Survey Analysis

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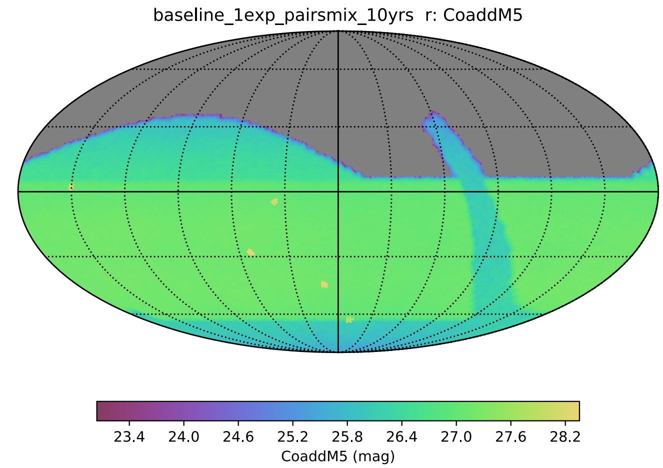
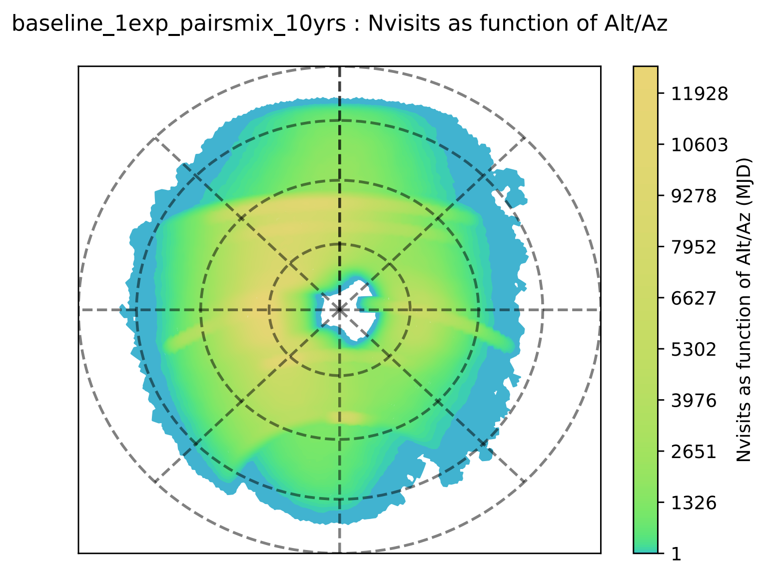
So far, all the runs have been checked for obvious bugs

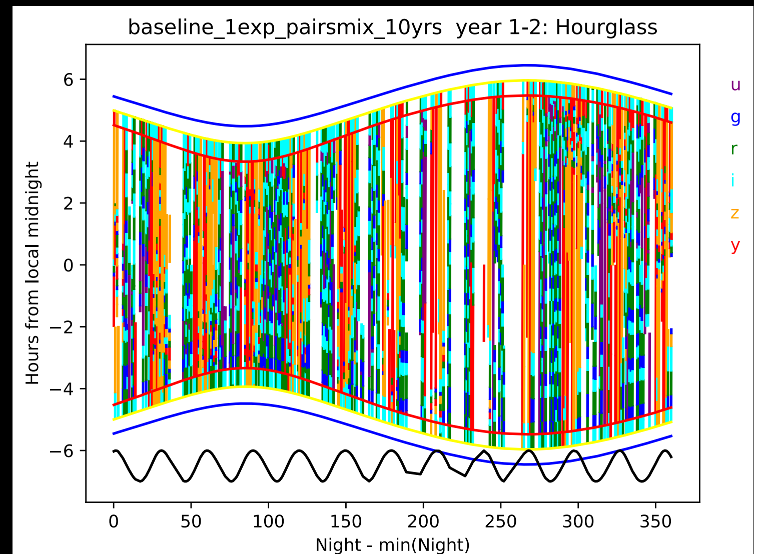
Footprint looks right



alt,az look good



Filter distribution looks ok

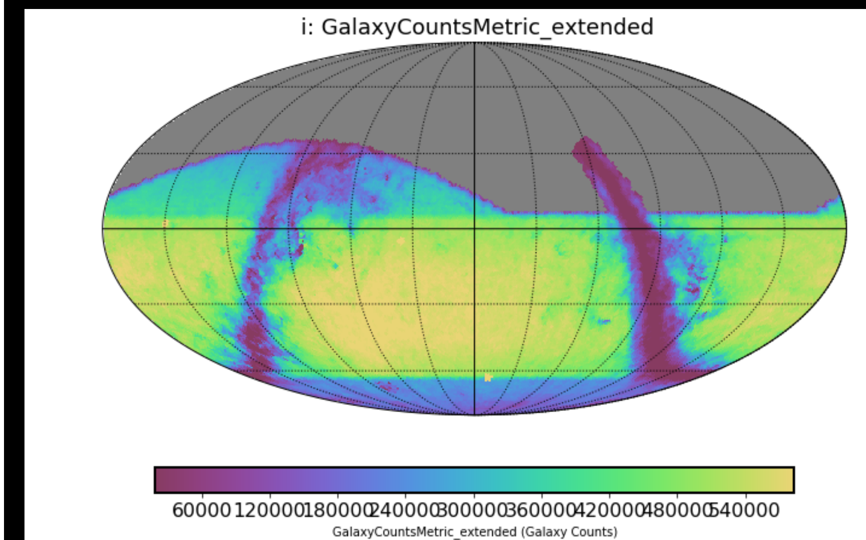


We are now building up the measurements that we can make to check the **science** of the simulations

