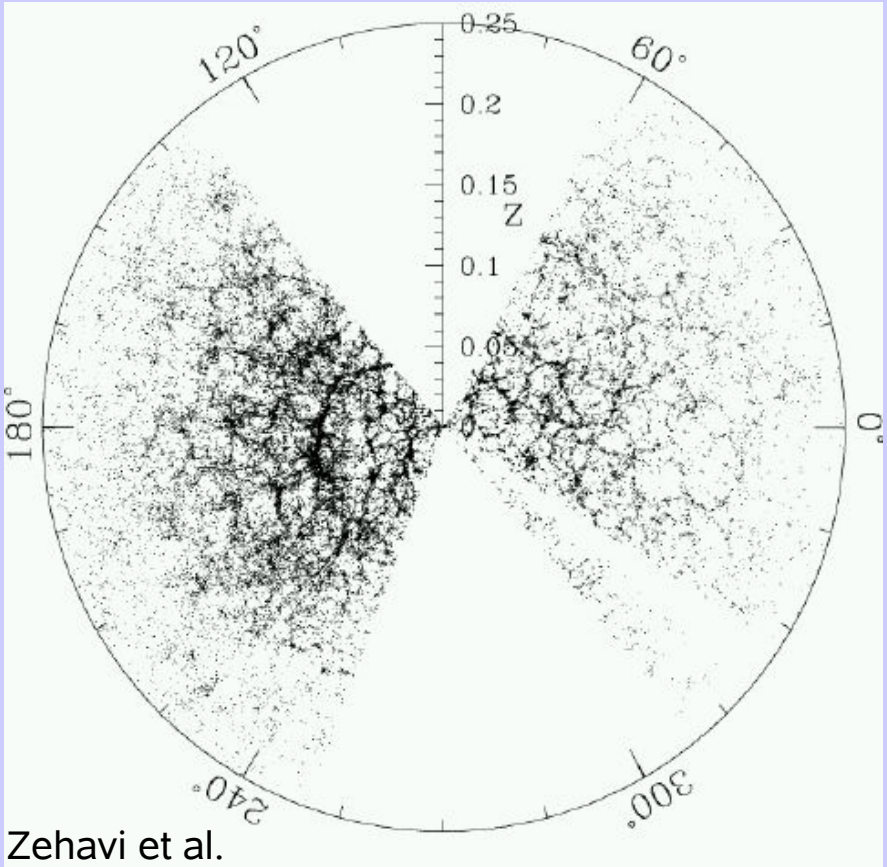
SDSS Phase-II

(Sloan Digital Sky Survey / www.sdss.org)

- Legacy Survey: complete spectroscopy
- SEGUE: galactic structure
- **Supernova Survey**



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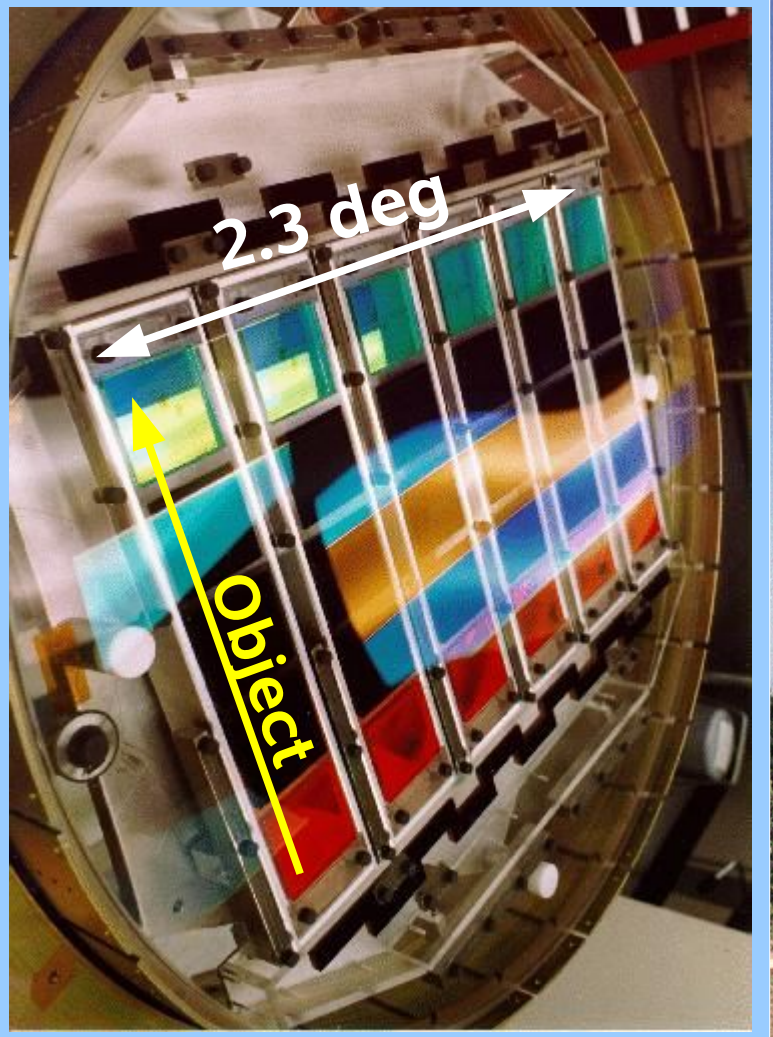
Apache Point Observatory
Southern New Mexico

