

Contributions to the APECS Pilot Line: Fraunhofer ISIT

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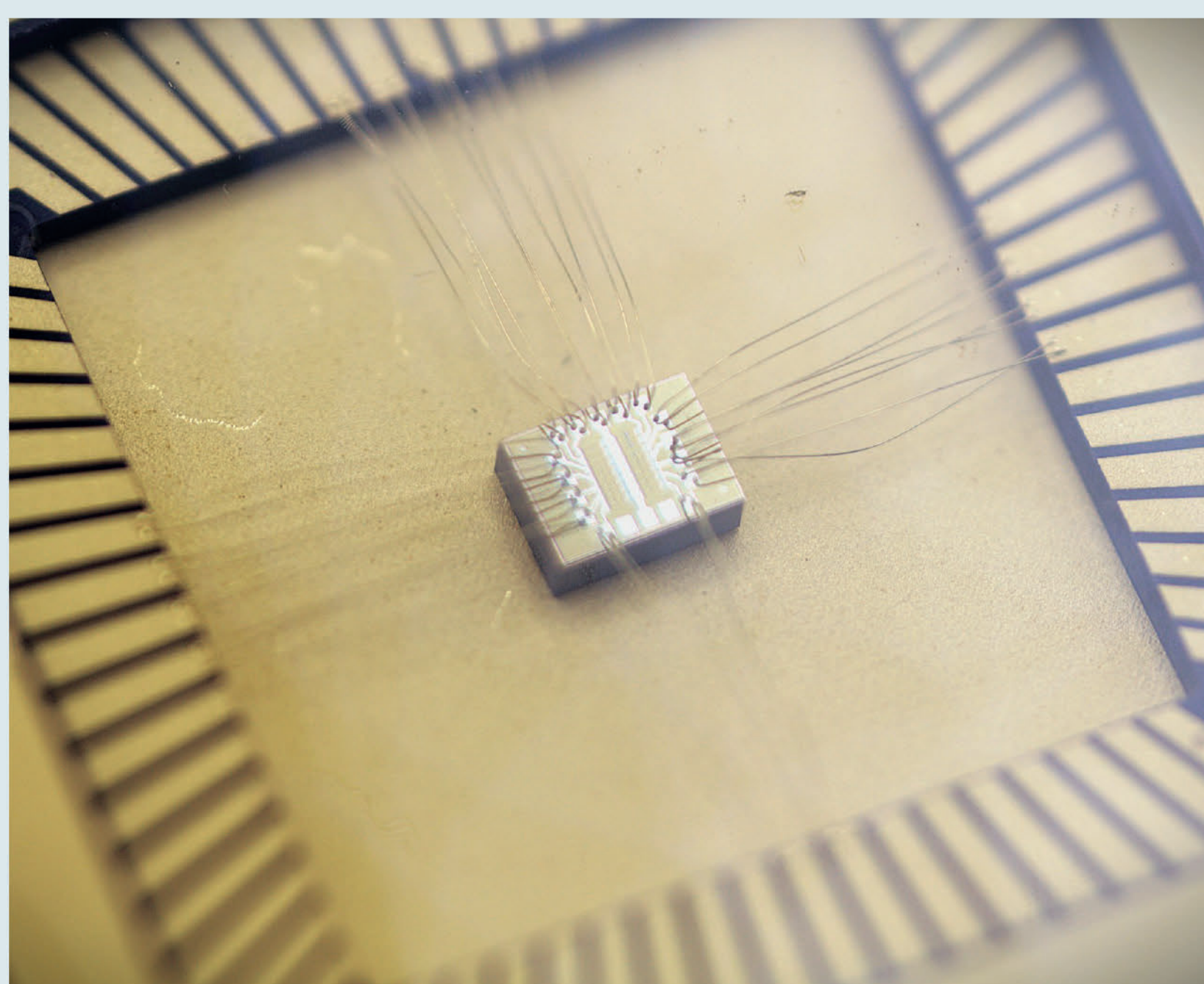
Fraunhofer ISIT is one of 14 German research institutes involved in the implementation of the APECS pilot line. As one of the 12 Fraunhofer institutes, Fraunhofer ISIT develops and manufactures application-specific components for microsystems technology and power electronics, covering the entire value chain from process and device simulation to process development and full component manufacturing in a 200 mm fabrication environment. These miniaturized components are deployed across a broad range of applications, including energy systems and automotive engineering, consumer electronics, medical technology, as well as communication and automation technologies.

