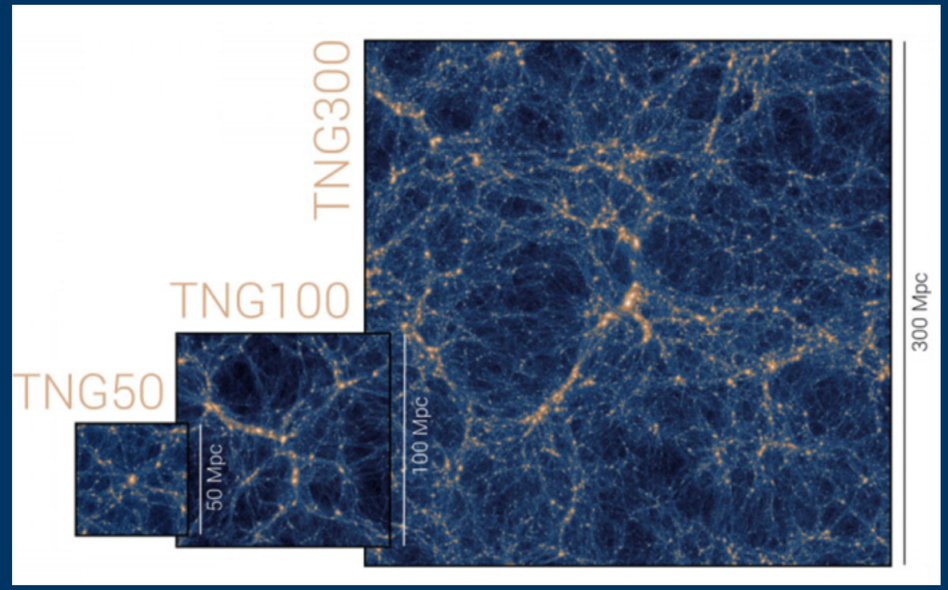
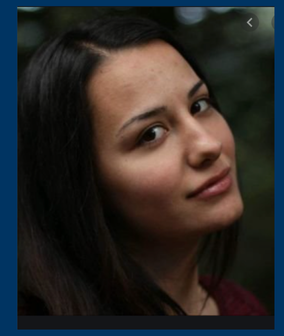
Oskar Klein centre



Simulations from https://www.tng-project.org

Where in the cosmic web live the ZTF supernovae?

Eleni Tsaprazi, Ariel Goobar, Hiranya Peiris, Jens Jasche



Eleni Tsaprazi

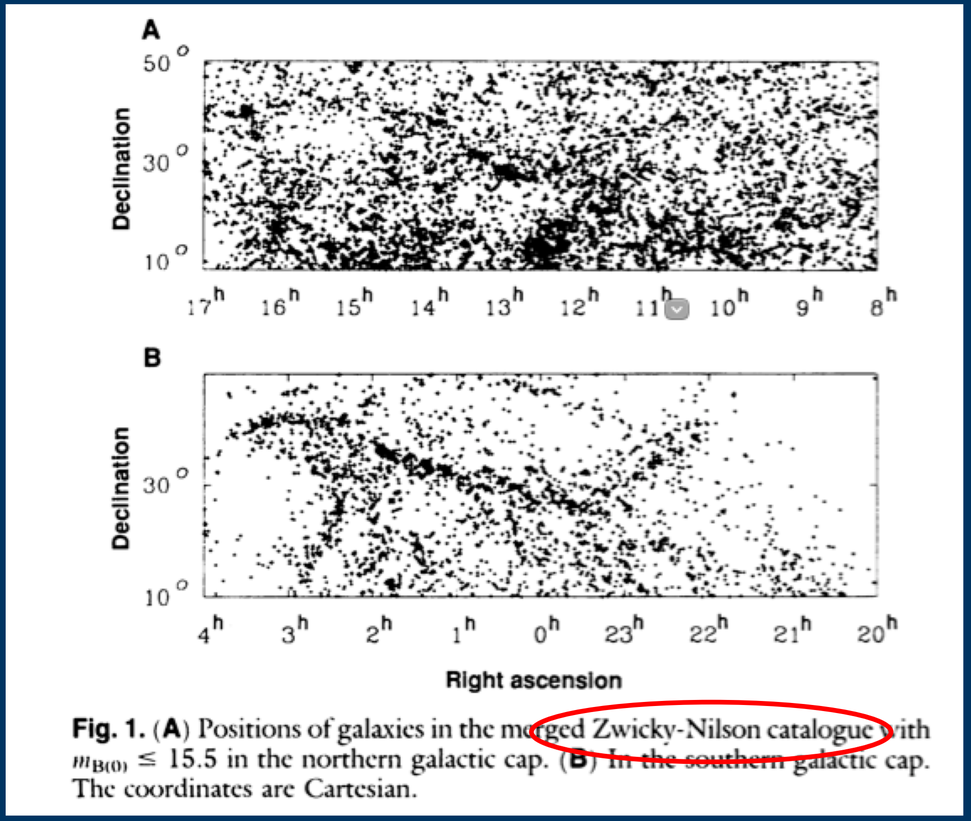
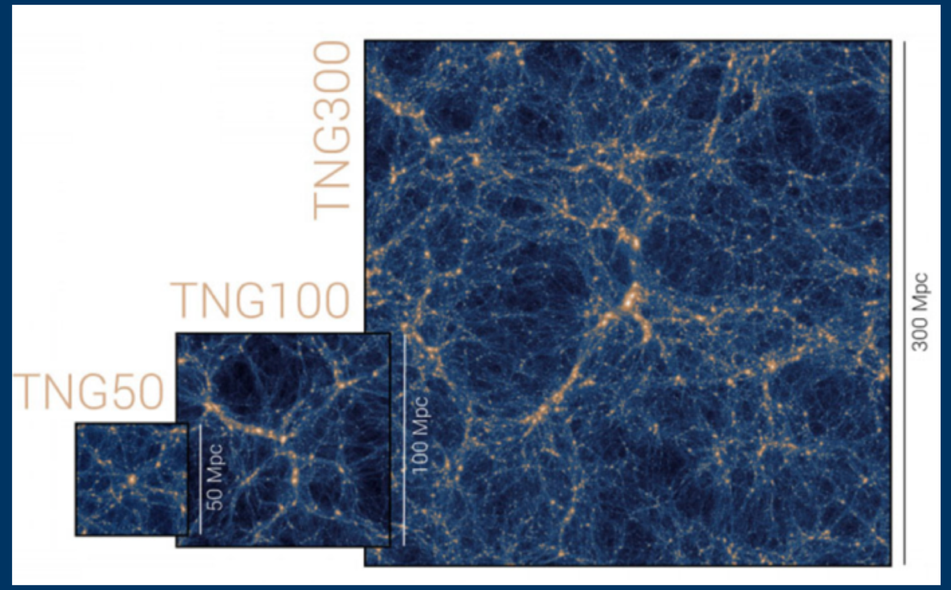


