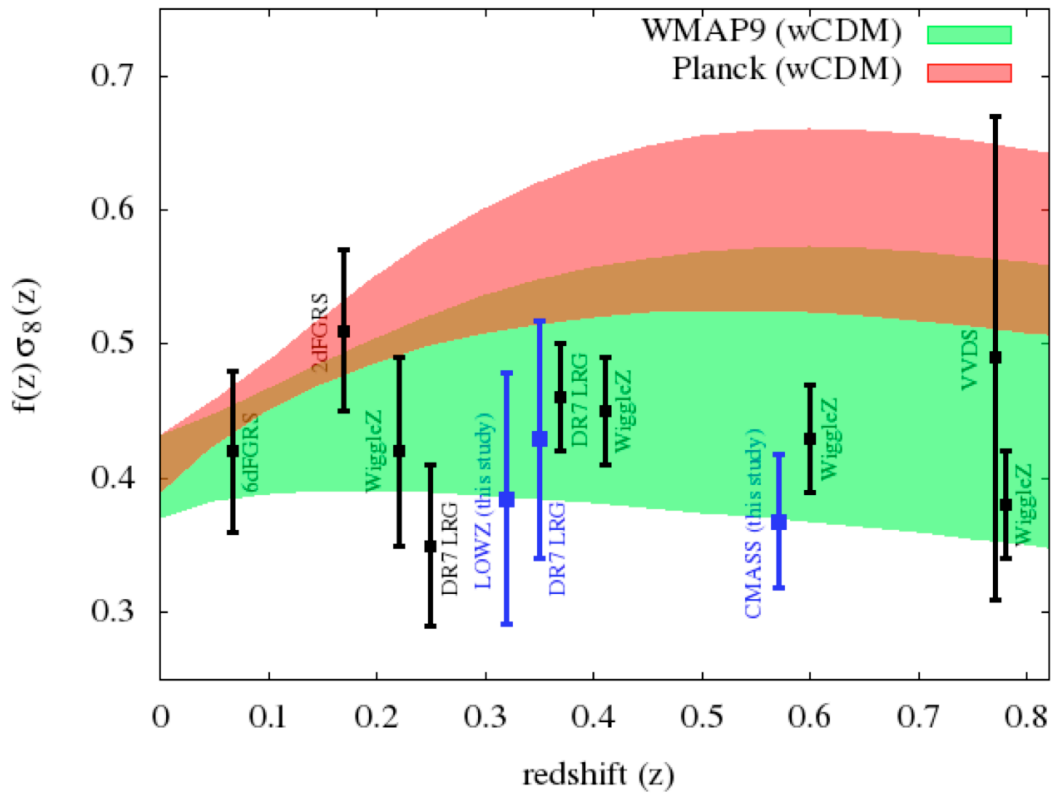
Anisotropic galaxy clustering

Redshift-space distortions

BOSS DR11

Largest volume of the Universe currently mapped

(Chuang et al. 2014)



