

# RCF Projects

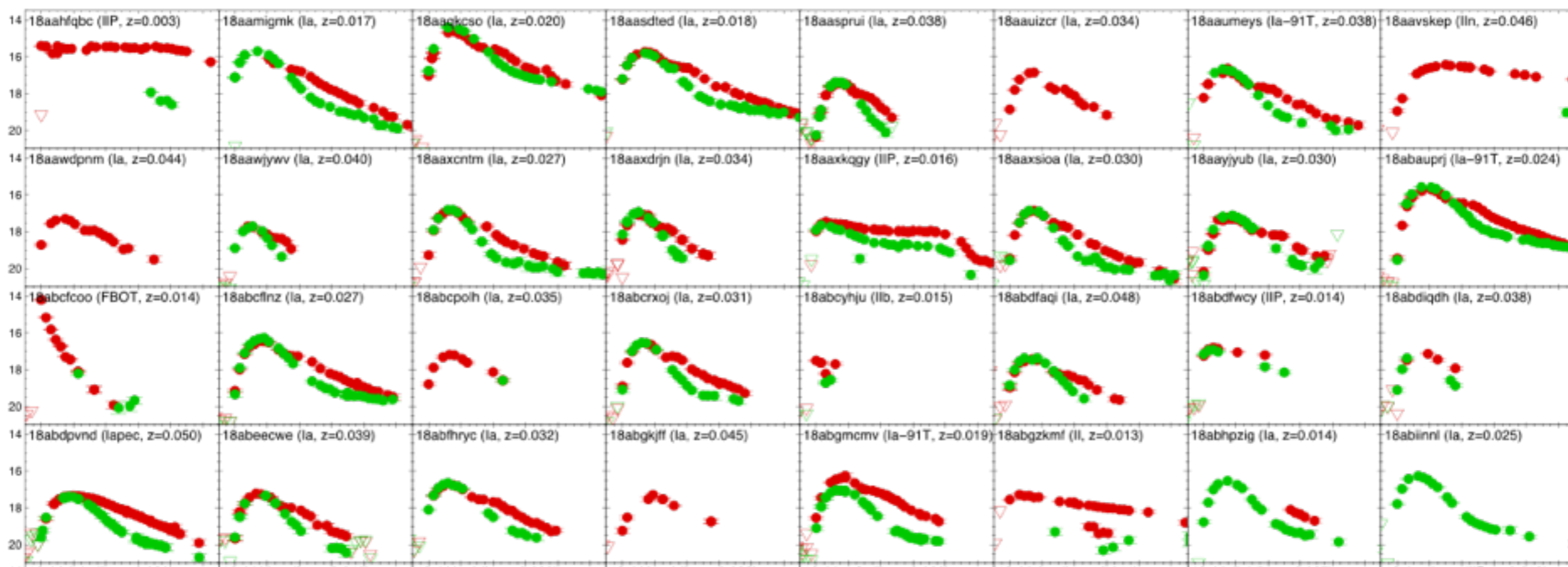
## 07-15-2020



- RCF Lightcurves (forced photometry) and analysis, Miller +
- RCF web portal + basic rates and statistics on the sample, Perley+
- Classification and subtype analysis of 2019 sample, Fremling, Miller + students + whole team
- SNIascore, Deep learning SEDM classification, Fremling+
- SN Ia lightcurves, rate and luminosity function, Biswas, Goobar + OKC +
- SNe as tracers of the Large Scale Structure (Tsaprazi + OKC)
- Host galaxy analysis, Perley + Shulze +
- Neutrino Correlation with RCF SNe, Necker + DESY +
- SNe II, correlation of photometric and spectroscopic properties (Goldwasser + Weizmann +)
- Deep learning subtype classification (Sharma)

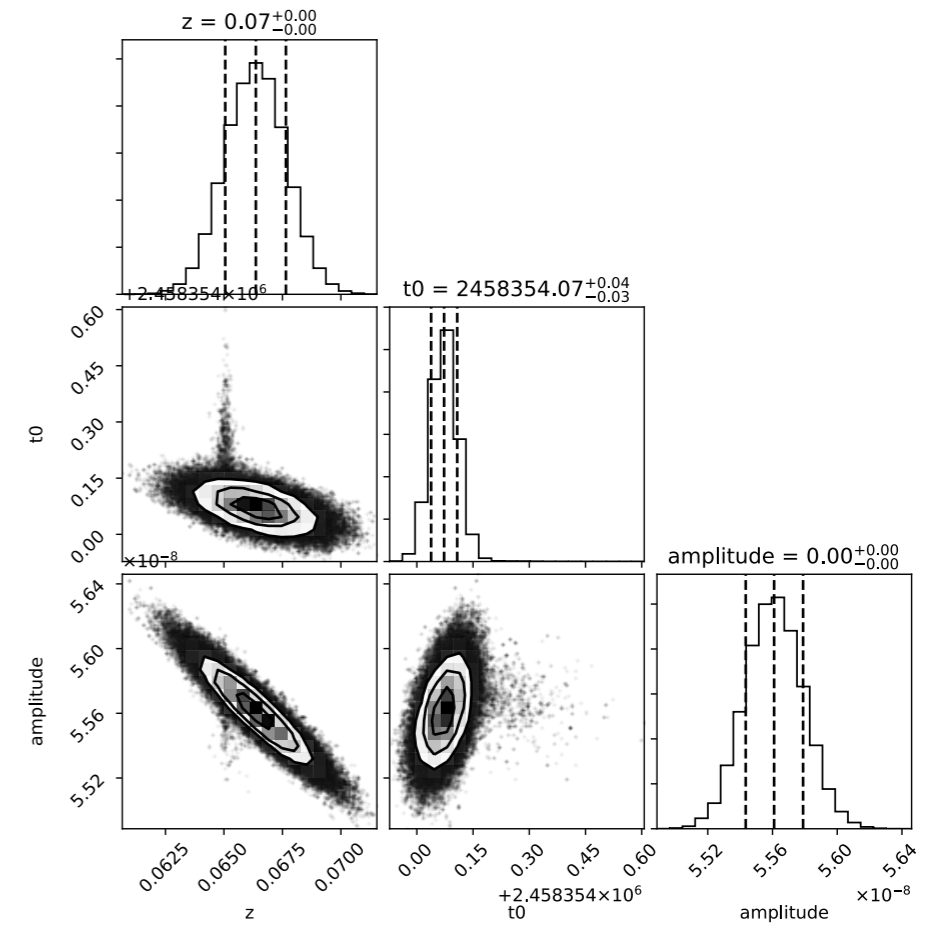
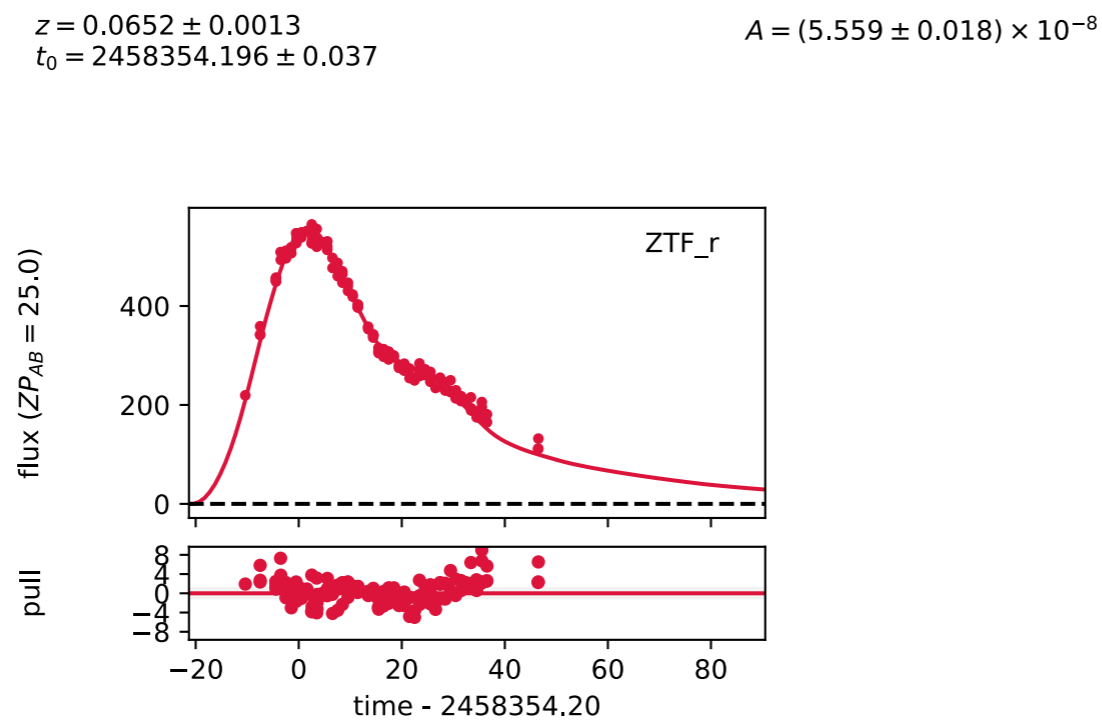
RCF lightcurves, forced photometry, and analysis, Miller +  
working on producing final LCs for all RCF SNe since 2018

