Exploring SNIa in voids

ZTF France @ LPC

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Building low-z void samples

SDSS main sample

SDSS-DR7 Main Sample
(Blanton 2005)

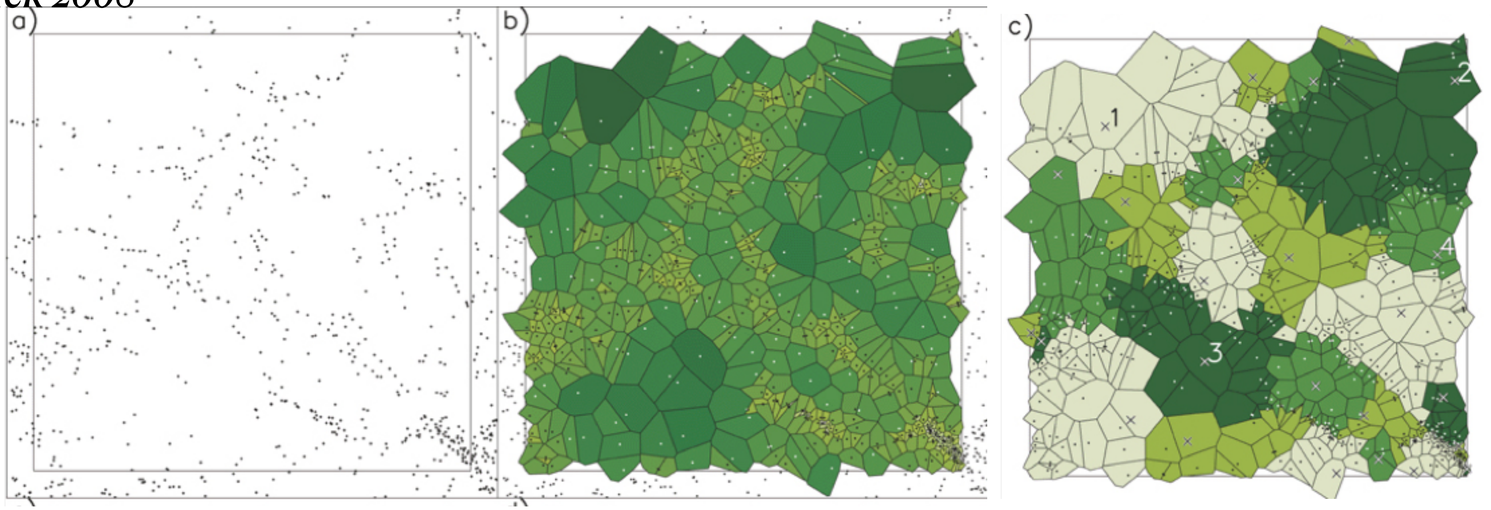
Contiguous footprint

3 volume limited samples (0.065, 0.08, 0.1) → Fainter to Brighter

2 redshift limited samples → (0.065 , 0.105)

