



# AntarctiCor: Solar Coronagraph In Antarctica For The ESCAPE Project

Silvano Fineschi<sup>a</sup>, Gerardo Capobianco<sup>a</sup>, Giuseppe Massone<sup>a</sup>, Luca Zangrilli<sup>a</sup>, Paolo Sandri<sup>b</sup>, Camille Galy<sup>c</sup>, Luc Damé<sup>d</sup>, Jean Marc Cristille<sup>e</sup>, Paolo Calcidese<sup>e</sup>

<sup>a</sup>INAF-Astrophysical Observatory of Torino, Pino Torinese (Torino), Italy; <sup>b</sup>OHB Italia S.p.A, Milano, Italy; <sup>c</sup>Centre Spatial de Liège, Liège, Belgium; <sup>d</sup>IPSL/CNRS/UVSQ LATMOS, Guyancourt, France; <sup>e</sup>Astronomical Observatory of the Valle d'Aosta Region, Nus (AO), Italy



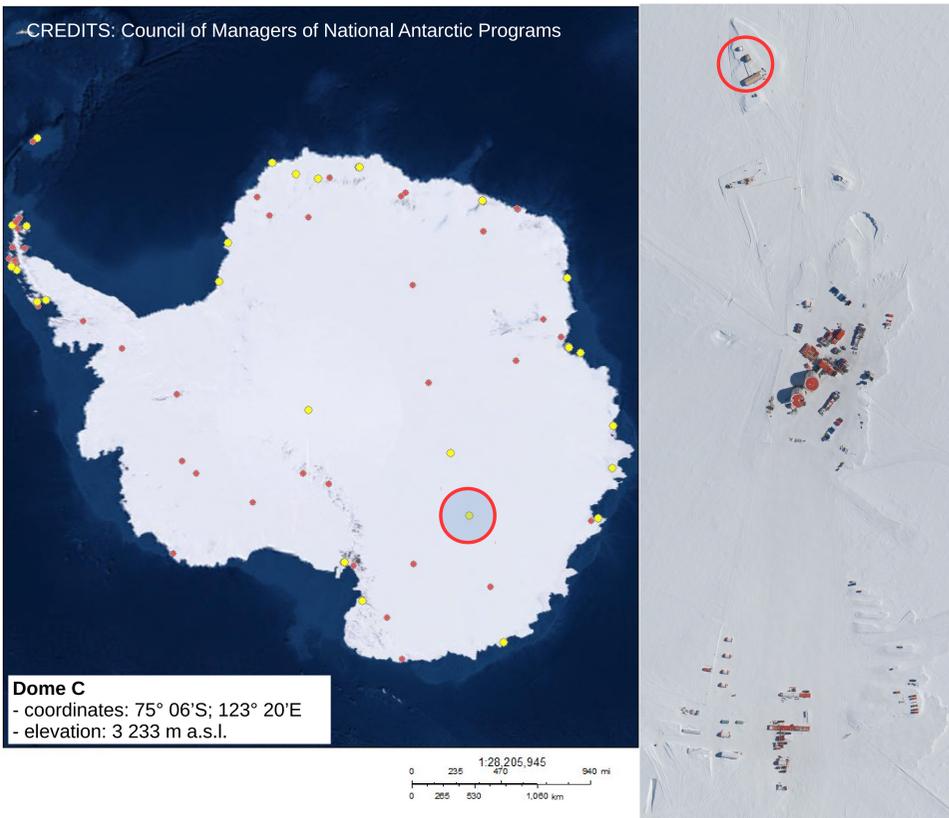
**Paper Number:**

**Contact Author:** silvano.fineschi@inaf.it Tel: +39.011.810.1919

## ABSTRACT

The Antarctica plateau of Dome C (coord: 75° 06'S; 123° 20'E) offers the unique opportunity for ground-based observations of the solar corona, due to the high altitude of the site (3,233 m above sea level) and the large amount of the uninterrupted daily hours for observations during the antarctic summer. The Antarctica solar coronagraph – AntarctiCor – for the "Extreme Solar Coronagraphy Antarctic Program Experiment" – ESCAPE – is based on the optical design of the ASPICS coronagraph for the PROBA-3 ESA mission. This presentation will describe the AntarctiCor design for ground-based observations of the polarized broad-band K-corona (545 nm – 604 nm) and of the narrow-band polarized emission of the coronal "Green-line" at 530.3 nm. The science goal of these observations is to map the topology and dynamics of the magnetic field in corona in order to address coronal heating and space weather questions. The telescope design follows the classical Lyot scheme of an internally-occulted coronagraph. The focal-plane instrumentation comprises a liquid crystal polarimeter. The CCD detector will image the corona in the field-of-view range of  $\pm 3.14$  solar radii from Sun's center. The use of relay lenses give the system diffraction limited at 530.3 nm and corrects the residual chromatic aberration in the narrow-band. This presentation will discuss and illustrate the optical design and the solutions adopted in order to control the stray-light.

