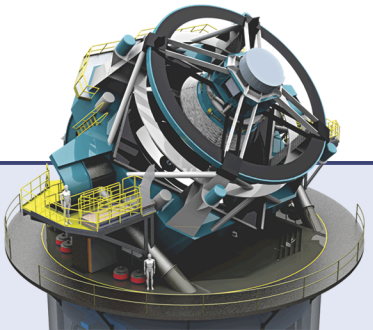
# Summary of current simulation tools

LSST DESC Meeting 2013, Pittsburgh
5th December 2013
Alexandra Abate



# People involved:

- LAL, Orsay
  - Reza Ansari, Marc Moniez
- LPSC, Grenoble
  - Aurelien Barrau, Adeline Choyer, Jean-stephane Ricol, Alexia Gorecki
- LPNHE, Paris
  - Sylvain Baumont
- Saclay, France
  - Christophe Magneville
- UArizona
  - AA, Lidens Cheng, Elliott Cheu, Matt Kirby
- UC Davis
  - Sam Schmidt
- UWashington
  - Andy Connolly, Zeljko Ivezic

# “Direct” simulations

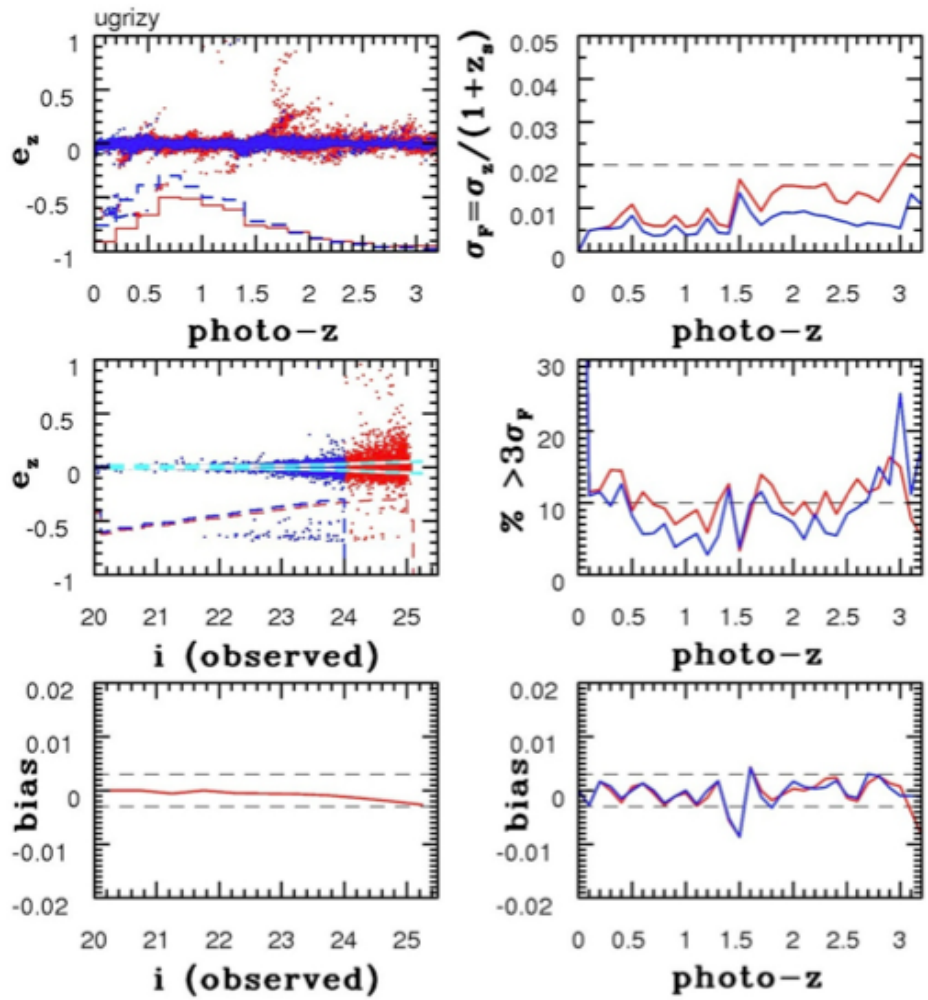
- a ``Direct” simulation:
  - distinct from CatSim efforts: faster, more flexible, can test specific aspects of photo-z estimation
  - galaxy properties (z, SED, luminosity reddening …) are drawn from empirical distributions
  - observed magnitudes simulated according to baseline LSST system properties and observing conditions
- Tools
  - “Science book” simulations
  - “FranZona” simulations