Revolver/Zobov voidfinder → Voronoi tesselation based algorithm

Neyrinck 2008



Tracer distribution | Voronoi tesselation | Watershed transform

Void centre $$X_v = \frac{\sum_i V_i X_i^g}{\sum_i V_i}$$

Radius $$R_v = \left(\frac{3}{4\pi} \sum_i V_i \right)^{1/3}$$

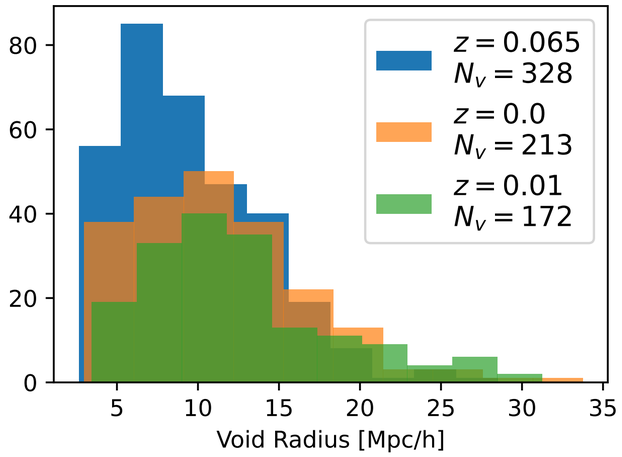
Low-z void samples

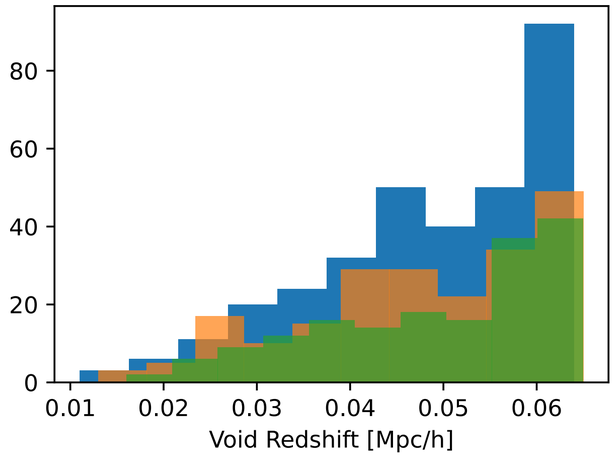
SDSS main sample

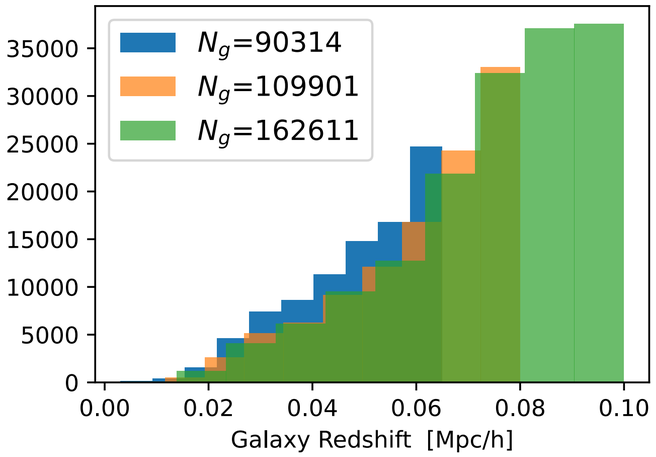
Volume limited voids.

Selection up to z → 0.06

$N_v \approx \mathcal{O}(10^2)$

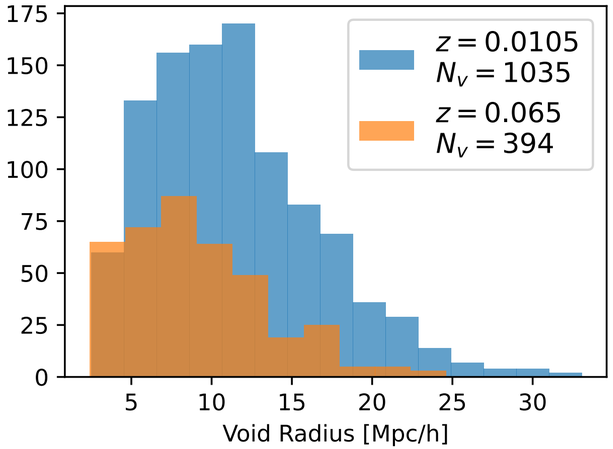


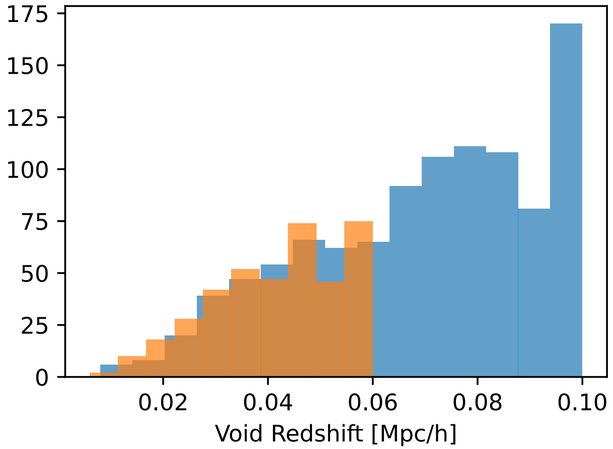


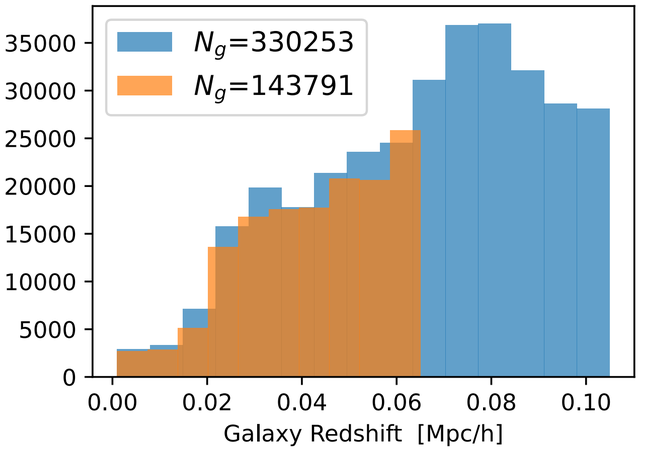


Redshift limited voids.