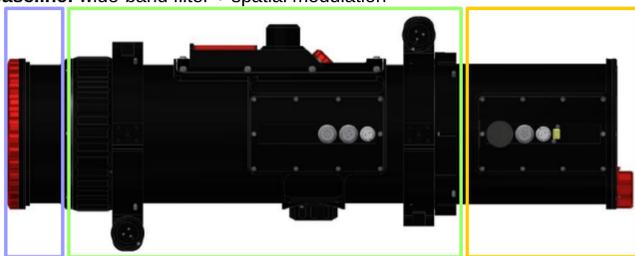
## OBSERVING SITE



## ANTARCTICOR CORONAGRAPH

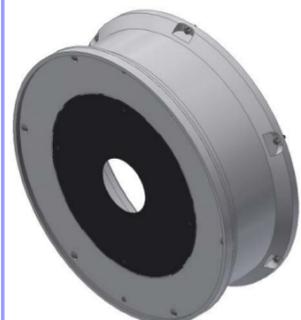
Observation of the polarized solar K-corona at two wavelengths:

- Monochromatic @ 530.3 nm (FeIV)
- Wide-band [545-604] nm
- Automatic sequential measurements in-band/off-band by tilting the filter
- Two different modulation schemes:
  - Temporal modulation (i.e., polarimeter + CCD);
  - Spatial modulation (PolarCam)
- Baseline: wide-band filter + spatial modulation



### Front Subassembly

Mainly contains the aperture stop (50mm)



### Rear Subassembly

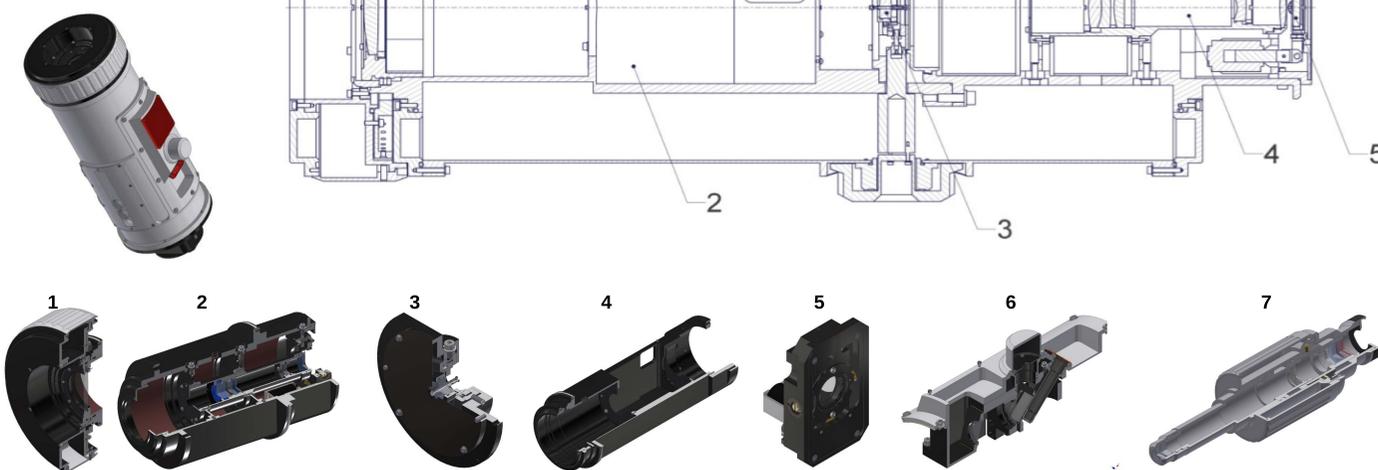
Contains the detector and the polarimeter



### Main Subassembly

Contains the following items:

1. Objective lens assembly;
2. Inner main barrel assembly;
3. Internal Occulter assembly
4. Lenses assembly
5. Filter assembly
6. Light trap assembly
7. Microscope assembly