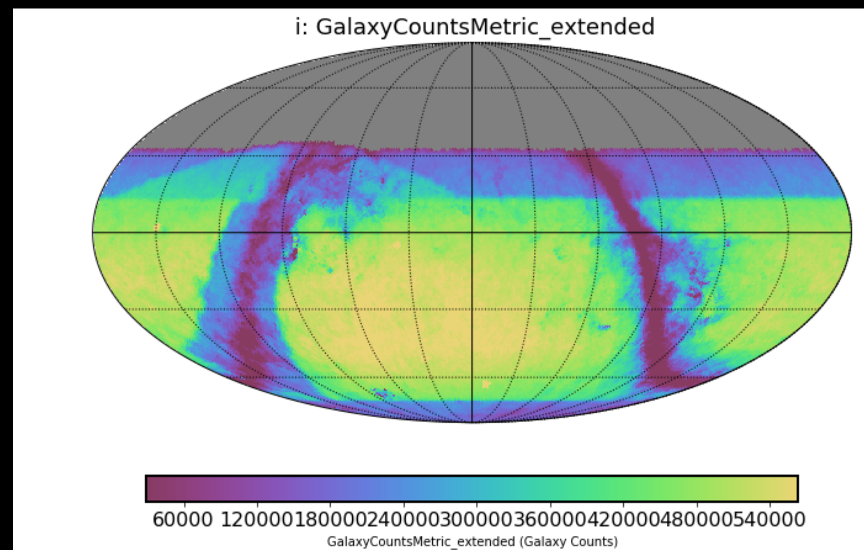
What makes a good science metric?

- Runs in reasonable time (we have 87 sims, and more coming)
- In MAF!
- Documented and understandable (e.g., an astronomer outside your specialty should be able to understand the units on the output)
- Output as compact as possible. It's easy to generate 20 plots, but then it becomes difficult to sift through and compare runs

Galaxy Count metric
(from Humna Awan)
Calculate the number of galaxies that should be available for LSS studies.

