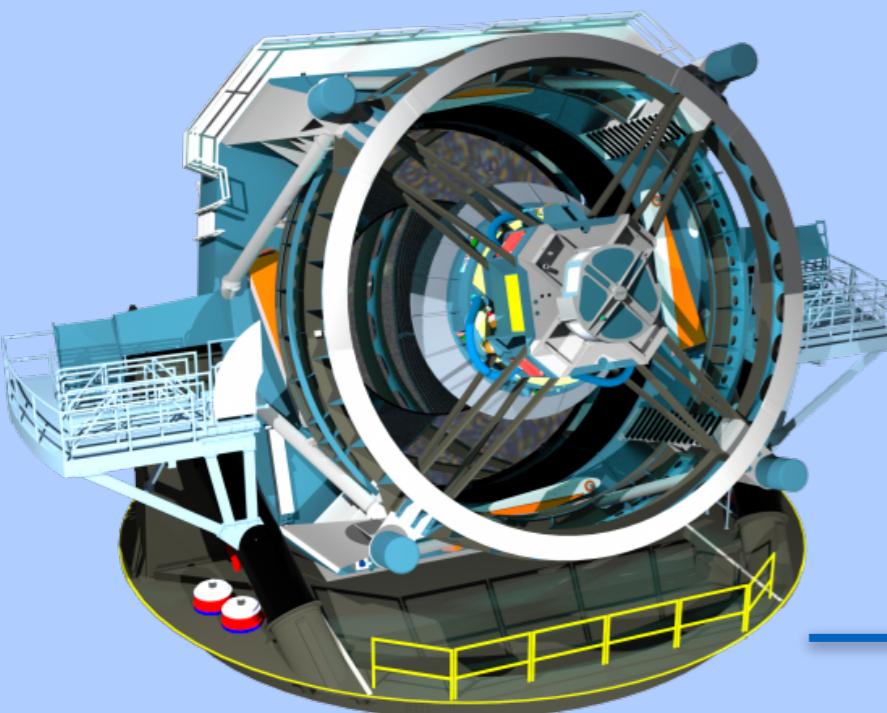


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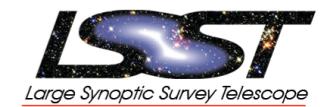
# LSST OpSim and MAF

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[lynnej@uw.edu](mailto:lynnej@uw.edu)  
@lynne73

