

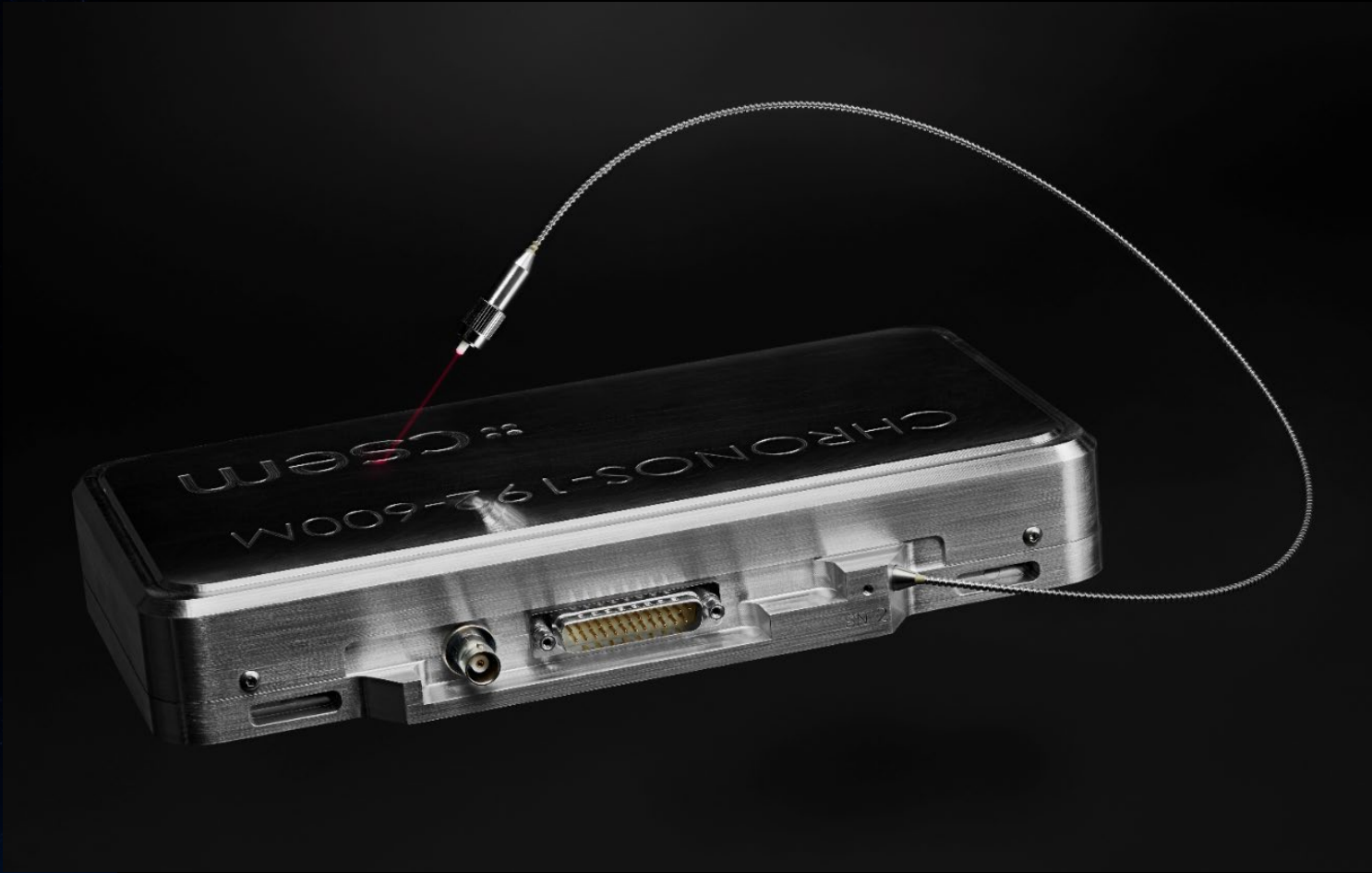
Microwave photonics – Integration and characterization

