From reactor to orbit: Chips powering fusion and space

Presentation by Jens Verbeeck, CEO
Date: Dec - 2025

MAGICS

About Magics Technologies

Our mission:

We design, qualify, radiation-hard semiconductor solutions that make space and clean-energy systems reliable and ready for volume

Located in Geel, Belgium, Magics is a European fabless semiconductor company specialized in radiation hardened integrated circuits for extreme environments in the energy (nuclear) and space industry

Magics in Numbers

40+

Engineering & PhDs. Backed by seasoned managers

150+

Years of combined expertise in RHBD: design, modeling, testing & qualification

10+

High-performance, low power rad-hard chips developed

€15M+

In custom projects for clients worldwide

2018

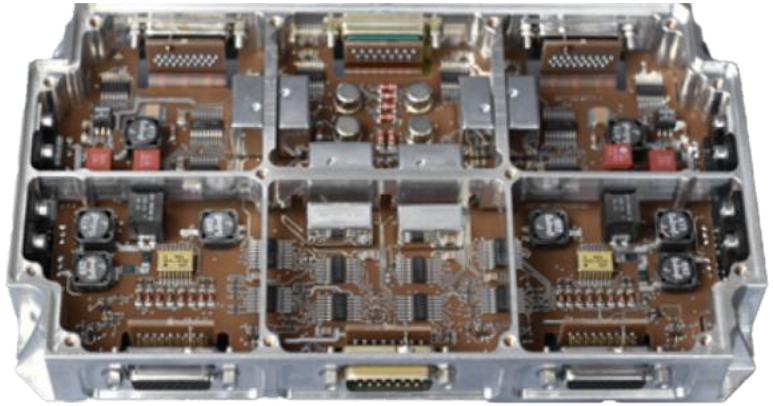
ESA partner since 2018 with multiple successful projects

10

Years of Magics Technologies

“We envision a future where high-reliability semiconductors act as catalysts in fostering innovative clean energy solutions, leading interplanetary exploration, and enhancing technologies that help build a more resilient world”

The problems for electronics in ionizing radiation

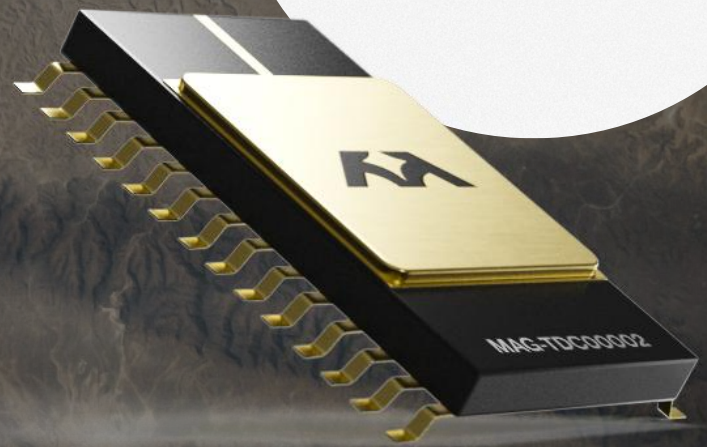


1 Simple components are used to withstand space radiation

2 Limited integration increases weight and costs

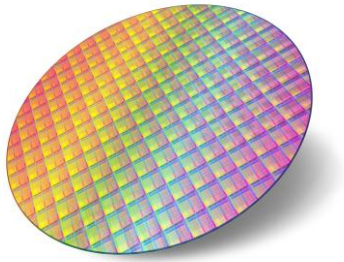
Systems must be smarter, cheaper and reliable

Our system-on-chip products enable integration and costs reduction for next generation systems



How do we do this?

