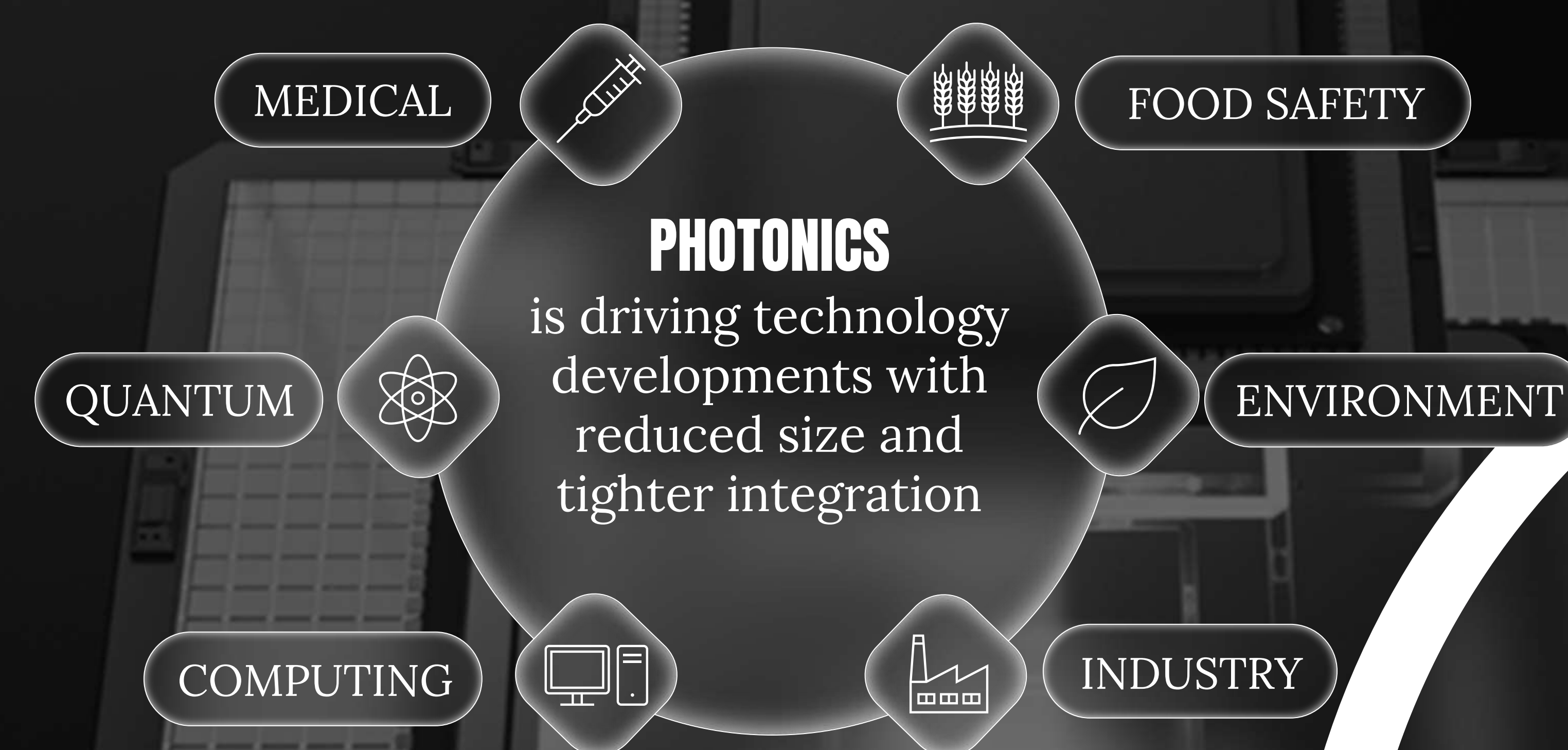


SELF-CALIBRATING PHOTODIODES AND NEW MEASUREMENT TECHNIQUES IN MINIATURISED INTEGRATED SYSTEMS

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MINIATURISATION

Development trending towards miniaturized and integrated photonic systems

SELF-CALIBRATION

New methods already developed in previous projects

How can we assure
MEASUREMENT ACCURACY
in an integrated measurement system?

SOLUTION

Self-calibrating techniques for SI traceability in photonic chips

NMI-ON-A-CHIP

Self-calibrating detectors integrated as a reference into applications operated at room temperature in a miniaturised measurement system

DIGITAL TWIN

Combine measurements with 3D simulations to achieve SI traceability

MEDICAL

Optical methods are used in diagnostic blood sample analysis

INDUSTRY

Development of technology relies on the ability to measure improvement

COMPATIBILITY

between microelectronic standards and photonic integrated circuits

SELF-CALIBRATION OF PHOTODIODES

An ideal photodiode have a responsivity given by **fundamental constants** and the radiation wavelength. By self-calibration we mean a method that quantifies the deviation from ideal performance of a real photodiode caused by reflectance and internal losses.

THREE SELF-CALIBRATION METHODS DEVELOPED

1

Simulation models fitted to measured charge-carrier lifetime measurements quantifying the expected losses of photodiodes manufactured with a specific passivation layer deposition. Led to the development of worlds best photodiodes with 10 ppm internal losses^[1].

2

Purely experimental method where photocurrent and electrical substitution at room temperature is combined on one chip to achieve a relative uncertainty of 150 ppm ($k=1$)^[2].

3

3D simulation models fitted to photocurrent vs voltage measurements. Extracts photodiode-defining parameters enabling a predictable spectral response from measurements at one wavelength only to 30 ppm uncertainty^[3].

References

- [1] Koybasi et al. Sensors. 2021; 21(23):7807
- [2] Solheim et al. Metrologia. 2024; 61(6), 065007.
- [3] Tran et al. Metrologia. 2022; 59.4: 045012.

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