



ULTRA-LOW SWAP IMAGERS HOSTING SMART EMBEDDED ECOSYSTEM FOR FUTURE SPACE MISSIONS

INFRARED DETECTION FOR SPACE APPLICATIONS

BERTIN-PHOTONICS : PARTNER IN ADVANCED OPTICS & OPTRONIC

DESIGN AND MANUFACTURING OF HIGH-PERFORMANCE OPTICAL SYSTEMS FOR :

- **BIG SCIENCE**

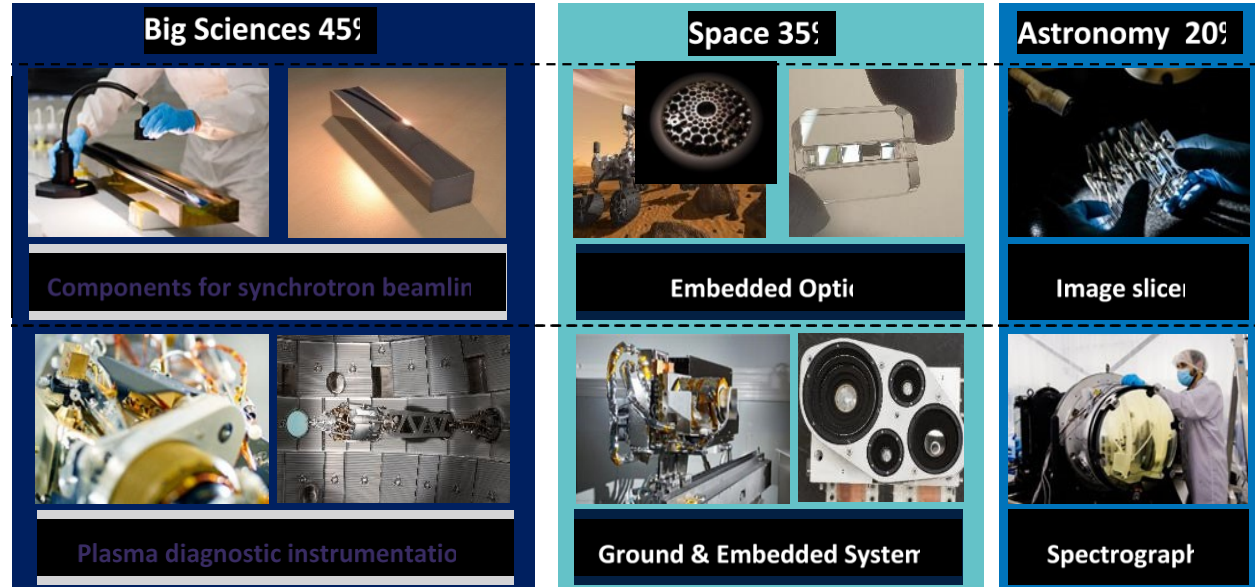
- Synchrotrons
- MegaJoule laser
- ITER

- **SPACE**

- Embedded optics
- Embedded optomechanics
- OGSE

- **ASTRONOMY**

- Image slicers
- Spectrographs



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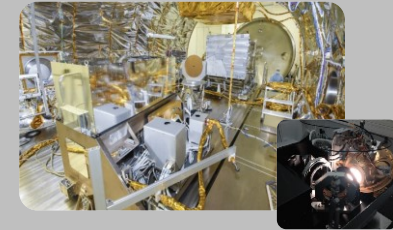
INSTRUMENTATION FOR SPACE :

- ✓ **Earth observation**
 - ✓ High quality optical components
 - ✓ High stability optomechanical systems
 - ✓ Optoelectronics instruments
- ✓ **Laser communication**
 - ✓ High power focal plane for GEO-ground communication
 - ✓ High power multiplexing (ground and on board)
 - ✓ Monolithic telescope
- ✓ **OGSE**
 - ✓ Source assembly for calibration and test
 - ✓ Vacuum compatible
 - ✓ Geometric and radiometric characterization
 - ✓ I&C – System Control & Supervision