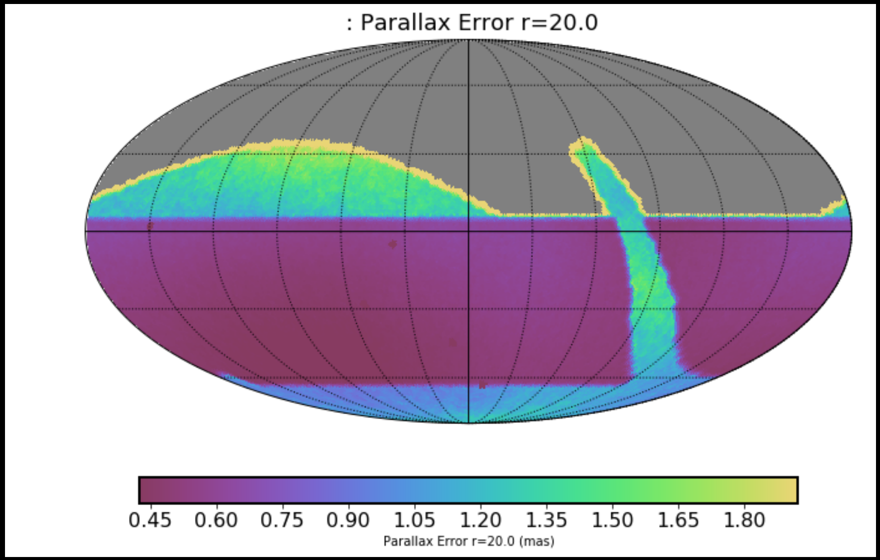


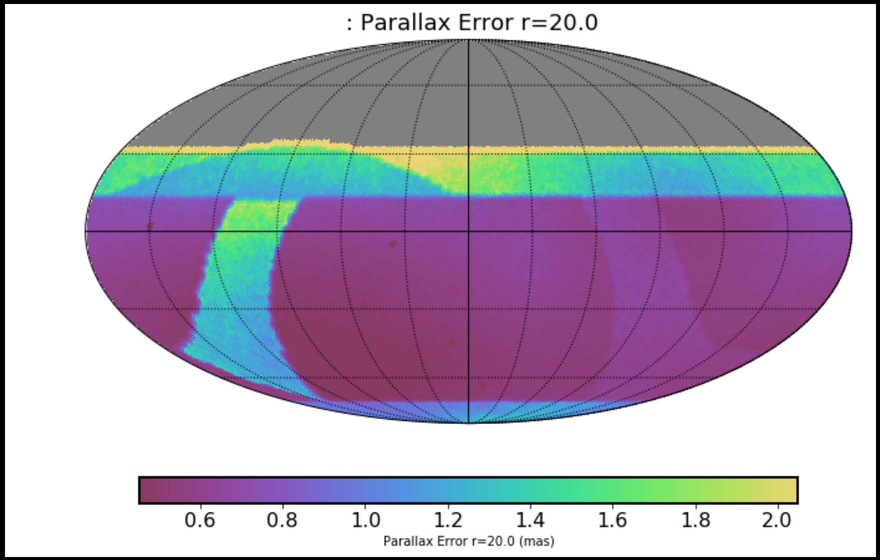
Baseline WFD: 10.8 billion galaxies



newB footprint WFD: 10.6 billion galaxies

Uncertainty in the parallax of an r=20 star





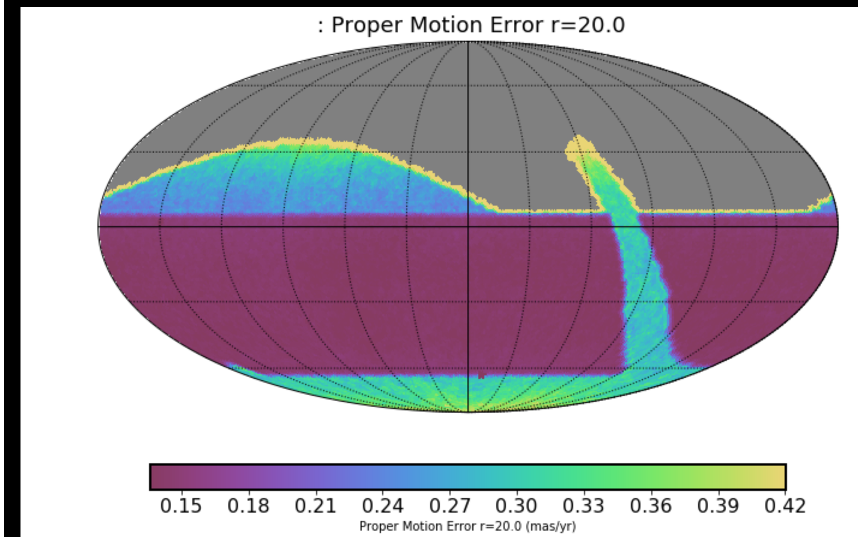
Baseline WFD median: 0.52 mas

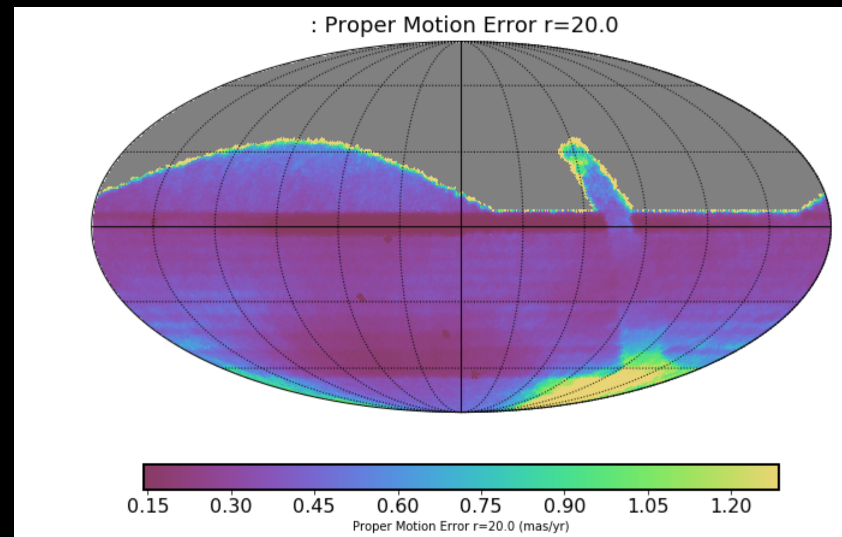
newB footprint WFD median: 0.58 mas

If there is no covariance with proper motion and central position, the uncertainty in the parallax is purely a fucntion of when a star is observed and it’s centroiding uncertainty.

Parallax is fairly robust across simulations

Uncertainty in the proper motion of an r=20 star





Baseline WFD median: 0.14 mas

simple_roll_mod10_sdf0.20 WFD : 0.30 mas

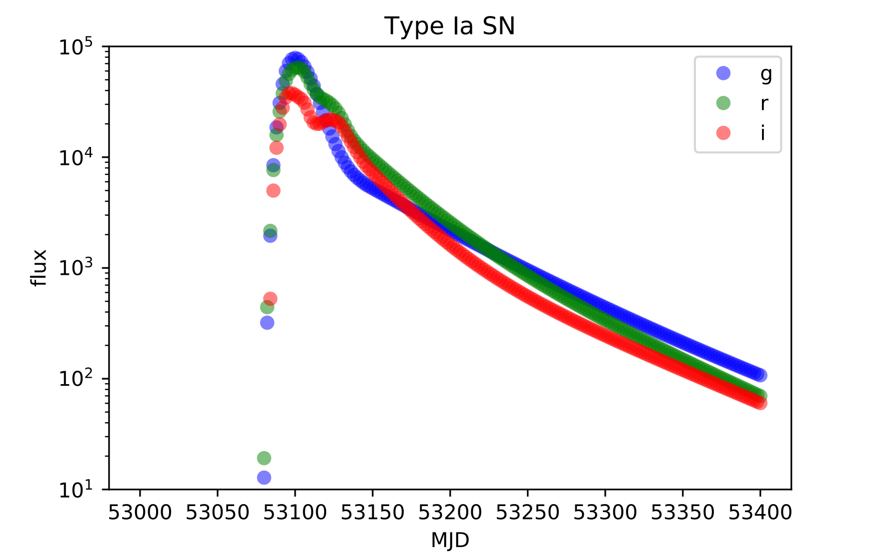
Again, if there is no covariance, the proper motion uncertainty only depends on when observations happen and the centroiding errors.

