



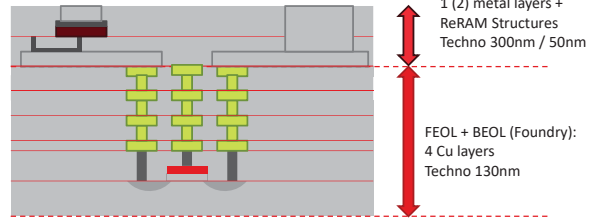
ADVANCED MEMORY FOR ENERGY EFFICIENT SOLUTIONS



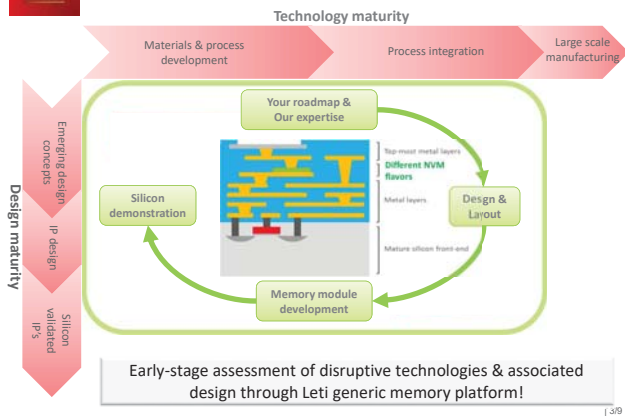
MEMORY ADVANCED DEMONSTRATOR

Foundry CMOS + CEA-LETI NVM

Test vehicle for ReRAM qualification

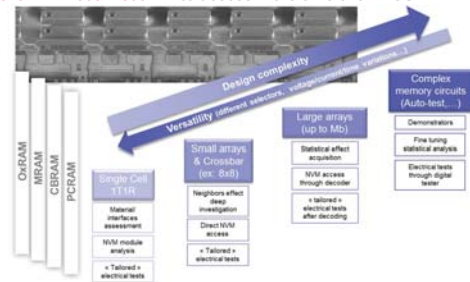


MEMORY ADVANCED DEMONSTRATOR (MAD)



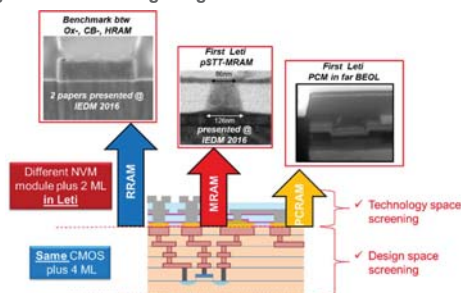
MEMORY ADVANCED DEMONSTRATOR (MAD) FOR DESIGN EXPLORATION

- Available in 200 mm and implemented on industrial production line
- Silicon demonstration of disruptive computing paradigm including Neuromimetic, Machine learning and AI hardware accelerators
- In 2019 : MAD300 – 300mm to access more efficient CMOS

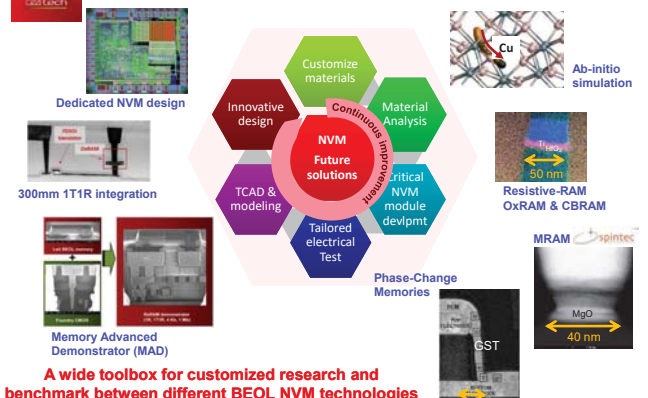


MEMORY ADVANCED DEMONSTRATOR (MAD) FOR TECHNOLOGY EXPLORATION

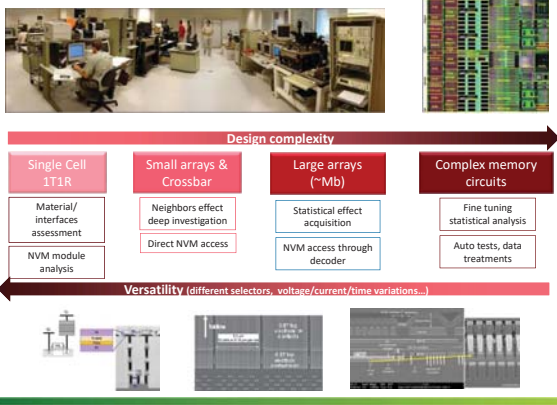
- Test Vehicle MAD operational with most emerging memory integrated
- Leti knowledge upgraded from single cell to matrix and complex design while continuing integration of new materials



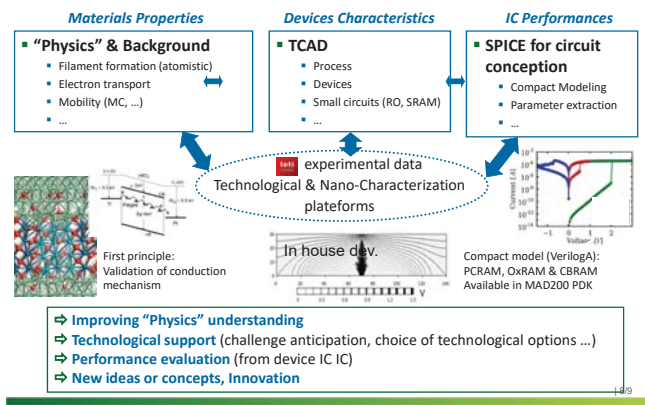
MAIN EXPERTISES FOR NON VOLATILE MEMORY



leti PARAMETRIC TESTS



leti Simulation & Modeling



leti Memory materials

Several deposition tools in 200/300mm :

- ALD / PEALD
- Pulsed PVD
- Co-sputtering

NanoCharacterization PlatForm :

X-Ray analysis (μ XRD, Synchrotron), Electron Microscopy (HR-STEM, TEM operando), Ion Beam Analysis (MEIS, TOF-SIMS), Surface Analysis (MXPS, X-PEEM, Nano-Auger), Optics (FTIR, PL, Cathodoluminescence), Scanning Probe (SSRM, SCM, KFM), Magnetic Resonance

Large variety of materials available :

- GeSbTe
- Ta₂O₅
- Mott insulators
- Super lattice
- SiO_x
- ZrO₂
- HfO₂
- TLTiN
- Al₂O₃
- TaCN
- HfAlO

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leti Case study : Hf-based OxRAM for high endurance

Ti/HfO₂ based OxRAM in a 28nm CMOS technology:

- Fast, low voltage ~100ns@1.3V
- Up to 10⁸ cycles

16kb, 28 nm demonstrator

A. Benoist et al., IRPS 2014, ST/Leti

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