2.5 m f/5 modified Ritchey-Chretien
- camera (u,g,r,i,z)
- spectrograph (640 fibers)

ARC-3.5m

NMSU-1m

0.5m photometric telescope (PT)



u	g	r	i	z
22.0	22.2	22.2	21.3	20.5

(56s, 95%, stars)

SDSS II SN Development/Operations

Fermilab: J. Adelman-McCarthy, F. DeJongh, G. Miknaitis, H. Lin,
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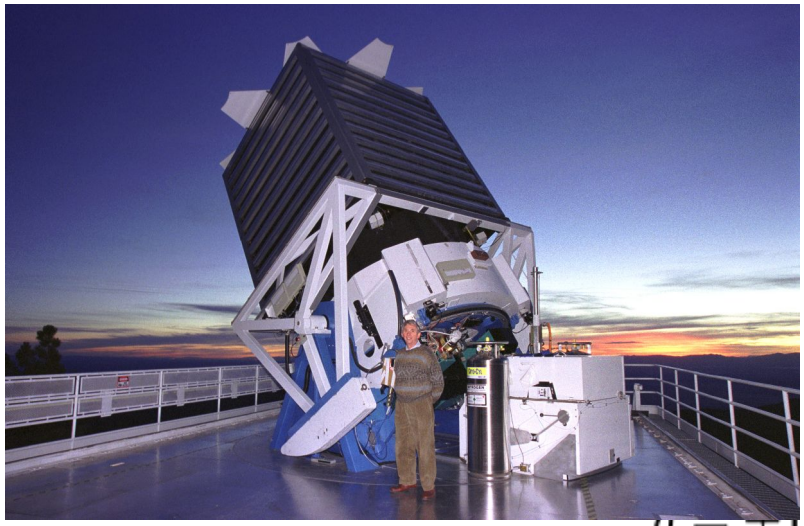
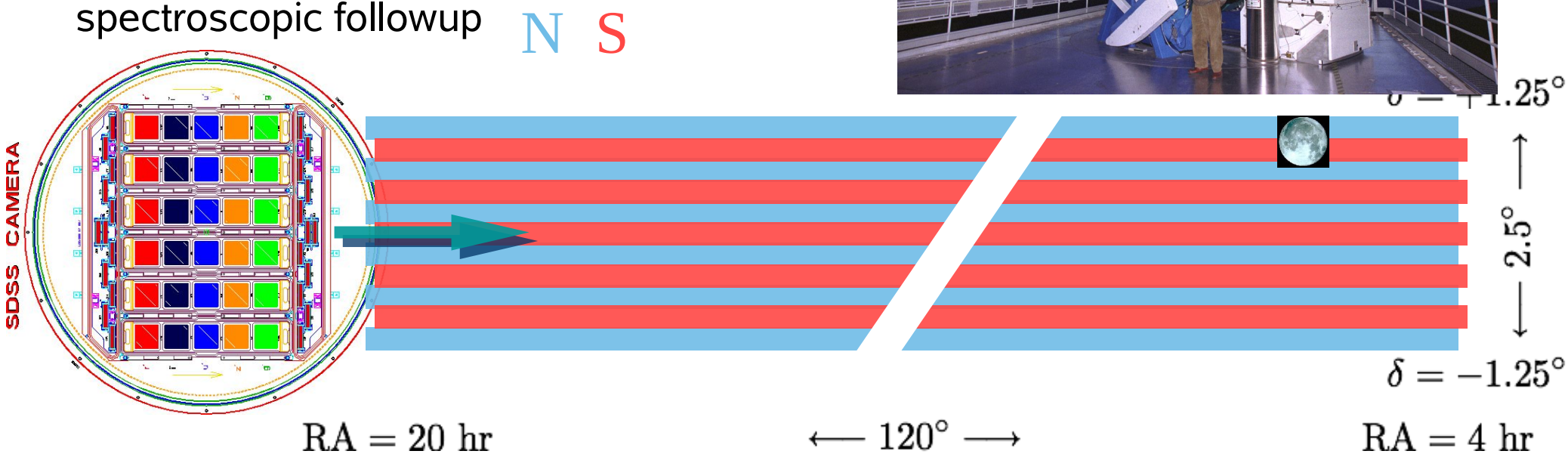
Additional collaborators on spectroscopic follow-up