# Science Book Simulations:

- Andy Connolly, Zeljko Ivezic, Sam Schmidt
- Designed to match empirical color and redshift distributions of COSMOS galaxies (by Andy Connolly)
- 181 templates from COSMOS 30-band photo-z paper (Polletta et al + BC03 templates)
- Template redshifts truncated to remain within observed colors of COSMOS (type prior added to eliminate spurious populations)
- Redshifts drawn to match COSMOS z distribution
- Magnitude errors matching 10 year LSST depth from Science Book
- No blends, no shapes, no clustering, discrete templates

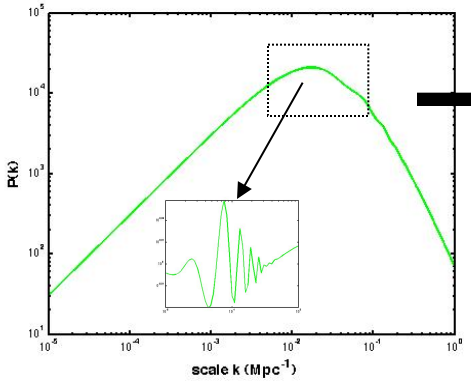
# Science Book Simulations

- Trim to LSST "gold" sample i<25.3 (red) and i<24 (blue)
- Apparent mag prior based on subset of data (to i~24, then extrapolated)
- All templates used (no template mismatch)

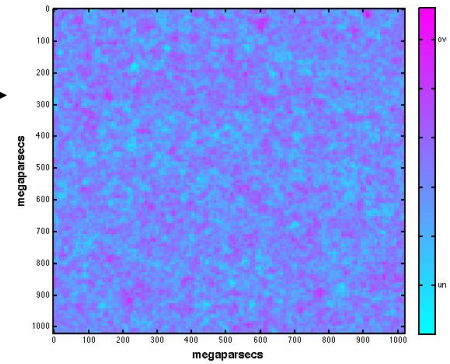


# Simulation summary

Assume cosmology -> matter power spectrum

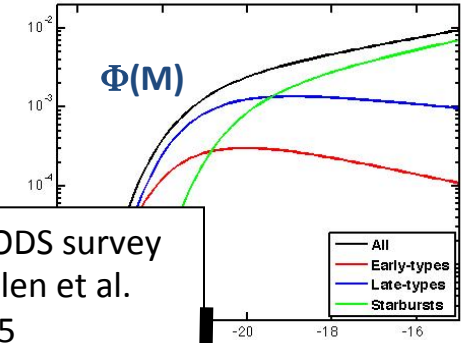



Generate 3D cuboid volume of over-densities




+

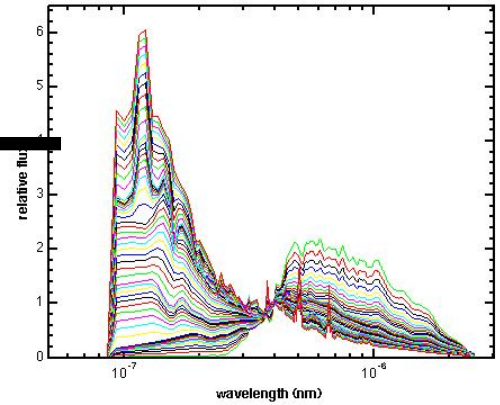
Observed galaxy luminosity functions by type




GOODS survey Dahlen et al. 2005

- Integrate total Φ(M): relate over-density to number density of galaxies
- Distribute absolute magnitudes according to Φ(M):
- Distribute galaxy types according to relative Φ(M)'s

