
DC1 & DC2 Key Project SA3: Collection and reduction of astronomical data with LSST sensors

Objective: Astronomical data could provide important complementary information on astrometric and photometric precision achievable with the LSST sensors; these studies also could be used to evaluate the atmospheric contributions to the PSF, exposure time dependence, brighter-fatter and other sensor effects using real astronomical sources. Some of these studies cannot be done in the lab environment.

The configuration of the needed camera hardware, control and analysis software, and overall preparations for this KP will be aligned and coordinated as much as possible with the Camera Project, Calibration and DM teams, though most of the work will be done within SAWG.

The initial measurements will be performed with a single sensor camera (MonoCam) at the US Naval Observatory Flagstaff Station (NOFS) employing its 1.53 m telescope, which has a similar plate scale to LSST. The preliminary discussions on the measurement program and necessary interfaces have been started. The science grade data would need to be taken at a bigger telescope using a multiple sensor camera. An example of promising science that could be done with limited observation time would be the studies of weak lensing by massive clusters and groups of galaxies. Full scope of this KP will need to be discussed with interested analysis groups.

Deliverable SA3.1 (09/16) – DC1 DP: Astronomical data taken with MonoCam at NOFS.

Objective: Prepare a minimal camera configuration and take data.

Key Task SA3.1.1 (03/16): Prepare a single sensor with full chain readout, adapt the Project software for control and readout.

Key Task SA3.1.2 (03/16): Negotiate for observing time and prepare necessary interfaces at NOFS, including the filters. Install and test MonoCam.

Key Task SA3.1.3 (09/16): Develop a measurement program, take and reduce the data.

Deliverable SA3.2 (09/17) – DC2 DP: Analysis of MonoCam data

Objective: Perform analysis of the reduced MonoCam data.

Key Task SA3.2.1 (01/17): Astrometric and photometric calibrations. Use a selection of calibrated stars to estimate the ultimate precision achievable with LSST sensors.

Key Task SA3.2.2 (03/17): Validation of corrections for all static sensor effects including crosstalk and fringes.

Key Task SA3.2.3 (03/17): Development of the PSF parametrization and fitting algorithms. Studies of atmospheric and sensor contributions to PSF and spurious shear. Comparison to Phosim simulations.

Key Task SA3.2.4 (06/17): Studies of transients; dependence on exposure time; studies of BF effect, validation of BF corrections.

Deliverable SA3.3 (12/18) – DC3 DP: Science grade data taken with MonoCam

Objective: This activity will be based on earlier experience of sensor studies with MonoCam; the scope will need to be discussed with analysis WGs. A decision will be needed on the hardware configuration (single- or multi-sensor camera) and a larger telescope will need to be targeted.

Key Task SA3.3.1 (06/17): Prepare the camera, adapt the Project software for control and readout. Prepare proposal for observing time and necessary interfaces at a telescope, in particular need to understand if any corrector is needed and to decide on necessary filters. Install and test the camera.

Key Task SA3.3.2 (12/17): Develop a measurement program, take and reduce the data.

Key Task SA3.3.3 (12/18): Develop analysis code based on DM and analyze the data. Publish the results.

Key Project SA4: Studies of the CCD parameter space

Objective: CCD operation is controlled by complex sequences of serial and parallel clocks and several other signals/voltages. Their exact timing and amplitude during exposure and readout are critical for the correct functionality, for example to avoid tearing (disruptions in dark images, caused by accumulation of holes along the channel stops in the sensor) and image persistence (appearance of bright objects from an exposure in consequent exposures). They also affect the sensor properties in more subtle ways, causing trade-offs between various characteristics, for example readout time, cross-talk, noise, CTE (charge transfer efficiency) etc.; and the configurations could be optimized for improved performance. Operational parameter space and trade-offs require dedicated studies, which were done in the first pass by the Project but have not been completed. This work will be done in close cooperation with the Project.