analysis will be based on parametric model fitting



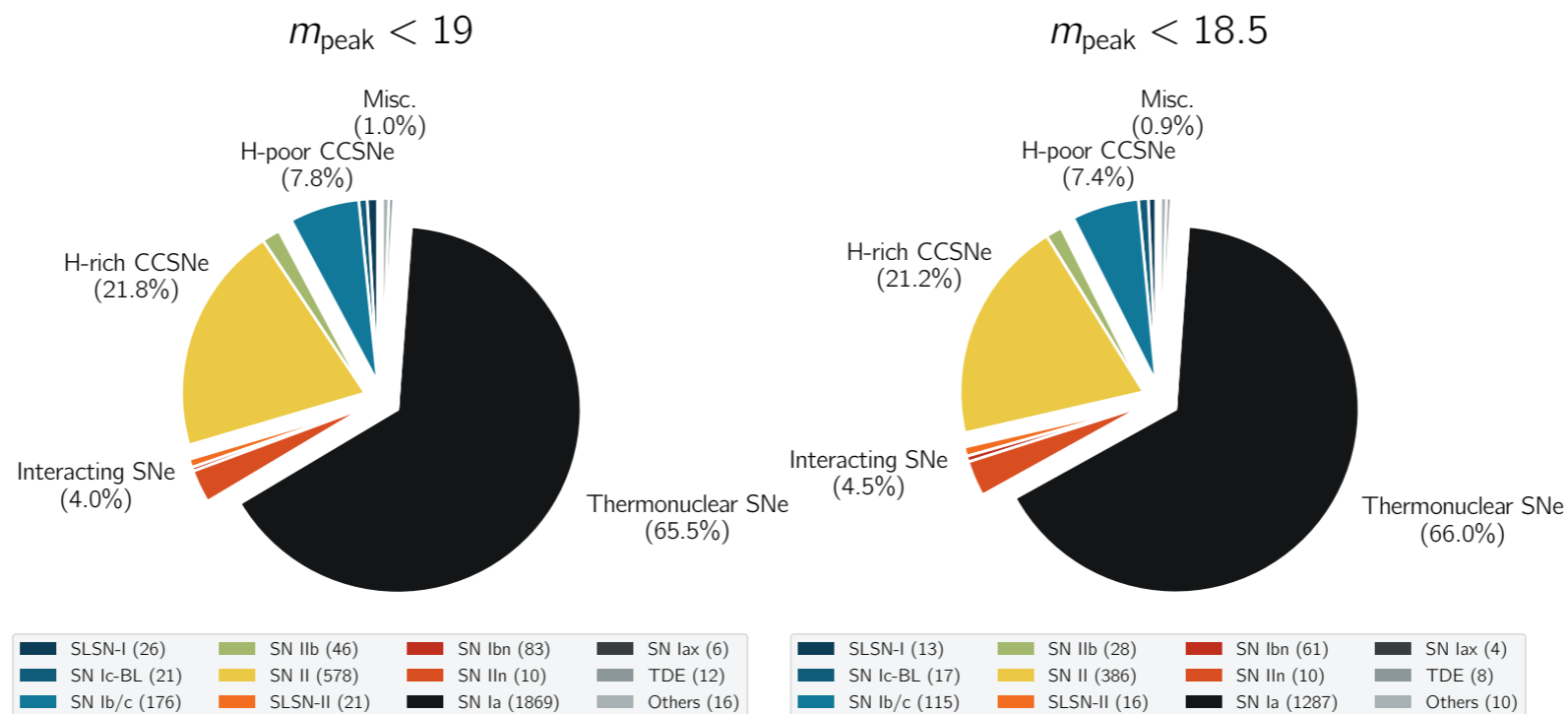
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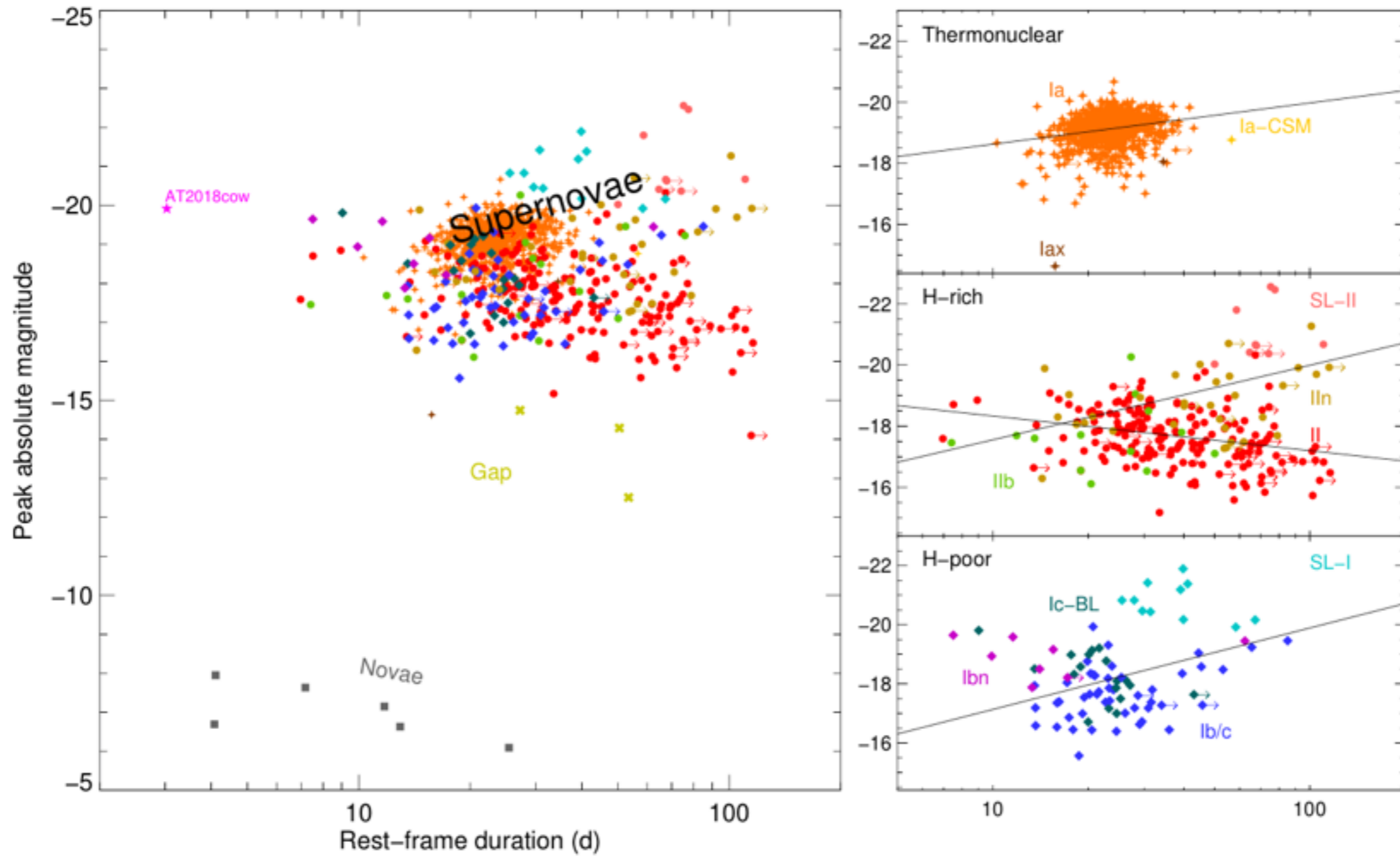
# Classification and subtype analysis of 2019 sample Fremling, Miller + students + whole team