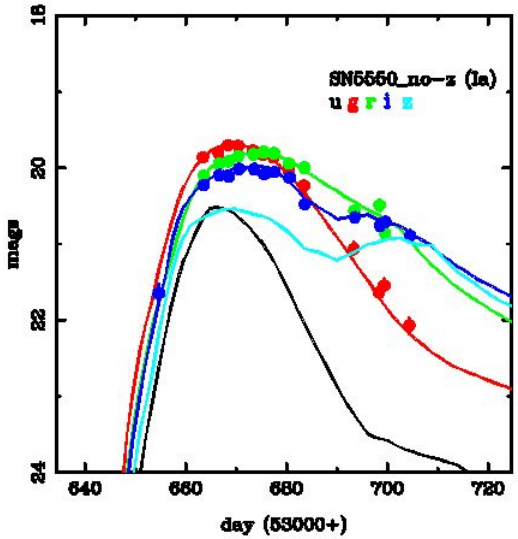
SNe Survey

September 1 – November 30 of 2005-2007
Scan 280 sq. degrees every 2 days
multi-color light curves
spectroscopic followup





- Type Ia supernovae (SNe)
  - spectroscopically confirm and obtain "well-measured" light curves of ~200 SN Ia from z = 0.05 ~ 0.4 in u,g,r,i and z
  - understand and minimize systematics of SN Ia
- Other SN-Types Ib/c, Type II
- Rates and Environment

