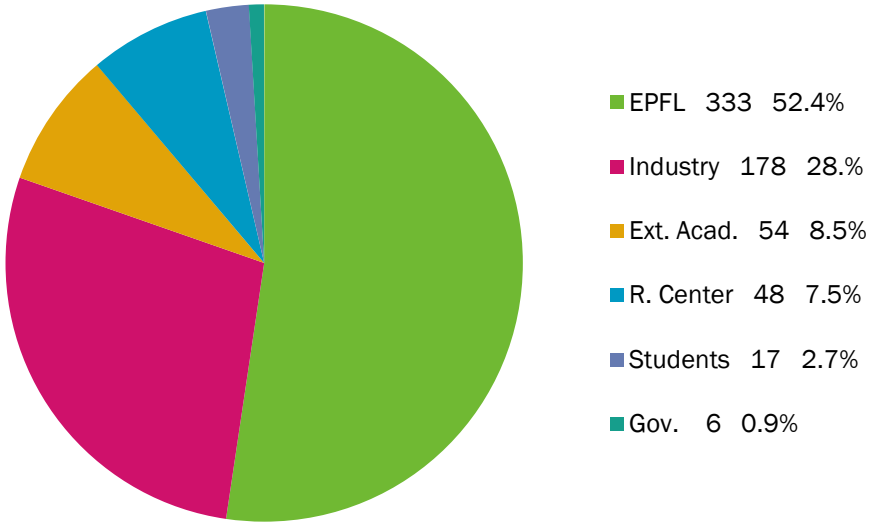
Next editions :

- 17th 03.05.2016
- 18th 02.05.2017

EPFL MICRONANOFABRICATION ANNUAL REVIEW MEETING

WELCOME & THANKS

- Welcome to the 16th edition of the CMi MicroNanoFabrication Annual Review Meeting
- 636 participants registered (with 30% from industry)
- Many thanks for your participation



- Global companies
- Local industry
- Startups
- Many Suppliers
- Government Agencies
- Researchers
- Faculties
- Other academic cleanrooms
- -> Traveling from over 15 countries

-> Networking & Connecting the dots

WELCOME ADDRESS

- Vice-Provost for Research
- Prof. Andreas Mortensen

OUTLINE

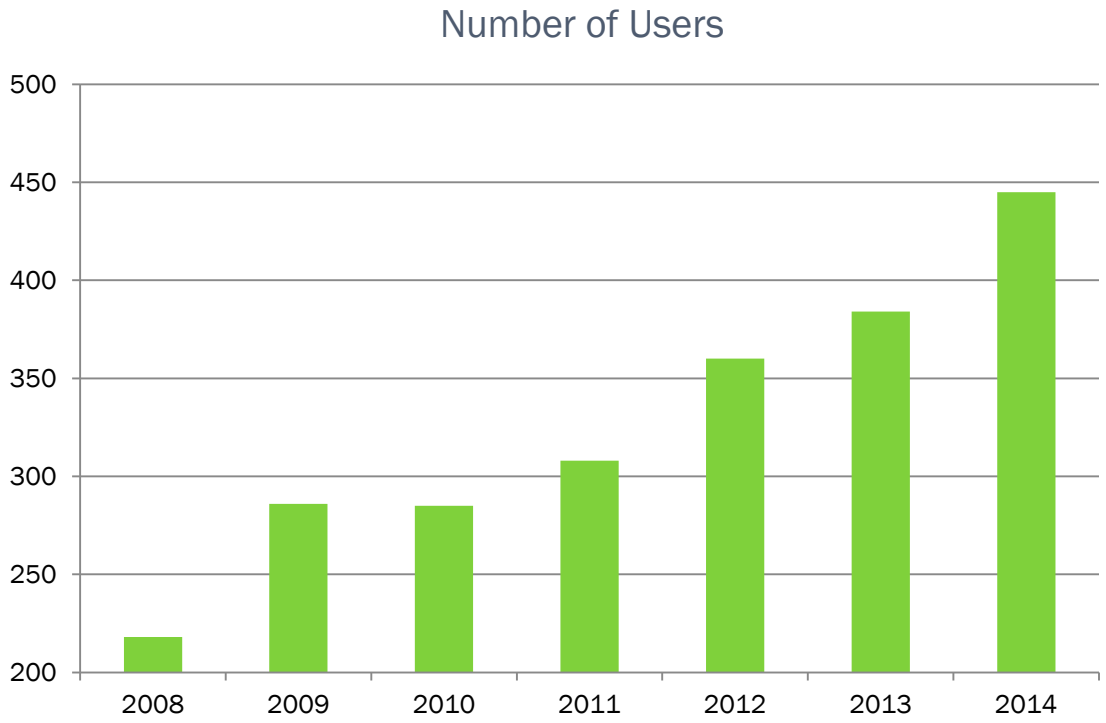
- Users
- Staff
- Cleanroom
- Tools
- Projects

