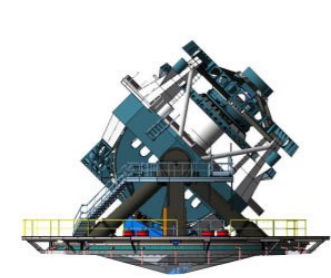




LSST Observing Strategy: From Opsim v3 to the Feature Based Scheduler

Lynne Jones & Peter Yoachim
LSST 2019 PCW
Aug 14, 2019



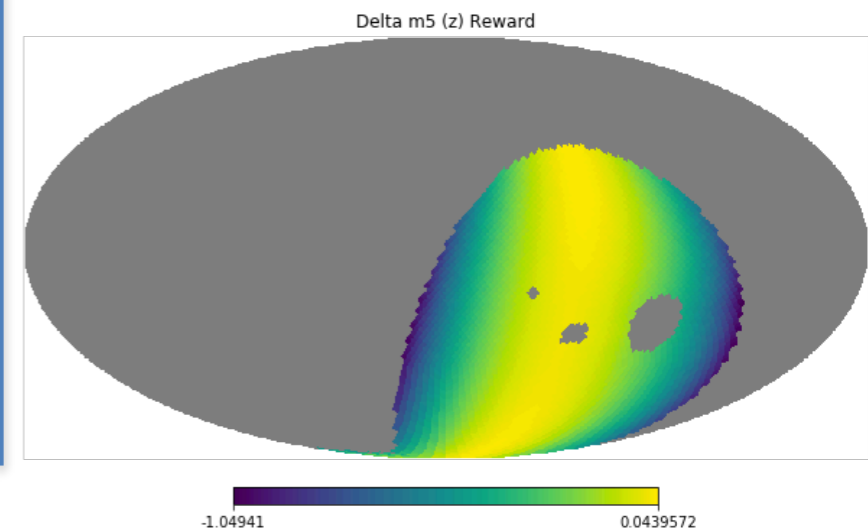
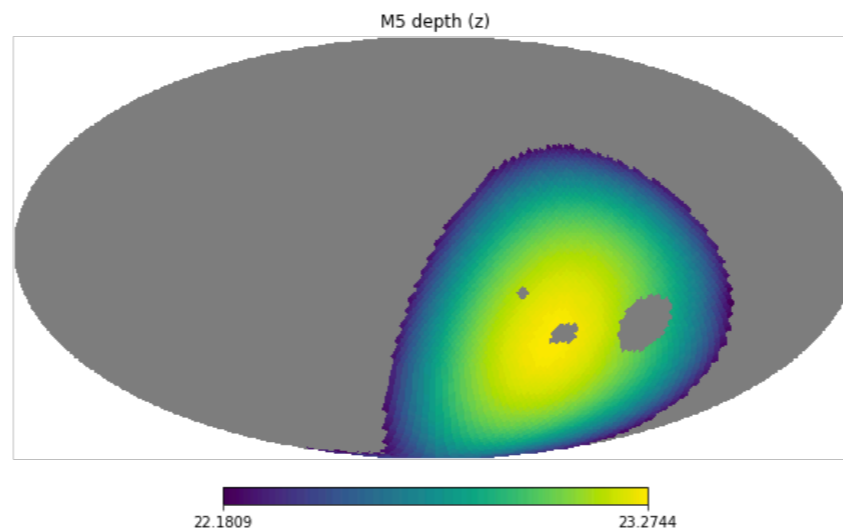