Fig. 1. (**A**) Positions of galaxies in the merged Zwicky-Nilson catalogue with $m_{B(0)} \leq 15.5$ in the northern galactic cap. (**B**) In the southern galactic cap. The coordinates are Cartesian.

P48 observations + Kvistaberg telescope in Sweden! (1961-1973)



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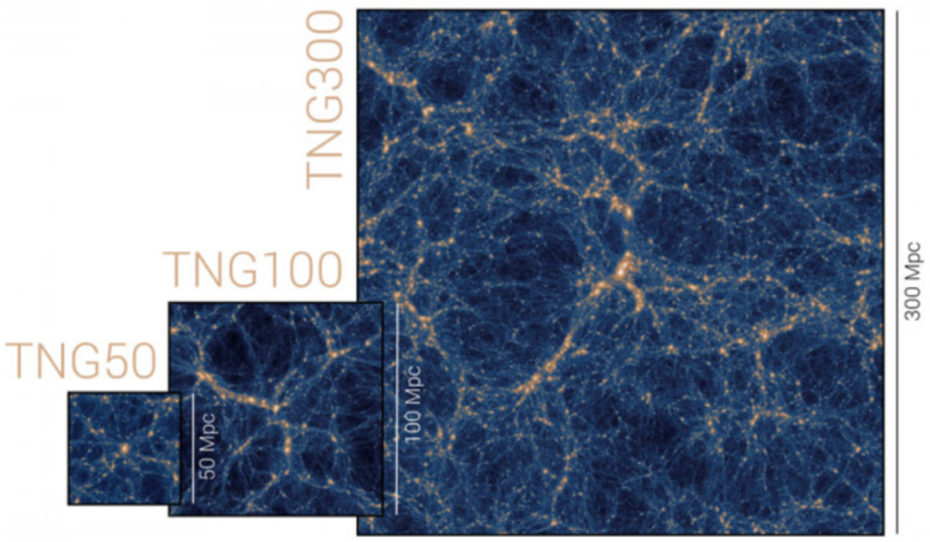
Eleni Tsaprazi

Why it matters?

- Understanding the growth of structures is of great importance to test the validity of our cosmological models and the underlying theory of gravity (GR)
- **Can supernovae complement the picture where observations of galaxies are limited, e.g., low-surface brightness, high-redshift, etc?**
- **Do all SNe types populate the same LSS regions, or do some environments foster certain kinds of progenitors?**



ZTF SNe: BTS + CLU SN sample

SNe Ia and CC up to z = 0.036 [d=154 Mpc comoving radius], “reasonably” complete set, both for the SN and galaxy sample:

- Study locations within Large Scale Structure of **365 (Ia)**** and **609 (CC)****: RA, DEC and z
- Use BORG* algorithm on *galaxy compilation* from (2MASS+SDSS DR7 + 6dF…), to reconstruct Large Scale Structure and associated gravitational potentials

