AGENDA

• LETI’S SHORT INTRODUCTION

• WHY LETI’s INVOLVEMENT IS SO STRONG IN ENIAC/ECSEL PROJECTS?

• WHAT KIND OF SOLUTIONS DID WE DEVELOP IN ECSEL PROJECTS?
  WHAT KIND OF STRATEGIES DO WE WANT TO DEVELOP?
  WHAT ARE THE BENEFITS FOR MY ORGANISATION AND FOR EUROPE?
  • Example of the success of SOI technology
  • Example on Imagers

• CONCLUSION
LETI IN NUMBERS:
A RTO FULLY INTEGRATED IN CEA (FRENCH ATOMIC AGENCY)

- Since 1967
- 1,800 people
- 64 startups
- 2,763 Patents
- 315 total budget (M€)
- 350 Industrial Partners
- 8,500 m² clean-room space
- 125 European projects
LETI: WORD-CLASS INFRASTRUCTURES AND PLATFORMS

The LETI is a Laboratory of CEA (French Atomic Agency)

- Clinatec
- Biochemistry
- Embedded systems integration
- Photonics (200 & 300mm)
- MEMS (200 & 300mm)
- Nanocharacterization
- IC Design Center

Micro and Nanoelectronics

Clinatec

IC Design Center
CEA, THE MOST INNOVATIVE PUBLIC RESEARCH ORGANIZATION IN EUROPE

TOP INSTITUTIONS, 2017 International ranking

1. Health & Human Services Laboratories, USA
2. Alternative Energies and Atomic Energy Commission, France
3. Fraunhofer Society, Germany
4. Japan Science & Technology Agency, Japan
5. National Institute of Advanced Industrial Science & Technology, Japan
Committed to innovation, Leti’s teams create **differentiating solutions** in miniaturization and energy-efficient technologies for its industrial partners.
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ECSEL PROJECT ARE FULLY IN LINE WITH CEA-LETI MAIN MISSION
LETI IS A RTO WORKING FOR INDUSTRY

A PERFECT MATCH BETWEEN LETI AND ECSEL

LETI IS FILLING THE GAP BETWEEN BASIC RESEARCH AND INDUSTRY

AN EUROPEAN INITIATIVE TO PASS THE KETS « VALLEY OF DEATH »
LETI : A STRONG INVOLVEMENT IN ENIAC/ECSEL PROJECTS

A CONTINUOUS PARTICIPATION OF LETI
17 PROJECTS ACCEPTED SINCE 2014

ENIAC CALL 2012-2
5 PILOT LINE PROJECTS ACCEPTED.
LETI WAS PARTNER OF ALL OF THEM
IMPACT FOR LETI: A STRONG FINANCIAL SUPPORT

JU ECSEL (Eniac-Artemis)
2009-2017: TOTAL FUNDING OF 156 M€
(without industrial funding for confidential reasons)

Main Technical topics:
- Substrates
- FDSOI
- Memory
- 3D
- RF SOI

+ VALUE CHAIN THANKS TO IC DESIGN
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WHAT DOES IT TAKE TO ENABLE A SEMICONDUCTOR TECHNOLOGY?

- Devices
- Modules
- Materials
- Small Circuits
- Complex Soc
- Industrial class
- Roadmaps
- Applications
- Ecosystems

Courtesy of Dominique Thomas (STMicroelectronics)
SOI: 27 YEARS OF HISTORY WITH A CONTINUOUS SUPPORT OF PA AND EUROPE

Supported by Public Authorities and JU ECSEL

1991 - A defining invention
Smart Cut technology invention in CEA LETI

1992 - From lab innovation to start-up business
Soitec creation
Creation of a joint Soitec-CEA laboratory

1999 - High Volume Manufacturing
First Soitec Smart Cut fab in Bémin

2002 - Scaling and anticipating microprocessor demand
Inauguration of a 300 mm fab in Bémin

2005 - Challenging GaAs supremacy
New material for RF devices

2008 - 2012 - Accelerating and diversifying R&D
NanoSmart project allows for more R&D resources to boost innovation

2009 - FD-SOI: the easiest path for transistor scaling with enhanced power efficiency
Soitec demonstrates atomic scale ultra-thin boxes
Proving the concept hybrid FD-SOI/bulk integration demonstration at CEA LETI

2012 - Becoming an industry standard
RF switch on SOI becomes industry mainstream

2013 - 2014 - Making it happen
ST Microelectronics demonstrates 35nm+ FD-SOI application processor for smartphones
Samsung licensing the FD-SOI 28nm
Extending the FD-SOI substrates and devices roadmap towards 10nm at CEA LETI

2015 - Announcing multi-foundries adoption
Development of 22FDX at GF
FD-SOI substrate ready for production at Soitec
Preparing the future at CEA LETI: Alternative smart scaling (III-V, Ge...)

