Lyman-alpha forest science with BOSS

- Lya working groups
- Lya observations
- Lya mocks
- Lya typical issues : continuum / DLA
- Lya science

Lyman-alpha Forest Cosmology Working Group (mars 2010)

« focus on **cosmological science** from the Lyman-alpha forest data obtained **using BOSS instrument.**

complete analyses of **lyman-alpha forest clustering** in Fourier and configuration space, on large (>10Mpc) and small (100kpc - 10Mpc) scales, in 3 dimensions, and along the sightline direction, carrying out all measurements **as a function of redshift**.

the distance-redshift relation from BAO

Alcock-Paczynski test

matter power spectrum on small scales.

catalogs of spectra and mock spectra necessary for clustering analyses. »

Lyman-alpha IGM science working group

« focused on **IGM science**.

study the **physical properties** of the intergalactic medium.

Metal line detection and clustering and metal-lya cross correlations

quasar-lya clustering and the quasar radiation **proximity effect.**

The measurement of damped Lya lines and Ly-limit systems

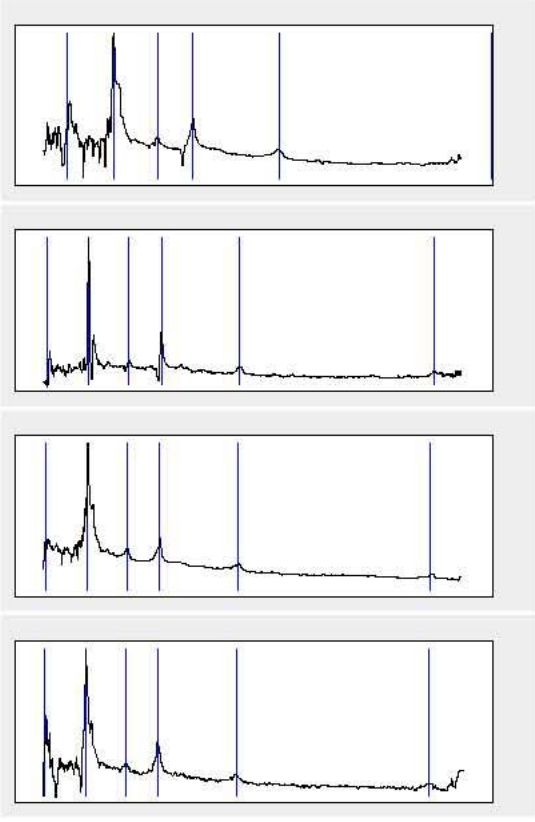
make available to the collaboration **samples of metal line systems and related data.** »

Lyman-alpha forest in BOSS QSO spectra

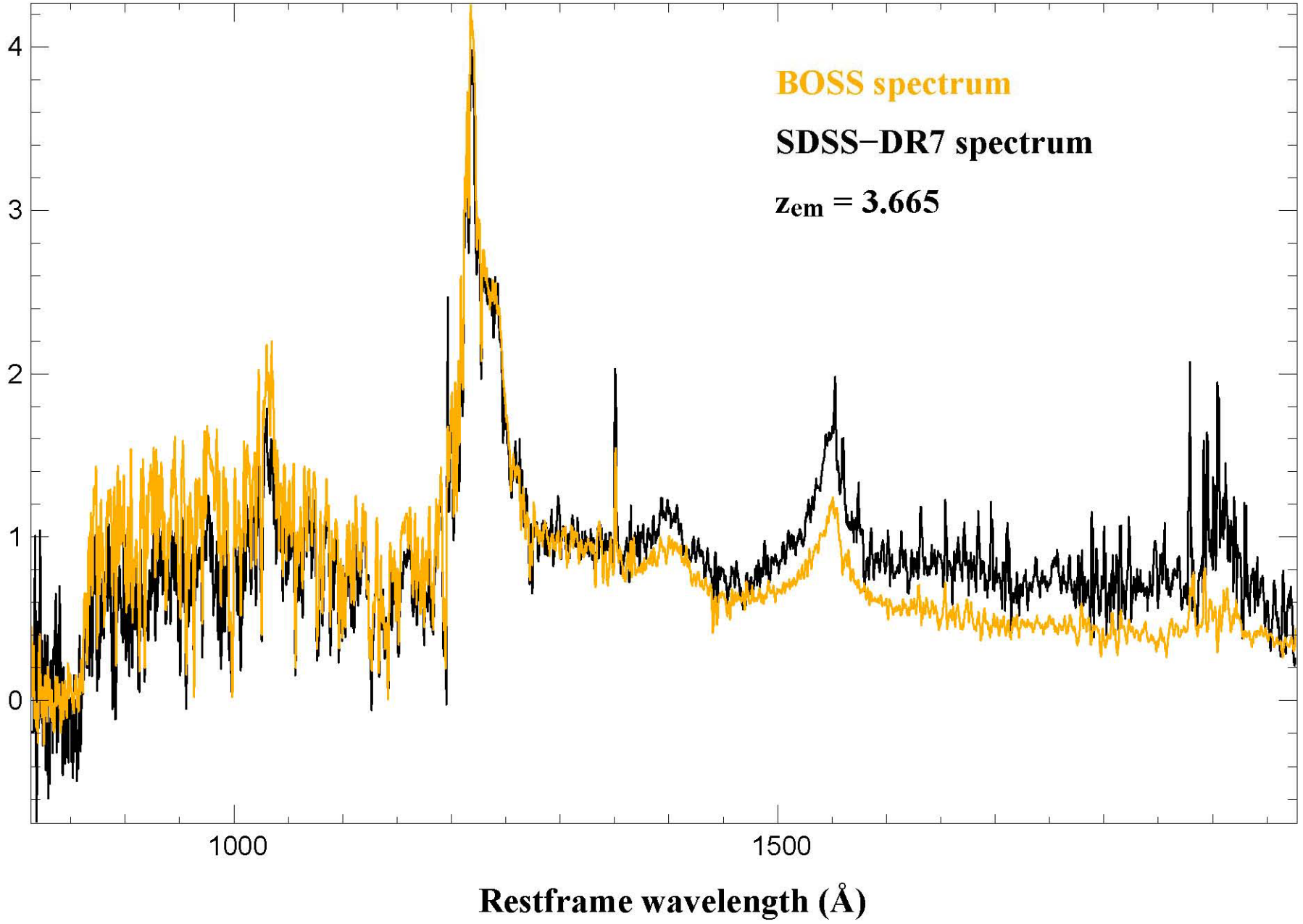
15/09/2010 QSO (plate 4223)

Current: plate 4223 all
any plate, all, no votes, no valid, validated, stars/nv, low-z qso/nv, high-z qso/nv, need check, bad, ?, valid qso, high-z valid qso, low-z valid qso, valid bal, valid bal low AI, valid qso high AI

id	g	z pipe paris (z fit)	type pipe paris (AI/BI)	z best	type best	int	pb spec
4223-55451-724	18.76	2.874 2.867 2.868	QSO (BROADLINE) QSO_BAL 561/ 81	2.870	QSO	X	
4223-55451-534	19.98	2.541 2.540 2.540	QSO (BROADLINE) QSO_BAL 1170/ 0	2.540	QSO_BAL		
4223-55451-184	18.28	2.537 2.521 2.533	QSO (BROADLINE) QSO 0/ 0	2.520	QSO		



