Photometric SN Candidates from the SDSS-II SN Survey

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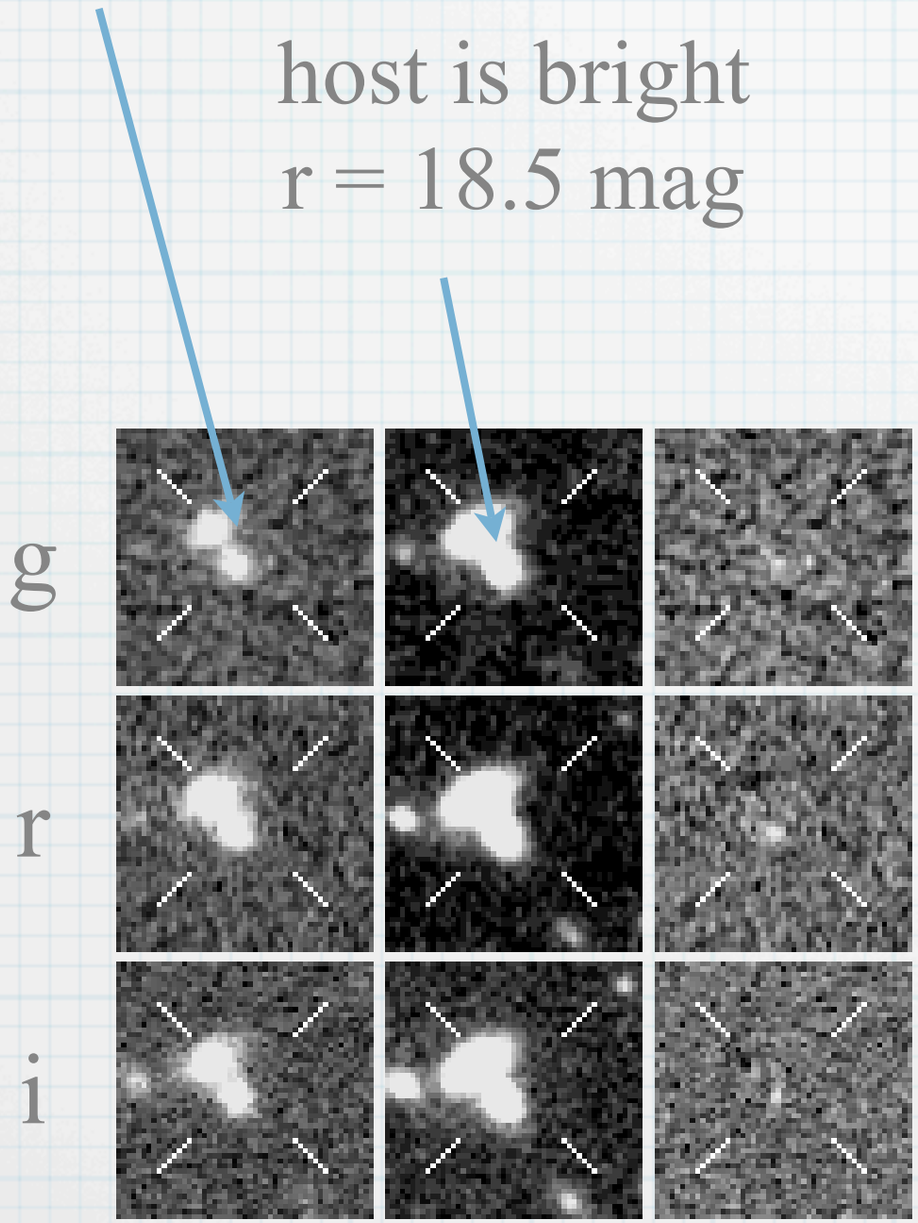
Sample of SN candidates with no spectroscopic data

* 322 + 31 + 44 spectroscopically confirmed + probable SN Ia and core-collapse SNe from 2005 and 2006 seasons
* Additional 80 SN Ia candidates with host galaxy spectra and redshifts (2005 only, so far)
* 7012 total sources tagged as SN candidates and detected at multiple epochs (2005 and 2006)
  * only ~7% of candidates have spectra!
  * large telescope time is limited, so spectra were obtained for a selected sample of "good" candidates (less host contamination, low A_V, etc)