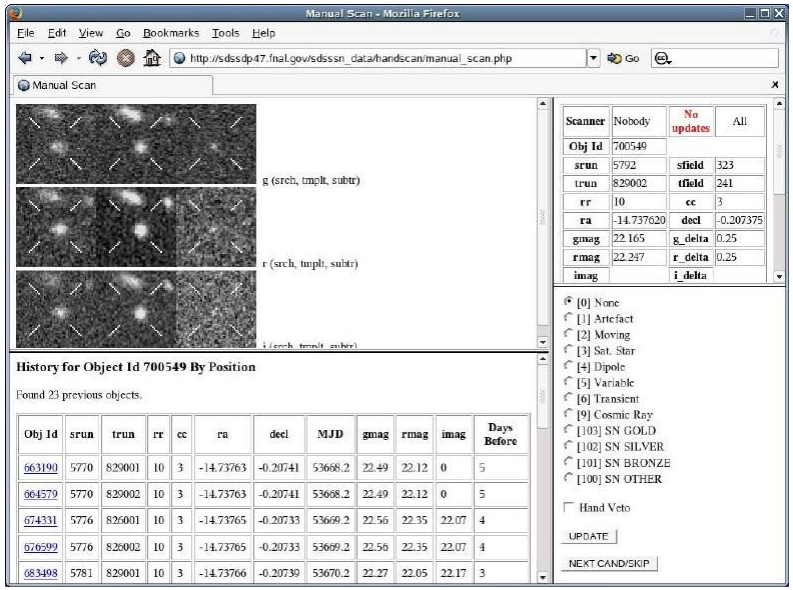


Data Reduction

Dedicated computer cluster (20 CPUs @ APO) + 1 Server @ Fermilab

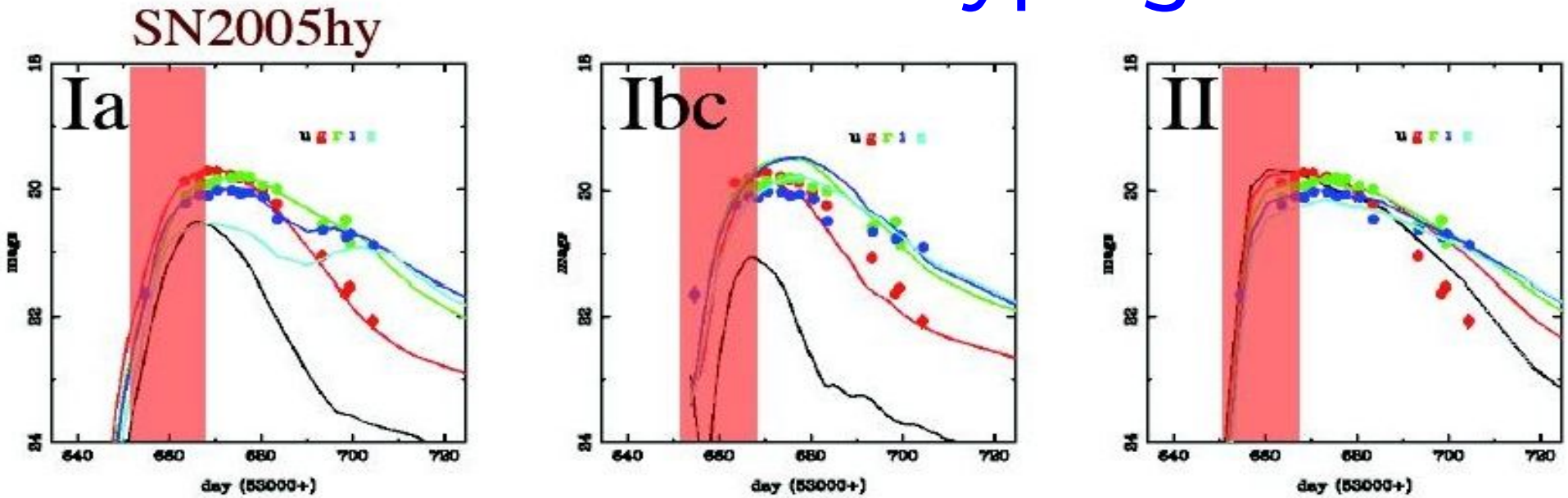
- **SDSS standard reduction** (photo)
  + *artificial SN*
- **image subtraction in g,r and i**
  coadded templates (~10 images)
  similar code as ESSENCE
- **rejection of false positives**
  - detection in two filters within <0.8”
  - veto catalogs of previous variable objects
- **visual inspection of objects**
  using a web based interface
  -> *candidates*
- **photometric typing**
  to select candidates for spectroscopic follow-up