2017 - Ramping up - Preparing the future
Technology in production at GF, Samsung, ST
Ultimate scaling FD-SOI R&D at CEA LETI and Soitec
Towards <7nm nodes
Enabling disruptive new design innovation

ECSEL Symposium 2018 | LEQUEPEYS Jean-René | June 20th, 2018 | 13
SEQUENCING OF FUNDING PROJECTS LEADING TO FDSOI 12NM TECHNOLOGY


**Design Platform for 28FD, 14FD and 22FDX**

- 4 FD Prototyping Readiness
- 14 FD Platform + 28FDSOI Enhancement

**Substrate, Techno FDSOI, Design platform**

- RFSOI and 12FDX
- ECOSYSTEM FDSOI
- PRIME
- Embedded memories and 22FDX

**Substrates SOI for RF / 22FDX**

- MCU 40nm and memories for 28FD
- MCU 40nm and PCM/28FD

**Enhancement to RF capabilities**

- PLACES2BE
- 14FDSOI and 14FD+ WAY TO GO
- Embedded Memory for Micro Controller
Soitec was created in 1992 by 2 researchers from Leti.

They pioneered to the development of PD- and FD-SOI CMOS within a full ecosystem.

FDSOI is an enabling platform for low-power and low-cost applications.

RF SOI is a reality.

Through European and National funding, SOI roadmap will continue to move ahead!

- Places2be
- WayToGoFast
- Ocean12
- Reference
ENIAC THINGS2DO: APPLICATION DOMAINS AND DEMONSTRATORS

MULTIMEDIA
- Home gateway platform development
- Pedestrian navigation system
  Development of a low power image/video processor in 28FDSoI

AUTOMOTIVE
- IMAGE PROCESSING SOC FOR ADAS APPLICATIONS
  - Automotive radar applications (77 GHz)
  - NEW BOSCH

AERONAUTIC
- WIRELESS IN-CABIN NETWORK
  - Reliability, low power

BIOMEDICAL
- IP developments for implantable medical devices.
- CoolRF DSP porting in 28FDSoI for lower audio applications.

Courtesy of Patrick Blouet (STMicroelectronics)
FDSOI, THANKS TO ECSEL, IS BRIDGING THE GAP BETWEEN R&D AND PRODUCTS

BRIDGING THE DEATH VALLEY
RFSOI: CREATION OF A WORLDWIDE INDUSTRIAL STANDARD

~24mm² RFSOI in 100% of Front-end module of Smartphones

First RFSOI product

R&D
RFSOI: KEEPING THE EUROPEAN LEADERSHIP THANKS TO ECSEL

Anticipating of the complexity evolution and market growth of RFSOI for 5G

First RFSOI product

PERFORMANCE: next Gen RFSOI
Material research, higher frequencies

SCALING: smaller nodes & 300mm
Technology tool box, a

PROTOTYPING: time-to-market reduction
New RF FEM design concepts,
POLIS Consortium gathers 21 partners from 7 countries:
- 17 industrial partners,
- 4 institutes or universities.

POLIS is **application-driven** with end-users in strategic markets for the European industry: **automotive**, **medical imaging**, **scientific instrumentation**, **high-volume consumers** and **robotics**.

The project also involves partners along the whole **value chain**: material providers, equipment manufacturers, integrated device manufacturers and end-users are integrated in the project.
WHICH APPLICATIONS?

- Tera
- Thermal IR
- Near Infrared
- Visible
- Ultraviolet
- X-Ray
- Gamma

Applications:
- Security
- Medical
- Home appliance
- Medical
- Automotive
- Consumer
- Medical
- Automotive
- Industrial
- Medical

WP2 WP4 WP3 displays

WP3: 3D-Stacking to cover a wide wavelength sensitivity

Total cost of the project: ~100M€
CONCLUSION

- **ENIAC / ECSEL PROGRAM IS A STRATEGIC FRAMEWORK FOR CEA – LETI**
  - Fully in line with our basic mission: working for Industry and preparing key enabling technologies

- **ECSEL IS ALSO THINKING BIG WITH THE POSSIBILITY OF LAUNCHING PROJECT HAVING A LARGE SIZE (IN TERM OF BUDGET AND NUMBER OF PARTNERS)**
  - Critical mass in term of manpower to ensure good results and to reach high level of TRL
  - Creating coherent and global ecosystems
  - Adequate tool to push first R&D results towards industry, with products and job creation

- **STRONG INVESTMENT OF PUBLIC AUTHORITIES, EU FUNDING AND PRIVATE FUNDING BY INDUSTRIAL COMPANIES**
  - 1€ of EU Budget, 2.9€ of public and private money

- **PILOT LINE CONCEPT IS ALSO KEY TO ENSURE THAT FUTURE PRODUCTION WILL BE MADE IN EUROPE**
Save the date!

MICROELECTRONICS
EMPOWERING TECHNOLOGICAL REVOLUTIONS
& NOVEL USE-CASES

Conference & Exhibition, July 4-5th, 2018
Grenoble
Maison Minatec
www.leti-innovation-days.com
CEA LETI: SUPPORTING EUROPEAN INDUSTRIAL ROADMAPS

Digital / FDSOI

Front End Modules - RFSOI

Technologies tool box

Boosters solutions

New material investigations

FDOSI roadmap Courtesy of SOITEC

FEM roadmap Courtesy of SOITEC