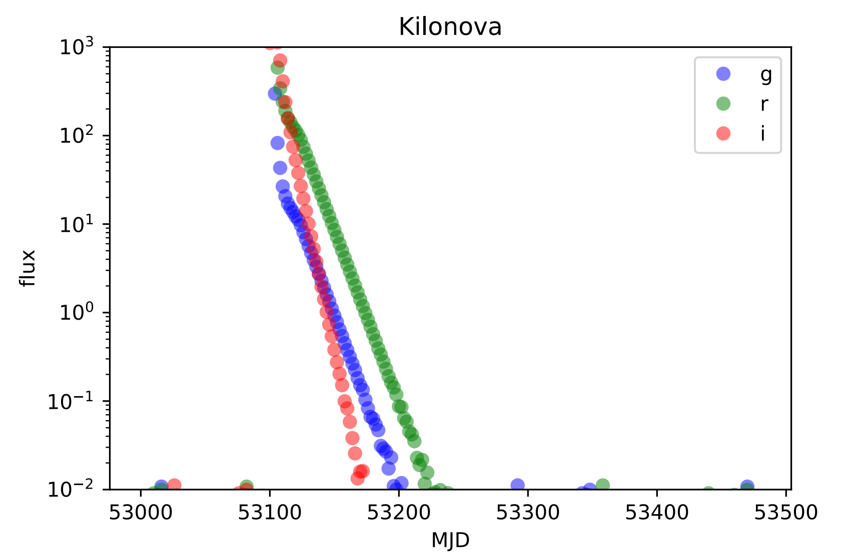
If we do a very aggressive rolling cadence, proper motion error blows up. Need full sky coverage in year 1 and 10 to keep proper motion errors low.

Transients

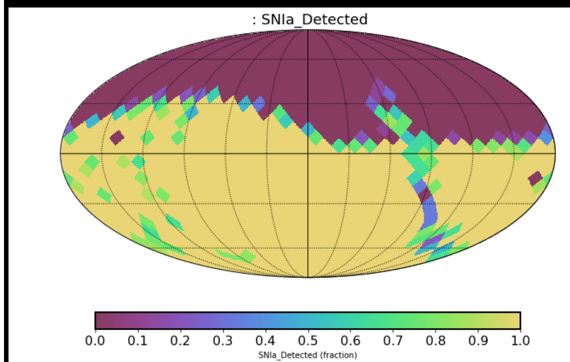
The easiest way to check how well we can do transient science (imho), is to generate a population of lightcurves, distribute them reasonably in space and time, then use MAF to see how many got observed.

Lightcurves from the **PLAsTiCC** challenge

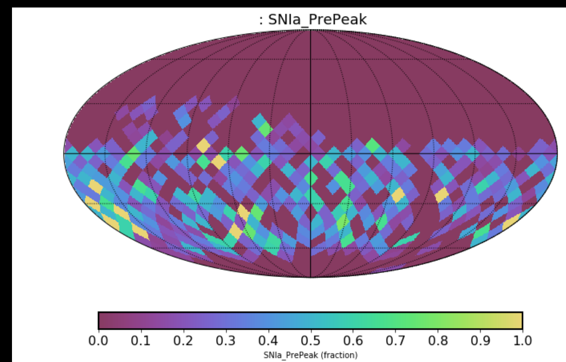




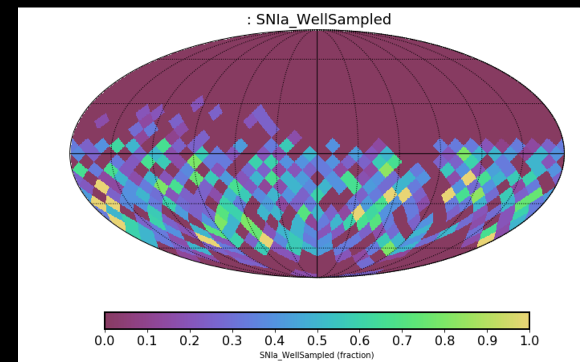
4k Type Ia SNe



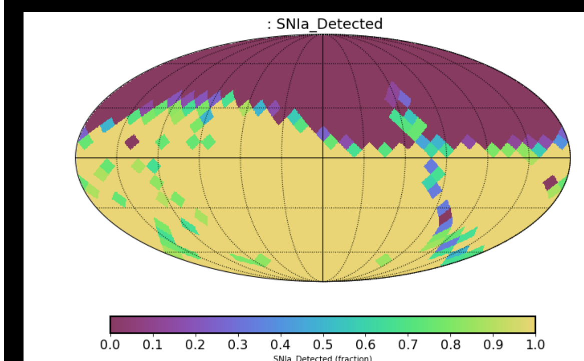
Pairs mixed 62% detected



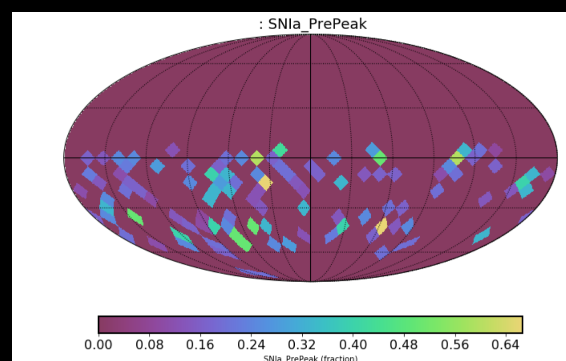
15% measured pre-peak



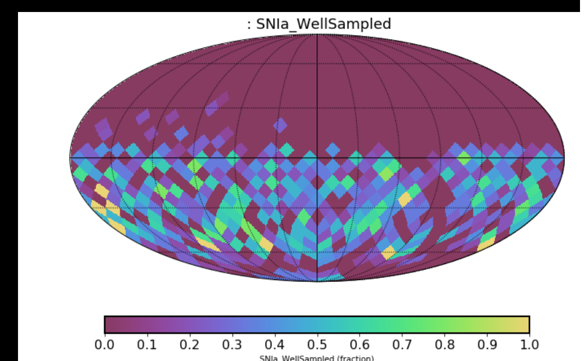
17% “well-sampled”