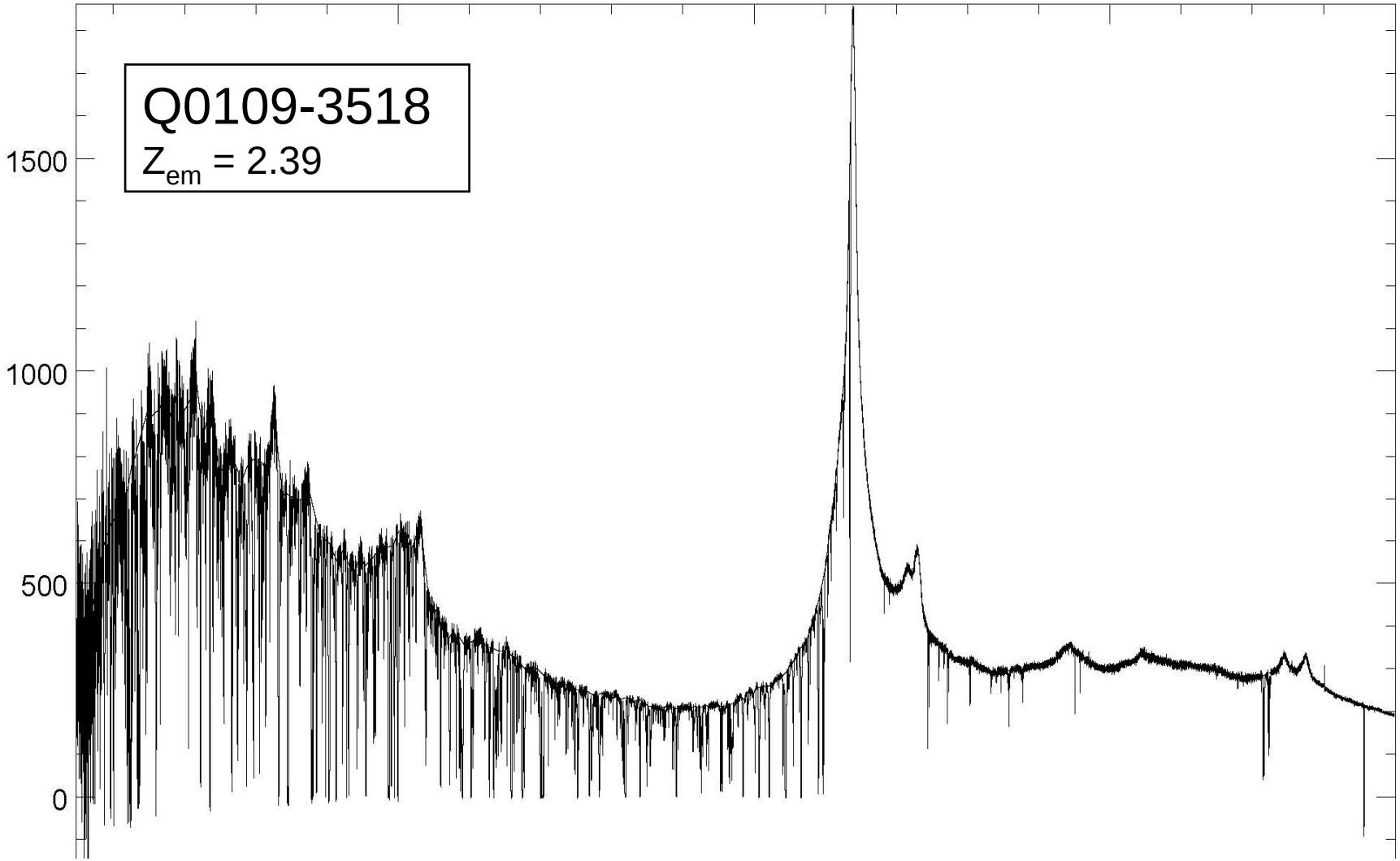
Patrick Petitjean (Friday)
As for Galaxy studies (Eyal Kazin, Ariel Sanchez), **comparison with SDSS-II spectra are necessary**


BOSS spectrum
SDSS−DR7 spectrum
z_{em} = 3.665
4
3
2
1
0
1000
1500
Restframe wavelength (Å)

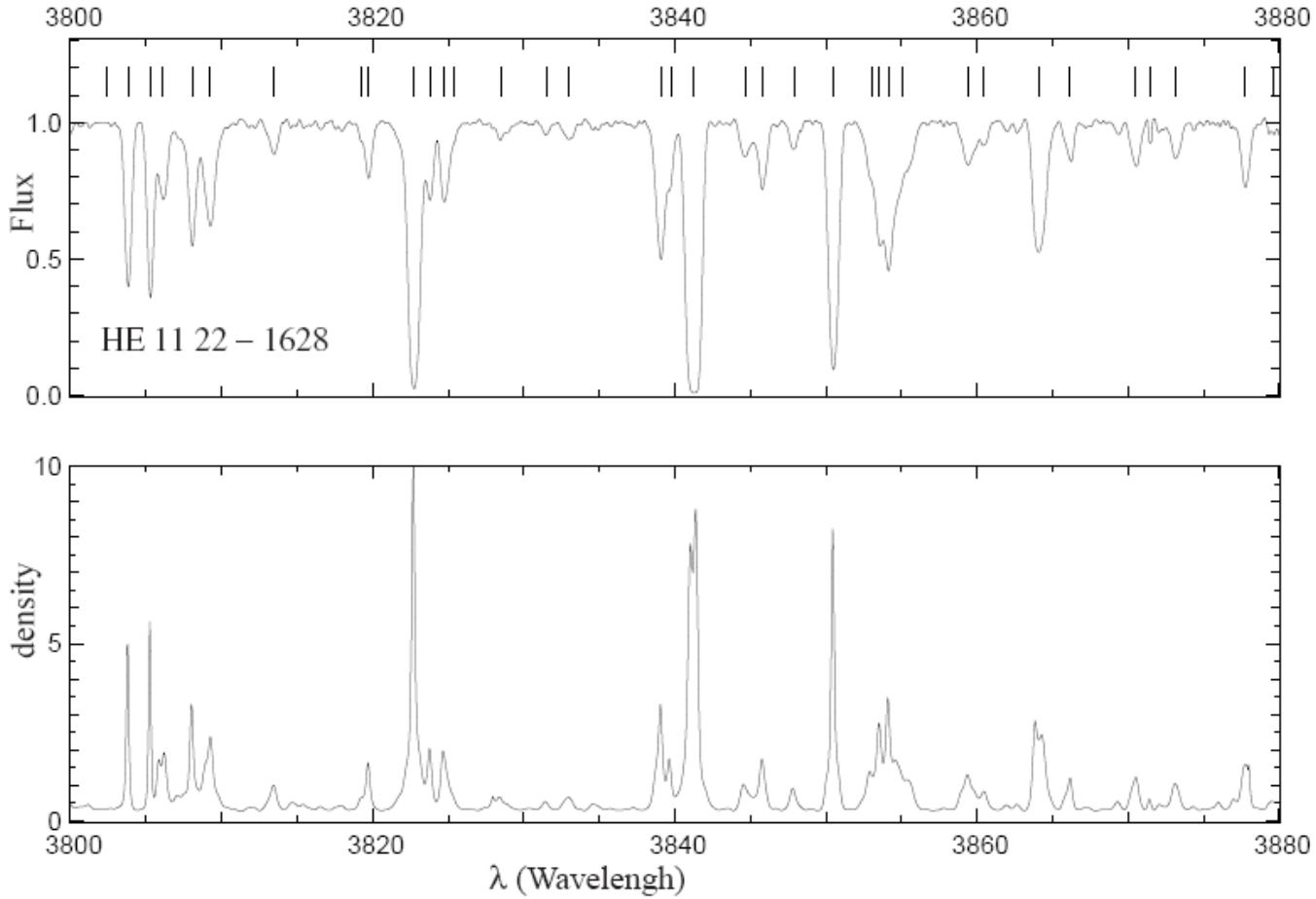
Lya observed / mock spectra

- Physics encoded in the Lya forest pixels
- Why is it so difficult to use Lya absorption spectra ?
- Different techniques to do mocks