USERS IN 2014

EPFL Engineering Sc.		Basic Sc.	Life Sc.	Ext. Ac.	Companies
STI-CMi	STI-IMT-LMIS4	SB-ICMP-LASPE	SV-BMI-LMNN	EXT-CERN	EXT-Abionic
STI-CBT-LBO	STI-IMT-LO	SB-ICMP-LOEQ	SV-GHI-UPKIN	EXT-CSEM	EXT-Aleva
STI-IBI-BIOS	STI-IMT-LOB	SB-ICMP-LPMC	SV-IBI-LDCS	EXT-EMPA	EXT-Bruker
STI-IBI-CLSE	STI-IMT-LPM	SB-ICMP-LPMN	SV-IBI-LLCB	EXT-ESIEE	EXT-Hamamatsu
STI-IBI-LBEN	STI-IMT-LPMAT	SB-ICMP-LPN	SV-IBI-UPDEPLA	EXT-HEIG-VD	EXT-Karmic
STI-IBI-LBNC	STI-IMT-LSBI	SB-ICMP-LPQM1	SV-IBI-UPLUT	EXT-LNE-PARIS	EXT-LémanMicro
STI-IBI-LBNI	STI-IMT-NAM	SB-ICMP-LUMES	SV-IBI-UPSUTER	EXT-UNIZH	EXT-Lemoptix
STI-IBI-LHTC	STI-IMT-ESPLAB	SB-IPSB-LCB	SV-ISREC-CDTSO	EXT-UNIBE	EXT-LSPR
STI-IEL-GR-JPC	STI-IMT-LAI	SB-IPSB-LPMV		EXT-UNIFRI	EXT-Mackinac
STI-IEL-GR-SCI	STI-IMT-LMTS	SB-ISIC-LEPA	ENAC-IIC-LESO-PB	EXT-UNIGE	EXT-Microsens
STI-IEL-LANES	STI-IMT-OPT	SB-ISIC-LIMNO		EXT-UNIL	EXT-Nanolive
STI-IEL-LEMA	STI-IMT-PV-LAB	SB-ISIC-LPI	IC-ISIM-LSI1		EXT-Nanoworld
STI-IEL-LSM	STI-IMT-SAMLAB	SB-ISIC-LSCI			EXT-Qwane
STI-IEL-NANOLAB	STI-IMX-FIMAP	SB-ISIC-LSPM			EXT-Rolex
STI-IEL-PHOSL	STI-IMX-LC				EXT-Sigatec
STI-IGM-LFMI	STI-IMX-LMM				EXT-SilMach
STI-IGM-RRL	STI-IMX-LMSC				EXT-TEL-Solar-Lab
STI-IMT-GR-LVT	STI-IMX-LP				EXT-Tronics
STI-IMT-LAPD	STI-IMX-SMAL				EXT-ValFleurier
STI-IMT-LMIS1	STI-IMX-SUNMIL				
STI-IMT-LMIS2	STI-SCI-CD				
281 (42)		55(14)	47 (10)	24 (11)	30(19)

