Saclay Mocks

- Tuning of b(z), beta(z) and P1D(k,z)
- Status of the production of 10 realisations
- Analysis of 1 realisation (v4.2)
- Foretaste of the analysis of 10 realisations (v4.4)
- Conclusion and plans

Thomas Etourneau, Jean-Marc Le Goff

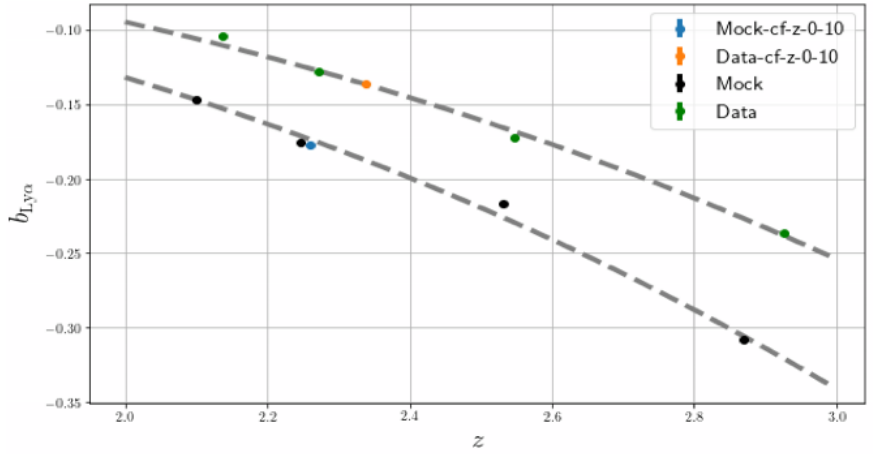
eBOSS-DESI France meeting

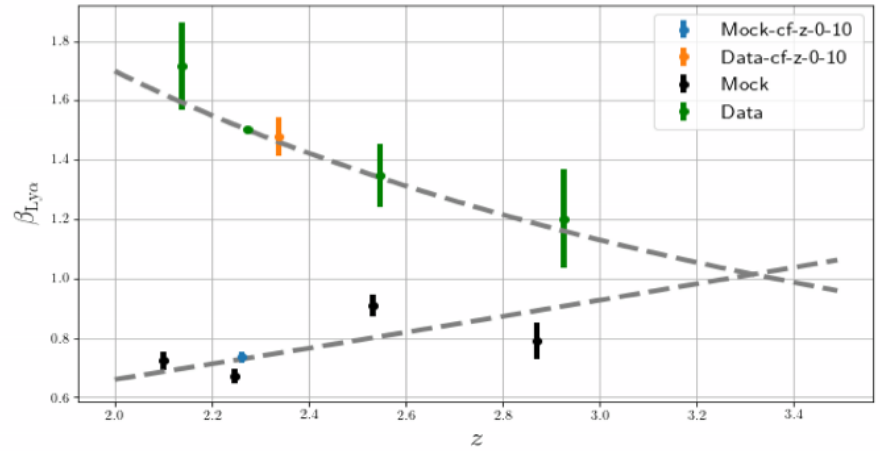
CEA Saclay, 07/05/2019

b(z) and beta(z) tuning

Last meeting:

$$F = \exp\left(-a\exp\left(bG(\delta_l + \delta_s)\right) - \bar{\tau}\,\eta\right)$$

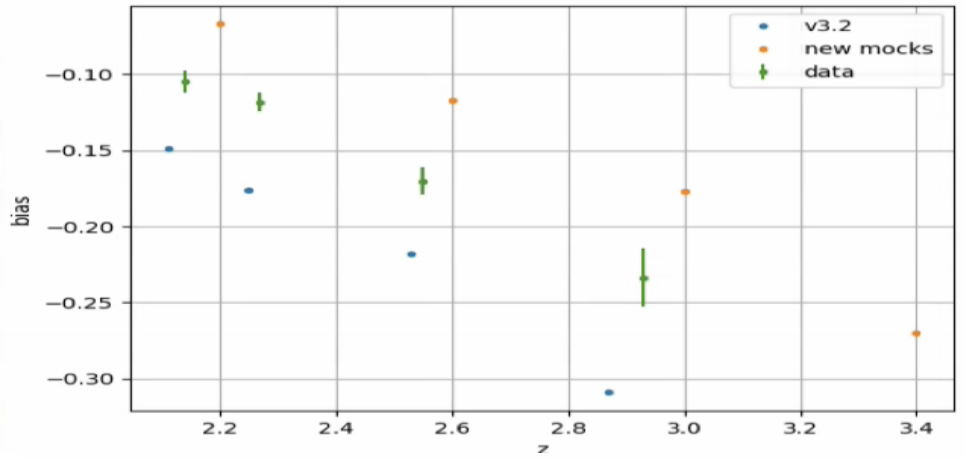


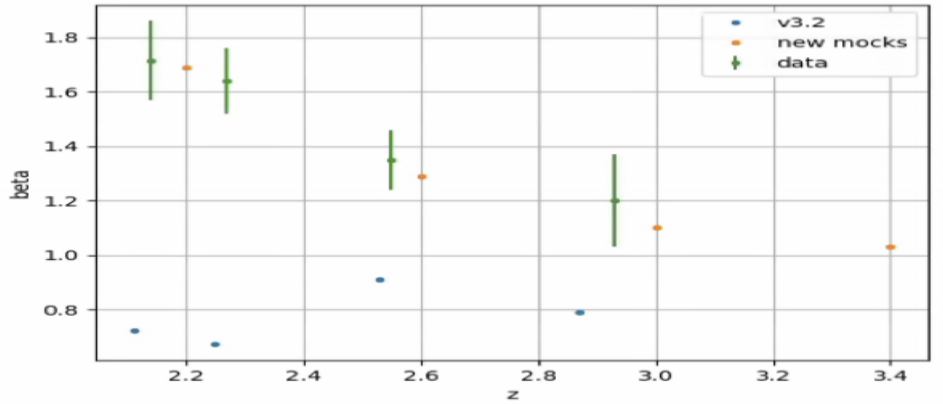


Added effective parameters to tune beta(z):

$$F = \exp\left(-a\exp\left(bG(\delta_l + \delta_s)\right) - \mathrm{c(z)}\,\bar{\tau}\,\eta\right)$$

