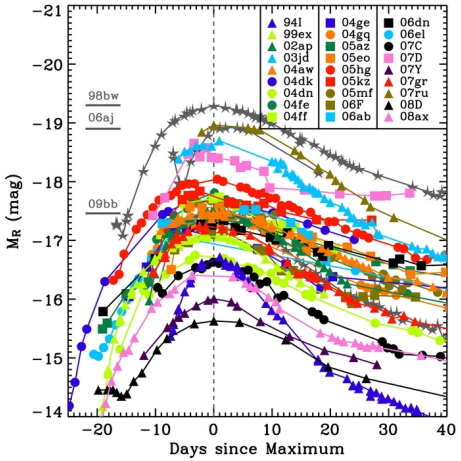


Overview of Simulations for PLAsTiCC

R. Kessler

Data Challenge Planning Workshop

July 14 2017

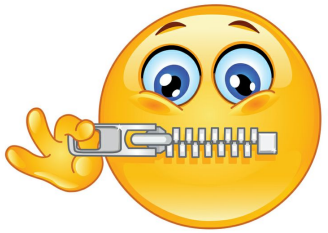
Vague Summary of Transient Models

- Extragalactic (e.g., Supernova)

- Galactic (proportional to stellar density)

- Based on observations and theory.
- About 20 models total, plus internal diversity within each model.
- Not possible without great community contributions.

- Please respect model-information policy: ``don't ask, don't tell"



Model Code of Conduct

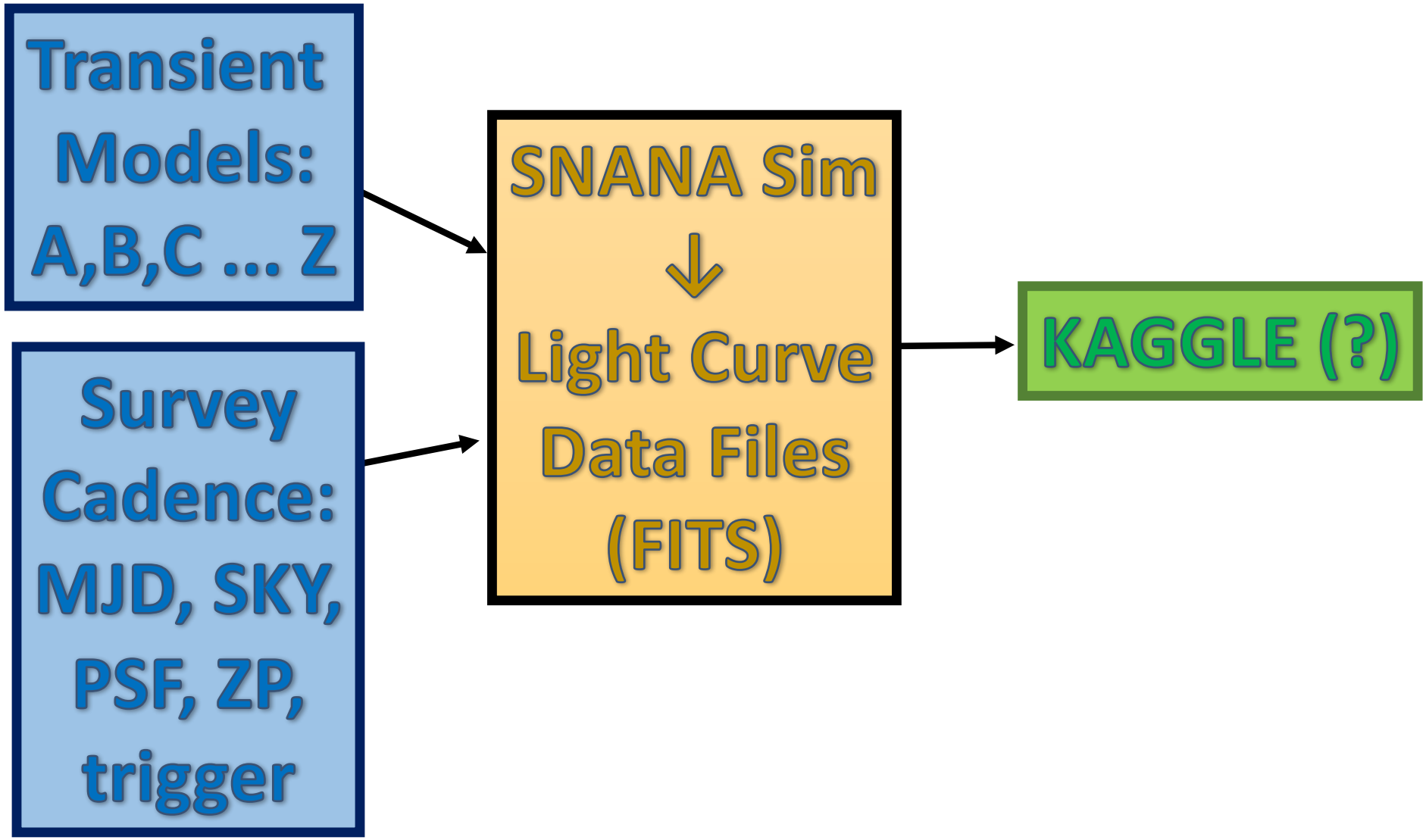
- *models shall not violate known observational constraints.*
- *try to provide models that are useful in any [optical] bands or cadence.*

