Next editions :

- 16th 05.05.2015
- 17th 03.05.2016

EPFL MICRONANOFABRICATION ANNUAL REVIEW MEETING

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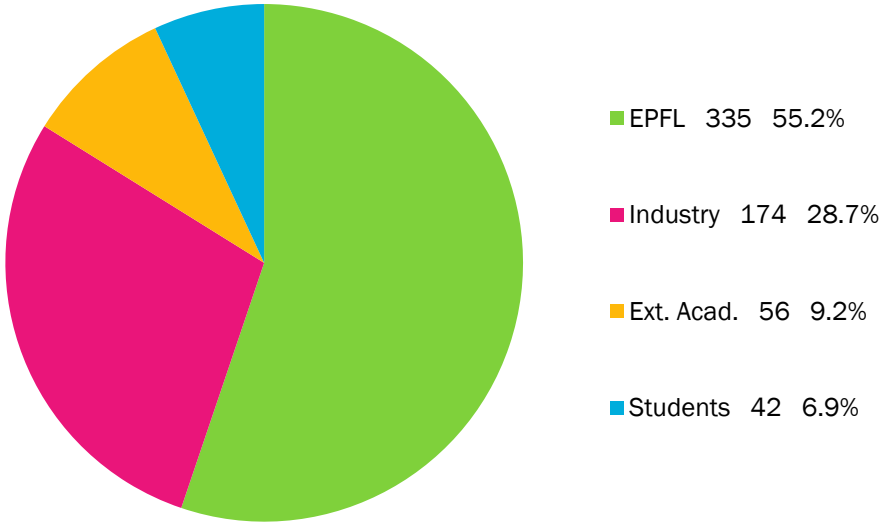
WELCOME & THANKS

- Welcome to the 15th edition of the CMi MicroNanoFabrication Annual Review Meeting
- 607 participants registered (with 30% from industry)
- Many thanks for your participation