And include RSD into δ_s to increase P1D and decrease |b(z)|

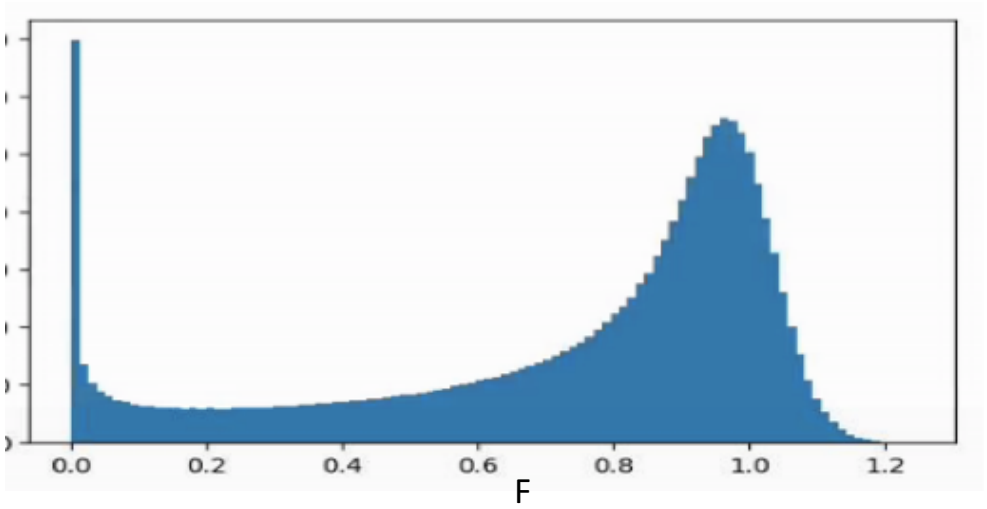




b(z) and beta(z) tuning

- Hard to tune both b(z) and beta(z)
- $\bar{\tau}$ is huge

→ $F = \exp\left(-a \exp\left(bG(\delta_l + \delta_s)\right) - \mathrm{c(z)}\ \bar{\tau}\ \eta\right) > 1$



Remove RSD from δ_s to decrease $\bar{\tau}$

→ Part of small scales directly into η

- part of the small scales into η

closer to what boxes with small voxels would give

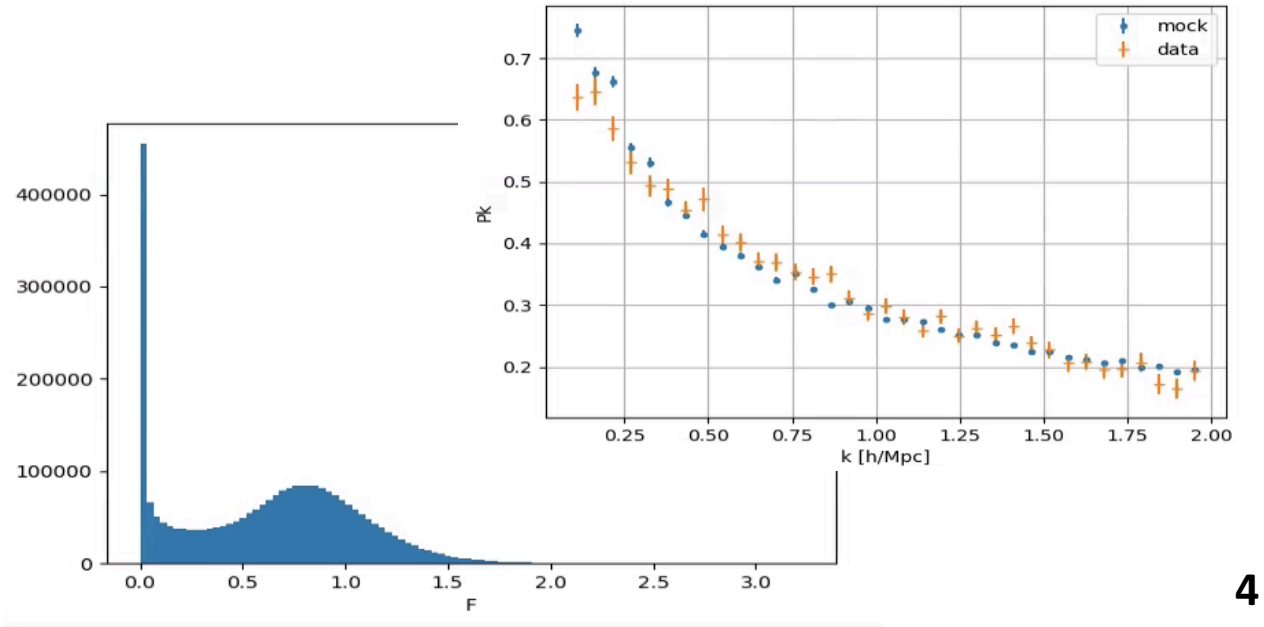
$\tau = a \exp\left(bG\ (\delta_l + \ \delta_s)\right) + c\ \bar{\tau}\ (\eta_l + \ \eta_s)$

$P[\delta_s] = \ P_{camb} - P_{camb,cut}\ W^2_{gauss}$ fixed

a, c, $P[\eta_s]$ to be fitted

=> managed to fit b, beta and P^{1D}

but F significantly larger than 1



b(z) and beta(z) tuning

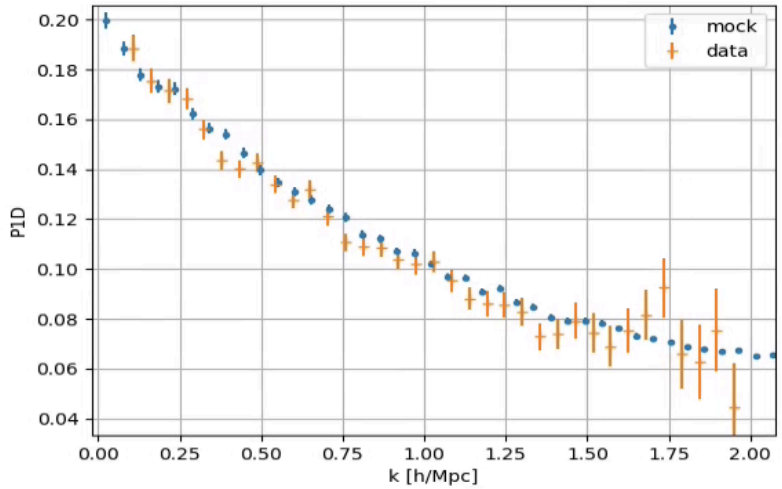
- all in FGPA:

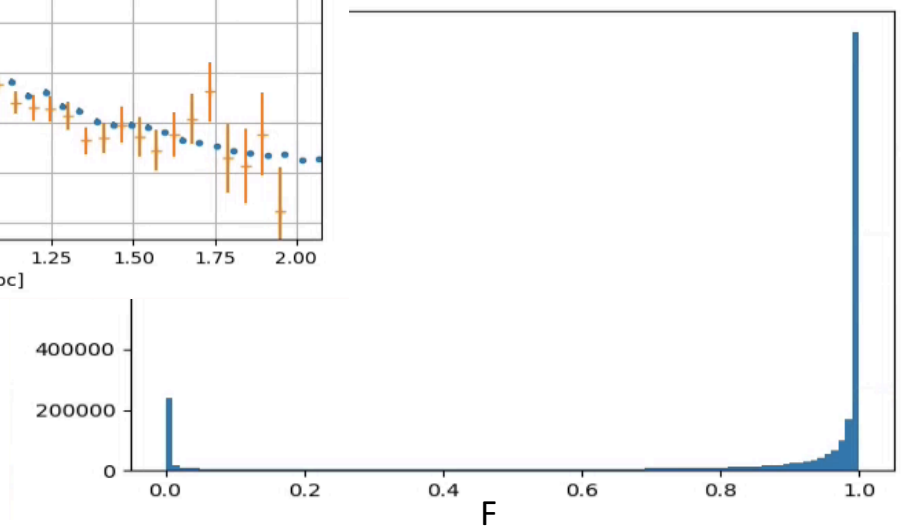
$$\tau = a\exp(bg) \quad \text{with } g = G\,(\delta_l + \delta_s + c\,\eta)$$