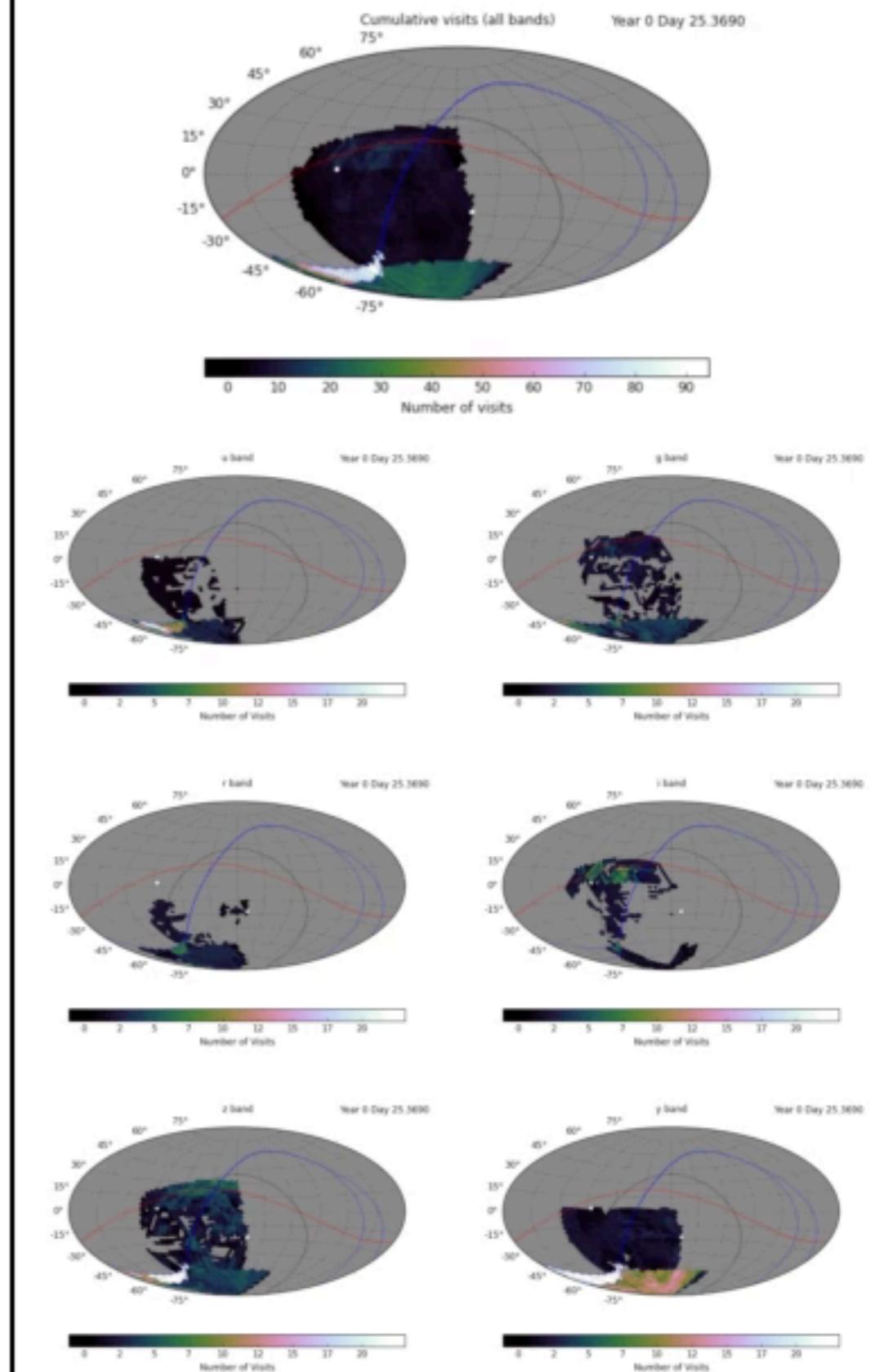
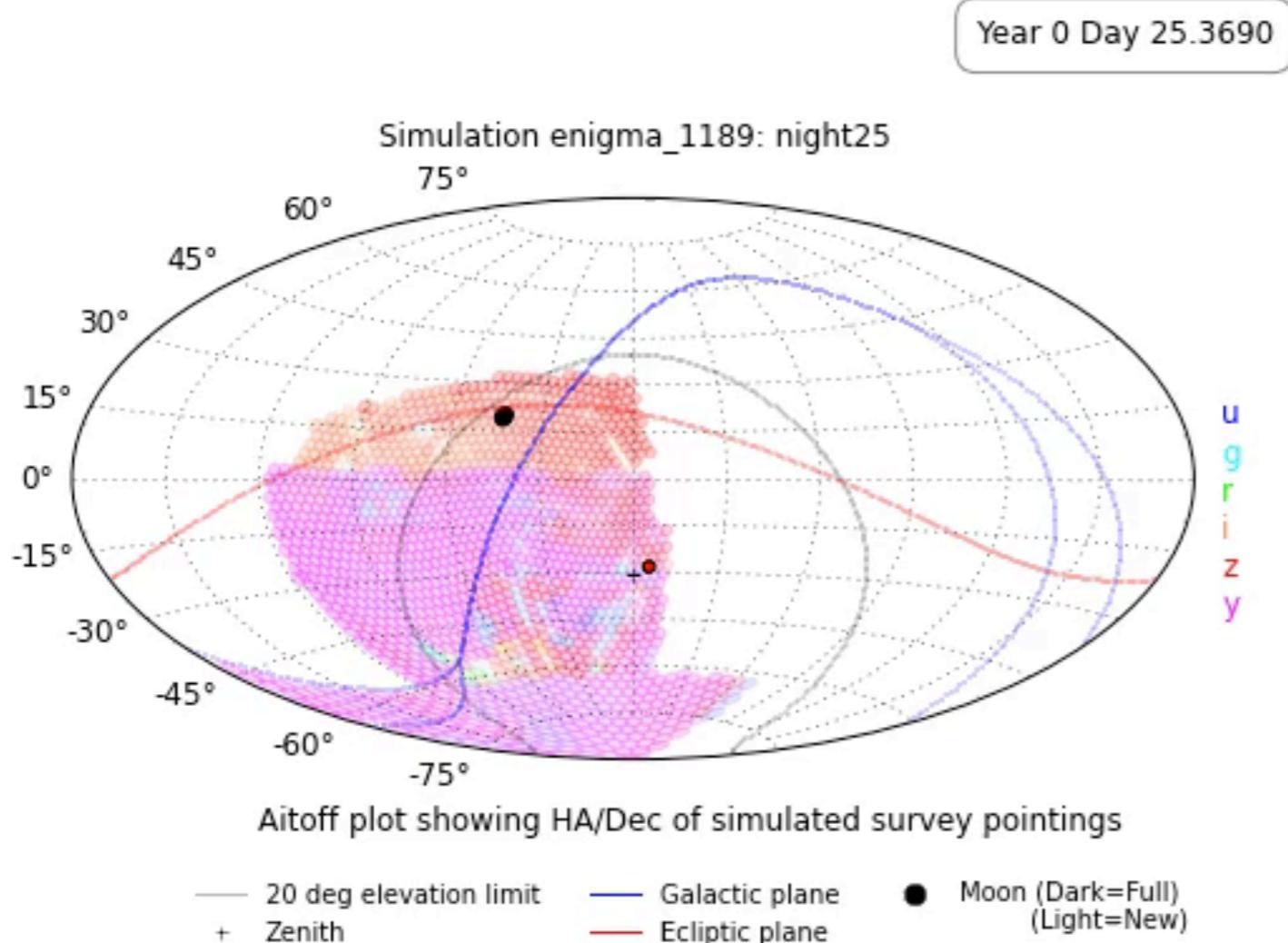
LSST TVS roadmap workshop  
3/24/2016