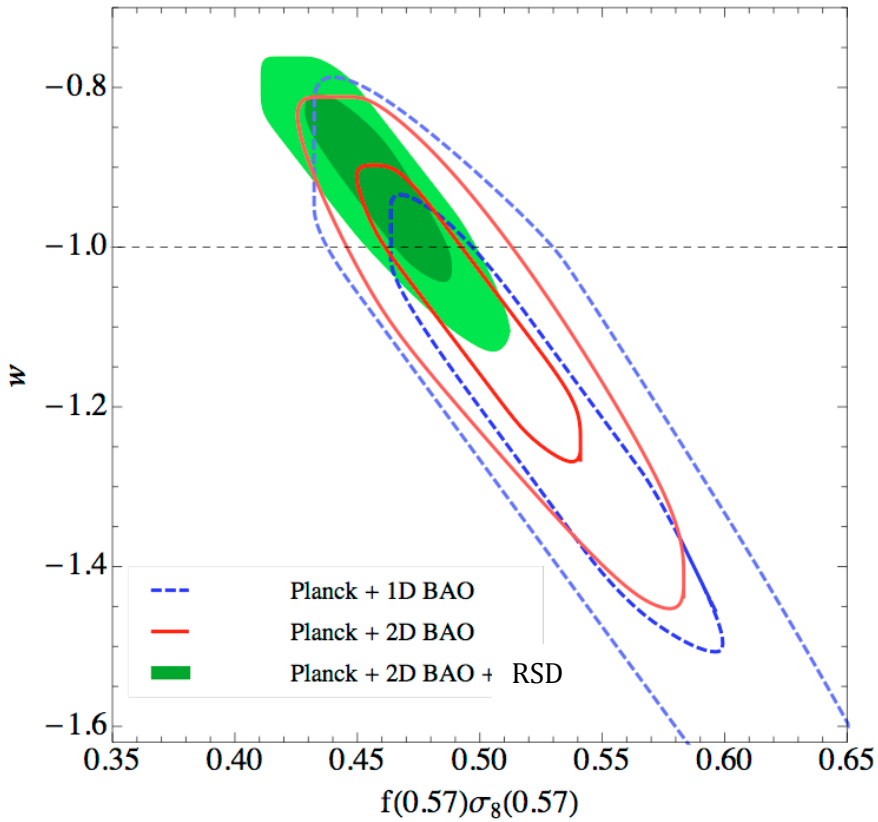
Constraints on gravity

Combined BAO and RSD constraints on Dark Energy

BOSS DR11

Largest volume of the Universe currently mapped

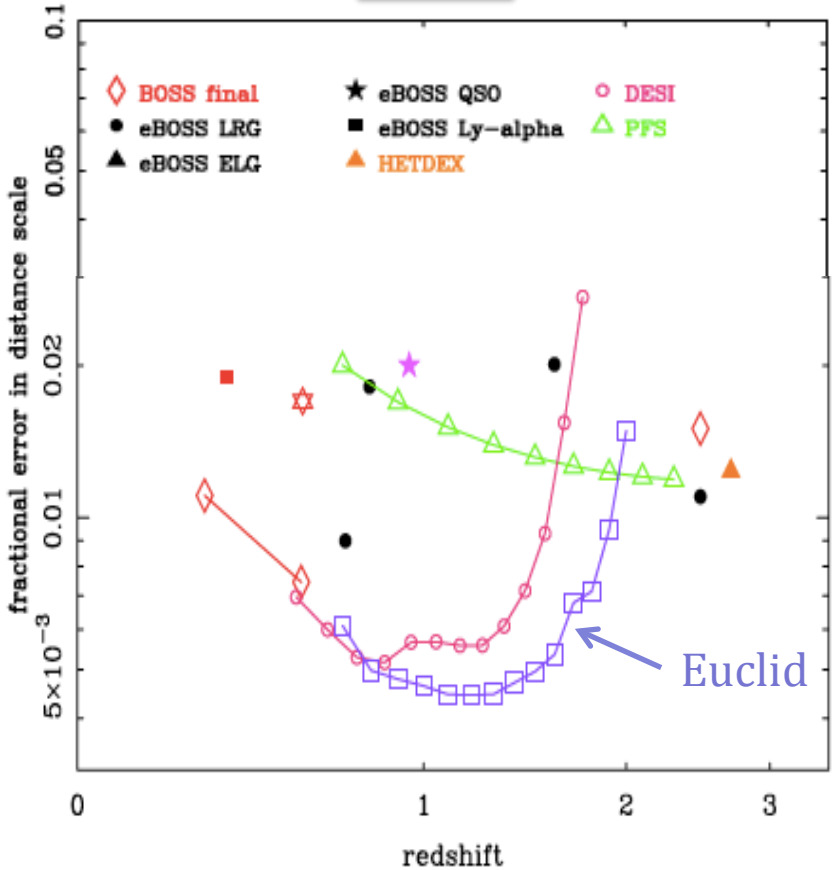
(Chuang et al. 2014)