What is encoded in the Lyα forest



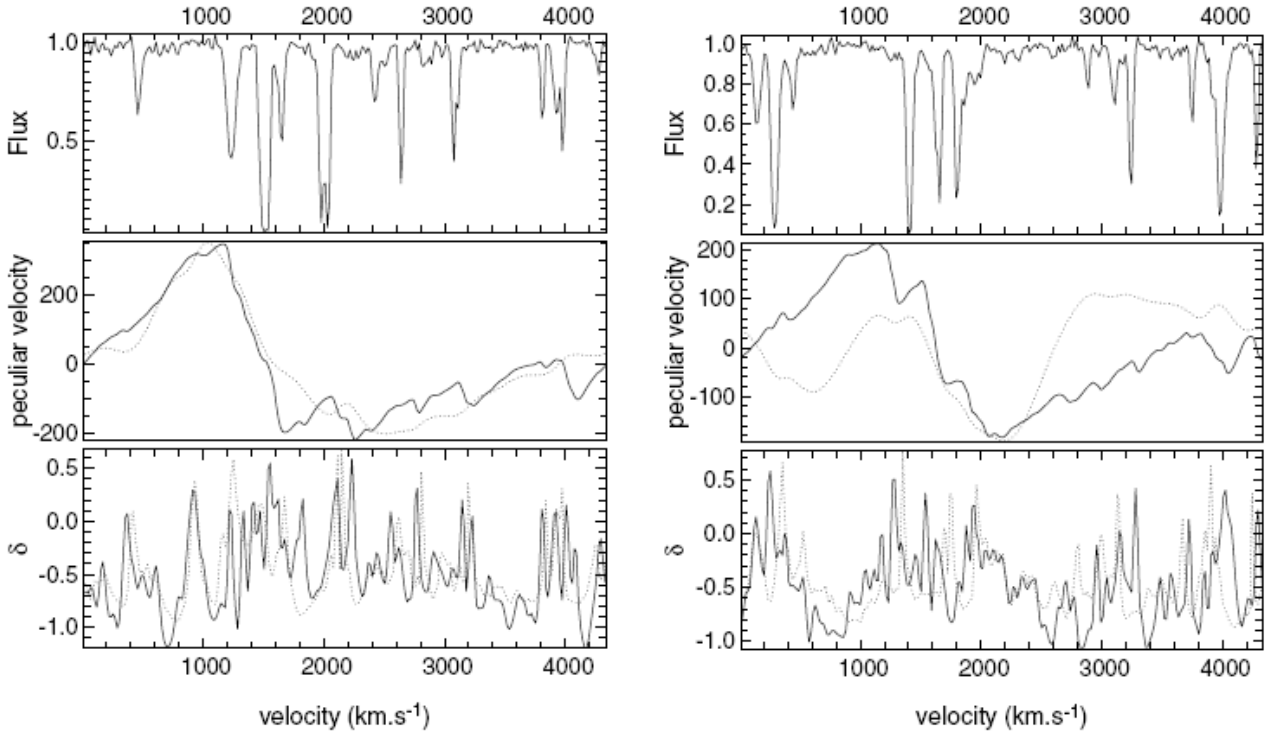
From gas to flux



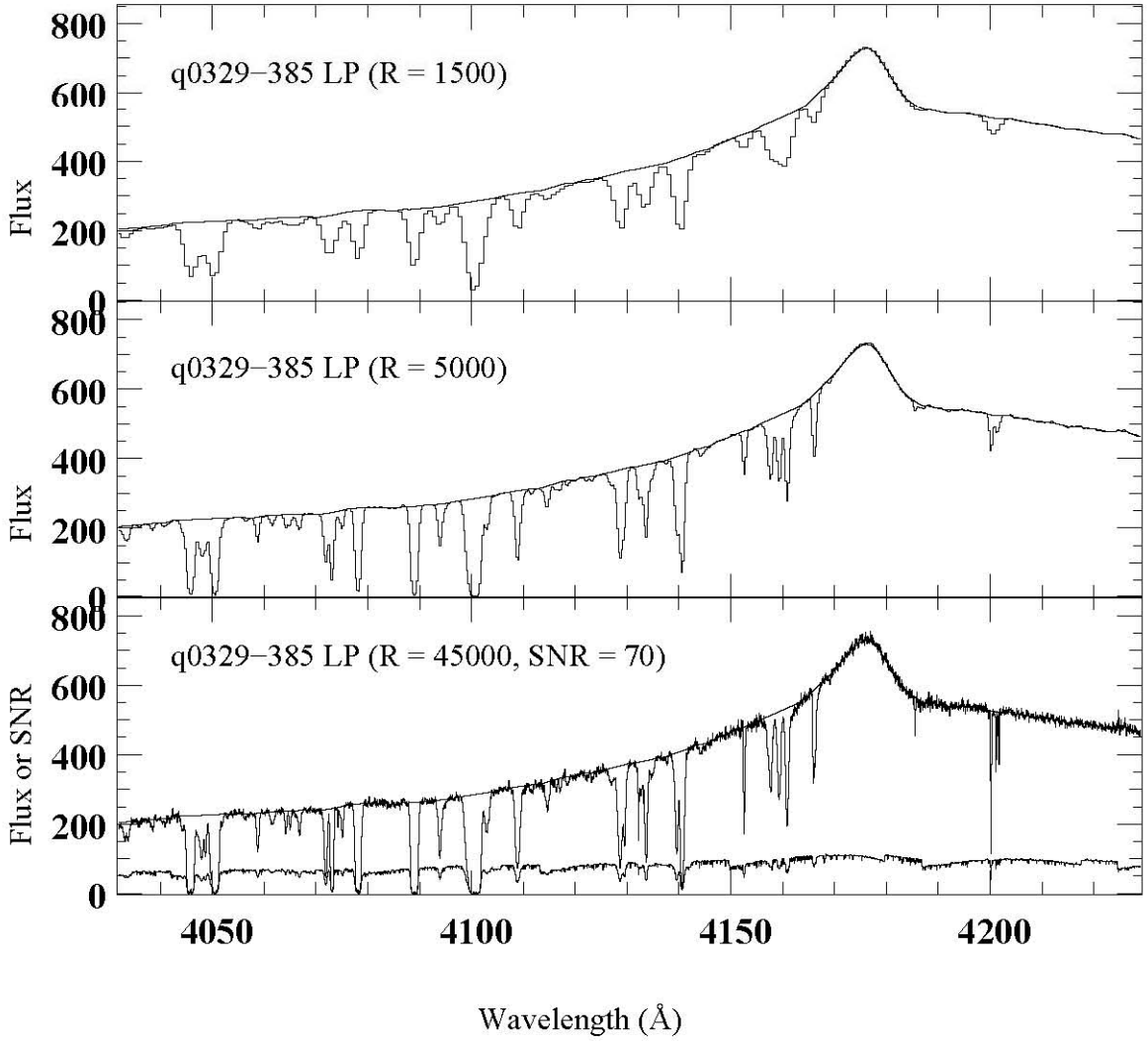
HE 1122-1618

$$\tau \propto \delta_{Hi} \propto T^{0.7}\, \delta^2 / \Gamma(z)$$

Peculiar velocities

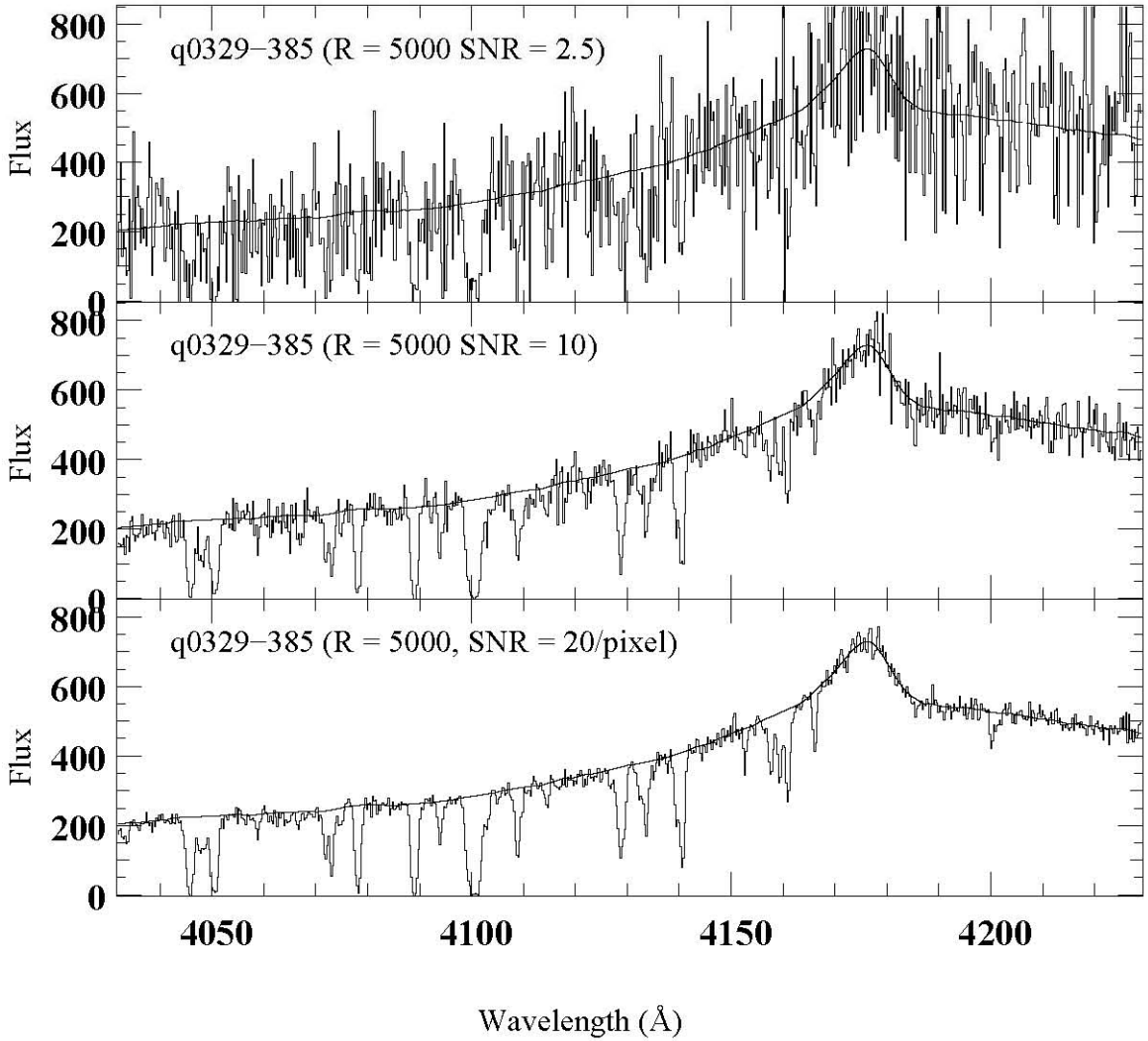


Observationnal parameters



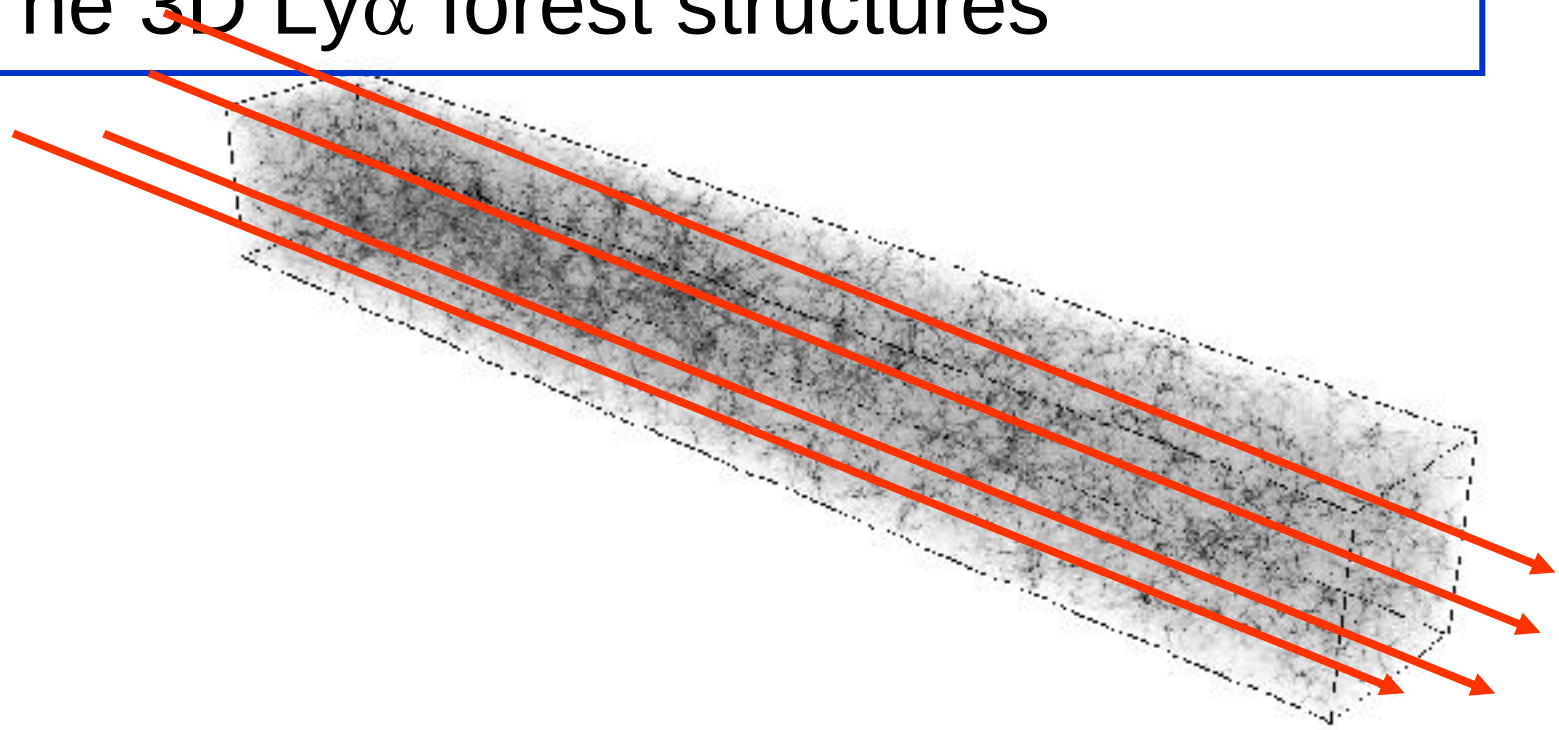
1 – Continuum
2 – Resolution

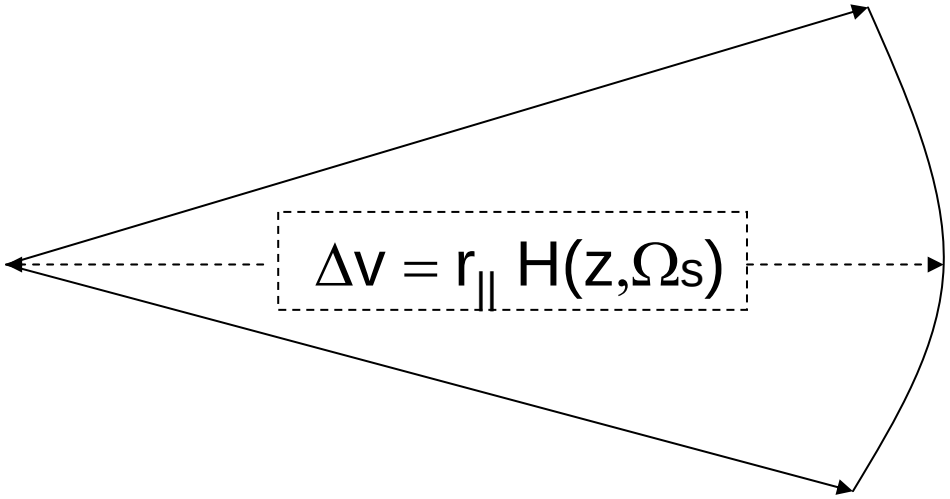
Observationnal parameters



1 – Continuum
2 – Resolution
3 – Signal to Noise

The 3D Lyα forest structures





$\theta \propto r_{\perp} f(z,\Omega s)$

Contraints on $\Delta v/\theta$

$\Leftrightarrow$

Constraints on Ω's

Measure of BAO scale
At different z

Lya Mock catalogs

Density to Flux :
Using Gaussian Fields + Fluctuating Gunn-Peterson Approximation

- 3D Density Gaussian Fields + LogNormal? Transformation (3DG+LN)
- Flux Gaussian Fields along correlated lines of sight + LogNormal? Transformation (1FG+LN)

Using **Dark Matter Simulations + Fluctuating Gunn-Peterson Approximation**

Add continuum…

Open Questions

- How to include small-scale effect ?
- How to account for a correct PDF, bias parameters : linear, scale-independent ?
- Can we improve the low-resolution DM simulations applying some kind of lognormal transformation?