- Total: 445 users (+16%) operating the CMi tools
- Total: 96 labs or companies

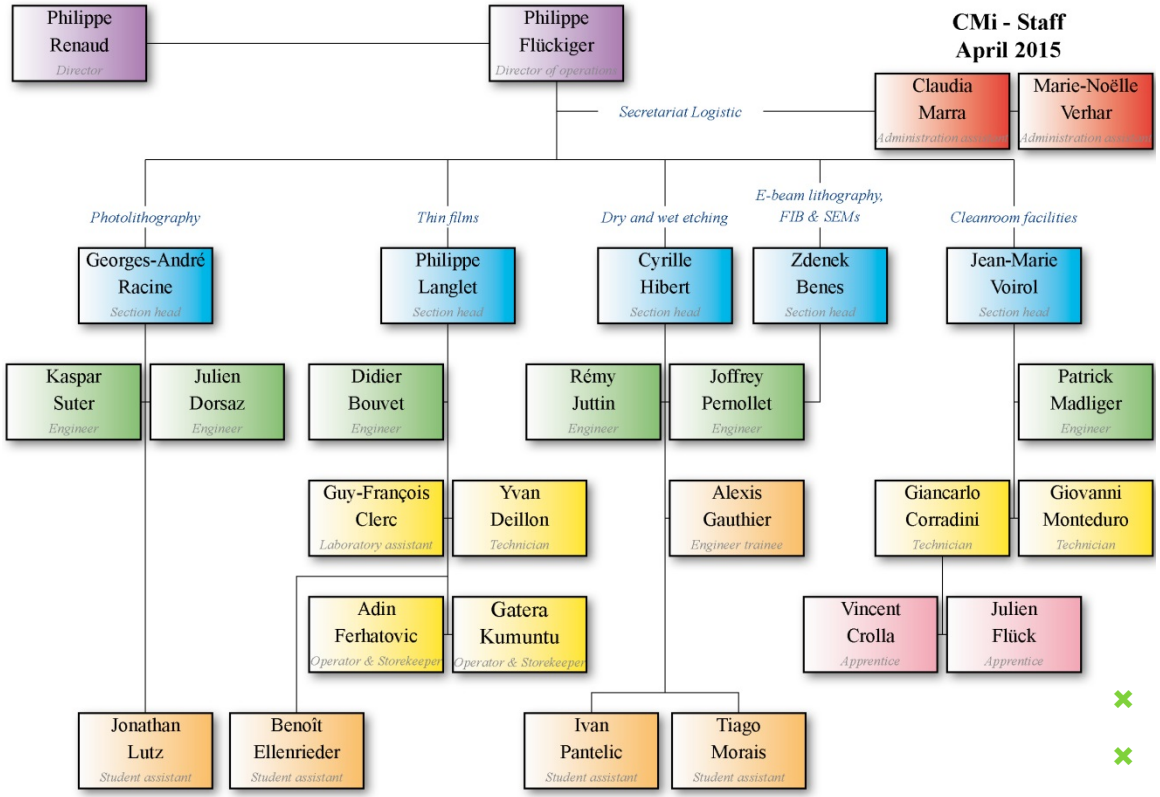
USERS IN 2014



Nanofabrication plays an increasing role in modern science.

- The number of Users increased over the past 6 years at an average rate of 13% per year
- We have doubled the number of Users in 6 years
- Our prevision is to maintain the growth rate above 10% per year for the next 5 years (new labs)
- We will reach the number of 500 Users in 2015
- We have some occupancy peaks with more than 50 Users simultaneously in the cleanroom

