What do we do with SN (spectrsoscopic) data

- data is a multi-band light curve for each SN with extent defined by some selection cut

- We have a model of such multi-band light curves obtained from previous data

- We fit the model to these data to obtain model parameters and uncertainties. We take these to be sufficient statistics in describing the light curves.

- We use an ansatz relating these parameters to the intrinsic brightness of these supernovae

- This along with a cosmological model to predict cosmological dimming can be used to obtain cosmological parameters.

Catalog Simulations

- What do we want to do?
    - answer questions on Observing strategy and performance of LSST (there are parts where image simulations might help) accounting for selection effects
    - study photometric classification of SN light curves, photometric redshifts of SN
    - study methods of obtaining cosmological parameters from light curves (Parts where testing with host galaxy is important)
    - Study the populations of SN from previous data (requires simulations + understanding of efficiency)

Simulation Requirements

- Be able to perform 10 year LSST simulations over all fields quickly in wall time (other methods can do equivalent stuff very quickly by distributing over many cores)

- Be able to faithfully follow OpSim (OK if we have other modes that make approximations for speed)

- Be able to keep a single simulation of SNe (for example to explore different OpSim runs) and also be able to quickly change simulations (for example to explore different populations of astrophysical objects)

CatSim: What Do we need to do

- Object light curves : In these analyses, it is often useful to be able to reconstruct the light curve of a particular object in CatSim (can do this somewhat easily for SN).
- Note that many of the operations we need to do are often best done over a field of view
    - But for multiple observations of a object, we still need to search the database and instantiate them
    - Worse for causal light curves like AGN

Object Light Curves: Code required

- The light curve generator (Scott demo-ed this in Belgrade and last telecon) is a step in this direction. There are two directions that it suggests:

- useful API (not yet there in photUtils) : astro_obj.bandflux(times, bands, metaData_vec)

- Grouping of obs_metaData for scaling up (Better to use tessellations than OpSim fields)

Current Status

- I have made SN simulations based on Enigma_1189 (DDF and WFD), and Minion_1016 (DDF) using SNANA and neglecting dithers/overlaps (similar assumptions to light curve generator).

- Want to move to using a simulation package (https://github.com/rbiswas4/SNsims) that (a) implements the above and (b) imports the more generic components with catsim and SNCosmo (c) changes/explores many of the underlying hard coded parts of SNANA.

- The engine for SN (using SNCosmo) is already part of sims_catUtils (SNObject) which is an example of an object which can give you its light curves

Image Simulations (phosim/galsim using Instance Catalogs

- resource intensive, bottleneck (phosim)
- Necessary to use DM pipeline
- good for understanding the pipeline status, but cannot be used to get optimal usage.
- Inform catalog simulations

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- Population distributions of SNIa (either from insitu distributions) or frozen tables of SN parameters on fatboy. Eg. TwinkSN is a table of parameters distributed over the Twinkles Fields

Current Status

- Gearing up for tying components together and running a full simulation with SNsims (without galaxies) Good enough for answering Observing Strategy related questions.
- Population and Improvement of SN cosmology extraction requires hosts. There is a way of doing this currently in catsim SNObject, but it is slow (querying GalaxyTiled)
- Have initial table of Probabilities of a galaxy being occupied by a SN which needs to be ingested into fatboy

