

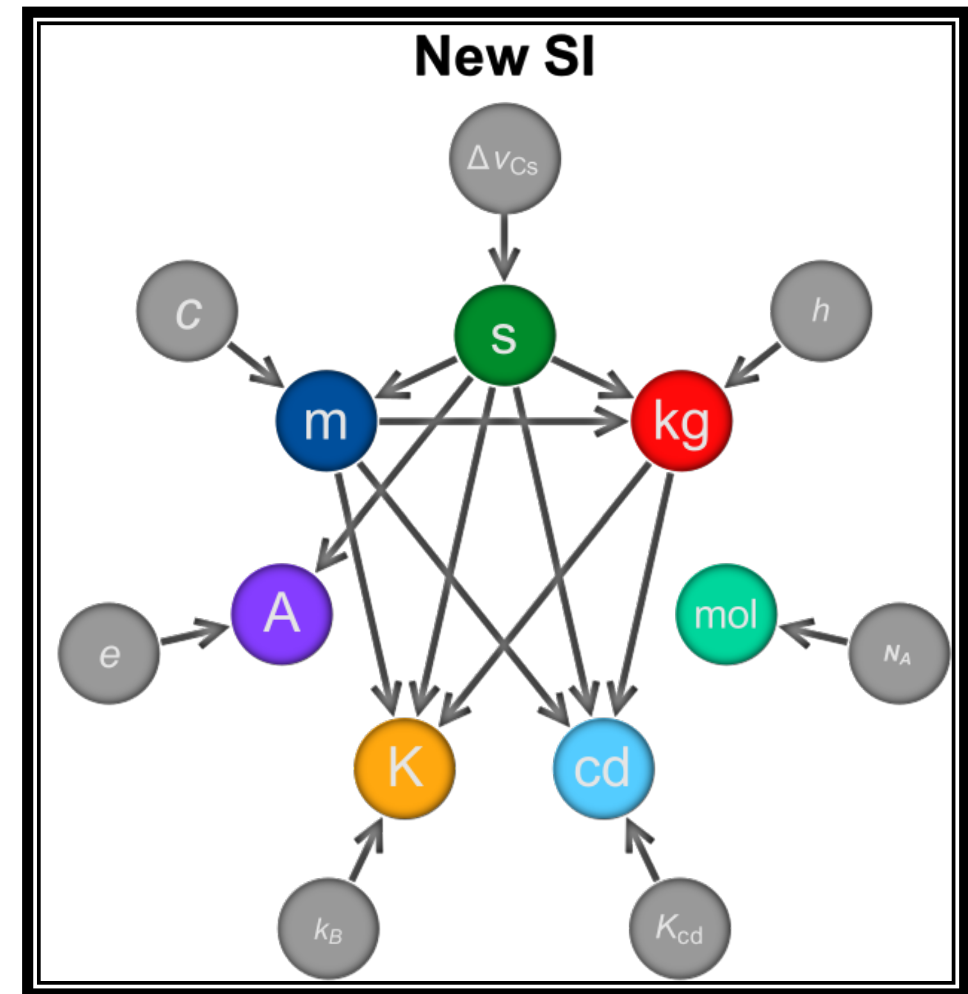
NIST-on-A-Chip Technologies

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Commercialization of
NIST-on-a-Chip
enables
democratization of
Quantum SI