THE STAFF

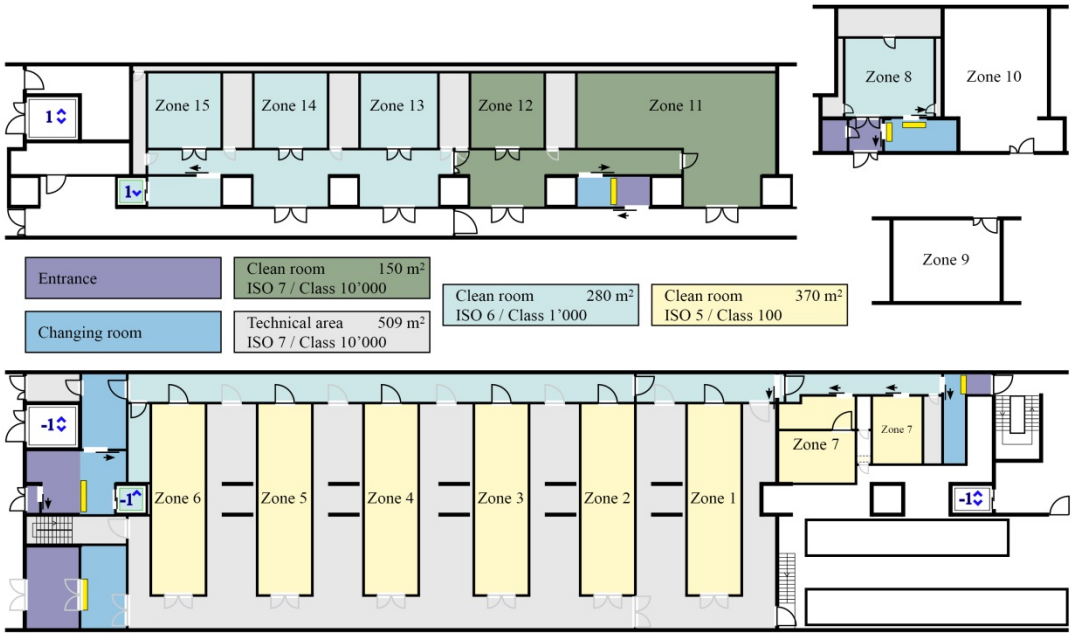


- 19 FTE staff members
- + Student assistants
- + Apprentices

CLEANROOM

- CMi BM+1

- CMi BM-1



2 levels

connected by elevator

Cleanrooms are full

What about the Future?

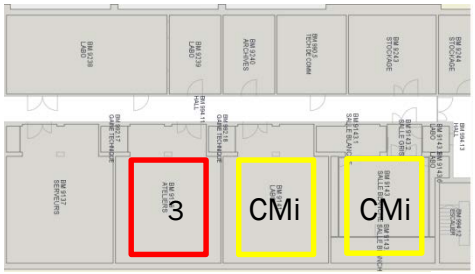
Initial surface (1998)	Extension (2010)	Total surface
1000m^2	300m^2	1300m^2

Any extension of nanofabrication facilities should be built in connection with the CMi.

GREYROOM EXTENSION ?