STANDARD COST COMPETITIVE CMOS TECHNOLOGY



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AUTOMATED RADIATION-HARDENING-BY-DESIGN PROCESS

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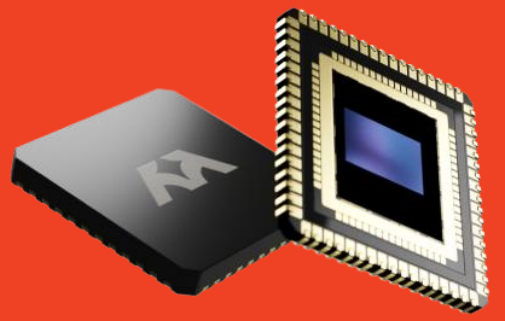
INTEGRATED PRODUCTS WITH SHORTER QUALIFICATION CYCLES



Embedding 100 years expertise and research knowledge

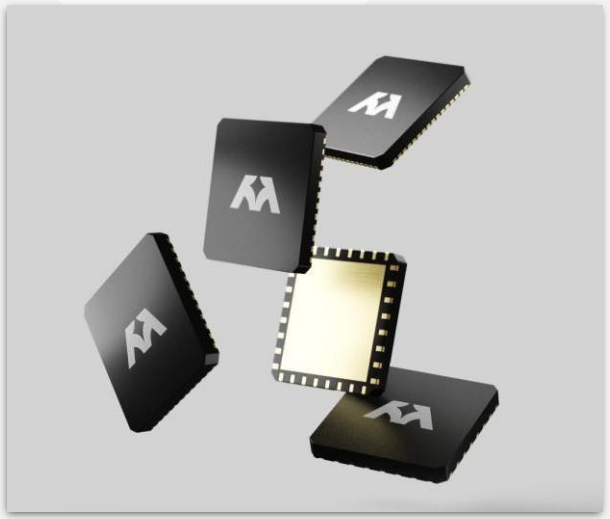
Markets

- Nuclear graded cameras
- Instrumentation & control
- Sensors

- Satellite subsystems
- Satellite communication
- Payloads, LIDAR
- Clock & timing

- Situational awareness

Our competences



Rad-hard IC Design

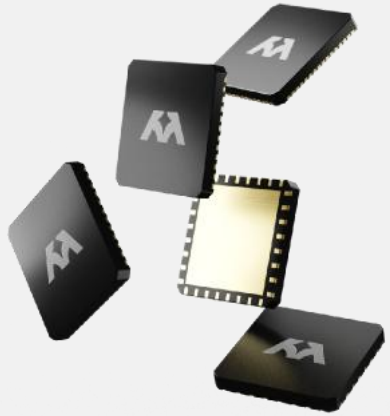
Testing and Characterization

System Integration

Product offering

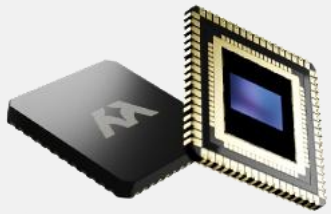
Time measurement & clock generation - Time

Market leading, patented clock generation and measurement chips



Data acquisition, control & sensor interfaces - Motion

A chip ecosystem for data acquisition & control.

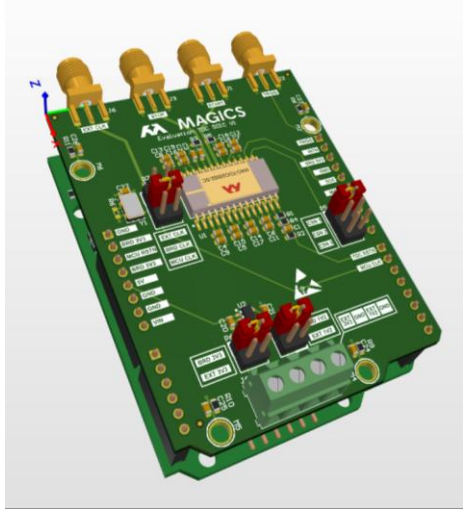


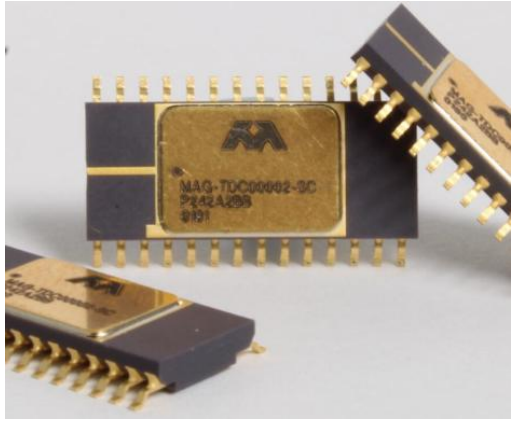
Rad-hard digital imaging & video transmission - Vision