SNID, Superfit (python version), DASH, etc.  
to finalize classifications and redshifts  
analysis will contain statistics on SN subtypes in RCF



# RCF statistical sample and web portal

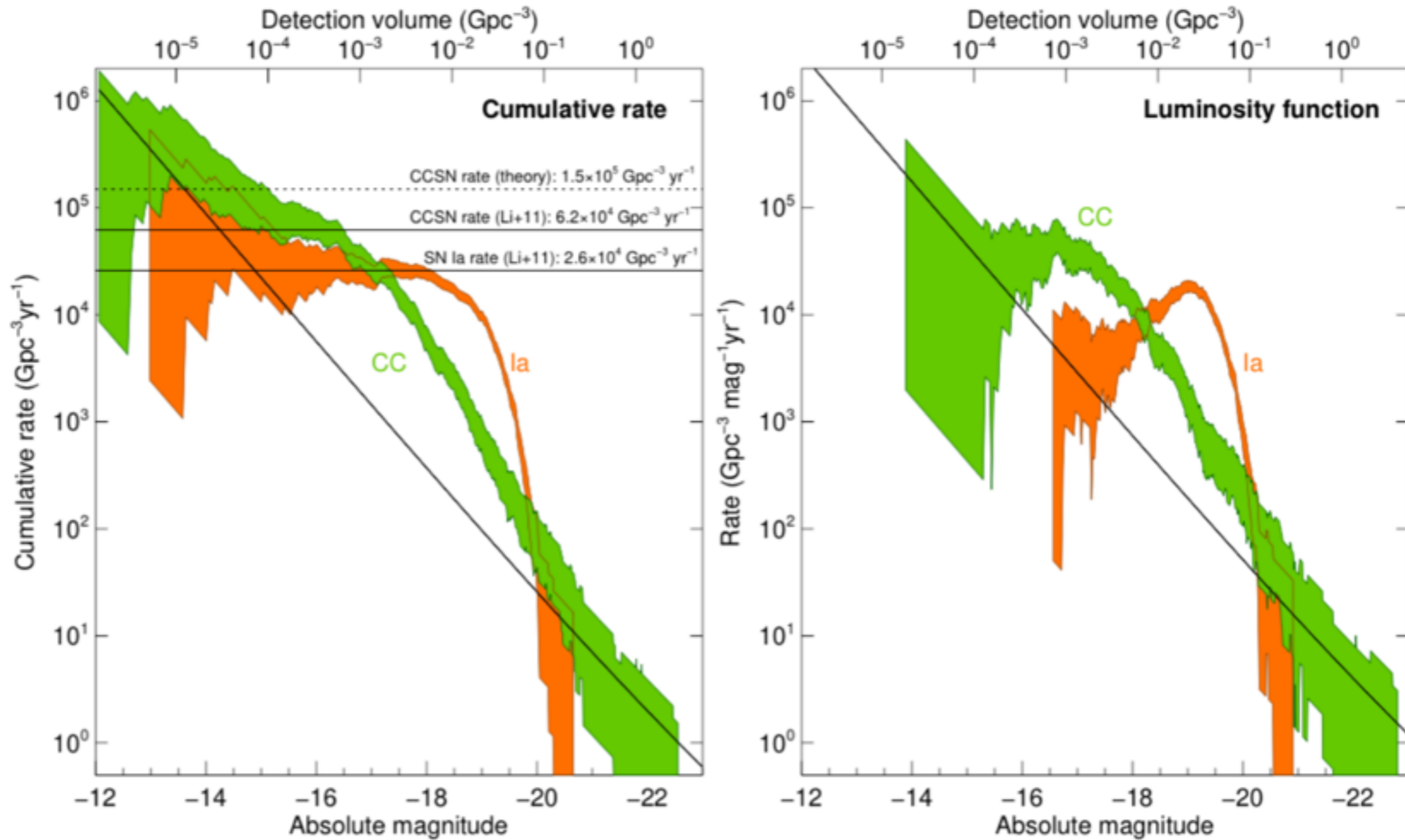
Perley, Fremling +



<https://www.astro.caltech.edu/ztf/bts/bts.php>

# RCF statistical sample and web portal

Perley, Fremling +



<https://www.astro.caltech.edu/ztf/bts/bts.php>

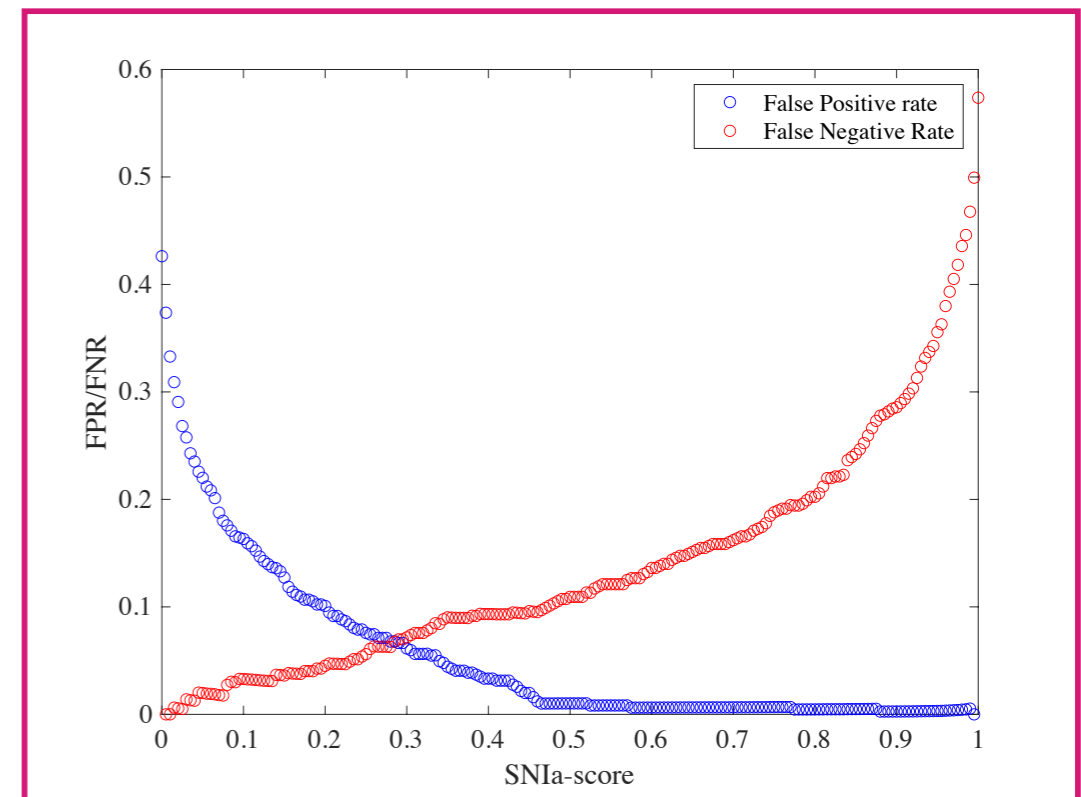
# SNiascore, Deep learning SEDM classification, Fremling+

Comparison to DASH (Muthukrishna et al., 2019), CNN network