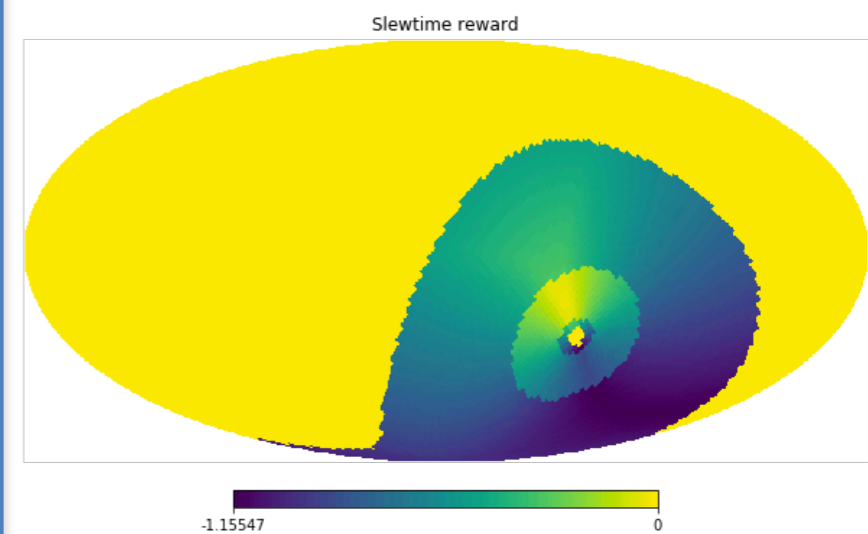
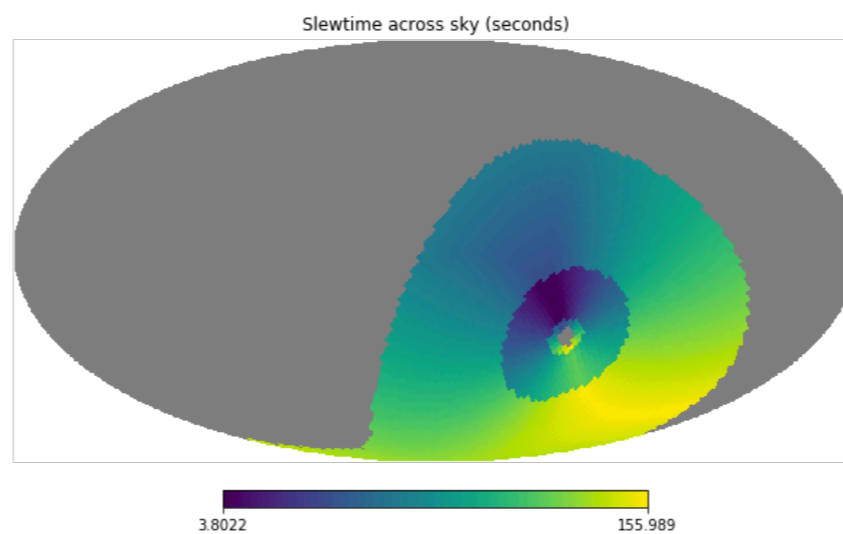
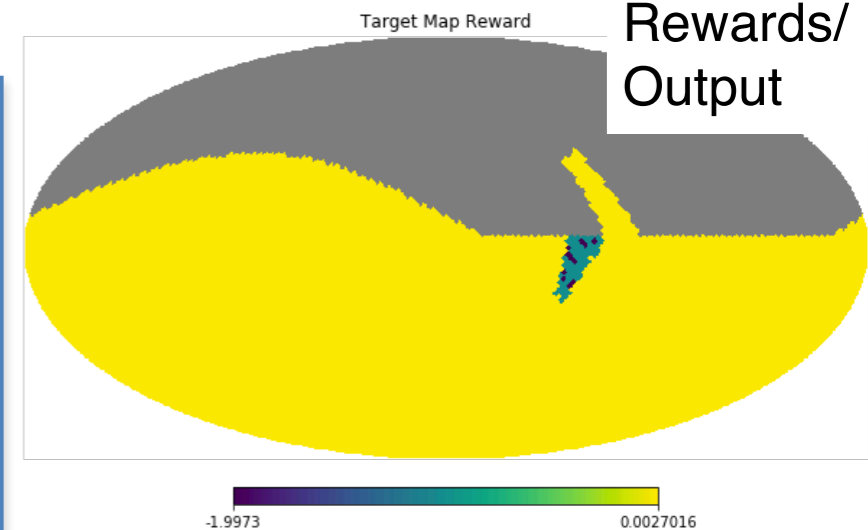
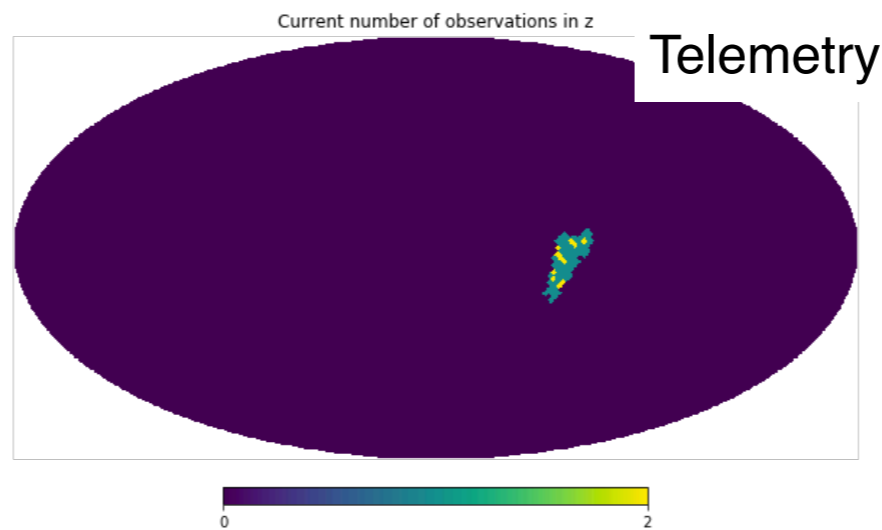
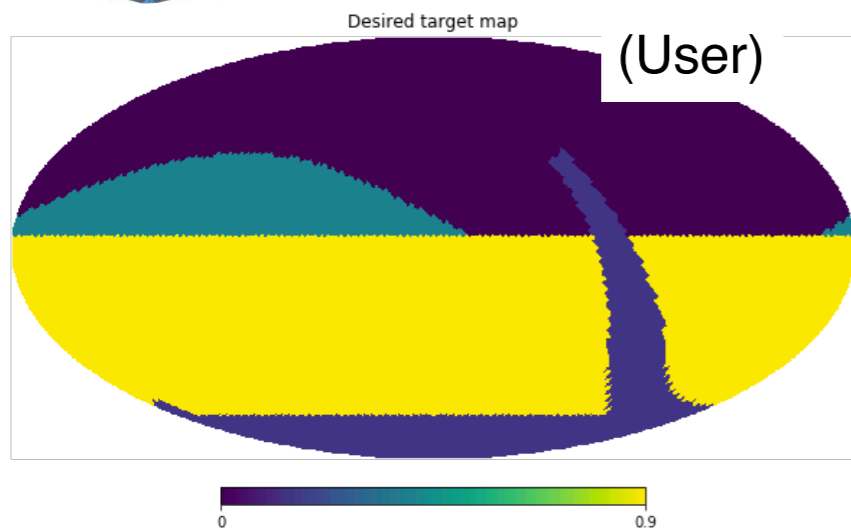
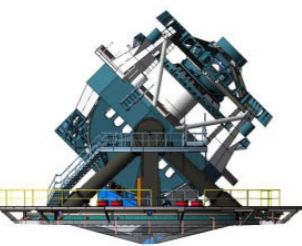