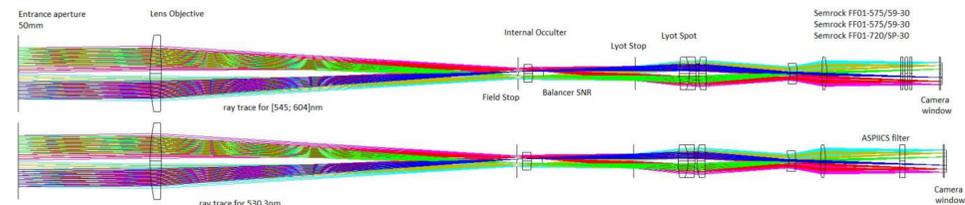


## ANTARCTICOR Optical performances

**Design:** Classic internally occulted Lyot coronagraph  
**Aperture:** 50mm  
**EFL:** 700mm (F/14)  
**Plate scales:** 4.3 arcsec (PolarCam with 2x2 binning) and 7.07 arcsec (CCD)  
**FoV:** +/- 0.84° (3.14 Rsun) along diagonal and +/- 0.6° (2.24 Rsun) along X and Y axis for PolarCam  
 +/- 0.84° (3.14 Rsun) along diagonal and +/- 0.84° (3.14 Rsun) along X and Y axis for CCD

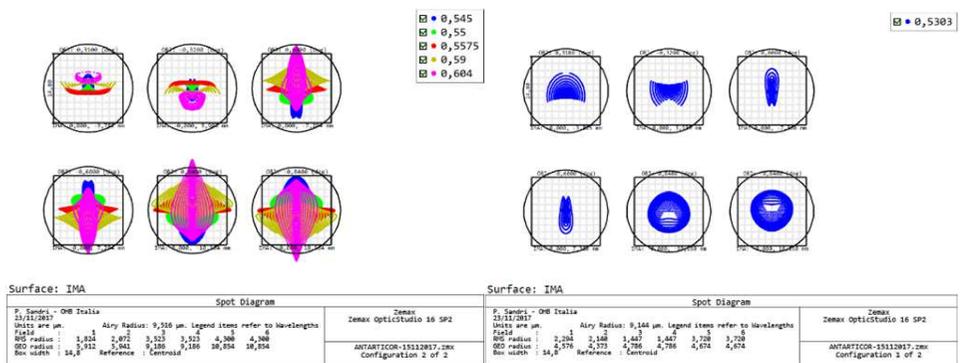
### Ray trace

wide-band (top) and narrow-band 530.3nm (bottom)



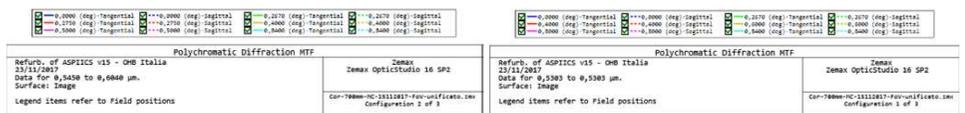
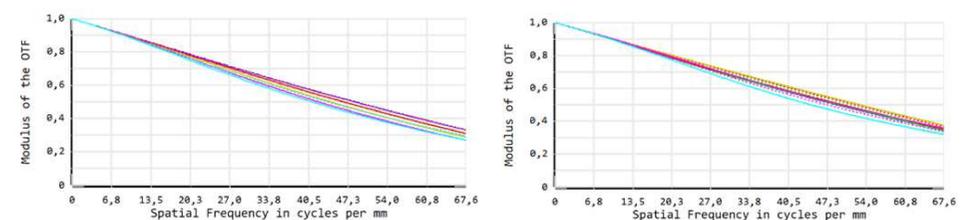
### Spot diagrams

Referred to the PolarCam detector, wide-band (left) and narrow-band 530.3nm (Right)

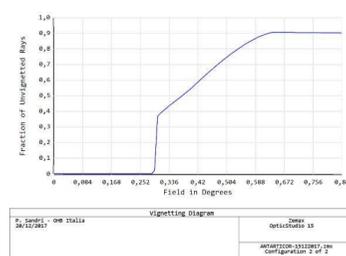


### MTF

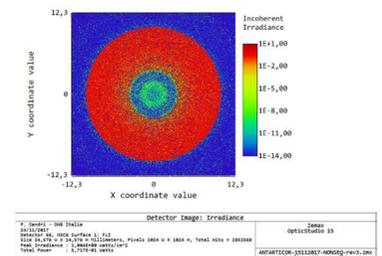
Referred to the PolarCam detector, wide-band (left) and narrow-band 530.3nm (Right)



### Vignetting



### Throughput



## Detectors

### PolarCam



Resolution: 1950x1950  
Pixel size: 7.4 micron

### FLI CCD Camera



Resolution: 1024x1024  
Pixel size: 24 micron

## Acknowledgments:

The ESCAPE/AntarctiCor project is supported by the Italian national Antarctic program (PNRA). PROBA3/ASPICS is supported by the European Space Agency ESA.