## BiLSTM+GRU

Out of 761 RCF SNe from 2018

|               | SNiascore_2  | SNiascore | DASH  | TRUTH |
|---------------|--------------|-----------|-------|-------|
| <b>SNe Ia</b> | <b>474</b>   | 466       | 302   | 533   |
| <b>%</b>      | <b>88.9%</b> | 87.4%     | 56.6% |       |
| <b>FPR</b>    | <b>0.6%</b>  | 2.7%      | 9.6%  |       |
|               |              |           |       |       |



(SNID, ~100 correct)



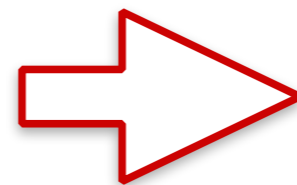
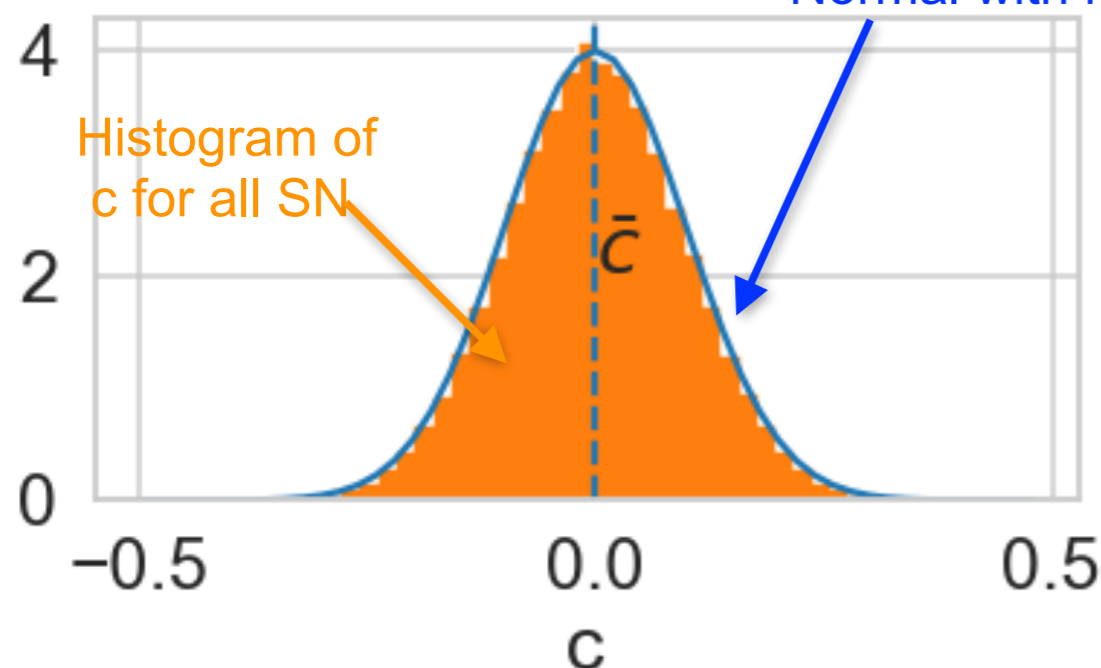
# Rates/Luminosities of SNIa using