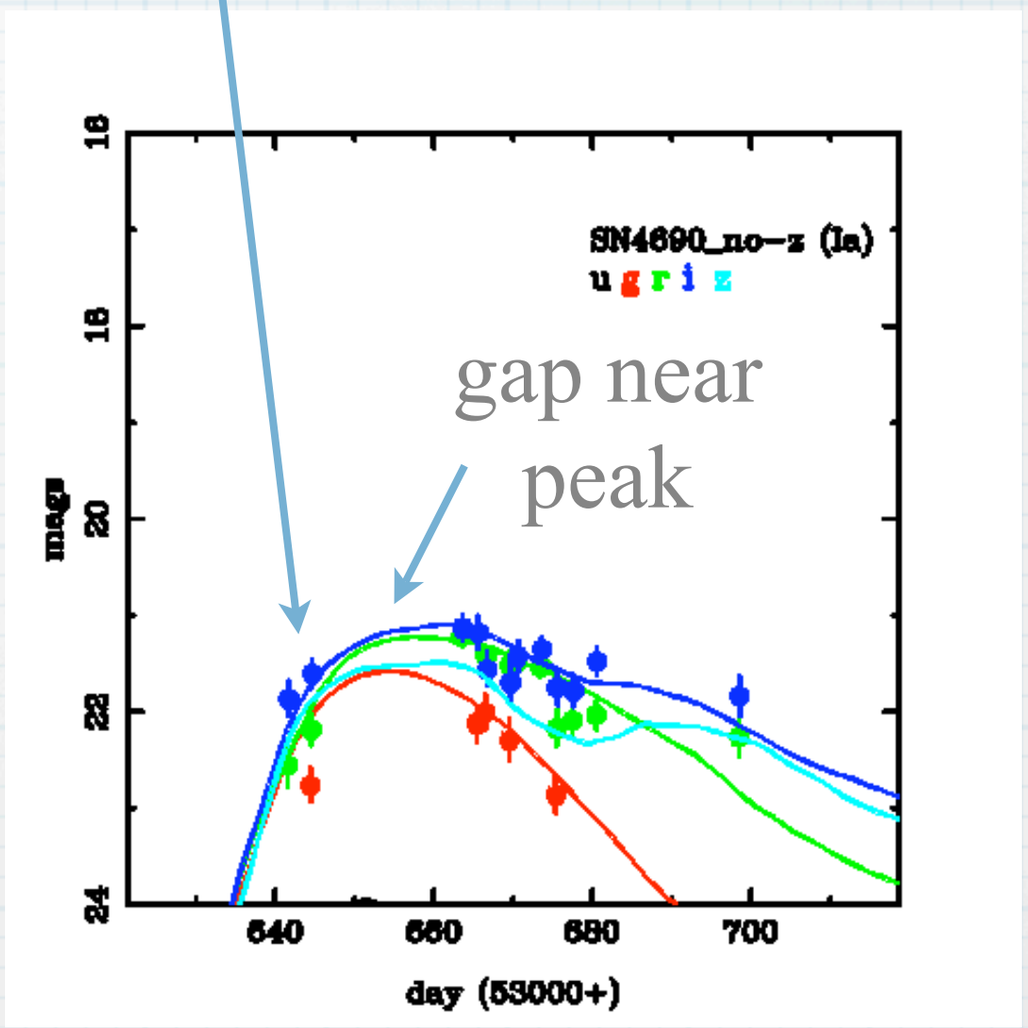
Why this candidate was not followed up...

near core of galaxy
more likely to be an AGN

host is bright
r = 18.5 mag



early time brightness
r~22 mag (need > 6m
class telescope)



Photometric typing

- Post-search analysis using all photometric data from SDSS 2.5m telescope.
- Compare observed light curves against templates of SN Ia/Ibc/II.
  - free parameters z, A_V, T_{max}, (Δm_{15} for Ia's)
  - template light curves built using spectra from Peter Nugent and SUSPECT database
  - with and without host galaxy photo-z prior
- For each candidate, calculate probabilities of it being a Ia, Ibc, or II.

see also poster by Ben Dilday 028.01

* Bayesian approach similar to Poznanski et al. (astro-ph/0610129); see also Kunz, Bassett, Hlozek (0611004) Kuznetsova & Connolly (0609637)