The role of Fraunhofer ISIT in the APECS pilot line

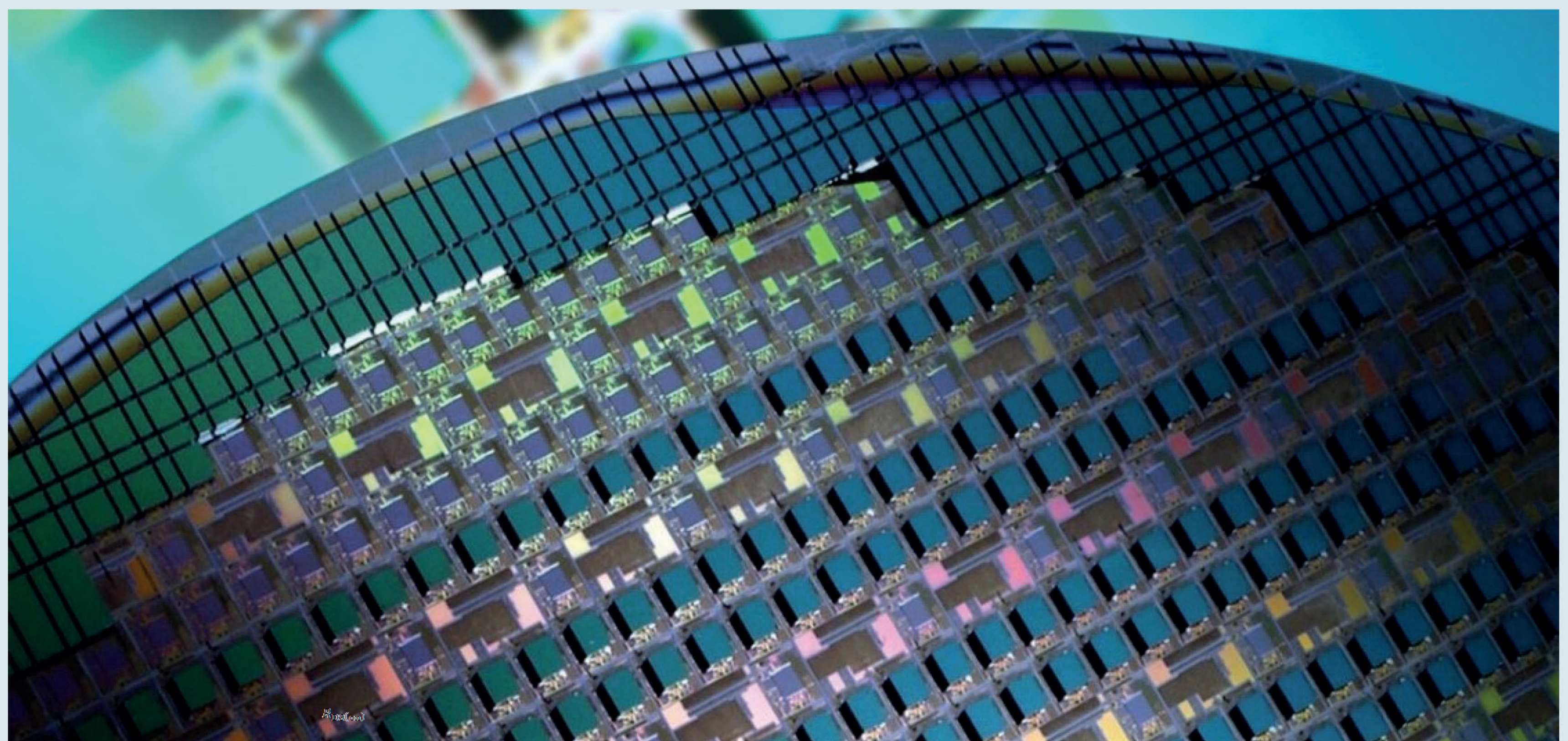
Fraunhofer ISIT focuses on the heterogeneous integration of advanced functional materials into complex semiconductor systems, such as MEMS, III-N semiconductors, and novel glass substrates. Beyond this role, Fraunhofer ISIT contributes its technical know-how across several key areas:

- **Heterogeneous integration and advanced packaging:** Developing technologies for integrating chiplets into a single system, with a particular focus on the integration of microelectromechanical systems (MEMS) and microelectronics components based on III-N semiconductors, enabling high-performance, reliable, and flexible electronic solutions
- **Power electronics:** Developing innovative power semiconductor devices, particularly based on gallium nitride (GaN), to increase energy efficiency and power density in electronic systems
- **Thermal management:** Finding solutions for effective heat dissipation in highly integrated systems to improve component reliability and lifetime
- **Reliability and testing methods:** Implementing approaches for monitoring, assessing, and predicting failures in electronic systems to ensure operational safety

