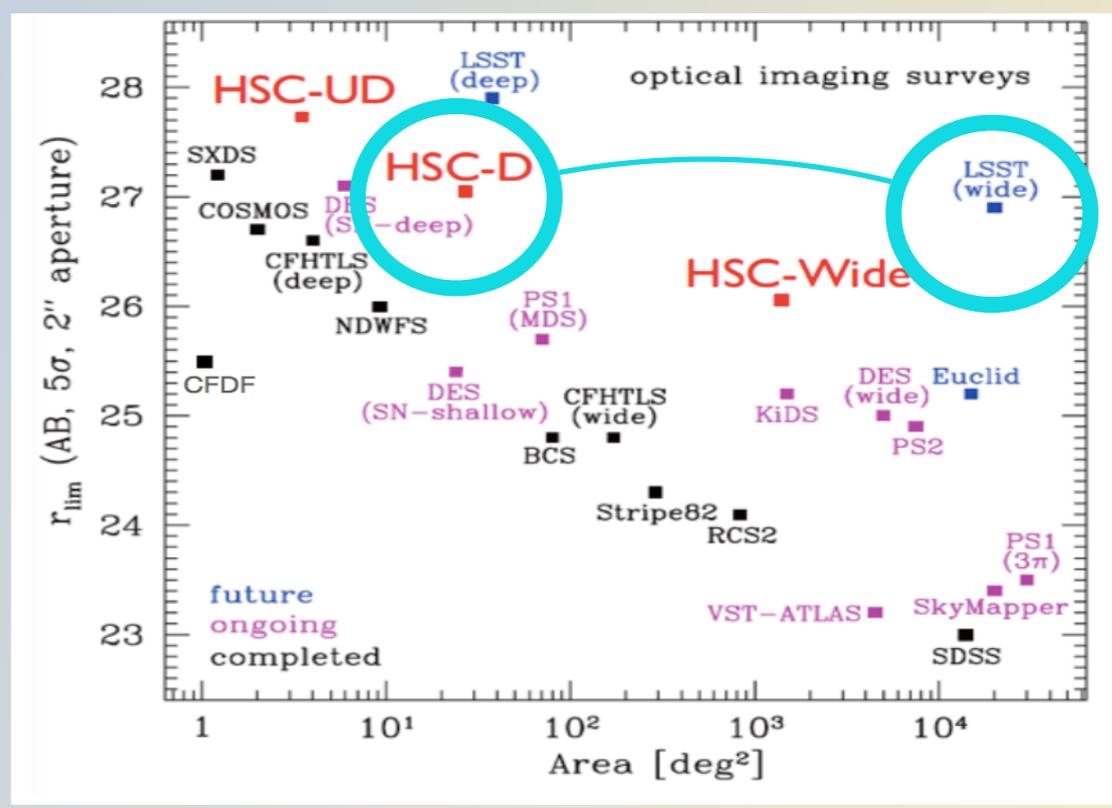
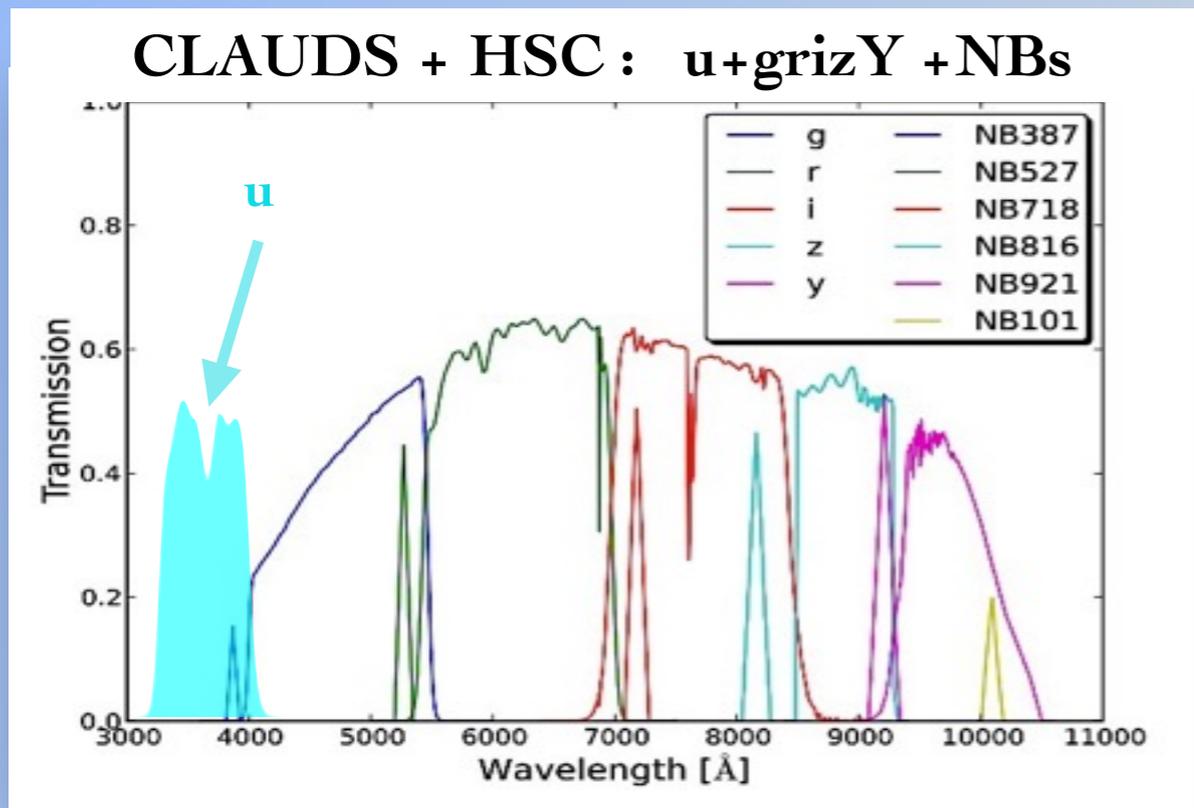
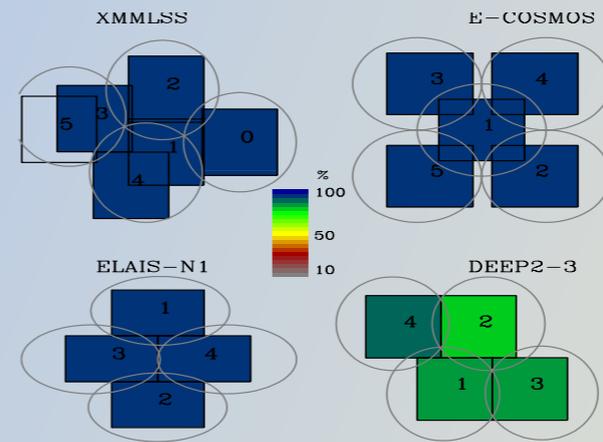
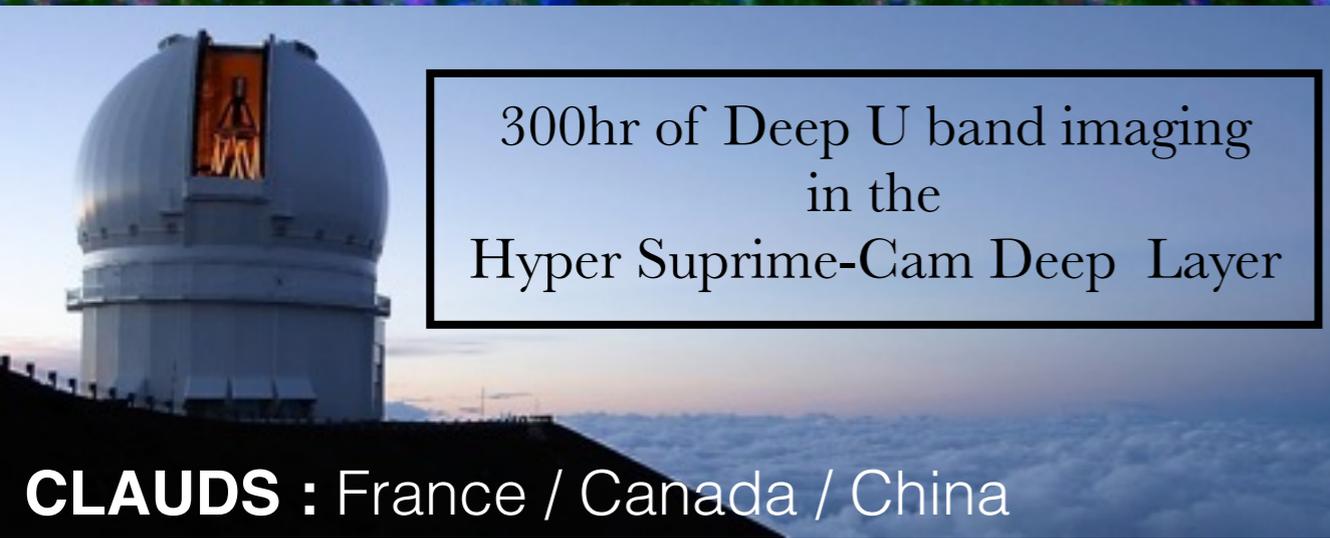


Exploring the Cosmic Web with LSST

- > LSST photo-z
 - CLAUDS + HSC-Deep
- > Exploring the role of CW in shaping galaxy properties
- > LSST and large scale spectroscopic surveys
- > LSST and cosmic web in 2D