**ZTF BTS** Biswas, Goobar + OKC +

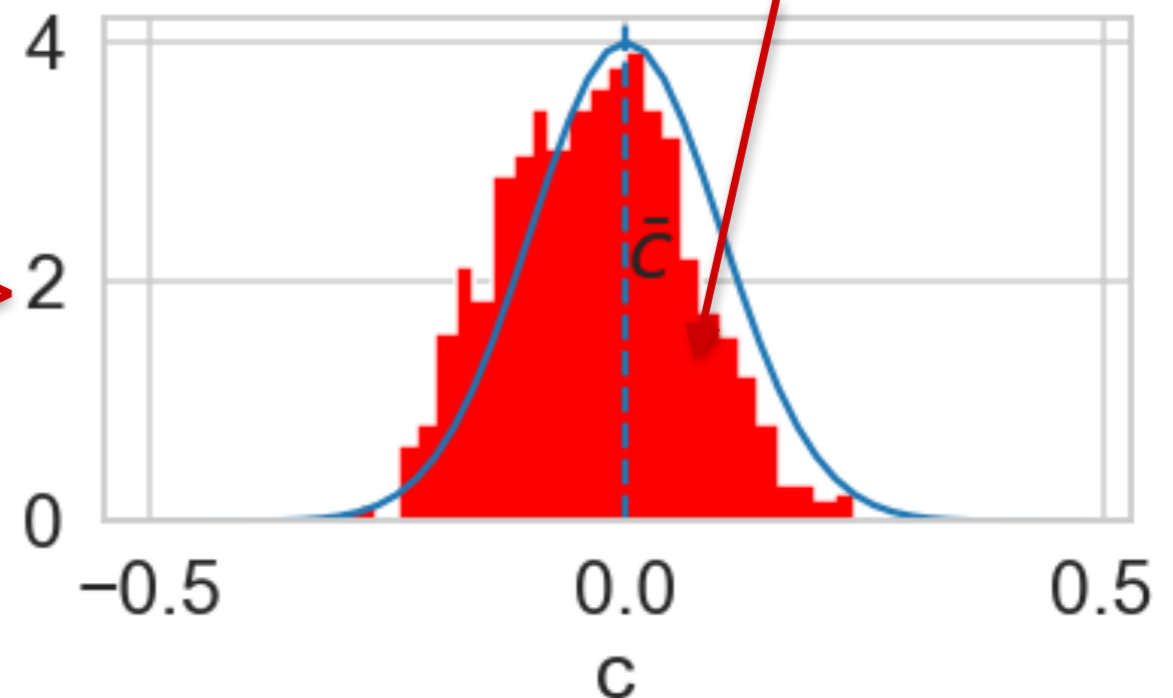
- Describe population distribution of SNIa : rate parameter  $r_v$  and a distribution of properties (e.g. Normal with unknown parameters eg. mean)

- Simulated example of situation:

Population Distribution:  
Normal with mean



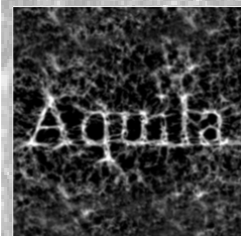
Histogram of  $c$  of ZTF like SN sample  
after selection from SN on the left



- Ongoing work at OKC + ZTF collaborators : simultaneously infer both  $r_v$  and parameters like  $\bar{c}$  from measured values of  $c$  in the (red) ZTF sample. Extends to other transients, multi-parameter complex distributions

- People involved at OKC : Biswas, Goobar, Mortlock and Peiris

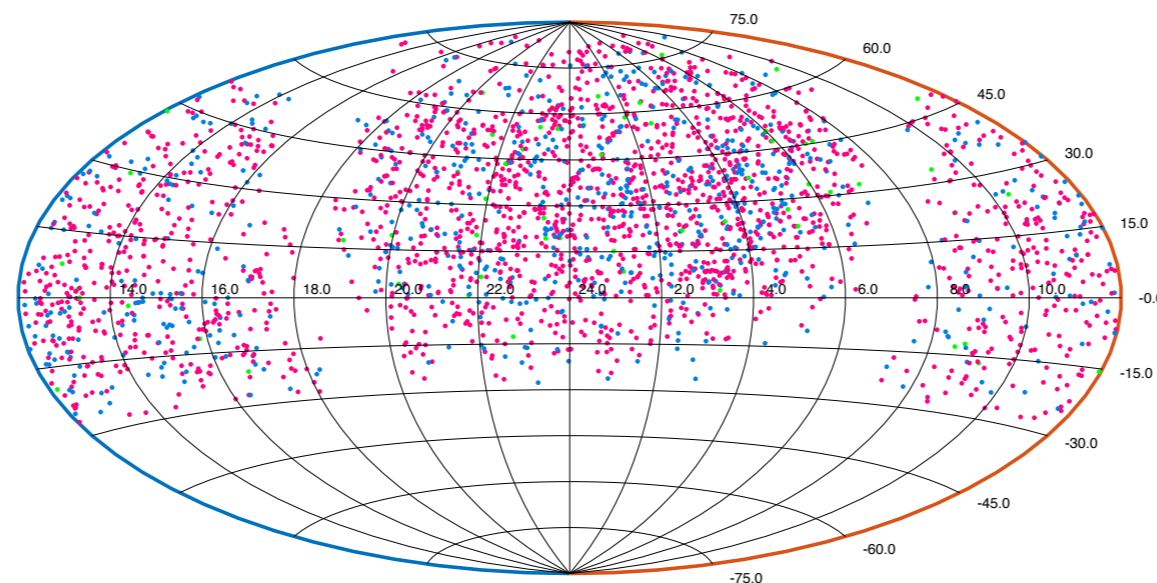
# - SNe as tracers of the Large Scale Structure (Tsaprazi + OKC)