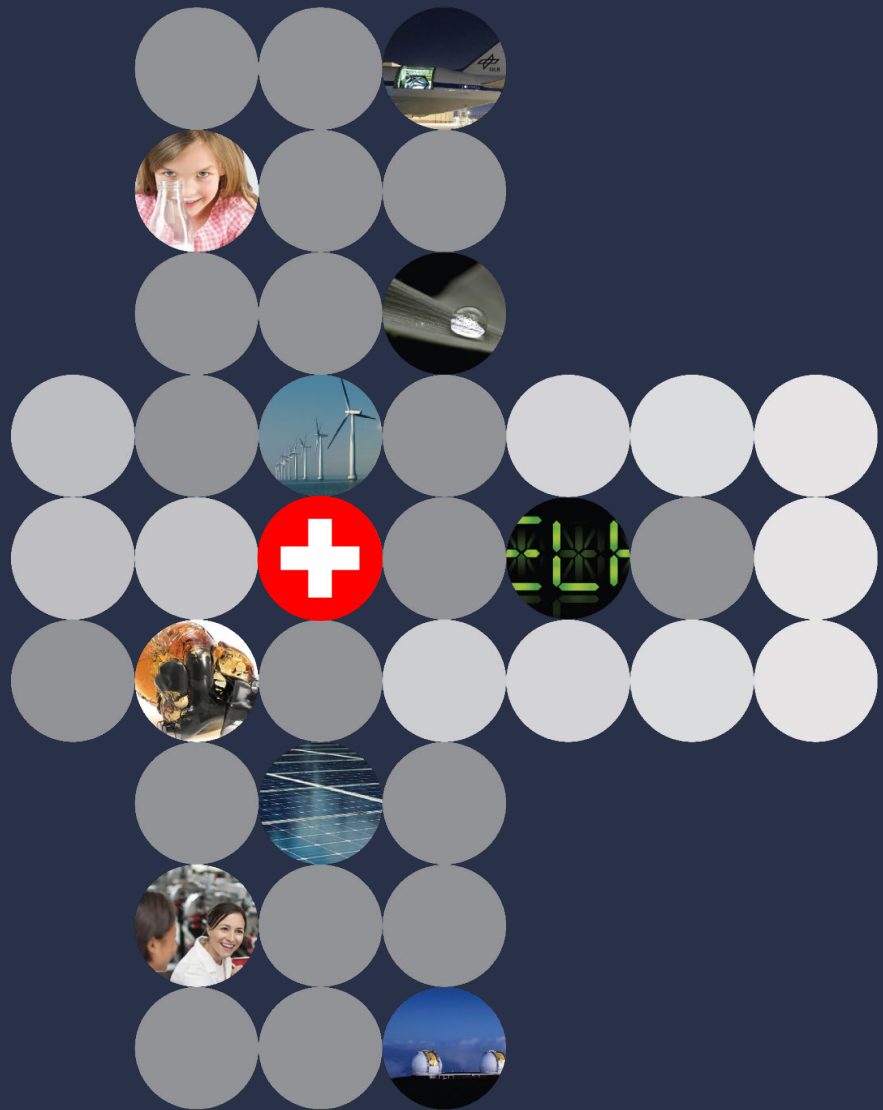
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by Steve Lecomte

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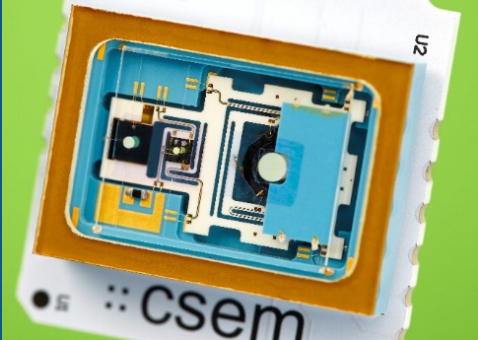
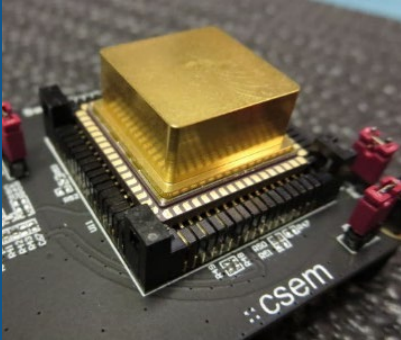
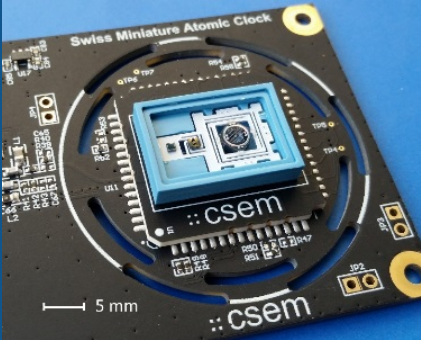
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Swiss Research
and Technology Organization (**RTO**)