+800 voids in z=0.1 sample.

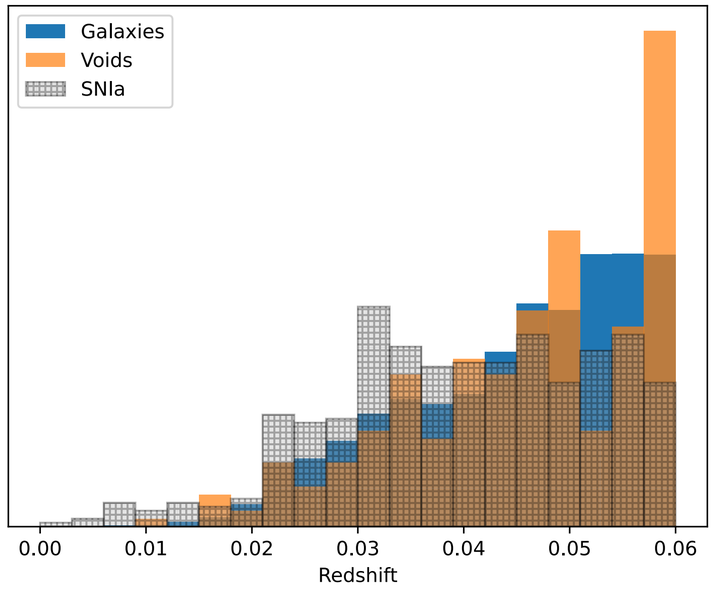


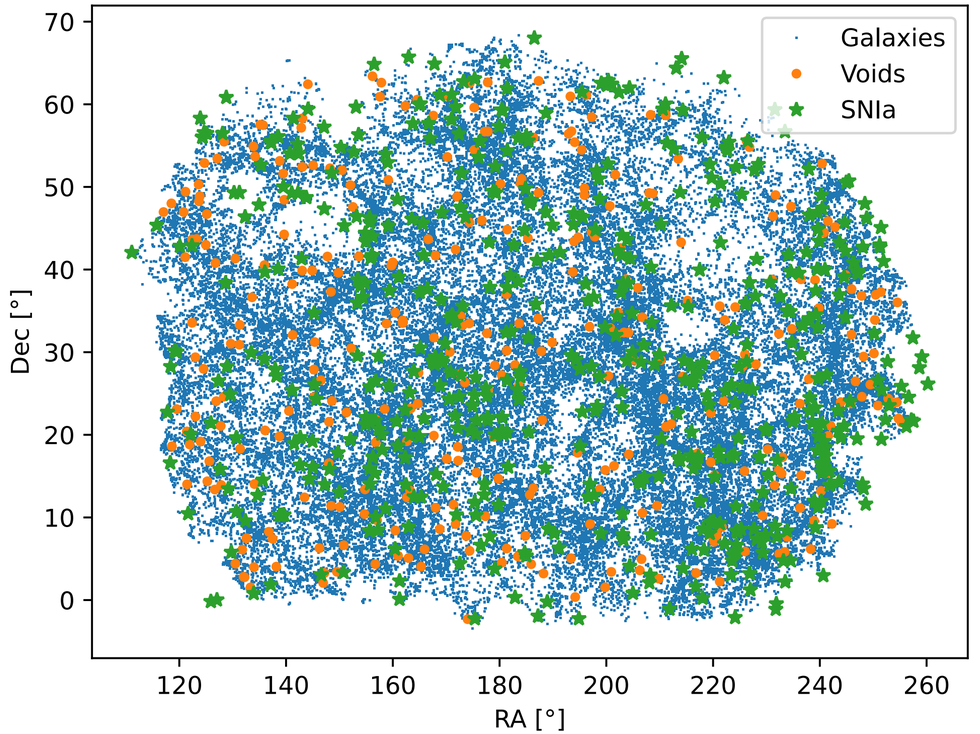




Using ZTF - SNIa DR2

- Select only SNIa within the SDSS footprint
- 3 selection :
  - Volume-limited + low-z redshift limited $z \rightarrow 0.06$: **546** SNIa
  - Redshift-limited $z \rightarrow 0.1$: **1149** SNIa