## ZTF x BORG: SN clustering at super-Mpc scales

E. Tsaprazi, A. Goobar, J. Jasche, H.V. Peiris

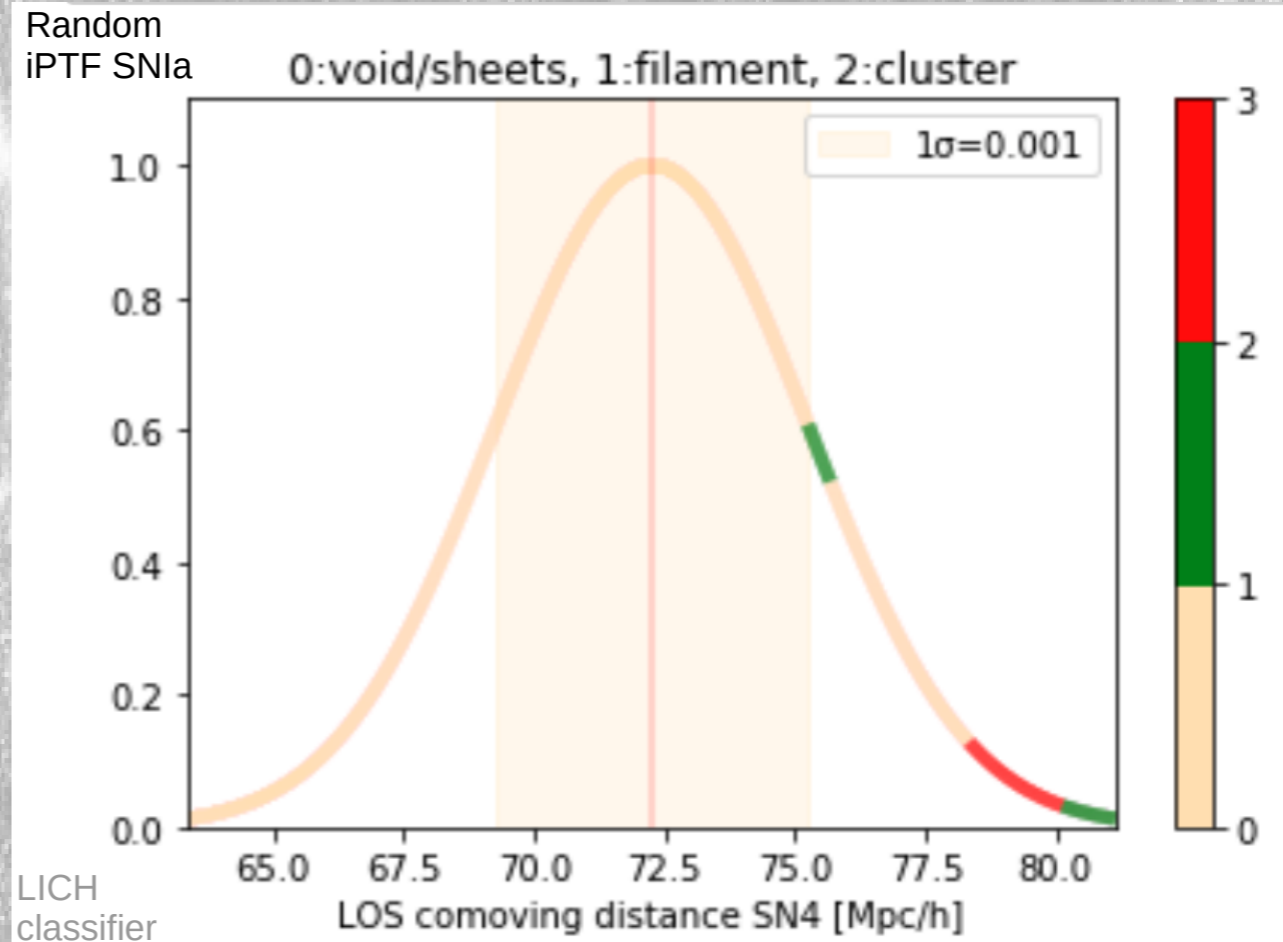
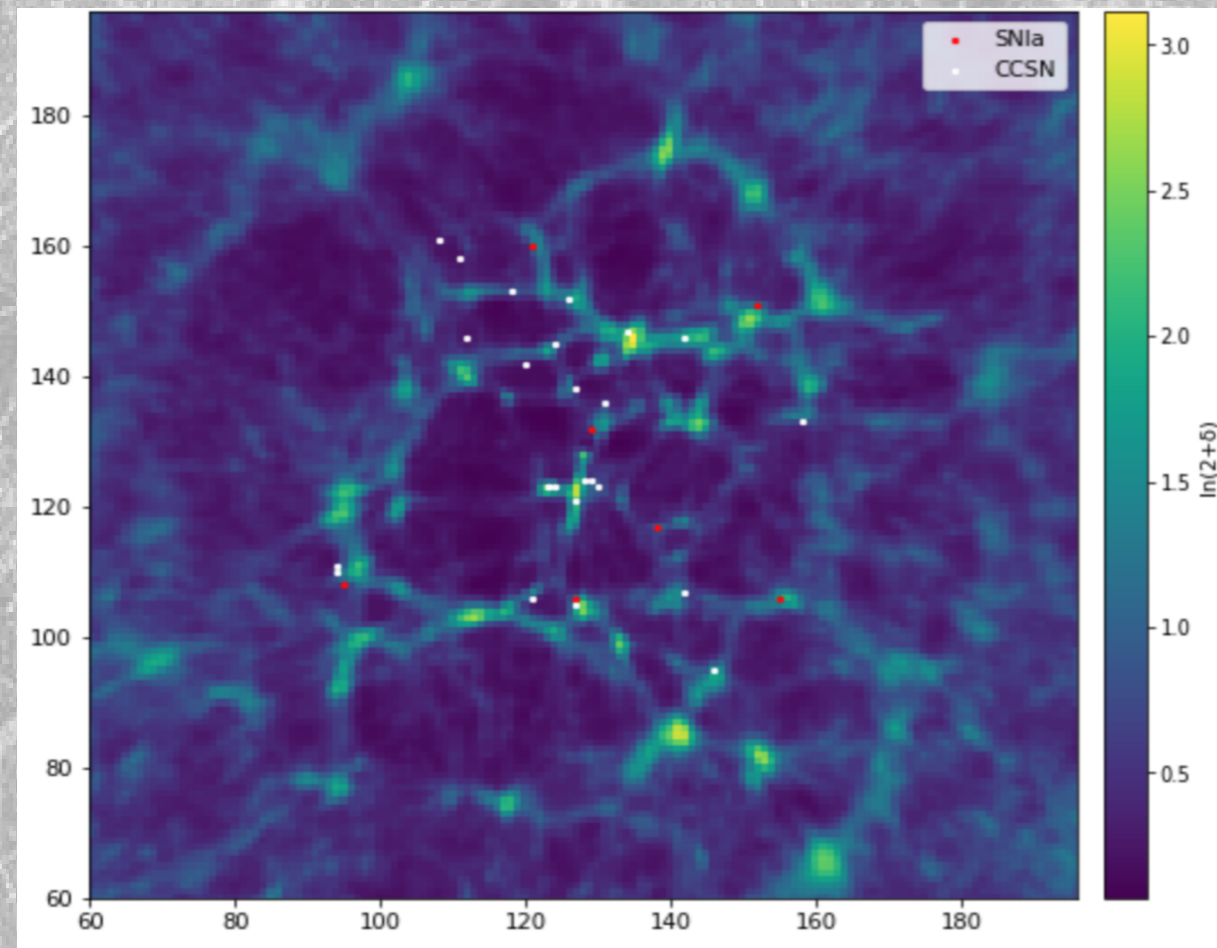
- Do SNIa reside in higher-density large-scale environments than CCSN?
- Do SNIa reside in different cosmic-web structures than CCSN?
- Can SNe be used as tracers of the LSS where galaxy surveys are sparse?



