

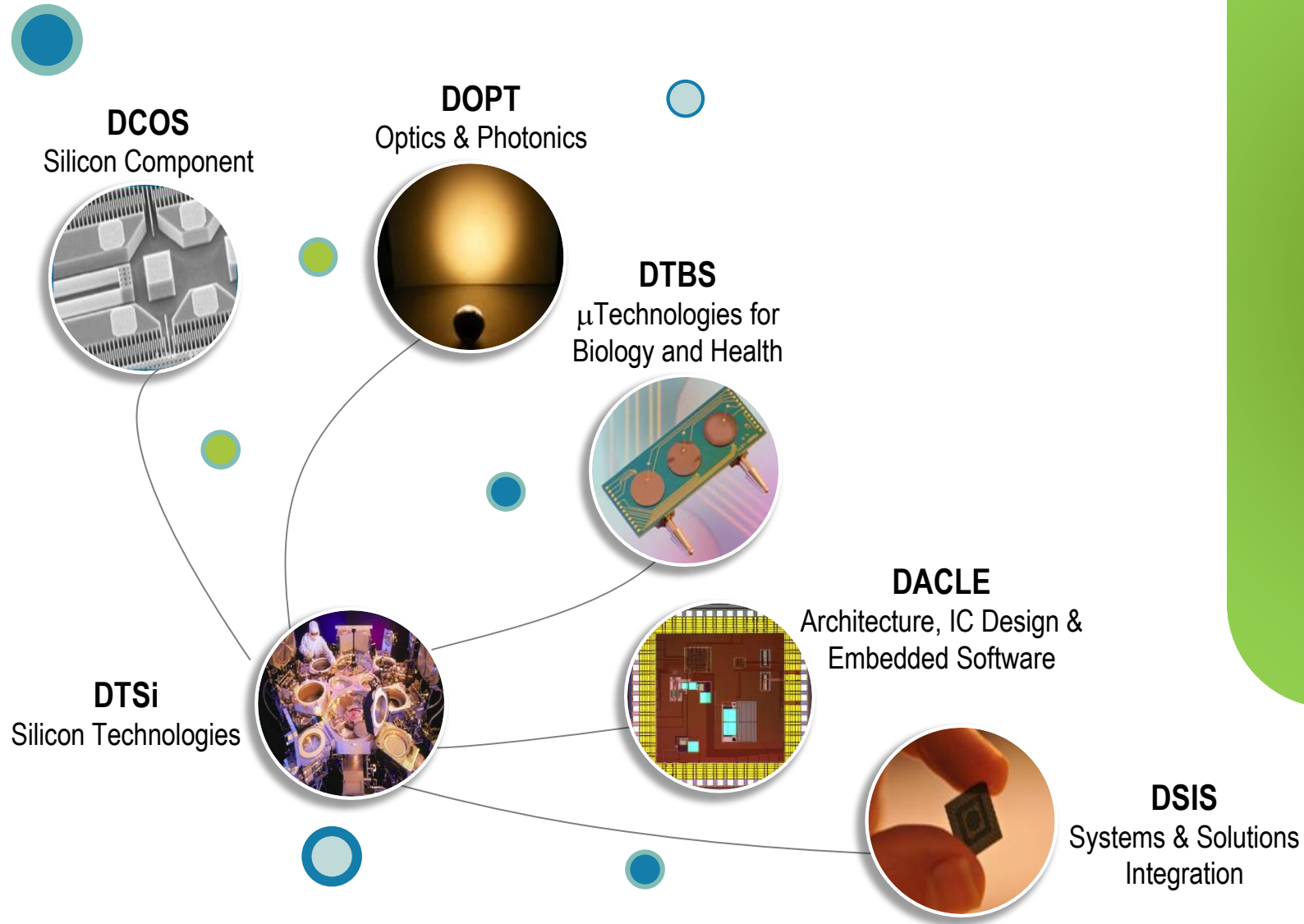
**INTRODUCTION – LETI ECOSYSTEM
MARCH 1ST 2018**