Classical SI Dissemination Chain

NIST

NIST



Primary Standard

SECONDARY
CALIBRATION LAB



Secondary
Standard Gauge

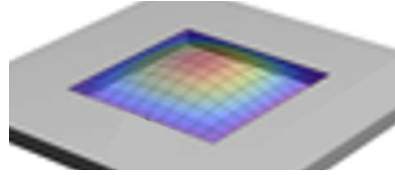
USERS



Calibrated
Gauge

Quantum SI Dissemination Chain

NIST



NOAC Pressure
Standard and Sensor

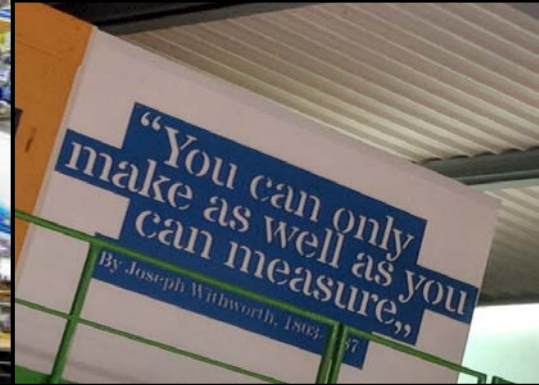
WHEN QUANTUM-
BASED METROLOGY
REPLACES CLASSICAL
METROLOGY

1. You interrogate nature so you get the right answer
2. Uncertainties still exist
3. SI traceability is intrinsic

NO NEED TO CALIBRATE

Metrology Matters

NIST

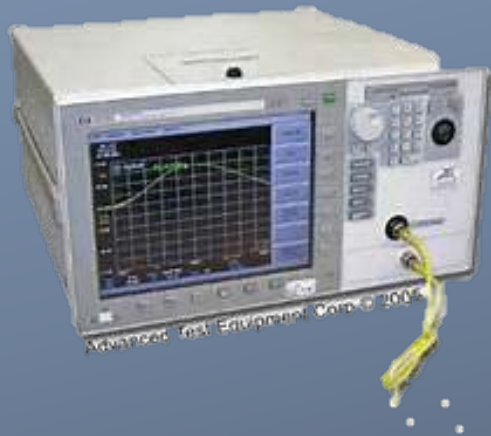


GOAL: Ubiquitous Metrology is NIST-quality standards and sensors available directly where customers/users need them

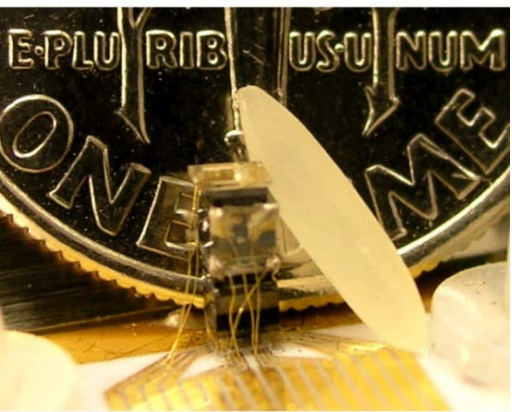
The Commercialization Path Forward

Fit for Purpose:

- Direct SI-traceable measurement capability built into instruments
- Devices become flexible, manufactural, and usable



An Example of Commercialization



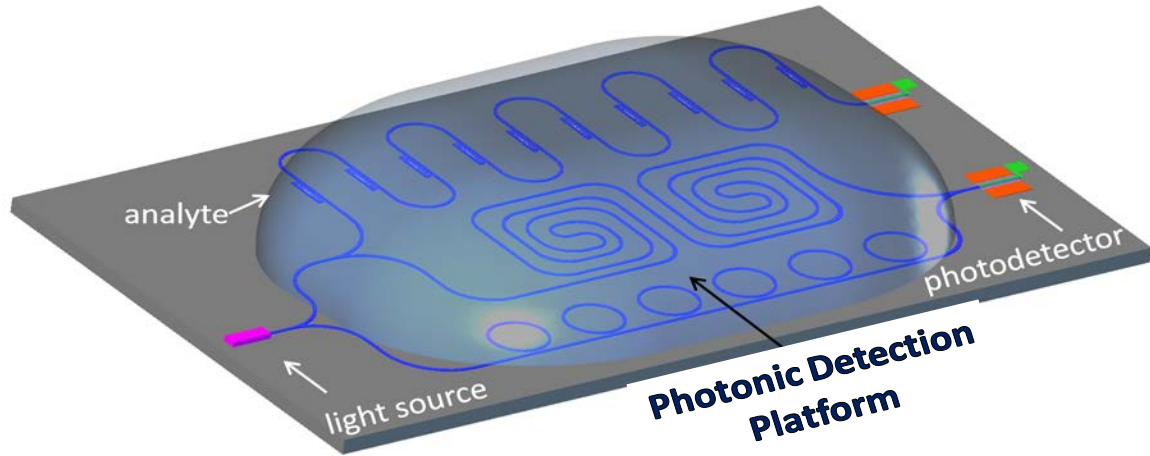
**Chip Scale Atomic Clock
(10^{-11} uncertainty)**