SNIa properties vs Distance 1/2

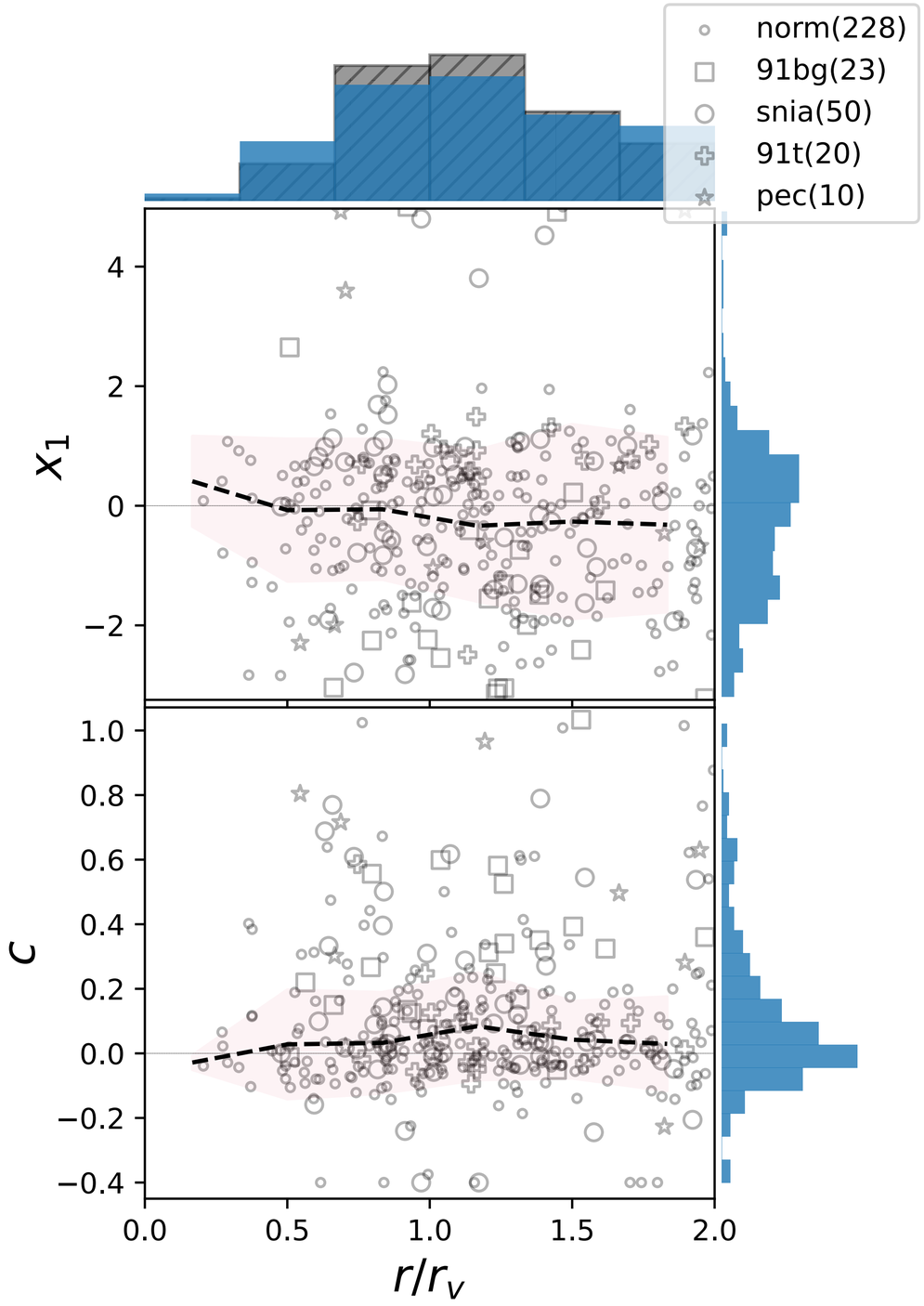
Z→ 0.06 volume-limited voids

Nearest neighboring void and obtain distances.