OUTLINE

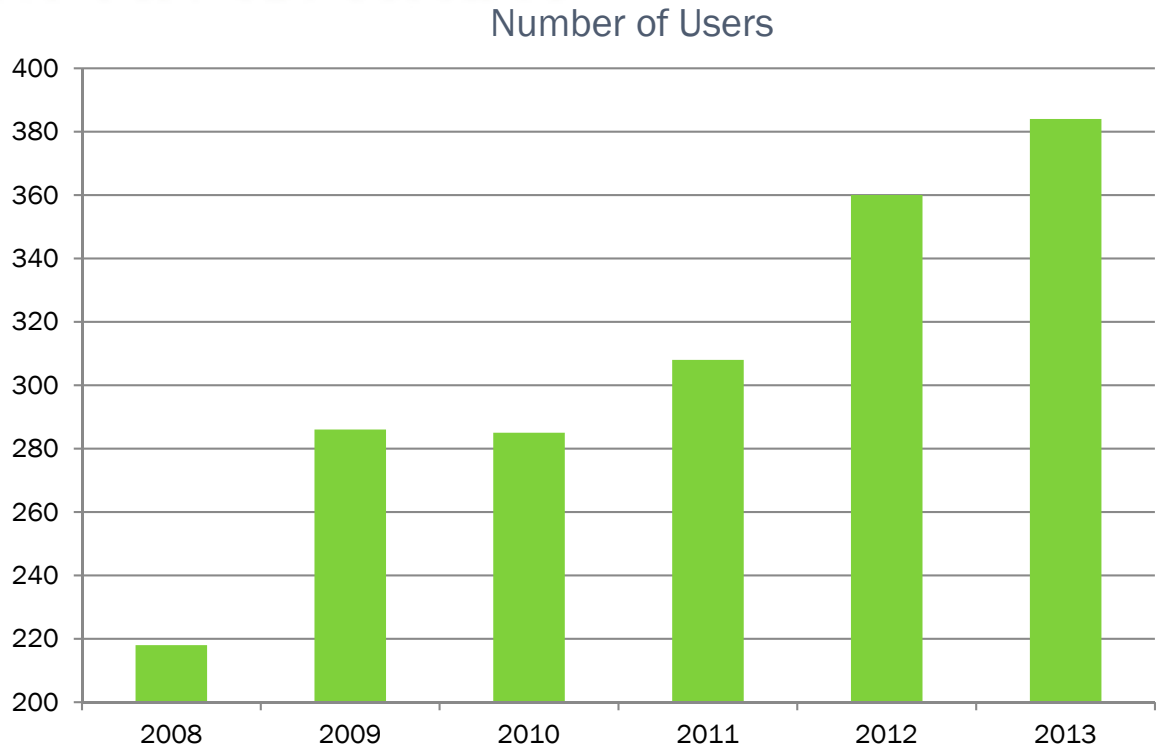
- Users
- Tools
- Projects

USERS IN 2013

EPFL Engineering Sc.		Basic Sc.	Life Sc.	Ext. Ac.	Companies
STI-CMi	STI-IMT-LMIS2	SB-CIME	SV-BMI-LMNN	EXT-CERN	EXT-Abionic
STI-IBI-LBEN	STI-IMT-LMIS4	SB-ICMP-LASPE	SV-GHI-UPKIN	EXT-CNRS	EXT-Aleva
STI-IBI-LBNC	STI-IMT-LMTS	SB-ICMP-LOEQ	SV-IBI-LDCS	EXT-CSEM	EXT-Asulab
STI-IBI-LBNI	STI-IMT-LO	SB-ICMP-LPMC	SV-IBI1-UPDEPLA	EXT-FEMTO	EXT-Attolight
STI-IBI-LHTC	STI-IMT-LPM	SB-ICMP-LPMN	SV-IBI1-UPLUT	EXT-HEARC	EXT-Biocartis
STI-IBI-UPALTUG	STI-IMT-LPMAT	SB-ICMP-LPN	SV-ISREC-CDTSO	EXT-HEIG-VD	EXT-Bruker
STI-IBI2-CLSE1	STI-IMT-LSBI	SB-ICMP-LPQM1		EXT-POLIMI	EXT-Debiotech
STI-IEL-GR-JPC	STI-IMT-NAM	SB-IPSB-LCB		EXT-UNIBAS	EXT-EMMicroelectroni
STI-IEL-GR-SCI	STI-IMT-OPT	SB-ISIC-LCOM		EXT-UNIBE	EXT-Karmic
STI-IEL-LANES	STI-IMT-PV-LAB	SB-ISIC-LCPPM	ENAC-IIC-LESO-PB	EXT-UNIFRI	EXT-Lemoptix
STI-IEL-LSM	STI-IMT-SAMLAB	SB-ISIC-LEPA	ENAC-IIE-DISAL	EXT-UNIL	EXT-Microsens
STI-IEL-NANOLAB	STI-IMX-LC	SB-ISIC-LIMNO			EXT-Nanoworld
STI-IGM-LFMI	STI-IMX-LMM	SB-ISIC-LPI			EXT-Qwane
STI-IGM-LTCM	STI-IMX-LMSC				EXT-Rolex
STI-IMT-ESPLAB	STI-IMX-LP		IC-ISIM-LSI1		EXT-Sensimed
STI-IMT-GR-LVT	STI-IMX-LTP				EXT-Sercalo
STI-IMT-LAPD	STI-IMX-SUNMIL				EXT-Sigatec
STI-IMT-LIB	STI-SCI-CD				EXT-SilMach
STI-IMT-LIS					EXT-TEL-Solar-Lab
STI-IMT-LMIS1					EXT-Tronics
239 (38)		53 (13)	39 (9)	24 (11)	29 (20)

- Total: 384 users (+7%)
- Total: 91 labs or companies (+7%)