Model Code of Conduct

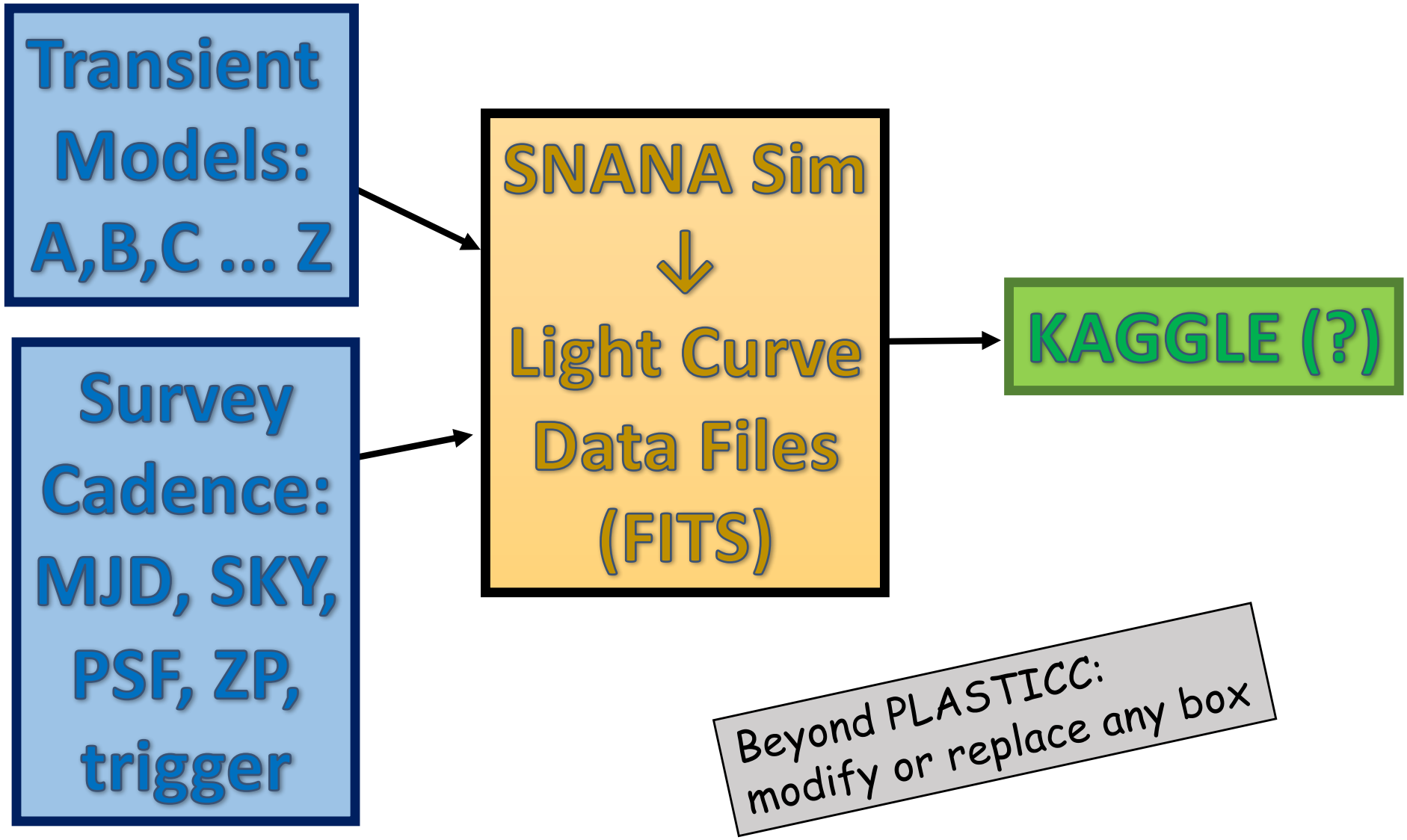
- *models shall not violate known observational constraints.*
- *try to provide models that are useful in any [optical] bands or cadence.*