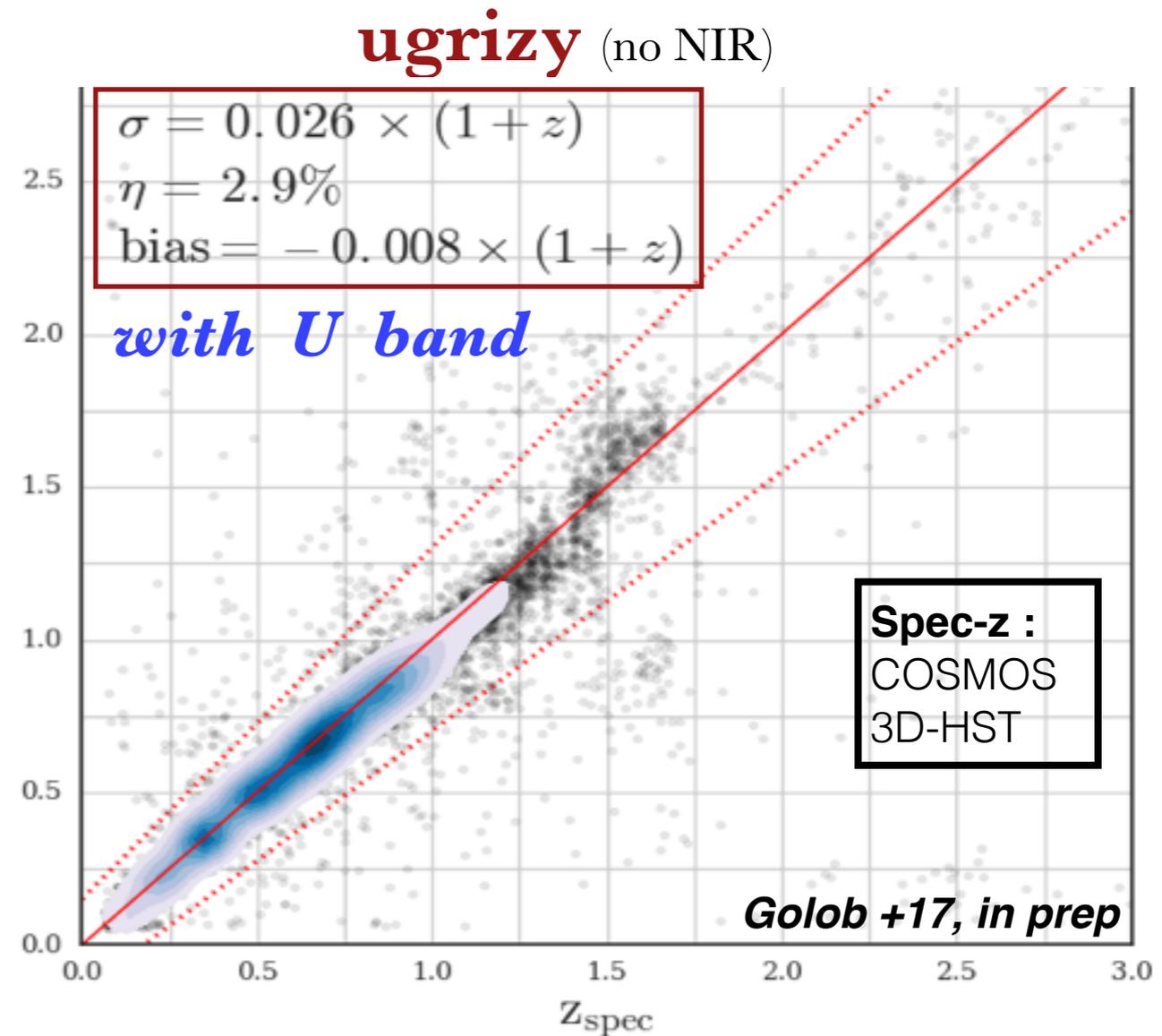
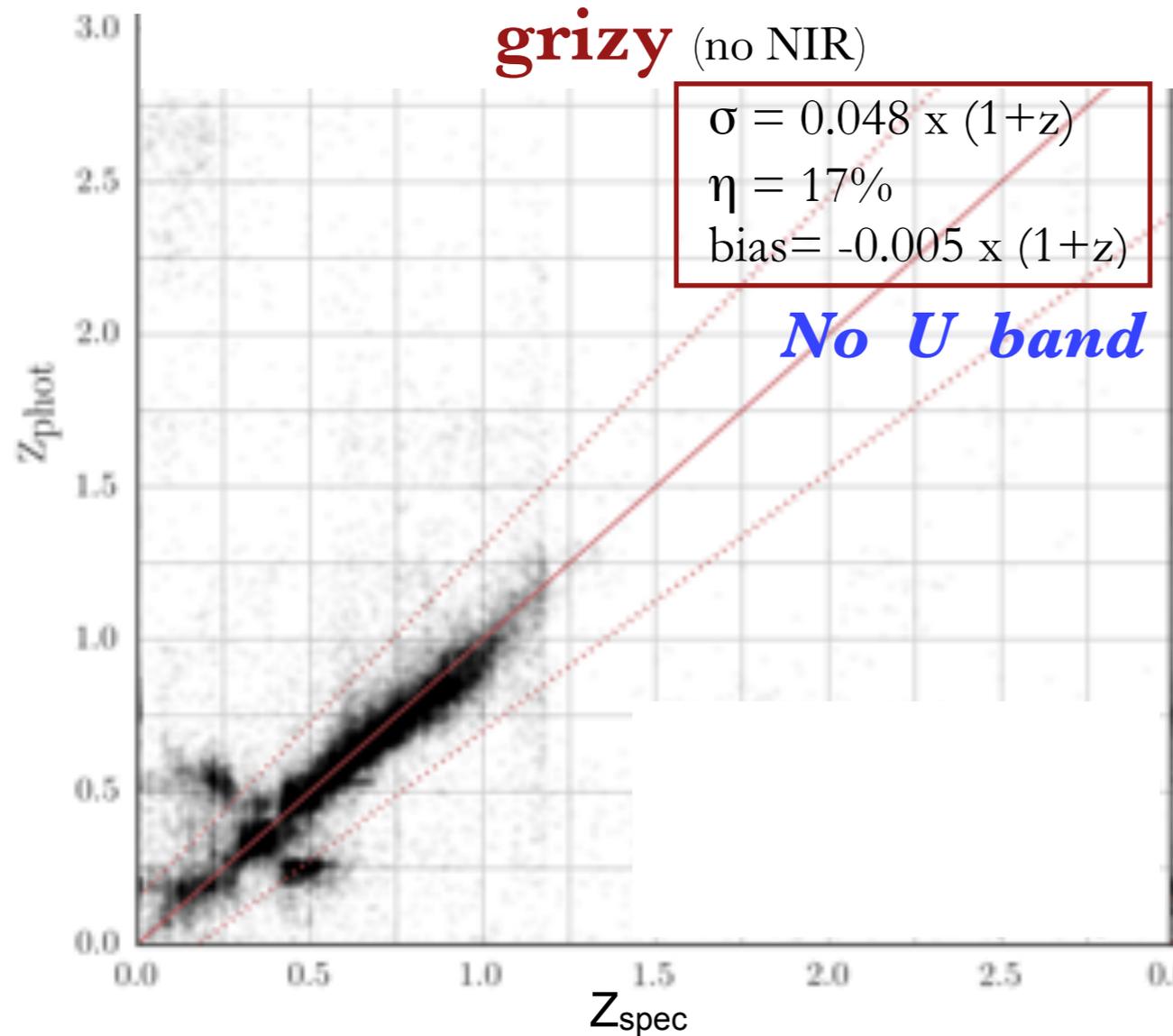
Prepare LSST with CLAUDS - HSC Deep



HSC Deep : 28 deg² at r~27 +NB (in progress)
CLAUDS : 25 deg² at u~27 (done)

CLAUDS+HSC deep
a unique dataset until LSST

Template Fitting Photo-z's with CLAUDS + HSC Deep



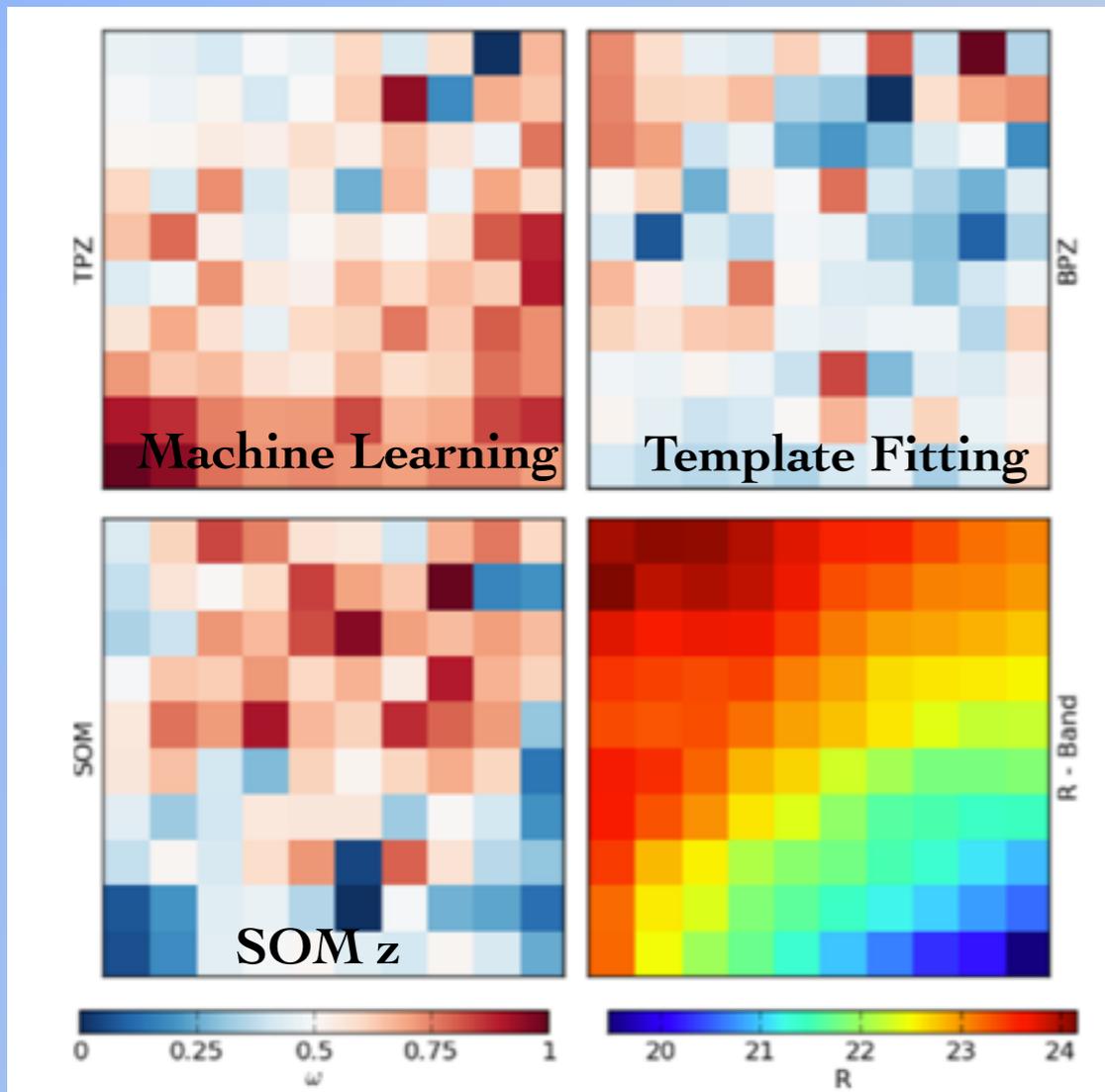
- Need for **DEEP u band** imaging in LSST
- room for improvements [with large training set]
 - ◆ Machine Learning z (from Artificial NN to deep learning [on pixels])
 - ◆ with deep NIR (Euclid/WFIRST)