Pairs same 62% detected



3% measured pre-peak

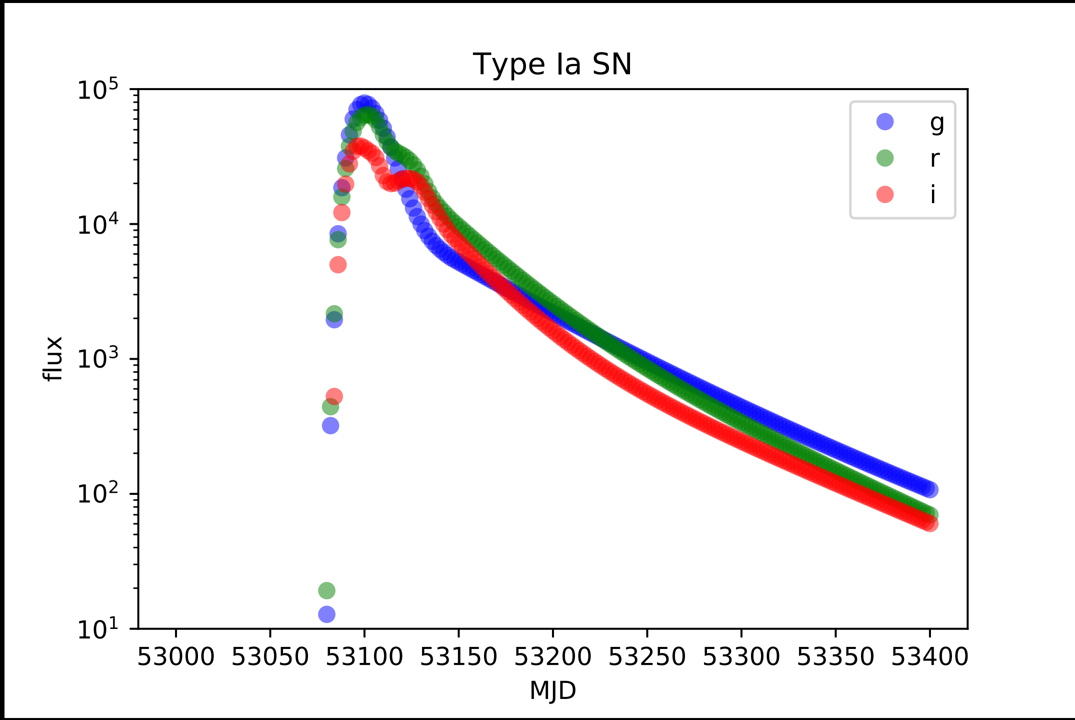


16% “well-sampled”

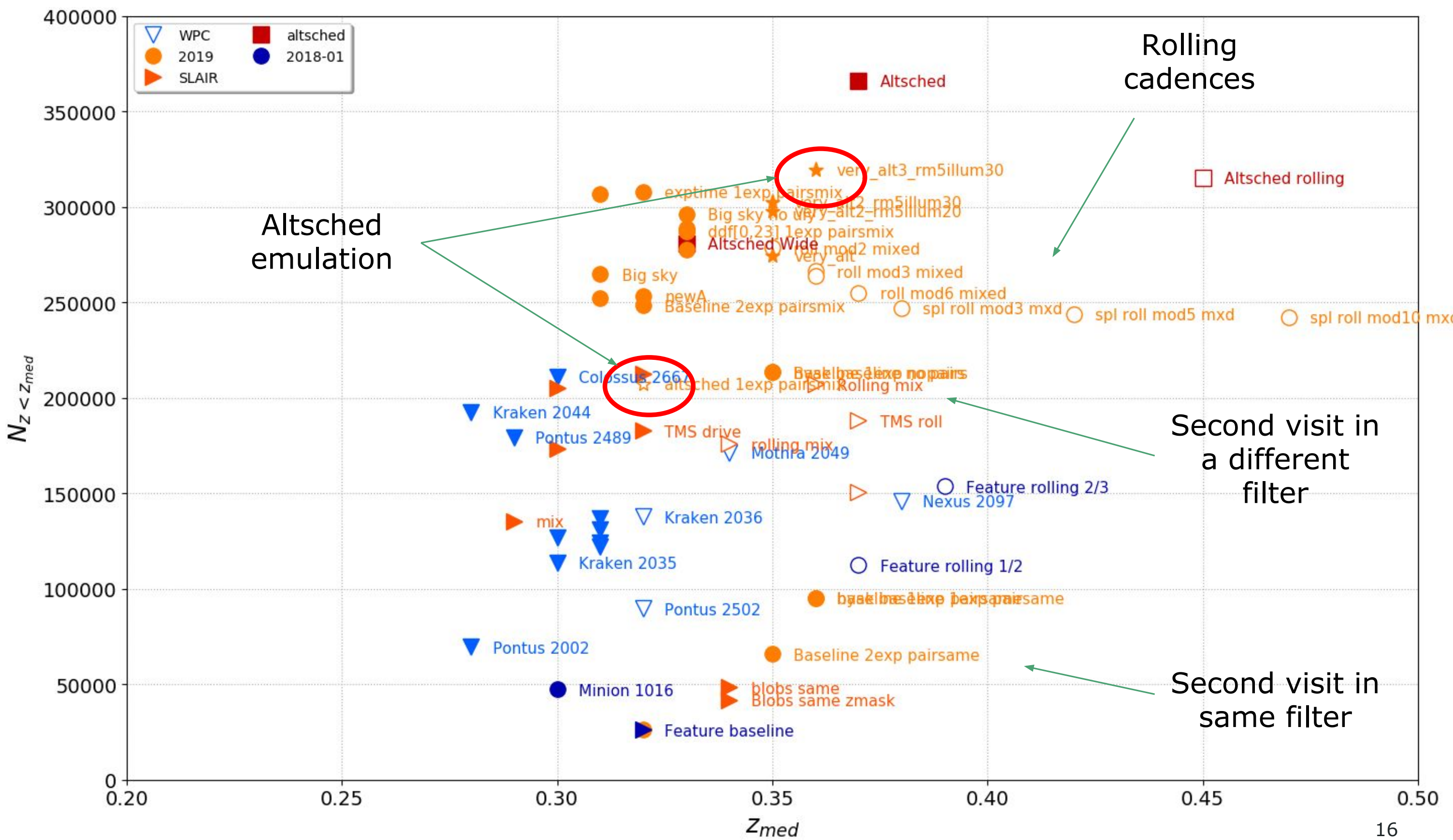
Pre-peak criteria: Measure a color before peak, and a rise slope in at least 1 filter