World-first chipset for digital CMOS-based camera solution for nuclear environments with 100Mrad radiation tolerance

Accurate time measurements - TDC

- **Developed with ESA support and following ESCC qualification guidelines.**
- **Radiation hardness: these ICs can withstand a TID >100krad / 1kGy and are hardened against Single Event Effects.**
- **Industries: space, nuclear and defense.**
- **Applications: see next slide**
- **Missions:**
  - Space Radiation Analysis (ESRA) CubeSat mission to GTO
  - Autonomous Ion Mass Spectrometer Sentry (AIMSS) to the International Space Station
  - LIDAR – nuclear market





Time measurement needs in space

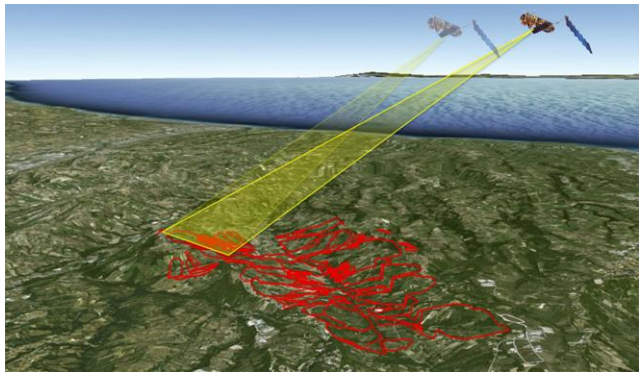
LiDAR

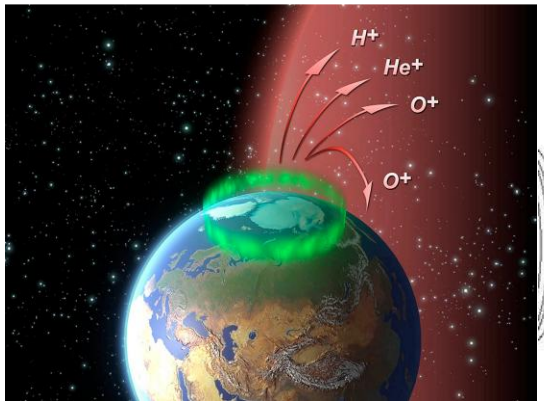
- Rendez-vous and Docking
- Earth observation