As Commercialized



**Telecom Networks
>\$2 trillion/year globally**



Holistic NIST-on-a-Chip Platform

- Additive measurement capabilities over time
- Replacement of classical sensors and standards
- Combination of sensors is a multiplier and enables completely new and exciting opportunities.



Flexible

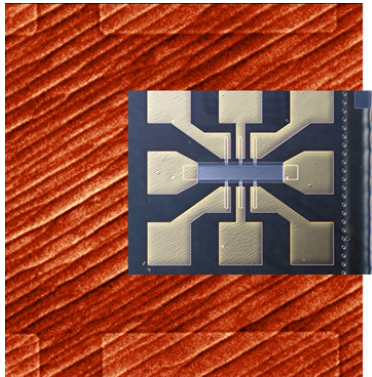


Manufacturable

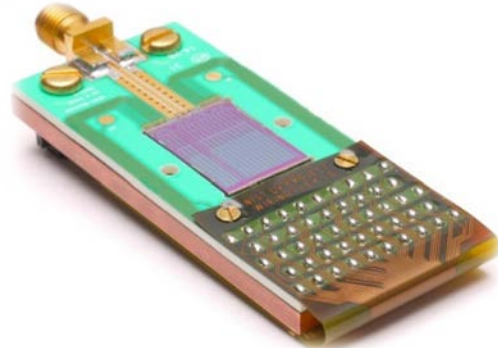


Usable