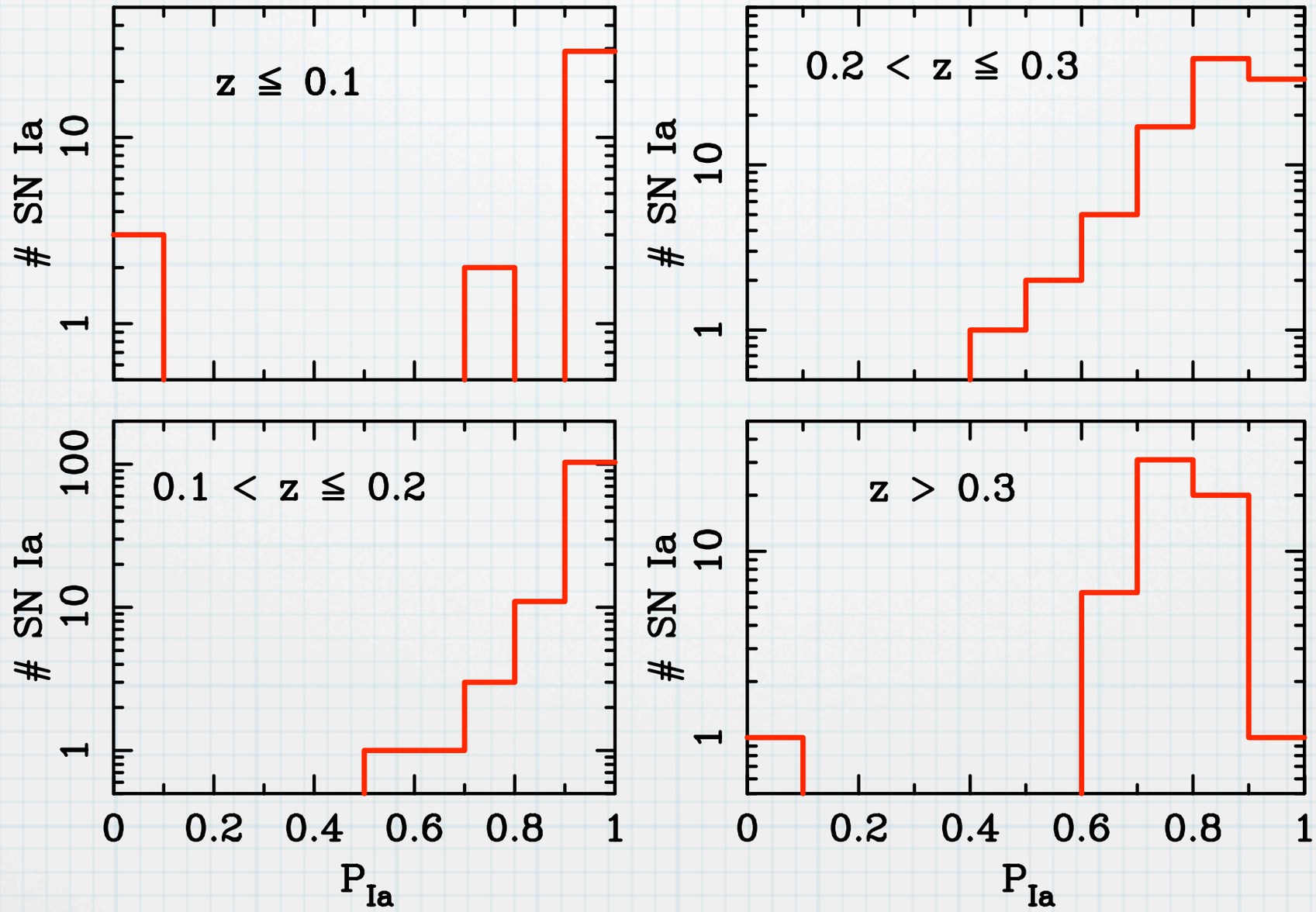
$$P_{\rm Ia} \propto \int [P(z)]\ e^{-\chi^2(z, A_V, \Delta m_{15}, T_{\rm max})}\ dz\ dA_V\ d\Delta m_{15}\ dT_{\rm max}$$