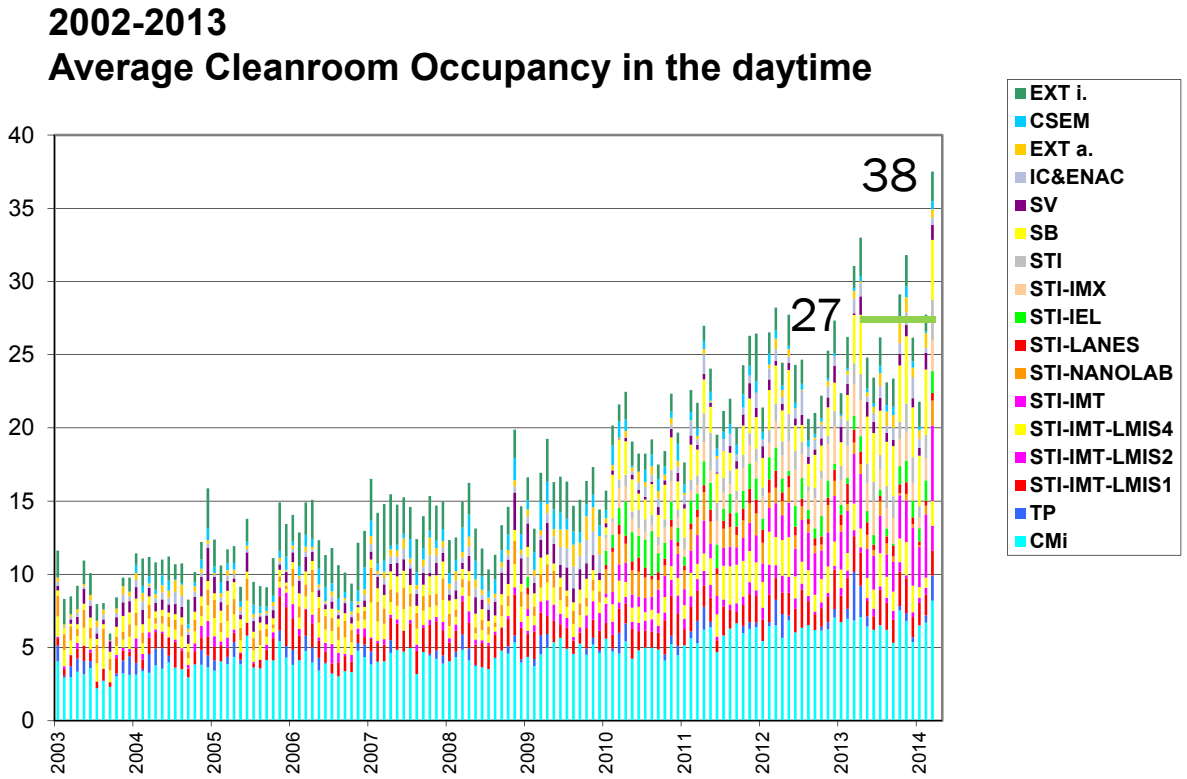
USERS IN 2013



Nanofabrication plays an increasing role in modern science.

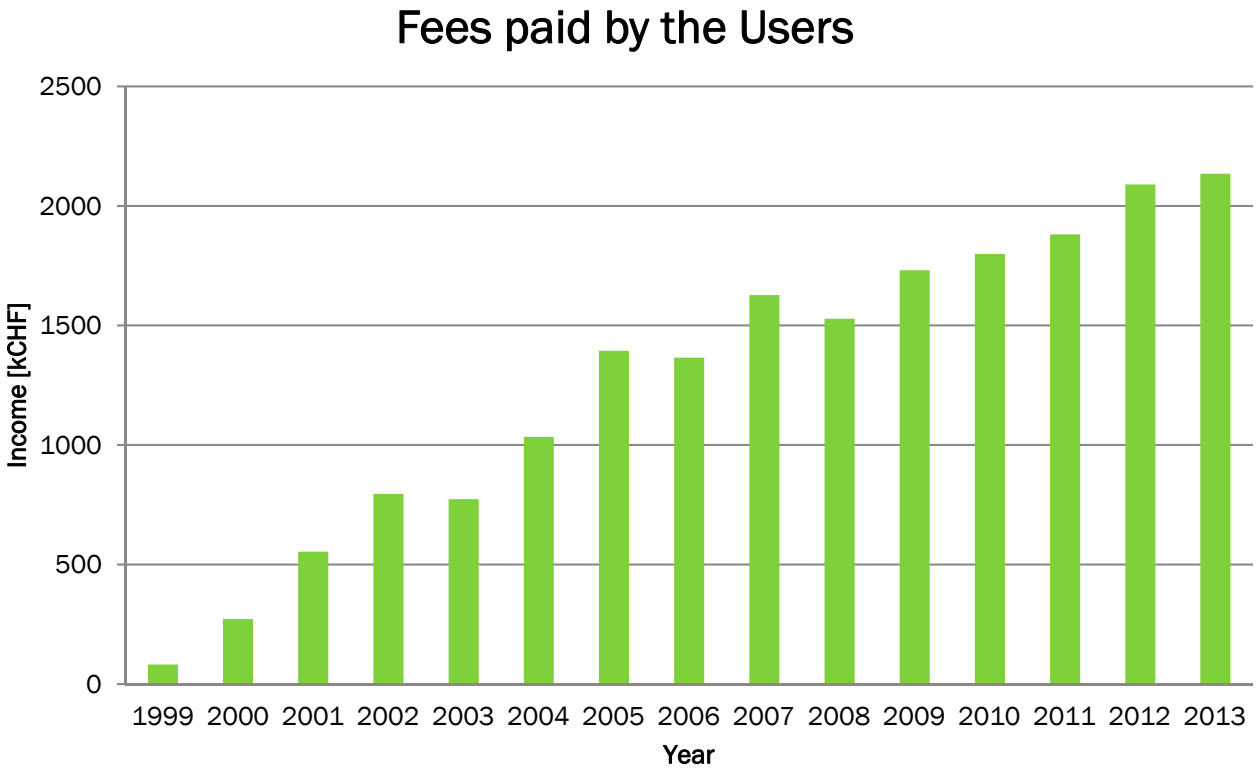
- The number of Users steadily increased over the past 5 years at a rate of 5-10% per year
- Our prevision is to maintain the growth rate at 7% per year over the next 5 years (new labs)
- We will reach the number of 500 Users in 2017.