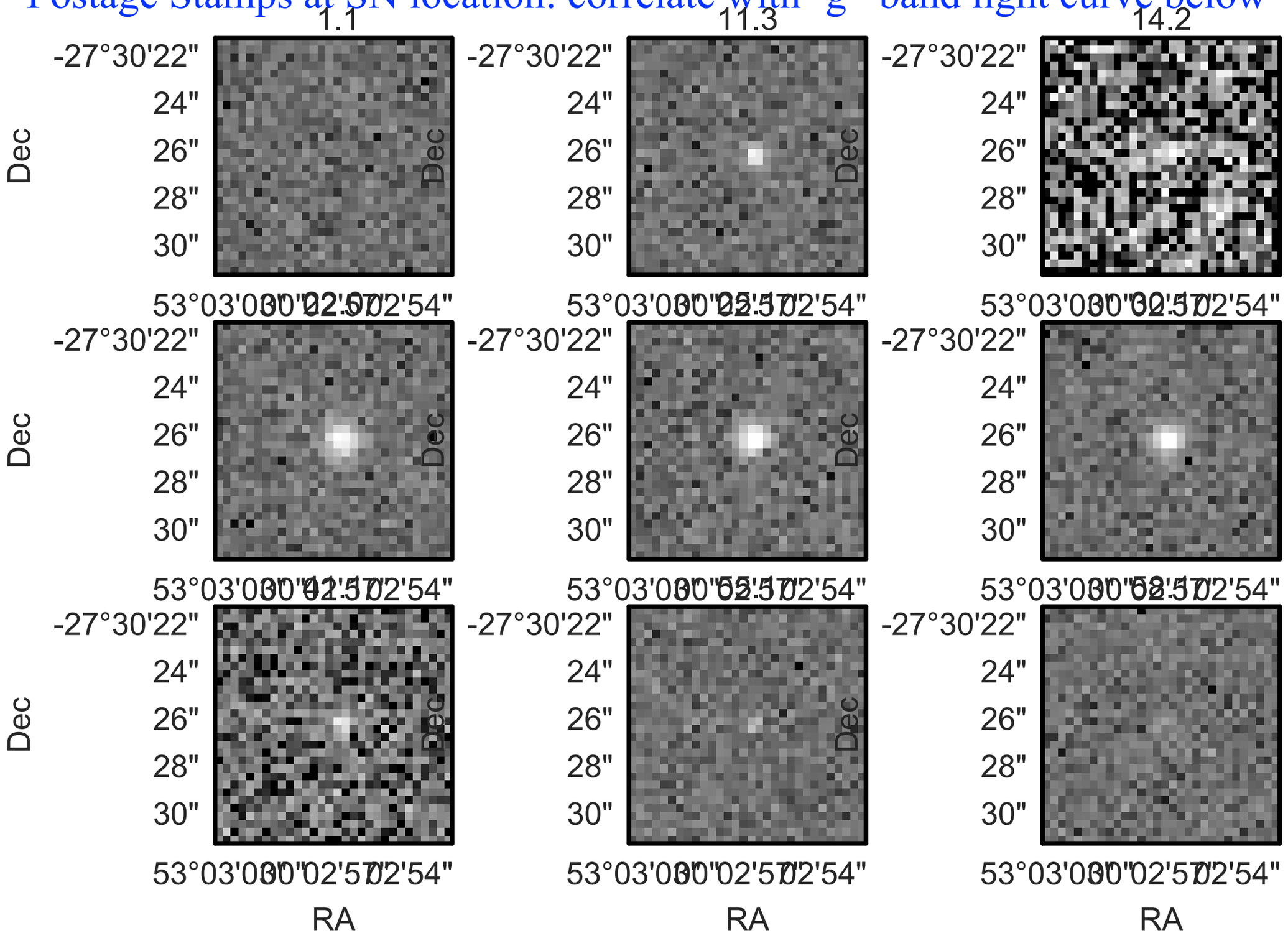
Image Simulations

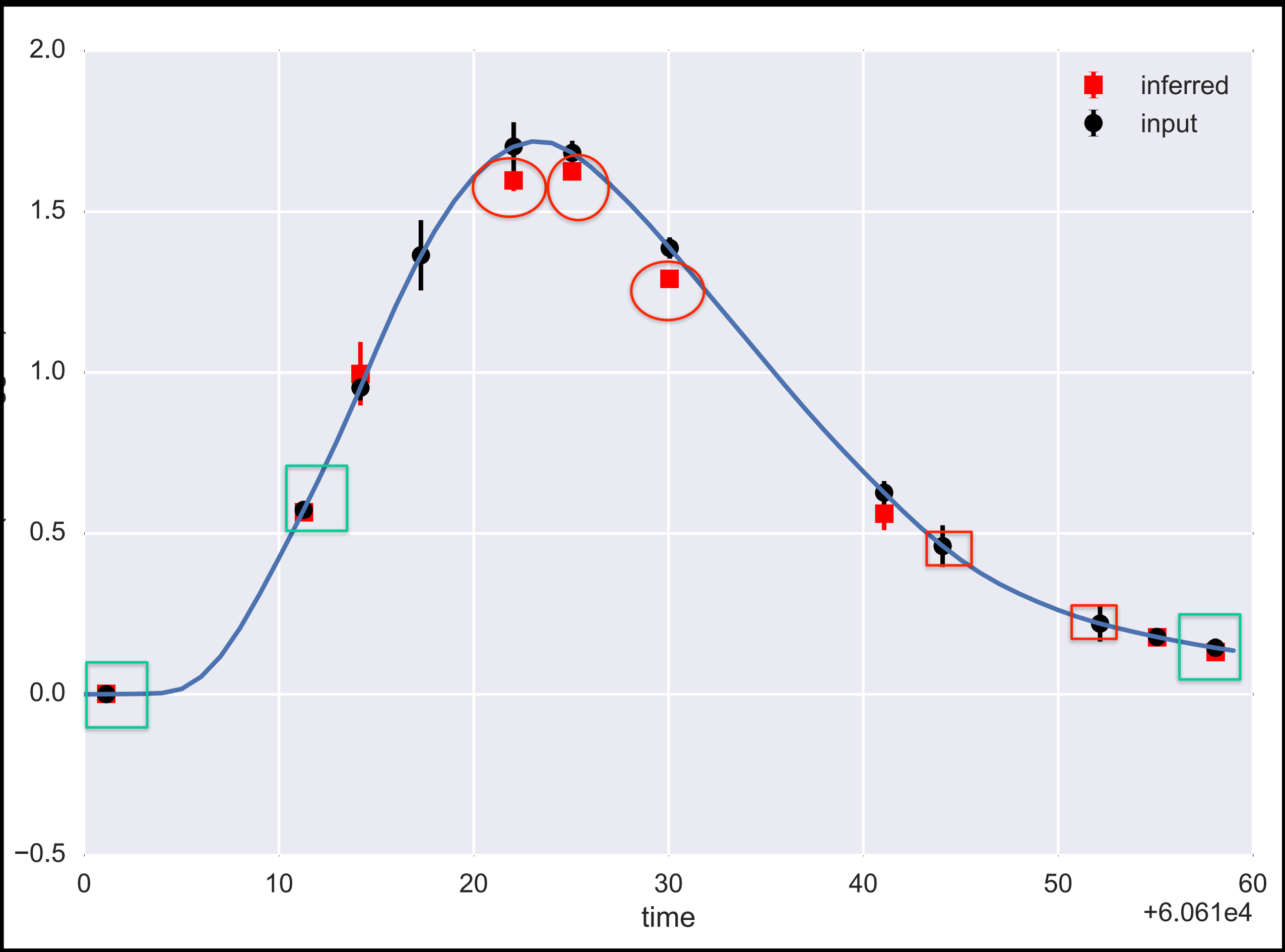
- Added BaseCatalogModel for SN for reading the tables of SN parameters on fatboy

- Phosim Instance catalog models including this and other objects in catsim (Generating aphorism and catsim instance catalogs takes a long time)

- Twinkles simulations : analysis underway and interesting.

Postage Stamps at SN location: correlate with ‘g’ band light curve below

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