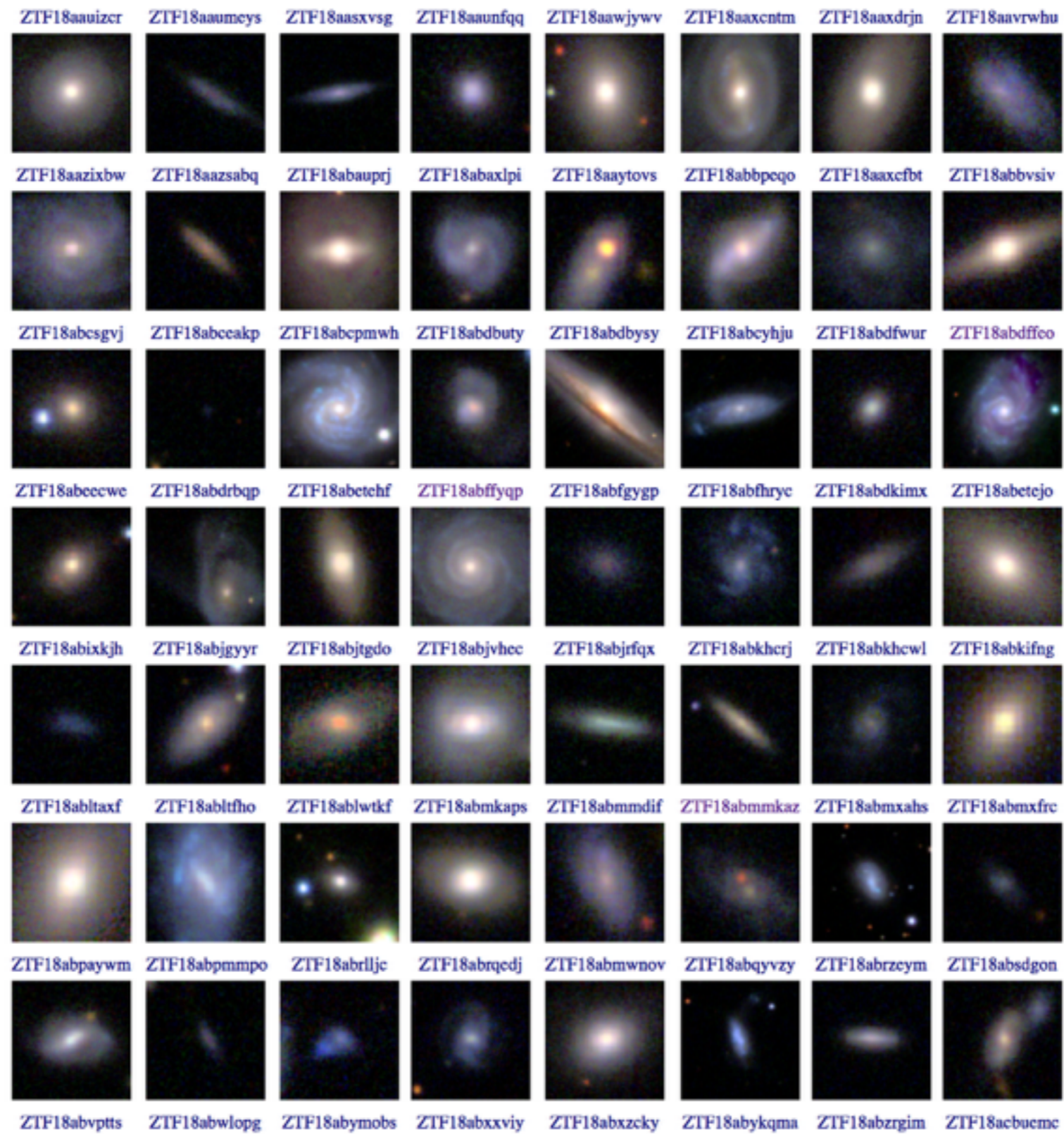
# BORG: LSS simulations constrained by galaxy surveys

ZTF: 342 Ia – 382 CC at  $z < 0.036$

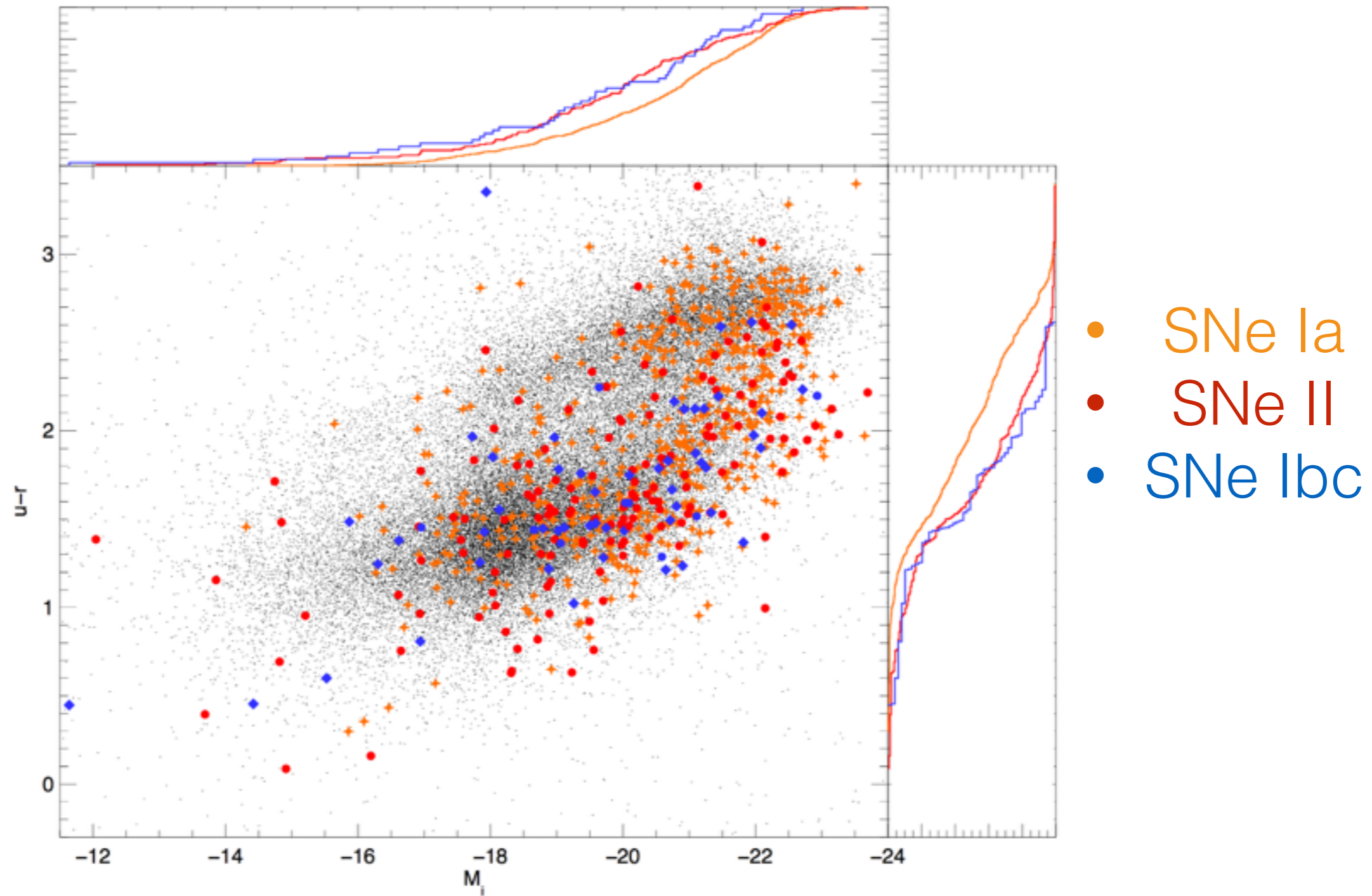
iPTF testing sample: 141 Ia – 274 CC at  $z < 0.036$