$$P_{\rm Ia} + P_{\rm Ibc} + P_{\rm II} = 1$$

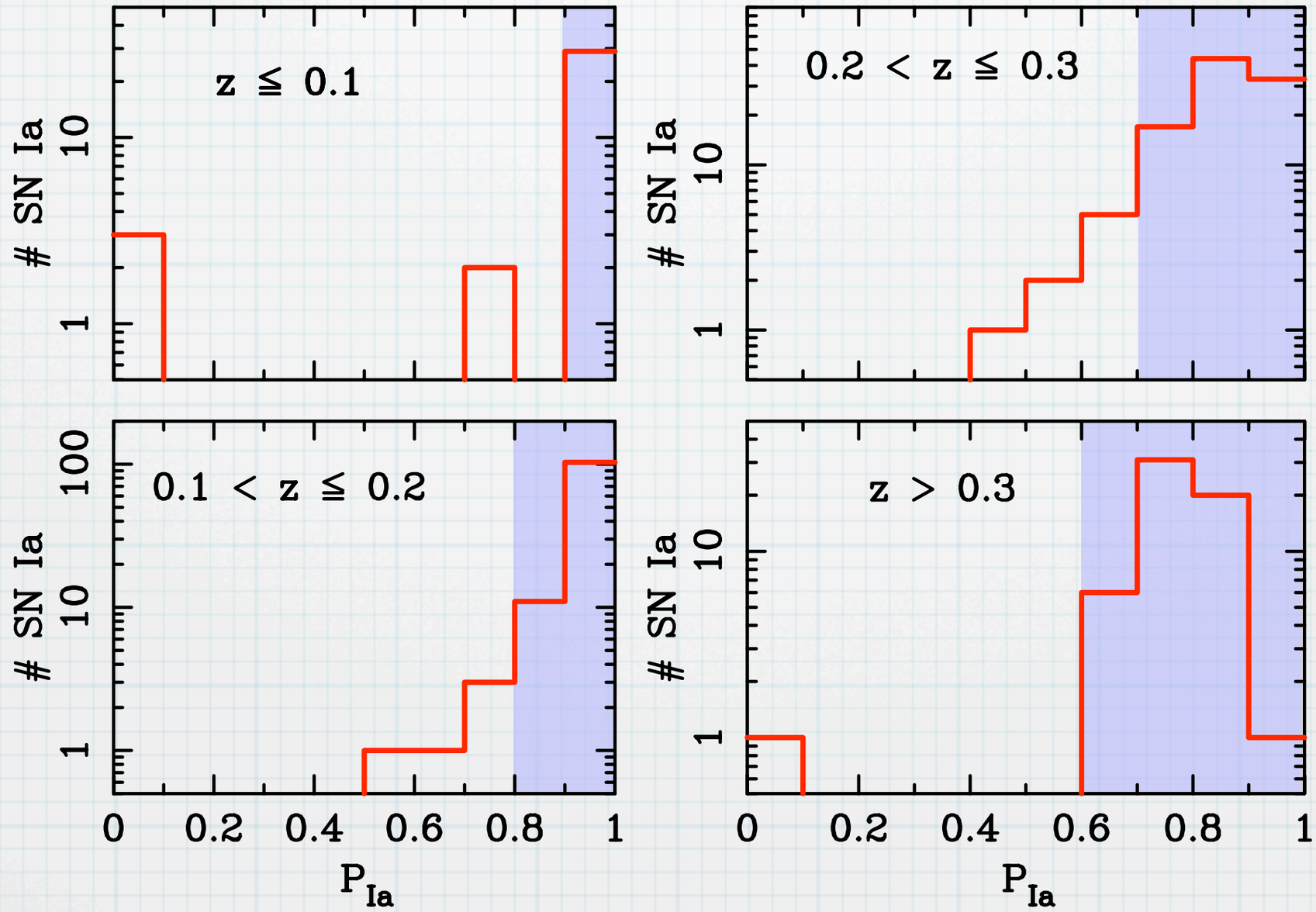
assumes all candidates are SNe!