BM Lev. 0

BM Lev. -1



Locaux BM niveau 0

BM 0.143 + BM 0.141 + BM 0.139 + BM 0.135 + BM 0.133 = 302m²

BM 0.246 + BM 0.242= 110m²

Surface BM niveau 0 = 412 m²

Local BM niveau-1

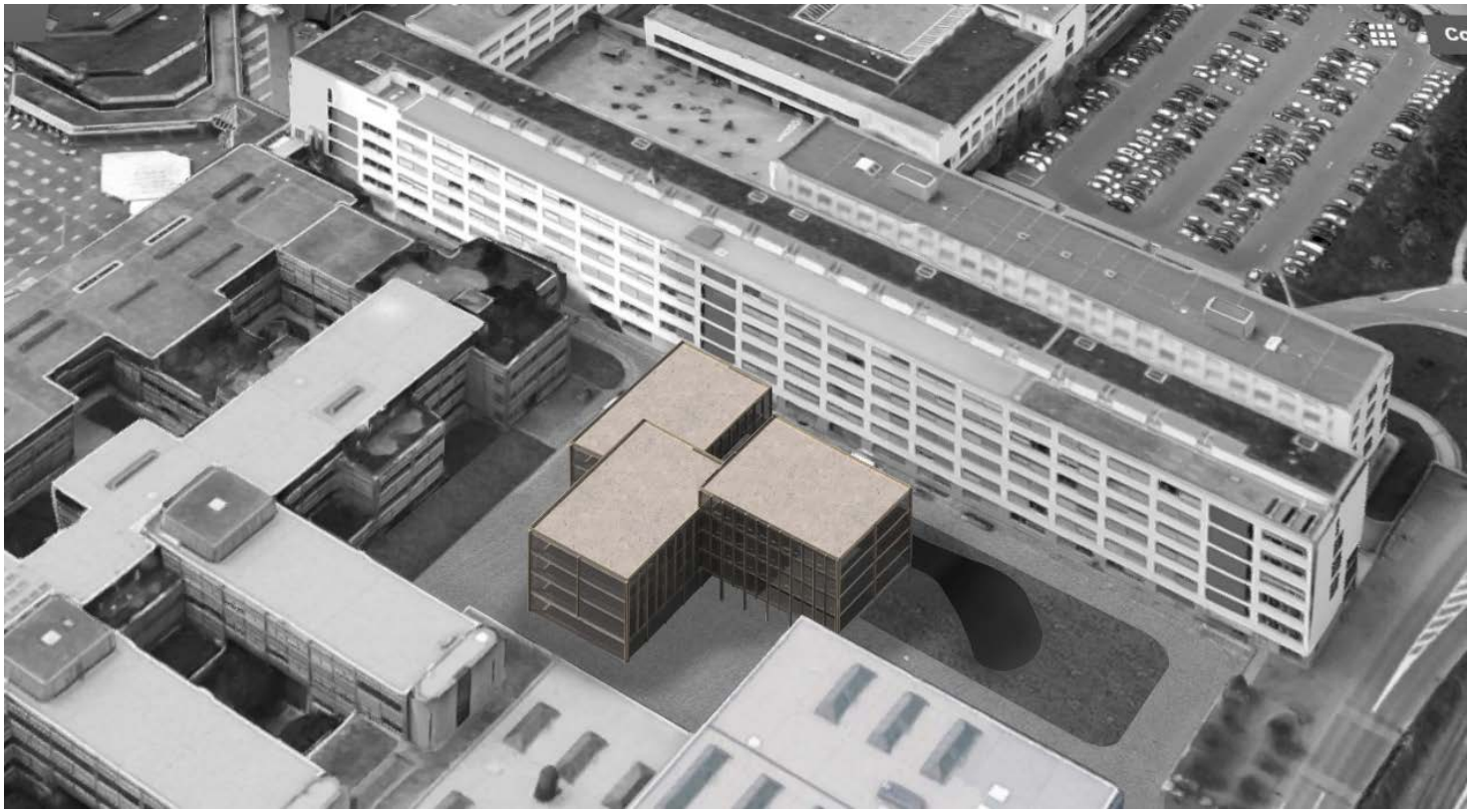
BM 9.139 = 66m²

Surface totale = 478m²

Short term option:

- Acquire the grey rooms at level 0
- Relocate the less sensitive tools into this space

A NEW BUILDING ?

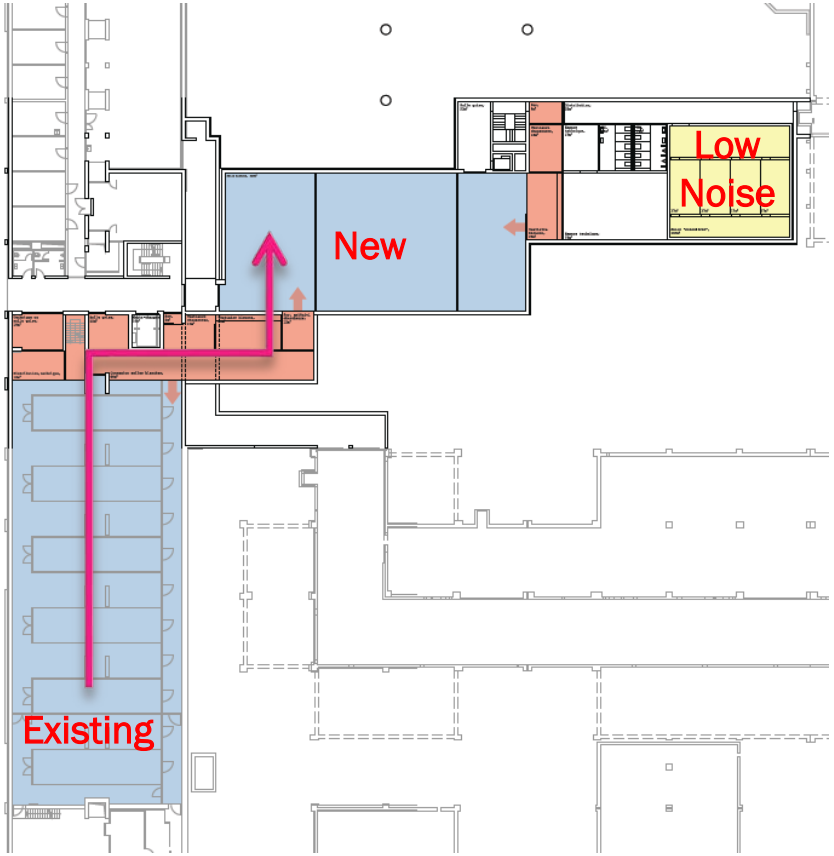


The longer term option would be to construct a new building :

- connected to the existing cleanrooms

A NEW BUILDING ?

A NEW BUILDING ?