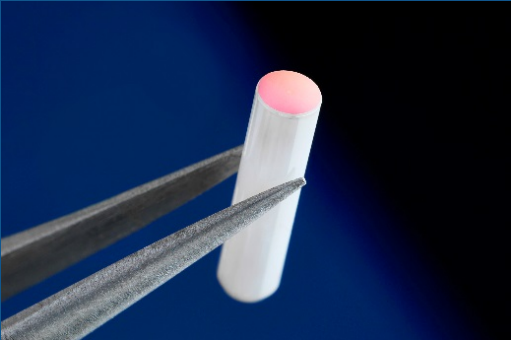
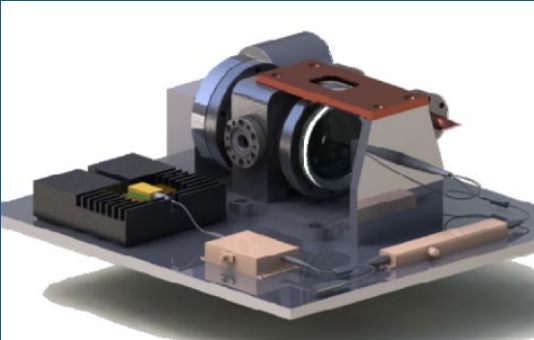
Mission: transfer technologies to industry