From the old Scheduler (v4) to the new (FBS)

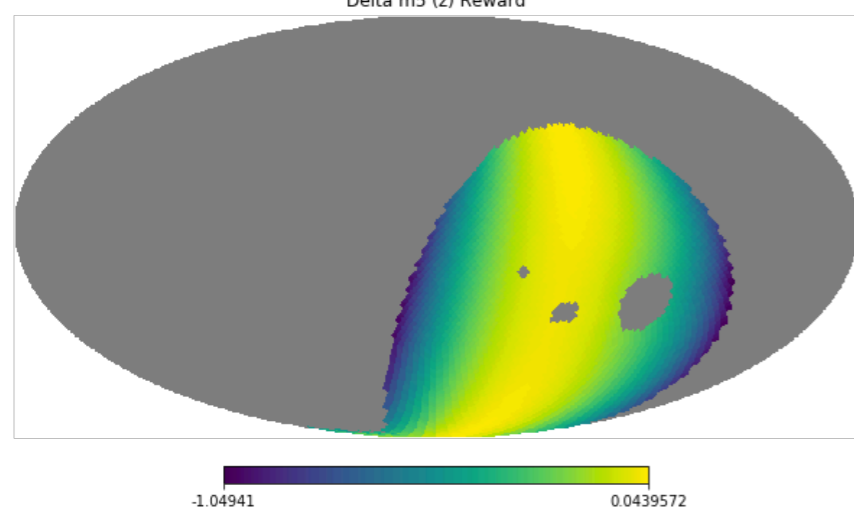
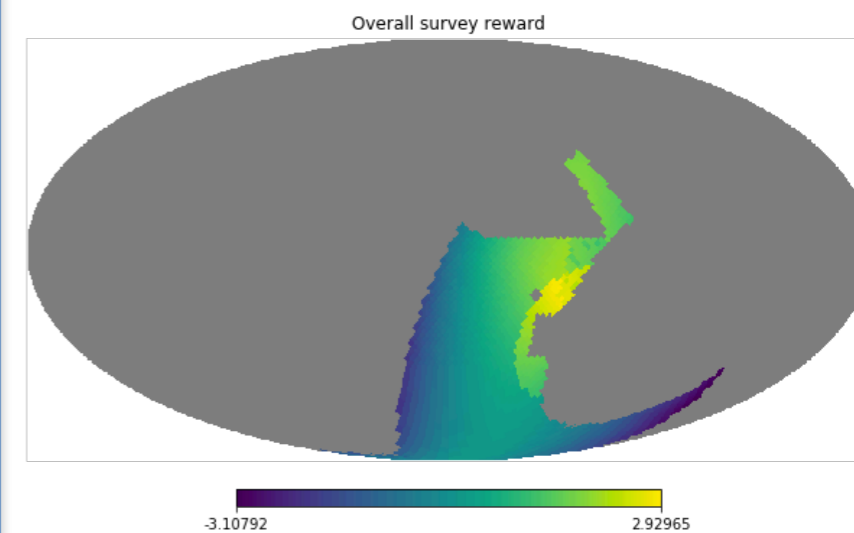
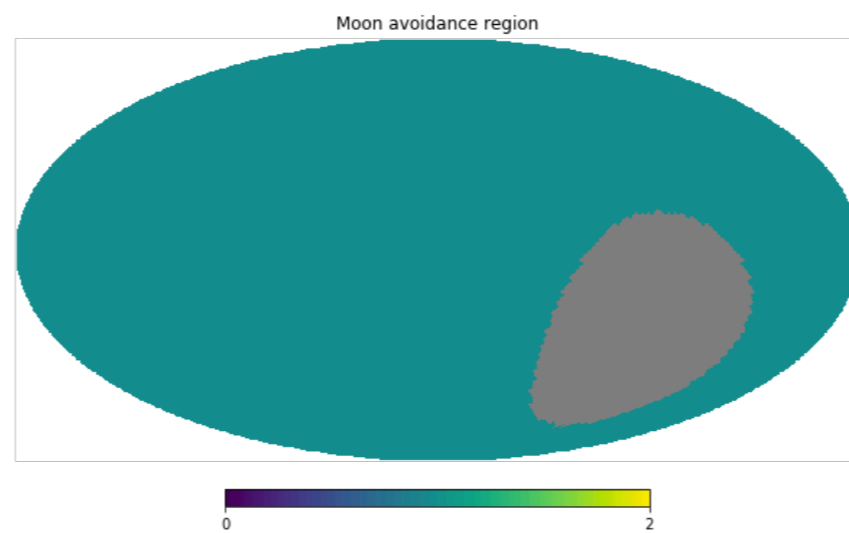
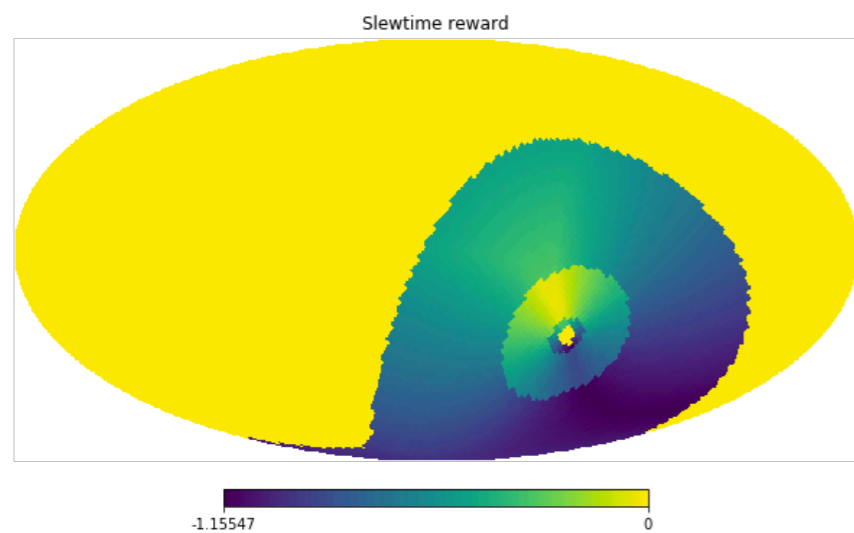
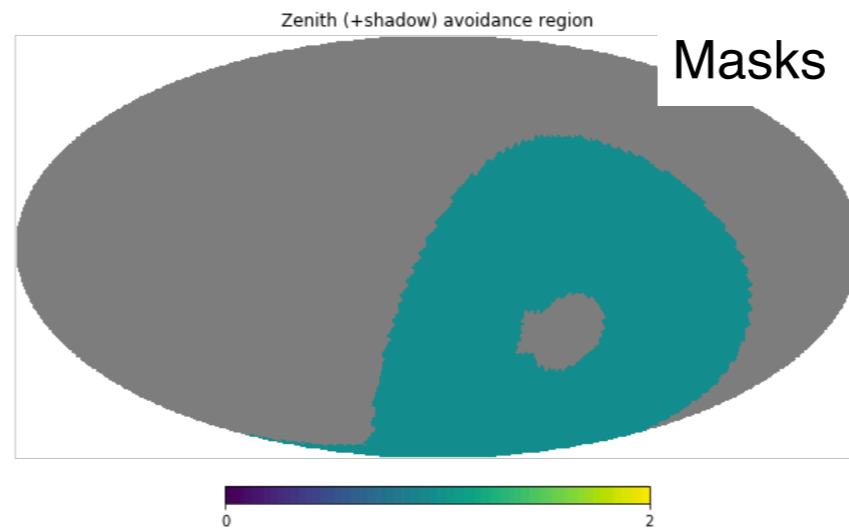
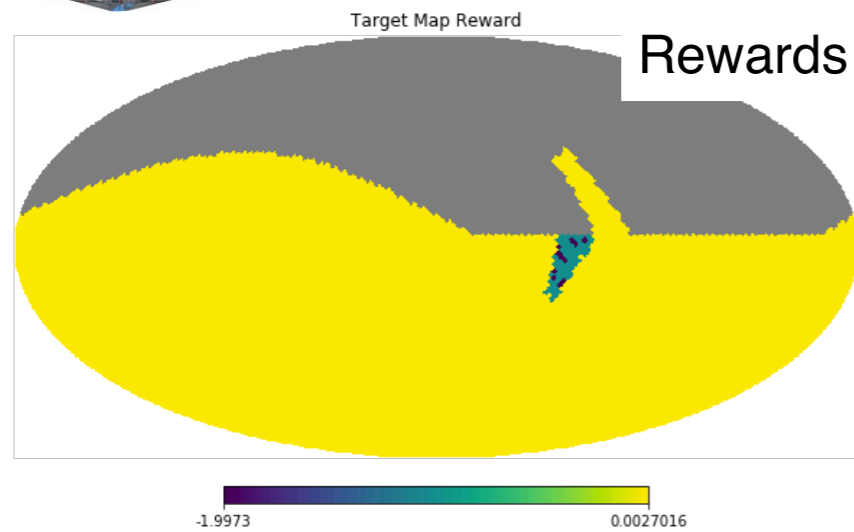
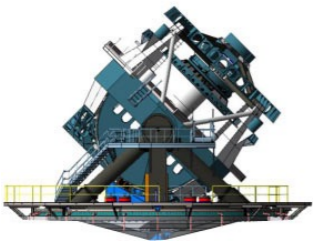


- Changes from Opsim v4 to FBS include:
 - FBS makes decisions about the survey using basis functions which are programmed and configured via python .. and entirely new basis functions can be added quickly (modular programming!)
 - OpsimV4 had an extremely limited equivalent of basis functions used to choose the next pointing, which were only configurable via simple parameters passed in text files. It was hard to add new functions.
 - Examples of commonly used FBS basis functions
 - (see <http://ls.st/s24>)
 - Target Map, Slewtime, Delta M5
 - + Filter Change, Visit repeat, Third visits, Sky Region ..

