The unique field-of-view and focusing budgets of PLATO

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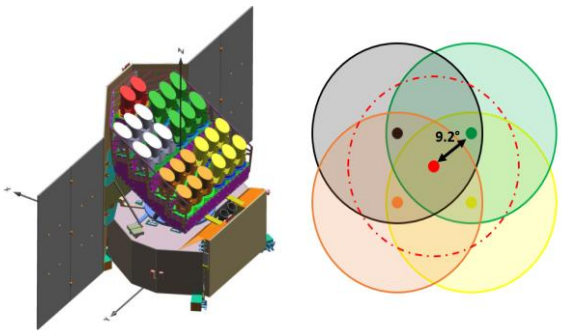

Fig. 1 *Left: Group arrangement of the cameras on the spacecraft. Credits: OHB System AG.*

Right: Tilt Angle of 9.2° for each of the 4 N-CAM groups.

The 26 cameras composing PLATO Payload are arranged on the spacecraft in 4 different groups, on top of the 2 Fast Cameras (F-CAMs) in red on Fig. 1 that are pointing to the Z axis of the spacecraft.

In each group, the 6 Normal Cameras (N-CAMs) are co-aligned and will point to the same field of view (FoV). Each group is tilted by 9.2° compared to the F-CAMs (or Z_{PLM}), as shown in the right sketch of Fig. 1.

Each Telescope Optical Unit (TOU) provides with its 6 lenses a very large optical field of view (FoV) of 18.8876° radius, represented with the red arc on Fig. 2. This illuminates the Focal Plane Assembly (FPA) composed by four 4510x4510 pixels CCDs butted together, with up to 2.4mm gap between each sensitive area.

Projecting the geometrical area ABCDE into the celestial sphere gives us the final FoV of each camera:

- 1037 deg² for the N-CAM
- 612 deg² for the F-CAM

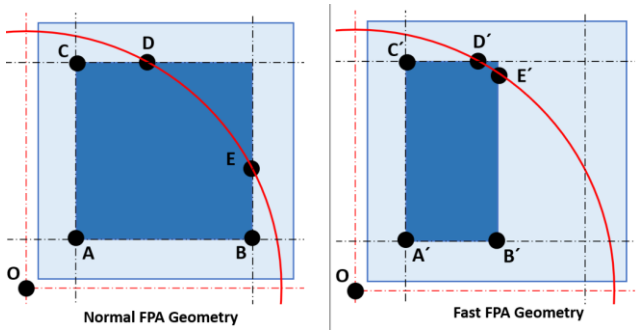

Fig. 2 *Detailed view of the N-FPA Geometry (left) and the F-FPA Geometry (right), focused on one of the four CCDs. The red arc represents the optical FoV, the light blue the package limit of the CCD and the dark blue the actual sensitive area. Sketch not to scale of the actual FPA.*

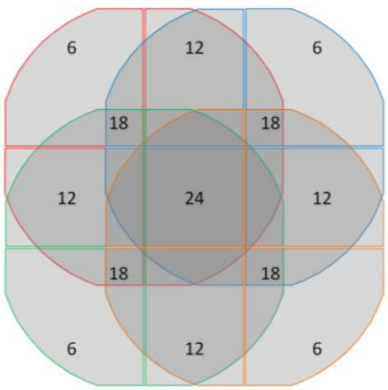

Fig. 3 *Overlapping field of view of the PLATO Payload*

In order to maximize the number of cameras observing each star and the total number of stars observed, the solution chosen was to split the N-CAMs in 4 groups of 6 with a 9.2° tilt. The resulting overlapping field of view figure on the sky is presented in Fig. 3.

The total estimated field of view is estimated to be approximately 2132 deg², with 294 deg² observed by 24 cameras, 171 deg² observed by 18 cameras, 796 deg² observed by 12 cameras, and 871 deg² observed by 6 cameras.

On top of this extraordinary large field of view, PLATO's cameras have the uncommon feature of thermal refocusing capability. While each camera is designed to be mechanically athermal, the optical design has been performed such as to offer optical thermal refocusing, with a linear change of ~10 µm/K. Knowing that the cameras are designed to meet all their performance requirements at -80°C ±10°C, the total available focusing range is of ± 100 µm. This focusing range is broken down into several contributors for each of the units and sub-systems involved in the camera. After calibration, each camera temperature will be independently tuned in-orbit to its best focus temperature.