Goals & Methods

Design, develop & test innovative devices:
- Power-MEMS : generators, actuators, sensors, supply & control
- Bio-Mag-MEMS : µfluidics for biomedical applications

Approach:
- Scale reduction laws & magnetic interactions

Analytical calculation tools and MEF:
- Dimensioning / optimisation of Mag-MEMS

Technologies:
- Prototypes, demonstration modules, models
- Integration of materials: µ-magnets, active hybrid materials
- Integration of functional devices

G2Elab
Grenoble Génie Électrique
Grenoble Electrical Engineering

Magnetic µSYSTEM
MAG-MEMS : MAGNETIC MICROSYSTEMS

Scientific actiuities

• ***Micro-energy:***
Energy harvesting, µ-sources of energy µ-actuators / µ-motors/ µ-generators

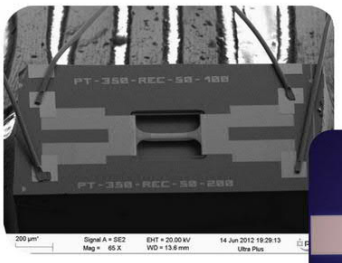
• ***Bio-Mag-MEMS:***
µ-fluidics for biomedical, lab-on-chip, µTAS
Diamagnetic levitation: digital µFluidics, µObjects

Experimental facilities

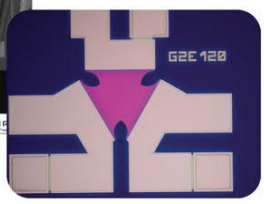
Embedded within CIME Nanotec @ MINATEC:
- Microsystems shared platform ($C^2µ$) (characterisation, prototypes, tests)
- PTA clean room
- Nano-Bio & µ-fluidic shared platforms

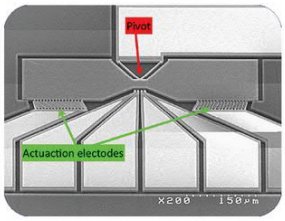
We benefit from the pioneering know-how of Institut Néel & CEA-LETI: creation & integration of functional materials, Si micro-technologies...

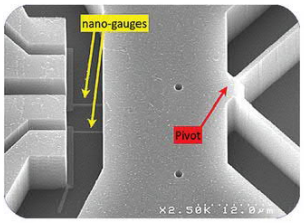
Integrated actiue materials



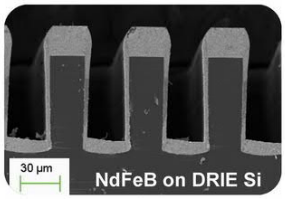
Hybrid transducers for voltage controlled actuation piezoelectric / magnetostrictive multilayers (@ CEA-LETI)







M&NEMS multi-modal sensor (directional magnetic & inertial) : Co-integration of nano-structured anti-ferromagnet multilayer, nanometric strain-gauges, & electrostatic feedback control (@ LETI)



Integrated high-performance magnets : thick NdFeB µ-magnet layers (30 µm) deposited onto textured Si substrate (Institut Néel, with LETI)

Productions

1- Integrated 8 mm Ø 3-phase dual-layer stator on Si for planar µ-machine / µ-generator (with LETI for DGA)

2- Array of 1 mm^2 µ-switches (bistable, 30~120 µm out-of-plane) Integrated FeCoP magnets, Si / Glass flip-chip-assembly (w/CEA-LETI)

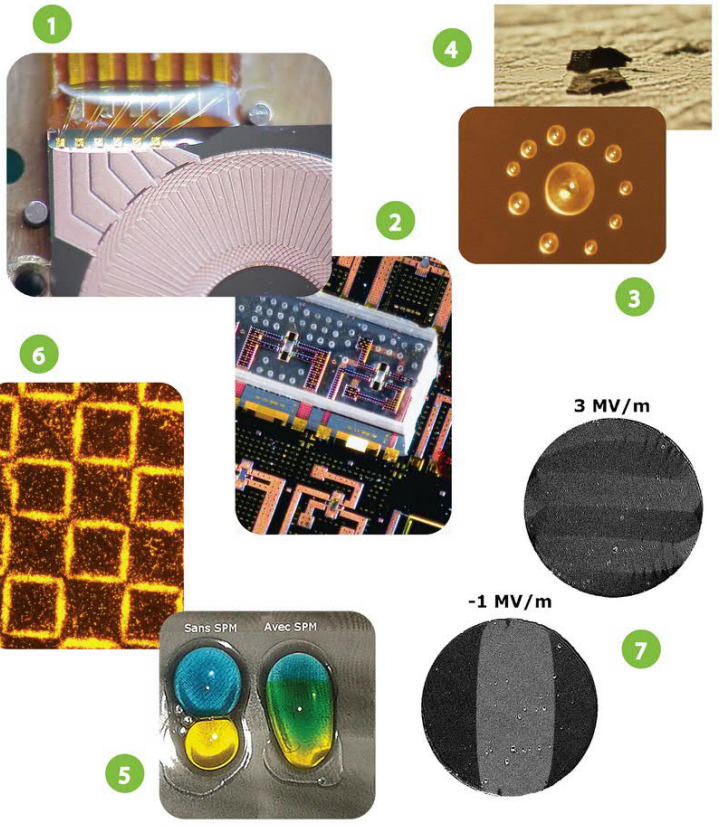
3- diamagnetic µ-droplets (H2O 30~150 µm) in levitation in a magnetic pit, in electrostatic repulsion (w/ CEA-LETI)

4- NdFeB magnet flake (thickness 5 µm) in levitation over diamagnetic HOPG graphite substrate (with I. Néel)

5- Bio-chemical reaction enhanced by superparamagnetic tagging. µ-fluidics for easy & fast diagnostics (with LMGP+Néel)

6- Bacteria tagged by magnetic nano-beads, trapped on 50 µm µ-magnet array (with I. Néel & Ampère /Lyon, for ANR Emergent)

7- Voltage control of magnetic easy axis orientation in nano-structured piezo-magnetic multilayer (with CEA-LETI)



Collaboratiue projects

MINATEC / $C^2µ$
micro-characterization, clean room (CIME Nanotec)

Institut Néel
integration of high performance magnets, exotic magnetic materials, diamagnetic levitation, bio-medical devices

LETI-CEA
integration on Si, µ-fabrication clean room, integrated active materials:
- PZT, magnetostrictive, shape memory

LMGP & IAB micro-fluidic bio-medical applications
TIMA energy harvesting, Ultra-Low-Power

Ampère-Lyon (& Biomis)
micro-manipulation of cells :
- superparamagnetic nanoparticles tagging
- diamagnetic trapping & selection

G2Elab
- ***ERT-CMF & SYREL*** magnetic sensors for Smart Grid supervision
- ***MAGE*** analytical design of Mag-MEMS design & constrained optimization
- ***EP*** smart power management
- ***MDE*** energy harvesting electrostatics for µ-fluidics & droplets