between l.o.s : $P_g(k) = (1 + c\mu^2)P_0(k)$

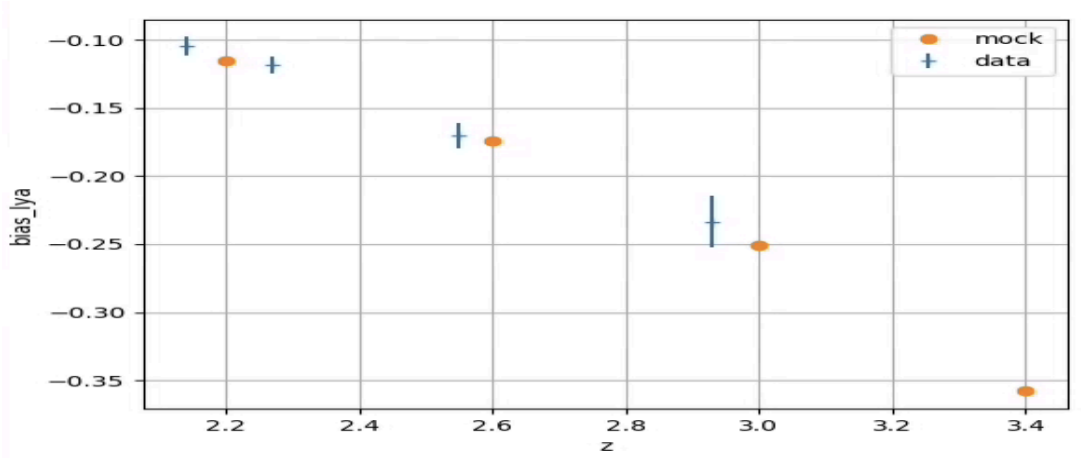
to first order P_F is a biased version of P_g and then $\beta_F = c$

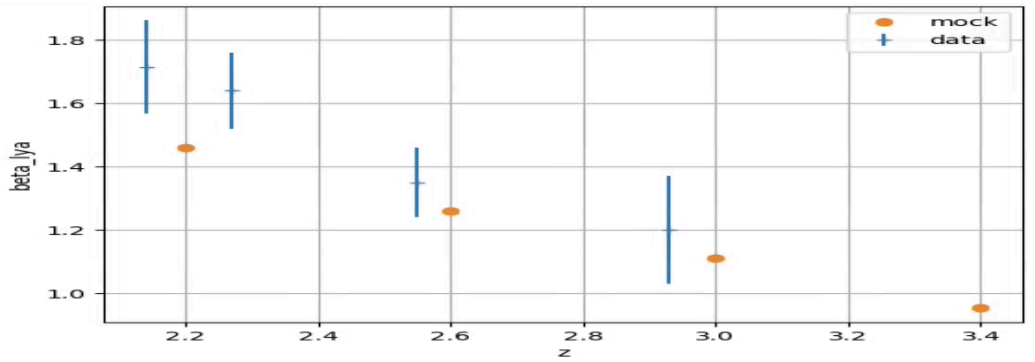
- a, $P[\delta_s]$ are fitted:

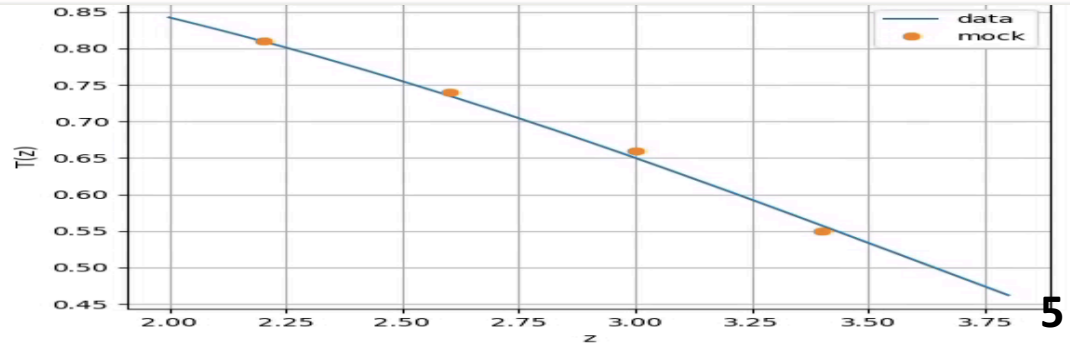




pixel size = 0.2 Mpc/h







I/O issues

- Produced a first realisation v4.2 end of march without any issue
- Realisation analysed by Helion:
  Looks good → 10 realisations

- Started production of 10 realisations early april
- Cori became very busy: great difficulties to get the jobs completed in time
- Pipeline production also became very difficult
- I/O very slow: 30 s to open a file observed by Stephen Bailey

- To solve the problem: Burst Buffer
  nodes with SSD disks (flash memory optimized for I/O)
- Adapted the code to run on burst buffer nodes

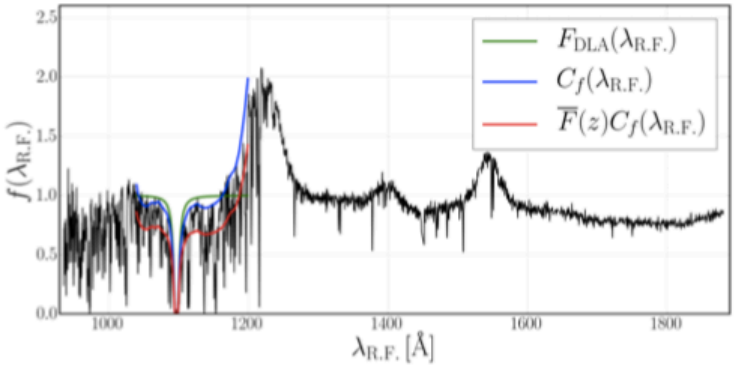
→ Allowed us to complete the production of the 10 realisations

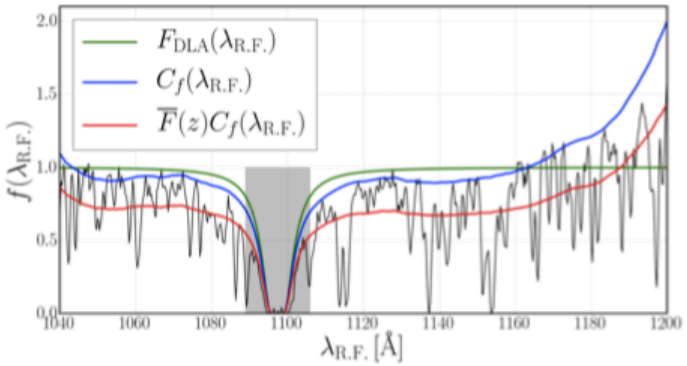
Saclay Mocks

Production of 10 realisations is now completed (v4.4.x)
Mock realisations are stored here:
/global/projecta/projectdirs/desi/mocks/lya_forest/saclay/v4.4/v4.4.0
…/v4.4.1
…/v4.4.2 …