refining photo-z & PDFs

◆ bayesian combination of photometric redshift PDFs from several codes

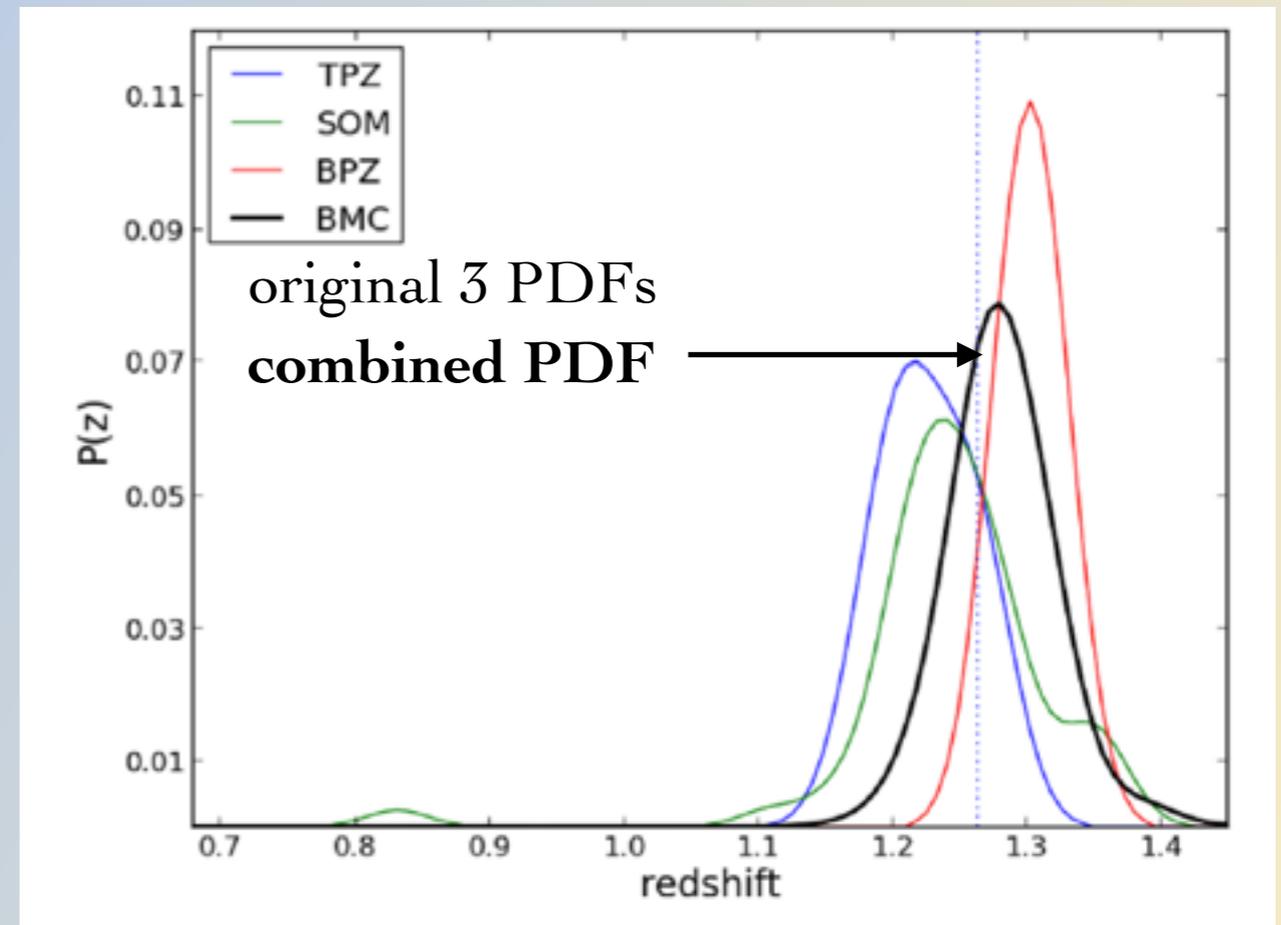
(Carrasco & Brunner 2014)