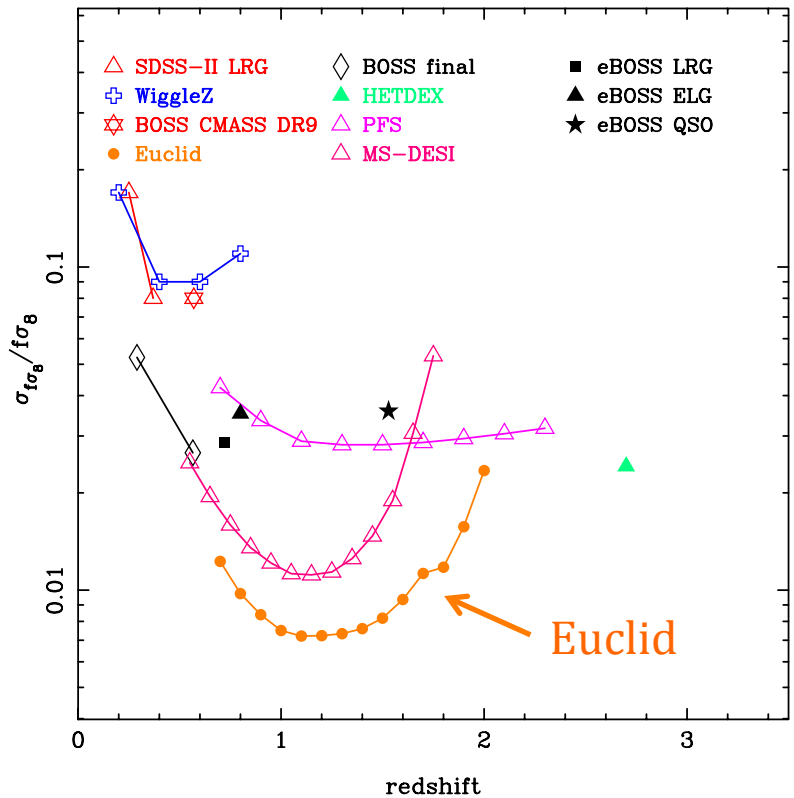
Latest EUCLID forecasts

Euclid Consortium

BAO



RSD



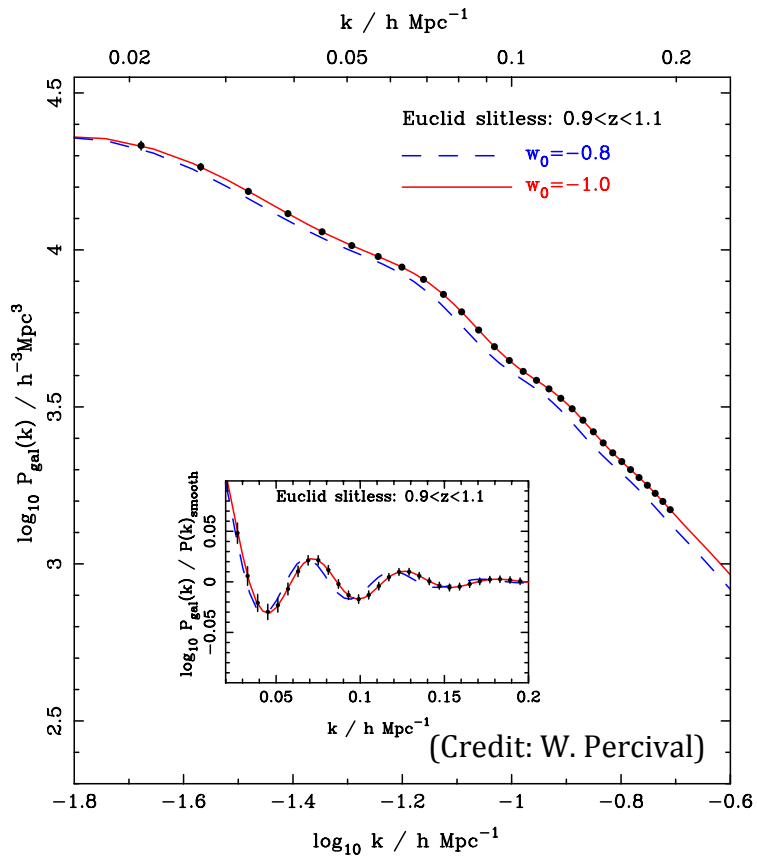
Euclid galaxy clustering requirements

Euclid Consortium

- Need:
  - Angular galaxy positions
  - Galaxy redshifts

- Need to understand:
  - Angular completeness
  - Radial completeness
  - Radial/angular density variations