In each directory, there is (soon):
…/v4.4/v4.4.0/eboss-0.0/ → quickquasars with eboss footprint, no DLA
…/v4.4/v4.4.0/eboss-0.2/ → quickquasars with eboss footprint, with DLA

DLA:
Damped
Lya
Absorption





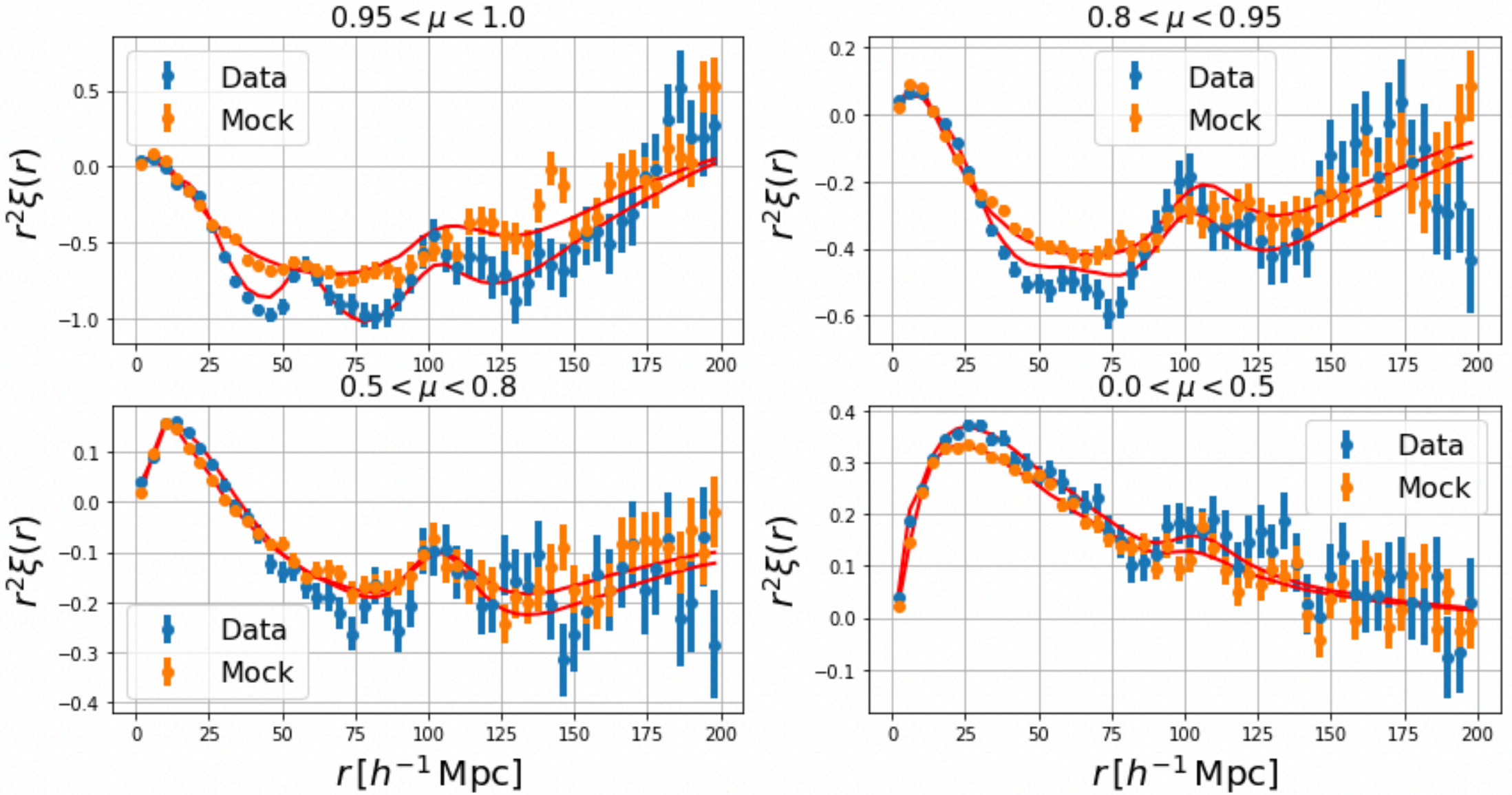
Saclay Mocks

- The code is now on GitHub:
  https://github.com/igmhub/SaclayMocks

running the code is now easier.

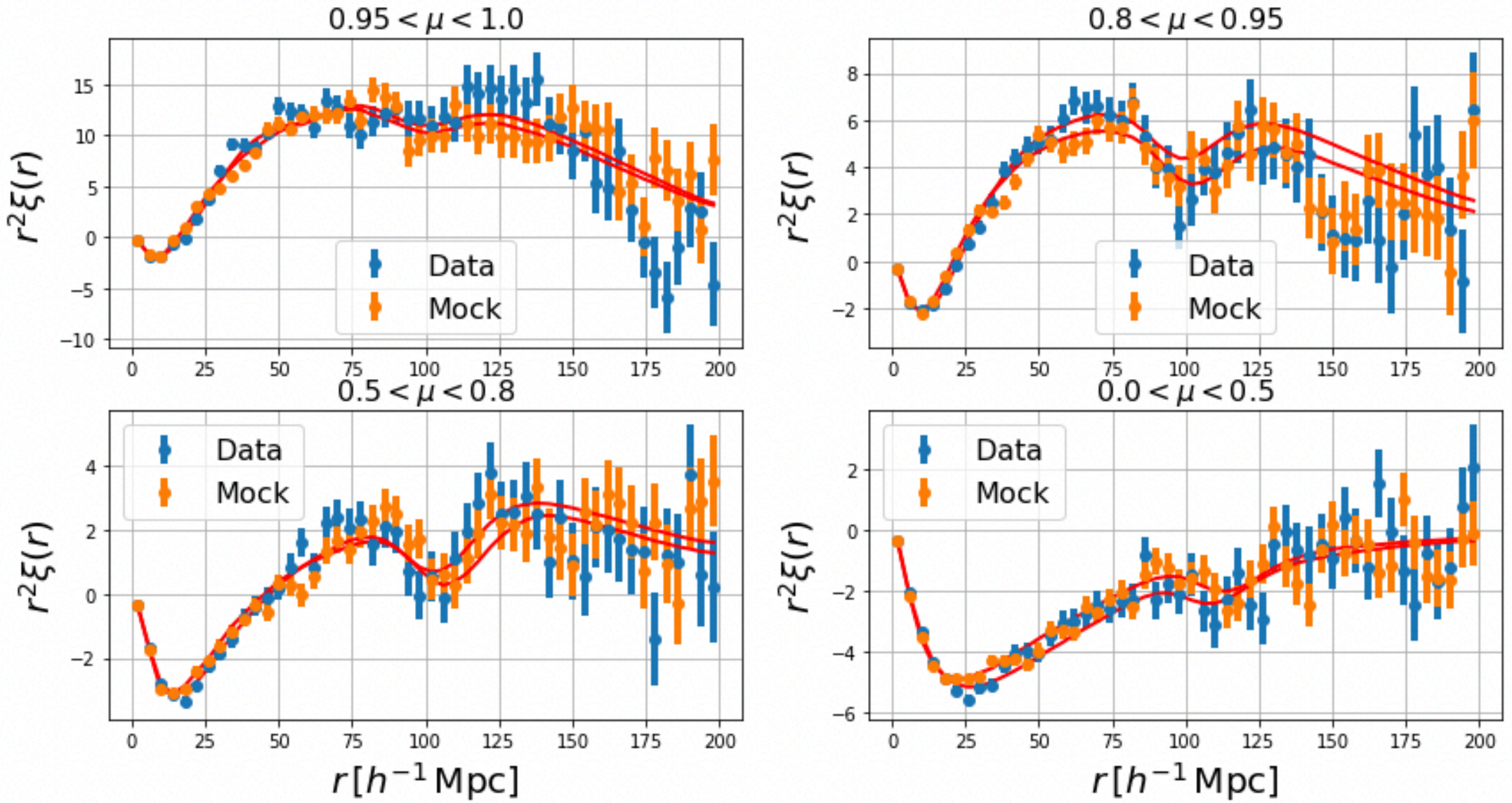
All issues / features are detailed here:
https://github.com/igmhub/SaclayMocks/issues