Relative weights applied to different codes



Self Organizing Map

PDF combination of different codes

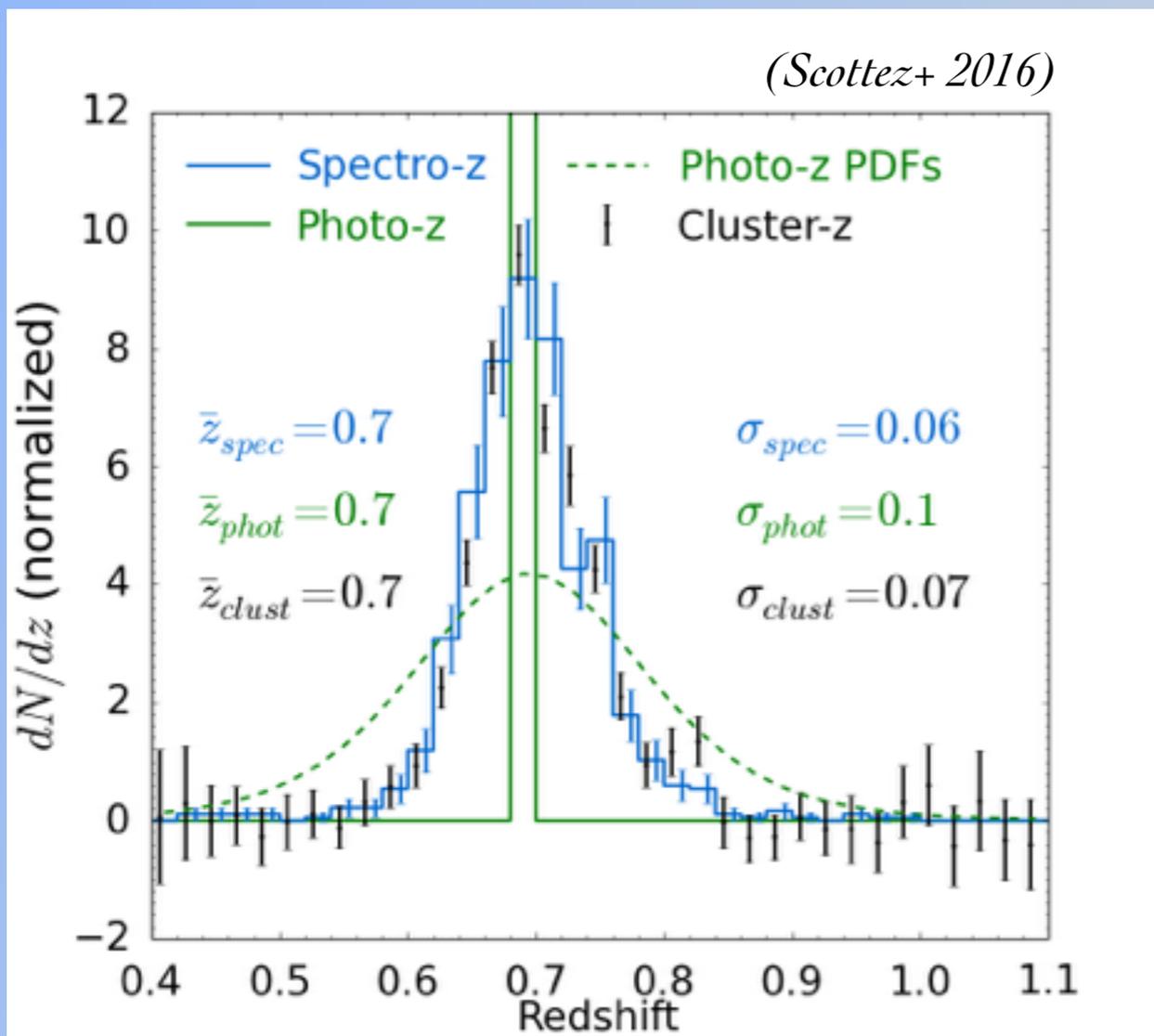


- ⇒ improve photo-z accuracy and PDF
- ⇒ decrease outlier fraction

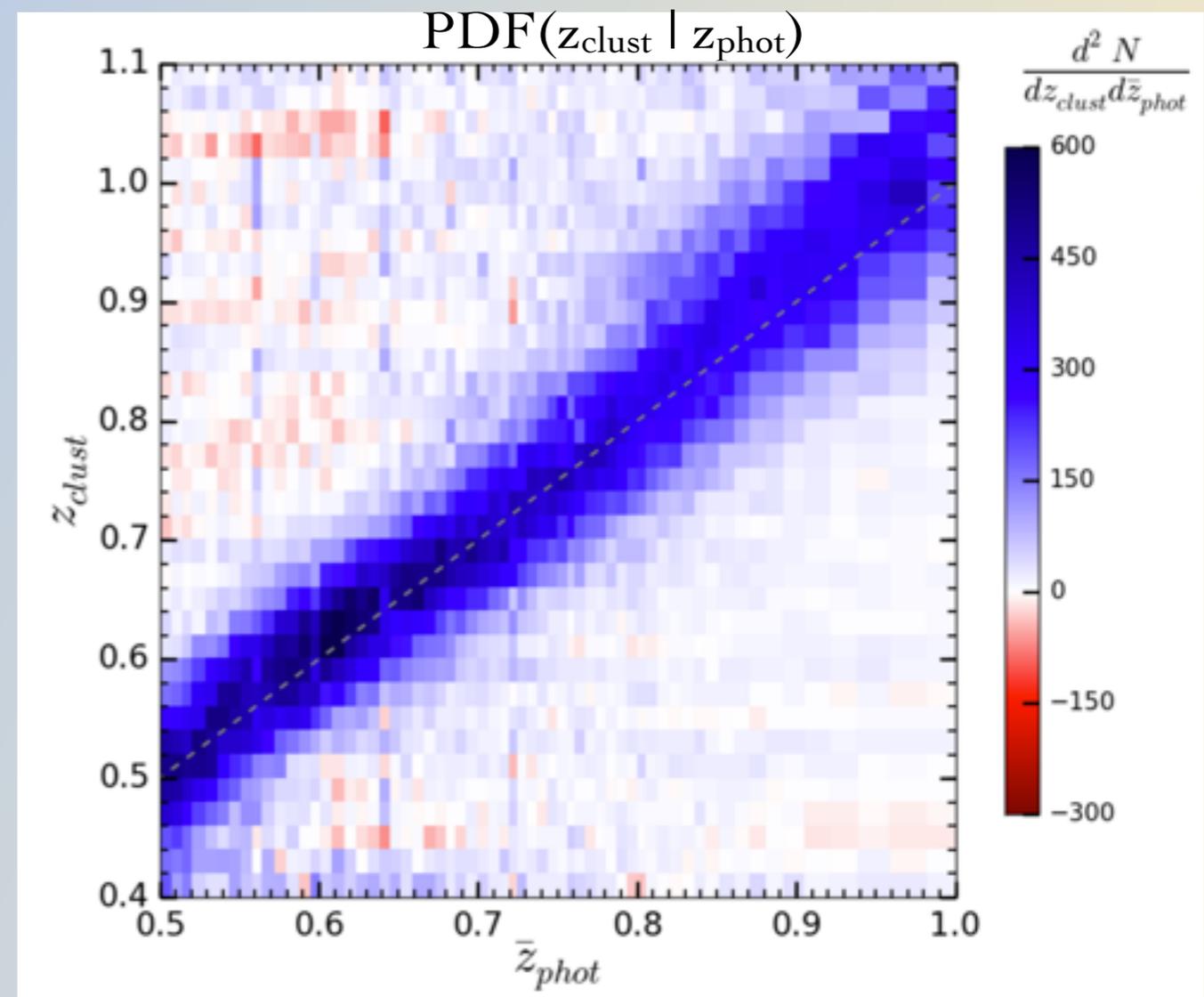
refining photo-z & PDFs

◆ clustering based analysis *(Benjamin+ 2010, Menard+2013)*

- ⇒ build the $N(z)$ of a selected population by x-correlation with a spec-z sample
- ⇒ population with unknown $N_u(z)$: multi-colors or SOM selections / photo-z
(the narrower $N_u(z)$ the better)
- ⇒ Application with VIPERS z-survey *(Guzzo+13)* + VIPERS-MLS photo-z *(Moutard+16)*



⇒ distribution with z_{clust} consistent with z_{spec}

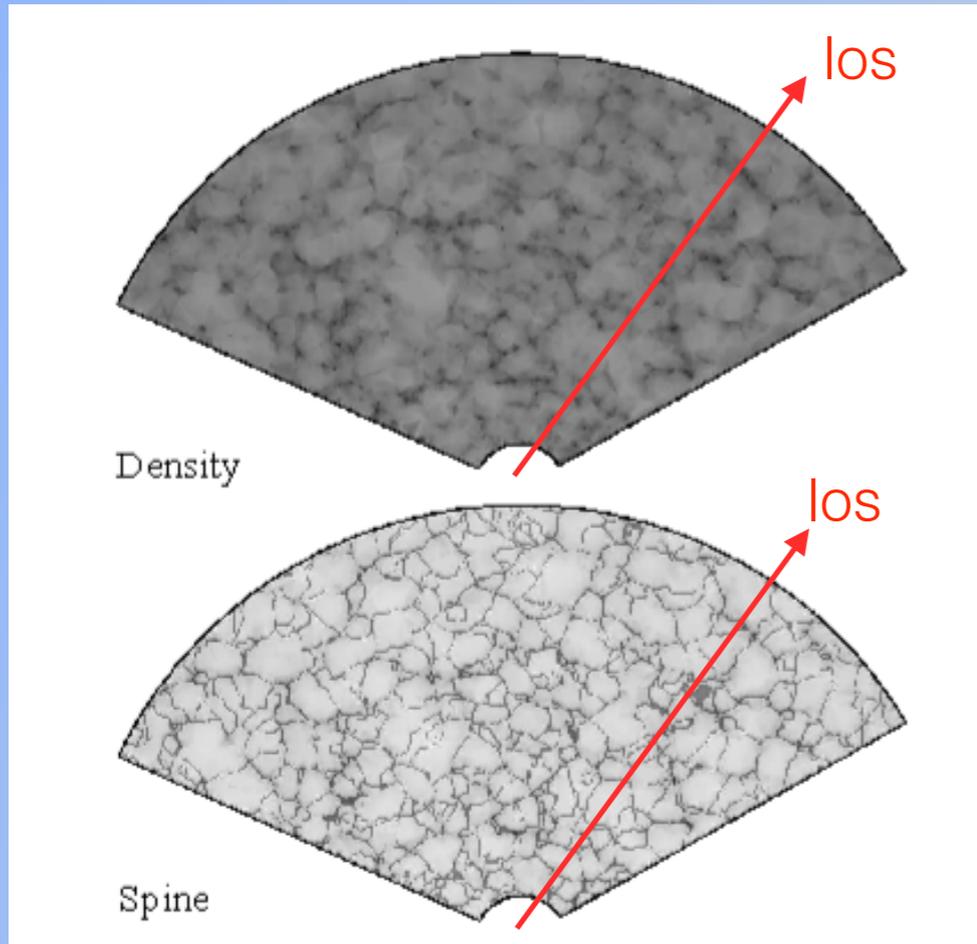


⇒ improved PDF distributions of z_{phot} populations

refining photo-z & PDFs

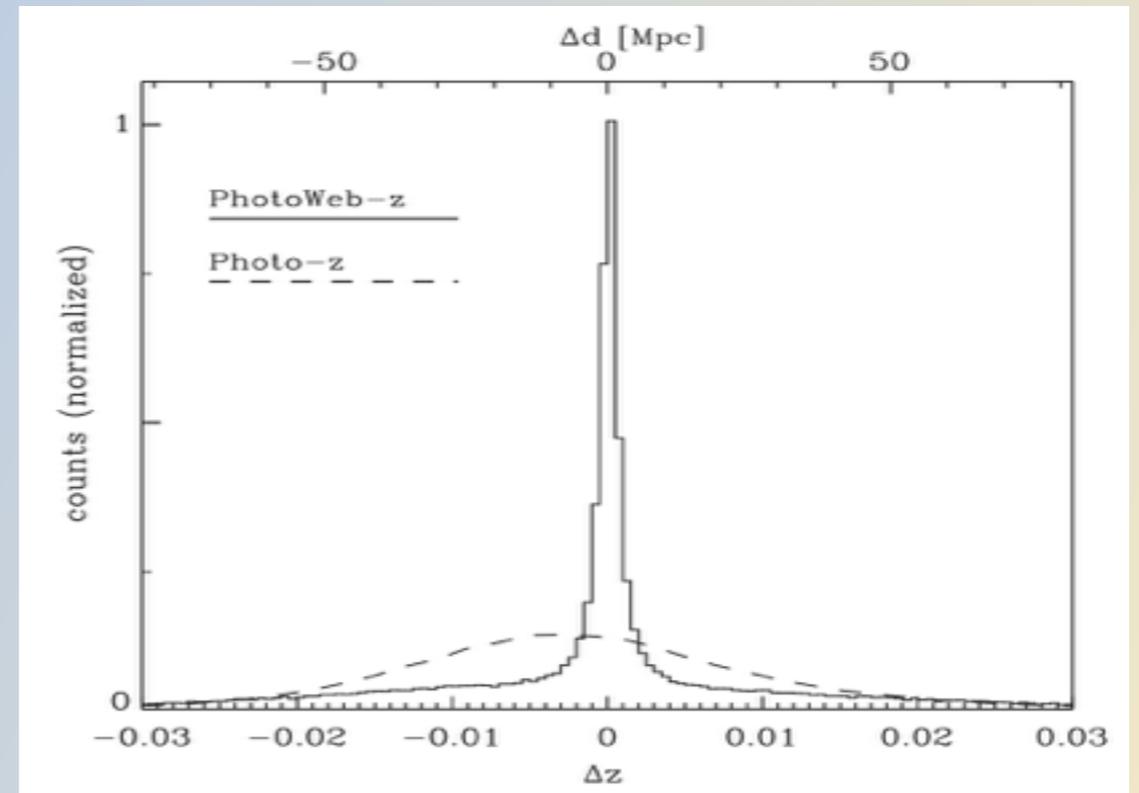
◆ Photo-web : Once the CW is mapped we can improve the PDF of photo-z galaxies

(Aragon-Calvo+15)

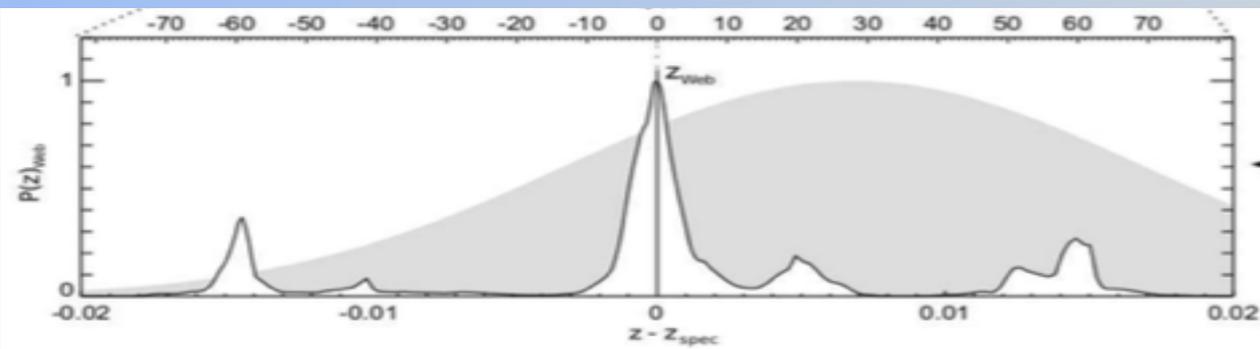


$$P(z)_{\text{web}} = P(z)_{\text{photo}} \cdot P(z)_{\text{den}} \cdot P(z)_{\text{geo}}$$