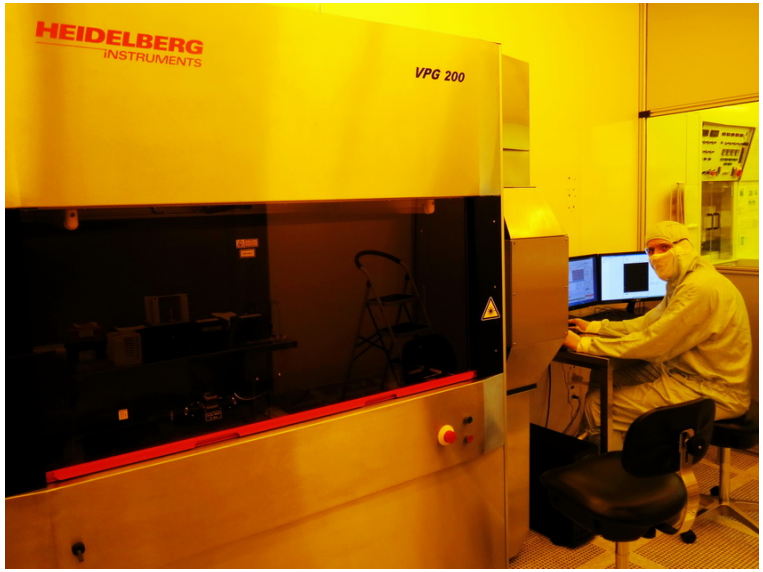


level -1 - gross floor area	1150 [m²]
net floor area	1022 [m²]
clean room	430 [m²]
noise-free room	137 [m²]
technical area	124 [m²]
distribution, changing rooms, access	331 [m²]

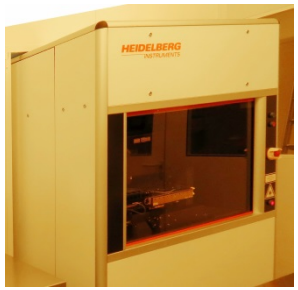
level -2 - gross floor area	516 [m²]
net floor area	476 [m²]
technical area	430 [m²]
distribution	46 [m²]

The Users would freely circulate between the existing and the new cleanroom !!!

TOOLS INSTALLED IN 2014



VPG200
Delivered June 2014

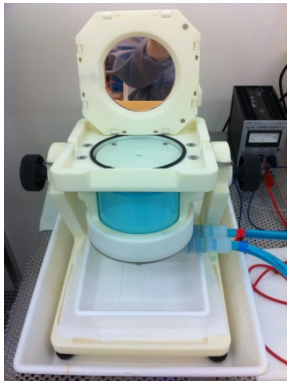


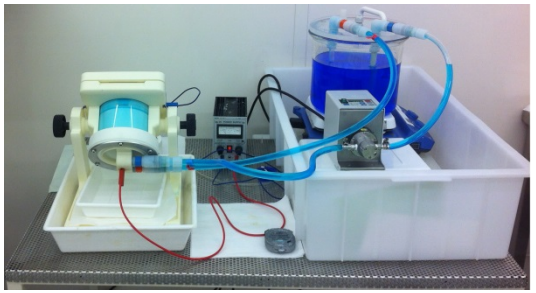
MLA150
Placed in Beta-site

Write Mode	0	I	II	III	IV
Minimum structure size [µm]	0.6	0.75	1	2	4
Address grid [nm]	5	12.5	25	50	100
Edge roughness [3σ, nm]	40	40	50	70	150
CD uniformity [3σ, nm]	65	65	75	110	300
Write speed [mm²/minute]	50	300	1050	3450	10000
Write time for 100x100mm² [min]	210	38	12	4	2

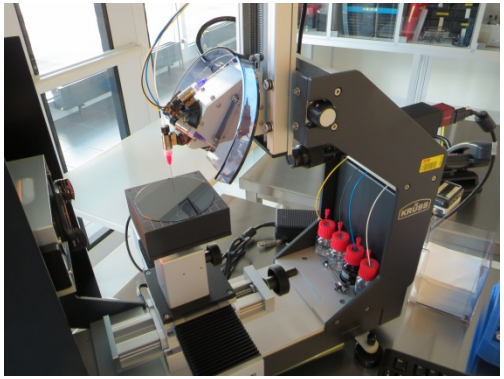
TOOLS INSTALLED IN 2014 (BUDGET 2013)