USERS IN 2013



- Average CR occupancy over the past year: 27 Users (with a record average of 38 Users in March)
- But also some occupancy peaks with > 40 Users simultaneously (not shown)

USERS IN 2013

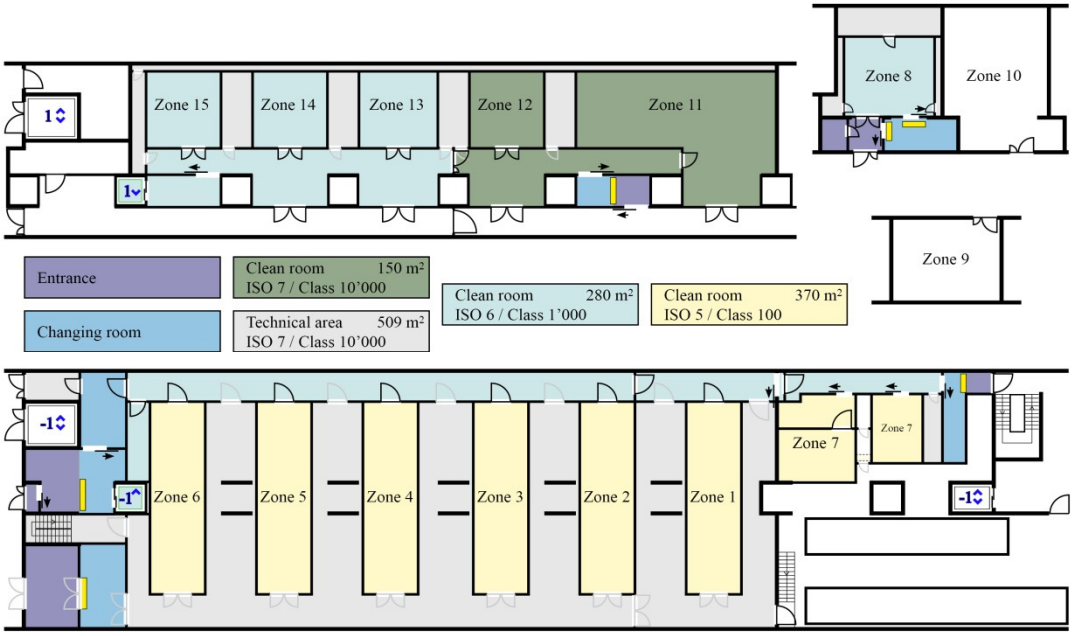


- Very regular growth of the Users' fees over the last 15 years
- The fees only cover the direct costs (i.e. consumables, around 25% of the total costs)
  - Therefore there should be no problem to get funded through SNSF