# Opsim and simulated lsst surveys



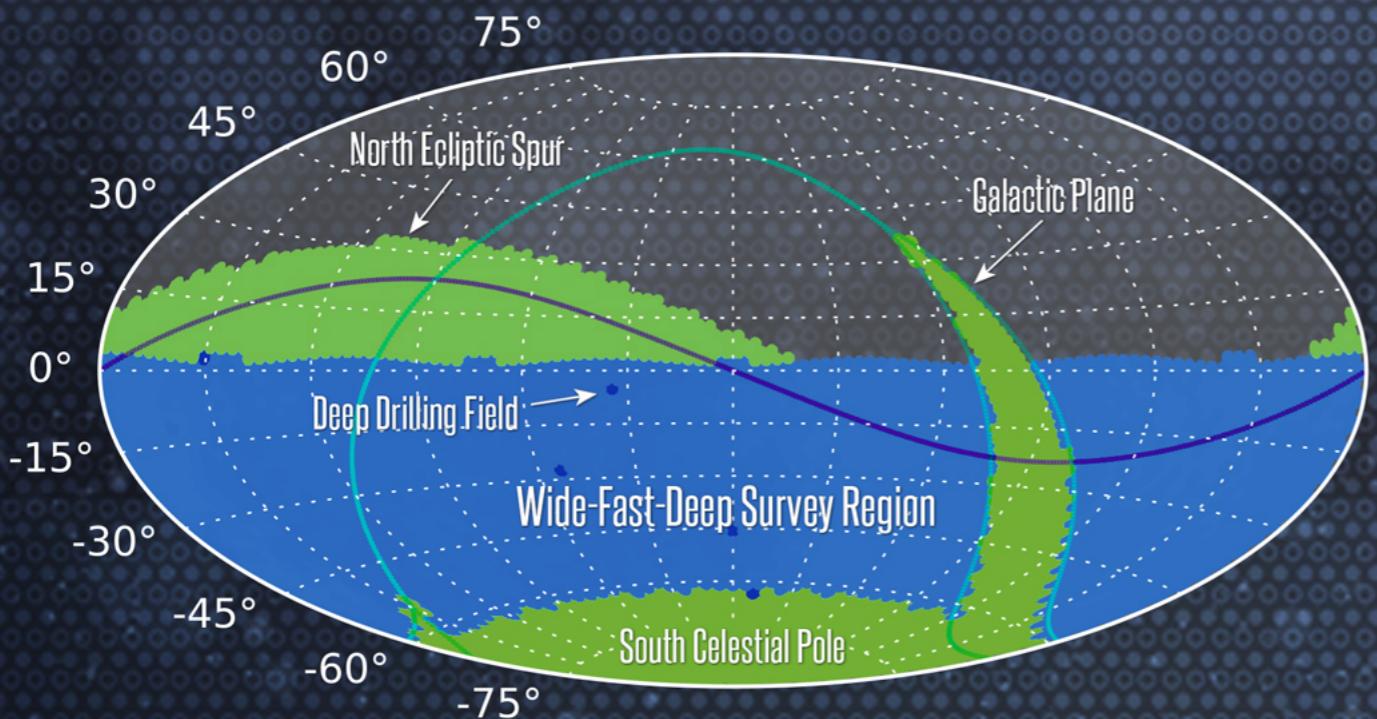
- OpSim (Operations Simulator) generates a simulated pointing history for the 10 years of LSST operations
  - Realistic weather conditions (seeing, skybrightness, cloud cover)
  - High fidelity telescope model (slew time, filter change time, pointing limits, scheduled downtime)
  - + Scheduler