→ **This is the hard part**



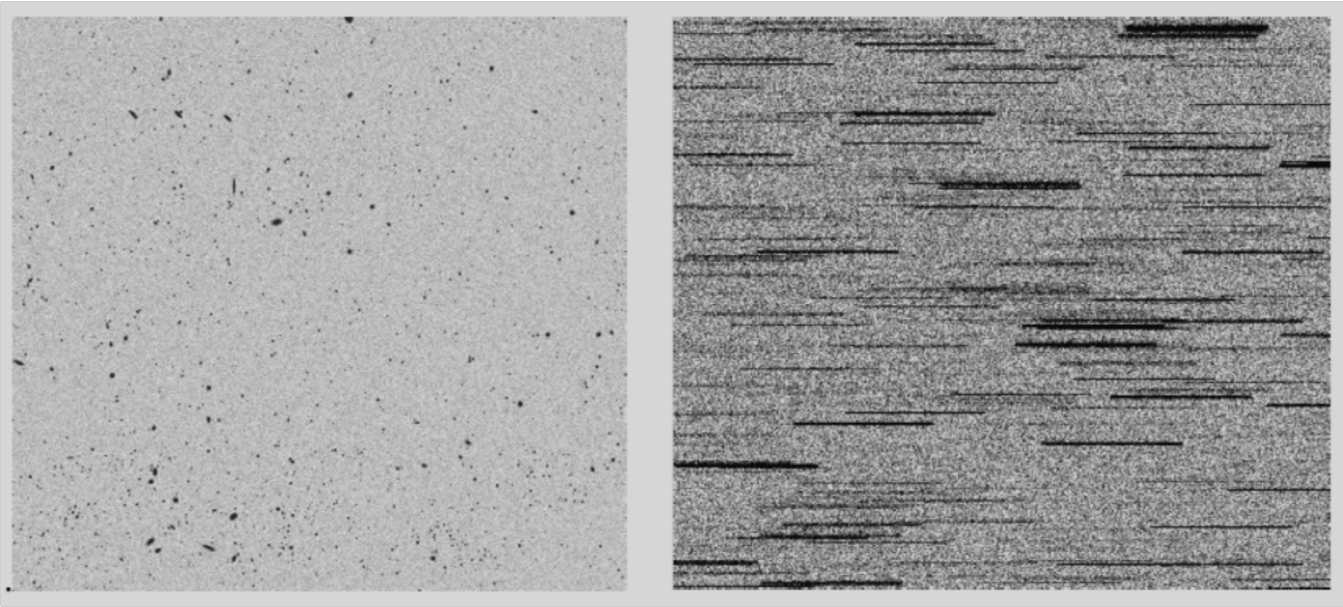
Predicted Euclid galaxy power spectrum

- Then measure two-point statistics:

$$\xi(r) = \langle \delta(\mathbf{x})\delta(\mathbf{x}+\mathbf{r})\rangle \qquad P(k) = \langle \delta(\mathbf{k})\delta(\mathbf{k})\rangle$$

Euclid slitless spectroscopy

Euclid Consortium



1 deg^2 of the sky simulated and propagated through end-to-end Euclid spectroscopic simulation (Garilli, Franzetti, Ealet, Roche, Rossetti et al.)

