JointCal Acceptance Tests

This document describes the procedure for validating the first non-beta release of the `jointcal` package as a replacement for `meas_mosaic`. Longer term requirements for `jointcal` are described in a separate document (draft here). Because `meas_mosaic` only runs on Hyper Suprime-Cam data, the scientific performance tests here are also focused on HSC data. The `jointcal` beta already supports additional cameras and we expect it to continue to do so, but as there's nothing to replace for other cameras there are no short-term requirements for its performance on them.

Basic Requirements

- `jointcal` shall be runnable as a command-line `Task` that takes the `src` and `ref_cat` datasets as input and produces (at least) a `wcs` and `photoCalib` dataset as outputs, which provide updated astrometric and photometric calibrations.
- `jointcal` shall perform a different fit for each tract, and allow multiple tracts to be run in single invocation (at least in serial, which is all `meas_mosaic` does). Some visits may thus be processed with multiple tracts.
- `jointcal` shall fit models that have a level of sophistication similar to those in `meas_mosaic` (if it fits simpler models, it will be because the tests below demonstrate that they are sufficient to generate similar-quality results). That involves:
  - astrometry: a full-focal-plane polynomial transform for each visit composed with a rotation and translation for each CCD (which is the same for all visits in the fit).
  - photometry: a full-focal-plane polynomial scaling for each visit multiplied by a constant scaling for each CCD (which is the same for all visits in the fit) and the determinant of the Jacobian of the astrometric model.

Science Quality Tests

As of ~~DM-10728~~ - Near-term jointcal acceptance: make jointcal and meas_mosaic use the same output formats DONE and ~~DM-10729~~ - Near-term jointcal acceptance: make validate_drp use meas_mosaic outputs DONE, the `validate_drp` package can now (optionally) utilize the `wcs` and `photoCalib` datasets to calibrate the `src` dataset prior to computing its astrometric and photometric accuracy metrics. To replace `meas_mosaic`, we require `jointcal` to match (no significant difference in metric value) or improve upon the following metrics as computed with `meas_mosaic` on HSC data.

- AM1, AF1 (astrometric accuracy and outlier fraction on 5 arcmin scales).
- AM2, AF2 (astrometric accuracy and outlier fraction on 20 arcmin scales).
- Median astrometric RMS (left plot of `validate_drp`'s `check_astrometry` plot).
- PA1 (astrometric accuracy).
- Median photometric RMS for SNR>100 (upper-left plot of `validate_drp`'s `check_photometry` plot).

No significant difference is a bit tricky to define here because most of these metrics are not accompanied by uncertainty estimates; to estimate them we'll use the RMS of the `meas_mosaic` metric (henceforth) results over different tracts of HSC Wide. Differences less than 0.1 mmag for photometry or 0.1 mas for astrometry (even if larger than the cross-tract RMS, though I doubt the RMS across tracts will be that small) can also be ignored.

We will run the metric comparison independently on each of at least 19 tracts of HSC-SSP Wide data, as well as the (single tract) HSC-SSP UDeep COSMOS dataset. No more than 1 of these 20 tracts shall have a regression from the meas_mosaic performance in that tract by more than 2, and none may deviate by more than 3. The number of tracts may be extended if initial failure to achieve these rates appears to be due to statistical fluctuations.

The WCS mappings and photometric scalings output by meas_mosaic and jointcal should also be manually inspected for at least 5 visits in each of 5 tracts (including COSMOS) to look for unusual differences.

Doing the Work

Scheduling work is obviously a T/CAM responsibility, but it may be best to try to share the generation of the input data repositories for these tests with re-run of the full HSC-SSP PDR1 (NCSA may have already scheduled some time for this later this cycle).

Scientific validation of the results is the responsibility of the Pipeline Scientist.