THE PLATO SIMULATOR

MODELLING OF REALISTIC HIGH-PRECISION HIGH-CADENCE SPACE-BASED IMAGING

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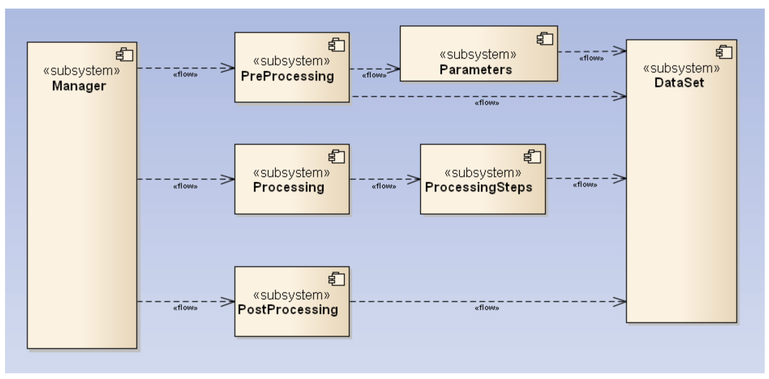
WHAT IS THIS?

The PLATO SIMULATOR is a software tool designed for the performance of realistic simulations of the expected observations of the PLATO mission.

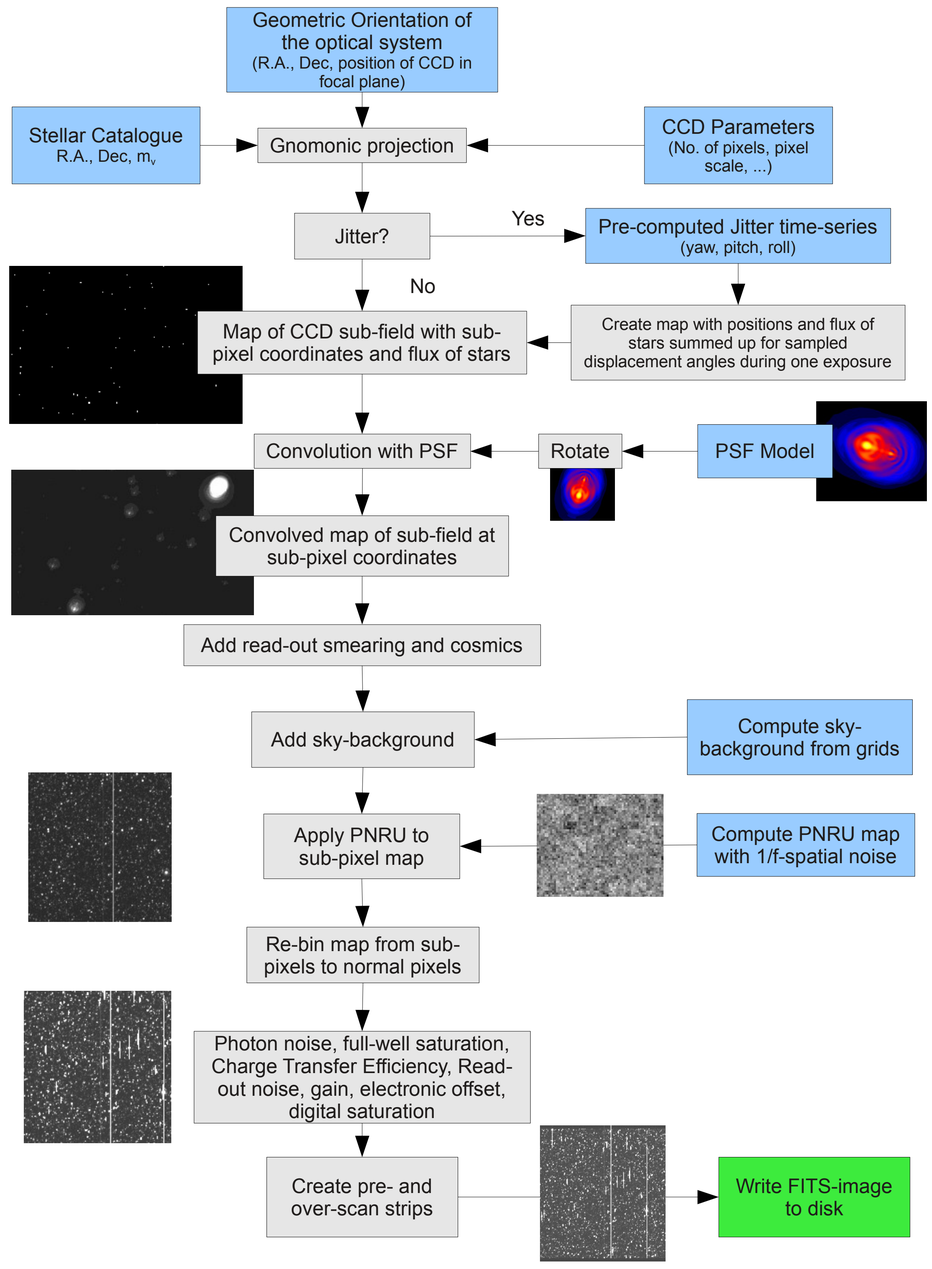
WHY IS IT NEEDED?

Do you have some hundreds of Meuros and want to launch a scientific space-mission? You better do some simulations first... You might not see what you were expecting!

