Control and protection of outdoor embedded camera for astronomy.

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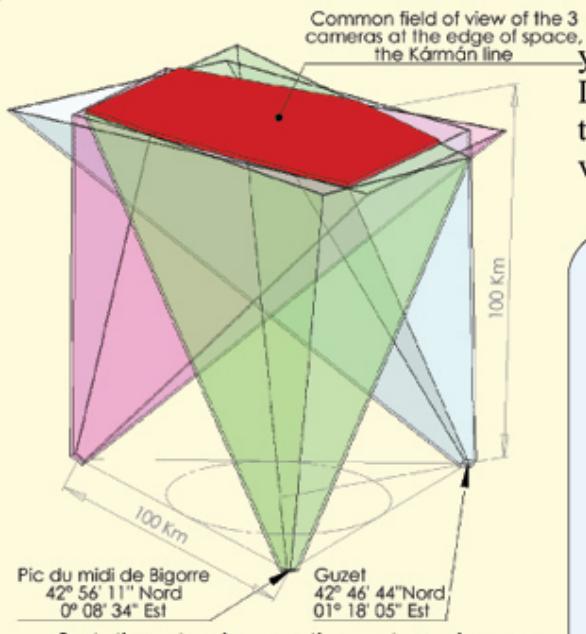

3 stations to observe the meteor showers

The objective is to make an outdoor camera to observe the sky every night for the coming 10 years. The purpose of the CABERNET- Podet-Met (Camera Better Resolution Network, Pole sur la Dynamique de l'Environnement Terrestre – Meteor) project is the automated observation, by triangulation with three cameras, of meteor showers to compute the meteoroids' trajectory and velocity. The scientific goal is to find the parent body, comet or asteroid, for each observed meteor.

Tripod, camera and camera lens, to test and develop the Cabernet pipeline
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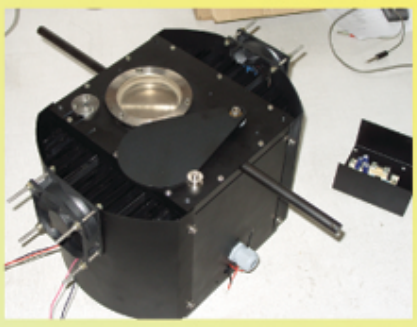
The test prototype: To compute the most precise orbit with a large field of view, the prototype is designed with a big CCD and a fixed focal length camera lens of high aperture.

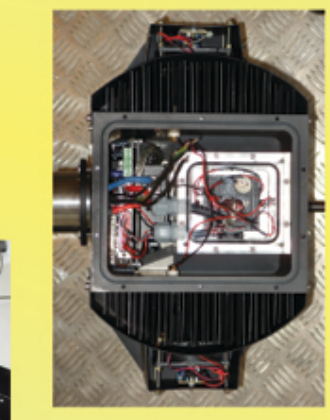
A Lheritier cameras, Kodak Kai 11002 sensor CCD, (4032×2688 14 bit/pixels of 9 µm) and a Canon EF 50mm f/1.2 are used for the prototype. The FOV is 40°×27° and the resolution is 35 arc-sec.

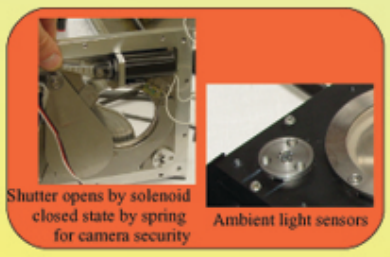
To compute the angular speed of the meteor, an electronic shutter interrupts the exposure at a given frequency and the total exposure last up to several seconds.

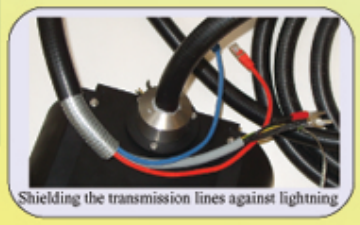
© IMCCE, Geminid meteor observed
Shutter freq. : 50Hz, 20 ms, 50%
One second exposure,
Without correction or cooling.

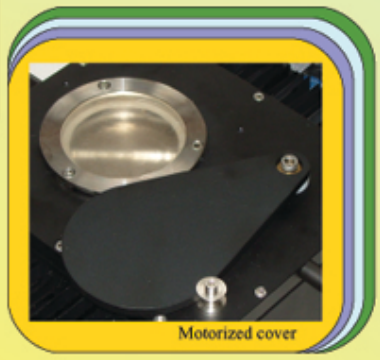
Main technical specifications:	
Climatic conditions	
Outdoor temperature Range	-20 to 40°C
Maximum wind speed for operation	100 Km/h
Humidity, cloud and rain	Protect.
Direct solar light may burn the detector	Protect.
The ice and snow on the windows	automatic melt
One camera will be installed at the "pic du midi" observatory, lightning regularly strikes the Lightning rod, close to the camera	Protect
Occasionally, hailstorm or bird droppings can fall on the windows	Protect during the day
Installation Constraints	
Length link between camera to computer	Up to 50 m
orientation	all rotations
Wall	horizontal or vertical
Performances	
Cooling the scientific detector	-10°C
Expected lifetime	10 years
Logging and alert	
Windows and camera temperature, moisture in box, state of power links	Record every minute
Failures alert transmission	lists of people configuration