Feb 2018 | L. Pain



Grenoble - France

CEA-LETI AT A GLANCE



- 1967 creation
- 1,900 people
- 64 startups
- »
- 315 total budget (M€)
- 2,763 Patents Portfolio
- 350 Industrial Partners



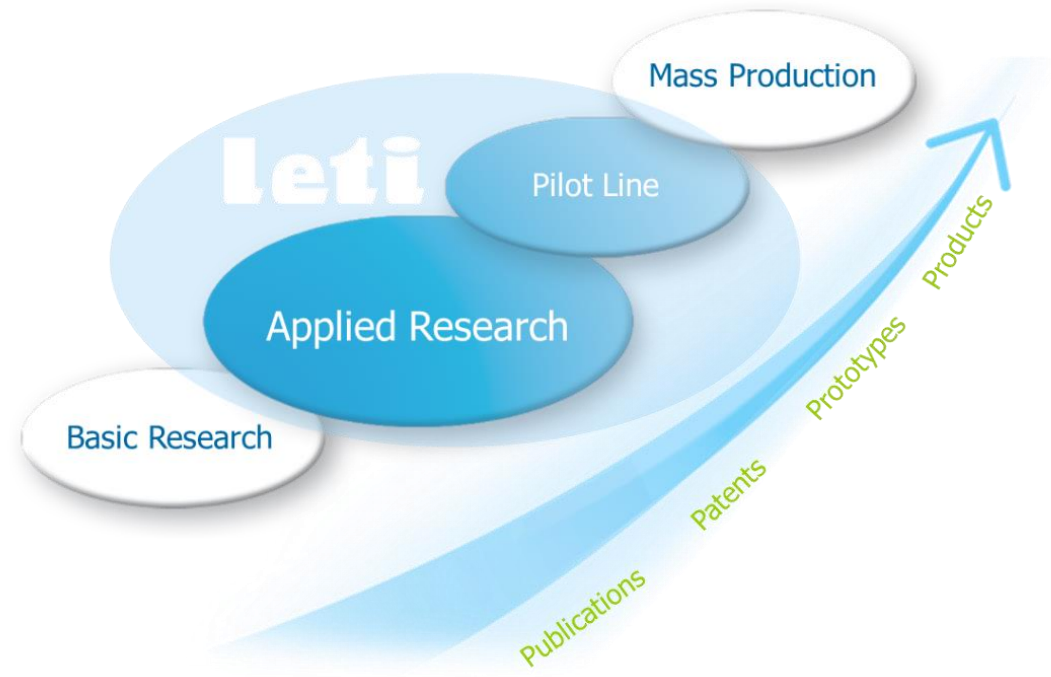
LETI'S MISSION AND POSITIONNING

Our mission

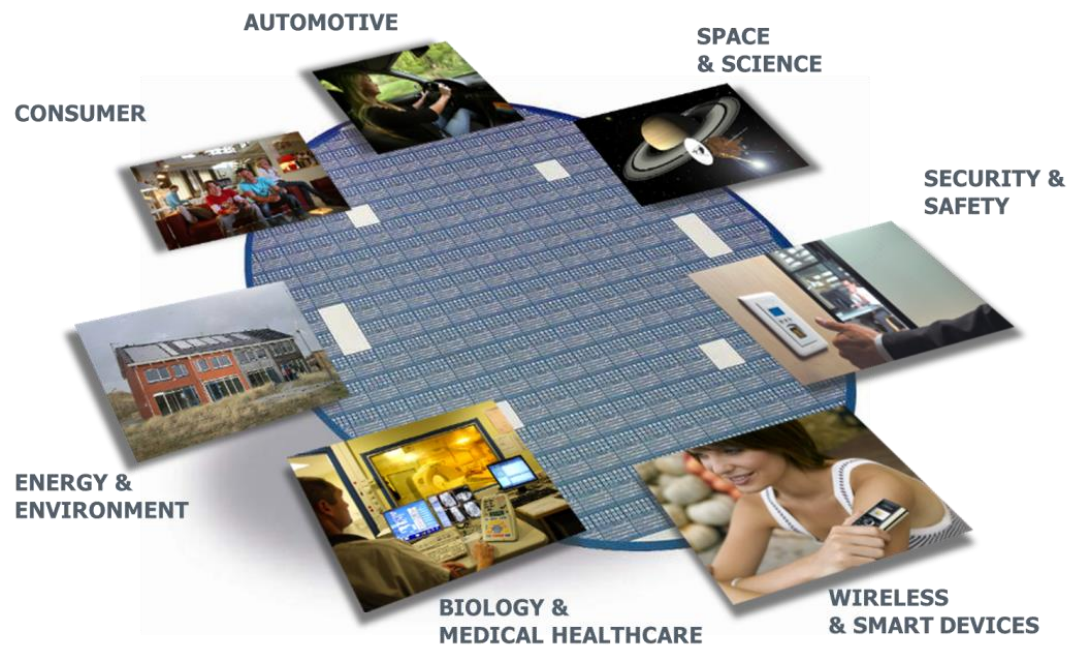
Create *Innovation* and Transfer it to *Industry*

