

# Bifocal Panoramic Camera (PANCAM) Applications

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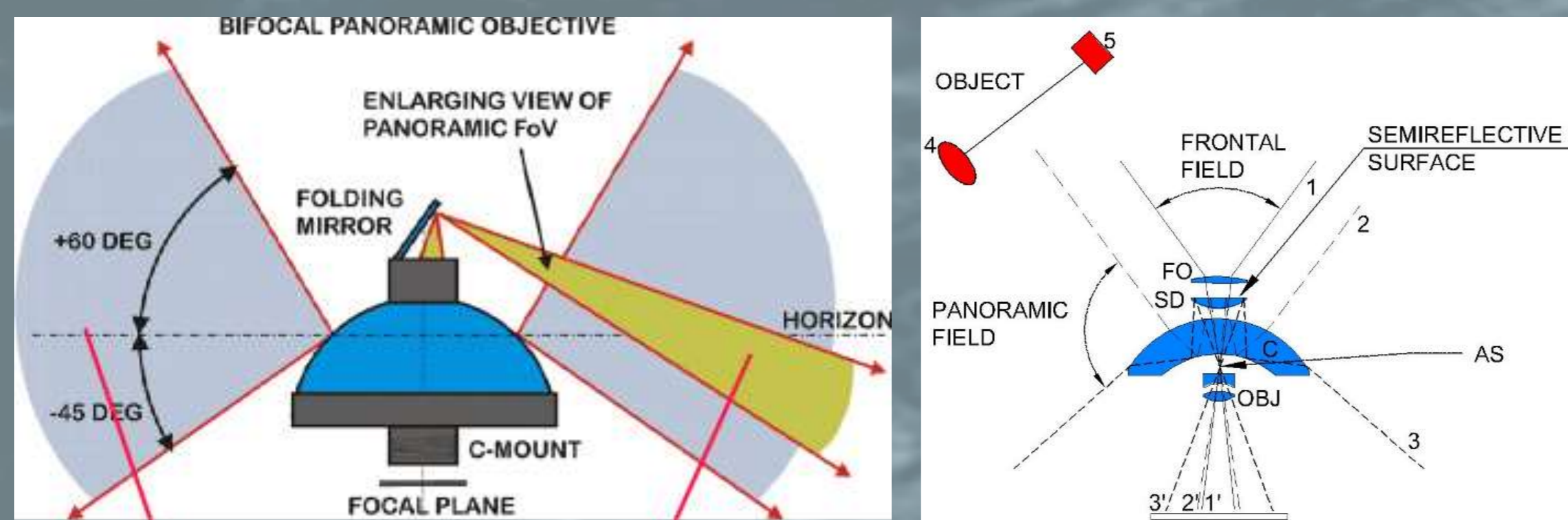
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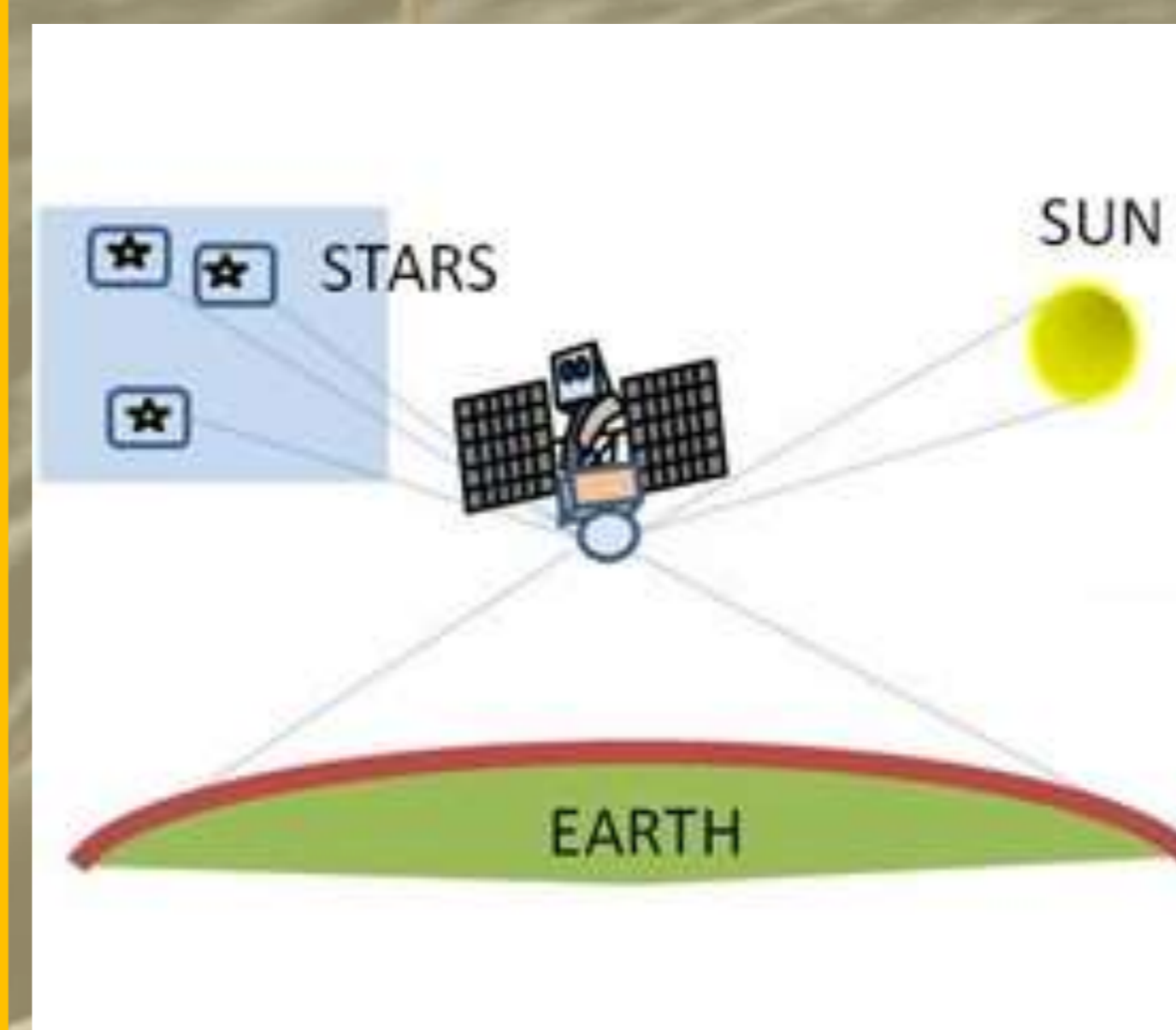
## ABSTRACT