ca. 200 Gbyte in long night
turn around 24 h



mysql, php + html based

Photometric Typing



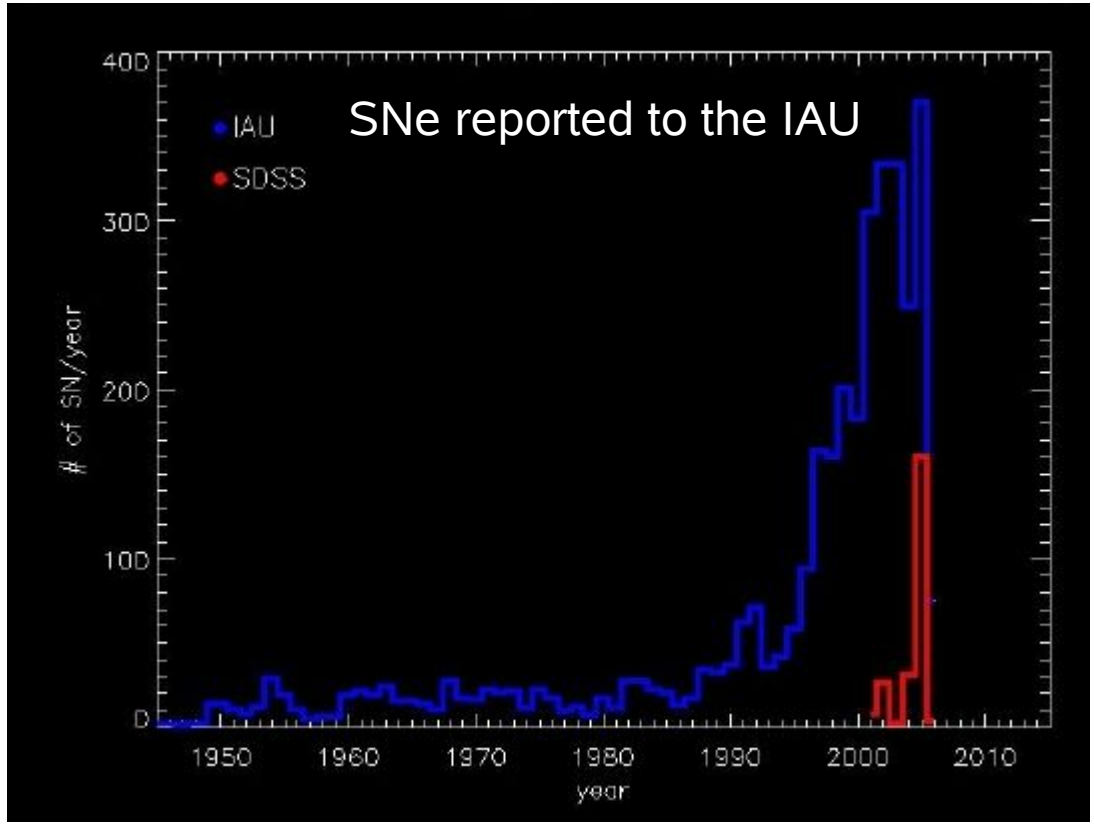
Spectroscopic Follow-up

ARC (3.5m) – 33 half nights, **HET** (9.2m) 90 hours of queue time
MDM (2.4m) 40 nights, **WHT** (4.2m) 6 nights,
Subaru (8.2m) – 6 half nights [**Keck** (10m) – 1 night]