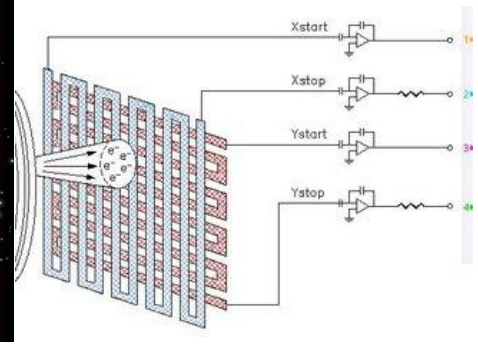
2-D Mass Spectroscopy

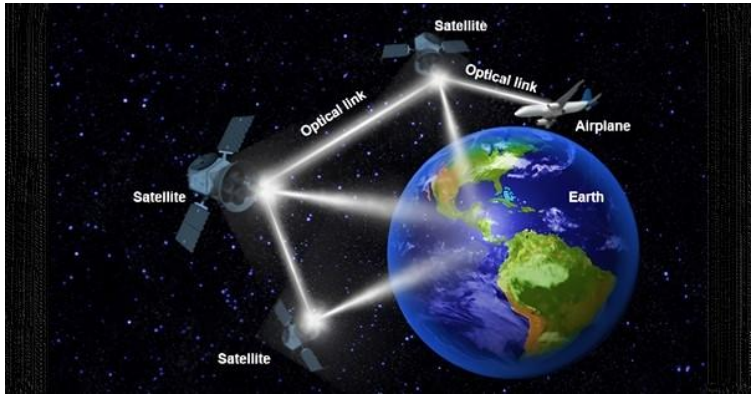
Time Tagging

Quantum Key Distribution & Optical communication









Sources:
https://www.esa.int/ESA_Multimedia/Images/2014/12/Illustration_of_satellite_scanning_an_area_on_the_Earth ,
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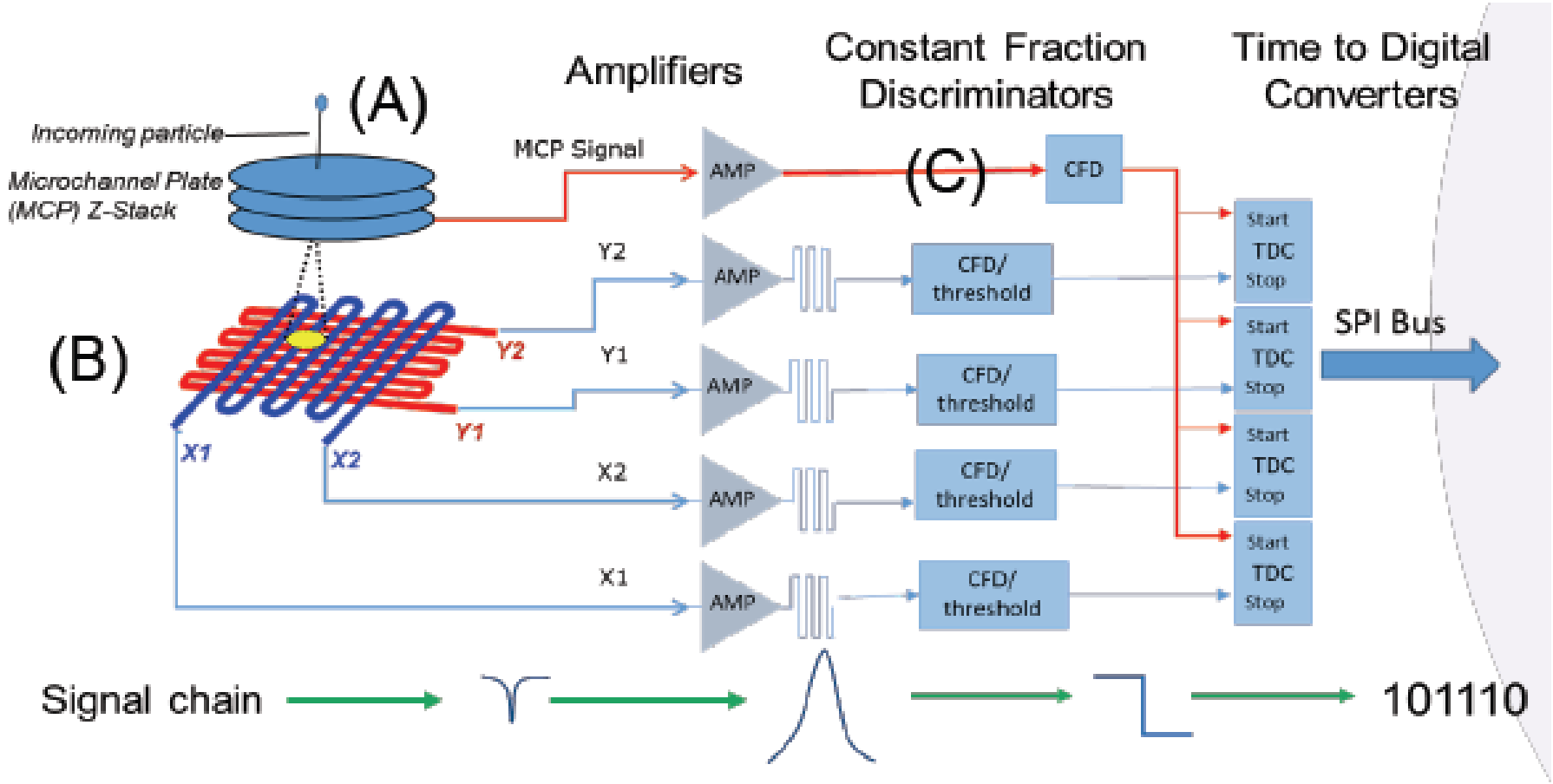
https://digitalcommons.usu.edu/cgi/viewcontent.cgi?filename=0&article=5297&context=smallsat&type=additional,
https://www.esa.int/Science_Exploration/Human_and_Robotic_Exploration/Astronauts/Rendezvous_and_docking ,
https://tecknexus.com/5gnews-all/optical-satellite-communication-the-future-of-high-speed-connectivity/