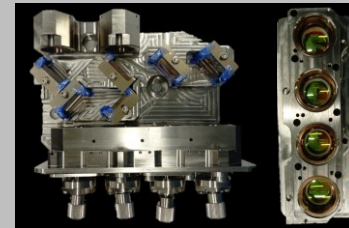
Optical components Manufacturing



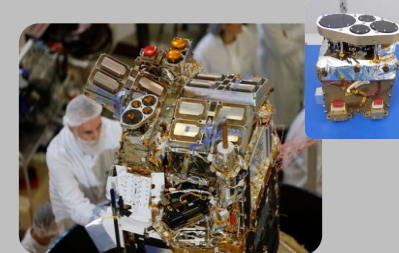
Optical Ground System Equipment



Optomechanical subsystems



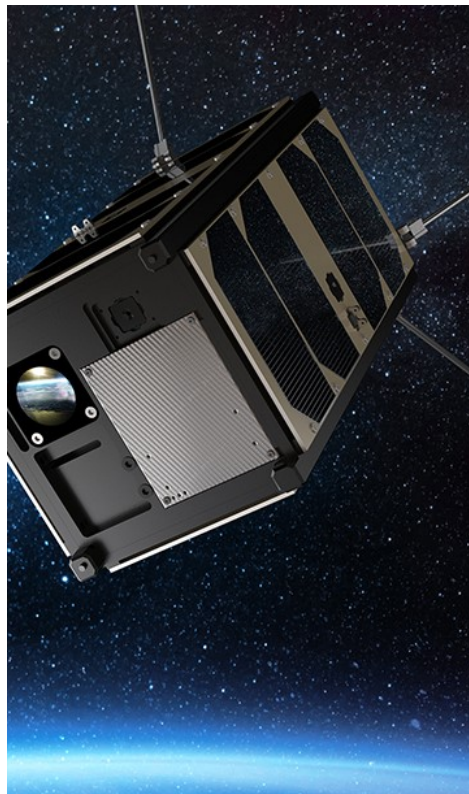
IASI NG - SWFS



PHU - Taranis

BERTIN-PHOTONICS : NEW-SPACE ROADMAP

- **Main partner for Small optical payload for constellations**
 - On going development : Spectro imager VIS & SWIR
 - Multispectral
 - High resolution GSD : <1m
 - Monolithic
 - Low cost / serial production
 - On going development : Lasercom module sub assemblies
 - Focal plane (Multiplexer / Rx-Tx management)
 - Telescope



BERTIN-PHOTONICS : CAMSIGHT LWIR CAMERAS

Bertin-Photonics develops and manufactures advanced LWIR optronic devices



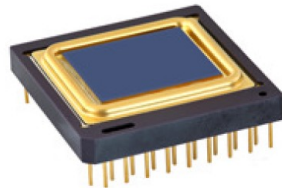
Low-power LWIR Infrared
« CamSight LP »



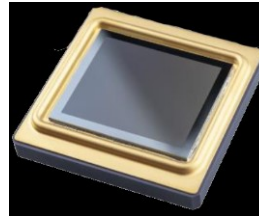
High resolution LWIR Infrared
« CamSight HD »



Low-Swap LWIR Infrared
« CamSight LS »



PICO 640
640 x 480 @ 17 μ m



ATTO 1280
1280 x 1024 @ 12 μ m

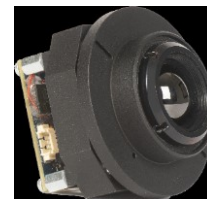


ATTO 640
640 x 480 @ 12 μ m

BERTIN-PHOTONICS : CAMSIGHT LWIR CAMERAS

CamSight family key parameters :

- Shutterless / 24/7 availability
- Low SWaP
 - **Size** : from 46 x 46 x 23 mm³ to **22 x 22 x 15 mm³**
 - **Weight** : between 83g to 30g (**9g without optics**)
 - **Power** : **As low as 800mW** (CamSight LS) - (Max. 4W with AI inference on CamSight HD)
- Wide range of resolution :
 - From 640 x 480 to 1280 x 1024
 - From 17μm pixel pitch to 12μm pixel pitch
- Versatile video output :
 - 3G-SDI / HD-SDI / SD-SDI
 - MiPi CSI-2
 - Parallel digital video + sync signals
 - Analog PAL
 - **Other on demand**