“well sampled”: Divide LC into 10 bins, demand 5 have observations (any filters). I would love a better criteria!

I would love it if someone gave me (or even better coded up) better criteria for how well a LC has been observed

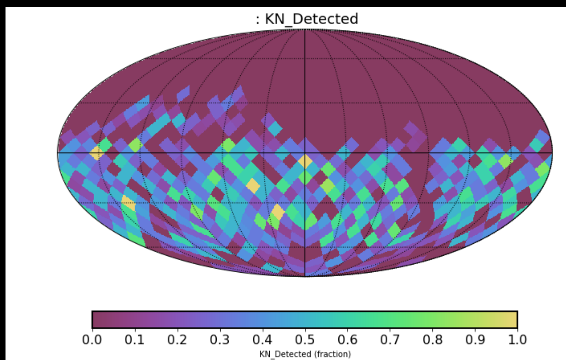


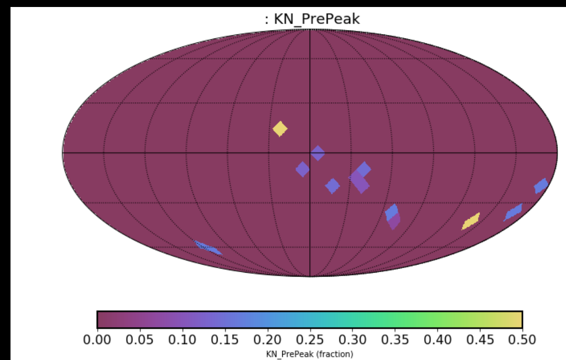
SNe group has been running more intensive analysis and giving feedback on sims