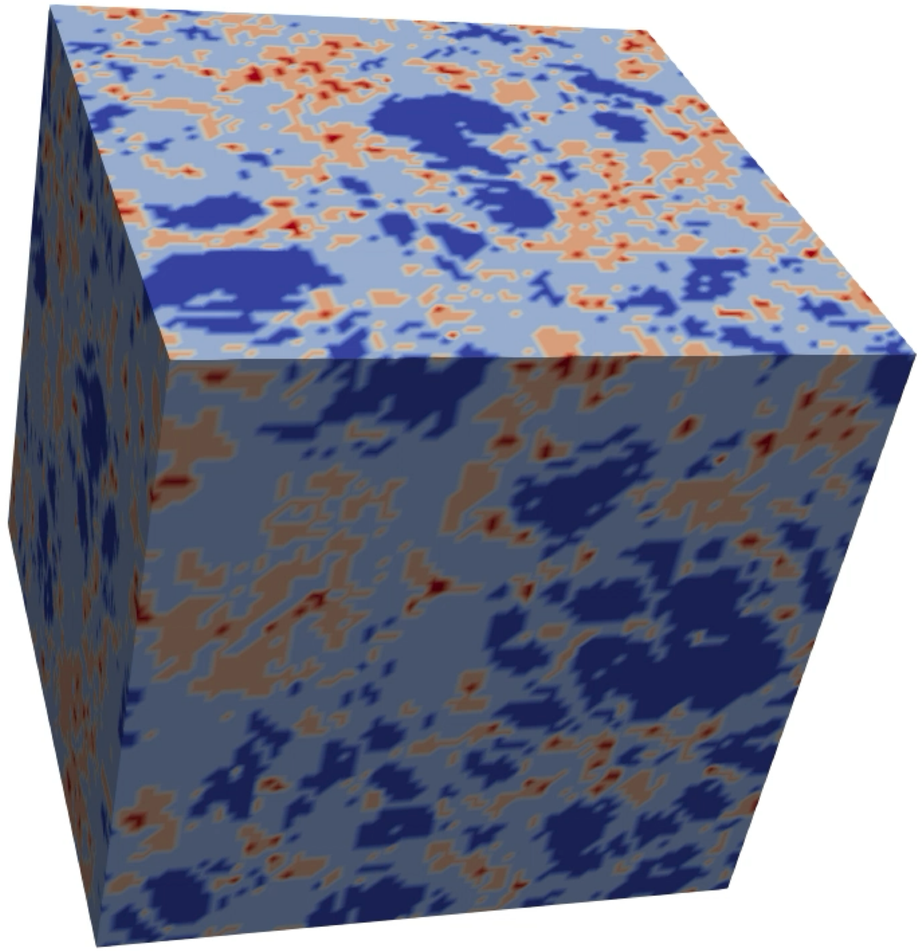
* BORG (Bayesian Origin Reconstruction from Galaxies, Jasche & Wandelt 2013, Jasche, Leclercq & Wandelt 2015, Lavaux & Jasche 2016), an algorithm developed for large-scale structure inference in the linear and mildly non-linear regime of cosmic structure formation.

** SNe with at least 3 digit precision in spectroscopic redshift

Web types: a visual impression

- Red: clusters/knots
- Orange: filaments,
  thread-like, feeding the clusters
- Cyan: sheets,
  2D, wall-like, surrounding voids
- Blue: voids

Classification in this work based on shape of gravitational potential, as reconstructed from galaxies in catalog



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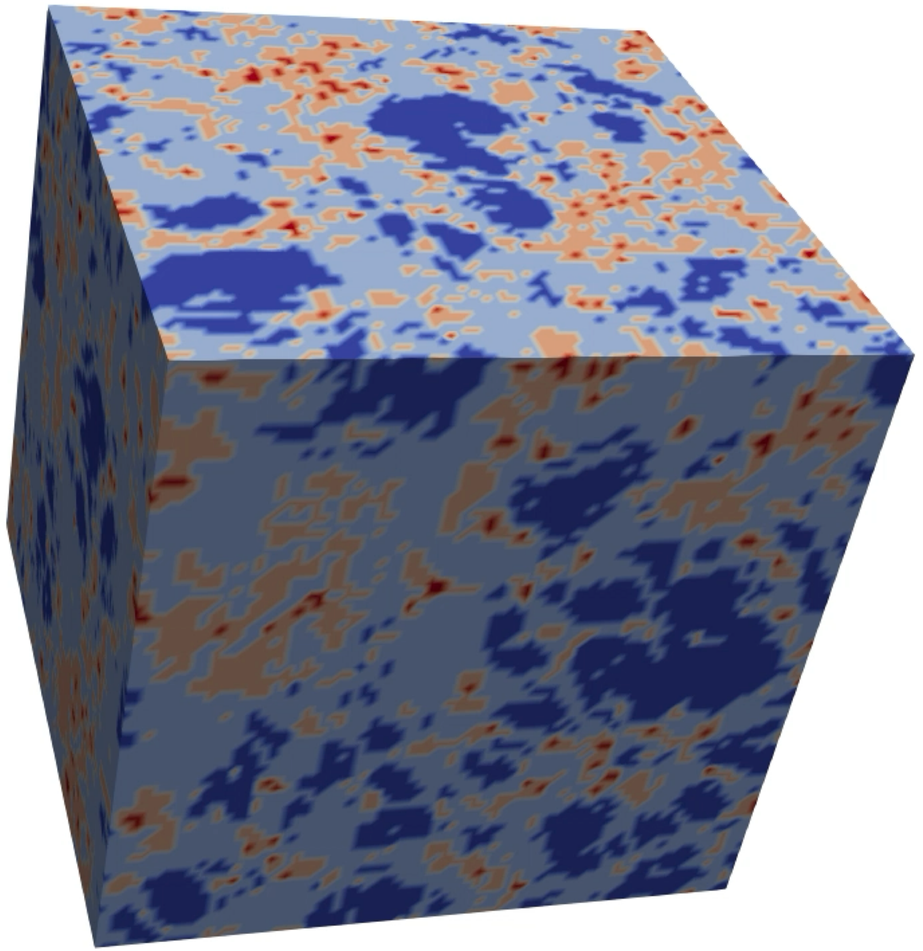