(simple) Example of FBS Basis Functions



(simple) Example of FBS Basis Functions

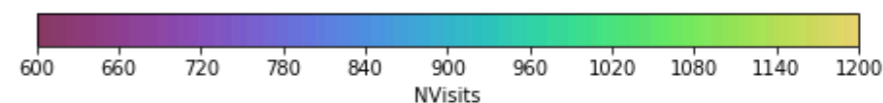
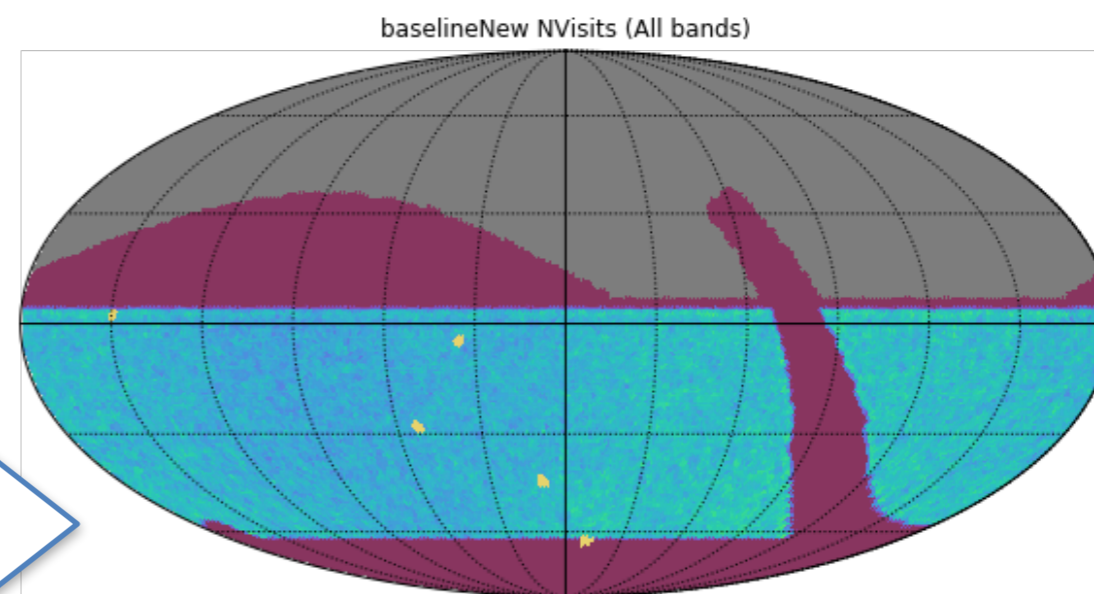
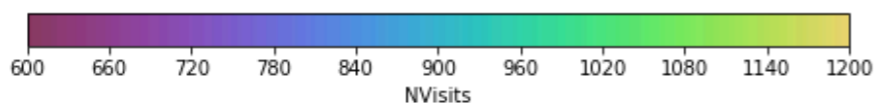
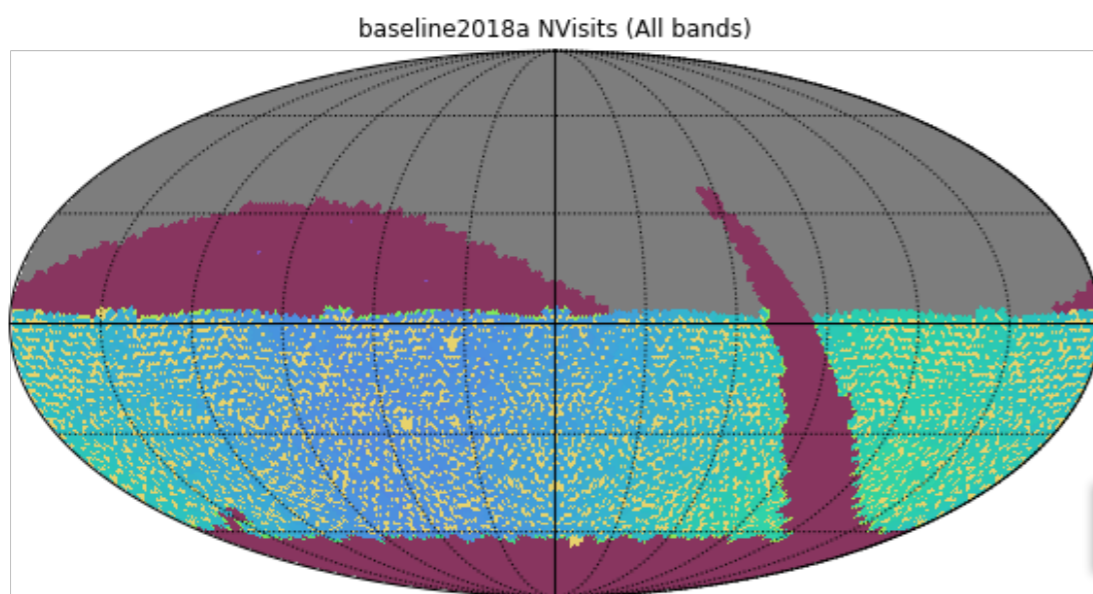


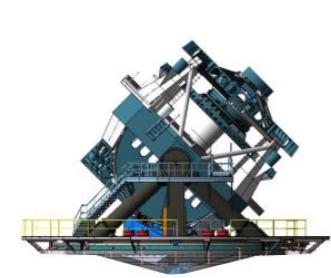
Next pointing @
place with highest reward

From the old Scheduler (v4) to the new (FBS)



- FBS calculates reward based on healpix grid, then chooses actual pointing using field tiling — but the field tiling is moved each night. Natural capability to include dithering and account for field overlaps.
- Opsim v4 had a fixed field pointing and calculated next best pointing at center of tiling points only.

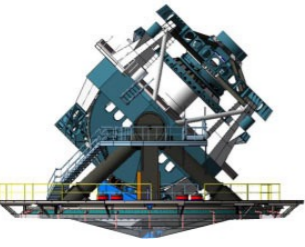




From the old Scheduler (v4) to the new (FBS)



- FBS has multiple modes of scheduling working in a hierarchy - scripted programs can preempt standard surveying and execute ('scripted'), visits during stable weather can be programmed in chunks ('blobs'), printings during variable time can still be chosen based on what is best for the next visits
 - OpimV4 only operated in greedy survey mode, only choosing next best pointing.
- Scripts == deep drilling, revisit field for second pair, ToO, etc.
- Blobs == a set of pointings with high reward value that should take about 30 minutes to observe, which are then ordered to optimize path between observations. Creates 'regions' where the scheduler is observing, so that footprint is more contiguous.
- Greedy == choose a single pointing that is the best option for the next visit. Tends to lead to 'lines' of observations.