→ remove SNIa close to edges

→ **417** SNIa considered.

No statistically significant dependency
of SNIa properties w.r.t distance either.



SNIa properties vs Distance 2/2

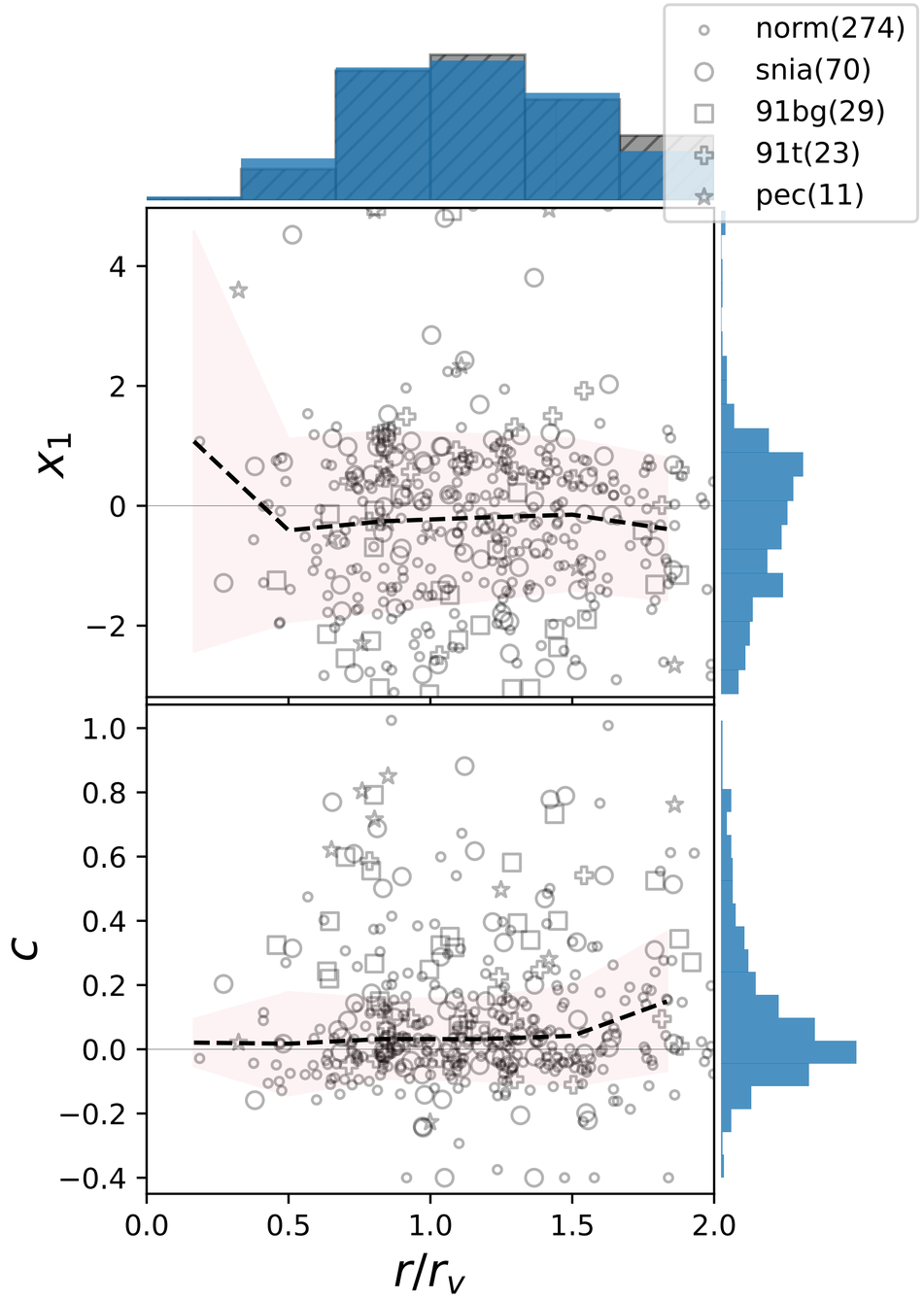
Z→ 0.06 all redshifts voids , same method.

Nearest neighboring void and obtain distances.

→ remove SNIa close to edges

→ **478** SNIa considered.