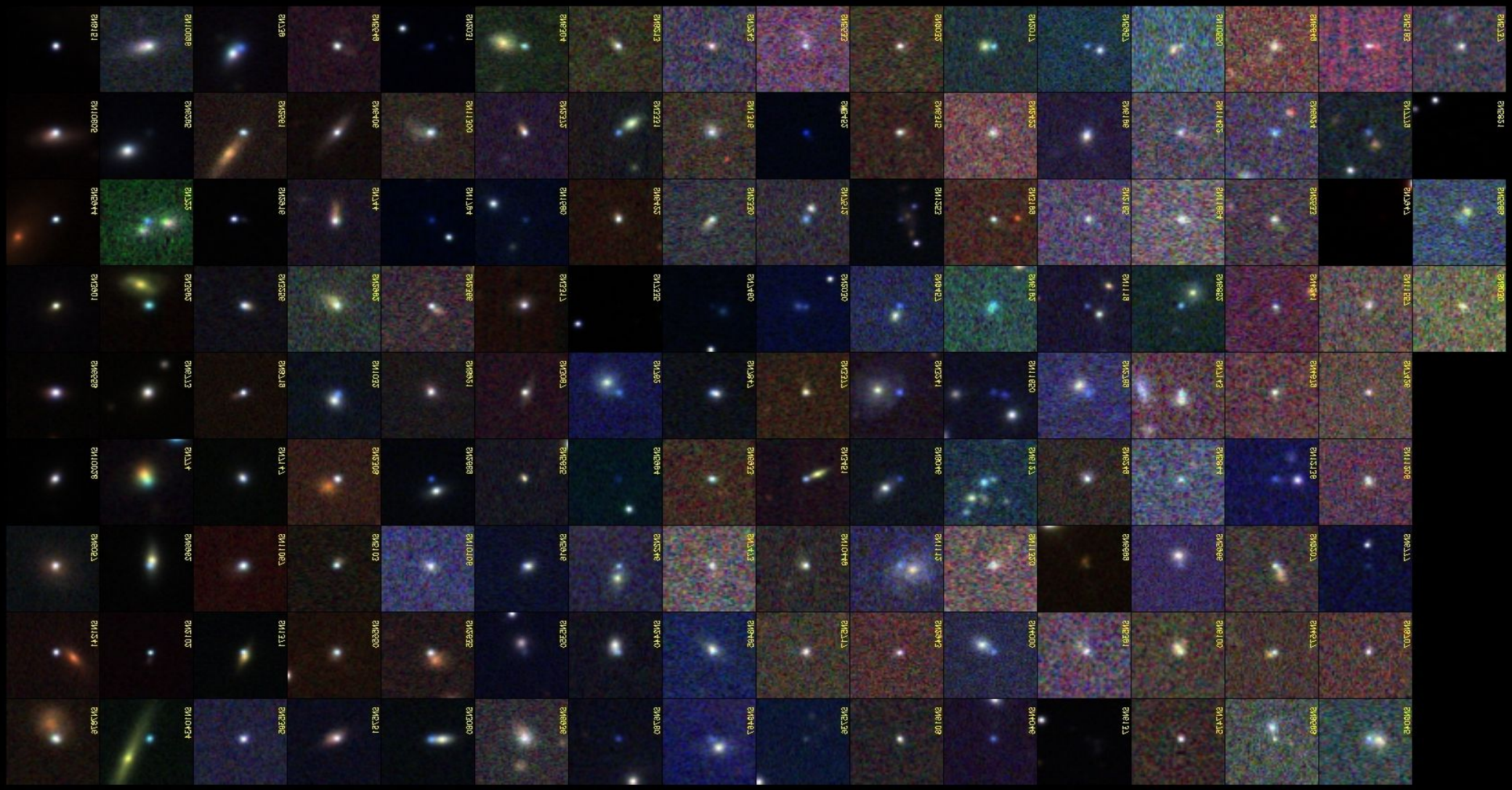
Fall 2005 Campaign

in total 53 imaging nights, over 200 SN spectra obtained

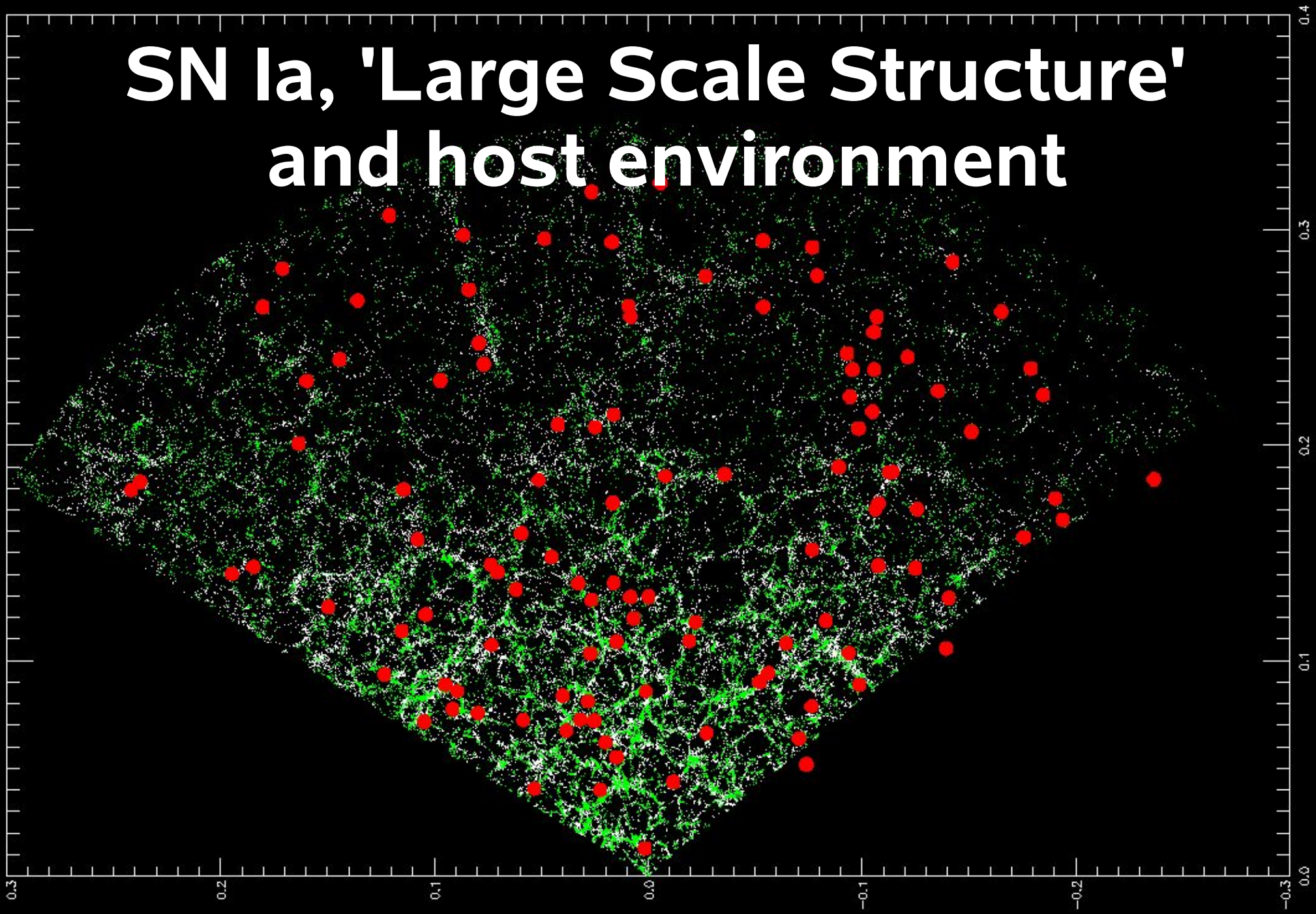
129 spectroscopically confirmed SN Ia ($0.05 < z < 0.4$)
(+16 SNIa from 2004)
15 spectroscopically probable SN Ia
31 photometric candidates (host-z)
6 SN Ib/c
11 SN II
5 AGN
~ 100 of unconfirmed SNe with good Lightcurves