Lya auto-correlation



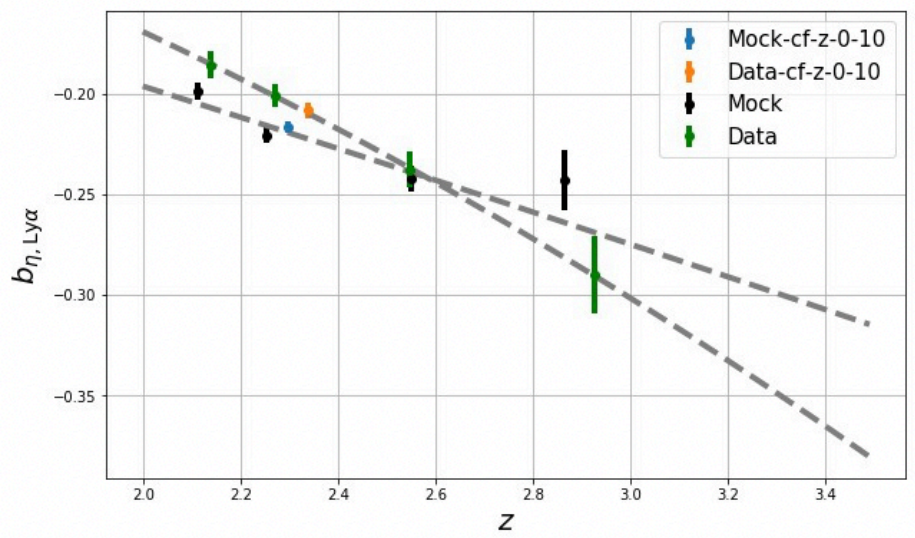
plots
from 2019-04-10
Hélion's
presentation

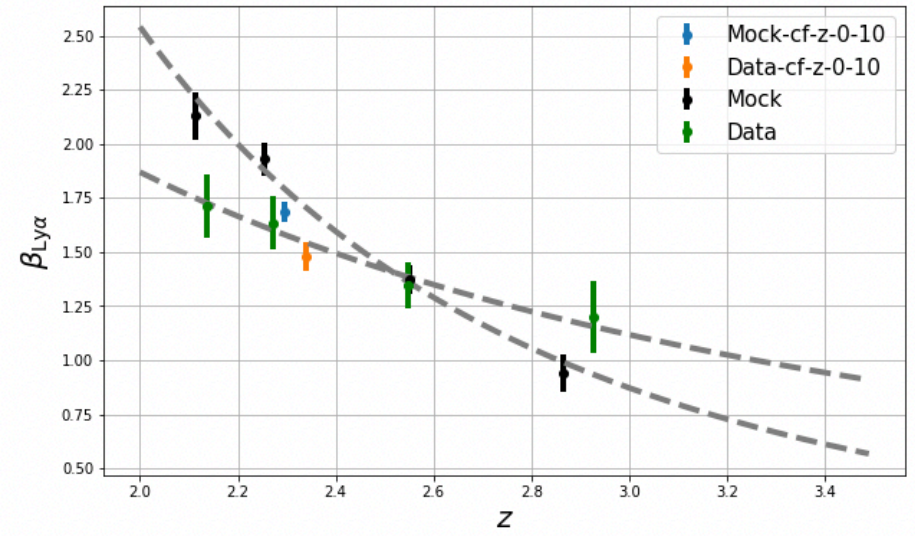
Lya – QSO cross-correlation



plots
from 2019-04-10
Hélion's
presentation

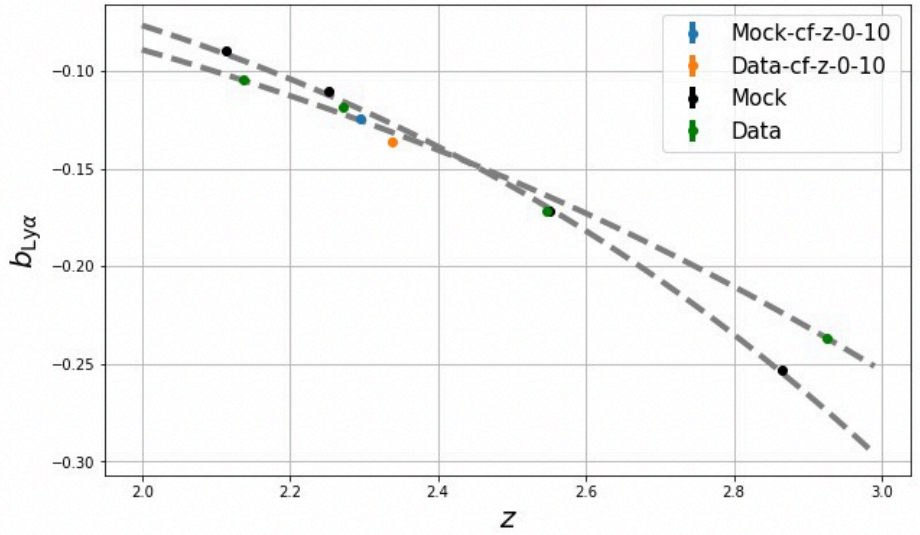
Lya bias and beta





- The bias and beta of Lya are similar to the one of the data.
- No need to do further tuning because reached the systematic from understanding DLA in data (?)