# RCF Host galaxy analysis, Perley + Shulze +

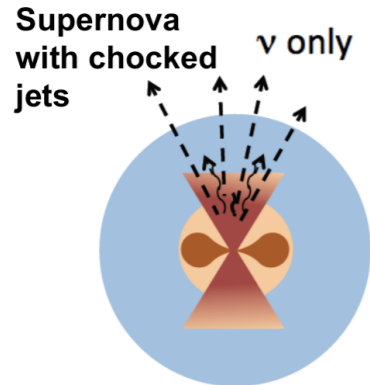


# RCF Host galaxy analysis, Perley + Shulze +



# Neutrino Correlation with RCF SNe Necker + DESY +

## High Energy Neutrinos from Stripped Envelope CCSN

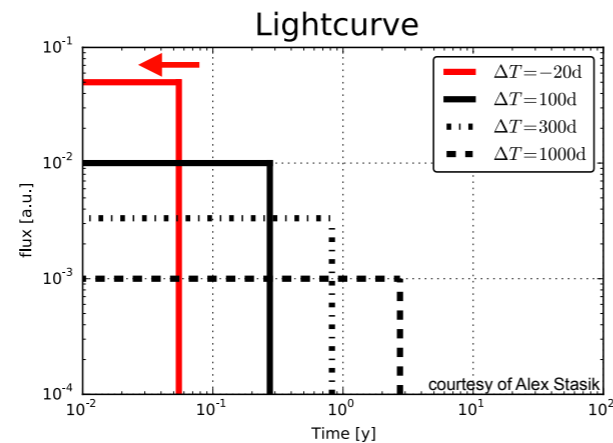


stripped envelope  
Type Ibc (no H/He emission lines)

choked jet scenario  
Supernovae Ibc

courtesy of Kowalski, Bartos

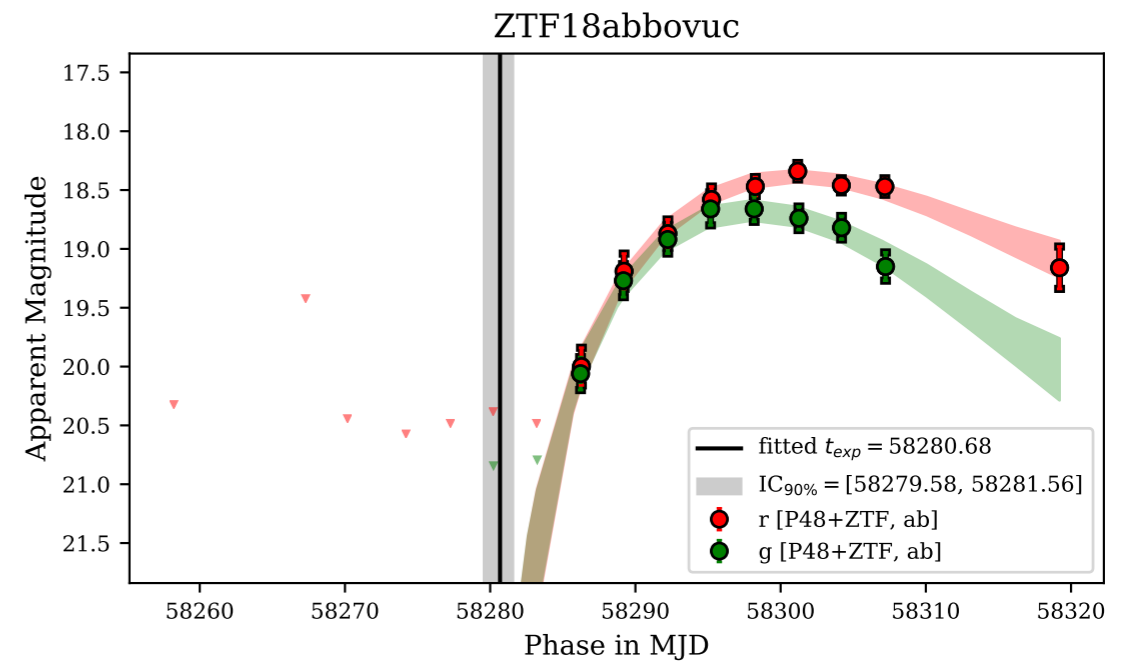
- ▶ Neutrinos at around explosion time
- ▶ Knowing explosion time → excluding more background
- ▶ Goal: constrain explosion time as good as possible



courtesy of Alex Stasik

Idea:

- ▶ use SNe Ibc from BTS sample
- ▶ estimate explosion time from lightcurves
- ▶ use explosion time estimate in IceCube Analysis



# RCF SNe II, correlation of photometric and spectroscopic properties

## Goldwasser + Weizmann +

following the works of Anderson (LCs), Gutierrez (spectra) and Rubin (rise time)