Spectroscopic Confirmed SNe in 2005

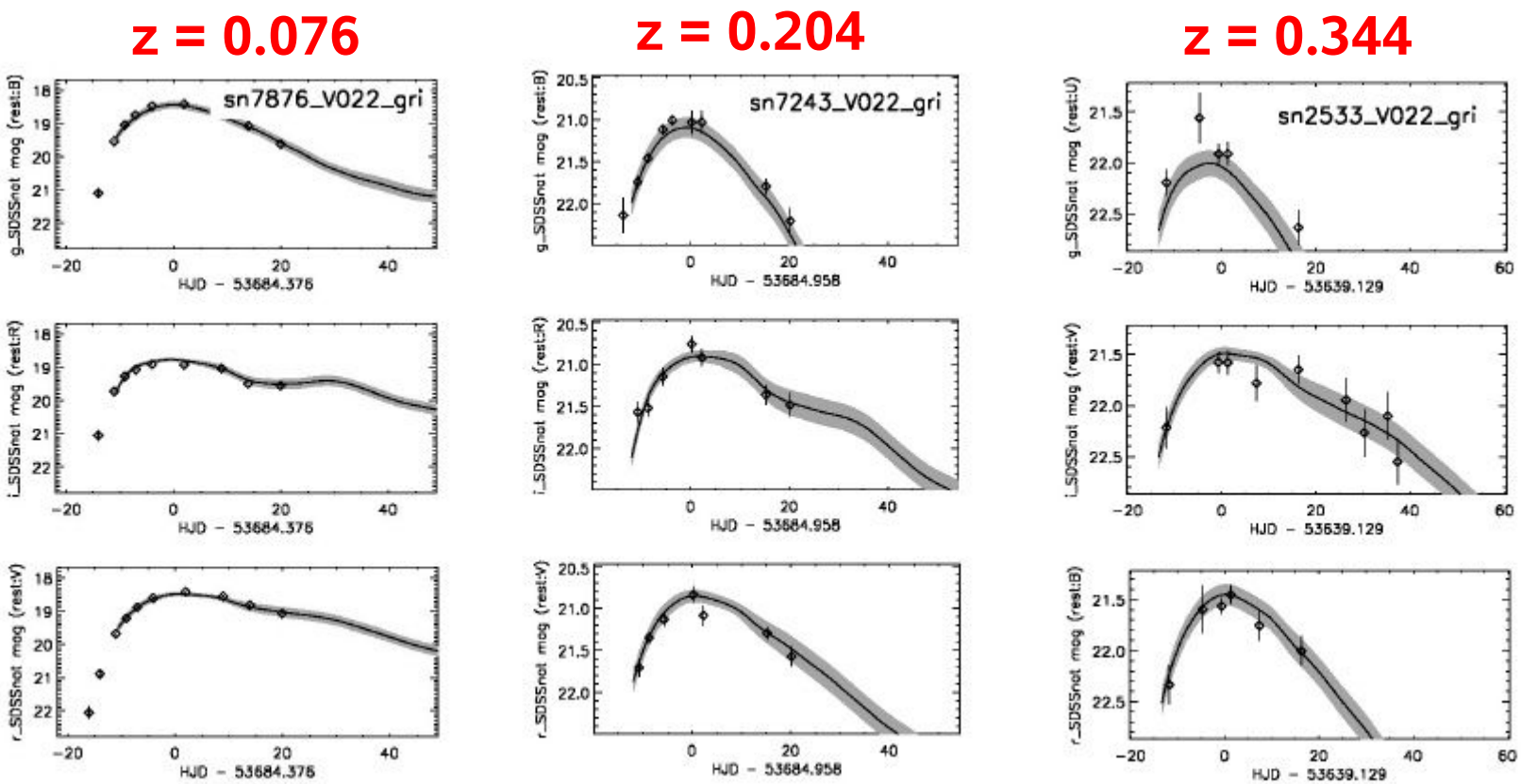


SN Ia, 'Large Scale Structure' and host environment



Representative Light Curve Fits using MLCS2k2

(S. Jha, 2002, Riess, ApJ 473,1996)