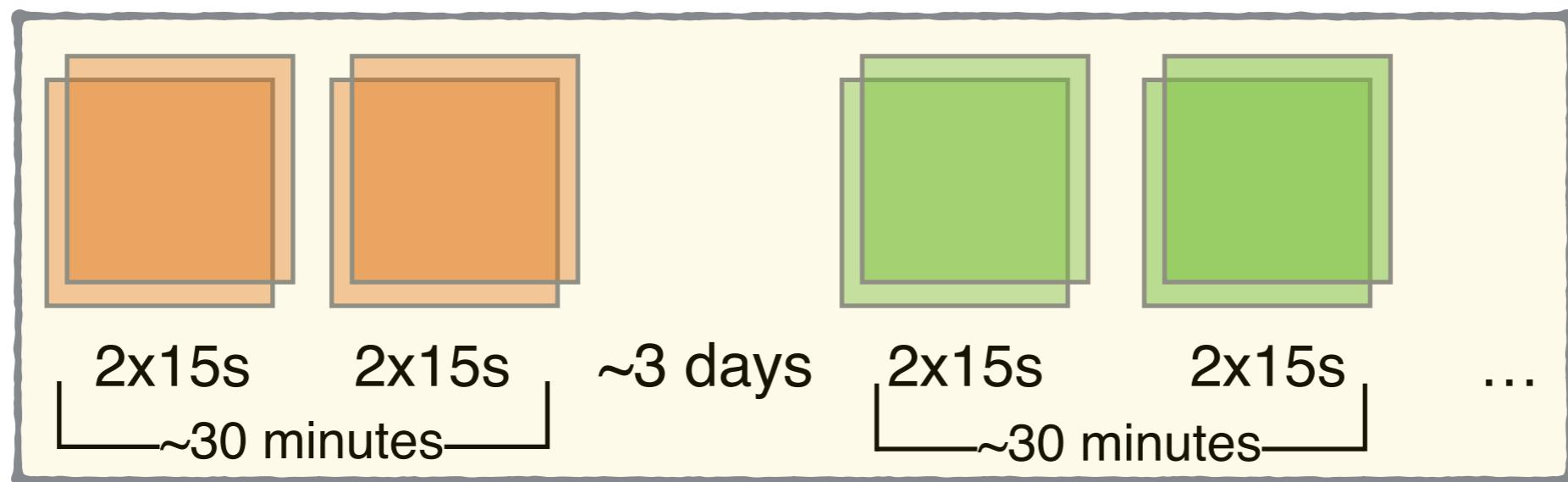
Pointing history with time, ra/dec, filter, seeing, skybrightness, m5 limit

# Number of Visits

(all-band, 10 years)

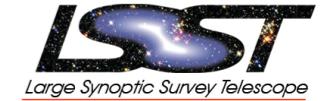


	<i>u</i>	<i>g</i>	<i>r</i>	<i>i</i>	<i>z</i>	<i>y</i>
# visits	70	100	230	230	200	200
m5 depth	23.6	24.8	24.4	24.0	23.3	22.4



# MAF - analyze opsim results and improve cadence

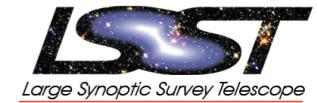
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- MAF is an open source, python framework designed to make it easier for the community to analyze “how well is a particular opsim simulated survey addressing my science?”
- We gather metrics in a standard framework, run them on all simulated surveys and tests of new cadences