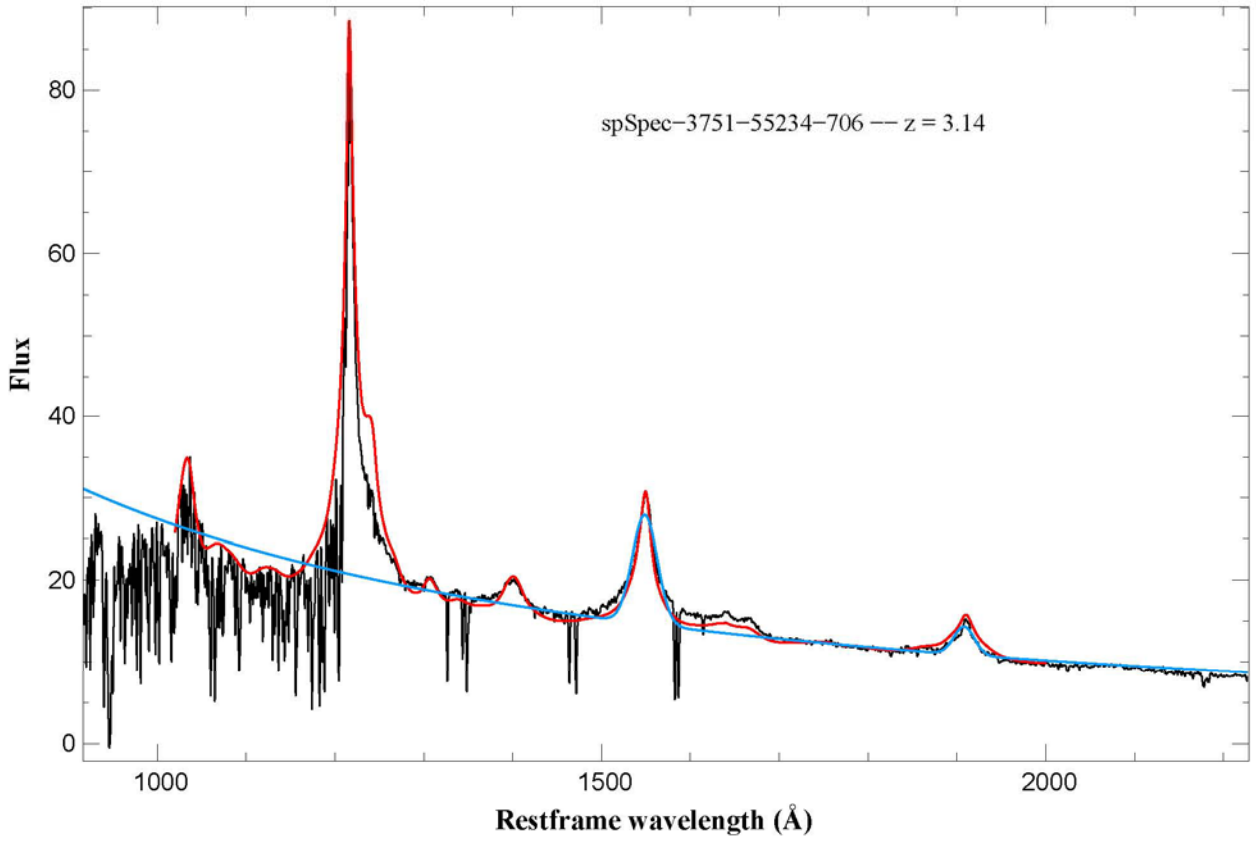
Mock catalogs

- Non-parallel lines of sight, density, noise etc…

Lya pre-analysis

- Continuum
- DLA

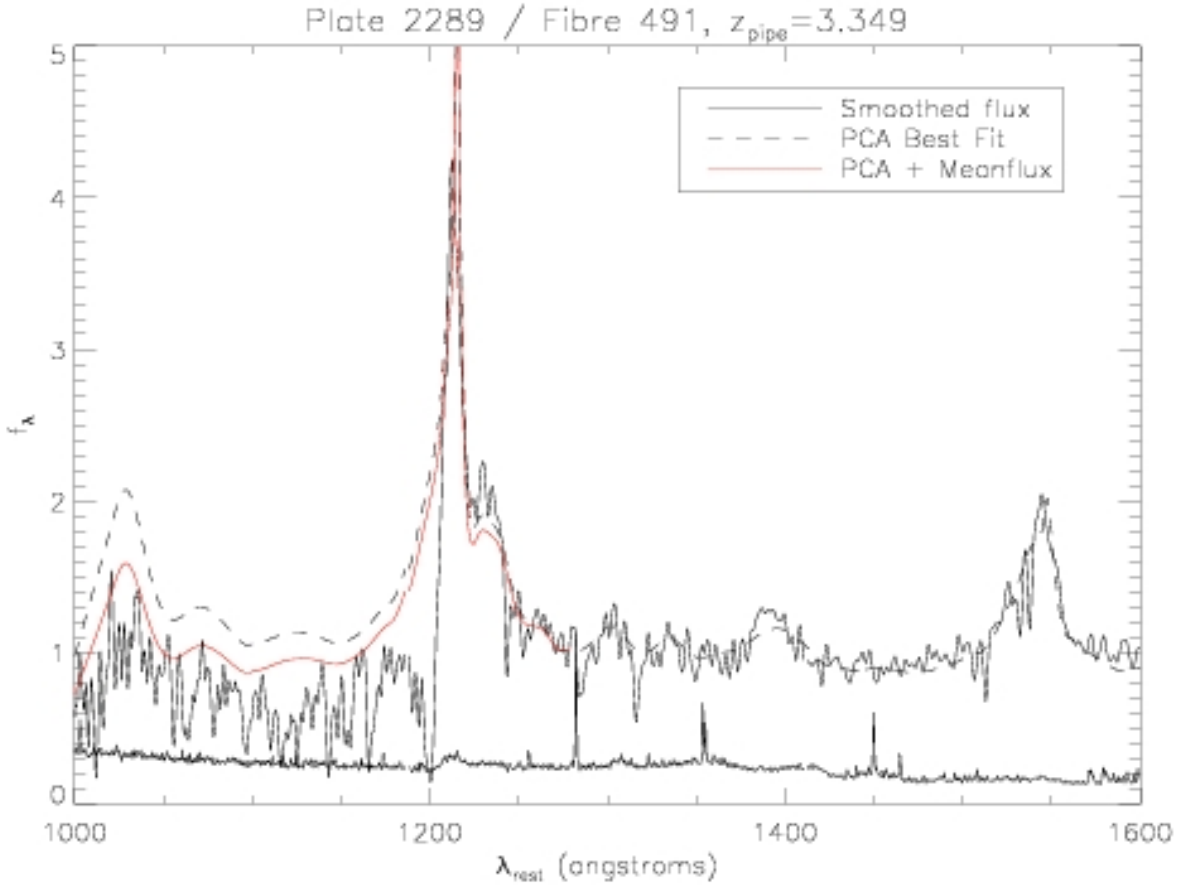
continuum



PCA / power law… :

Nao Suzuki, KG Lee (Friday), Isabelle Paris (Saturday)

continuum



PCA / power law… :