Volume filling fractions (reconstruction)

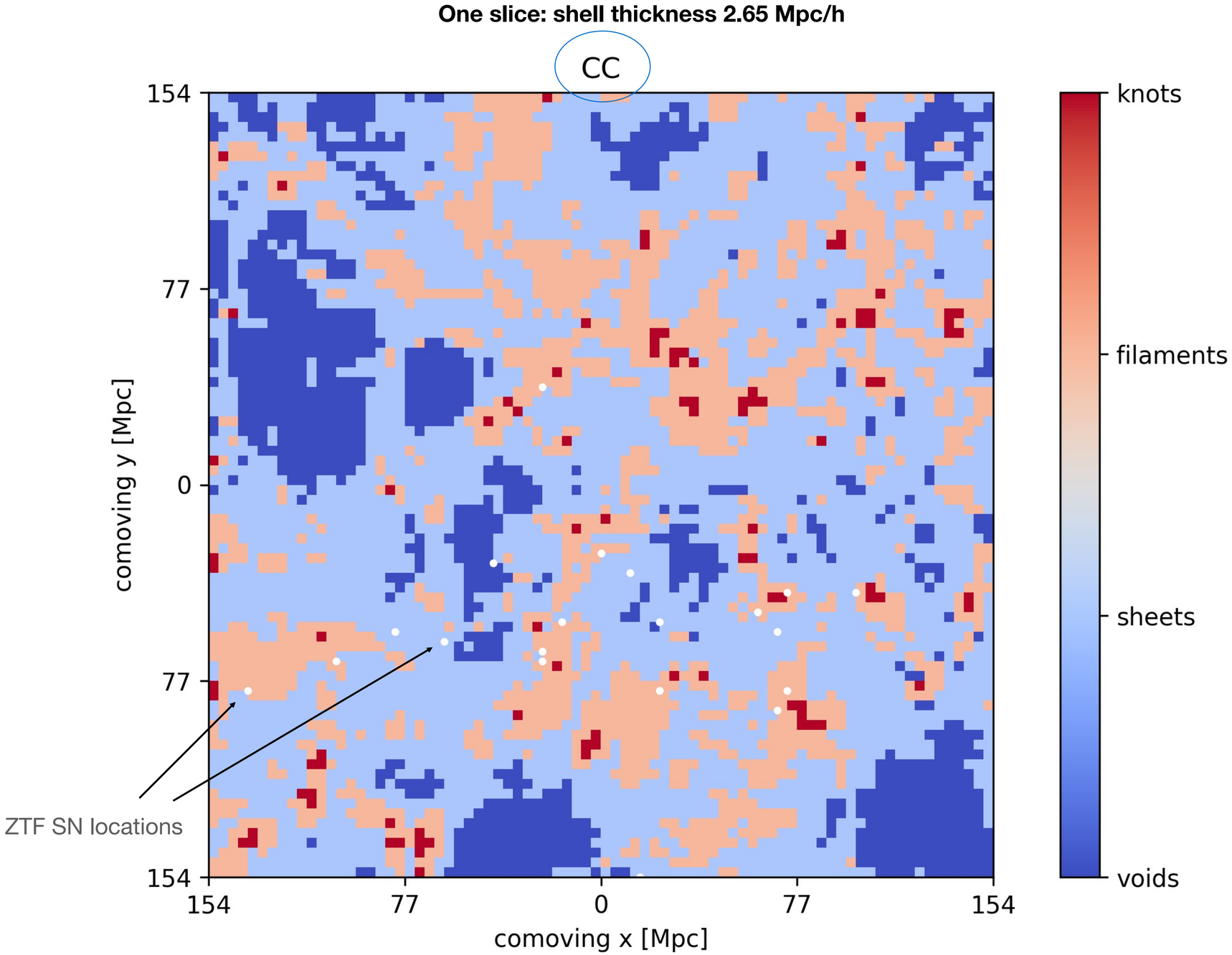
Knots: 2%

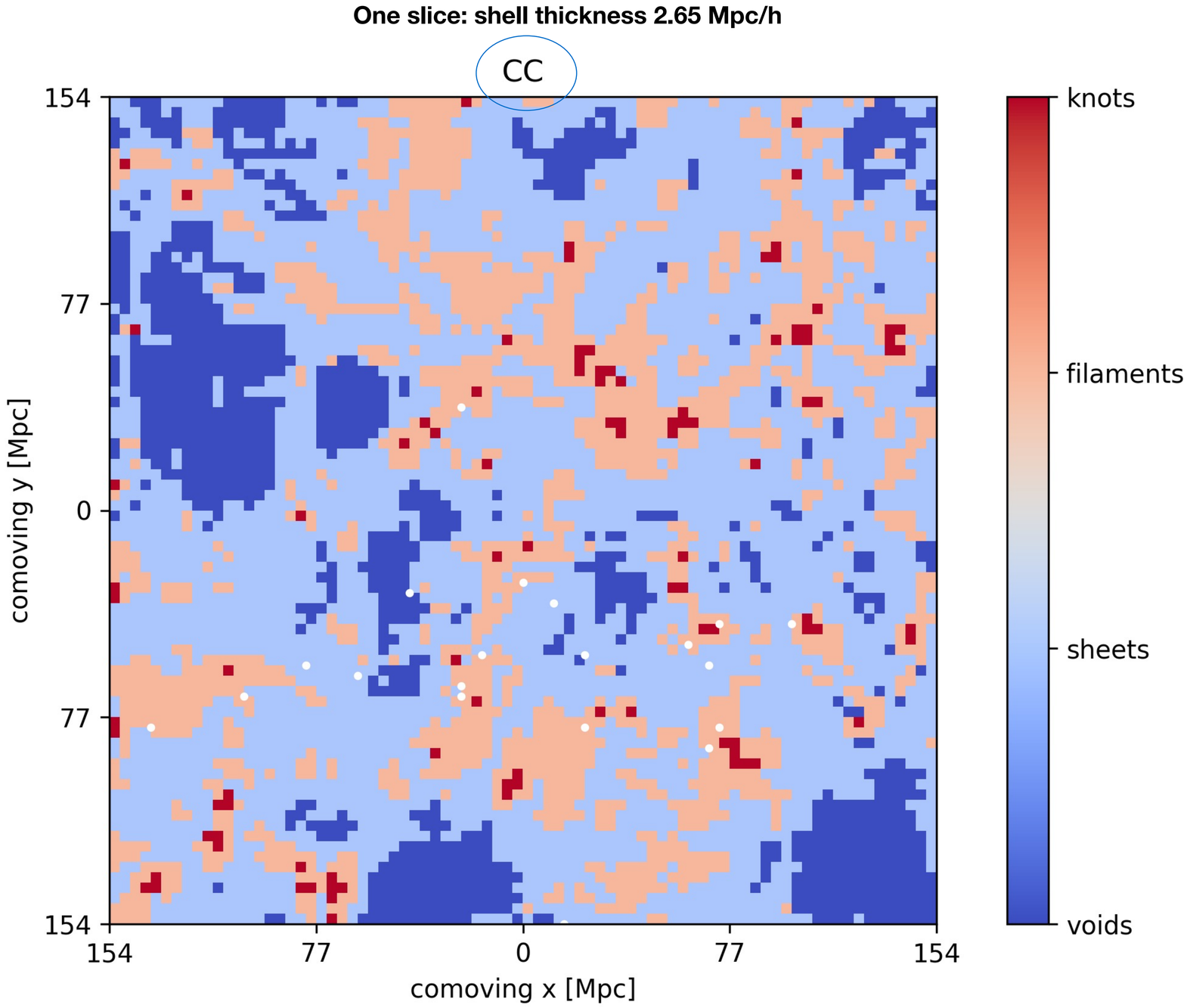
Filaments: 24%

Sheets: 58%

Voids: 16%

Disclaimer: T-WEB classification, there are different techniques for web type inference that produce somewhat different fractions!


One slice: shell thickness 2.65 Mpc/h
CC
154
77
0
77
154
comoving y [Mpc]
154
77
0
77
154
comoving x [Mpc]
knots
filaments
sheets
voids
ZTF SN locations