Photo-z improvements



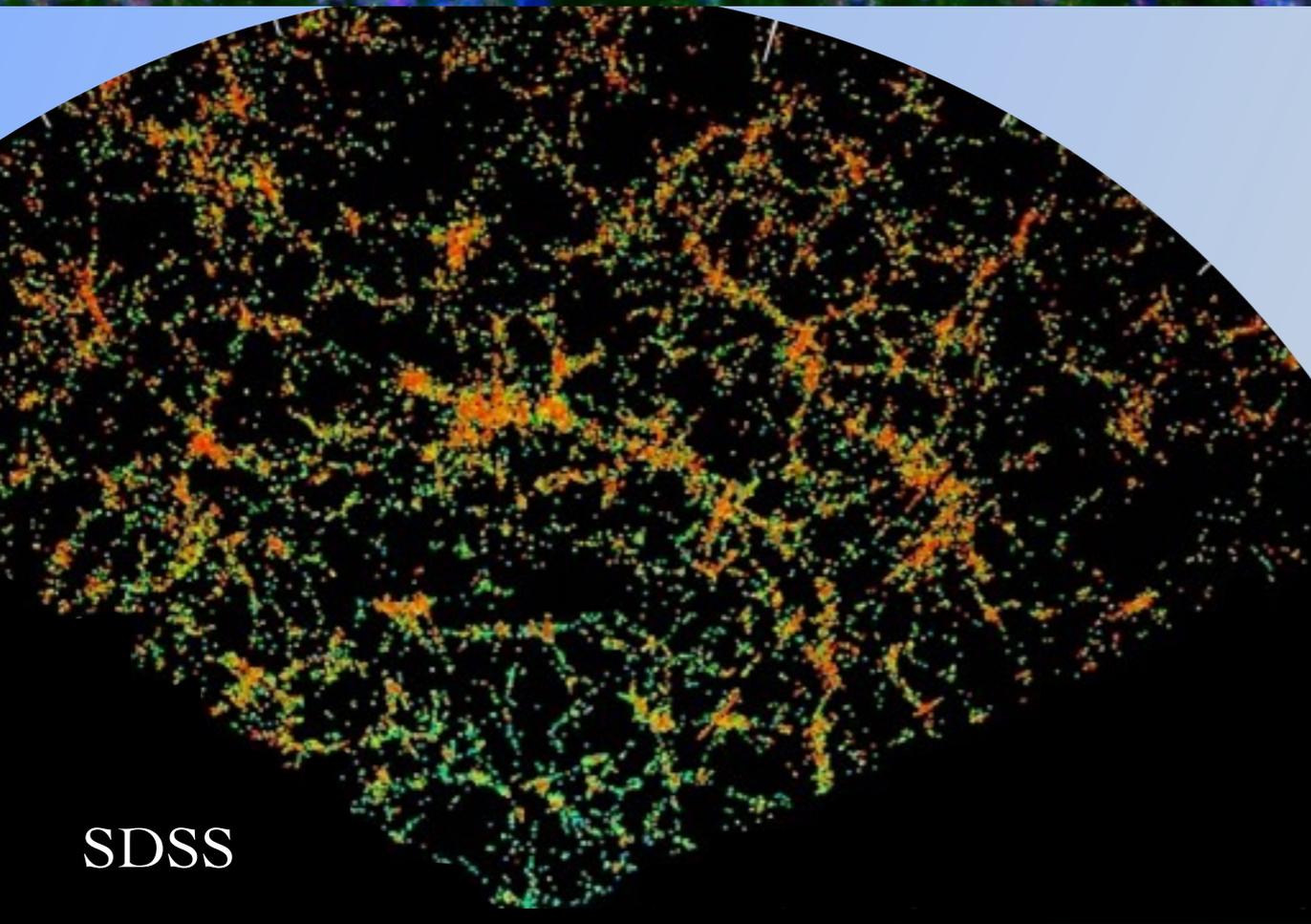
⇒ requires good (<0.01) and unbiased PDF



* CLAUDS + HSC deep with PFS z-survey

* LSST with WAVES / .../ WFIRST / Euclid Deep

Exploring the Cosmic Web with LSST



SDSS

➤ Cosmic Web : environment where galaxies form and evolve



© Pichon C.

➤ Does it play a role in shaping galaxy properties ?

◆ Cold streams from CW filaments can feed high-z galaxies with 10^4 K gas disks (*Katz+05, Keres+05,...*)
⇒ observations of proto disk at intersection of filaments (*Martin +16*)

◆ DM halos inherit some level of coherence from Large Scale Flows : filamentary flows advect Angular Momentum into newly formed halos & disk of galaxies (*Hahn+07, Pichon+11, Codis+12,.....*)

◆ observational evidence in SDSS with spin alignments (*Tempel+13*) and simulation (*Dubois+14*) :



Low Mass galaxies : spins parallel to filaments



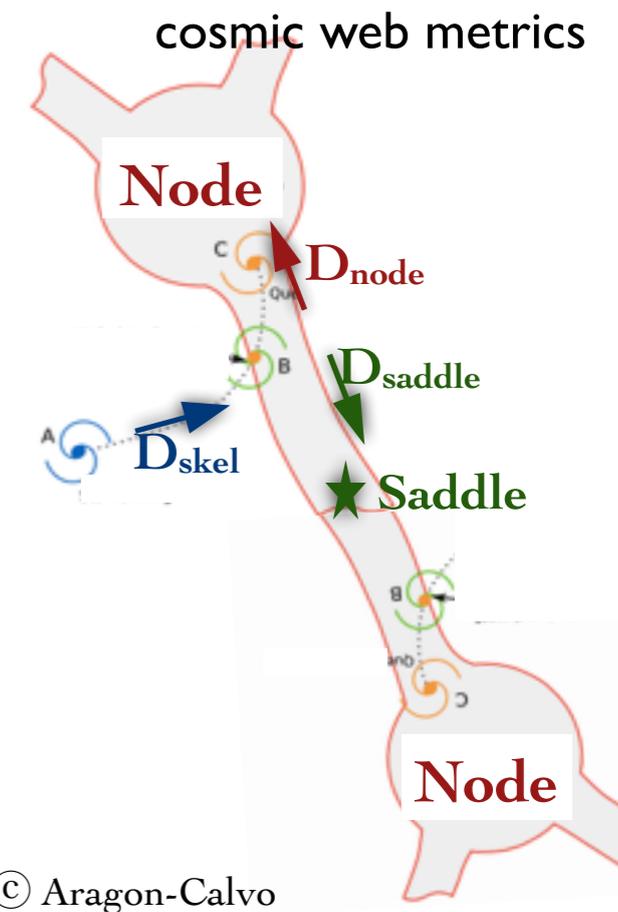
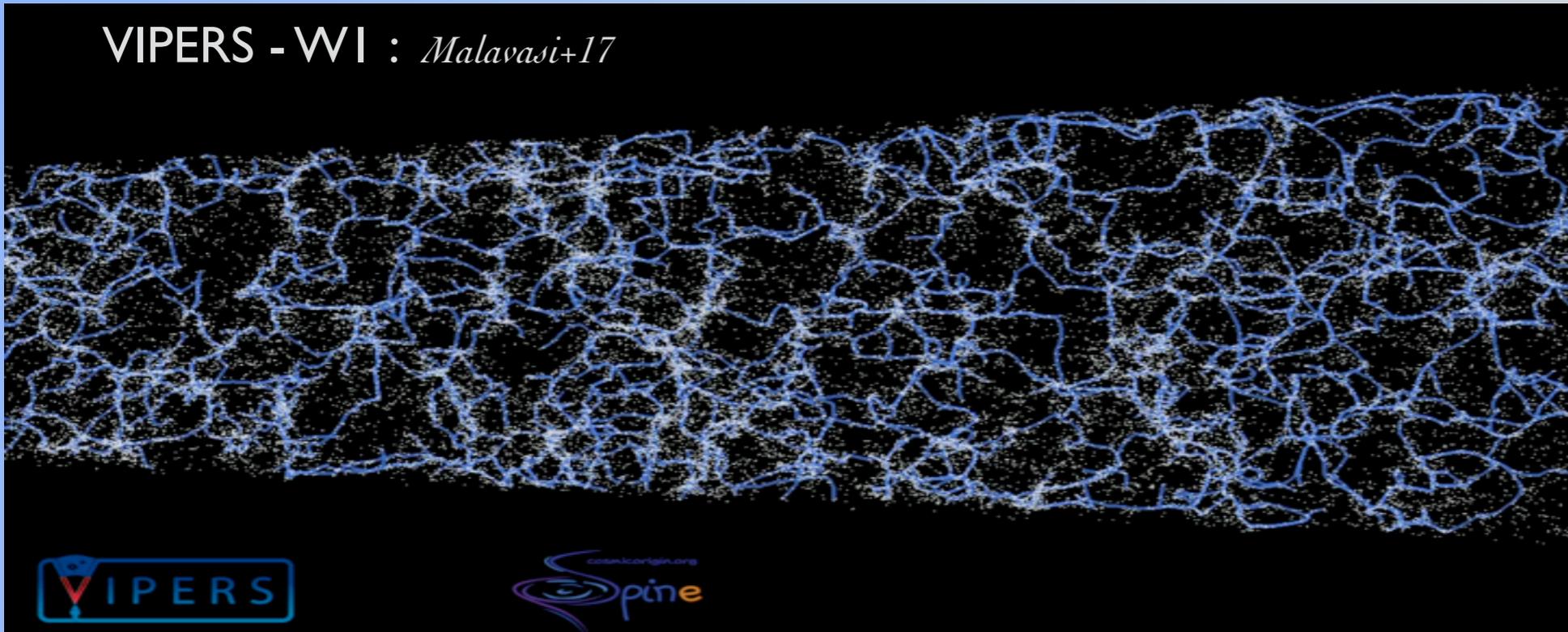
High Mass galaxies : spins perpendicular to filaments