- EVA 760 Alliance Concept



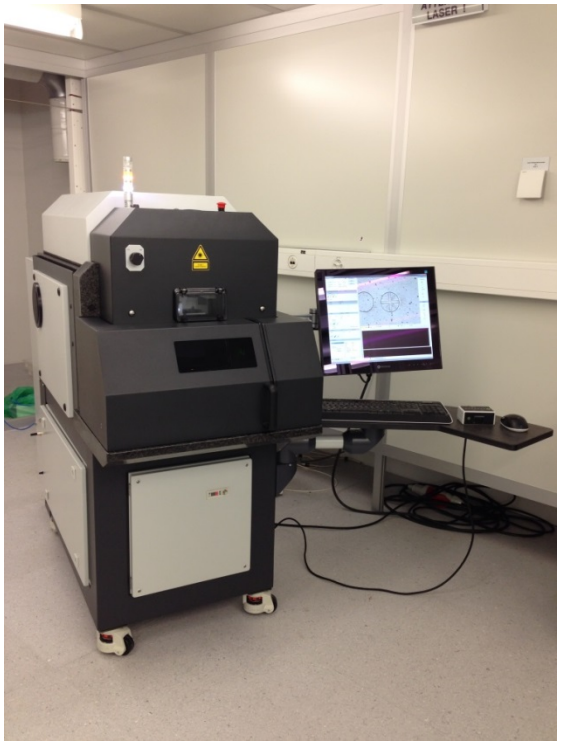


- Silicet electroplating



- Krüss DSA30 - Drop Shape Analyzer
  - Contact angle, Surface free energy, wetting, adhesion

TOOLS INSTALLED IN 2014



- Optec LightShot (LSV3) Micromachining System
  - ArF Eximer Laser
  - 193nm, 6ns, 15mJ/pulse, 300Hz
  - PET, SU-8, Si, Parylene, Polyimide, Polycarbonate, …

- TBT HB-10 Wire Bonder
  - Wedge, Ball and Bump bonding
  - Pick & Place kit

TOOLS TO BE INSTALLED/PURCHASED IN 2015

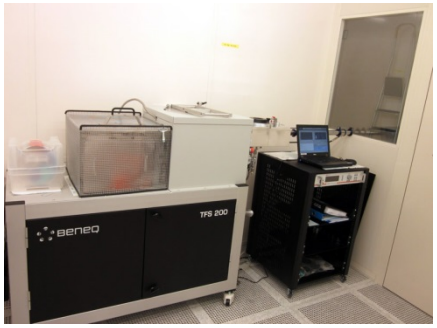
- Electronics Upgrade of the 10 existing furnaces
- Installation of a TEOS furnace

- Coater Developer

- Mask Aligner

POSTPONED TOOLS

- Second ALD ?



- RIE Metal & HBR ?

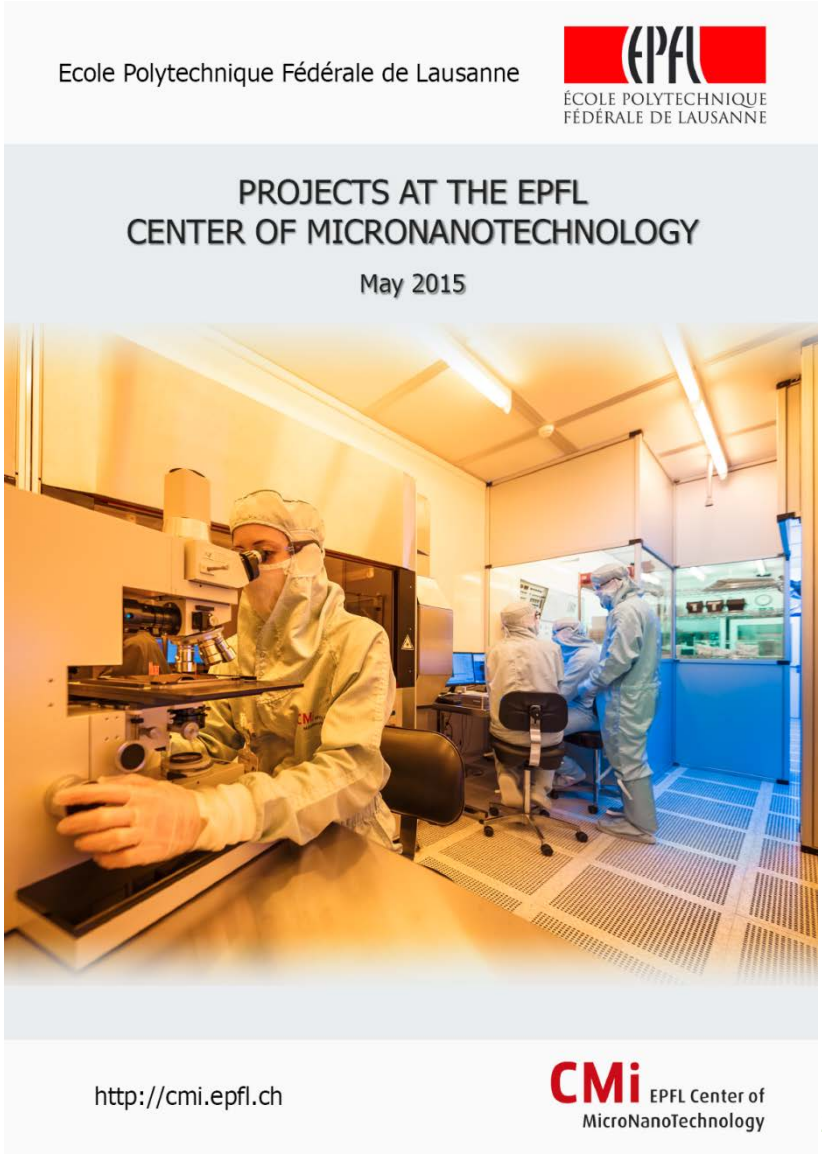
- Second EBEAM writer ???