Leti's Value Proposition

Strategic Partnerships along the value added chain



Application Domains



200MM & 300MM PLATFORM

200mm

- 1. Power GaN
- 2. Sensors/actuators
- 3. Display
- 4. Lighting
- 5. Photonics on Si
- 6. 3D Integration
- 7. RF Filters

300mm

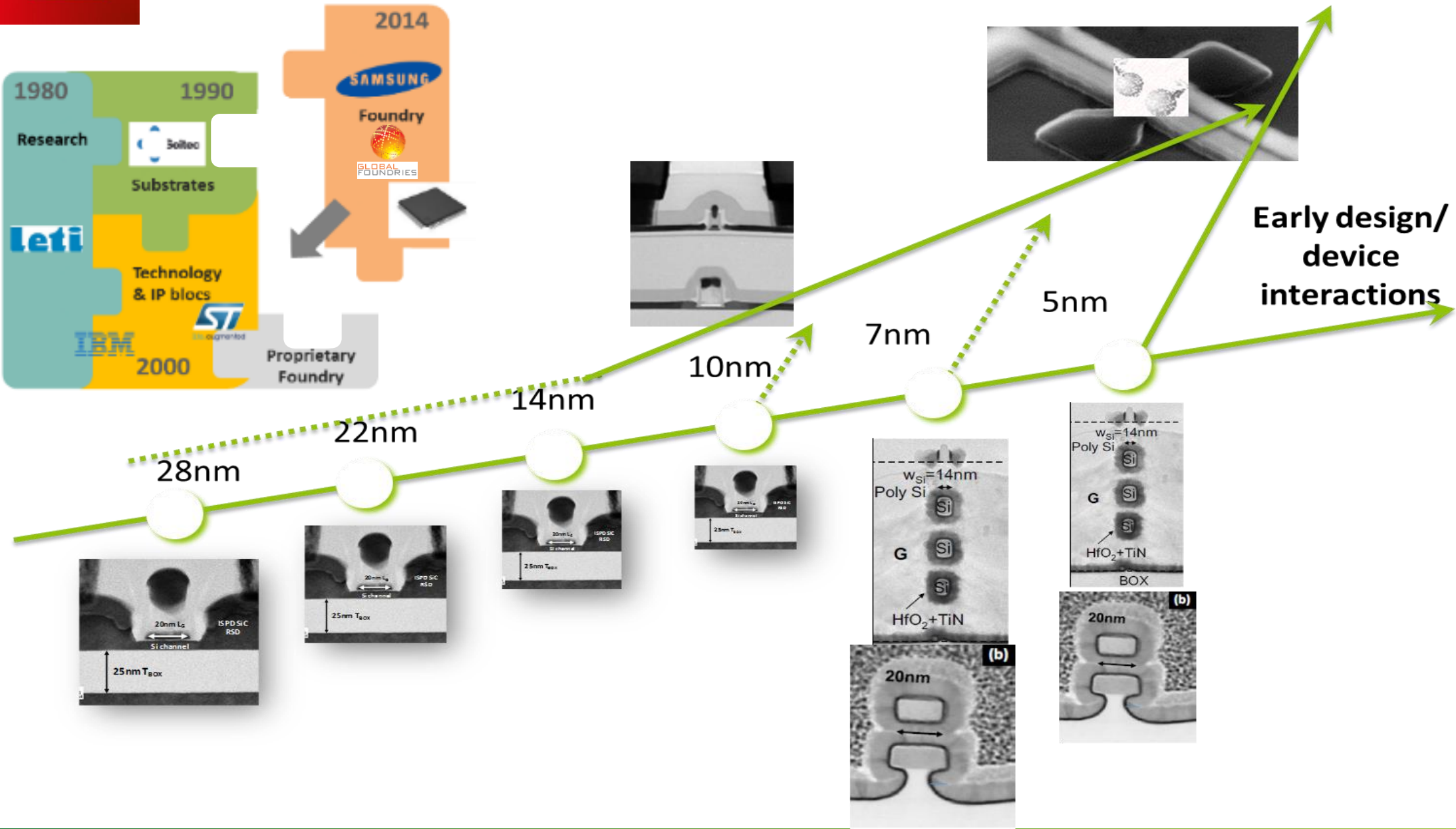
- 1. Imager
- 2. eNVM (PCRAM, OxRAM,....)
- 3. Photonics on Si
- 4. 3D Integration
- 5. FDSOI
- 6. Quantum
- 7. 3D sequential « Cool Cube »

