Req 5.5.3

Title:

Rotator Plate Positioning and Telescope Tracking

Objective:

Verify that the rotator performs properly and simultaneously that the telescope is tracking correctly.

Up to Zenith distances of 60 degrees and wind speed of 18 m/s with a dynamical component of 30%, the free tracking of the telescope shall be better than 0.2 arcsec rms. With closed-loop autoguiding, the rms deviation shall not exceed 0.05 arcsec

Two kinds of image deformations will be inspected.
First, check at various telescope positions the global performance of the rotator plate which is driven by the pointing model. When the rotator plate is not performing optimal, the objects are *elongated* in a circular pattern (concentric rings) with the rotator plate axis at the center. This inspection is done using **req. 554** *PSF Anisotropy*.

Second, check for the tracking of the telescope to find functional dependency with telescope position. This is purely a verification. As an internal check, do this for each **OmegaCAM** observing mode. This inspection is also done using **req. 554** *PSF Anisotropy*. When the telescope is not tracking correctly the shapes of stellar objects are systematically elongated. The amount of elongation may not exceed a certain value, corresponding to the basic tracking requirements given above.

The offset information from the Guider CCD's is another element in the functional check. When offsets for guide stars are becoming too large, rotator plate errors or telescope tracking errors are apparent as different patterns of offsets during an exposure time.

Positional information on single objects can be determined at 0.02 arcsec rms. Thus for a minimum of 100 objects the rms deviation of 0.2 arcsec rms for open-loop tracking and 0.05 arcsec for closed-loop autoguiding is readily available. A series of short exposures will give at least such numbers of objects for analysis, but longer exposures can yield as many as 100.000 objects for analysis allowing a higher signal to noise ratio for the determination of rotator plate and tracking errors.

Rotator plate determination should be carried out near zenith to allow for the largest field rotation possible during an observation. For moderate exposure

times of a few minutes the field rotation can be sufficient (several tens of degrees equals one tenth of a full rotation) to produce detectable errors to verify the required accuracy.

Fulfilling or fulfilled by:

Data reduction of standard science observations (almost all will do).

When performed/frequency:

Commissioning, at each change of the pointing model, in RP to be determined by experience. In CP check once with the ADC in and out.

Sources, observations, instrument configurations:

Most observations can be used.

Outputs:

Conformance flags
Source extraction files
Source extraction calfiles (configuration, parameters files)

Required accuracy, constraints:

VST requirements:
free tracking better than 0.2 arcsec r.m.s.
autoguiding tracking better 0.05 arcsec

Estimated time needed:

First method: 2 min, Second method: 0.01 sec.

Priority:

very important

Needed functionality:

see **req. 554** *PSF Anisotropy*

CA:

Run Recipe of **req. 554** *PSF Anisotropy*
Do an interactive analysis on the output **CalFile– 554**.

Note:
Inconsistent Rotator Plate motion can be detected by inspecting the systematic behaviour of stellar object elongation and position angle. The pattern of elongation/position angle reveals a concentric orientation when the rotator plate is not revolving correctly during an exposure. Furthermore, the elongation of stellar objects should progressively increase from the rotation axis of the plate outward. When this pattern is recognized at a significance level set by the

instrument (PSF anisotropy) a non-conformance flag should be raised.
solve f(Alt,Az) = h(Theta) : Theta $< 1'$

Inconsistent telescope tracking can be detected by inspecting the systematic behaviour of stellar object elongation. Therefore the objects shape parameters are inspected and the systematic behaviour of elongation parameters, e.g. position angle and elongation of the bounding ellipse are inspected. Whenever the ensemble of objects with a significant ($> 3\sigma$ elongation not equal 1 and a $> 3\sigma$ position angle not equal 0, where the two values are dictated by the known performance of the instrument (PSF anisotropy) a non-conformance flag should be raised.