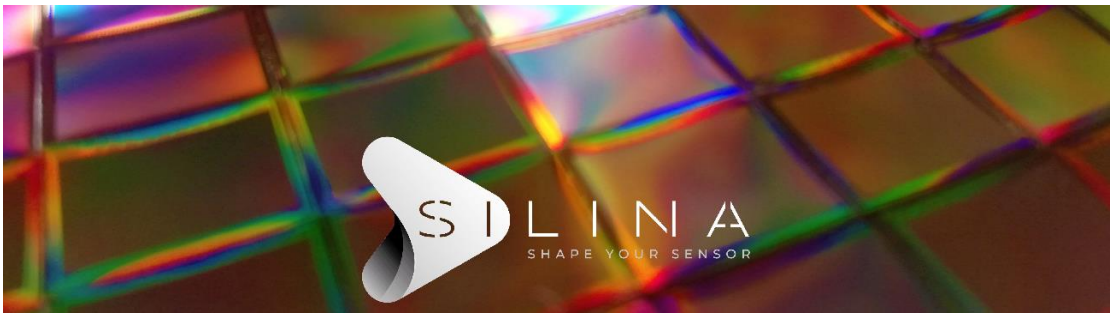

CIFRE PhD THESIS

CURVED IMAGING SENSOR
IN SPACE ENVIRONMENT

• Company	SILINA (Gardanne)	Wilfried JAHN: wilfried.jahn@silina.io
• Laboratory	ISAE SUPAERO (Toulouse)	Pierre MAGNAN: pierre.magnan@isae-supaero.fr

• Contract	Doctoral contract, CIFRE
• Working hours	Full time
• Starting date / Duration	December 1st, 2021 / 3 years
• Field	Engineering / Design, simulation, experimentation
• Profile	Physics (F/H)

SILINA *is a deeptech startup in microelectronics offering to curve the imaging sensors produced by traditional sensor manufacturers, at industrial scale. Curved imaging sensor is the next major innovation for the imaging industry. It unlocks hardware limitations that no software can solve, and bring a whole new generation of vision systems. It enables drastic improvements on four key fields: increase of the image quality and detection capability, and reduction of cost and bulk of instruments. SILINA was founded through the Entrepreneur First incubation program at Station F in Paris by:*
- Wilfried JAHN (CTO), from the Institut d'Optique, PhD in high resolution optical system design using curved sensors, postdoctoral scholar on a NASA grant at the California Institute of Technology (Caltech) in the Aerospace Department
- Michael BAILLY (CEO), from the Ecole Polytechnique and UC Berkeley, former industrial project manager in major industrial groups
SILINA is incubated by three incubators, Nubbo and ESA BIC Sud France (related to the European Space Agency) in Toulouse, and Agoranov in Paris.[Article,Video,LinkedIn]

ISAE SUPAERO *is a world leading research and engineering school dedicated to aerospace technologies. For more than 100 years, ISAE SUPAERO supports the development the aerospace industry by training world-know highly-skilled scientists and engineers. ISAE SUPAERO develops its activities on three areas such as education, research and innovation, by actively participating to research and development activities of the aerospace field. Precursors and inventors, their engineers contribute to numerous technological innovations in the field of aerospace. Their excellence is recognized by the industry which leverages the visibility and reputation of ISAE SUPAERO at the international level.*

Description

Topic: The PhD thesis will take place within the R&D team of SILINA located on the microelectronics platform in Gardanne (South of Aix-en-Provence) and within the CIMI research department of ISAE SUPAERO (Toulouse). The aim is to enable the raise of the technological maturity, the understanding and analysis of the performance in space environment of new generation of matrix and linear sensors with a curved shape. This curved shape is inspired by the human eye which enables the improvement of observation instruments.

Problem to solve: Current imaging CMOS and CCD sensors have a planar shape, which implies a high complexity of the optical system, a degradation of the image quality in the field of view, such as an increase of the overall cost and mass/volume budget of the instruments.

Solution: Curved imaging sensor technology is a major innovation for the imaging industry, notably for space and satellite applications. It unlocks technological barriers and brings a whole new generation of observation instruments, such as telescope, camera and spectrometer. It enables drastic improvements on four key fields: increase of the image quality and detection capability, and reduction of cost and bulk of instruments.

Objectives: Develop, characterize, analyze and optimize the curved imaging sensor technology in space environment, understand the physical response to space constraints and enable the raise of the technology readiness level.

Tasks & Activity

In more detail, we will have to:

- Perform a deep survey of the state-of-the-art literature regarding:
    - the technologies of CMOS and CCD sensors optimized for space imaging applications
    - the technologies of CMOS and CCD curved sensors
- Understand the physical phenomenon induced by the deformation of the sensors which could modify or degrade its performance *vs* classic flat sensors:
    - Depending on the sensor type and technology (architecture, shooting mode, pixel pitch, spectral bandwidth, use of micro-lenses, ...)
    - Depending on the various parameters of a space mission (temperature: shock, cycling, vacuum, vibrations,...).

  This section is made of two parts: first, you will be in charge of modeling and simulating the multi-physics phenomena, then you will be in charge of testing existing curved imaging sensors.
    - Define the various equipment, processes and methods of characterization
    - Analyze the performance of the curved imaging sensors prototypes optimized for space application, perform the electro-optical characterization thanks test facilities provided by the laboratory and the company
    - Cross-correlate the results of modeling and simulation with experimental results
- Propose improvement solutions on
    - Design of curved sensors: directly linked to the curving process (materials, parameters,...)
    - Post-processing : to reduce the amplitude of the eventual drop of performance

Foreign travels are possible to present the results in scientific conferences and workshop. You have to agree on travelling following the effective restriction due to the Covid-19 situation.

Skills

We are looking for candidates with a certain expertise:

- Hold an engineering degree (or any equivalent)
- Formation, experience or internship in physics: semi-conductors and/or microelectronics and/or optronics and/or sensor
- You like the applied research, from simulation to experimentation
- Writing and oral skills in English and French
- Communicative, team spirit, well organized, good priority management
- Sense of synthesis, autonomy, rigor, methodical, listening skills