Maybe useful for:
PS1
DES
HSC
ZTF
WFIRST

Simulation Architecture



Simulation Architecture



Overview of SNANA Sim Features:

- Redshifting
- Cosmological dimming (Ω_Λ , Ω_M , w)
- Rate models (SFR + several z-dependent parametrizations)
- Intrinsic brightness variations (λ-dependent and λ-independent)
- Trigger (detection prob vs. SNR + boolean logic)
- Efficiency maps (spec and host-z)
- Instrumental noise (search + template)
- Host galaxy (noise, extinction, photo-z, properties)
- Mis-matched host model (→ wrong redshift)
- Galactic extinction
- Weak lensing (profile vs. z, magifications < 4)
- Arbitrary z-dependence on transient model parameters
- Spectra (phase ranges, compute Texpose from SNR request)

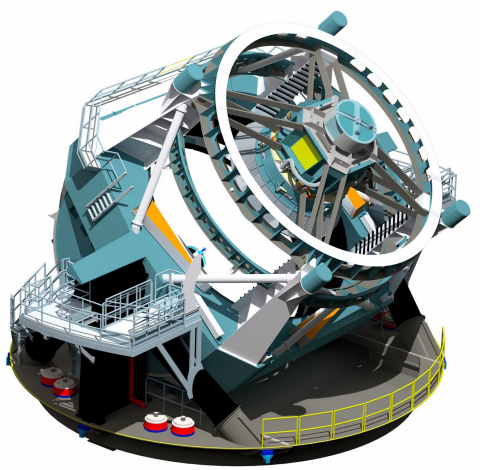
Overview of SNANA Sim Features:

- Redshifting
- Cosmological dimming (Ω_Λ , Ω_M , w)
- Rate models (SFR + several z-dependent parametrizations)
- Intrinsic brightness variations (λ-dependent and λ-independent)
- Trigger (detection prob vs. SNR + boolean logic)
- Efficiency maps (spec and host-z)
- Instrumental noise (search + template)
- Host galaxy (noise, extinction, photo-z, **properties**)
- Mis-matched host model (→ wrong redshift)
- Galactic extinction
- Weak lensing (profile vs. z, magifications < 4)
- Arbitrary z-dependence on transient model parameters
- Spectra (phase ranges, compute Texpose from SNR request)

Wechsler, private comm:
Galaxy library merging
observer mags +
intrinsic properties →
maybe end of summer?

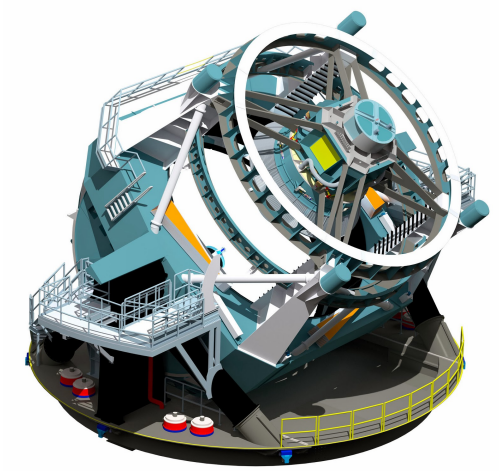
LSST-DESC status ?