One slice: shell thickness 2.65 Mpc/h
CC
154
77
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comoving y [Mpc]
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77
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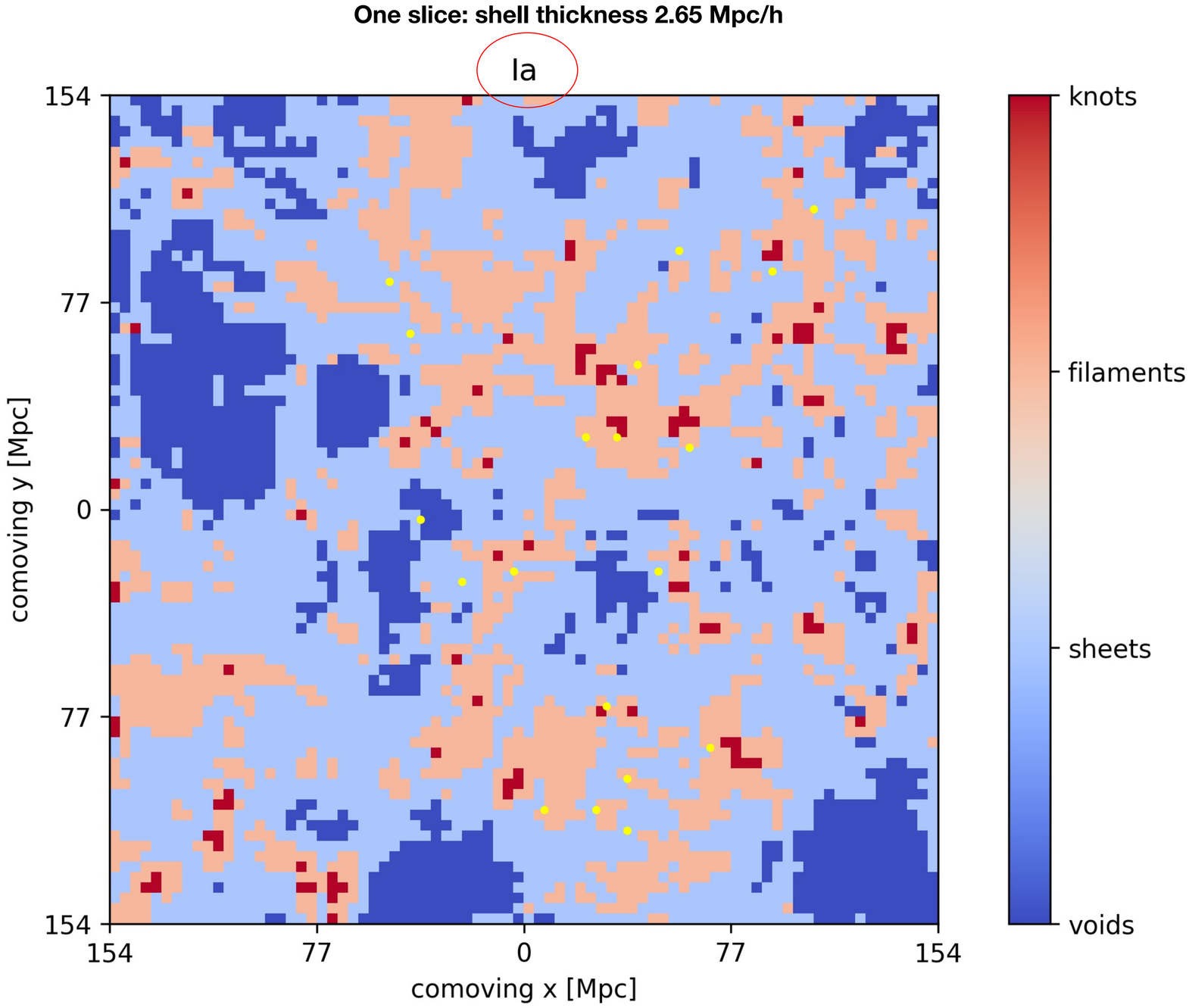
77
154
comoving x [Mpc]
knots
filaments
sheets
voids