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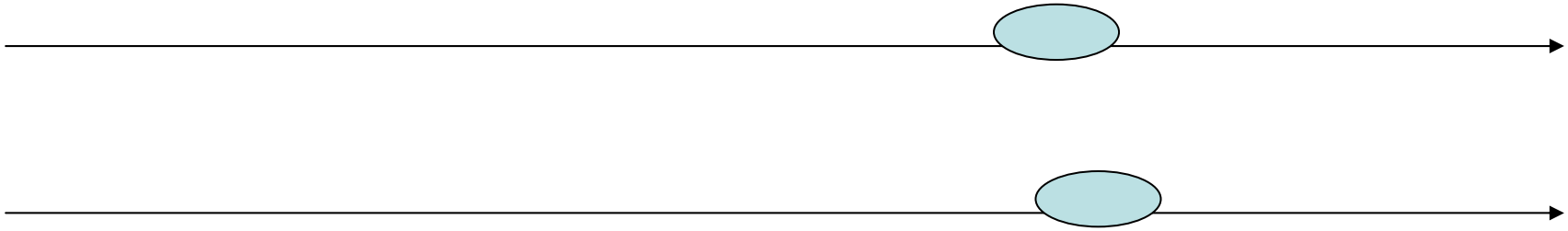
DLA

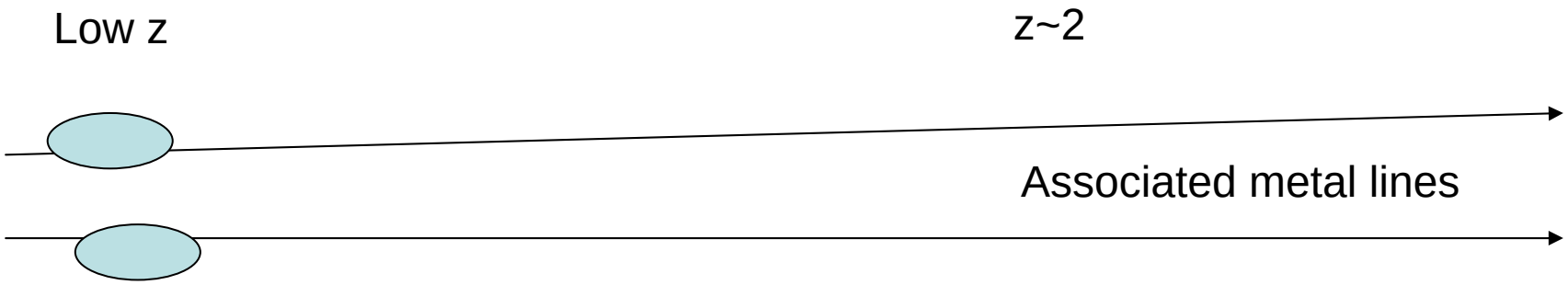


If DLA show the same correlation as galaxy, could add a signal… where do we place DLAs in Mock ?

Can also modify the ‘simple’ IGM signal…

Andreu Font’s talk (Friday)

DLA



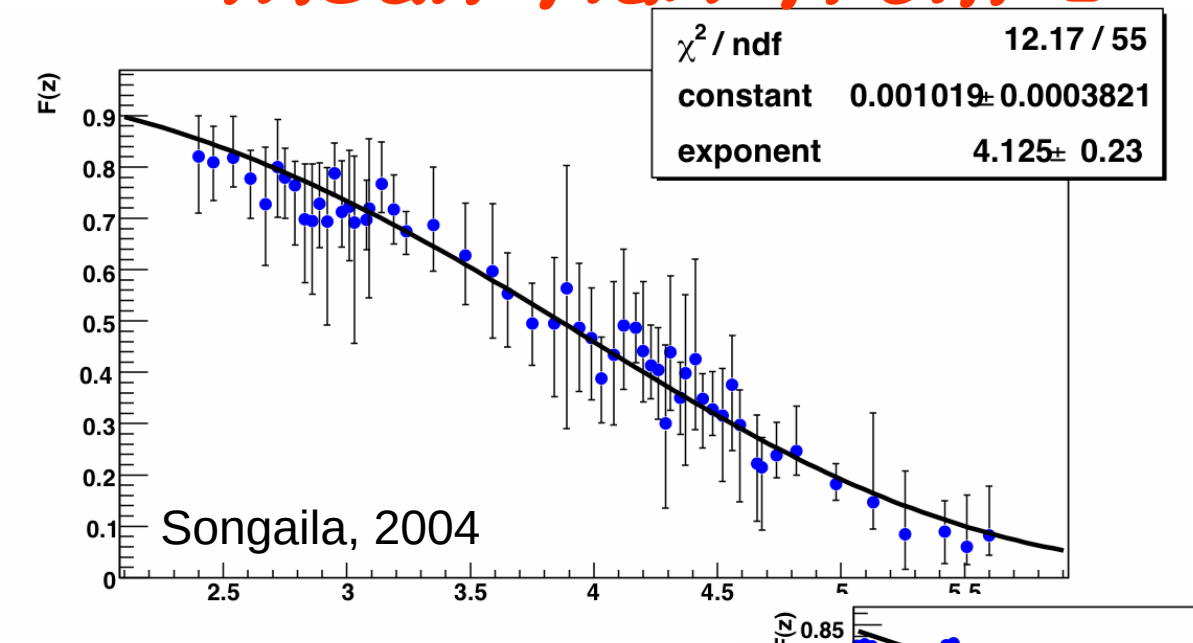
Metal lines associated to low redshift structures….

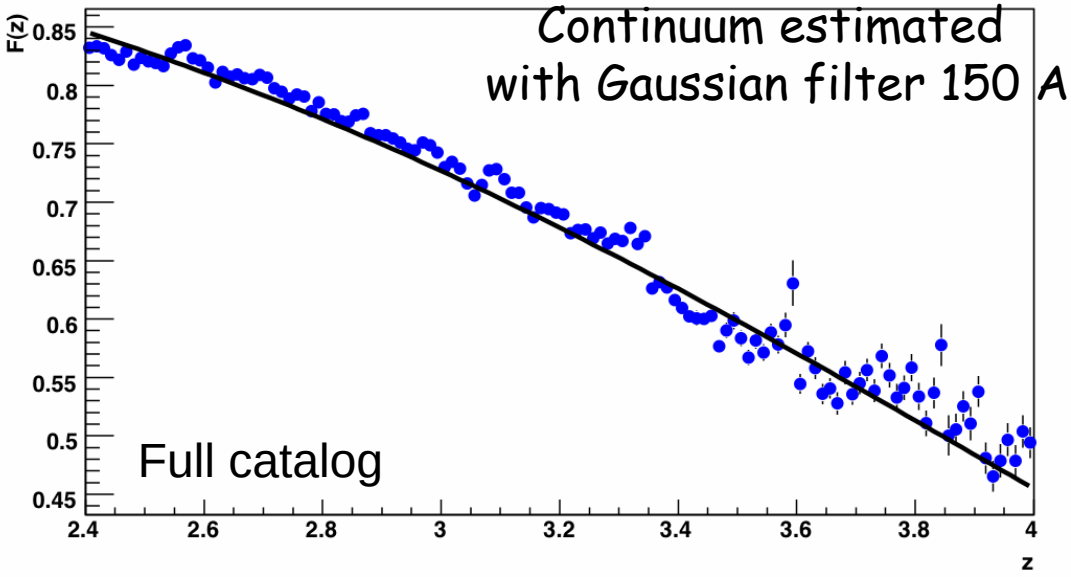
Add correlation at different comoving length scales (??)