Hints of dependency of SNIa properties w.r.t distance either but → **not** statistically significant.



SNIa properties vs Voronoi volumes 1/2

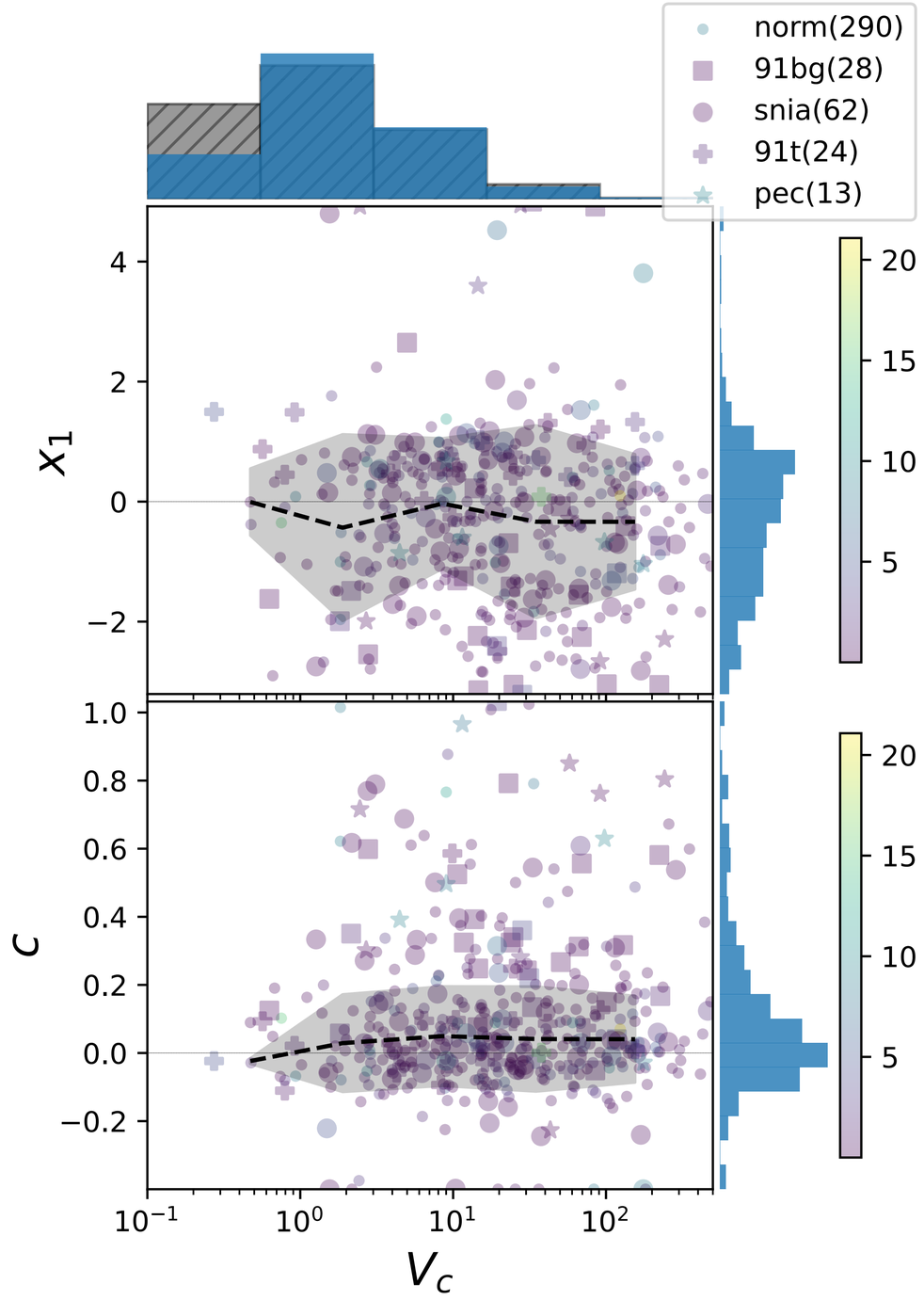
Void finding provides estimation of the local volume in the vicinity of each galaxy : V_c

Volume limited → 0.06

Nearest neighboring galaxy and obtain distances.

→ remove SNIa close to edges (earest neighbor galaxies with unreliable volumes are discarded.)

→ **417** SNIa considered.