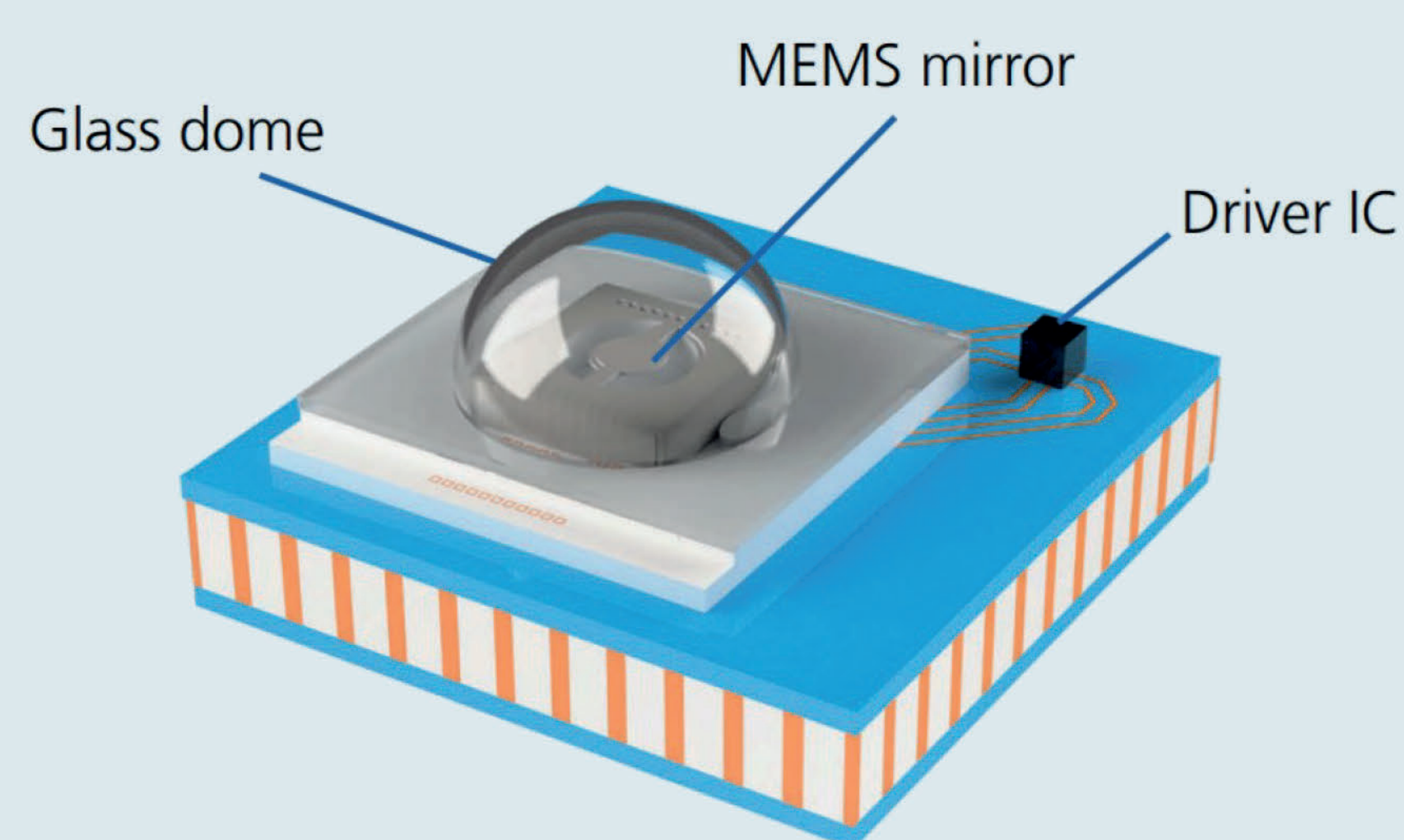
Subdemo GaN-Sensor Chip, packaged Iteration 1.0
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Post-CMOS pressure sensor chiplets with wafer-level packages before dicing of the wafer.
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MEMS Mirror Chiplet
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Contributions to the APECS pilot line

Within the APECS pilot line, Fraunhofer ISIT builds on its long-standing expertise in microsystems technology, power electronics, and system integration. Through APECS, these competencies are applied to address current challenges in the European semiconductor industry and to support the development of innovative, application-ready solutions. This institute also holds the technical lead for the developing of the Multi-Material Sensor Demonstrator within APECS.

GaN sensor chiplet for hydrogen detection:

This chiplet will incorporate a high-electron-mobility transistor (HEMT) on a silicon interposer, with an $R_{DS(on)}$ of approximately 100-500 Ω . It will use sensor chips with low to no cross-sensitivity and is expected to provide high sensitivity in the ppm range, as well as a signal-to-noise ratio of more than 500:1. In addition, the chiplet will include a dedicated readout integrated circuit (ROIC) on the interposer.

MEMS mirror:

The MEMS mirror will be an AlScN-driven, biaxial, resonant device with an expected field of view (FoV) of $90^\circ \times 90^\circ$ at 2–5 kHz or $60^\circ \times 60^\circ$ at 15–25 kHz. The mirror will be mounted on a glass interposer with through-glass vias (TGVs) and hermetically sealed within a glass dome.

What is APECS?

APECS (Advanced Packaging and Heterogeneous Integration for Electronic Components and Systems) is one of 5 European pilot lines established under the EU Chips Act. APECS is the foundation for Europe's competitive position in heterogeneous system integration and advanced packaging. It plays a vital role in enhancing Europe's strategic autonomy by reducing dependence on foreign suppliers and strengthening Europe's capabilities in critical technology areas.

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Additional information

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