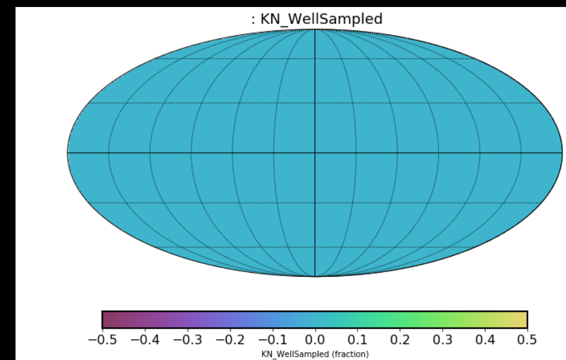


From Nicolas Regnault

Now for kilonova



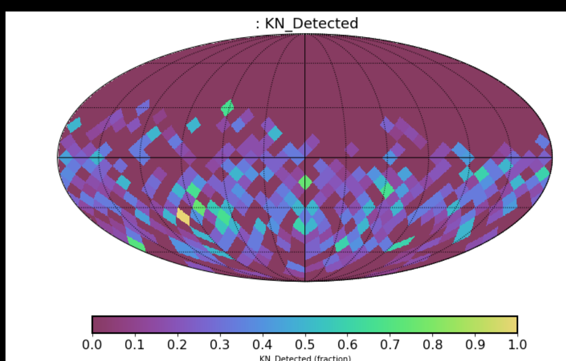


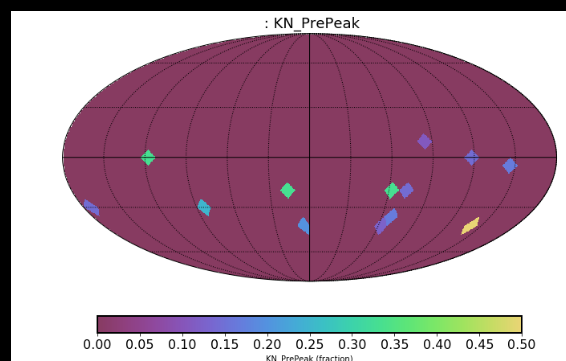


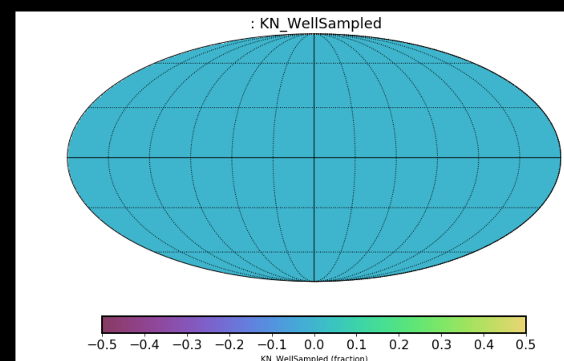
Baseline 19% detected

0.3% pre peak

0% well sampled





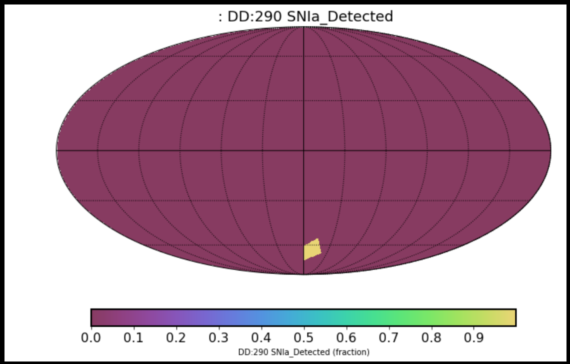


10-band rolling 11% detected

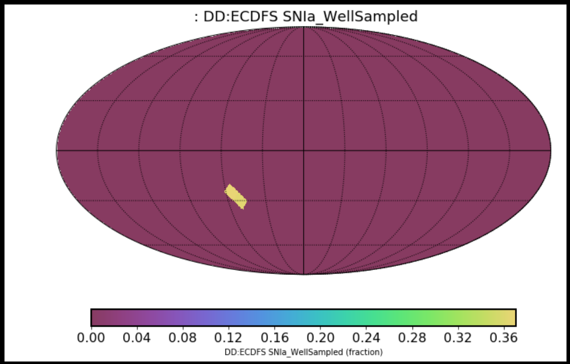
0.3% pre-peak

0% well sampled

For the DDFs, we can use the same lightcurves, but now distribute them around the DDF location



Baseline DDF290 Type Ia, 100% detected, 26% pre-peak, 27% well sampled



A bug and a feature, some DDFs were too constrained and fell behind, but this shows up in the science metric!

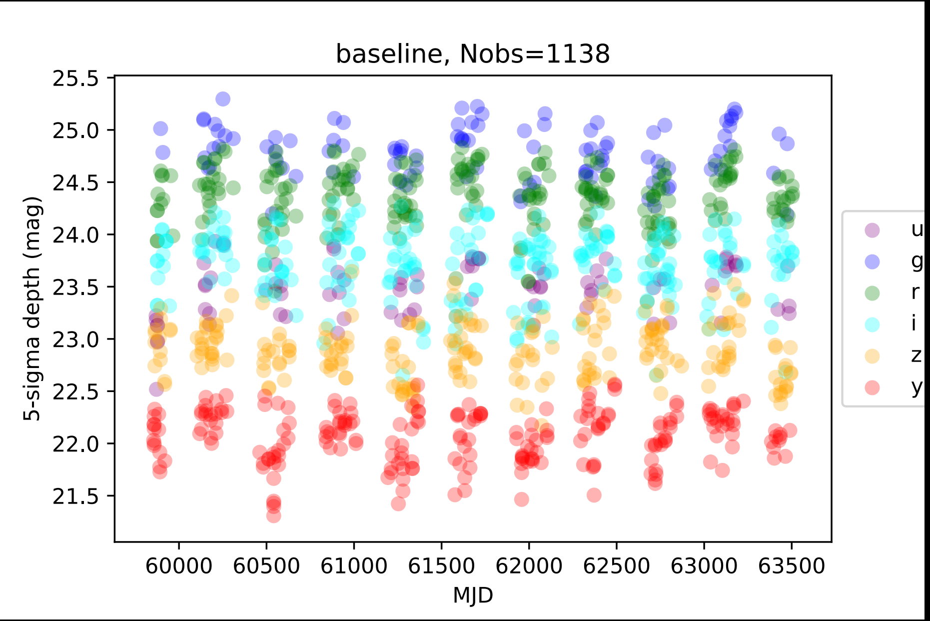
Baseline DDF ECDFS Type Ia, 100% detected, 46% pre-peak, 37% well sampled

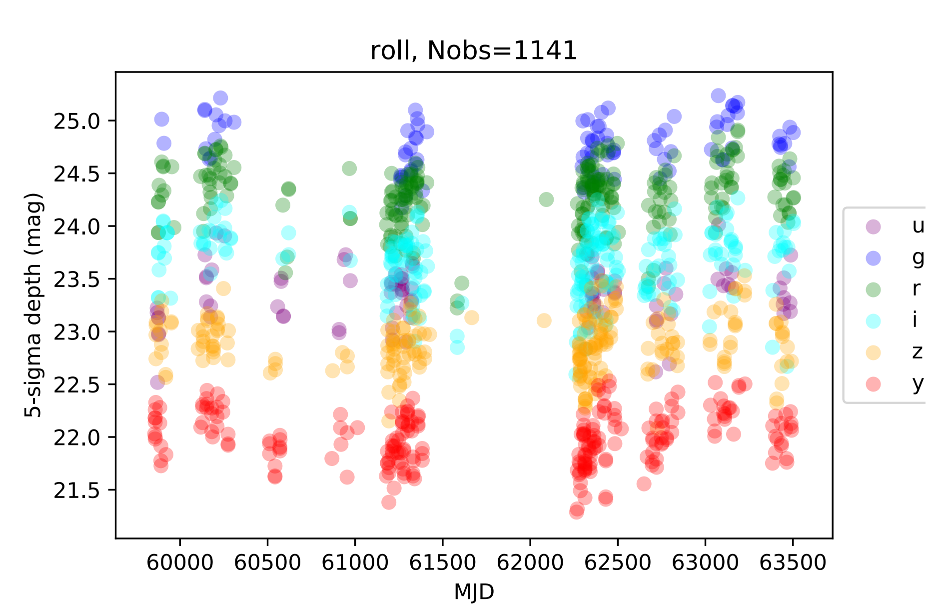
On the plus side, current science metrics take only 90 minutes to run on a single simulation