One slice: shell thickness 2.65 Mpc/h
Ia
154
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comoving y [Mpc]
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filaments
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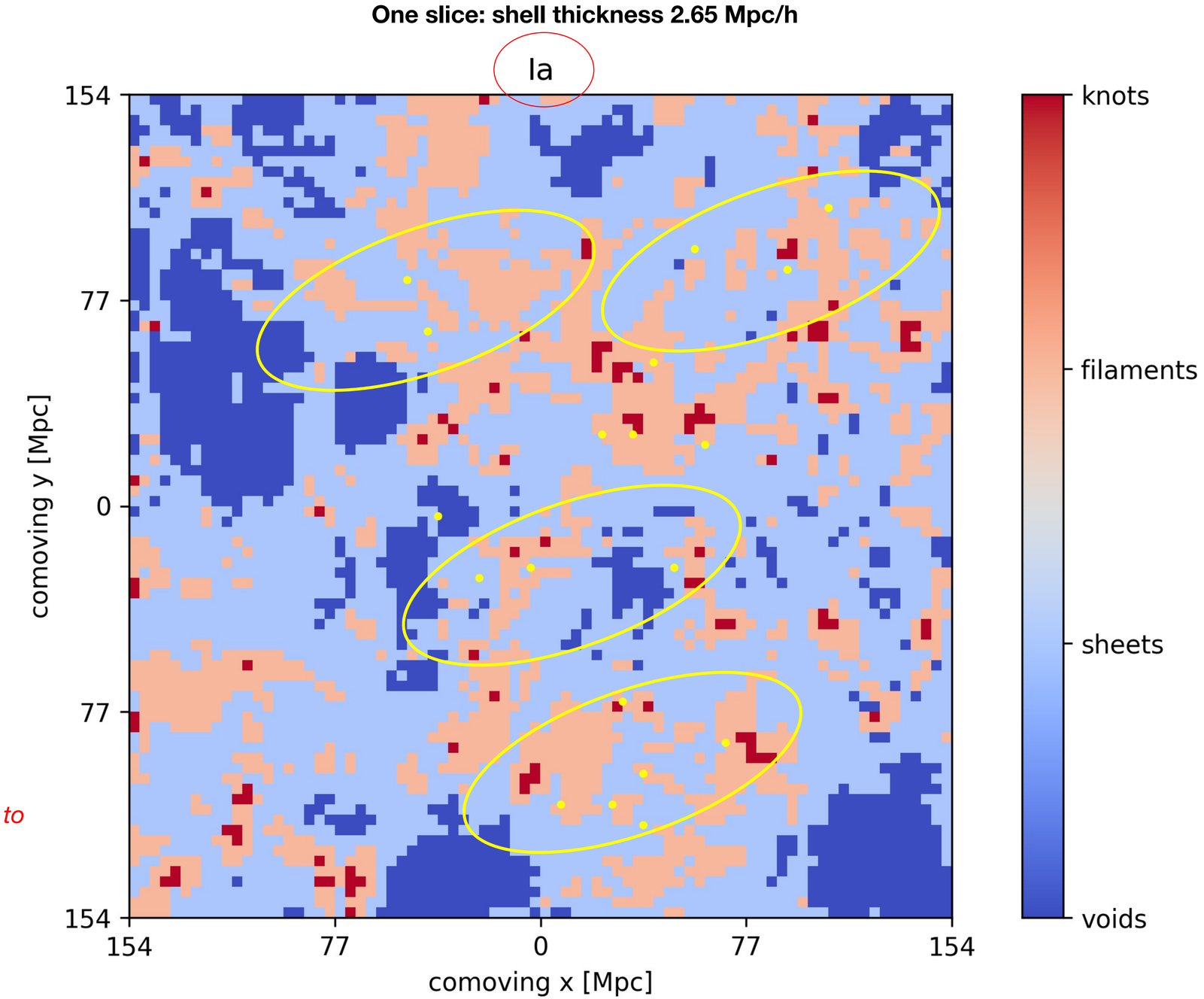
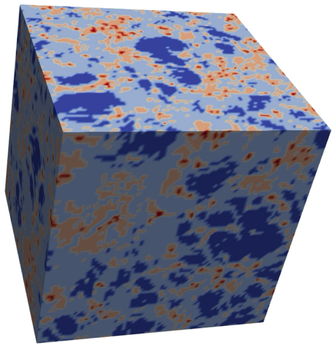


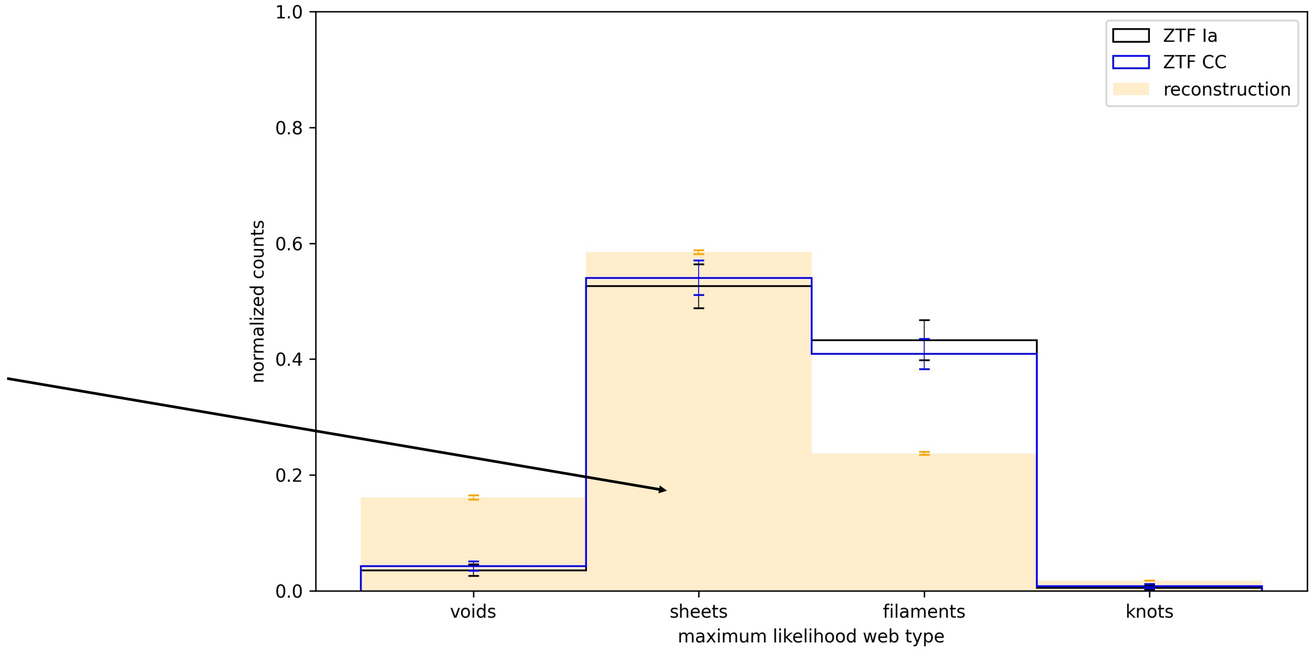
Investigating if Ia hosts in sheets tend to be at the edge of filaments!