SNIa properties vs Voronoi volumes 2/2

Void finding provides estimation of the local volume in the vicinity of each galaxy : V_c

Redshift limited → 0.06

Nearest neighboring galaxy and obtain distances.

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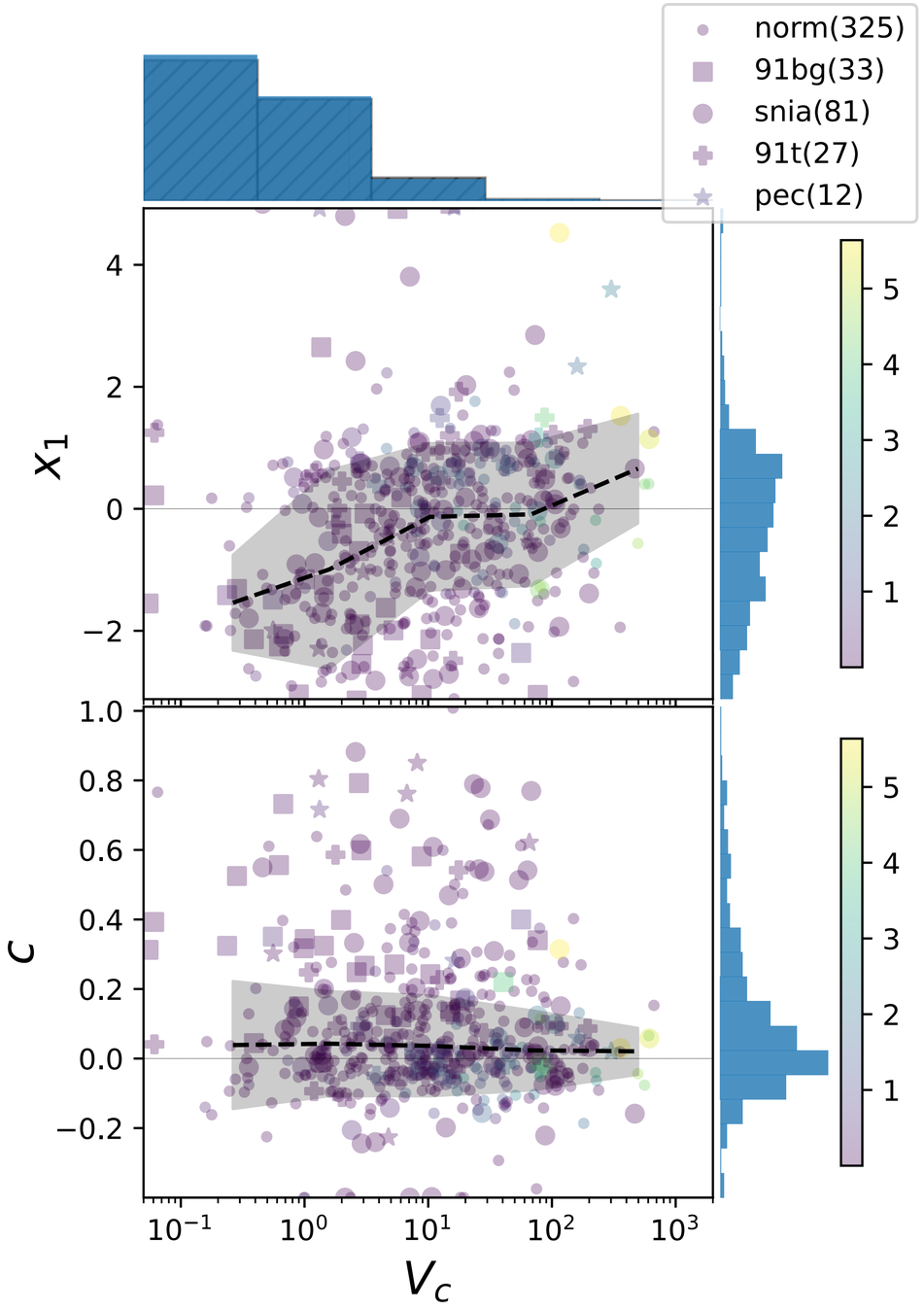
→ **478** SNIa considered.

Can observe a trend in the stretch w.r.t the volume around the galaxy.