- Slitless provides an *a priori* uniform sample (no target sample)
- Slitless spec. means that almost all spectra are contaminated: contamination is the largest source of redshift failures
- Uniformity, completeness, purity are the key issues to be kept under control → Simulations and Deep survey are crucial

Update on SWG-GC activities

- Reorganization of the Work-Packages:

WP	Lead	Task	Priority
Sample selection	Daniel Eisenstein & Bianca Garilli	Define optimal galaxy selection for galaxy clustering	High
Survey mask	Ben Granett & Marco Scodeggio	Define Euclid spectroscopic masks and random catalogues	High
Slitless spectroscopy effects	Sylvain de la Torre	Define methodology to remove slitless effects on galaxy clustering	High

- These WPs are the most important and have to be addressed in priority

  → Understand and control systematics on galaxy clustering to very high accuracy

Update on SWG-GC activities

Euclid Consortium

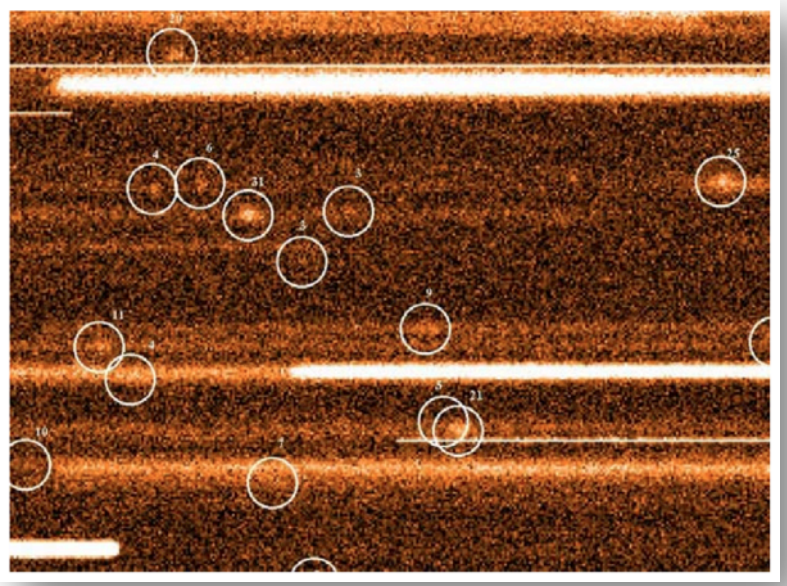
- Reorganization of the Work-Packages:

WP	Lead	Task	Priority
Likelihood fitting	Ariel Sanchez & Will Percival	Define likelihood fitting approach	Medium
Reconstruction	Nikhil Padmanabhan & Francisco Kitaura	Define and test methods for reconstruction (for BAO)	Medium
High-order statistics	Emiliano Sefusatti & Cristiano Porciani	Quantify how high-order stat. can be used to improve cosmological constraints	Medium
Additional probes	Juan Garcia-Bellido & Olivier Doré	Investigate new (non-standard) observational probes	Medium
Photo_z clustering	Shirley Ho	Investigate photo-z clustering as additional probe	Medium

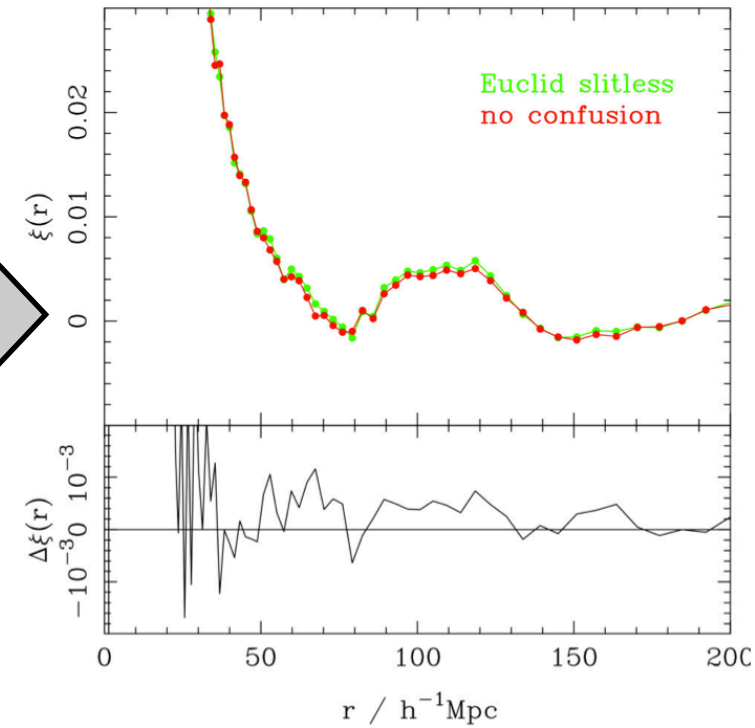
Update on SWG-GC activities

Euclid Consortium

- WP3: Slitless spectroscopy effects



First attempt to quantify these effects (Red Book)