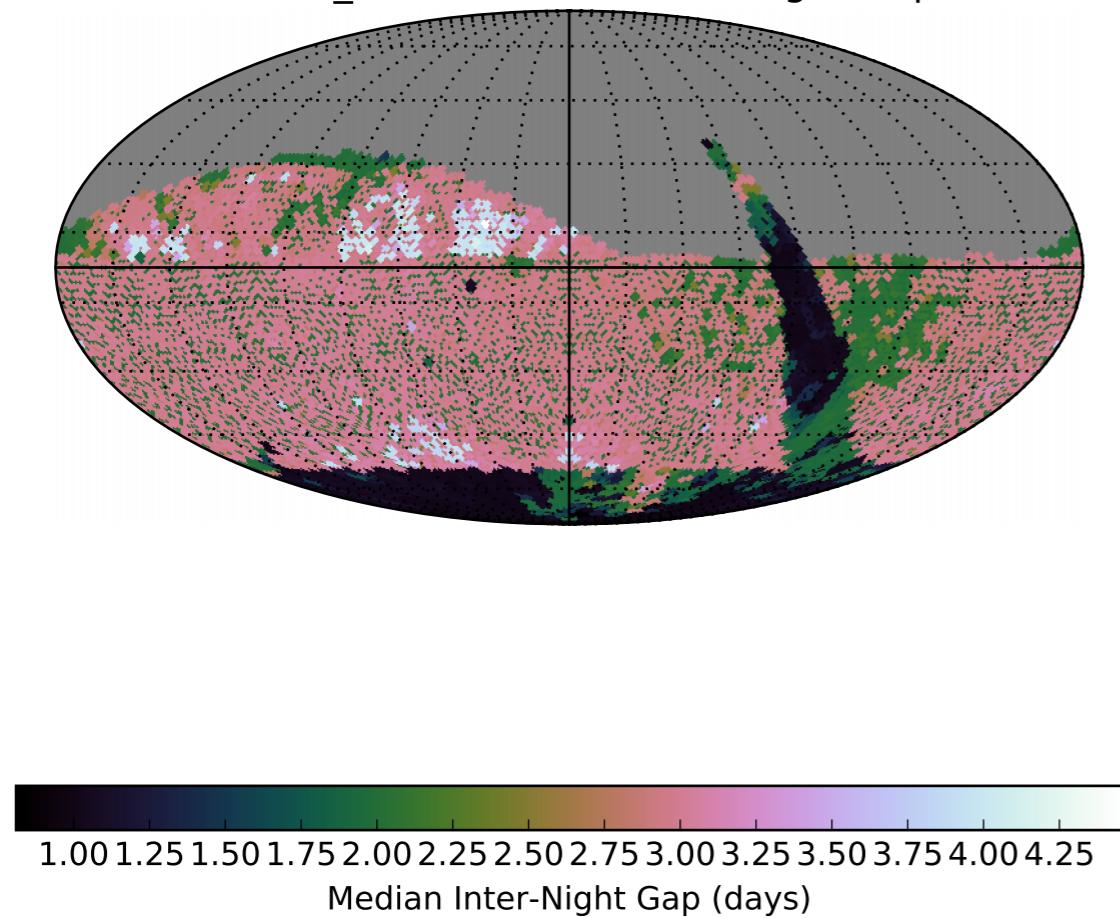
# Example of MAF analysis

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