Instrumental Simulation



- DDF & WFD from OpSim (3 seasons)
- Light curve fluxes; errors include Poisson noise from sky+source (+host?).
- Produces catalog-level light curves, corresponding to output of Difference-imaging pipeline (input to transient broker)
- Should we include subtraction artifacts:
  - 1% 5 sigma outliers ?
  - excess scatter on bright galaxies ?

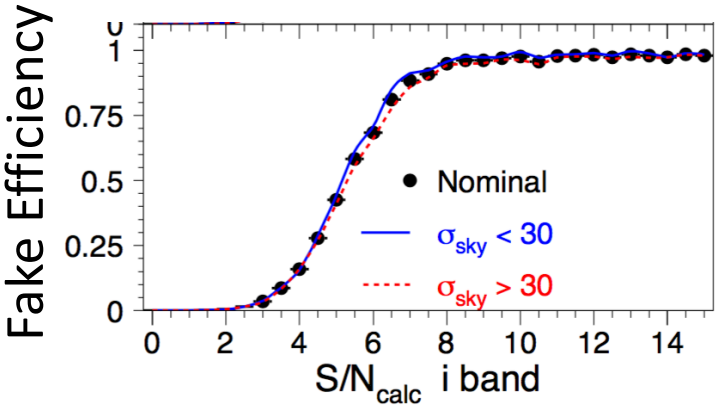
Instrumental Simulation *DOES NOT* :



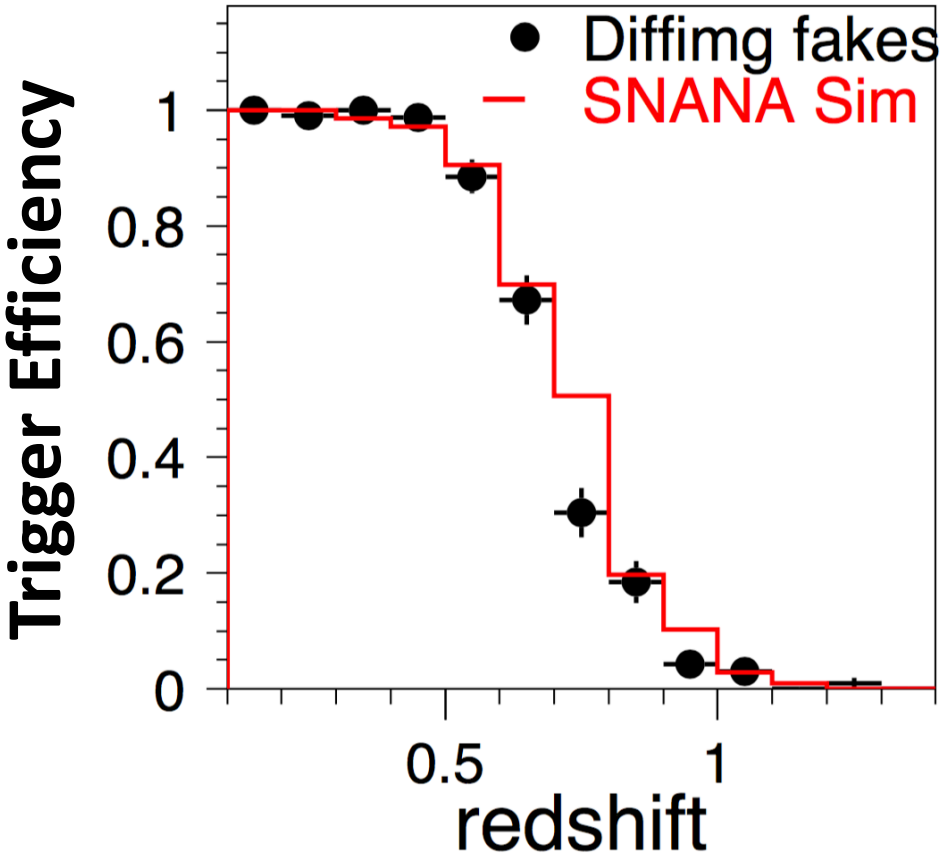
- generate images or any kind of pixel-level data
- generate multi-epoch catalog of stars and galaxies.