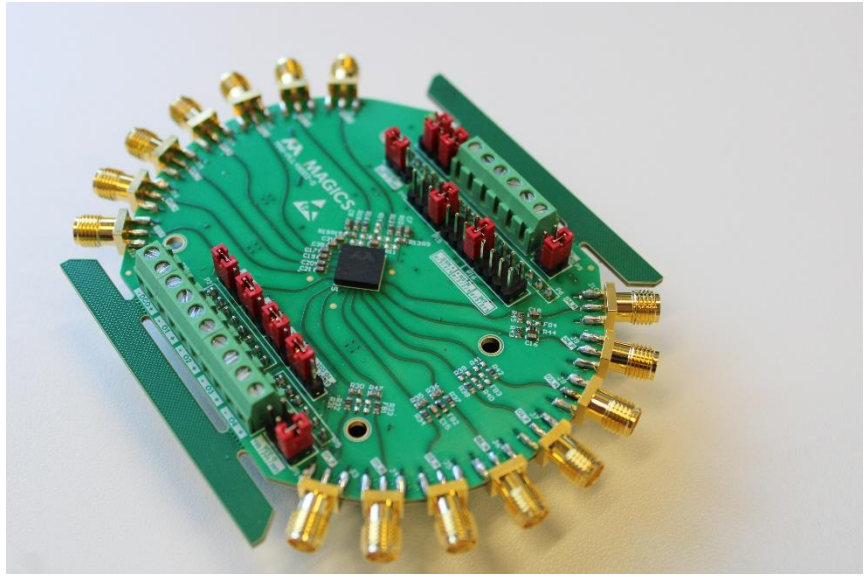
Example: 2D mass spectroscopy

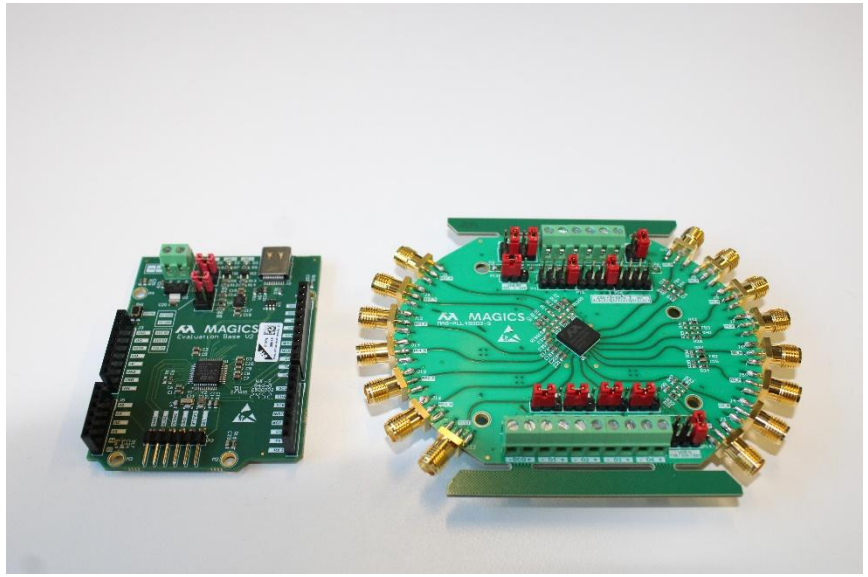


Reference: Radiation Hardened Approach to Ultra-Low SWaP2D Imaging Spectrometry

Clock synthesizers - PLL

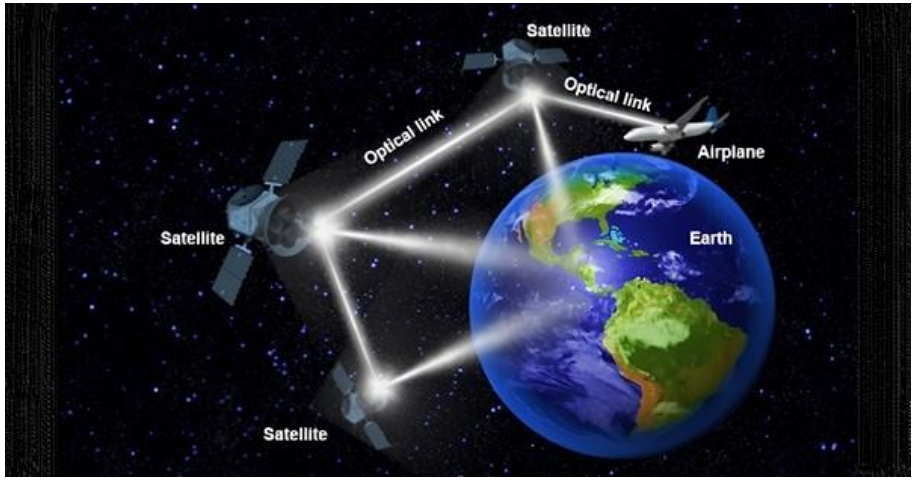
- **Developed with ESA support and following ESCC qualification guidelines.**
- **Radiation hardness: these ICs can withstand a TID >100krad / 1kGy and are Single Event Effects tolerant.**
- **Industries: space and defense.**
- **Applications: Clock distribution, Local oscillators, jitter cleaning, on board computing, SATCOM**
- **Missions:**
  - Selected for satellite constellations





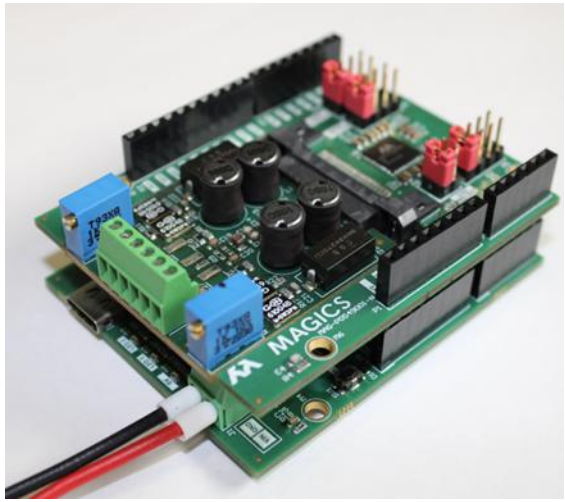
Time Clocking needs in space

- Communication satellites
  - Low jitter clock for SATCOM
- On board computing
  - Reliable low jitter reference clock
- Local oscillators
- Clock distribution



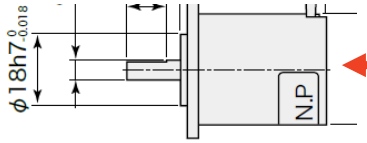
Data acquisition and control

- **Radiation hardness: these ICs can withstand a TID >100krad / 1kGy and are Single Event Effects tolerant. Nuclear graded version available (>100 Mrad/1 MGy)**
- **Industries: space, nuclear and defense.**
- **Applications: Data acquisition, Reaction wheels, Robotics, Motion control, Sensor interfaces and Signal conditioning**
- **Missions:**
  - Standard component in Remote handling and diagnostics in at ITER (Fusion)
  - Used in nuclear graded camera's
  - I&C applications in Nuclear power plants and legacy or incidental waste sites.