SOME RECENT ACHIEVEMENTS

Offer easier access	• 24/7 access • Flexibility has dramatically increased with the cleanroom extension • Low Cost
Eradicate most critical bottlenecks	• Deep Reactive Ion Etching • Sputtering • Evaporation • EBEAM2
Renew key technologies	• Direct Laser Writer • Photoresist Coater • Mask Aligner • Furnaces (electronics upgrade & TEOS Process) • RIE HBR & Metal
Bring new high end technologies	• Eximer Laser Machining System • ALD2 • PECVD ? • Stepper Lithography ? • Epi-Si ?

ABSTRACTS IN 2014

- 232 abstracts



PROGRAM

- Very exciting program

- 11 presentations
- Spanning an exceptionally broad range
- Try to be different every year different
- Not always invite the heavy users
- Emphasize on the new Professors @ EPFL
- Sometime also some exotic users
- One common point:
  - MicroNanoFabrication

CMi EPFL Center of MicroNanoTechnology

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

MicroNanoFabrication Annual Review Meeting

Date: Tuesday May 5th, 2015
Time: 09h30 – 17h00
Place: EPFL, Forum Rolex Learning Center, RLC E1 240

Program:

09h30-10h00	Coffees and Croissants, Distribution of Badges and Proceedings
10h00-10h05	***Andreas Mortensen***, *Vice-provost for Research*, Welcome address
10h05-10h15	***Philippe Flückiger*** *(http://cmi.epfl.ch)*, Introduction
10h15-10h55	***Thomas Kenny***, *Stanford University, USA*, The long path from MEMS resonators to timing products
10h55-11h10	***Simon Henein*** *(http://instantlab.epfl.ch/)*, Mechanical design at the watch scale: invention, theory and materialization
11h10-11h45	**Break**
11h45-12h00	***Christophe Moser*** *(http://lapd.epfl.ch)*, Non conventional optical imaging
12h00-12h15	***Esther Amstad*** *(http://smal.epfl.ch/)*, Production of amorphous nanoparticles using a microfluidic nebulator
12h15-12h30	***Silvio Dalla Piazza*** *(http://www.microcrystal.com/)*, Quartz Tuning Forks: A high-volume, low-cost, high-tech MEMS product
12h30-14h00	**Lunch & Poster Session**
14h00-14h15	***Yves Bellouard*** *(http://bellouard.eu/)*, Tailoring material properties using ultrafast laser exposure: a step towards new micromanufacturing paradigms
14h15-14h30	***Félix Bussières*** *(http://www.unige.ch/gap/qtech/)*, Single-photon detectors using amorphous superconducting nanowires
14h30-14h45	***Elison Matioli*** *(http://powerlab.epfl.ch/)*, Nanostructured devices for energy efficiency applications
14h45-15h15	**Break**
15h15-15h30	***Ross Stanley*** *(http://www.csem.ch/)*, Microfabrication for photonics at CSEM
15h30-15h45	***Steffen Diez*** *(http://www.himt.de/)*, Maskless Lithography
15h45-17h00	**Cocktails & Poster Session**

ENJOY THE CONFERENCE

THANKS FOR YOUR ATTENTION