200mm and 300mm Platforms Advanced CMOS/3D/MEMS/Photonics

- 7800 square meters Cleanroom - ISO3-5
 - 200mm equipments : ~400
 - 300mm equipments : ~110
 - 24/7 operations

Leti plans to complete 300mm platform by 2018/19

LETI ADVANCED DEVICE ROADMAP



Early system/
device
interactions

Early material/
device
interactions

ADVANCED MEMORY -SYNAPSE NEURAL NETWORK @LETI

PCM

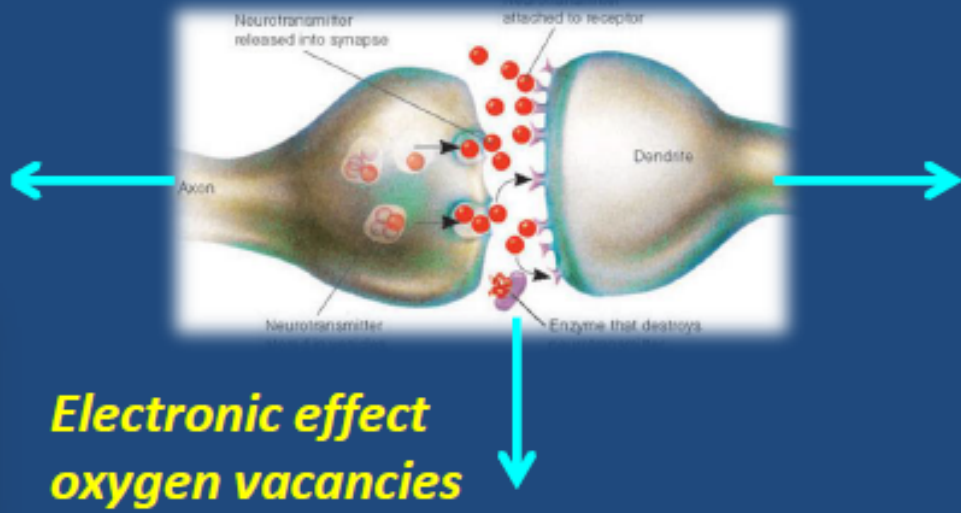
GST
GeTe
GST + HfO₂

M.Suri, et. al, IEDM 2011
M.Suri, et. al, IMW 2012, JAP 2012
O.Bichler et al. IEEE TED 2012
M.Suri et al., EPCOS 2013
D.Garbin et al., IEEE Nano 2013