BTS sub-sample + CLU

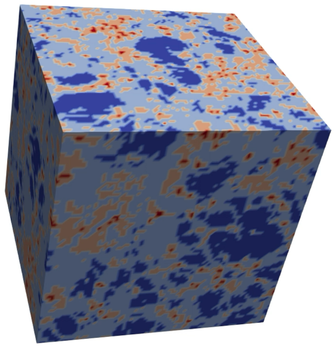
Supernova hosts *not* randomly distributed



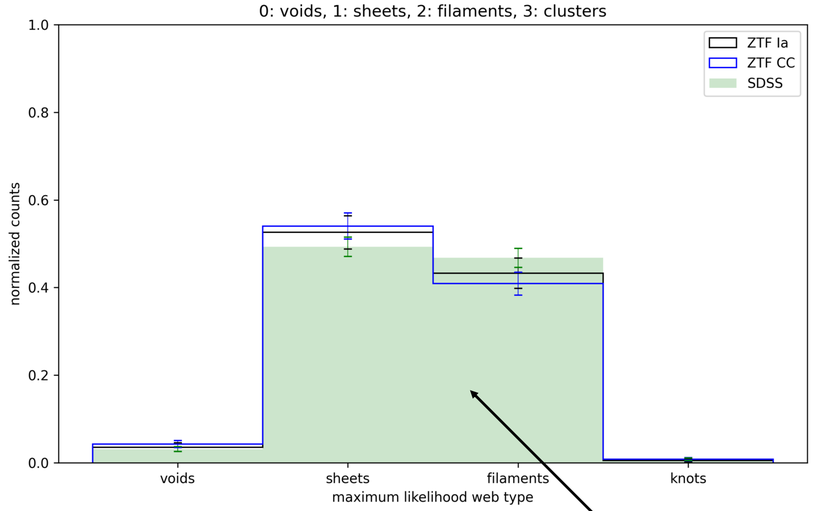
Volume filling



BTS sub-sample + CLU

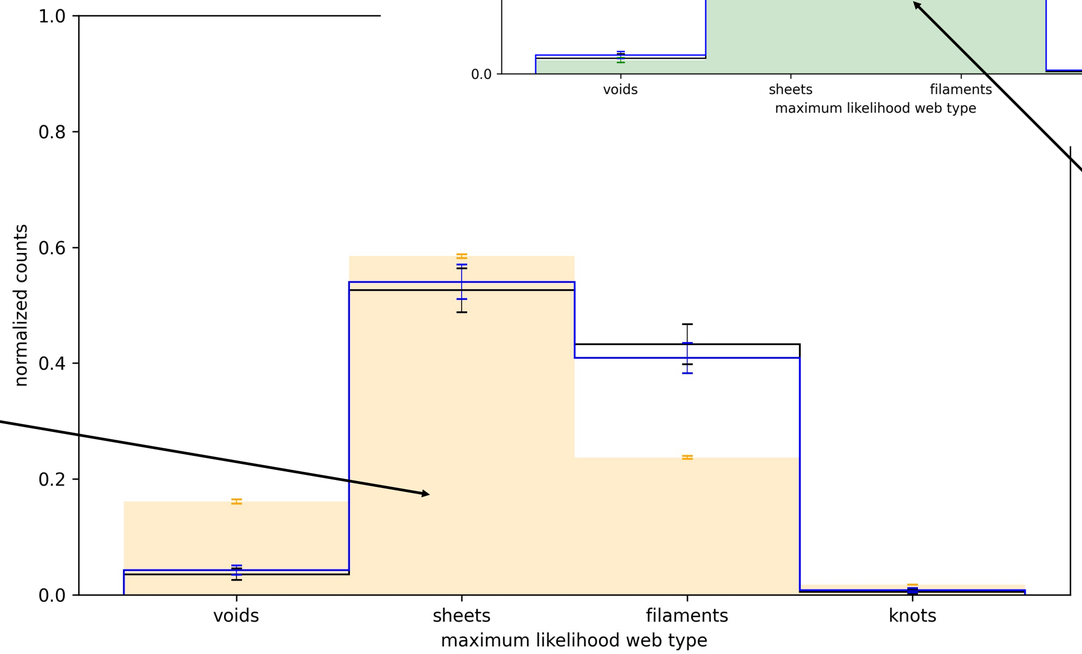


However, SNe do populate *same* web types as *a random set of SDSS galaxies* in this redshift range



Random spectroscopic SDSS galaxy sample

Volume filling



Results & Outlook

- ZTF SN Ia - CC samples reside in the same web types: mostly in 2D sheets and filaments (although a potential trend in Ia's closer to filaments under investigation, requires higher resolution)
- ZTF SN hosts generaly share same cosmic structures as field galaxies
- SN and galaxies alike can be used to trace LSS, and can be combined to optimally cover redshift evolution of clustering [Plan to explore implications for LSST]
- SN and galaxies can be combined to measure peculiar velocities and derived quantities, one of the goals for ZTF-II

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Thank you!