High density → Negative stretch (consistent with F. Ruppin work)

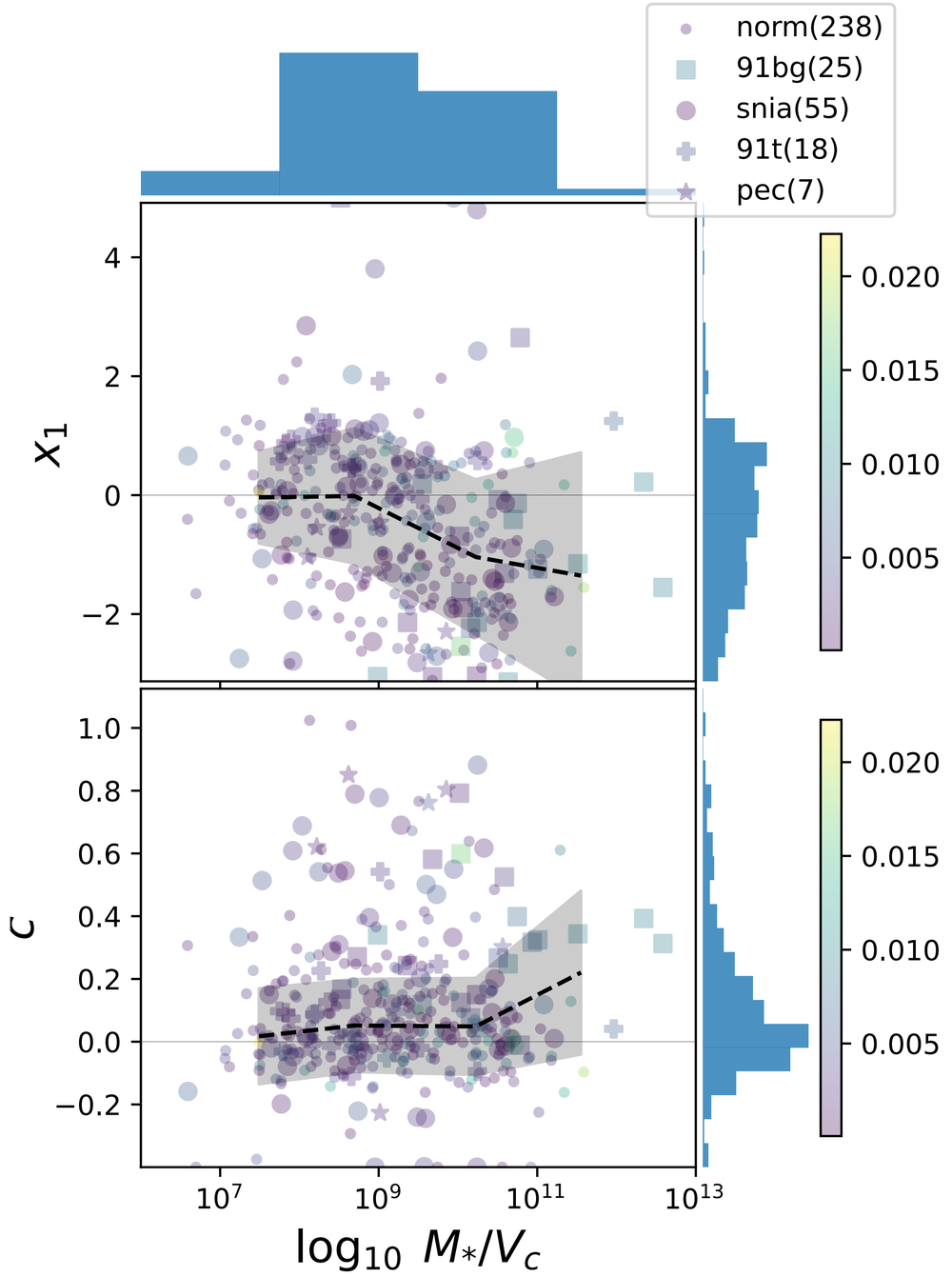


SNIa properties vs Host volumes

- Considering only host of SNIa included in the galaxy sample :

  → **343** SNIa - Host pairs
  → Selection : **50** Kpc/h tolerance for distance (just in case)

- Mesure the local mass density around each host w.r.t the SNIa intrinsic properties.



Conclusion

Very much a work in progress (still).

Result seems to be highly sensitive to void sample definition and galaxy sample selection.

WIP - Take home message :
→ Defined void centres and void radii does not highlight any sensitivity of SNIa properties
→ Local volume (density) might be a better estimate for LSS environment sensitivity of SNIa properties.