Lya science from 1st year data and mock catalog

- Mean flux
- 1d power spectrum
- 3d power spectrum

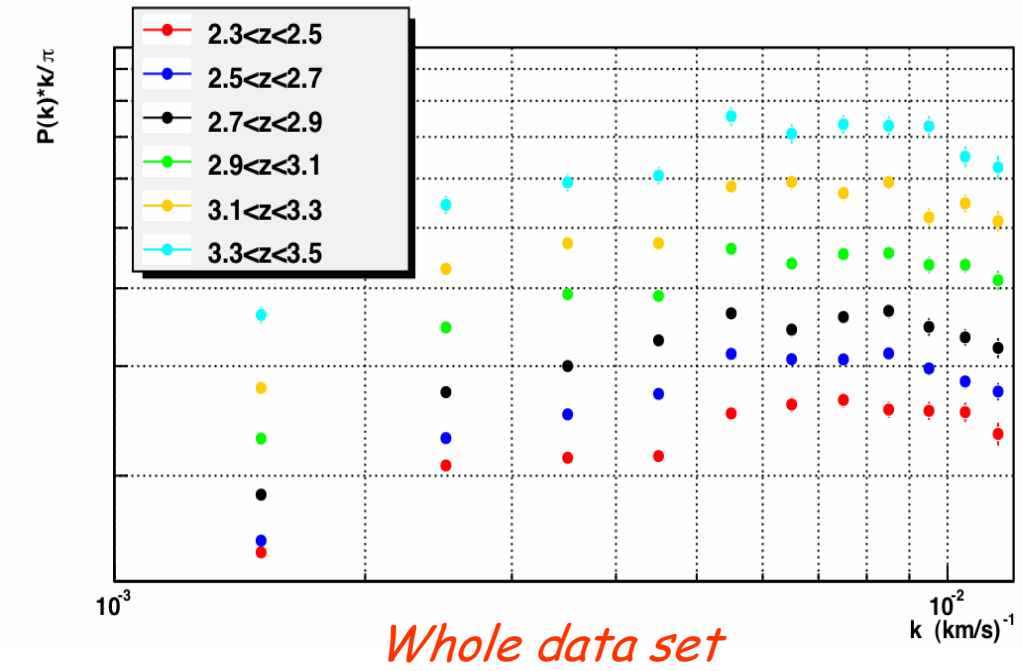
Mean flux from 1st year data



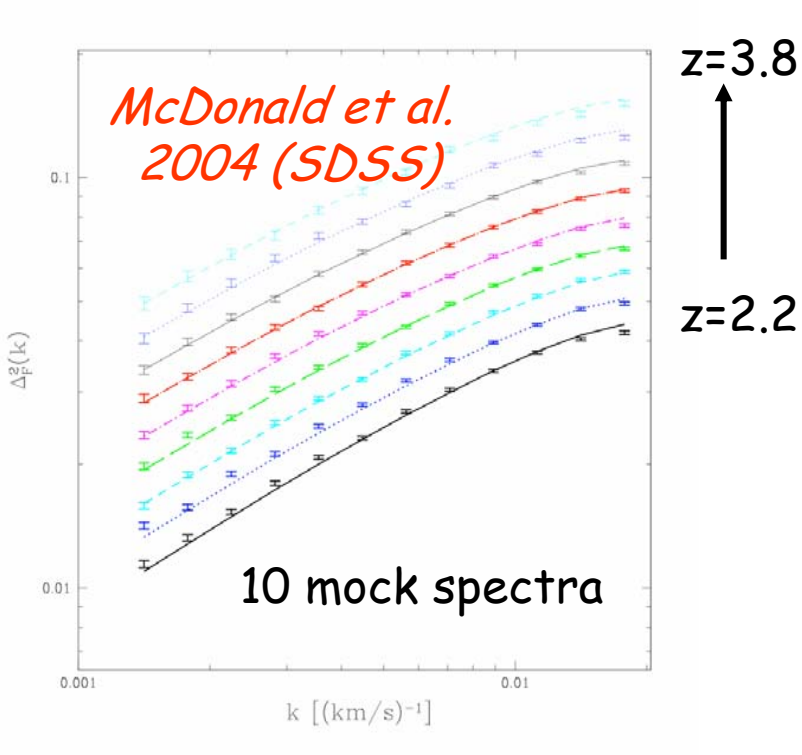


C. Yeche, june 2010

1d power spectrum from 1st year data

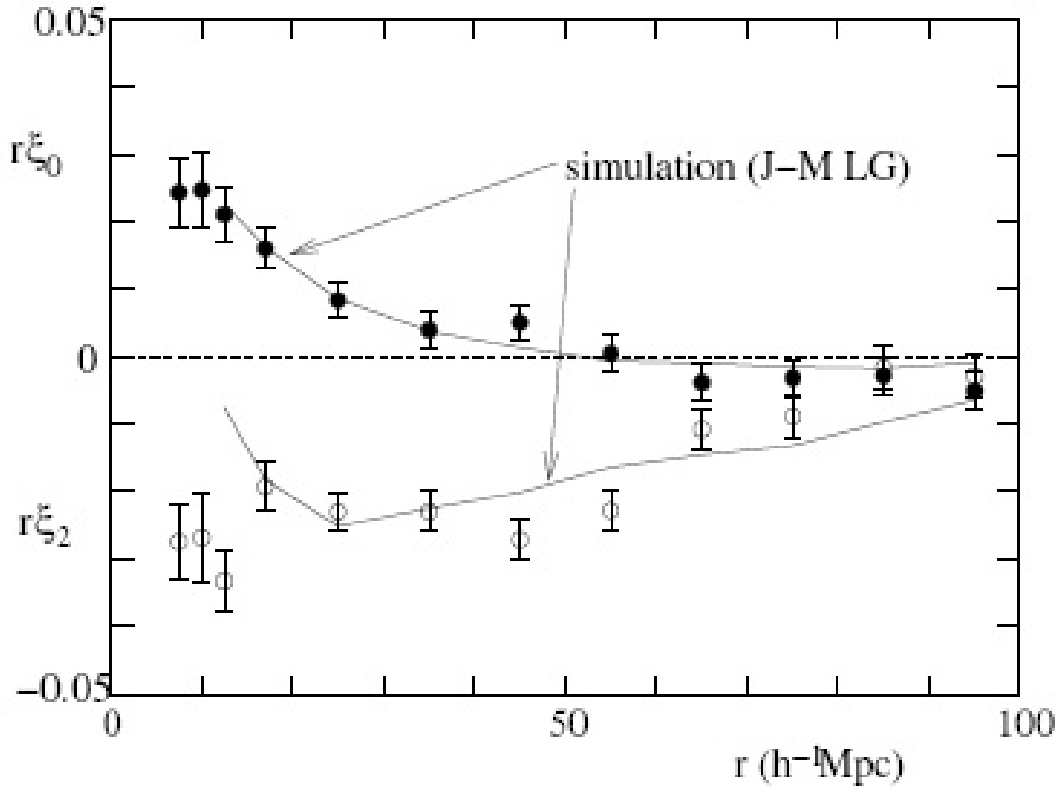


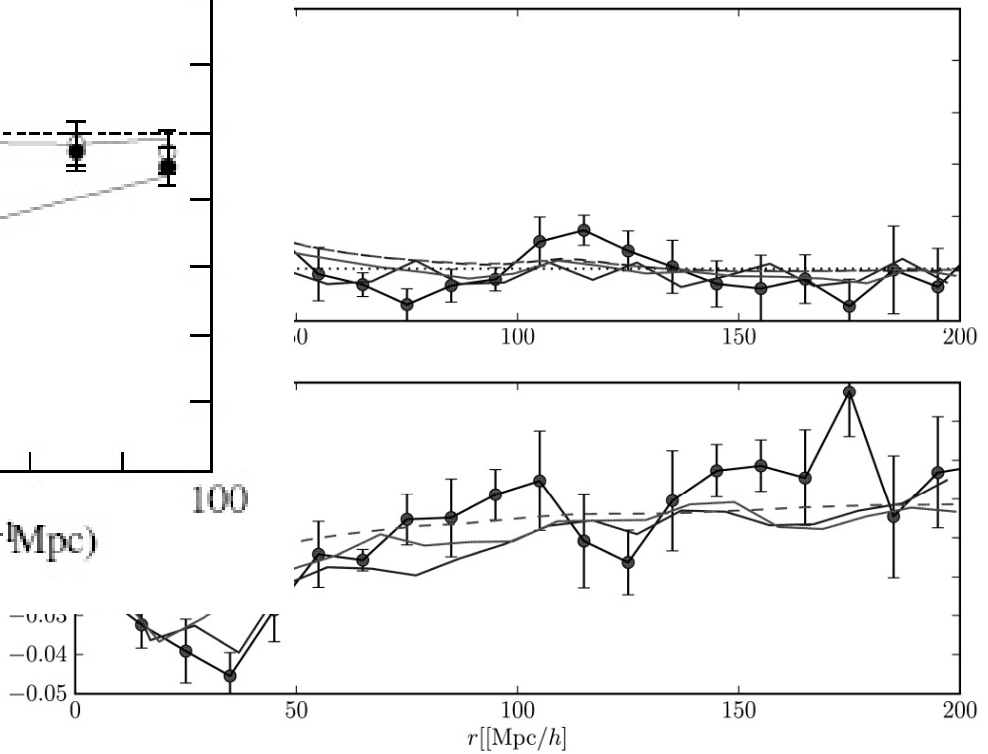
Whole data set



- After subtraction of the noise, fairly good agreement with Pat's P(k) !!!