Extracting Cosmic Web features



3D ridge Extractor extracts cosmic web features
Nodes, filaments, walls and voids (*Sousbie 2011a,b*)

VIPERS - WI : *Malavasi+17*



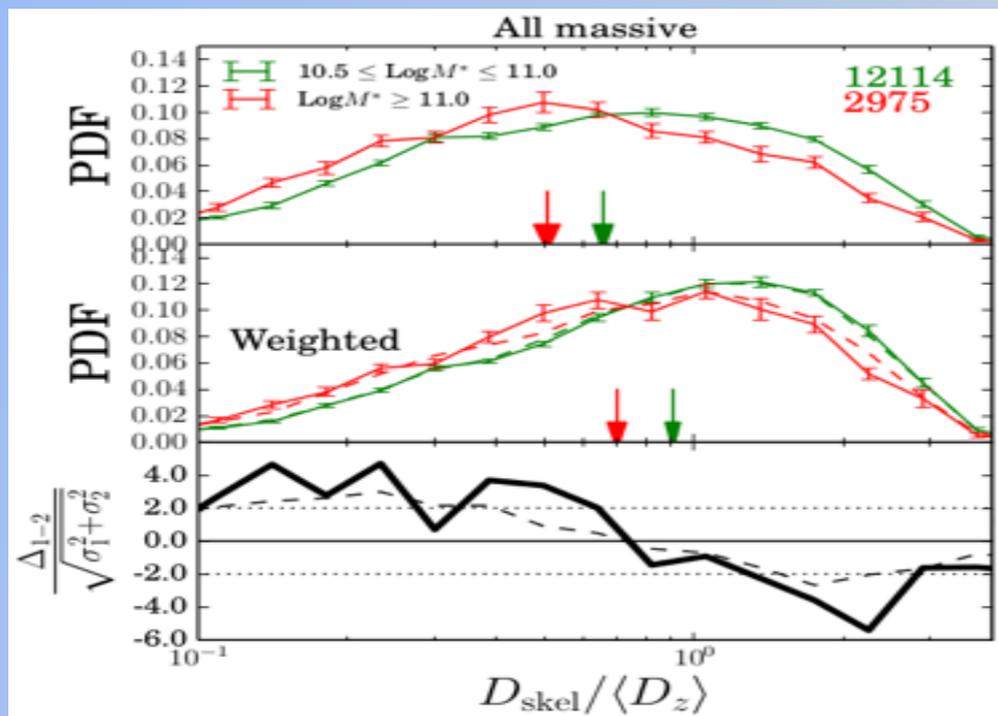
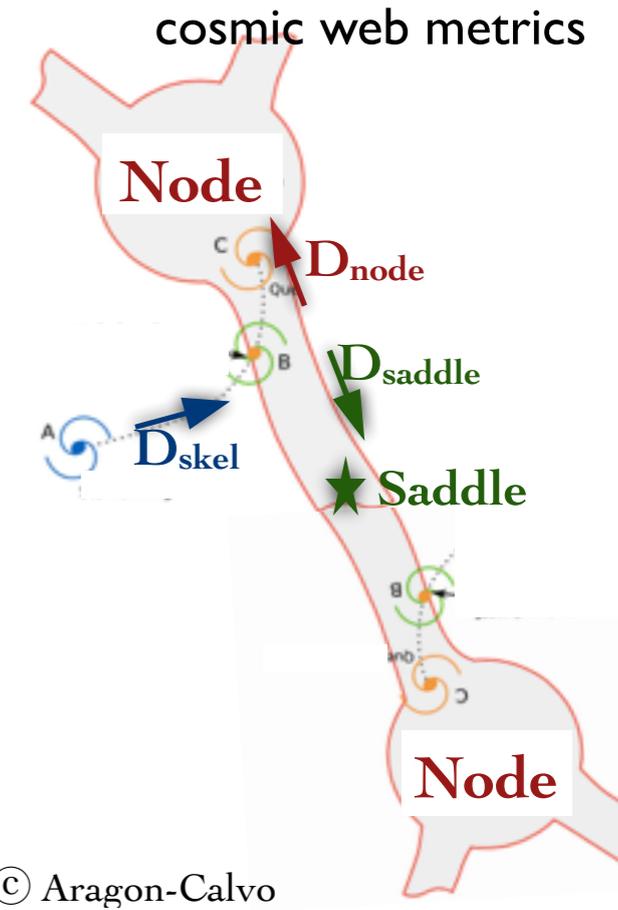
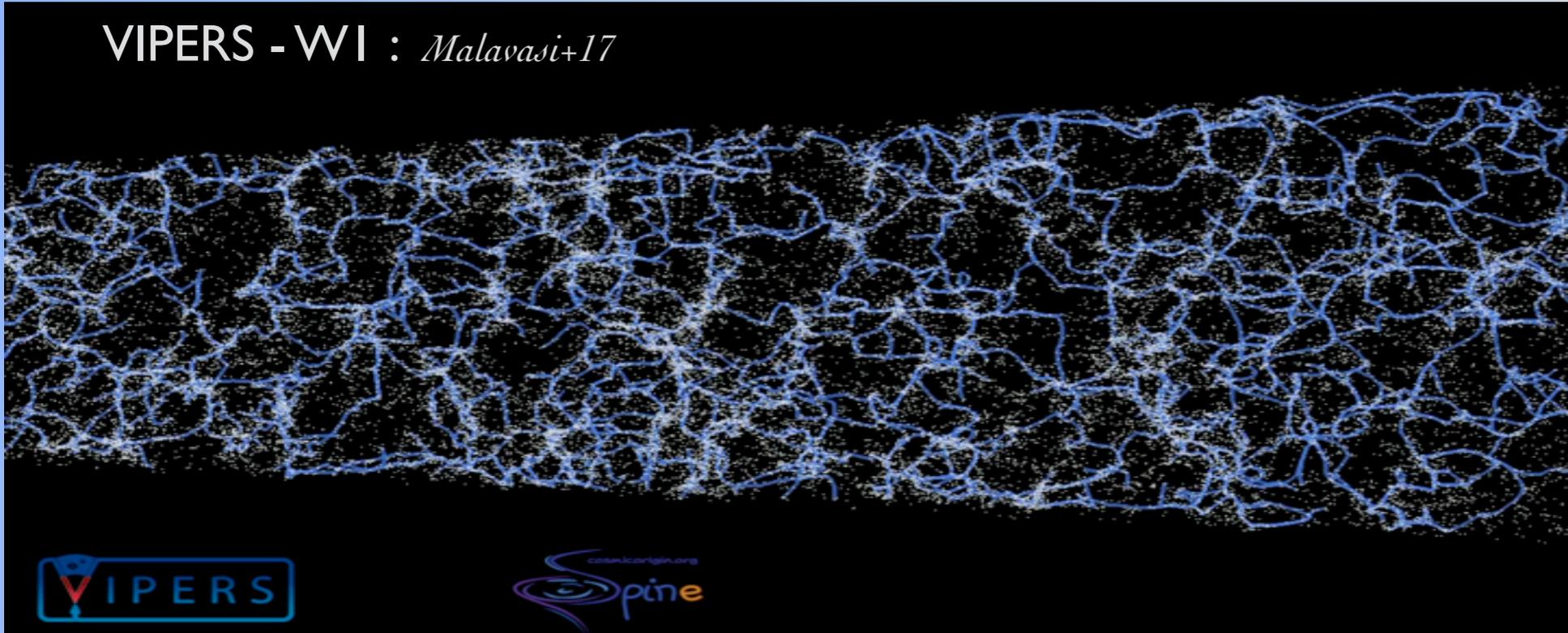
Kraljic+17 (in prep)

Extracting Cosmic Web features

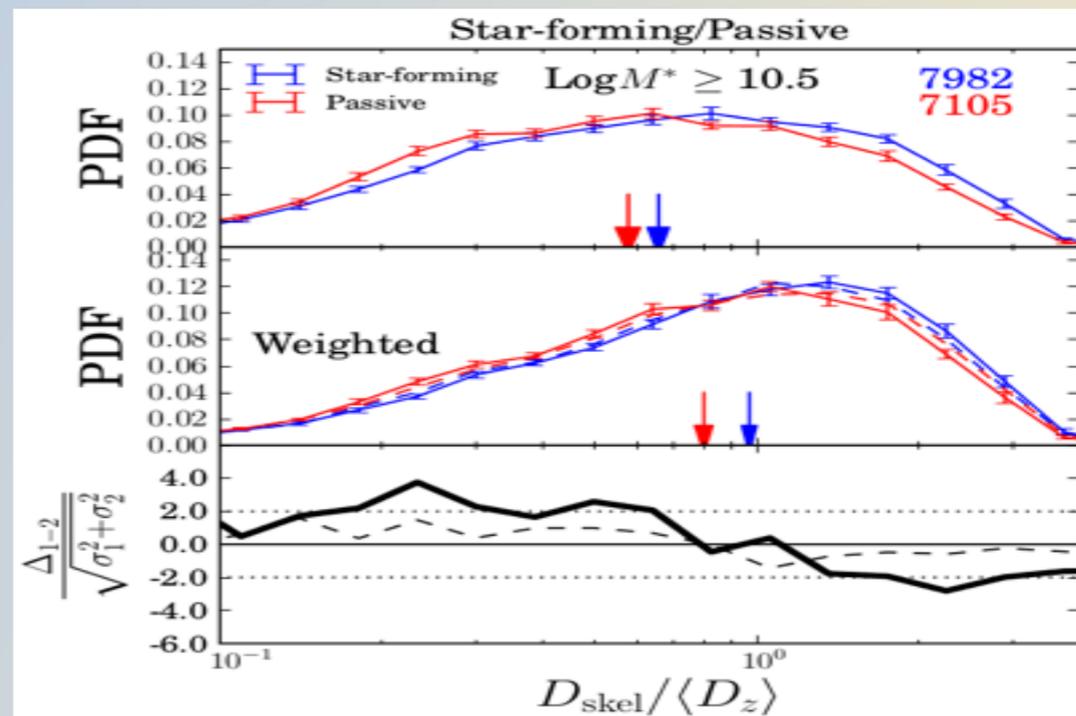


3D ridge Extractor extracts cosmic web features
Nodes, filaments, walls and voids (*Sousbie 2011a,b*)