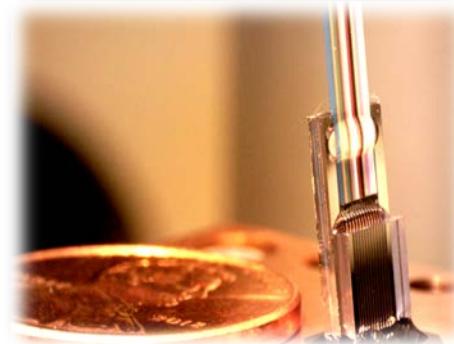
NIST-on-a-Chip Devices



Resistance
Graphene QHR



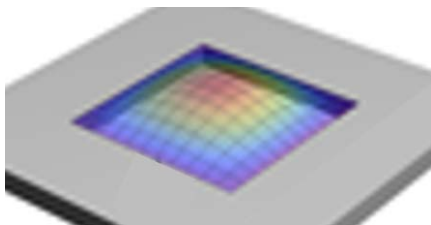
Voltage
AC and DC



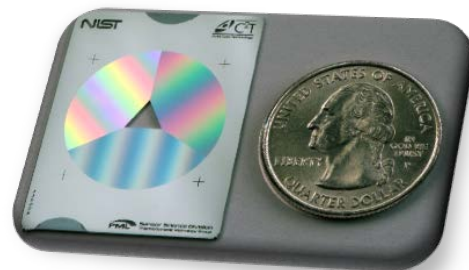
Temperature



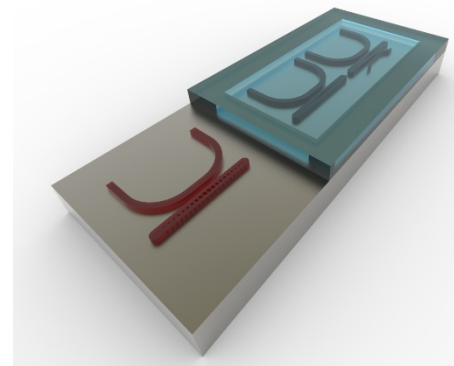
Radiometers
Optical-Fiber Power



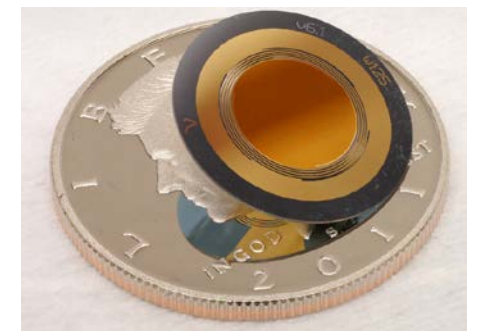
Pressure



Vacuum
UHV and XHV

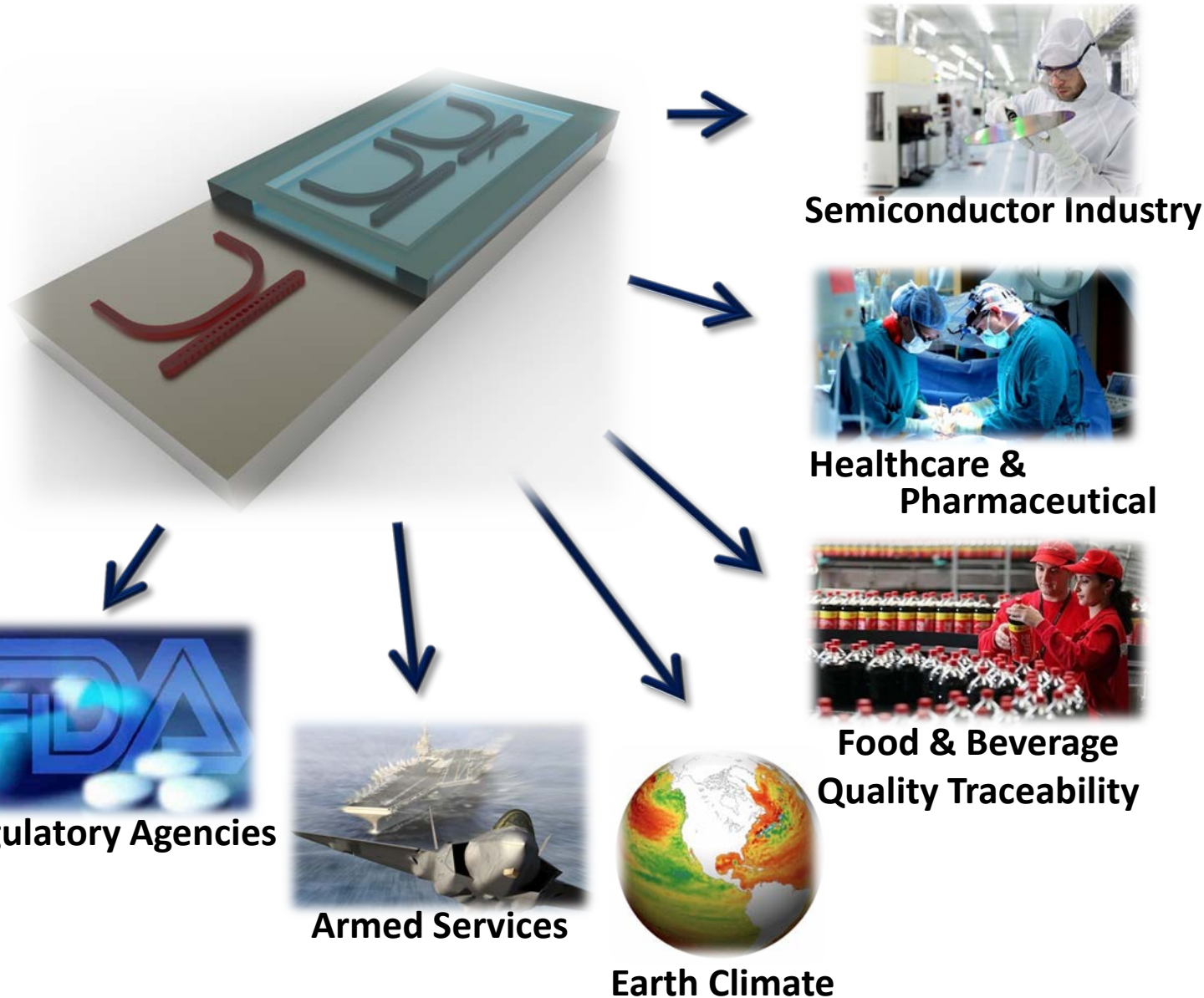


Humidity



Smart Mirror