CLEANROOM EXTENSION

- CMi BM+1

- CMi BM-1



CMi BM+1 mainly dedicated to:

- Metrology
- Wet Chemistry
- Photolithography
- PDMS processing
- Thin films
- Backend activities
- Exploratory processes

Total Surface	NEW surface
1300m^2	300m^2

- The 300m^2 cleanroom extension was inaugurated 3 years ago
- It was a fantastic accelerator to the development of the CMi

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
Renew key technologies	• Direct Laser Writer • Photoresist Coater, tender published 16.04.20014 • Mask Aligner • Furnaces (electronics upgrade & TEOS Process)
Bring new high end technologies	• Laser machining • … • UNDER DISCUSSION WITH OUR USERS


HEIDELBERG
INSTRUMENTS
VPG 1400

VPG Technology

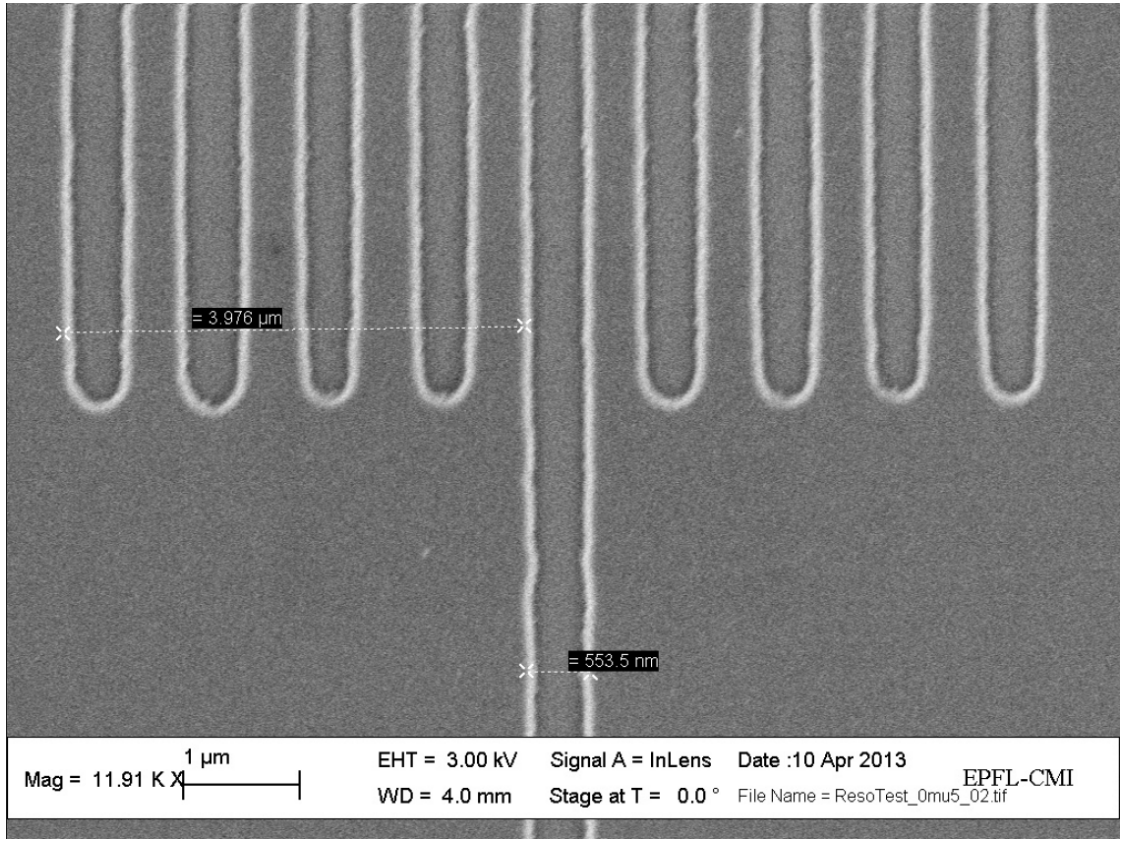
VPG technology has now been transfered from large area production systems to small area systems.