Time and Frequency

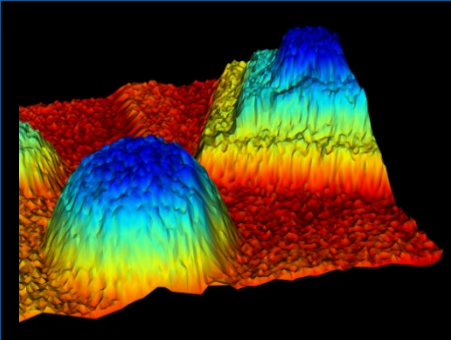
Quantum sensors



Lasers

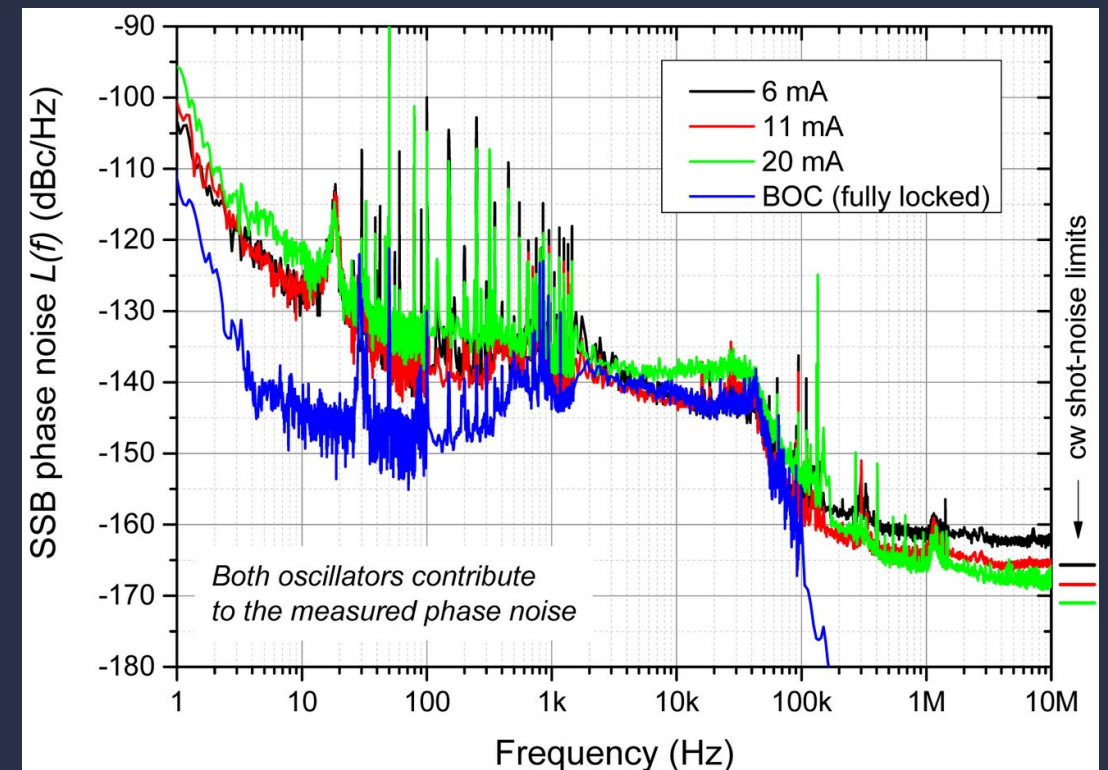
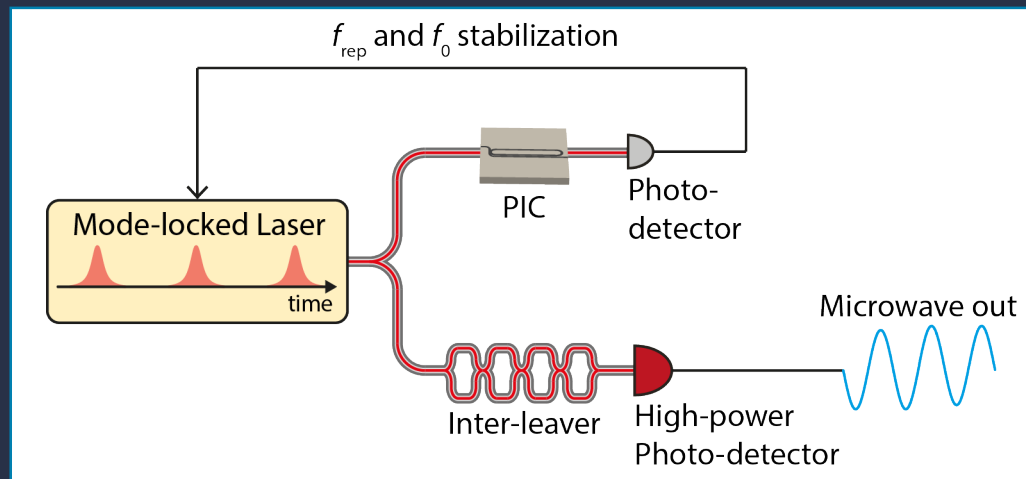