What we know we need

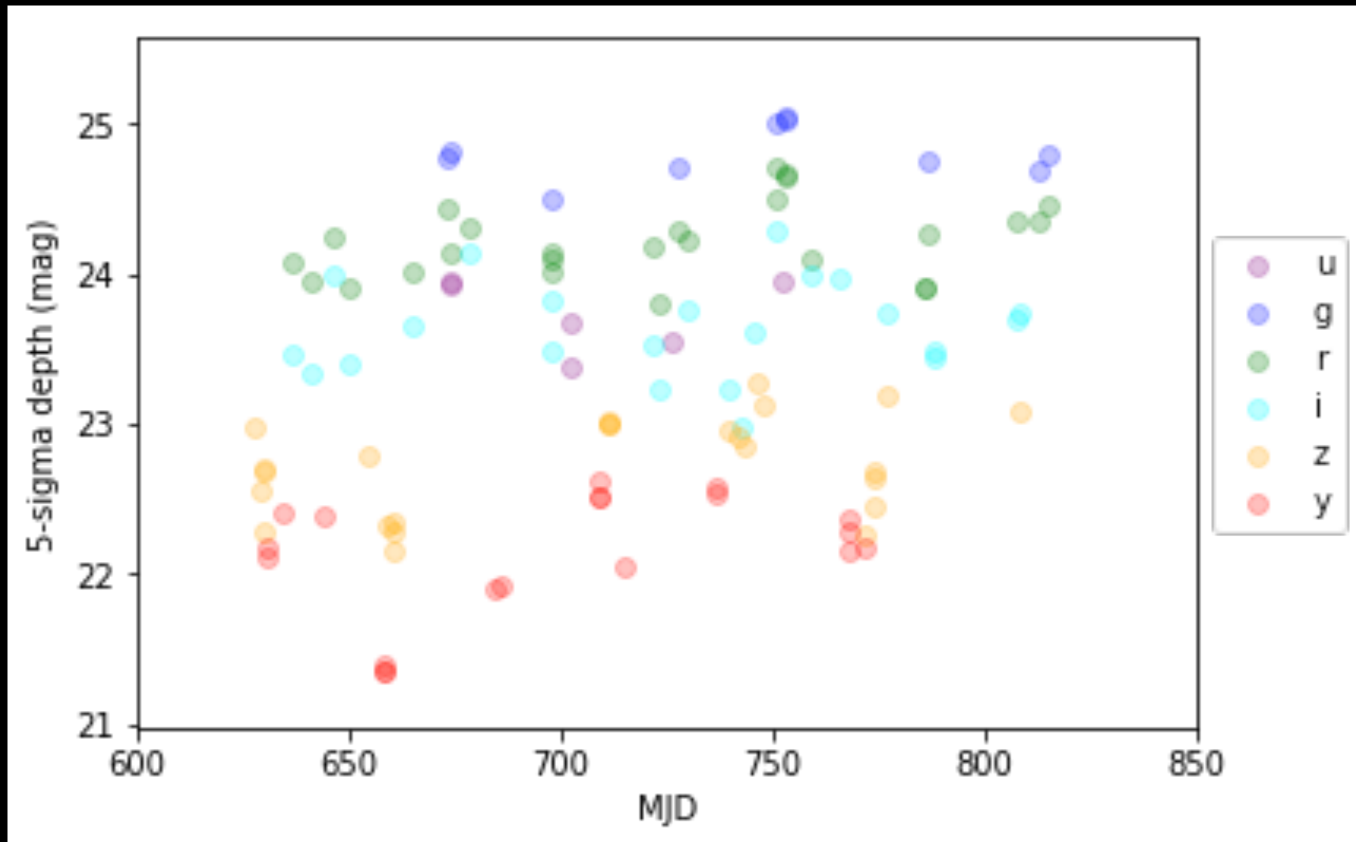
- microlensing events (light curves and proper spatial distribution)
- Should we have SNe at a few redshifts?
- Expand galaxy counts to more filters? Have some metric for photo-z?
- Bulge and galactic plane metrics
- Better criteria for what “well-sampled” means! Do we need different criteria for different objects?
- More DDF-specific metrics
- Galaxy shape metric (for rotational dithering check)
- Checks on periodic sources (are we aliased?)
- AGN metric?
- Checks for DR-1 science?

Working on some example notebooks to help folks climb the learning curve (start with 1,000 observations at a point, rather than 2,500,000 over the full sky)





Comparing (ra,dec) = (20,-40) for 2 sims



Zoom in on one season

I think the goal here is to have a suite of metrics that the project and science collaborations can look at to see “did we kill a science case?”

It’s still up to science collaborations to do their own extra-detailed calculations, but it would be nice to be able to check the basics and compare to how the baseline performs.

I still want to make radar plots