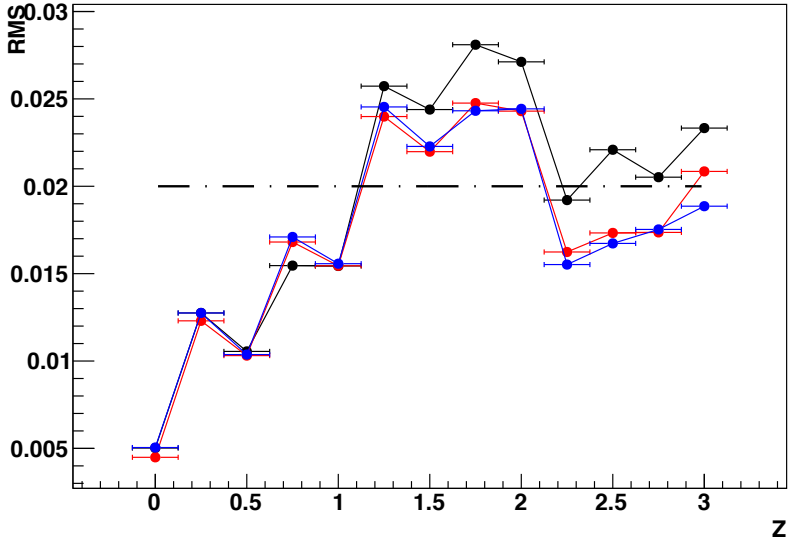
+

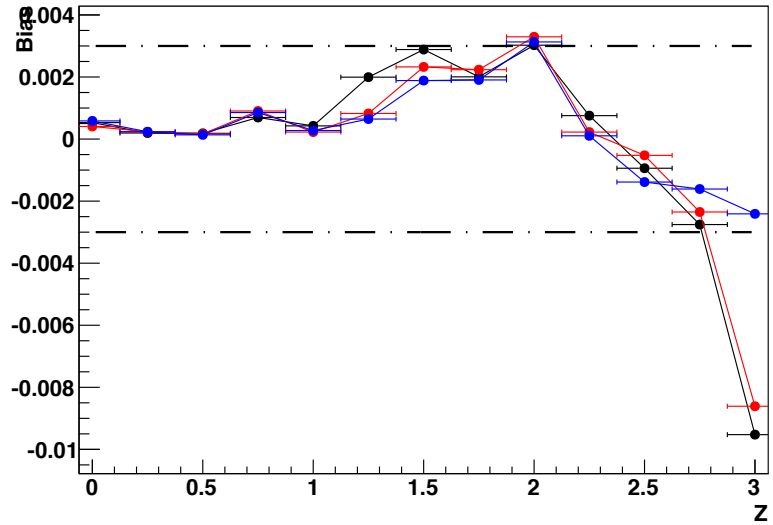


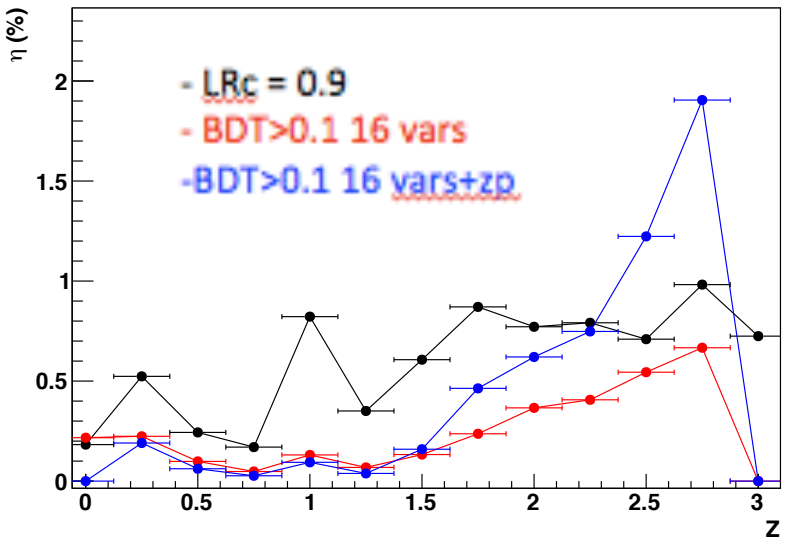

- Using SED+absolute magnitude compute reverse K-correction
- Calculate apparent magnitude observed through each LSST filter

Have catalog of galaxy observations

Photo-z estimation & sample selection




- selection removes 30-50% of galaxies (depending on the z bin)
- bias is below LSST spec (0.003) up to z=2.5 or 3 (depending on prior/method)
- the RMS is not in LSST goal (0.02), but close 0.025-0.03 and within spec (0.05)
- % of outliers are below 1%

# Wish List of improvements

(in order of most add-able):

- Stars: draw stars and add to catalog *(in progress)*
- IGM stochasticity *(in progress)*
- Morphology/size information
- Galactic dust extinction errors
- Zero-point variation: utilize maps generated from OpSim?
- Blends: use direct catalogs as input into ImSim or GalSim
- Filter transmission function change with observing condition, filter position
- Seeing effects on possible size/surface brightness priors

# Synergy

- H-1. SN: Optimize analysis methods and quantify the error budget of photometric redshift and classification of SNe and their host galaxies

- H-2. Phz: Produce realistic tools to test photo-z strategies and impact on science requirements