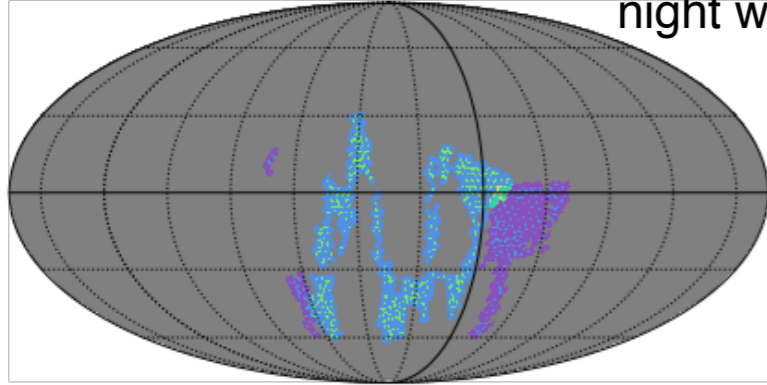


Compare a night

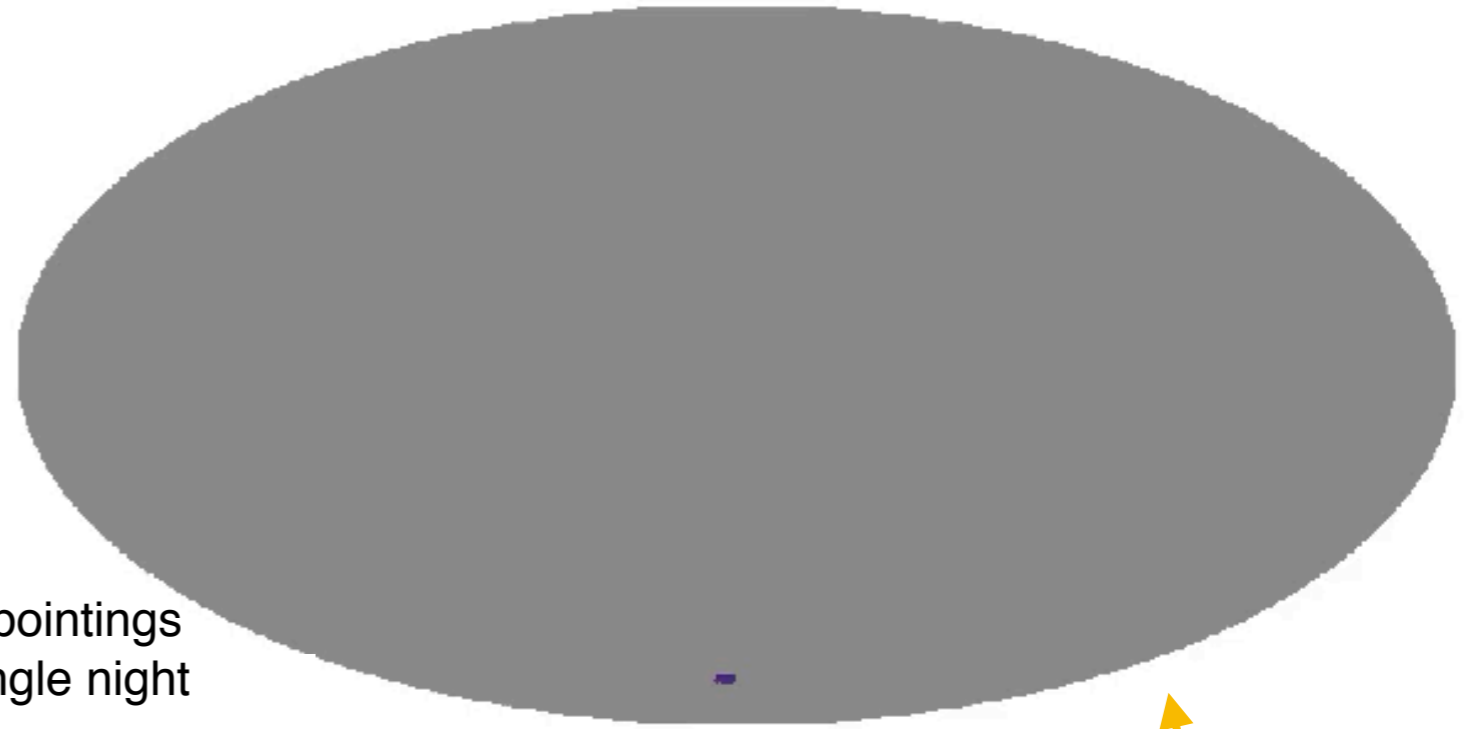


Footprint of one night with opsim v4

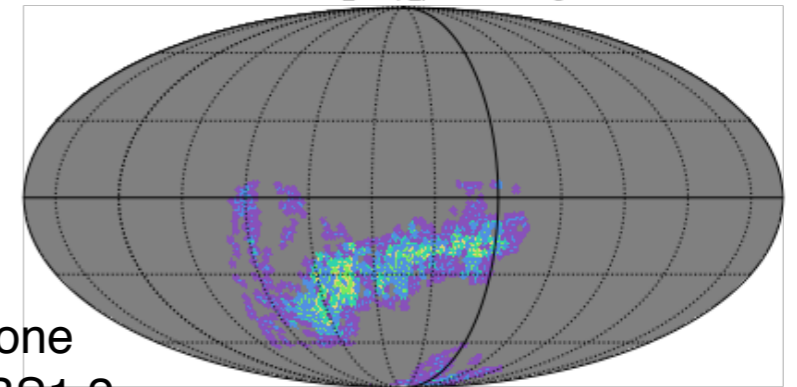
Visits baseline2018a night 31



Movies of pointings within a single night

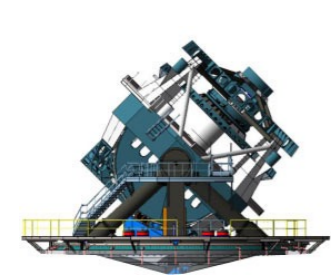


Visits baseline_2exp_pairsame night 31



Footprint of one night with FBS1.2



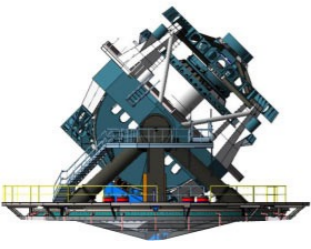


From the old Scheduler (v4) to the new (FBS)

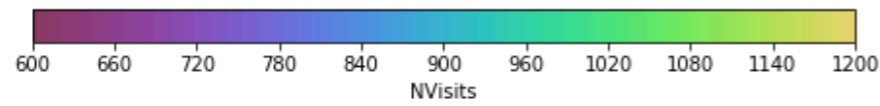
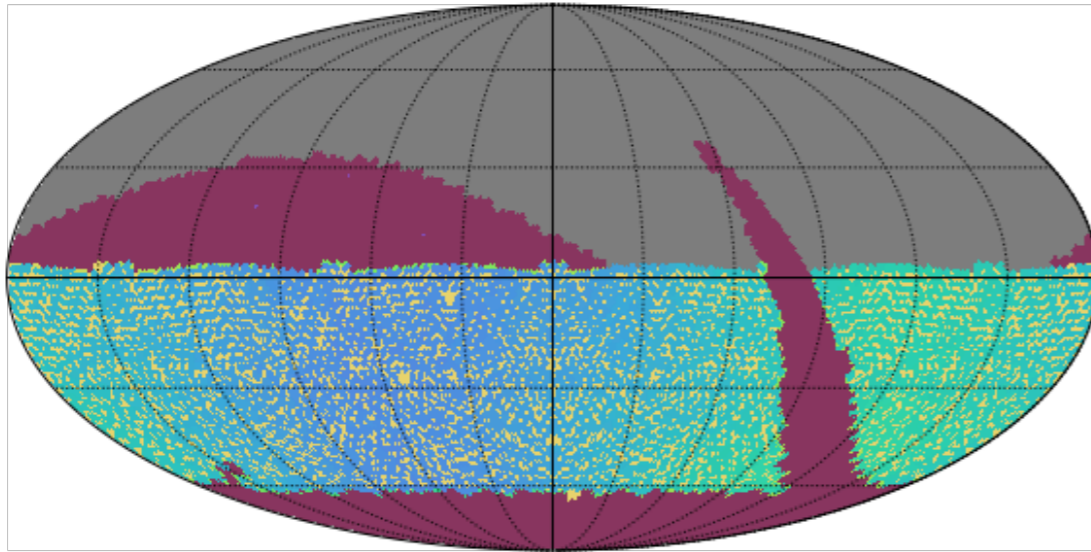


- baseline2018a: the last baseline LSST survey simulation created with opsim v4 (“the old scheduler”)
 - `baseline2018a`
- baseline_2exp_pairsame_10yrs: the most closely equivalent baseline simulation with the Feature Based Scheduler (FBS) (“the new scheduler”)
 - `baselineNew`