Candidate Trigger

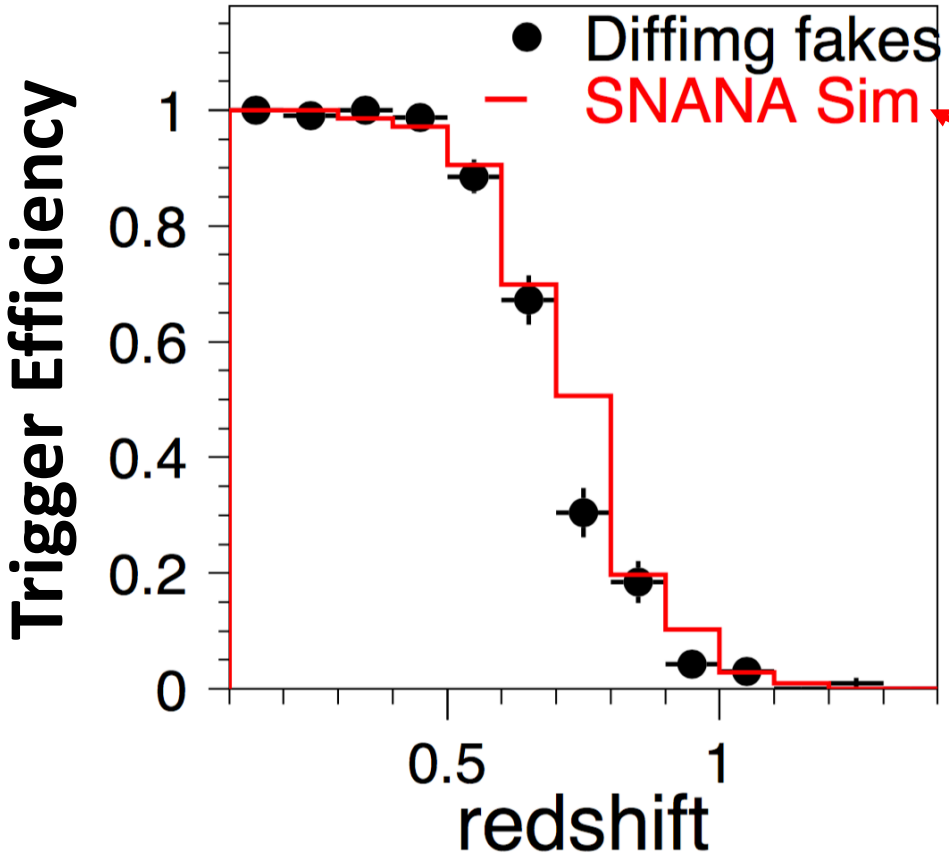
- Candidate requires 2 ``**detections**'' (any band) separated by at least 30 minutes.
- Time-sep to reject asteroids.
- "**Detection**" defined by DES Efficiency-vs-SNR (from fakes)
- Eff = 50% at SNR ~ 5
- Can modify trigger or Eff(detect) with more LSST-specific information
- QUESTION: trigger on negative flux ? (previous answer always "no")



How Reliable Is the Simulation?
(check with DES-SN, 1507.05137)