* Assumes a cosmology
  * fits absolute magnitudes for an assumed redshift
  * cannot (yet) be used for inferring redshift and distance

Training with confirmed SN Ia sample

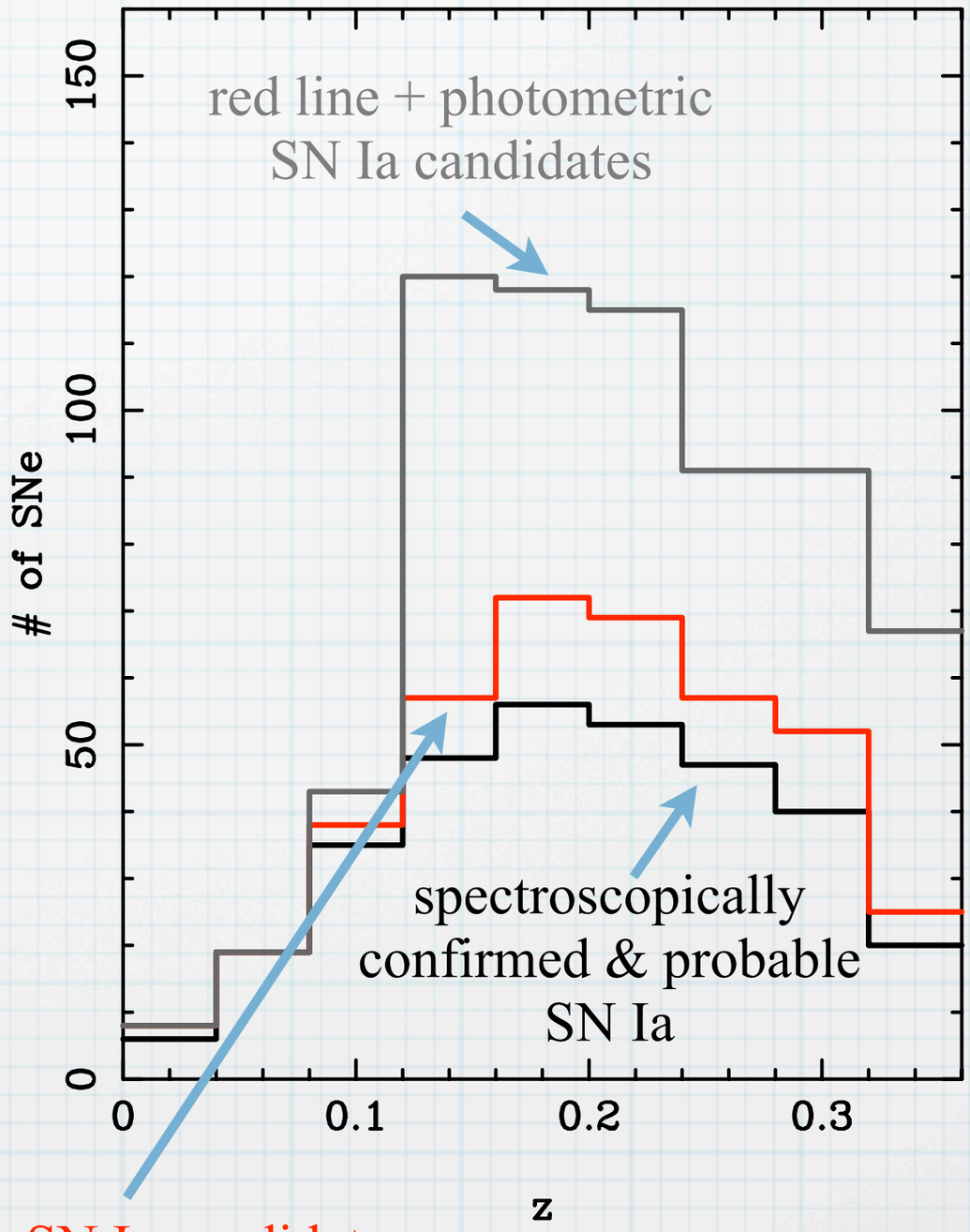


Training with confirmed SN Ia sample



Preliminary results

* Identified an additional 239 high-quality photometric SN Ia candidates at $z < 0.36$
* sample not complete!
* continue to obtain host redshifts; need more time on > 4m-class telescopes!



black line + SN Ia candidates
with measured host galaxy redshifts

Applications / work in progress

* Statistical studies of host galaxy properties
  * e.g., underluminous hosts
* SN Ia rates at $z > 0.12$
* Better reliability of core-collapse SNe typing
  * study CC rates (see also poster by David Cinabro 028.04)
* Extract redshift from light curves *without* assuming cosmology
  * spectra-less Hubble diagram