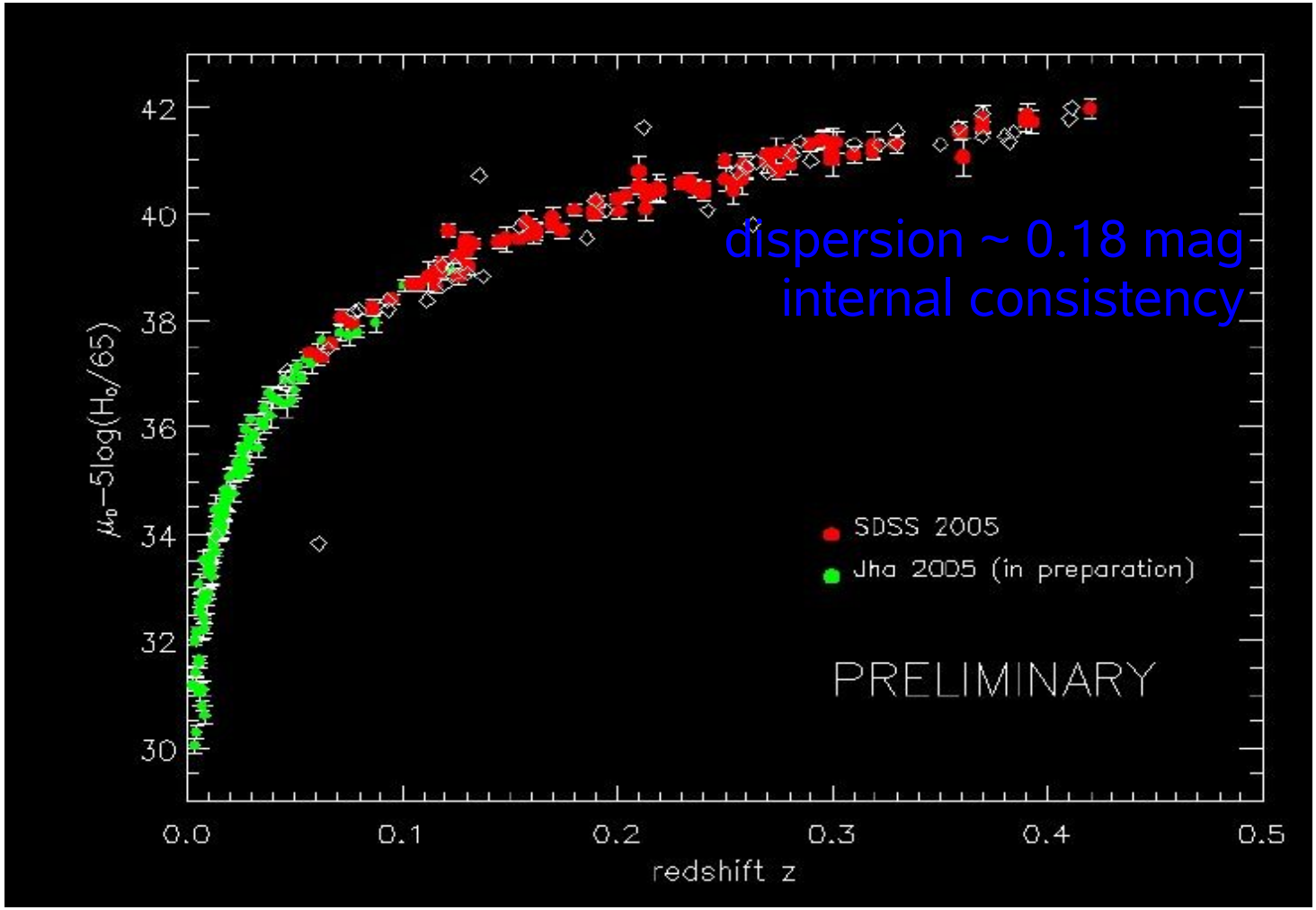


Criteria for for high quality fit:

- measurement around maximum
- measurement in g,r and i
- at least 6 points on LC

expected ~ 80/129 high quality fits

Preliminary Hubble Diagram



- SDSS will probe w = -1 in the low redshift range (z ~ 0.2) and will also provide constraints on exotic acceleration models
- Combination of SDSS and high redshift data will lead to improved constraints on w, due to broader redshift leverage.

Current Status and Plans

2005 - LC fitting and comparison of different methods (MLCS, dm15, etc.)
- host properties & rates
- investigation of photometric typing for cosmology

2006 - fall observing starts beginning of September
- find and follow up other types of SNe (IIP, Ibc, hypernovae ...)

2007 ...