D.Garbin et al. IEDM 2014
D.Garbin et al., IEEE TED 2015

Thermal effect

Electrochemical effect



**Electronic effect
oxygen vacancies**

CBRAM

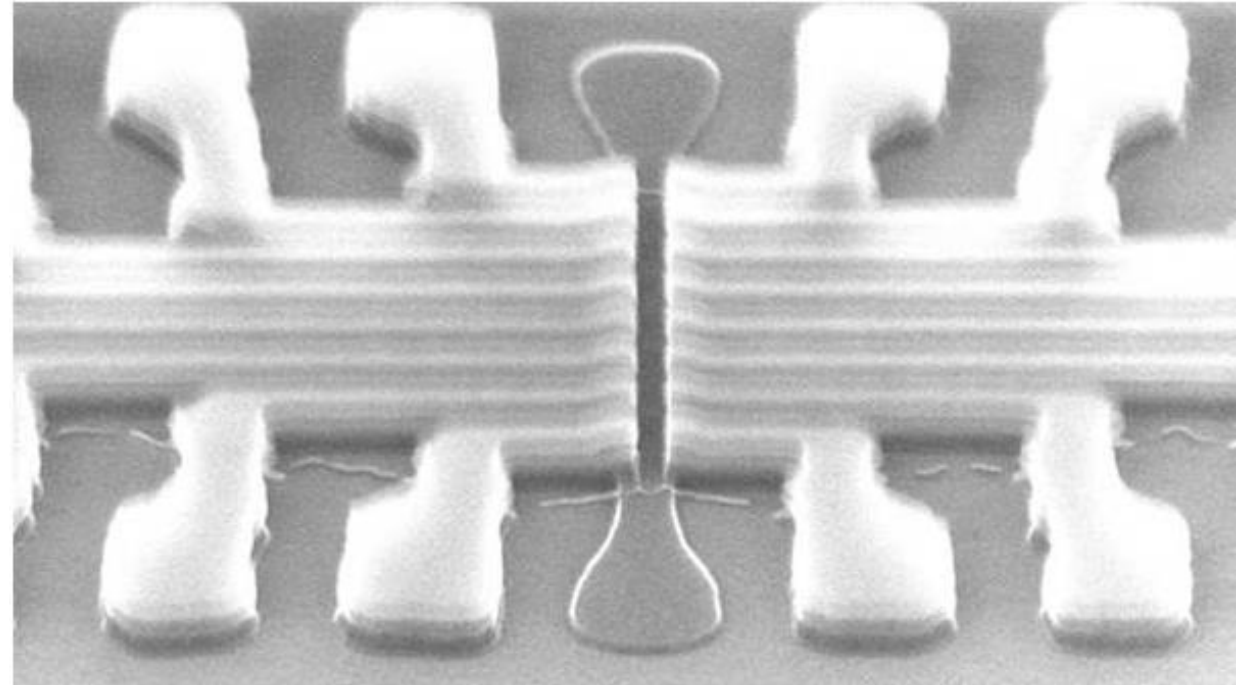
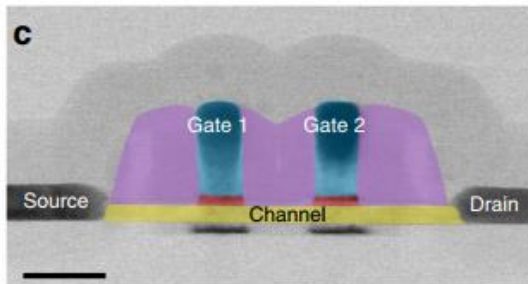
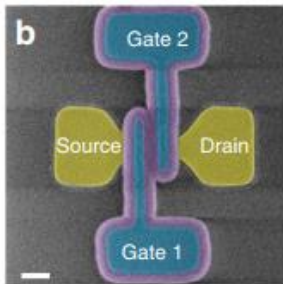
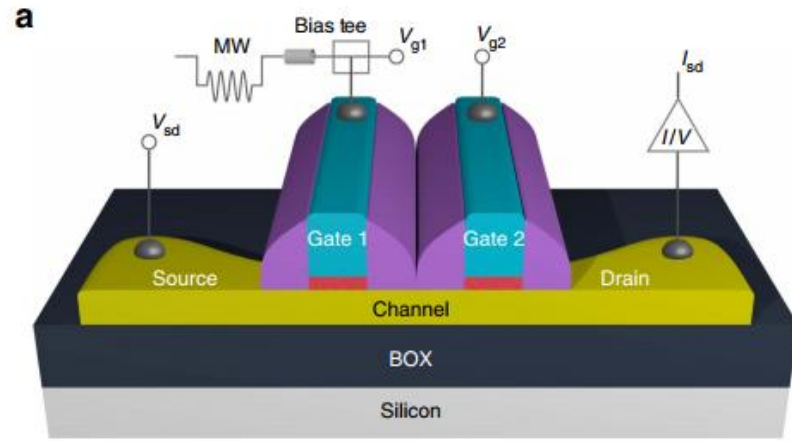
Ag / GeS₂