VIPERS - WI : *Malavasi+17*

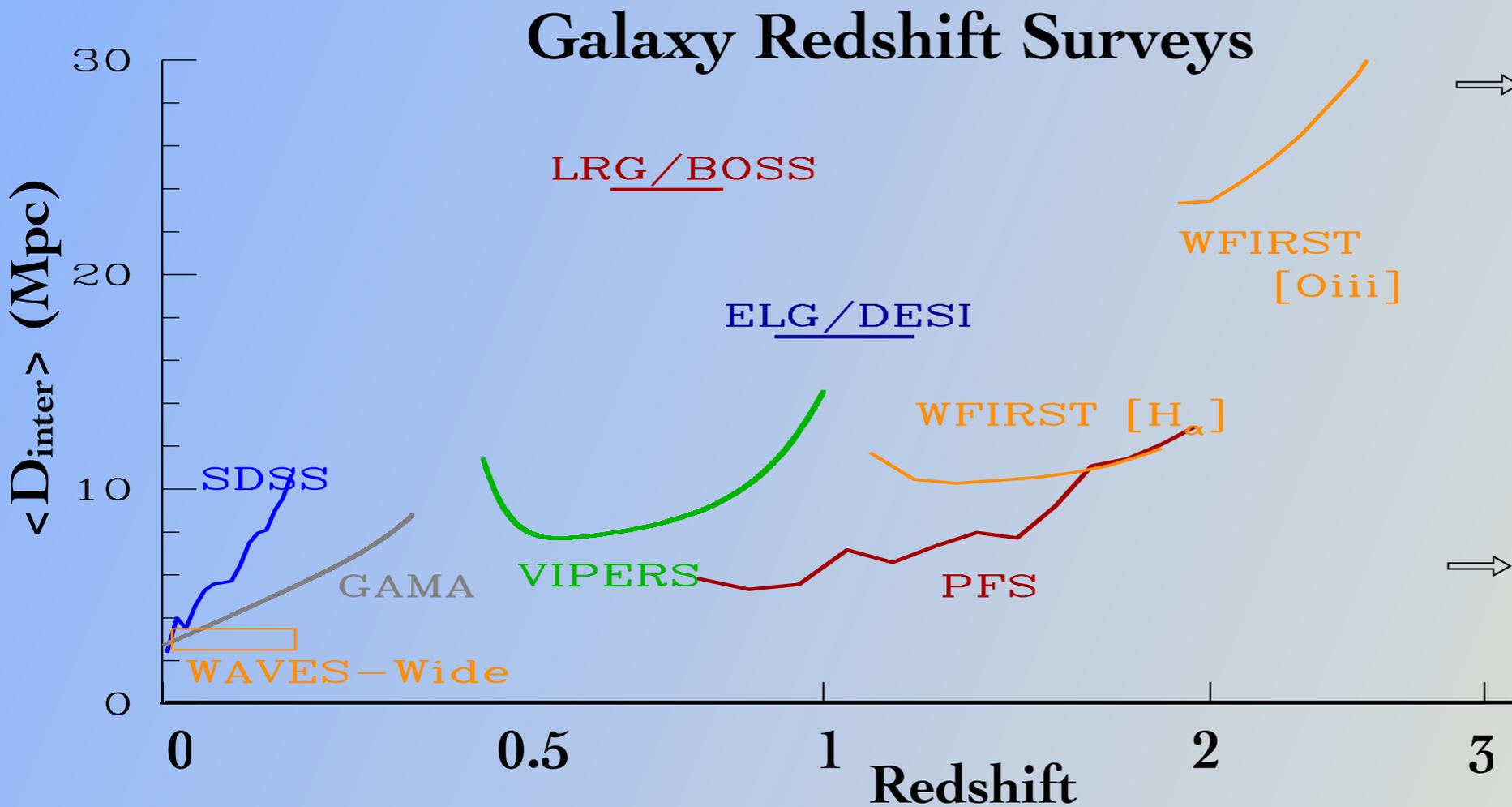


→ Mass segregation effect



→ Star-forming vs Quiescent segregation effect

Mapping the Cosmic Web over Cosmic Time



* WFIRST $\sim 2200 \text{ deg}^2$, $z > 1$

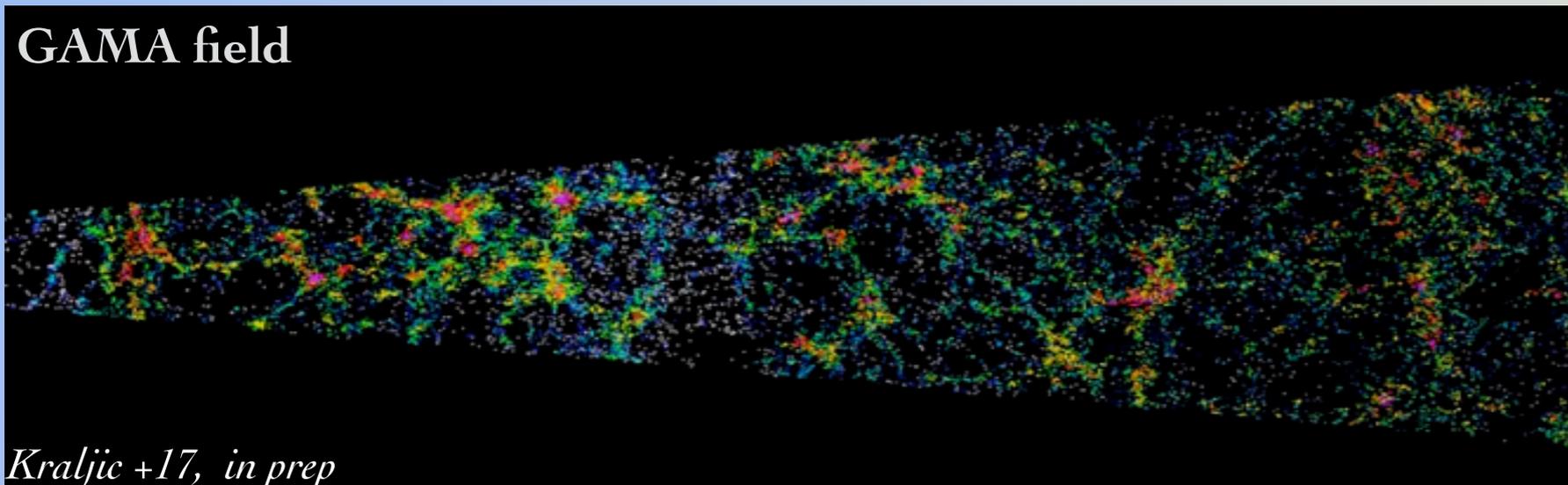
\Rightarrow extend galaxy properties vs CW near the peak of cosmic SFR

* WAVES $\sim 1500 \text{ deg}^2$, $z < 0.15$

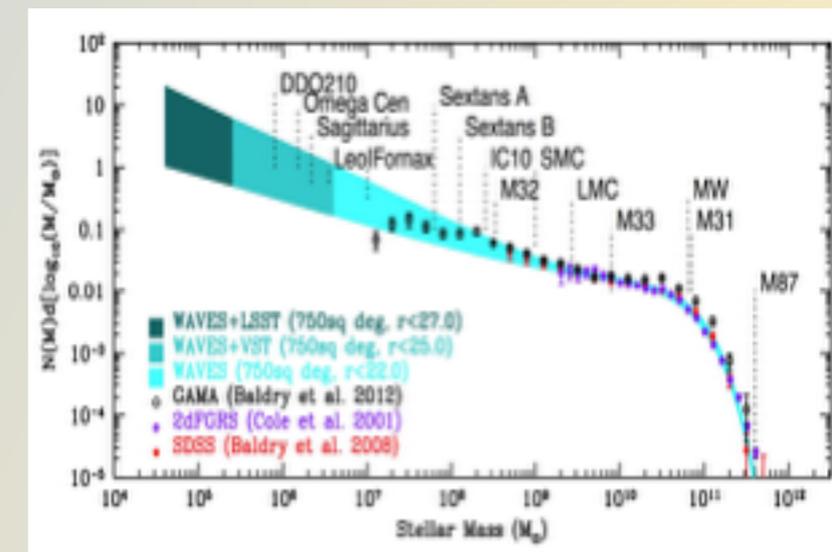
\Rightarrow CW metric vs LSST morphology

- spin alignment per type
- merging signatures
- very low mass satellites in nodes