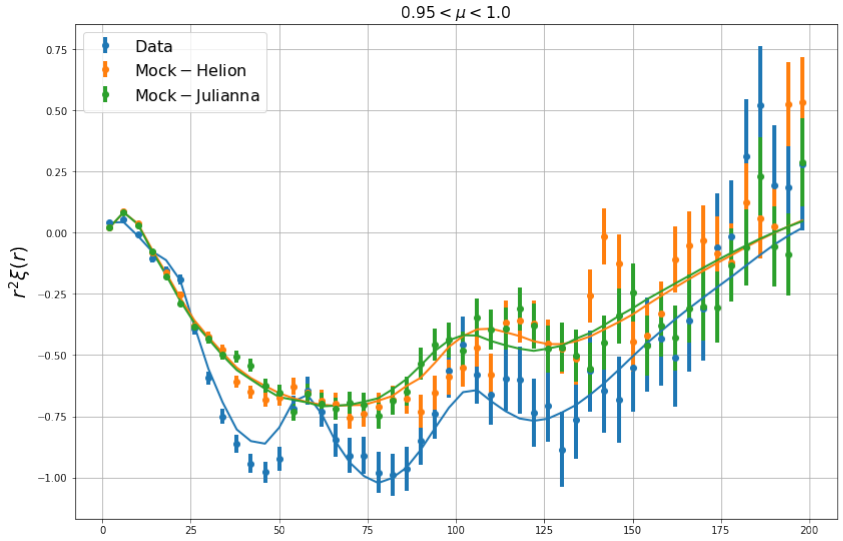
slide from 2019-04-10 Hélion's presentation

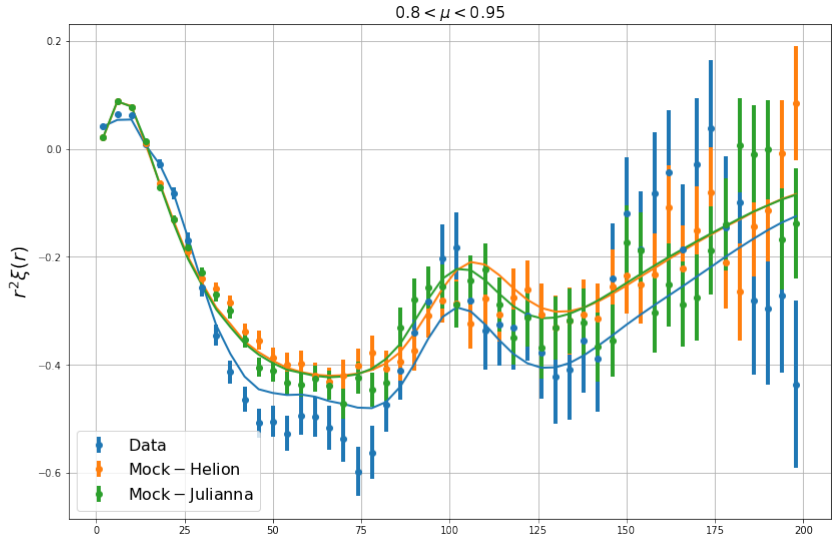


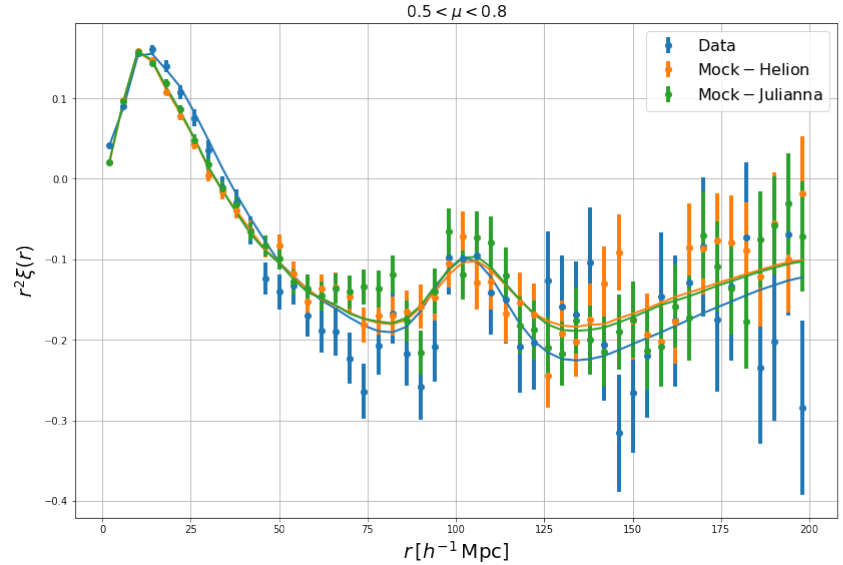
Analysis of the 10 realisations

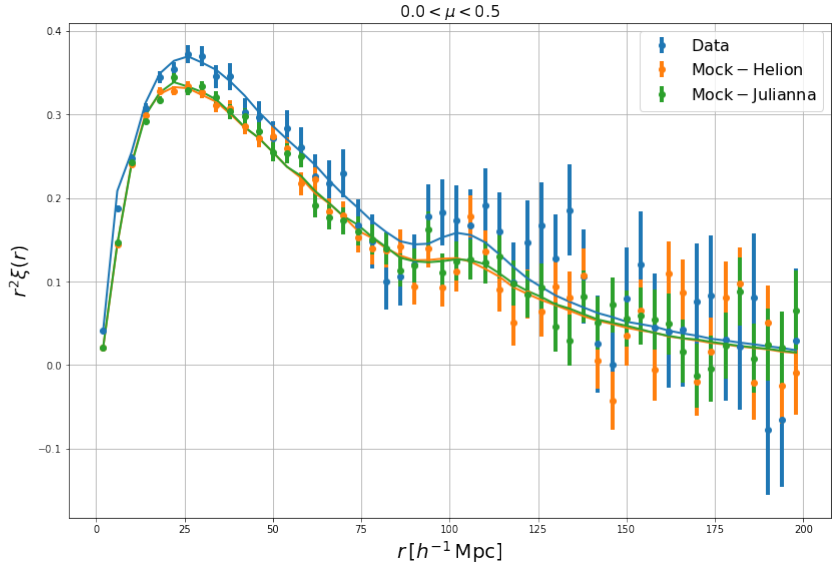
- Julianna is taking care of the analysis of the 10 realisations:

- recover Helion's analysis
- do the 10 quickquasars and picca runs



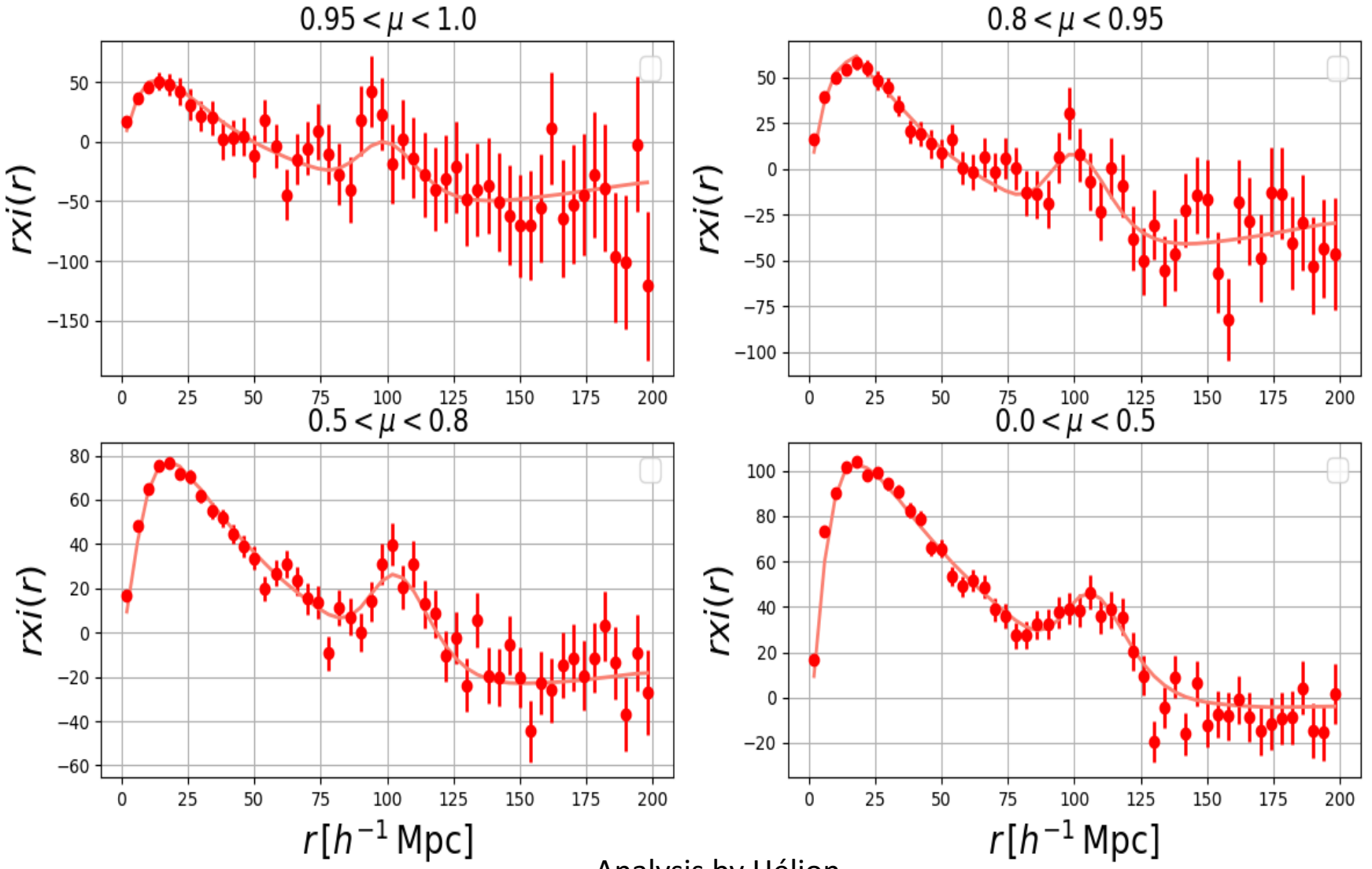






Plot from Julianna
The seeds for the 2 picca runs are different

QSO auto-correlation



- Stack of 10 realisations: model fits very well the mocks on <u>all scales</u>

- Standard fit

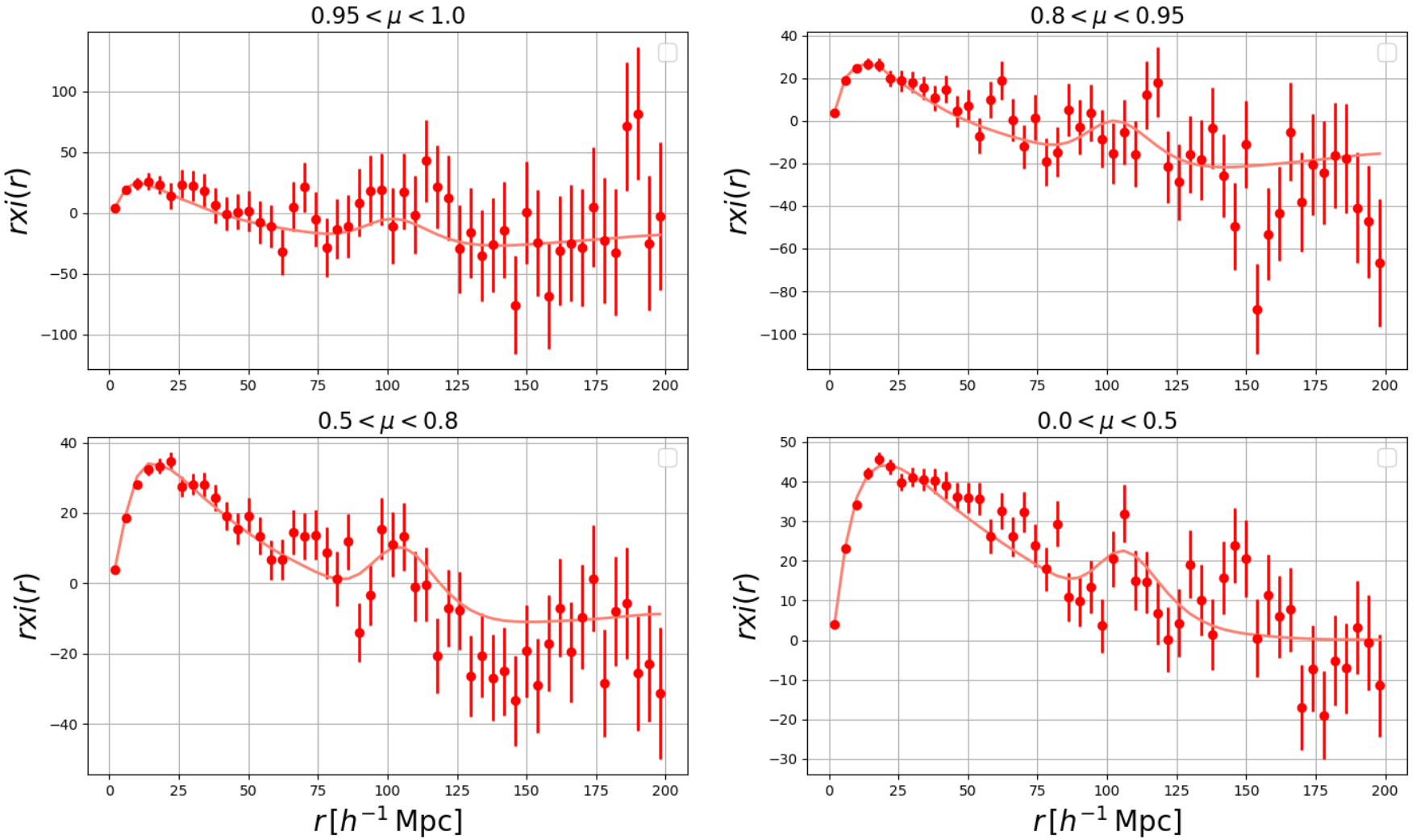
ap = 1.040 +/- 0.029
at = 0.957 +/- 0.019