Laser, RF, & μ wave Power

NOAC for Humidity: Broad Markets



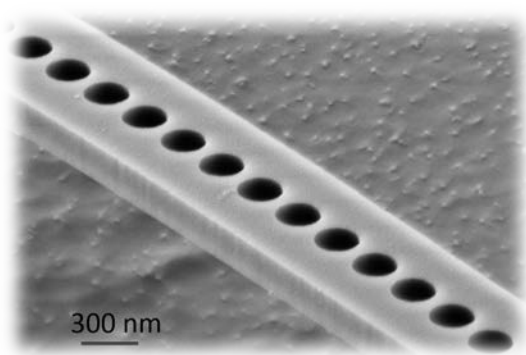
Deployable & Accurate:

- “Humidity” from thermodynamic temperature
- Inherently quantum phenomenon
- Consistent with emergent Quantum-SI

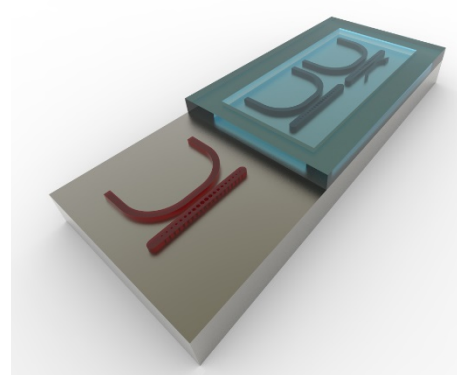
Robust & Low Cost:

- Integrated photonics – leverages advances in telecom
- Based on SOI platform
- Amenable to mass manufacturing