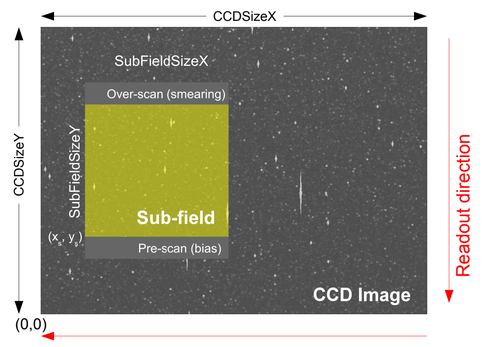


This simulator has been built under modularity principles in order to be generalized for the application to other space missions and other types of detectors. Each of the effects applied to generate a synthetic image are separated in a different module or "processing step".

METHODS

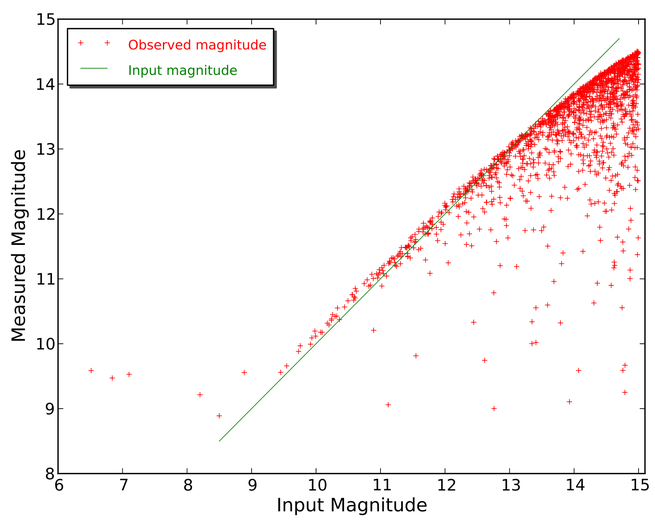


Several sources of noise for the instrument have been included and modelled. These include readout noise, read-out smearing, full-well saturation, and digital saturation. These have been modelled in the same way as described in [1].

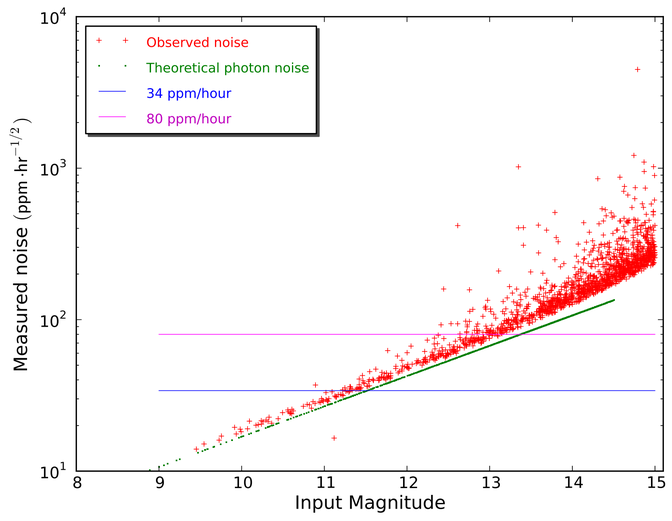


For reasons of computational expense, the full CCD image is not calculated, but rather just a few hundred square pixels sub-field.

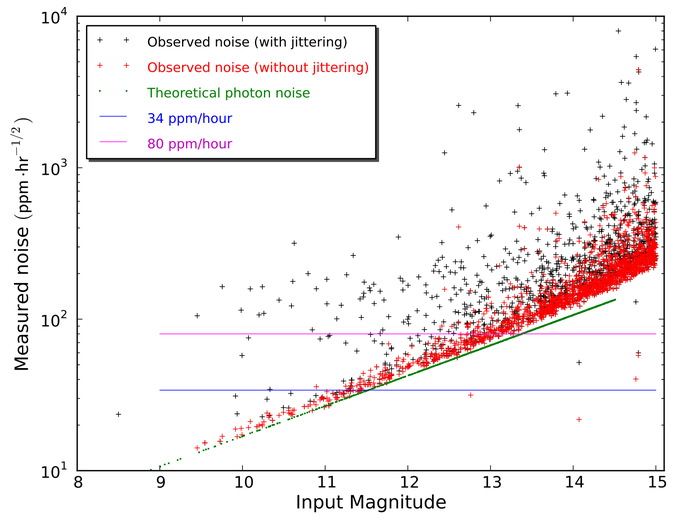
SIMULATIONS



Effect of stellar crowding:
Magnitude of the stars measured as a function of the input magnitude (red crosses). The green line indicates the measured magnitude equal to the input magnitude. As the brightness of one star might be affected by another star because of the crowding, its measured magnitude is lower than its input magnitude.



Noise-to-signal ratio as a function of the input magnitude. The deviation of the measured NSR from the theoretical photon noise occurs because only a fraction of the stellar flux is measured in the photometric algorithm. Two horizontal lines represent the noise limits at 34 and 80 $ppm\ hr^{-1/2}$ defined as mission requirement [2].



Effects of jitter:
Simulations with and without jitter option activated. The higher NSR when the jitter effect is present (black crosses) compared with the no-jitter case (red crosses) is is due to the fact that the jitter affects the pollution from crowding and increases the NSR.

CONTACT

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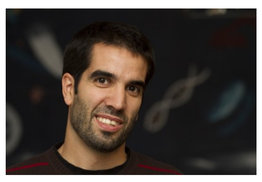

REFERENCES

[1] De Ridder, J., Arentoft, T., & Kjeldsen, H. 2006, MNRAS, 365, 595
[2] ESA. 2011, PLATO Defintion Phase Study report RED BOOK, Tech. Rep. 1, ESA