beta(z=2.19) = 0.270 +/- 0.013
f(z=2.19) = 0.930 +/- 0.041
b_QSO(z=2.19) = 3.44

Delta chi2 = fixed BAO to fiducial - free BAO
= 1555.12 - 1550.19
= 4.93

Analysis by Hélion

DLA auto-correlation



- Stack of 10 realisations
- Standard fit

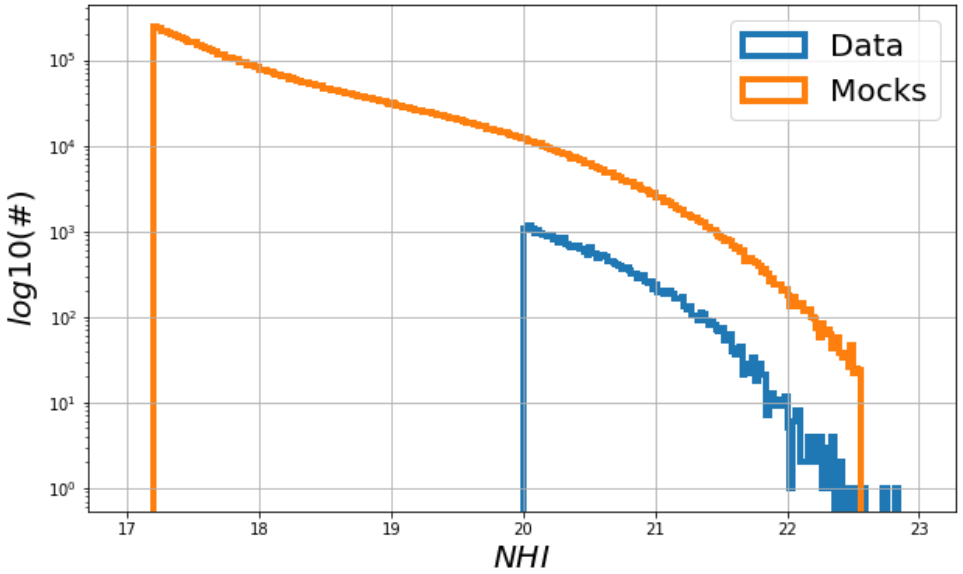
ap = 1.008 +/- 0.093
at = 0.960 +/- 0.047

beta(z=2.26) = 0.390 +/- 0.028
f(z=2.26) = 0.865 +/- 0.050
b_DLA(z=2.26) = 2.220

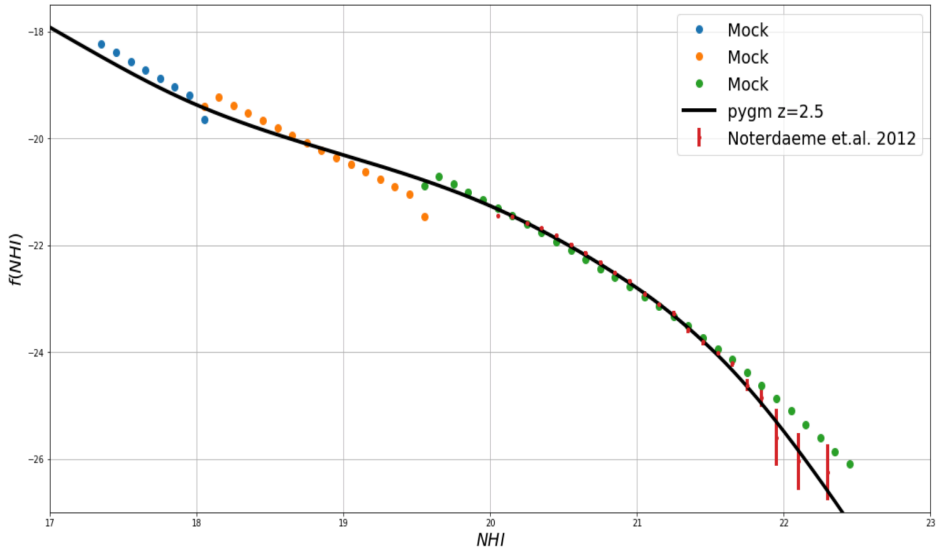
Effect of Gaussian smoothing on sigma velocities is ~ 5%

Analysis by Hélion

DLA features

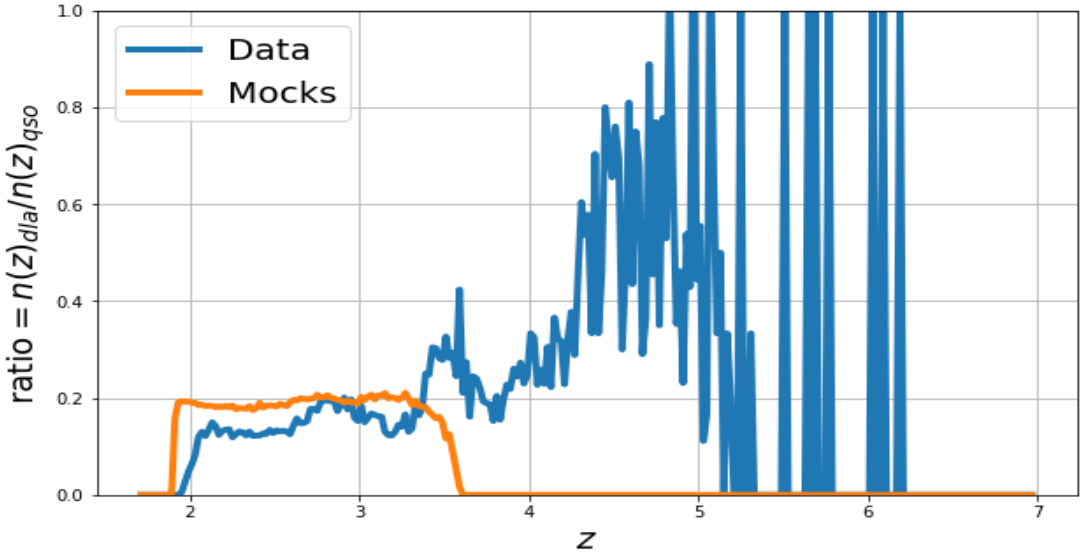


f(NHI) from pyigm (plot from Alma)



DLA have the proper:

- N_HI distribution
- number of DLA per QSO vs z



Saclay Mocks

Conclusion:

- 10 realisations ready, close to be analysed
- First results look great:
  - Correct lya field (bias, beta, P1D)
  - Correct QSO-QSO (full shape, bias, beta)
  - Correct DLA (bias, N_HI distribution, n(z))

Plans:

- Analyse the 10 realisations in details (Julianna)
- Run the DLA finder on the 10 quickquasars runs (Solène)
- Correct small bugs / features
- Work on DLA (f(N_HI), …)
- Improve b(z), beta(z)
- Discuss which improvement is needed for DR16 analysis, DESI