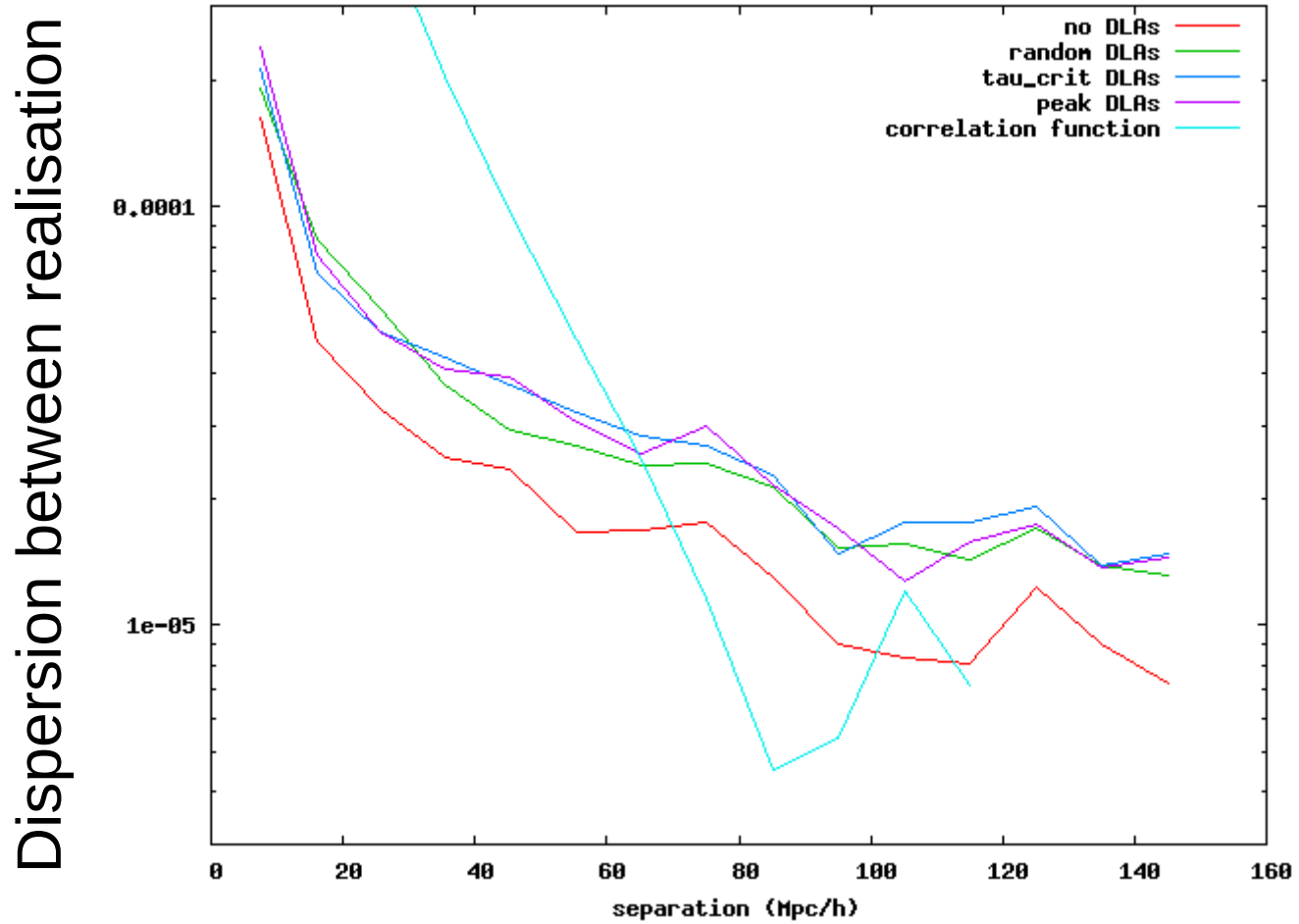
3d coorelation function from 1st year data





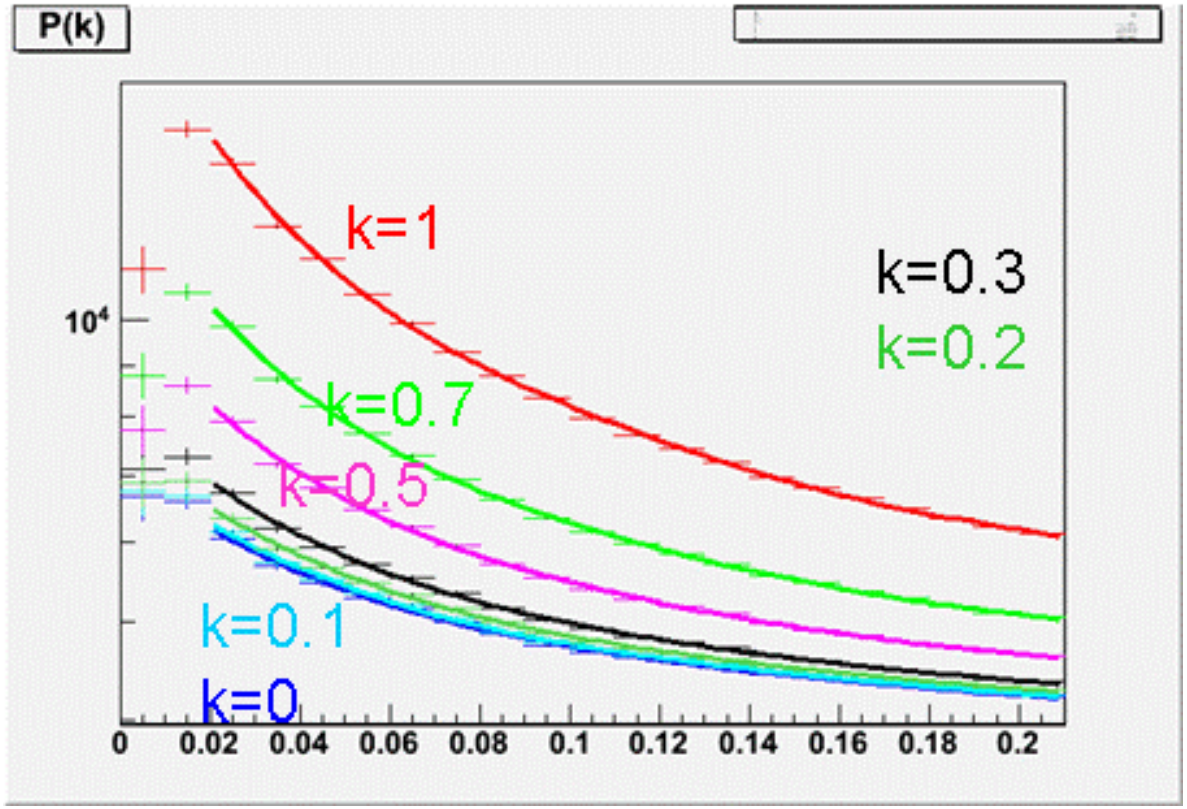
Jim Rich (Friday), A. Slozar, S. Ho…

3d correlation function from 1st year Mock data – effect of DLAs



A. Font : mocks for 2pc catalog

3d power spectrum dependence on continuum with Mock BOSS



Future works

- Add more baryonic small-scale physics
- Add more ‘side-effect’, metals, DLA
- Continuum…
- Mocks with different surveys
- Play with on-going data !!