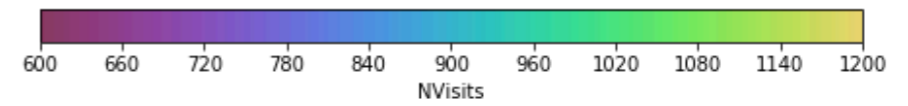
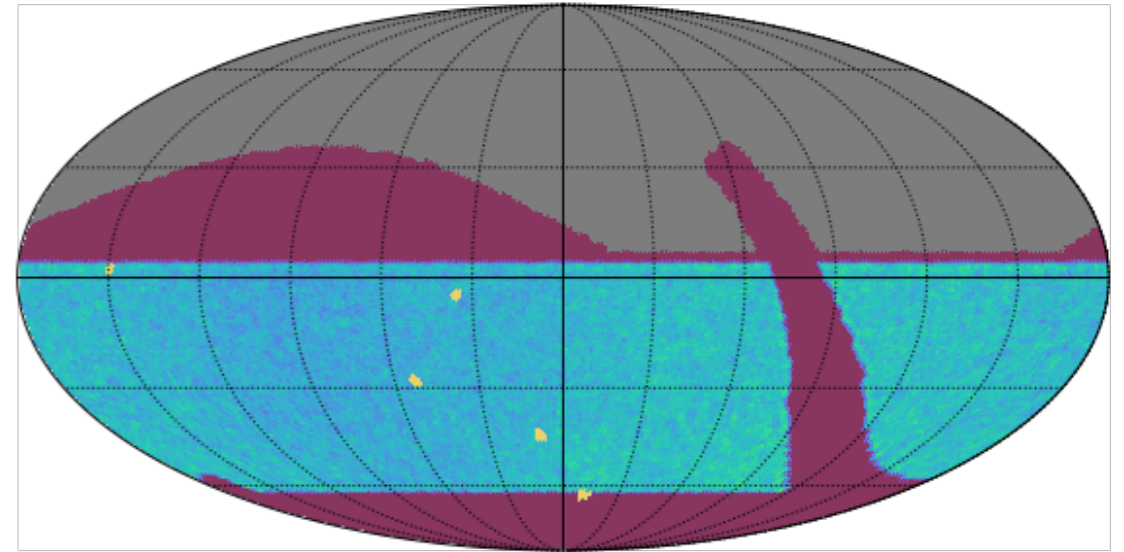
baseline2018a -> baseline_2exp_pairsame ('New')



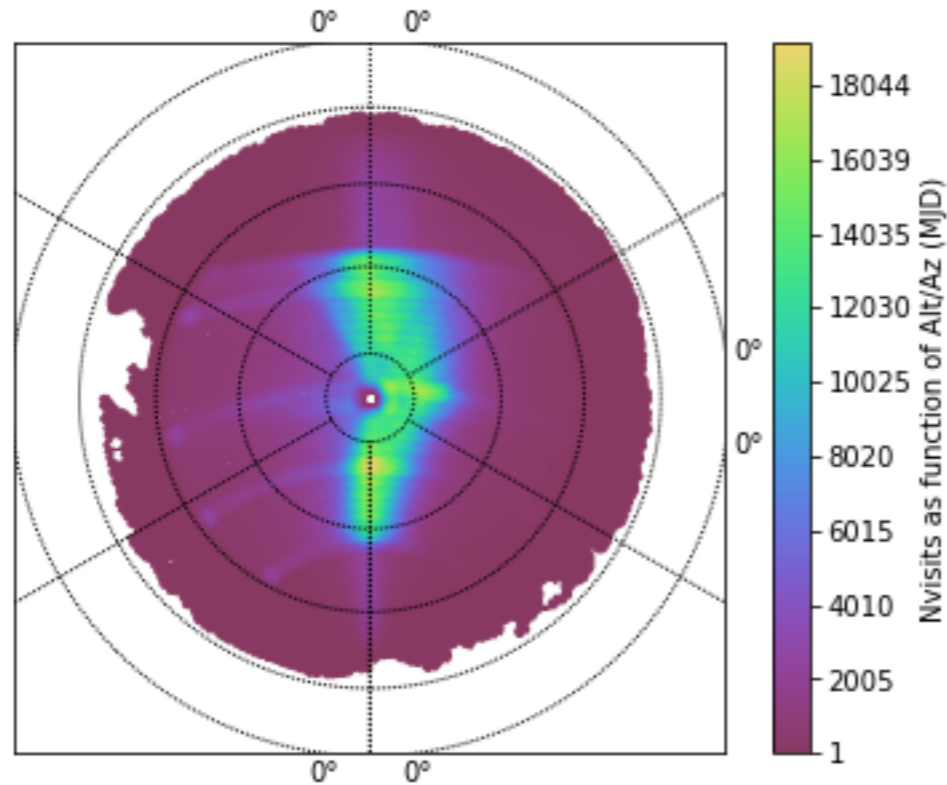
baseline2018a NVisits (All bands)



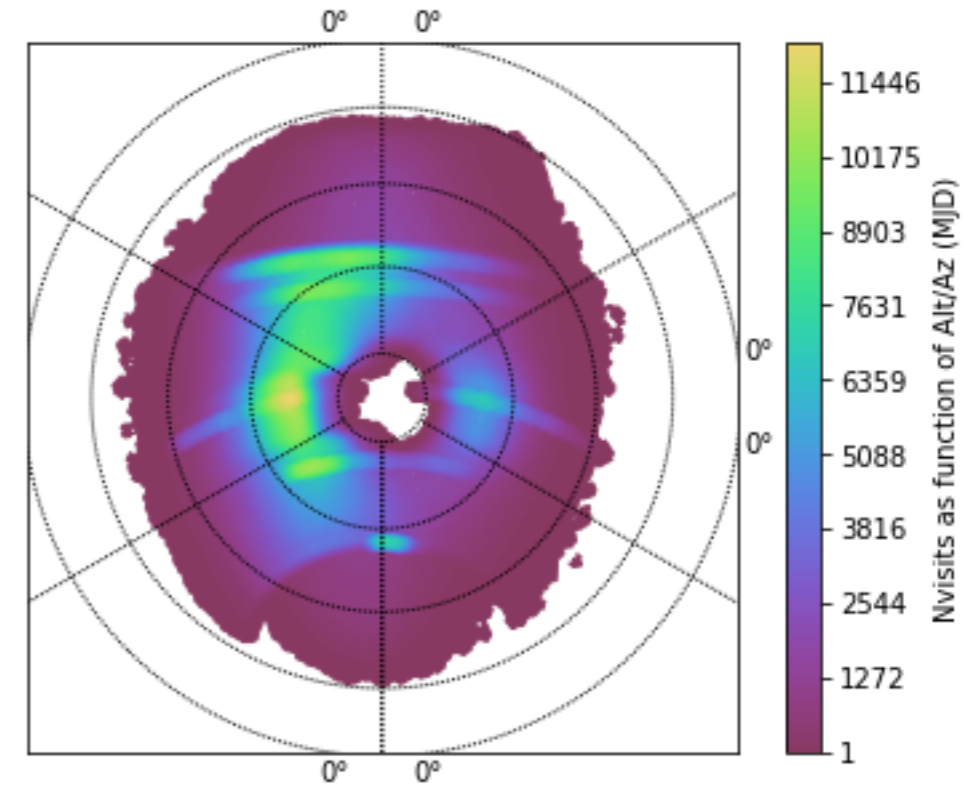
baselineNew NVisits (All bands)