VPG 200 MASKLESS ALIGNER SYSTEM

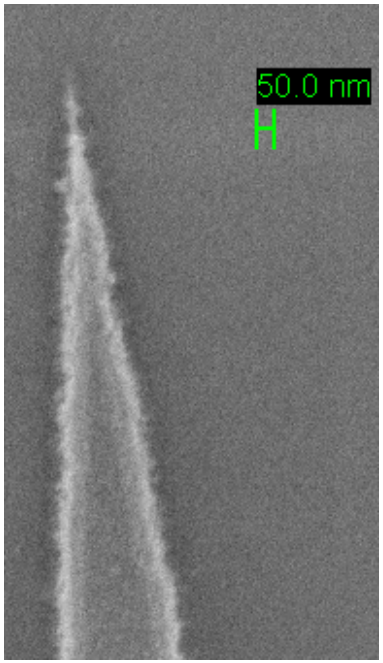
- High speed, high accuracy maskless lithography tool
- Exposure of 4” wafer in down to 2 minutes
- Minimum features sizes down to 600 nm
- Field proven exposure optics based on MOEMS
- Reliable, high power and long lifetime DPSS laser (355nm)
- SU-8 capability
- Includes automatic handling system for masks and wafers

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

VPG 200 MASKLESS ALIGNER SYSTEM



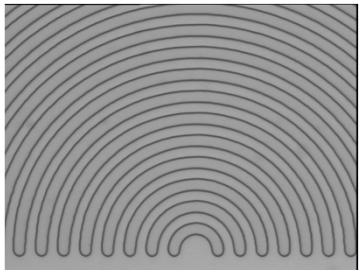
500 nm lines and spaces



Apex of a triangle

- VPG 200 will be delivered by the end of May

DIRECT LASER ALIGNER - BETA SITE AT CMI



- Fast exposure: 4” wafer < 15 min
- Fast setup for alignment and exposure: << 1 min
- Easy and rapid operation: step by step wizard
- High yield: non-contact, mask-less exposure
- Very economical: no mask consumption, reliable laser
- Flexibility: precise dose control, variable substrate size
- Options: gray scale exposure, automatic handling, backside alignment

Requirements	Value
Min. Feature Size	1 µm
Global Overlay Accuracy, TSA	< 1 µm
Local Overlay Accuracy, TSA	< 0.5 µm
Global Overlay Accuracy, BSA	< 2 µm
Uniformity	120 nm, 3σ
Max Substrate Size	8”

- DLA, different technology, less resolution, less speed, … less expensive

EVA 760 EVAPORATION TOOL

- Process configuration:
  - 6 pockets Electron beam source
  - Cryogenic pumping with dry primary unit
  - Smart thickness controller
- Substrate holder:
  - Single rotating dome configuration;
  - 4'' and 6'' compatible;
  - 250, 350, 450mm working distances available, automatically adjusted
- Pumping performances:
  - Dry 120m3/h primary unit;
  - On board 400 cryogenic secondary unit (6000l/s on air, 17500l/s on water vapor);
  - P<5.10-8mbar after 24 hours
  - p<1.10-6mbar in less than 10mn from P_{atm}

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

alliance concept

CMi EPFL Center of MicroNanoTechnology

UNINTERRUPTIBLE POWER SUPPLY

Generator

Motor :
1350 [Kg] 1500 [rpm]
335 [KW] 80 [l/h]

Alternator :
3Ø 50 [Hz] 400 [V]
440 [KVA]