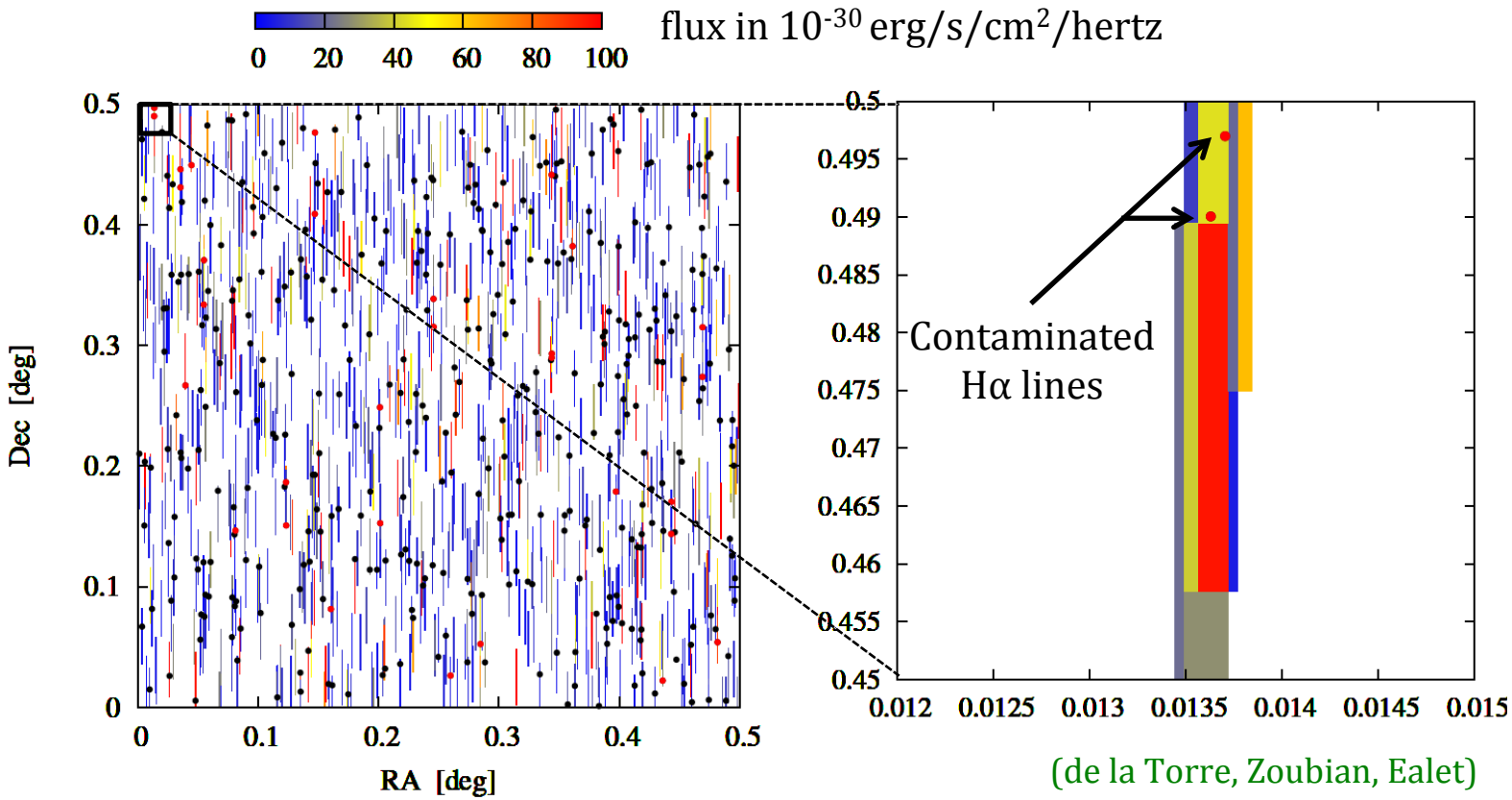
- *Fast Euclid observation simulator*: quickly reproduce slitless spectroscopy effects on arbitrary Hα galaxy catalogue