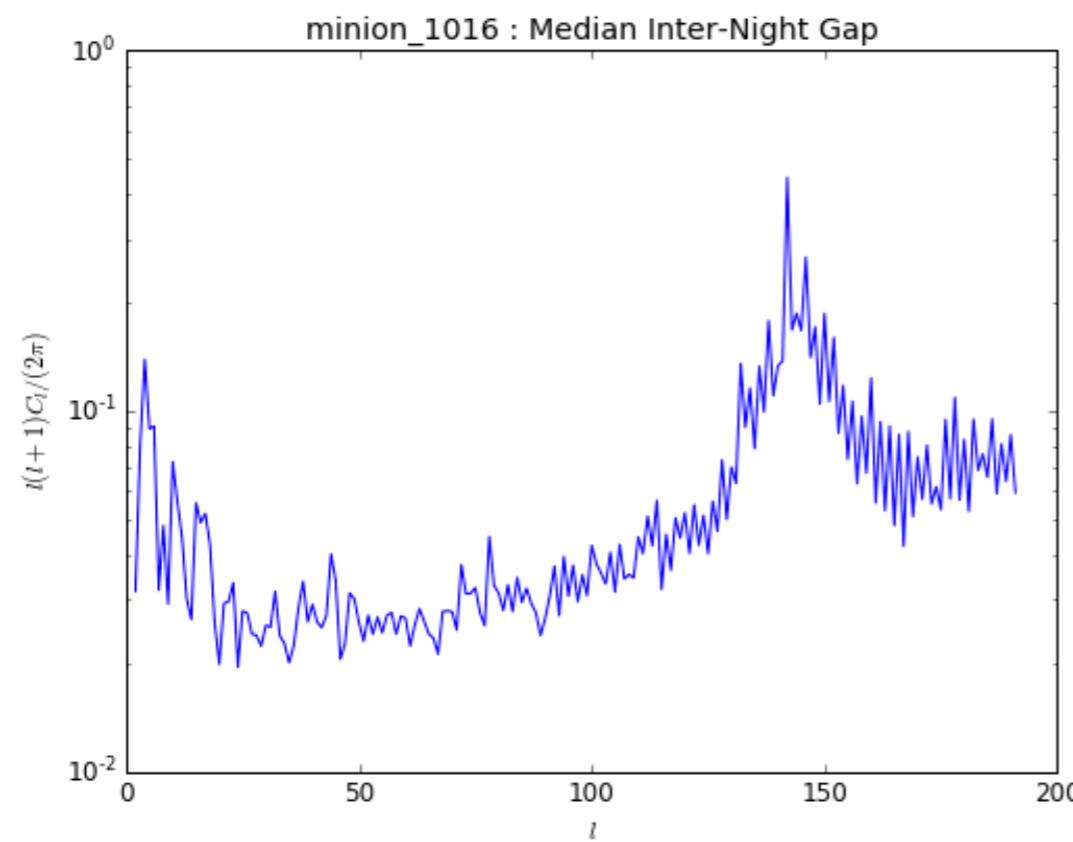
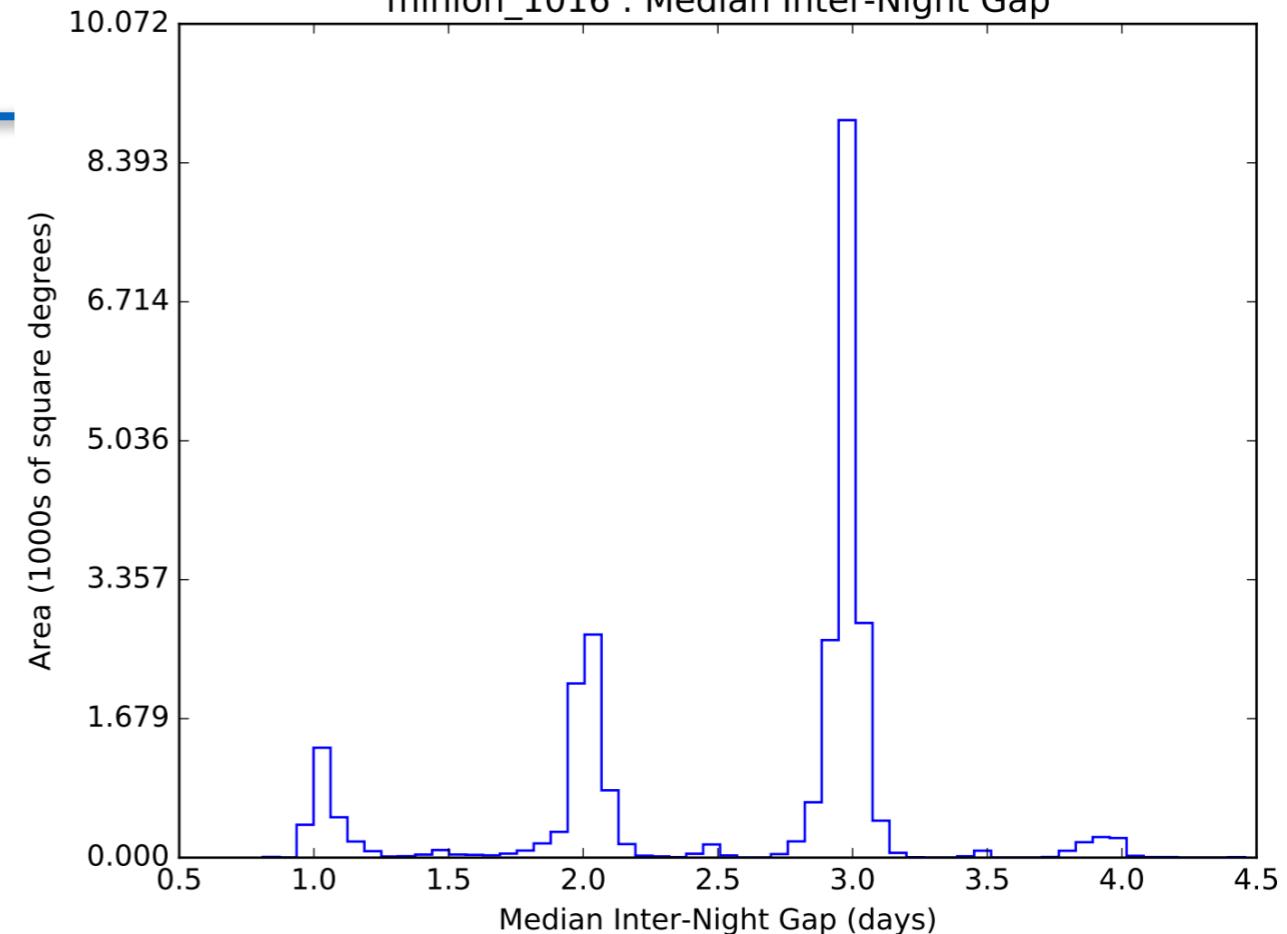