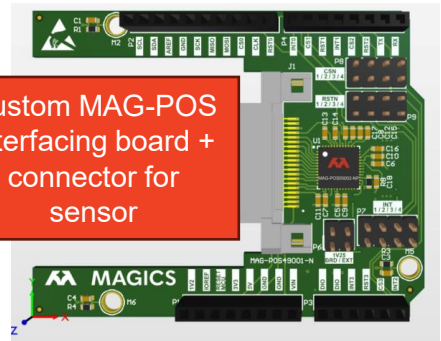


Example evaluation kit of data acquisition and control chips

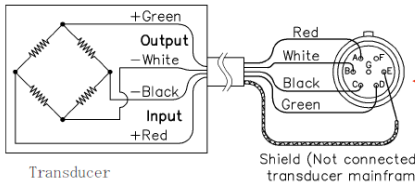
Full data and control systems can be created



Custom MAG-POS interfacing board + connector for sensor



[MAG-POS49001-N]



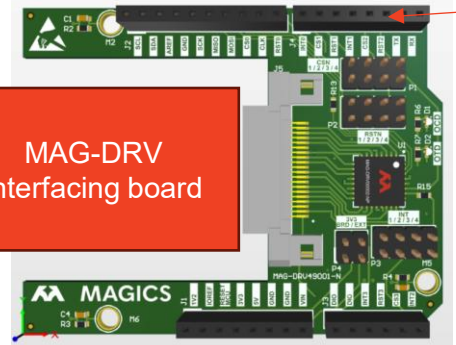
Custom MAG-SEI interfacing board + connector for sensor

[MAG-SEI49001-N]

All these EVKs are stackable through the pin headers! No cables required.

DRIVER CIRCUIT UNCLEAR

MAG-DRV interfacing board



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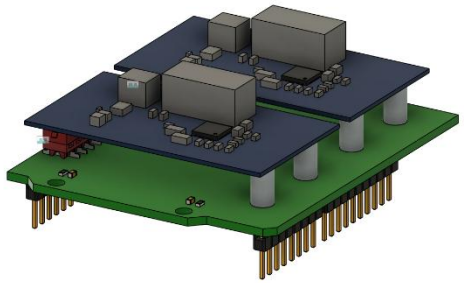

[MAG-PSU49001-N]

[MAG-BUS49001-N]

EtherCAT To PC

[MAG-BCM10001-N]

UTP cable [100m]

Power cable 9V [100m]

Chipsets for Imaging in radiation environments

- **Radiation hardness: these ICs can withstand a TID >100krad / 1kGy and are Single Event Effects tolerant. Nuclear graded version available (>100 Mrad/1 MGy)**
- **Industries: space, nuclear and defense.**
- **Applications: Full HD imaging, Camera's.**
- **Missions:**
  - Nuclear graded camera's worldwide

Thanks! Questions?

Jens Verbeeck

CEO

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MAGICS

BELGIUM, 2024

Partners & References

10

Years of Global Leadership in Rad-Hard Electronics

10+

Customers in space applications

10+

Customers in Nuclear applications

*Radiation-resistant camera technology creating new opportunities in dismantling and inspection of nuclear sites | SCK CEN
**Breaking new ground in electronics to cope with radiation - Fusion for Energy
***Radiation Hardened Approach to Ultra-Low SWaP2D Imaging Spectrometry

Get in touch

Data sheet

Request the product datasheet via our website: www.magics.tech

Quotes

Contact our sales managers:
(EU) Teo De Lellis: Teo.delellis@magics.tech
(US) Anton Quiroz: Anton.Quiroz@magics.tech

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