→ First step in the characterization of biases on galaxy clustering

Update on SWG-GC activities

Euclid Consortium

- WP3: Slitless spectroscopy effects



(de la Torre, Zoubian, Ealet)

- *Fast Euclid observation simulator*: quickly reproduce slitless spectroscopy effects on arbitrary Hα galaxy catalogue

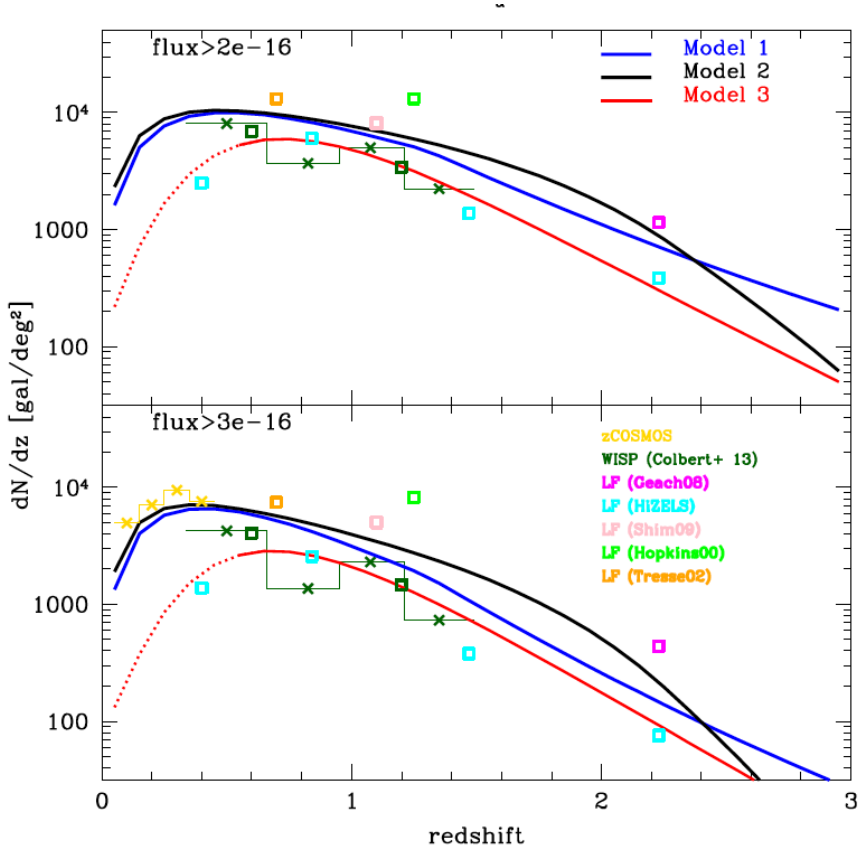
→ First step in the characterization of biases on galaxy clustering

Update on SWG-GC activities

Euclid Consortium

- Addendum to the Interim Science Review:

  - Updated modelling of H_α N(z)



→ Updated Euclid predictions for the accuracy on cosmological parameters

→ Crucial for spectroscopic strategy optimization

Status of SWG-Galaxy Clustering

- SWG-GC/OU-SIR/OU-SPE/NISP:
  - Consolidation of the spectroscopic strategy (NISP configuration, redshift range, etc) and N(z) predictions for H-alpha galaxies
  - Updated forecasts on cosmological constraints

- SWG-GC/OU-LE3-Int/OU-LE3-Ext
  - New baseline of spectroscopic survey frozen
  - Reorganization of the WPs for higher efficiency
  - Spectroscopic selection function, masks, confusion corrections are worked out in details now