Throughput models in the Catalogs Simulation Framework

The package named 'throughputs' contains models for the system response curves of several different instruments, as well as models for transmission through the atmosphere. After running

```
source loadLSST.sh
setup throughputs -t sims
```

to setup the stack, several environment variables will be set up to tell the stack where throughput information is stored, these can all be seen using the comment

```
printenv | grep "THROUGHPUT"
```

The sub-directories of the throughputs package are all very well-documented already. We reproduce the README files from each sub-directory here for the sake of ease.

To see a discussion of spectral energy density models, see this page.

throughput/

For "normal" LSST baseline evaluations, use the files in "baseline".

y4 is (for now) being used as the baseline y filter, so is also linked to simply 'y' in this directory. Note that while this is our current baseline performance, it represents our current idealized view of LSST behavior and does not include degradation of performance over time or with various contaminants.

For SRD evaluations of limiting magnitudes where X=1.0 is the desired atmosphere, use srd-1777. This collection is identical to the baseline set, except for the atmosphere added to the total throughput (thus total throughput and atmosphere are different).

The files in 'imsim' are related to the throughputs used in the imsim simulations. The 'goal' directory holds the throughputs used as goals for imsim development at the time of tagging (of this SVN directory), and the 'actual' directory holds the imsim actual throughputs, at the current time (as this is imported from the imsim directory).

Megacam and sdss should be self-explanatory, but hold total system throughputs for megacam and SDSS, as published by those telescopes.

The directory 'atmos' contains various airmass atmospheres.

More information is available in README files within each directory.

If you are only concerned with calculating expected magnitudes for LSST in various bandpasses, then you really only need the 'baseline' throughputs.

throughputs/atmos/

v1.0 atmospheres from David Burke, MODTRAN, March 1, 2010.

The atmospheres here were produced with MODTRAN by David Burke to conform to typical conditions expected at LSST's site at Cerro Pachon.

Each atmosphere has similar ratios of water vapor, ozone, and scattering components, but different airmasses --- the airmass is represented by the number at the end of the filename. For example: atmos_10.dat is a 1.0 airmass atmosphere, while atmos_25.dat is a 2.5 X atmos.

atmos_std is a 'special' atmosphere that has been used to represent LSST's standard accepted atmosphere, and comes from observational data. It has slightly different components than the other atmospheres here, but is very similar. It should be equivalent to the atmos_12.dat throughput.

atmos_12_hiwater.dat and atmos_12_lowater.dat are attempts (by Lynne Jones) to take the modtran outputs from David Burke and use these to munge a 30% higher and lower water component. These were created by taking the 1.0 and 1.6 airmass atmospheres and using the water components from those atmospheres instead of the water component from the 1.2 airmass atmosphere. (this should probably be redone properly with MODTRAN).

throughputs/baseline/

From Docushare collection 1777, v1.0, March 2010.

Updated from Docushare Collection 1777, March 2012. This update includes an update to the detector & the mirror surfaces.

The throughput curves in this directory should be considered 'baseline' for the current behavior of LSST.

Note that these throughput curves are subject to change as our knowledge of the LSST systems improve and prototypes become available.

- m1.dat, m2.dat, m3.dat represent the current mirror throughputs used in the SRD.
- lens1.dat, lens2.dat, lens3.dat represent the current lens throughputs ""
- detector.dat is the current detector sensitivity in the SRD.

filter_u / g / r / i / z / y. dat represent the current filter (filter only!) throughput curves used in the SRD. Note that y = y4 is the current baseline filter.

atmos_std.dat is the standard atmospheric bandpass at X=1.2

total_*.dat throughput curves represent the combination of all components in the LSST system - mirrors, lenses, filter, detector, and the zenith atmos_std.dat atmosphere.

All curves are in nanometers, with throughput represented by a number between 0 and 1.

throughputs/imsim/

This directory contains the throughput curves represented by the imsim images.

The 'goal' directory contains the curves that the imsim is currently attempting to match. Because the imsim uses physics to reproduce some of these curves (such as the detector) the output from imsim's raytrace code will not match these curves exactly, but should be close.

Because of the need to match code to actual throughput, rather than just being able to substitute a different file, the imsim will potentially lag behind the current "baseline" or various development curves. (thus the reason for this collection).

The 'actual' directory contains throughput curves produced by raytrace's efficiency.pro tool, which represent the actual throughput resulting from the image simulator.

The actual raytrace code output will differ from the goal curves due to:

- atmosphere (imsim raytrace uses its own simulated atmosphere, and does so in a series of screens)
- filter throughput (raytrace uses the actual incident angle of the photons to predict how they will travel through the filter, rather than just the response averaged over a variety of incident angles - which is what is represented in these single curves - they are averaged to an incident angle of about 14 degrees)
- detector sensitivity (raytrace simulates the detector's response to photons, along with various coatings on the detector surface).

throughputs/megacam/

Megacam filter throughput curves http://www2.cadc-ccda.hia-iha.nrc-cnrc.gc.ca/megapipe/docs/filters.html

throughputs/sdss/

SDSS throughput curves from http://www.sdss.org/dr3/instruments/imager/index.html#filters

Return to the main catalog simulations documentation page