ARGO 1.0
MULTICAMERA STAR TRACKER

Smart Plug&Play design
High performance
Robustness
Reliability
Flexibility
Low Cost

Flight heritage since 2021

ARGO 1.0 is a novel star tracker architecture specifically designed to maximize performance and reliability of multicamera configuration, targeting the needs of the emerging small satellites market, especially in term of cost-competitiveness

- **Fully autonomous** (no need of other sensors - f.i. gyros, sun sensor...)
- **Flexible configuration according to customer needs, from 1 camera** (monocamera) **up to 5 cameras** (multicamera)
- **RPCU available for multicamera version**
- **Flexible camera accommodation in the platform**
- **High accuracy also in monocamera version**
- **Intelligent real-time data fusion of data measurements of all cameras** (multicamera)
- **Smart in-flight camera model calibration**
- **Smart in-flight relative camera attitude calibration** (multicamera)
- **Smart data processing to filter platform jitter**
- **Output @ 10 Hz: attitude** (quaternion)**, angular speed, angular acceleration**

HIPPARCOS S.r.l. *develops high accuracy attitude determination and control systems for SmallSats. Our product portfolio includes several architecture of multicamera star trackers, having flight heritage since 2021. HIPPARCOS is a spinoff company of EICAS AUTOMAZIONE S.p.a. and leverages on a 40 years' heritage in the field of attitude determination from star measurement, starting from the HIPPARCOS Mission. Discover our heritage in detail at www.hipparcos.space/heritage/*

Hipparcos
ATTITUDE DETERMINATION & CONTROL

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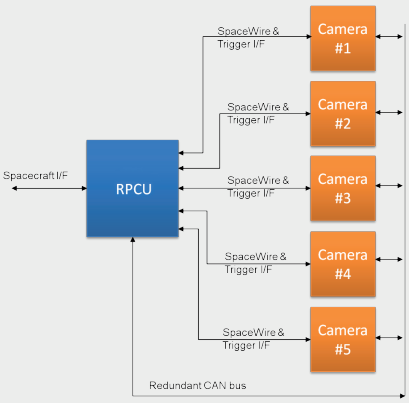
OUR SMART ARCHITECTURE

ARGO 1.0 is composed of:

- **Smart cameras**, including Focal Plane Assembly (FPA), main electronics (with integrated smart processing capabilities) and **custom designed radiation tolerant optics**.
- **RPCU**, in charge of data interface between the satellites and the cameras and working as both communication controller and reconfiguration module.

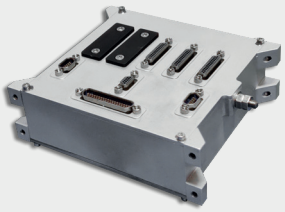
When connected to the RPCU, one camera is configured as Master while the others as Slaves:

- **Master Camera**: it performs image data acquisition & processing, controls and synchronizes the Slave Cameras, collects their pre-processed data and applies the data fusion algorithms for attitude determination and relative camera attitude calibration.



- **All Cameras** perform image data acquisition, pre-processing and camera model autocalibration.

One camera has to be stiffly fixed to the payload (typically it is the Master Camera), while other cameras can be freely accommodated in the S/C. A smart FDIR mechanism is able to detect camera faults and to automatically re-assign the role of Master camera to a Slave camera, in case of detection of fault of the Master camera. The thermal design of the entire camera has been carefully carried out so to minimize thermal gradient and to guarantee very good performances from thermal structural point of view.
The FPA is comprised mainly of the thermal buffer, the focal plane PCB, hosting the detector and the proximity electronics and the mechanics to ensure a very stable positioning of the focal plane w.r.t. the overall camera assembly.



The RPCU is provided with two independent circuits (primary and secondary), based on two different (in density and reliability) FPGAs. In nominal conditions the primary circuit implements the data routing among the cameras and between the cameras and the spacecraft. The secondary circuit is based on a smaller density (but higher reliability) FPGA that, in nominal condition, performs only the health monitoring of all the components of the system (cameras and router primary circuit). In case of fault of one FPGA, the RPCU is able to reconfigure itself and the second FPGA covers the functionalities of the first FPGA.

OUR SMART AADS SOFTWARE

By using **the wide redundancy of the raw data provided by the OHs**, ARGO 1.0 implements smart data fusion algorithms able to determine in real time the S/C attitude, rate and acceleration and to perform in-flight calibration of each camera model and of camera relative attitude. In addition, a smart filtering process is included, able to provide the star tracker outputs filtered from platform jitter, aiming to contribute to reach high manoeuvrability and stability of your platform.

DATASHEET

Detector	CMOS
FOV	± 11,2°
Number of tracked stars	Up to 20 per OH
Update rate	10 Hz
Acquisition time from Lost in Space (up to 3°/s)	< 3 s

Accuracy (BRF) - EOL - @1°/s

	1 OH (XY)	*2 OH (XYZ)*	*3 OH (XYZ)*
Systematic Error (arcsec)	3	2	1
NEA (arcsec, 3σ)	15	9	6
Max tracking rate	10°/s	10°/s	10°/s

Reliability

Camera	780 FIT
RPCU	590 FIT
EEE components class	Flight-proven industrial COTS MIL/Space grade
Lifetime	5 years in LEO
TID - Optical assembly	30 krad

Mechanical interface

	Camera	*RPCU*
Size incl. mounting feet (mm)	73 x 91 x h79	106 x 91 x h39
Mass (g)	385	355

Electrical interfaces

Power supply	9-60V
Power consumption	
Camera	2,7 W
RPCU	1,1 W

Data interfaces

RPCU vs Spacecraft	Spacewire/RS422/CAN

Environmental features

Operational temperature	-30°C to 60° C
Storage temperature	-40°C to 70° C
Vibration levels (random)	17,38 g RMS

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