M.Suri et al., IEDM 2012
M.Suri et al., IEEE TED 2013

OXRAM

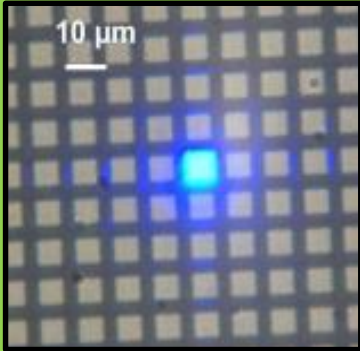
TiN/HfO₂/Ti/TiN

- 1st 300mm Silicon data demonstrated @LETI



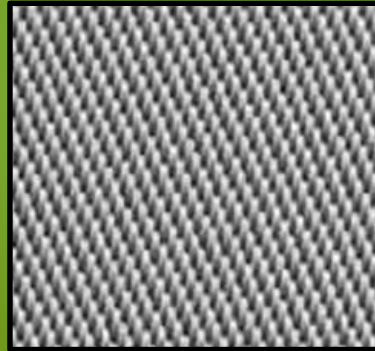
Displays

High brightness
solutions for augmented reality



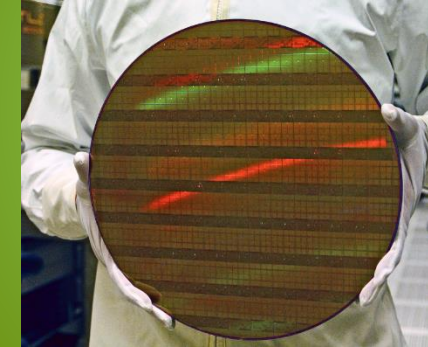
Solid-state light emission

Integrated smart LEDs
LEDs on Si



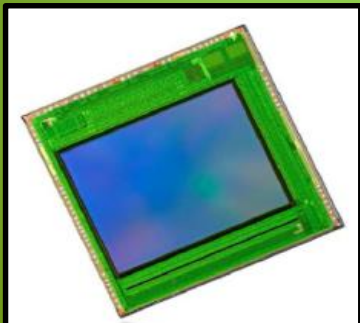
Silicon photonics (300mm)