BERTIN-PHOTONICS : CAMSIGHT LWIR CAMERAS

CamSight family key parameters :

- Embedded Image Processing close to the sensor
 - Embedded image enhancements
 - Various histogram processing (Linear / CLHE / CLAHE)
 - Image sharpening
 - Contouring
 - Lens compensation (de-vignetting)
 - **On demand video processing**
- Edge computing
 - Embedded AI inference
 - **On demand on edge processing**



CamSight LP with 11 mm lens

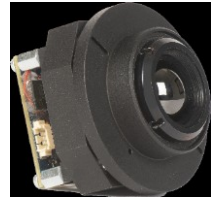
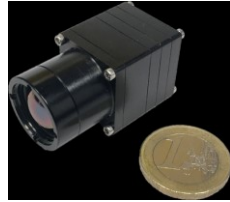


Embedded CNN inference
(YoloV3)

BERTIN-PHOTONICS : CAMSIGHT LWIR CAMERAS

CamSight family already uses “space compatible” technologies :

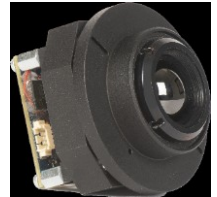
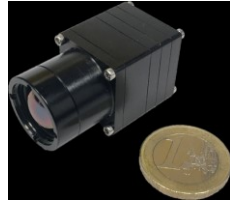
- **Uncooled Infrared sensors**
 - ➔ easier to integrate
- **Flash-based FPGA (Microchip PolarFire)**
 - ➔ Same family of FPGA are space-proven (PolarFire RT)
- **Military compliant environmental qualifications**
 - Climatic qualifications :
 - AECTP-300 : -40°C ~+70°C storage / -32°C ~+70°C operational
 - Shocks / Vibrations qualifications :
 - AECTP-400 : vibrations 4,3g(RMS)/ 3 axes | shocks : 30g / 18ms
 - EMC : AECTP-500



BERTIN-PHOTONICS : CAMSIGHT LWIR CAMERAS

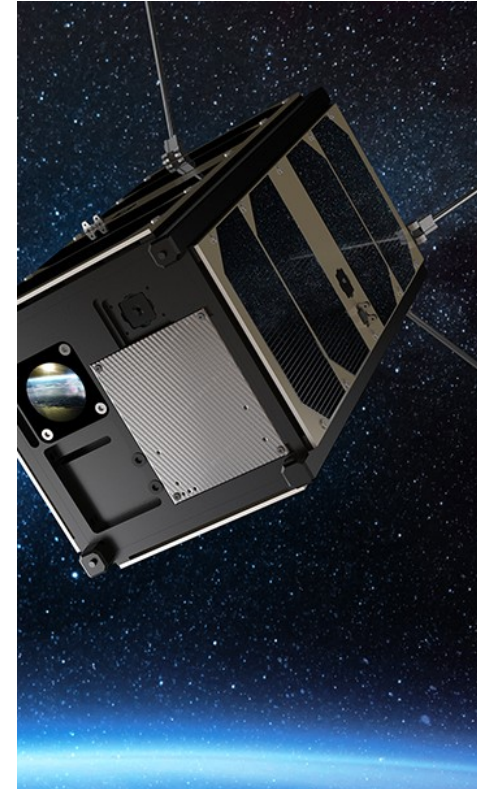
CamSight are ready to be qualified for your future application !

- CamSight Cameras are **production proven**
 - 2000+ devices sold
 - Robust design / mastered in-house
- CamSight Cameras are **already qualified**
 - w/ Military grade qualifications
- CamSight Cameras **can embed your processing**
 - digital Time Delay Integration (for example)
- CamSight Cameras **can be customized to your needs**
 - All hardware & software development mastered by Bertin internally



BERTIN-PHOTONICS : NEW-SPACE ROADMAP

- **Main partner for Small optical payload for constellations**
- **Ongoing :**
 - Spectro imager Visible & SWIR
 - Lasercom module sub assemblies
- **Future :**
 - **LWIR camera provider for space applications**





Thank you for your attention