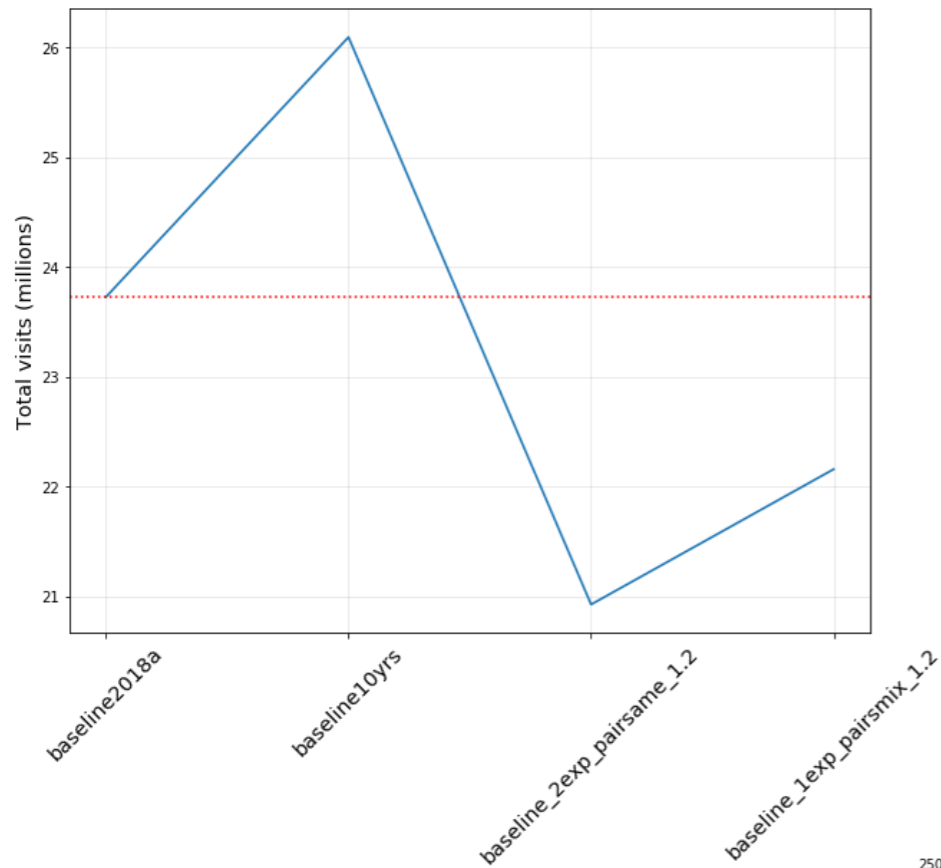
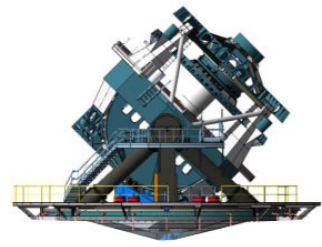
baseline2018a all bands: Nvisits as function of Alt/Az



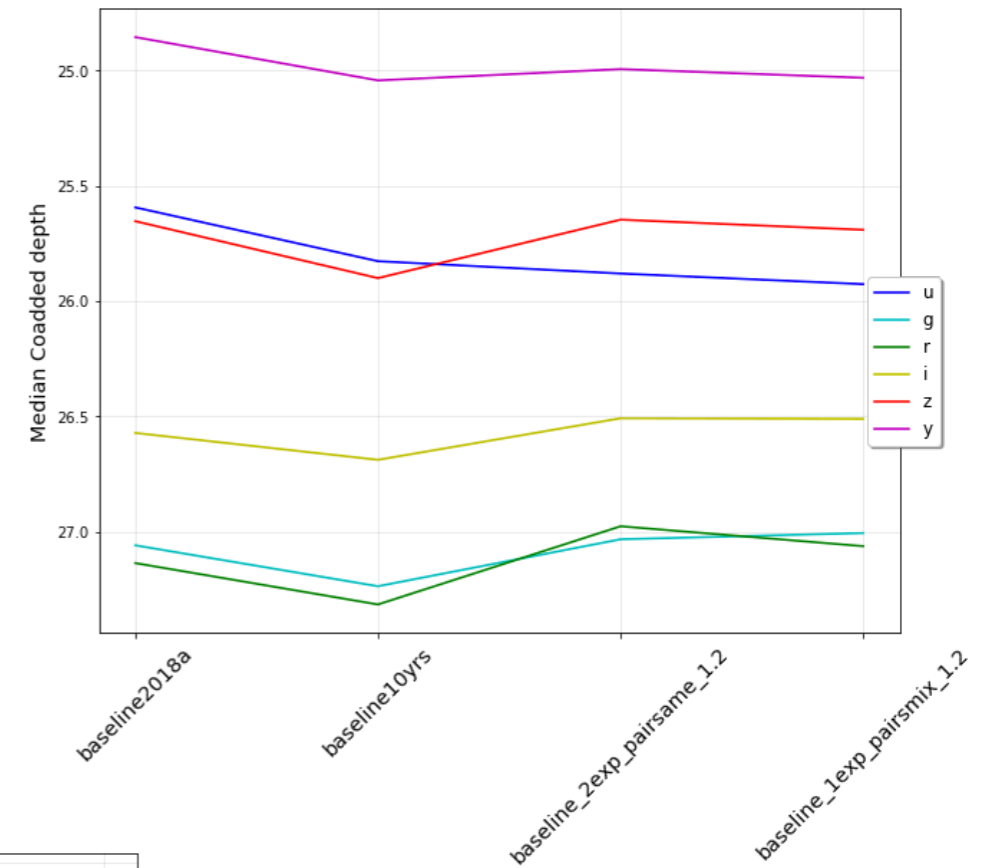
baseline_1.2 all bands: Nvisits as function of Alt/Az



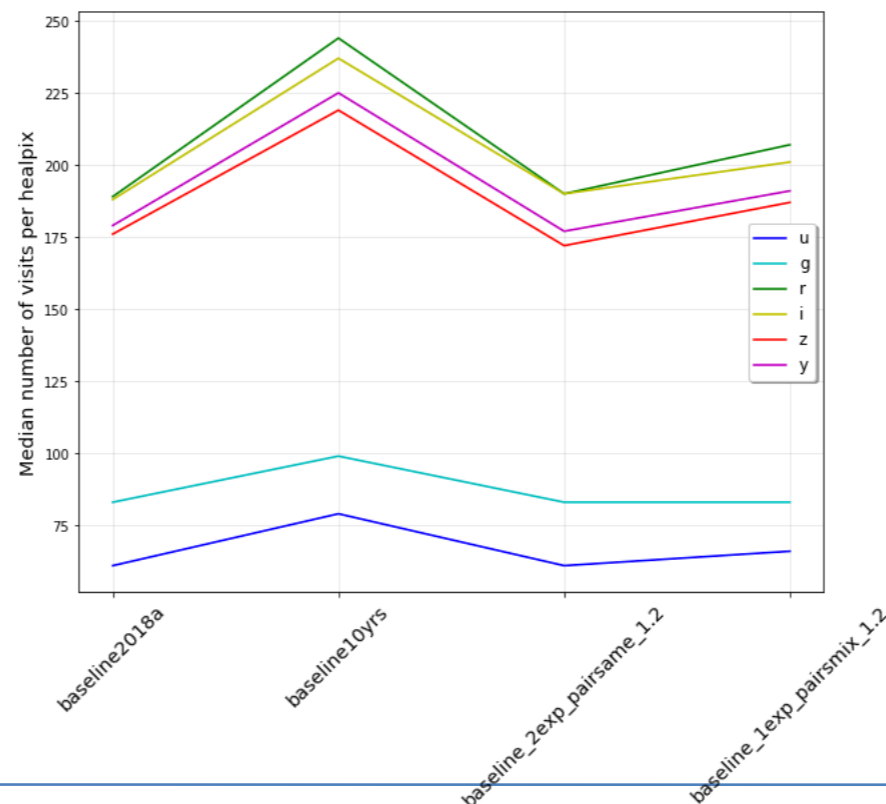
baseline2018a -> baselineNew



opsim v4 (baseline2018a)
 ->
 FBS 1.1 (baseline10yrs)
 ->
 FBS 1.2 (*_1.2)