Laser integration
Integrate photonic



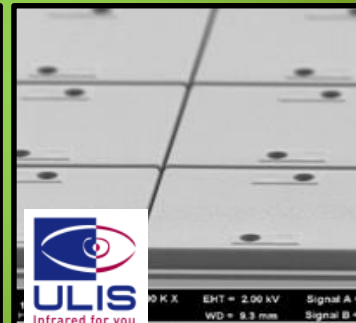
Visible imaging

Innovative pixels
Integrated filters & optics



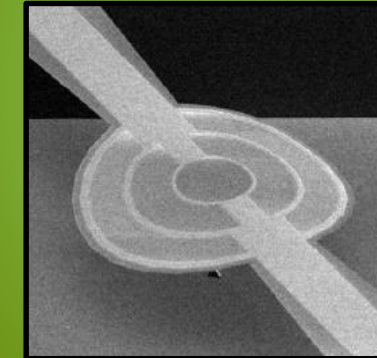
IR imaging

Uncooled technology
Cooled technology



Optical sensors

Biophotonics
Gas analyser



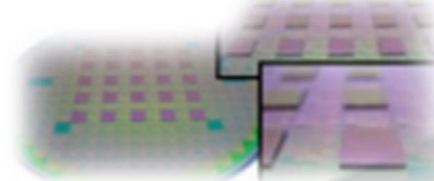
PILOT LINE : FROM R&D TO PROTOTYPING

- High Resolution lithography (eBeam, multi Beam)
- MEMS & 3D Packaging lithography
- CD, Depth Overlay
- Dry Etching
- Stripping

Patterning



Surfacing



- Wet Etch and clean
- Thermal Treatment and high T° deposition
- Epitaxy and Implant
- CMP and Grinding
- Bonding

Advanced Materials



- Dielectric and Metal dep. (PVD, ECD, PECVD, MOCVD etc..)
- ECD for MEMS & 3D packaging
- Co-Sputtering for metallic alloys

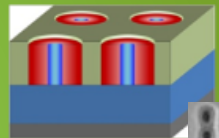
ADVANCED LETI LITHOGRAPHY PLATFORM



ML2



DSA



Imprint



Optical lithography
ASML NXT1970C

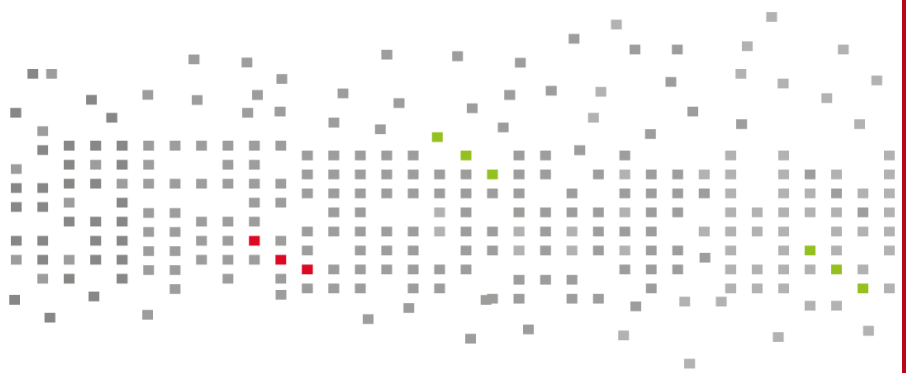


ECOSYSTEM PARTNERS



AGENDA –

- **L Pain Patterning program manager – 10'**
Introduction – the Leti ecosyteme
- **O Vatel – Sr VP & CTO SCREEN Semiconductor Solutions Co – 20'**
Accelerated innovation through strategic collaboration with LETI
- **ML2 session – 30'**
 - **M Wieland CTO MAPPER lithography BV** : Latest results of MAPPER technology toward its industrialization ramp up
 - **C Laviron litho laboratory manager CEA-Leti** - The FLX performance status in the Leti pilot line
- **DSA session – 30'**
 - **C Navarro DSA material product development manager ARKEMA** - DSA of block copolymers as alternative lithography: from materials ...
 - **R Tiron DSA program manager CEA-Leti** - DSA of block copolymers as alternative lithography: ... to integration
- **Break**
- **NIL session – 30'**
 - **M. Eibelhuber Business development manager EVG** – EVG SmartNIL technology for patterning requirements in More than Moore applications
 - **H. Teyssedre NIL program manager CEA-Leti** - INSPIRE: the LETI NIL assessment platform
- **L Pain Patterning program manager – 10'**
The Leti « Lithopole »
- **– Y Borodovsky – SPIE fellow & Intel fellow (retired) – 20'**
L'avenir est comme le reste: il n'est plus ce qu'il était / The Future isn't what is used to be



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