



## CEA-Leti is driving European ATP innovation through strategic collaborations in microelectronics

Best practice category **ATP in Europe and Partner collaboration**

Stakeholder group **Research and academia**

Value chain position **R&D**

### General Information

CEA-Leti is one of the leading institutes for applied research in microelectronics and nanotechnologies, focusing on applications for defence and security, low carbon energies, industry research, as well as physical and life sciences research. It is the technology research unit of CEA Tech, the French Atomic Energy and Alternative Energy Commission.

Based in Grenoble (France) with offices in the Silicon Valley and Tokyo, CEA-Leti puts together 1,900 researchers with 250 active bilateral industrial partners who develop design, manufacturing and ATP solutions for 100, 200 and 300mm wafers.

### Activities and best practices

In the ATP sphere, CEA-Leti offers on-wafer photonic integrated circuit (PIC) testing services. As a result of its research, thousands of dies can be measured in one day by leveraging 5 automatic probers compatible with 300 mm wafers, and 1 prober compatible with 200 mm wafers. Fully packaged PICs can also be tested on the dedicated testing benches at the institute.

As part of its broad research collaboration, CEA-Leti participates in multiple EU-funded projects, with those relevant to ATP advancement highlighted below.

- Along with several other partners, CEA-Leti is part of the photonixFAB consortium, which aims to build a European photonics device value chain and initial industrial manufacturing capabilities. The project intends to develop scalable packaging and testing solutions in alignment with the PIC platform developments, in addition to enabling PDK-based design automation for the photonic platforms.
- With the Partnership for Realisation and Validation of AI Hardware Leadership (PREVAIL), four European research institutes – CEA-Leti, IMEC, VTT and Fraunhofer-Gesellschaft – are collaborating to establish a multi-hub Test and Experimentation Facility (TEF) for edge AI hardware. As a multi-hub platform providing prototype chip fabrication capability in advanced technology to EU stakeholders for AI applications. PREVAIL will enable a trusted infrastructure in Europe where companies and research institutions will be able to fabricate early prototype samples based on innovative technologies and test them in real edge AI applications.

- With the NEURO-BMI project, four European research institutes and medical companies are collaborating to develop an embedded neuroprosthetic, an innovative brain-spine interface technology for people with a spinal cord injury. One of the objectives of the project is the introduction of an auto-adaptive framework, which allows for calibrating the neuronal activity decoder in adaptive manner in real time during the neuroprosthetics' self-directed use using neural data.
- In the REDFINCH project, partners from five Member States cooperated to build three fully-integrated, PIC-based, chemical sensor demonstrators. With the CEA-Leti took a new step towards cost reduction, extreme integration and mass deployment of such PA sensors with a miniaturised silicon PA-cell fabricated on standard CMOS tools. This new sub-centimeter PA cell built on a silicon platform has been designed, fabricated and characterised. Initially, the component was designed using a detailed physical model accounting for viscous and thermal losses and metamodel-based optimisation techniques.

Moreover, in November 2022, CEA-Leti and Intel provided a breakthrough for the future of die-to-wafer (D2W) bonding by optimising hybrid direct-bonding – a self-assembly process that has the potential to increase the alignment accuracy as well as fabrication throughput by several thousand dies per hour. Researchers focused on how chips are cleaned after they are cut – by increasing the speed of the costly cleaning strategy, they achieved a much higher throughput. Thus, the project led to the creation of a high-throughput industrial production process that is precise to under one micron and is currently being used in CEA-Leti cleanrooms.

## Challenges addressed with this practice

CEA-Leti excels in highly specialised ATP processes, enabling high-throughput testing and packaging methods, particularly for emerging technologies like PICs. This deployment of technology in specialised areas, such as healthcare and biomedical interfaces, effectively bridges diverse areas of research. Through collaborations with partners in various projects, like the EU-funded photonixFAB. CEA-Leti fosters cooperative efforts that drive the advancement of the EU semiconductor value chain. CEA-Leti provides highly specialised ATP processes that allow for high-throughput testing and packaging methods, especially for emerging technologies like PICs.