- A simple example: what is the median gap between nights of observations? (at a given RA/Dec)
- MAF takes care of reading the visits from the opsim sqlite database output, pulling out visits which overlap each RA/Dec value (in turn), and passes these particular visits to your <metric>. It takes the values calculated at each RA/Dec value, and makes plots. You can also calculate ‘summary values’.

minion\_1016 : Median Inter-Night Gap



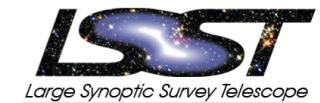
minion\_1016 : Median Inter-Night Gap



Plots:  
‘skymap’, histogram, powerspectrum.

‘summary values’ examples:  
mean value across the sky or rms

# Use existing metrics or write your own



- Many metrics are very configurable - run existing code with your own specifications
  - See “Introduction Notebook” (and others) in MAF tutorials
  - [https://github.com/LSST-nonproject/sims\\_maf\\_contrib/tree/master/tutorials](https://github.com/LSST-nonproject/sims_maf_contrib/tree/master/tutorials)
- Writing your own metric is intended to have a low barrier
  - Standard API for <metrics>, just plug and play into framework.
  - See the “Writing a new metric” notebook in MAF tutorials

```
class InterNightGapsMetric(BaseMetric):
    """
    Calculate the gap between consecutive observations between nights.
    """

    def __init__(self, timeCol='expMJD', nightCol='night', reduceFunc=np.median,
                 metricName='Median Inter-Night Gap', **kwargs):
        """

        """

        units = 'days'
        self.timeCol = timeCol
        self.nightCol = nightCol
        self.reduceFunc = reduceFunc
        super(InterNightGapsMetric, self).__init__(col=[self.timeCol, self.nightCol] ,
                                                units=units, metricName=metricName, **kwargs)

    def run(self, dataSlice, slicePoint=None):
        dataSlice.sort(order=self.timeCol)
        unights = np.unique(dataSlice[self.nightCol])
        if np.size(unights) < 2:
            result = self.badval
        else:
            # Find the first and last observation of each night
            firstOfNight = np.searchsorted(dataSlice[self.nightCol], unights)
            lastOfNight = np.searchsorted(dataSlice[self.nightCol], unights, side='right') - 1
            diff = dataSlice[self.timeCol][firstOfNight[1:]] - dataSlice[self.timeCol][lastOfNight[:-1]]
            result = self.reduceFunc(diff)
        return result
```

## Example code for a <metric>

Testnotebook (play with jupyter notebook)

Introduction Notebook (what are <slicers> and <metrics>)

Science example (including some ideas about what metrics can be)

Other tutorials:  
stackers, other slicers, dithering, writing a new metric

[http://github.com/lsst-nonproject/sims\\_maf\\_contrib](http://github.com/lsst-nonproject/sims_maf_contrib)

Support?  
<http://community.lsst.org>  
github issue @ sims\_maf\_contrib  
[lsst-imsim@lsstcorp.org](mailto:lsst-imsim@lsstcorp.org)  
[lynnej@uw.edu](mailto:lynnej@uw.edu), [yoachim@uw.edu](mailto:yoachim@uw.edu)