Survey Strategy Simulations v2.0 and v2.1

Peter Yoachim University of Washington

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Quick reminder of how we schedule observations

We have a kinematic model of the telescope, historic weather, seeing, etc

Simulate observing for 10 years, generating a log of ~2 million observations. Check if DDF sequence can be done There are 5 DDFs, each one gets ~1% of the total time

If it's not twilight, and there is enough time, observe a contiguous blob: u+g, u+r, g+r, r+i, i+z, z+y, or y+y

Second observation separated by ~33 minutes

Sky area selected by using a linear combination of limiting depth, survey footprint progress, and slewtime

(Twilight time) contiguous area with pairs of r+i, i+z, z+y, y+y15 minutes between observations

Greedy algorithm, rizy filters



- What's new in v2.0
- What will probably be coming in v2.1
 - Goal to release runs in February 2022
 - SCOC phase 2 recommendations early summer (this will be recommendation for operations)



Classic v1.x footprint



v2.0 footprint

- Decrease visits in dusty plane
- Cover the bulge
- Add SMC and LMC
- Increase pair timing from 22 minutes to 33 minutes

Year 2.5-3.5



v1.x: No rolling WFD ~80 visits per year (all filters)



Rolling on by default in WFD for 6 seasons Now WFD gets ~16 or ~140 visits per season

Progress!

New footprint and rolling seem like an across the board improvement

SNe benefit from rolling

Microlensing benefits from bulge coverage

Everything else about the same



Retro

- 1 run like v1.x baseline (just run with new code, latest dither updates)
- 1 run like the v2.0 baseline, but with the old footprint



The metrics we have strongly favor the new footprint. The retro runs are here in case there's a science case that would benefit from the old footprint



Long_u

 Testing out longer u-band exposure times so no longer readnoise limited Same number of visits, longer exposure

Same total exposure time, fewer visits

TDE folks should weight in on this Photo-z folks should weigh in



Long_gaps, long_gaps_nopair

- Get observations with gaps of 3-7 hours
- It works, but the only way to do this is to start or end at high airmass



Lots of metrics say losing depth is bad. Need **science metrics** that quantify how good this strategy is

Presto, presto_half

- Similar to the long_gaps, focused on getting three observations in a night
- Initial pairs of g+r, r+i, i+z or g+i, r+z, i+y
- Vary target gap length from 1.5-4 hours
- Full time or half of nights for triples

TDE and KNe metrics should benefit from this, but don't show much change

A generic "transient classification metric" would be great



Rolling rolling rolling!

- Noroll
- Rolling: half WFD, third WFD
- rolling_all_sky: Roll in the dusty plane
- rolling_bulge: Roll in the bulge
- rolling_bulge_6: 6-stribe rolling in the bulge
- rolling_early: Roll a little earlier to get 7 seasons of rolling rather than usual 6
- rolling_six: 6 bands of rolling in the WFD

They all look nearly identical after 10 years, but lots of ways we can increase the cadence in rolling years



Rolling tends to improve SNe and other transient metrics (less area, but cadence increases past a critical value)

Rolling means many annual data releases will be non-uniform

There's no good way around nonuniformity while rolling.

See <u>https://pstn-052.lsst.io/</u> for a whole document on rolling

We don't have a metric that quantifies how bad non-uniformity in middle years is





Vary_nes

• Vary the amount of time in the NES

We have lots of solar system metrics!

I didn't see strong trends on the few solar system metrics I looked at, so the science collaboration should dive into it help interpret their metrics



Microsurveys

- ToO follow up of gravitational waves
- Extra observations of local galaxies
- Short (1-5s) exposures
- Adding a northern stripe
- Roman bulge DDF
- Carina region
- SMC in movie mode
- NEO search in twilight
- Virgo cluster
- Variable exposure times

Lots of these look fine, but we risk death by a thousand cuts



Add the Virgo cluster to WFD area

DDF

- 2 simple DDF runs, giving more or less time to DDFs
- SCOC asked for more, and we have cadence notes and white papers with good DDF ideas, just ran out of time
 - More sophisticated DDFs planned for 2.1

We have good SNe metrics for DDFs. We have some AGN metrics. Need some static science DDF metrics.

Scheduling DDF observations with Gurobi Integer Programming optimization

Compute expected 5-sigma depth of the DDF every ~15 minutes for 10 year survey





- Easy to modify the desired curve to do things like extend seasons, or execute rolling
- Need some logic on how to handle missed scheduled observations
- Note this DDF starts mid-season, maybe we want to wait until a full seasons is possible

V2.0

- 127 new simulations
- Metrics up at: <u>http://astro-lsst-01.astro.washington.edu:8080/</u>

Looking ahead to v2.1

- New baseline incorporating suggestions from 2.0 sims
 - U-band exposure time
 - Detection vs classification
 - NES strength
 - Dusty plane strength
 - Rolling preferences
- DDF experiments (note we have some DDF runs now, so you don't need to wait to start writing DDF metrics!)
- Microsurveys
- Any more footprint fiddles