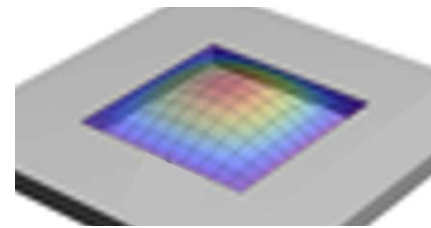
“Just four” NOAC devices



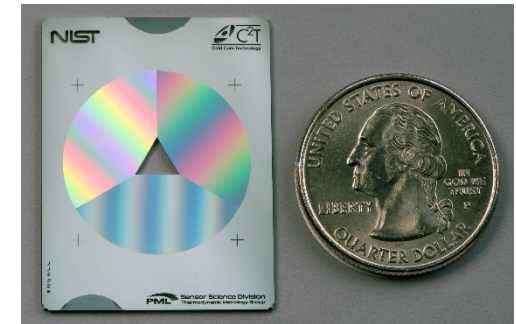
Temperature



Humidity

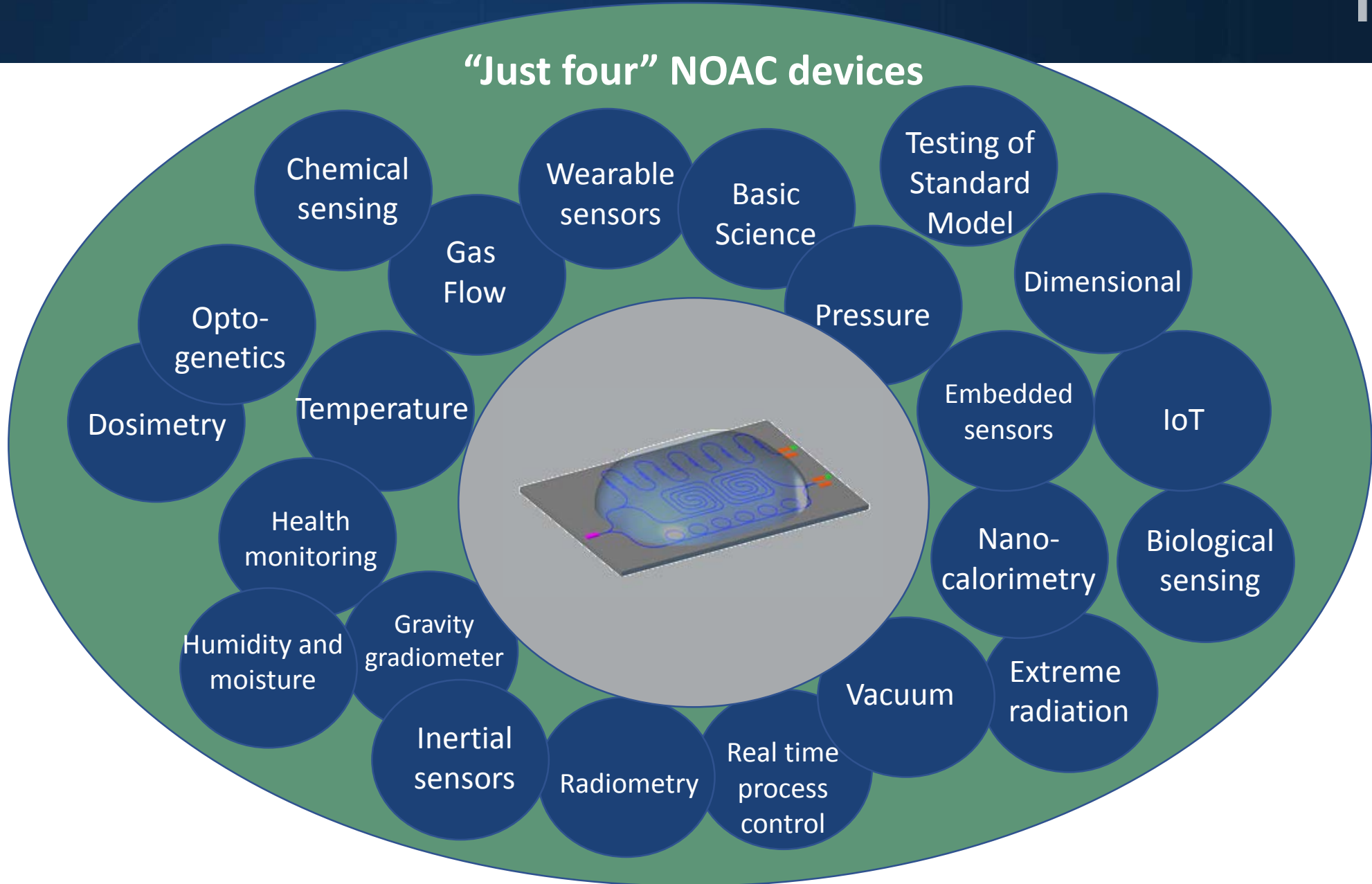


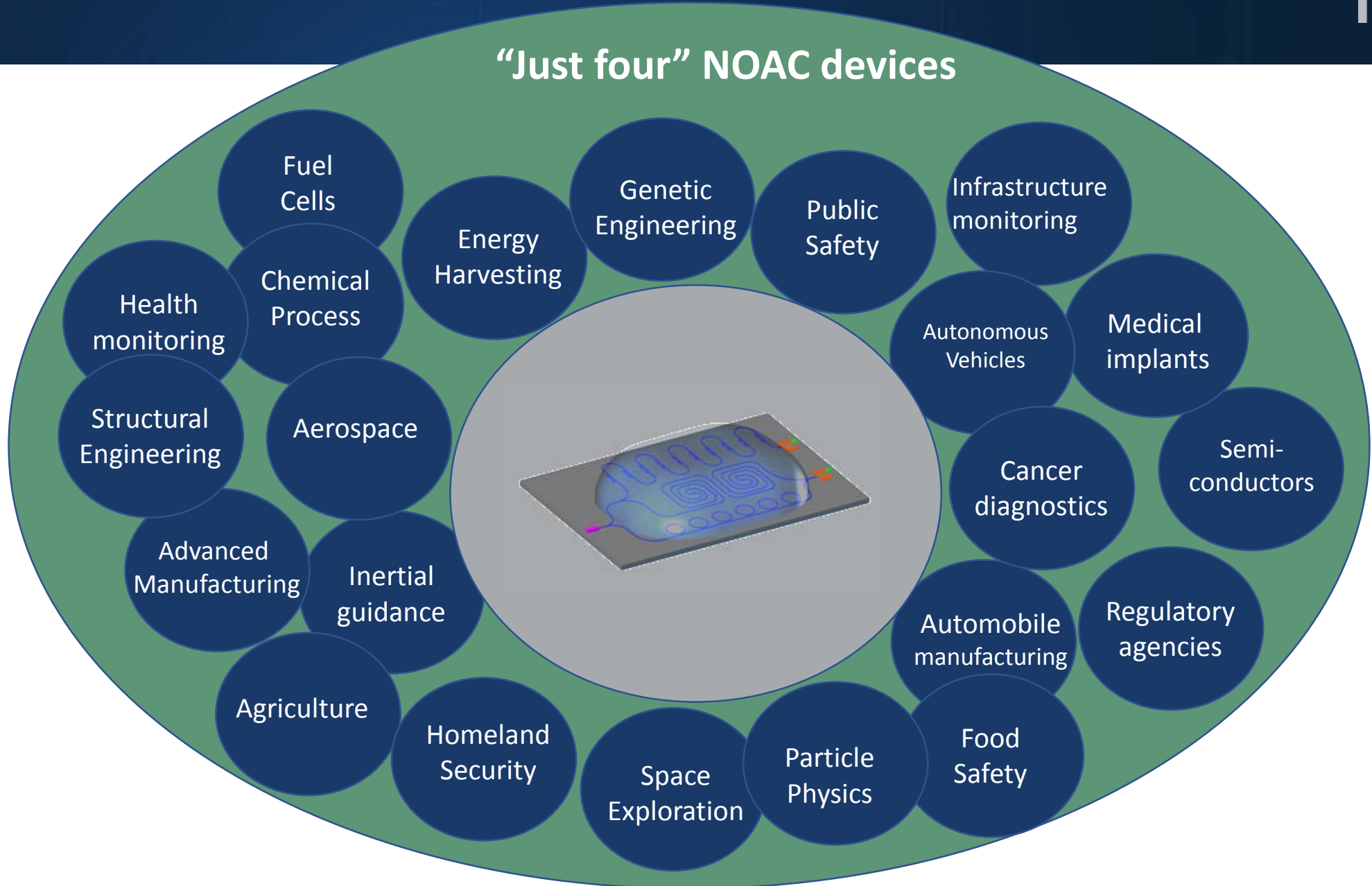
Pressure



Vacuum

What happens if you integrate all four onto one chip ?







QUESTIONS?