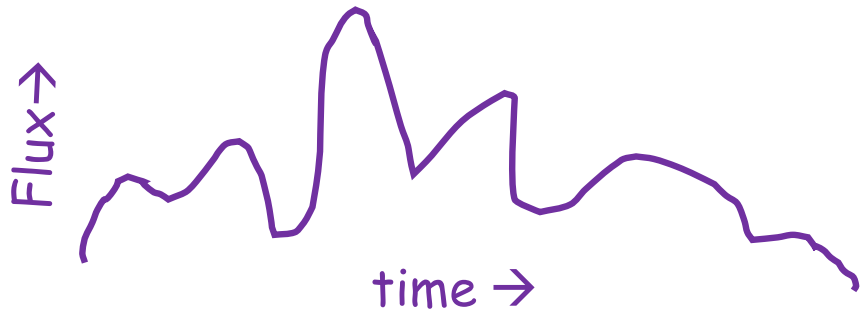
How Reliable Is the Simulation?
(check with DES-SN, 1507.05137)



Few weeks with 100's of cores at NERSC

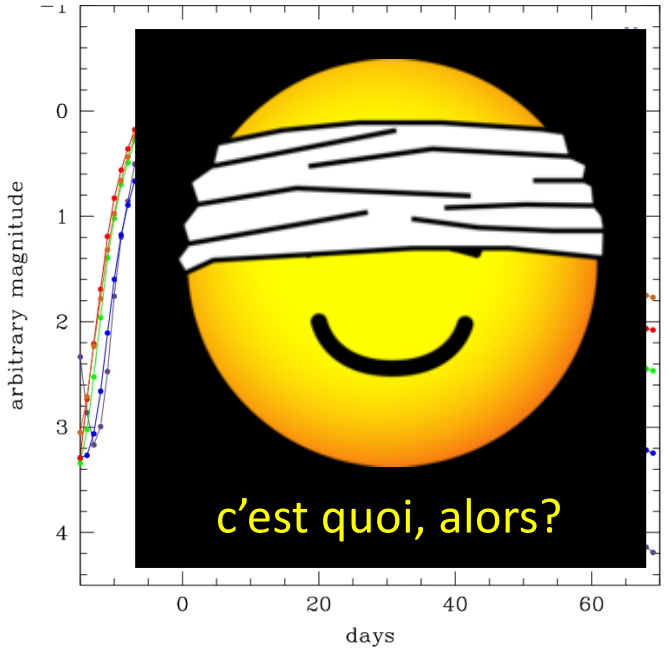
Few minutes, one core (50 Hz)

Light Curve Data



- Each observation reported as flux & error (not mag)
- Flux can be negative due to sky fluctuations.
- If model overlaps any part of a season, fluxes for entire season are reported (avoids giving valuable time-scale information).
- ``Seasons" are separated by 90+ day gaps.
- $MJD_{trigger}$ marked for each light curve; pre-trigger fluxes included (forced photometry)

Early-Epoch Challenge



- Important for LSST startup: classify transients with few epochs → enables spectroscopic follow-up.
- Full light-curve analysis is fun for science, but less critical for LSST operations.
- In 2010 SN(Ia+CC) challenge, **NOBODY** tried early-epoch classification !
- Should we ***require*** early-epoch classification to accept a submission ?
- How is early-epoch challenge defined ? Nobs past trigger ? Ndays past trigger ?
- How many early-epoch ranges to include ?

Data Volume

- Nevt: Current guess about 10 million . . .
  if we don't go to extreme Galactic extinction.
- Size per event: 5kb → **50 GB total**
- Should fit on a USB drive
- Is the data volume reasonable ?
  - small enough for community.
  - big enough to test broker.

When will PLASTICC Go Public

- 1-2 months after all models are received
- Need preparation time for:
  - release platform (Kaggle?)
  - release document (ArXiv?)
  - **analysis-validation exercises (volunteers?)**
  - post-challenge truth tables
  - check for unwanted correlations

When will PLASTICC Go Public

- 1-2 months after all models are received
- Need preparation time for:
  - release platform (Kaggle?)
  - release document (ArXiv?)
  - **analysis-validation exercises (volunteers?)**
  - post-challenge truth tables
  - check for unwanted correlations

October Challenge release →
models delivered by August !

Beyond-PLASTICC Goals

- Improve simulation infrastructure for LSST and other surveys.
- After Challenge results are submitted, all codes & models will be made public.
- Help develop transient broker.
- More challenges, or periodic sim updates ?
- **Anyone can continue development with all or part of the PLASTICC infrastructure.**