GAMA field



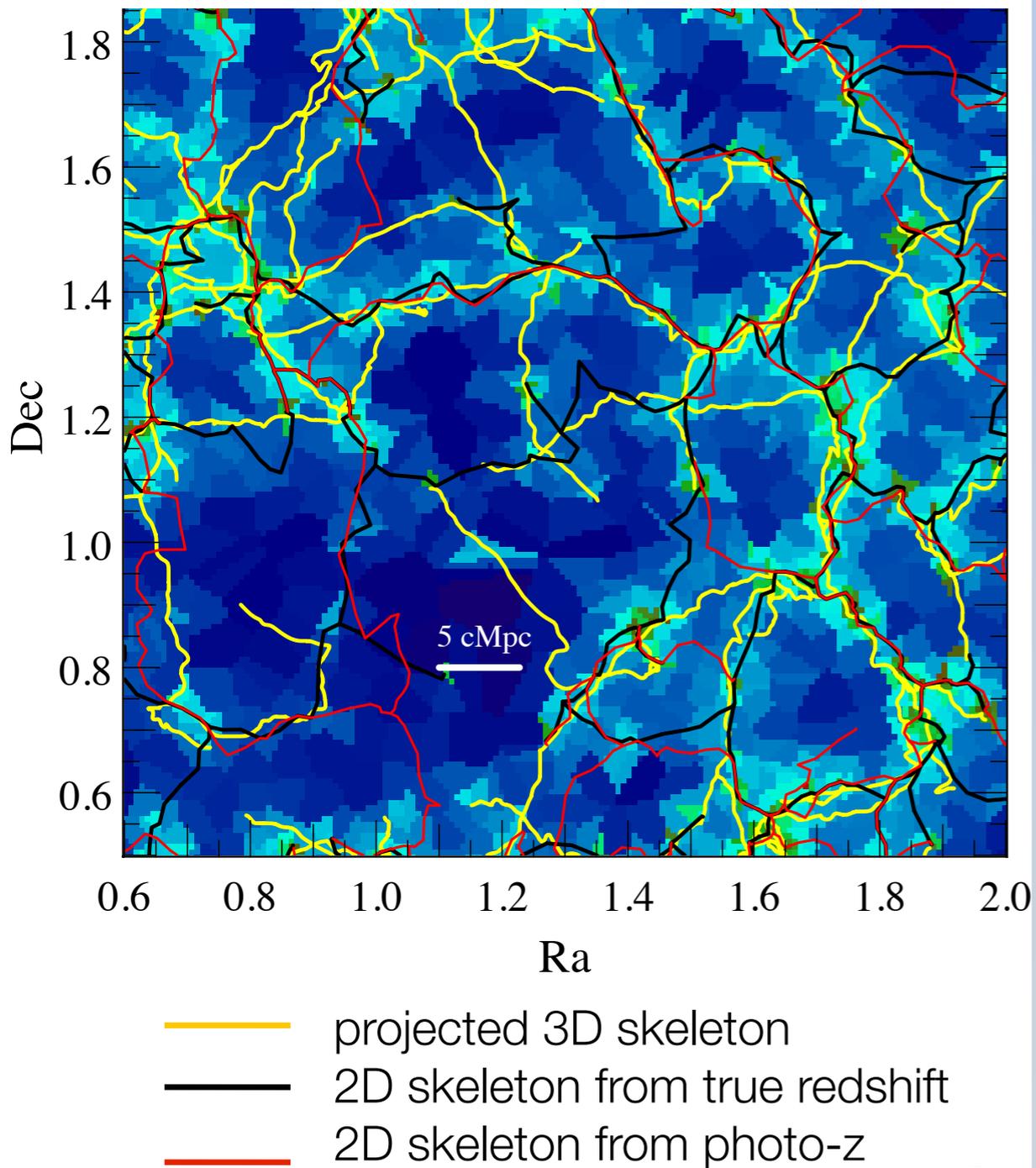
Kraljic +17, in prep



Exploring the 2 D Cosmic Web with photo-z

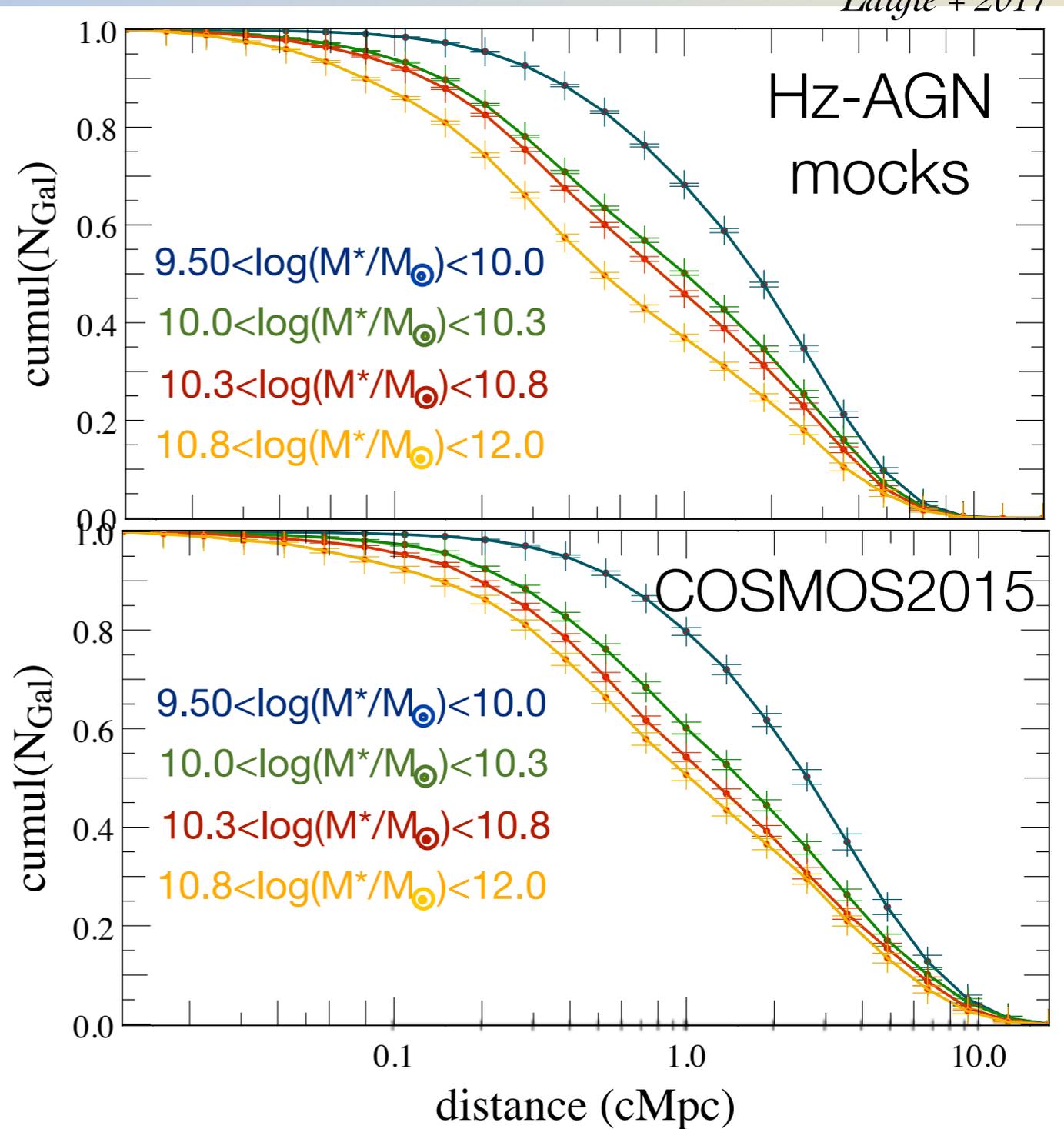
◆ Cosmic Web in thin photo-z redshift slices in COSMOS field 2deg²

horizon-AGN simulation (Dubois +2014)



74

Laigle + 2017

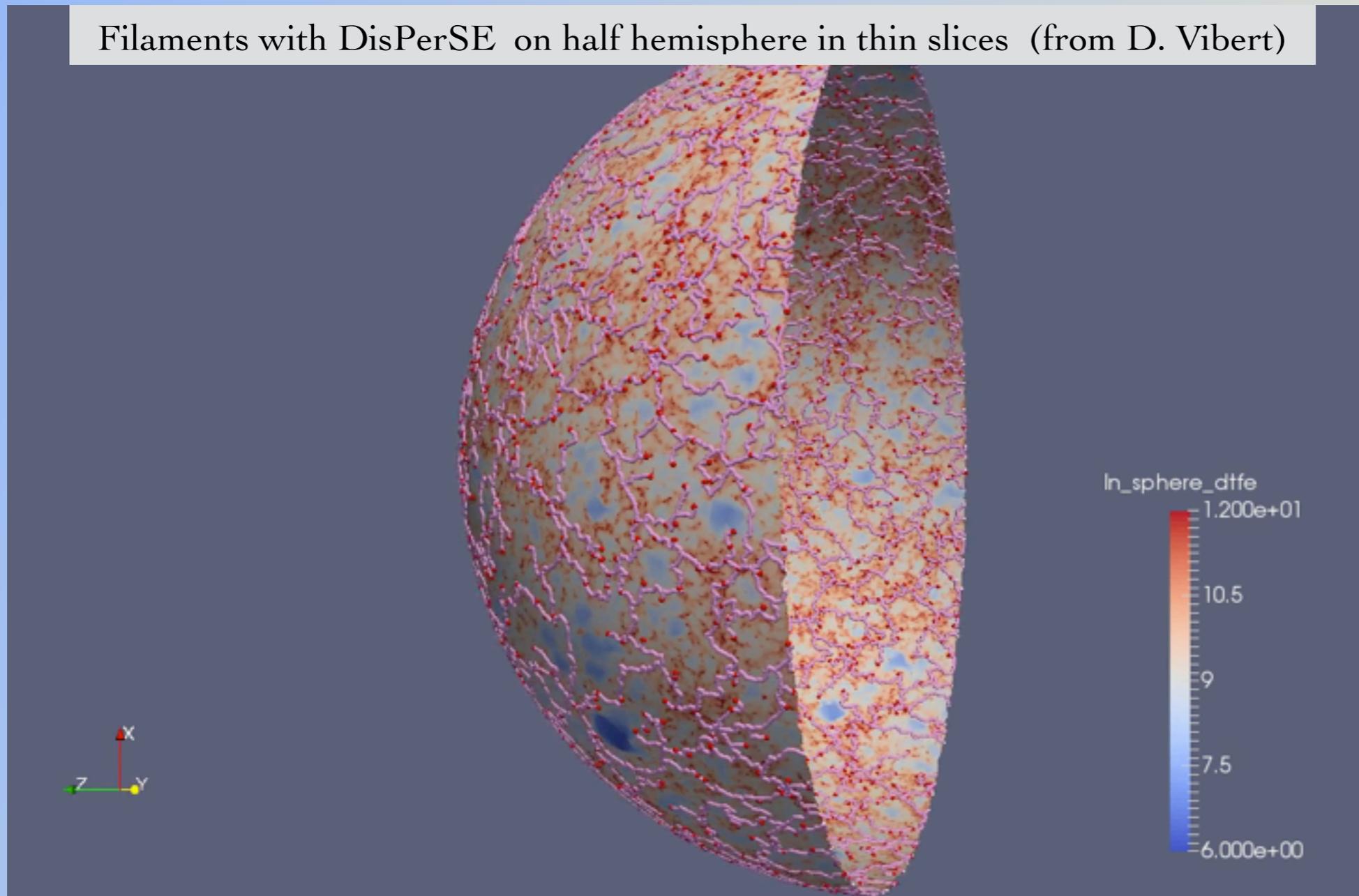


Exploring the 2 D Cosmic Web with photo-z

◆ from COSMOS (2 deg²) to LSST

⇒ with photo-z accuracy similar to COSMOS, we can achieve CW in slices of 75-100 Mpc

Filaments with DisPerSE on half hemisphere in thin slices (from D. Vibert)



⇒ cosmology with connectivity of filaments on nodes with redshift (to be tested on simulation)