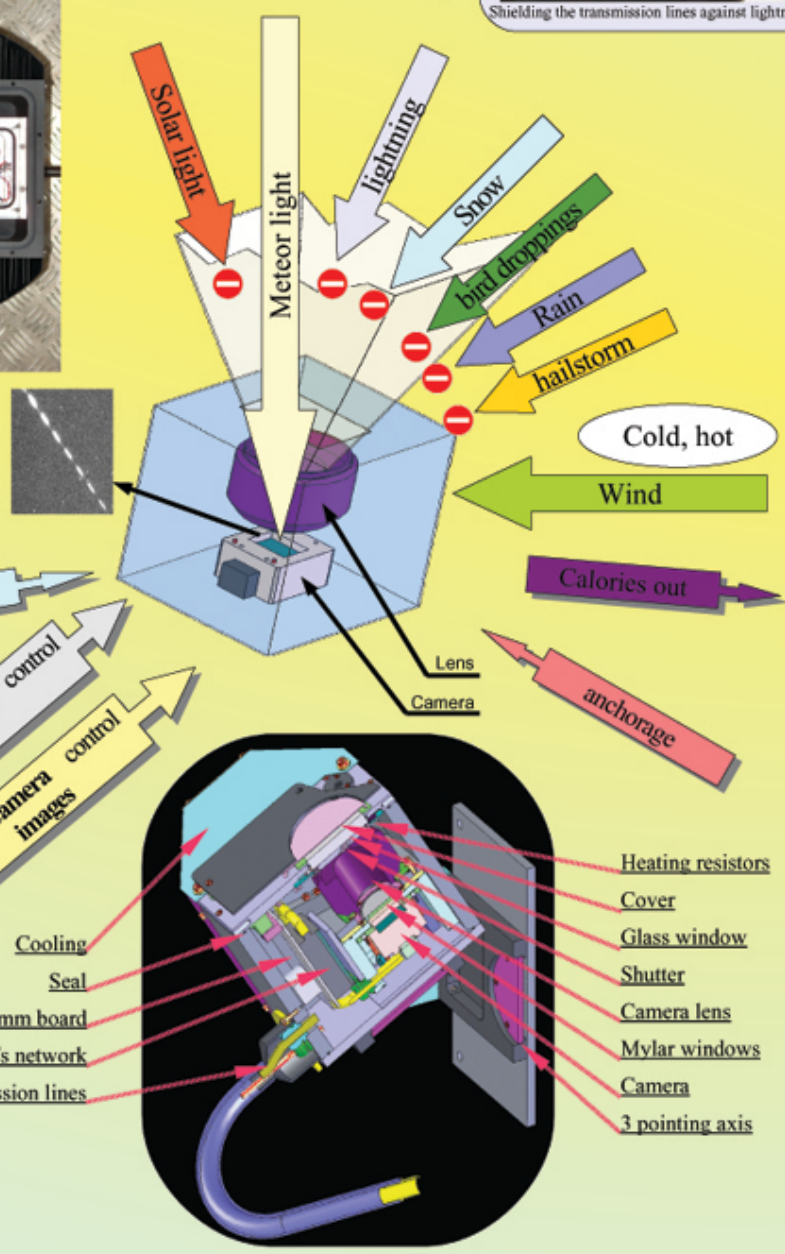


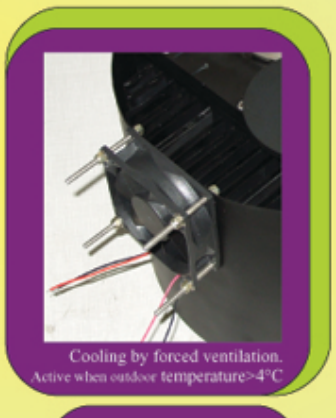


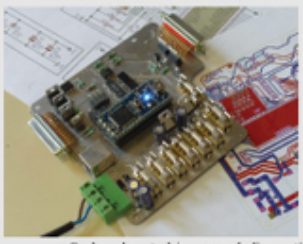








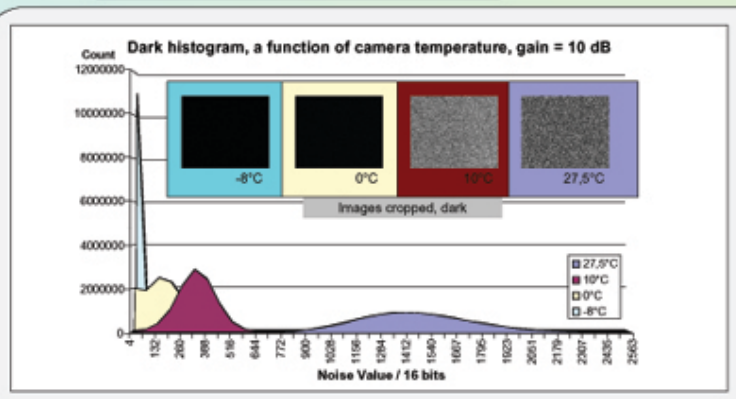




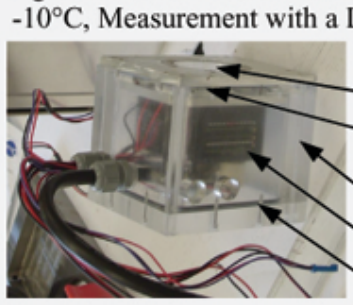
On-board control / command, diagnostics,
- failure alert by mail
- Camera status, sensor, fuse and manual command by **Embedded web server**
- in-flight reprogramming
- 3 Watts power consumption
- 8 power-lines protected by fuse to limit fault-propagation

Web server query status.

Computer:
- Data selection pipeline
- ethernet data transfer
- control box software log and e-mail send



To increase the number of observed meteoroids, a better signal-to-noise ratio is achevied by cooling the CCD at -10°C, Measurement with a Lheritier LH11000 camera.



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