LiDARs



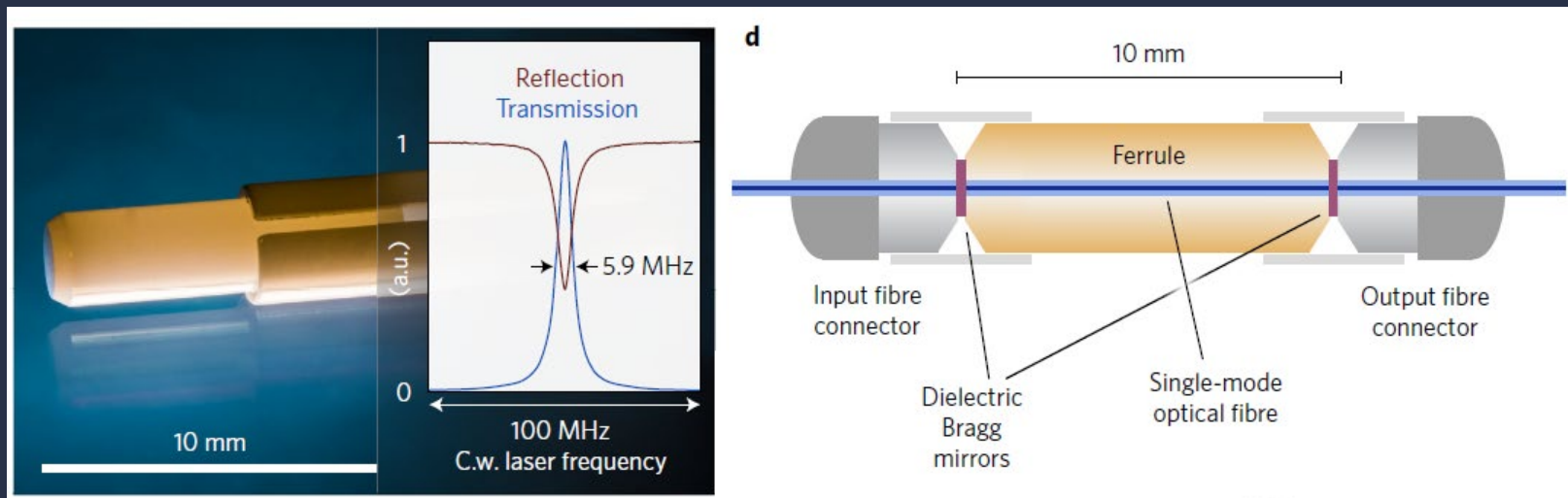
Microwave photonics at CSEM

Modelocked laser based ultralow phase noise microwave generation



Microwave photonics at CSEM

Fibered microresonator



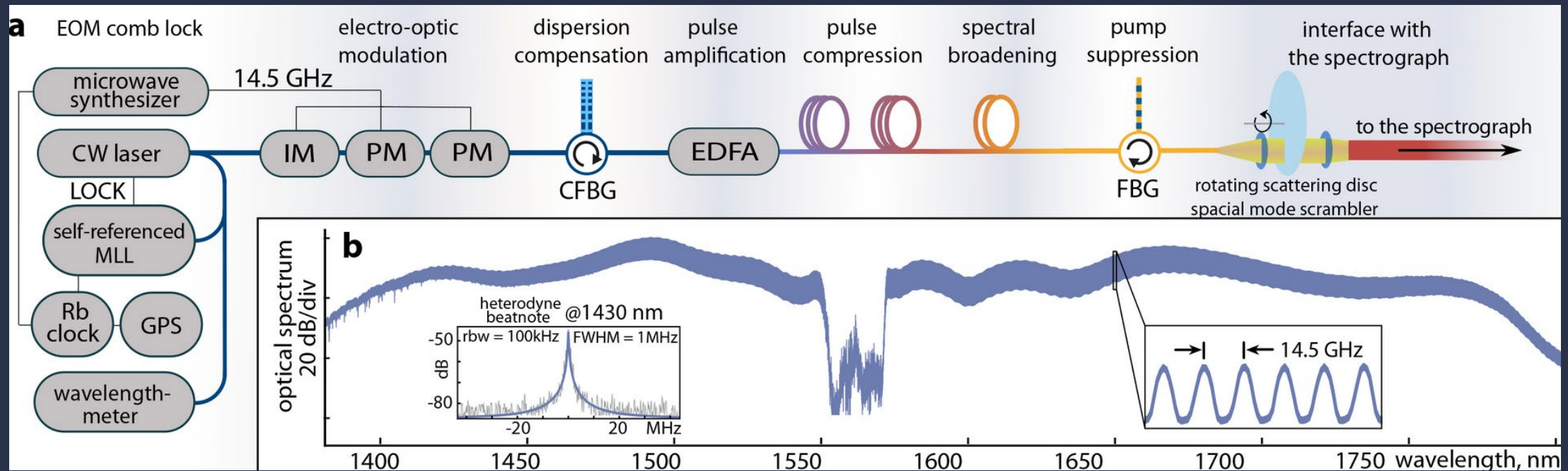
- High-Q
- Cheap and handy
- Optical filter
- Optical frequency reference
- Soliton generation
- Nonlinear filtering

Obrzud, E., Lecomte, S. & Herr, T. Temporal solitons in microresonators driven by optical pulses. *Nature Photon* **11**, 600–607 (2017). <https://doi.org/10.1038/nphoton.2017.140>

V. Brasch, E. Obrzud, S. Lecomte, and T. Herr, "Nonlinear filtering of an optical pulse train using dissipative Kerr solitons," *Optica* **6**, 1386-1393 (2019)