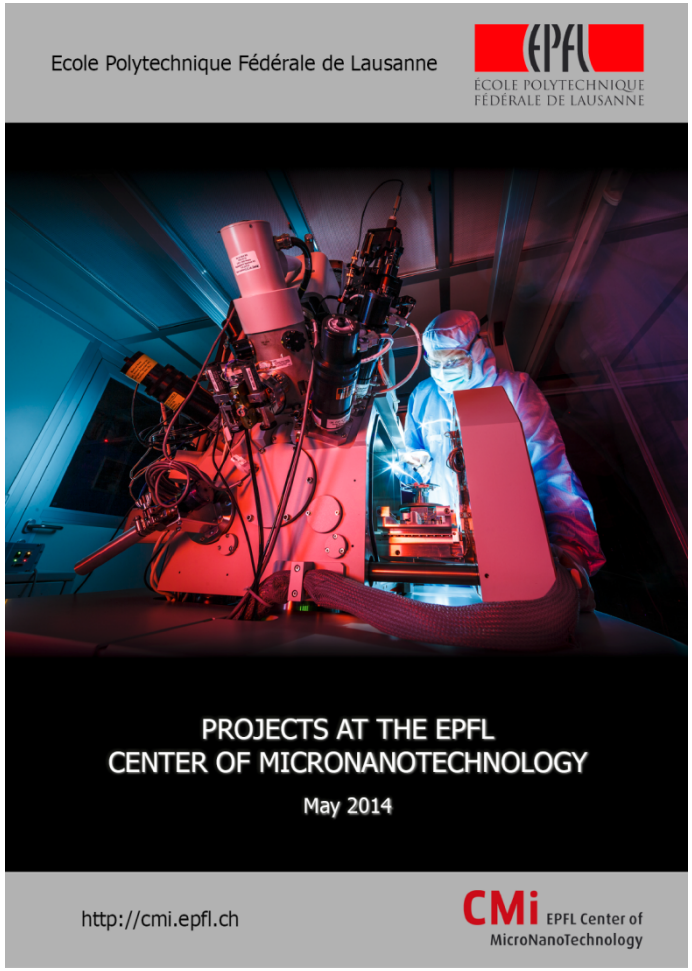
Tank capacity :
3000 [ltr] 37[h]

AC-DC-AC Converter

3 Cells in //
3 x 32 elements 12 [V] 160 [Ah]
Actual 45[min] / 45 [KVA]

- Sensitive tools powered without any interruption

ABSTRACTS IN 2013



- 219 abstracts

PROGRAM

- Very exciting program
- 11 presentations spanning an exceptionally broad range
- One common point:
  - MicroNanoFabrication

CMi EPFL Center of MicroNanoTechnology

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

MicroNanoFabrication Annual Review Meeting

Date: Tuesday May 6th, 2014
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	***Demetri Psaltis***, *Dean of Engineering*, Welcome address
10h05-10h15	***Philippe Renaud*** *and* ***Philippe Flückiger*** *(http://cmi.epfl.ch)*, Introduction
10h15-10h35	***WeiLeun Fang*** *(MicroDevice Laboratory, National Tsing Hua University, Hsinchu, Taiwan)*, CMOS MEMS: a key technology towards the more than Moore era
10h35-10h55	***Francesco Stellacci*** *(http://sunmil.epfl.ch)*, Unconventional way for light detection and light-matter interactions
10h55-11h15	***Andras Kis*** *(http://lanes.epfl.ch)*, MoS2 and two-dimensional electronics
11h15-11h45	**Break**
11h45-12h00	***Bart Deplancke*** *(http://deplanckelab.epfl.ch)*, Linking microfluidics with high-throughput sequencing to study the DNA binding principles of transcription factors
12h00-12h15	***Hatice Altug*** *(http://people.bu.edu/altug)*, Integrated nano-plasmonics for ultra-sensitive vibrational spectroscopy and high-throughput bio-sensing
12h15-12h30	***Michel Despont*** *(http://csem.ch/)*, MEMS, enabler in product innovation
12h30-14h00	**Lunch & Poster Session**
14h00-14h15	***Martin Gijs*** *(http://lmis2.epfl.ch/)*, Sensitive immunoassays and accurate cancer diagnosis using microfluidics
14h15-14h30	***Guillermo Villanueva*** *(http://nems.epfl.ch/)*, Resonant micro and nano mechanical sensors
14h30-14h45	***Loïc Jacot-Descombes*** *(http://www.microresist.de)*, Microlenses by inkjet printing on pre-patterned substrate and technology transfer to production environment
14h45-15h15	**Break**
15h15-15h30	***Nicolas Abelé*** *(http://www.lemoptix.com/)*, MEMS mirror-based laser projector, a technology platform ranging from wearable display, gesture control, mobile to heads-up display applications
15h30-15h45	***Christophe Ballif*** *(http://pvlab.epfl.ch/ & http://csem.ch/)*, Cost effective patterning and microstructures for high efficiency silicon photovoltaic
15h45-17h00	**Cocktails & Poster Session**

THANKS FOR YOUR ATTENTION

ENJOY THE CONFERENCE