Although omnidirectional panoramic optics has been largely studied since the beginning of the XX century its explosive growth in applications is quite recent. This is a consequence of the market availability of low-cost silicon-based digital sensors. Indeed, an omnidirectional image, due to its extremely large field of view, results strongly anamorphic and needs some distortion-correction algorithms to make it useful. The introduction of digital image sensors on the market makes the distortion correction quite simple working directly on the digital output. Recently, our research group developed two innovative omnidirectional lenses with hyperhemispherical and bifocal capabilities and many applications has been studied.

### How a bifocal panoramic lens works



### POLIFEMO



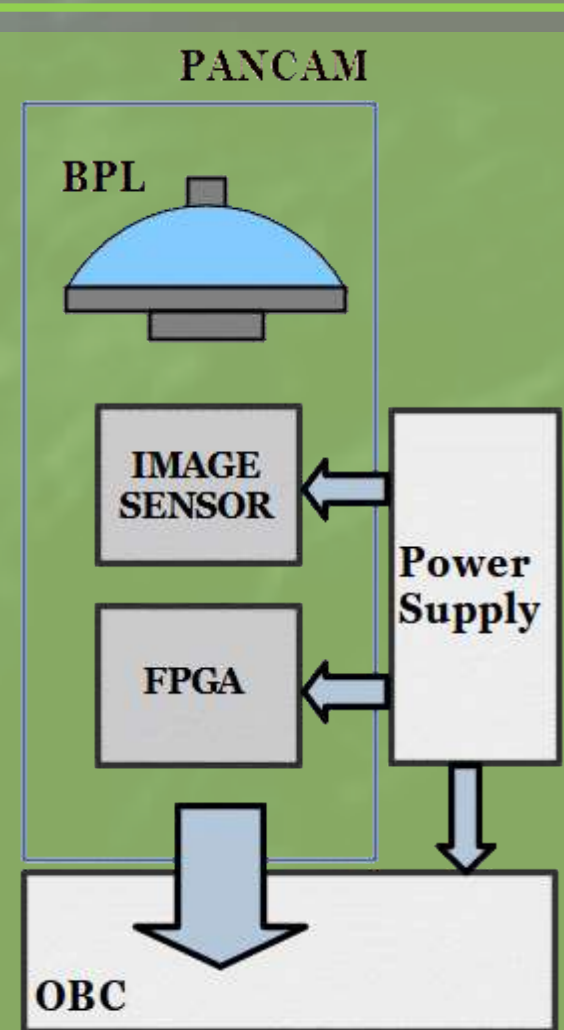
A PANCAM-based star tracker for micro satellites and cubesat has been funded within the EU H2020-SMEINST call. The system is based on a new possible paradigm for star tracker functionality: the very large field of view permits to look at the entire sky, although with low sensitivity (the limit magnitude of 7 has been calculated). Simulations demonstrated that for every satellite position, a tens of stars are visible, giving a mean attitude accuracy below  $1^\circ$ .

### DAEDALUS-CAM



In 2021 a robotic sphere named DAEDALUS (Descent and Exploration in Deep Autonomy of Lava Underground Structures) has been funded by ESA-OSIP and participated to a subsequent ESA CDF (Concurrent Design Facility) which certificated its feasibility. One of the robot payload is composed by four PANCAM which will allow an immersive and stereoscopic monitoring of the pit during the cave descent. ASI already funded the preliminary study.

### Earth-Moon-Mars Project



Recently the Earth-Moon-Mars (EMM) project has been funded by means of Italian NRRP (National Recovery and Resilience Plan). EMM is intended as a suite of eight instruments with the aim of monitoring planetary surfaces. One of the instruments is the PANCAM.

### PANVISION



It has long been recognized as gathering of people is one of the major risk factor in spreading of viral epidemics. Social distancing is then one of the most simple and powerful system to mitigate the spread of infections. A video surveillance system based on the bifocal panoramic lens has been funded within the INAF funds dedicated to the Covid-19 contrast emergency fund and by INAF transfer technology office. The core of the system is a deep learning-based software for people gathering automatic monitoring. Further work are in progress.

Visit the PANCAM website @INAF-OAPD



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