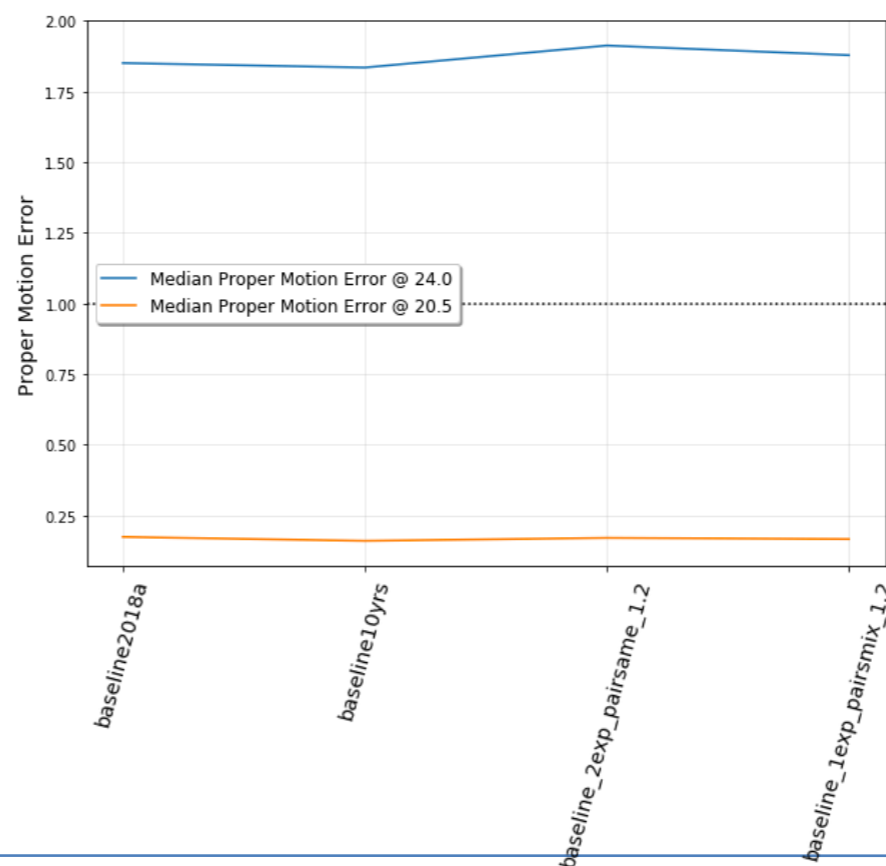
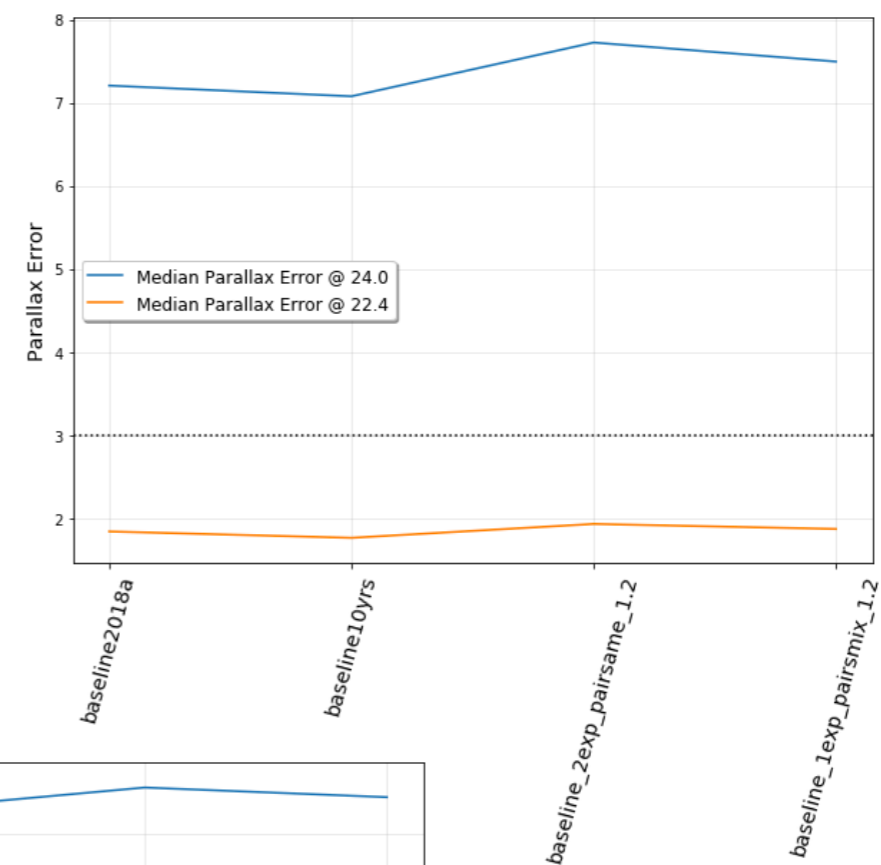
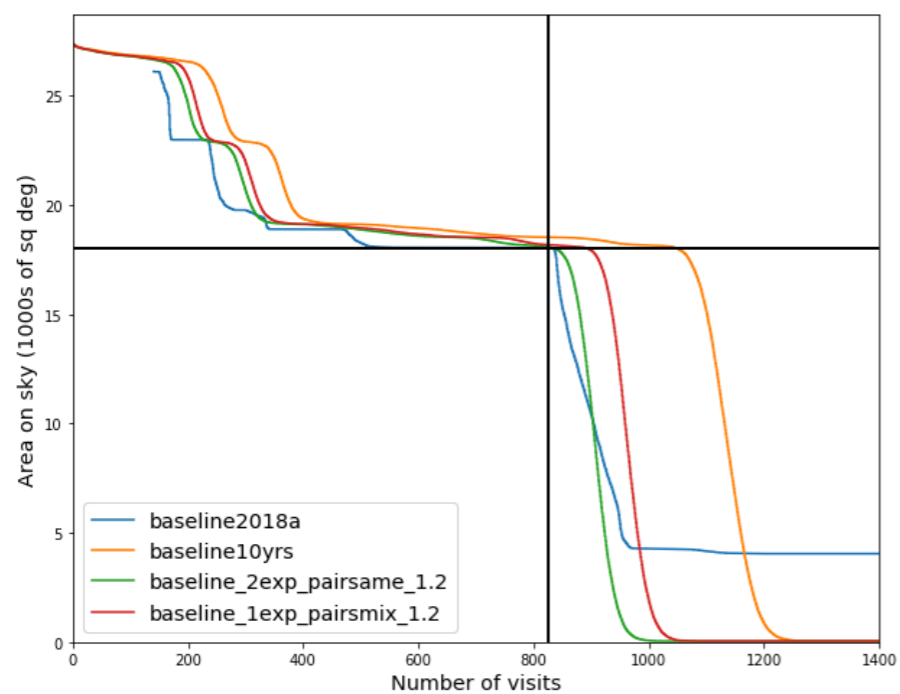
Note that the total number of visits drops when we reach FBS 1.2 runs (baseline_2exp_pairsame_1.2) because we added much more downtime due to weather. So - FBS improves compared to opsimv3, but weather decreases overall performance at FBS v1.2

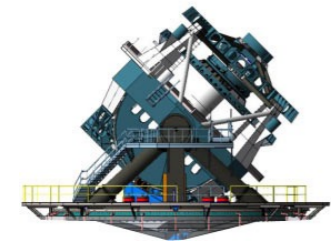


FBS v1.2 included new filter throughput curves that improved throughput in the u band.



baseline2018a -> baselineNew





baseline2018a -> baselineNew