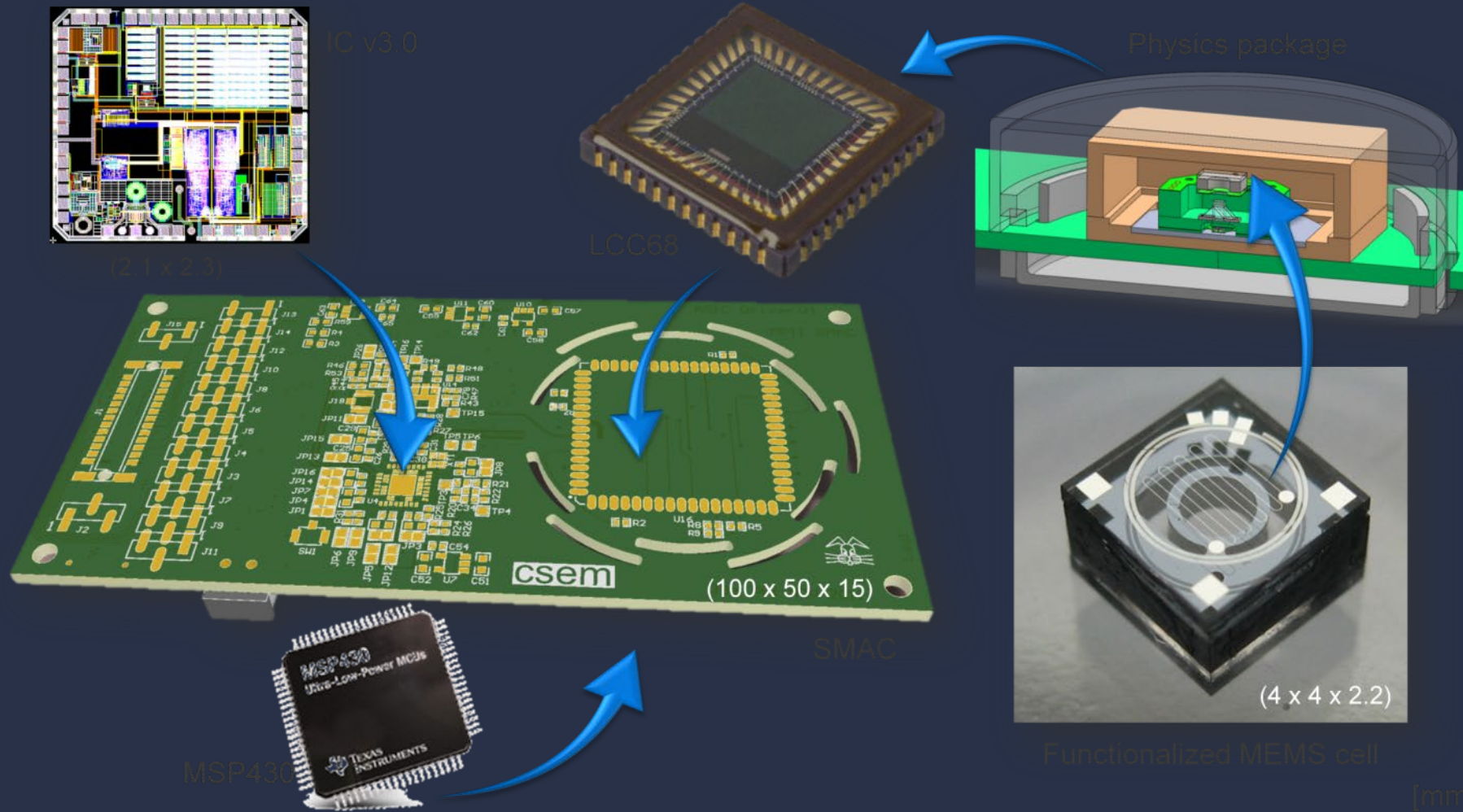
Microwave photonics at CSEM

Ultrabroadband optical frequency comb based on electro-optic modulation



E. Obrzud, M. Rainer, A. Harutyunyan, B. Chazelas, M. Cecconi, A. Ghedina, E. Molinari, S. Kundermann, S. Lecomte, F. Pepe, F. Wildi, F. Bouchy, and T. Herr, "Broadband near-infrared astronomical spectrometer calibration and on-sky validation with an electro-optic laser frequency comb," *Opt. Express* **26**, 34830-34841 (2018)

Integration of a miniature atomic clock



Collaborations

- What CSEM offers
 - System design and integration
 - System characterization
- What CSEM is looking for
 - Collaborations with industrial partners for technological transfer and product development
 - Collaborations with academic partners for R&D projects with complementary skills and technologies (for instance photonics integrated circuits)

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