POLITECNICO
MILANO 1863

Laurea Magistrale / Master of Science in ELECTRONICS ENGINEERING

prof. Franco ZAPPA

Summary

1. what is ELECTRONICS
2. ELECTRONICS compared to others
3. Laurea Magistrale / Master of Science in **ELECTRONICS ENG**
4. expertizes, skills, employment opportunities
5. research labs in ELECTRONICS
6. further info

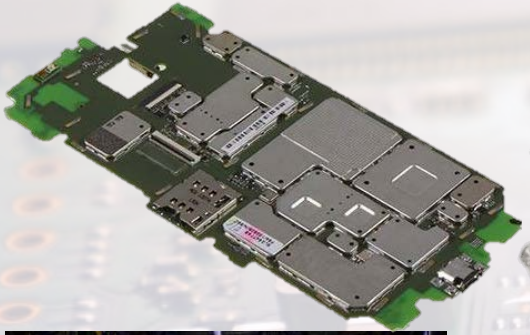
What is ELECTRONICS: $H_{ardware} + F_{irmware} + S_{oftware}$

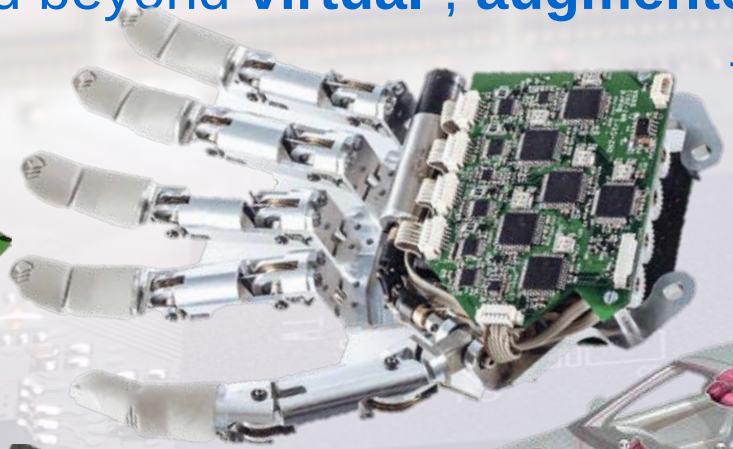
embedded systems, intelligent machines, communication networks …

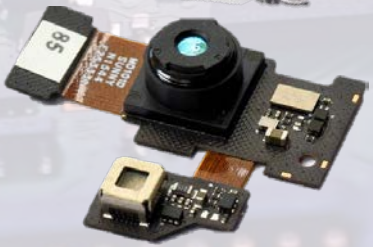
smart-, autonomous-, **wearable-** **products and systems**

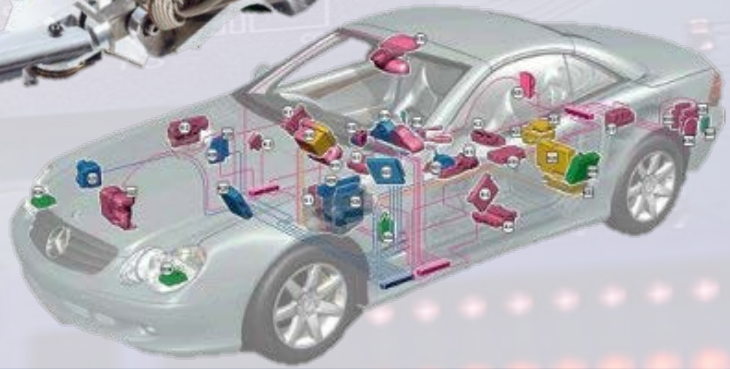
for **real world** and beyond **virtual-**, **augmented-, mixed- reality**

for **humans** and **robots**







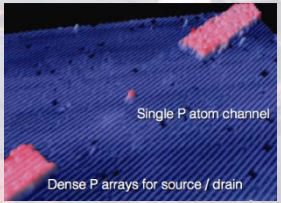


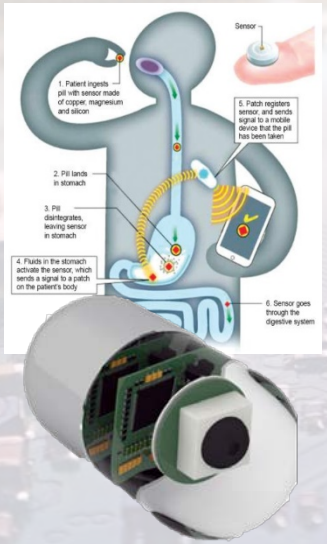
Who is the ELECTRONICS ENGINEER

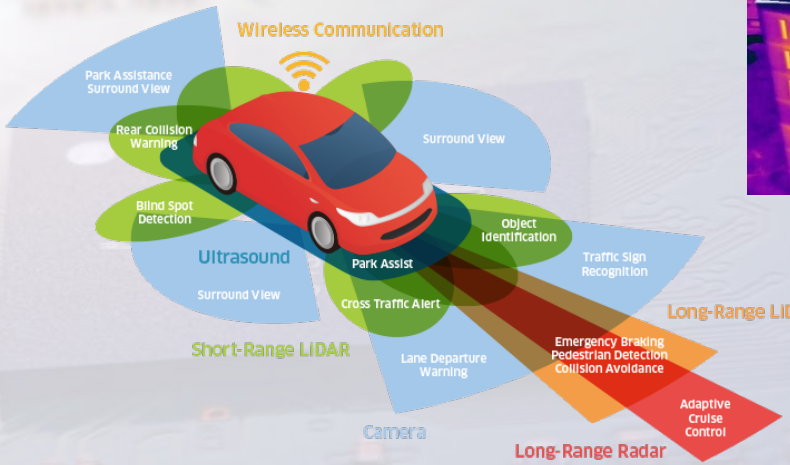
identify and understand a **need** and invent a **solution**:

conceive, simulate, design, develop, build, validate, install…

devices, components, circuits, products, apparata, systems







… for every "smart" task of everyday's modern life!

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"POLIMI OPEN DAY" (info day about POLIMI)

POLITECNICO MILANO 1863

		PRESENTAZIONI (edificio - aula)
ARCHITETTURA Campus Bovisa Durando	Ingegneria Edile e delle Costruzioni	Edificio B8 - 0.5
	Ingegneria Edile-Architettura	Edificio B8 - 0.3
	Progettazione dell'Architettura + Urbanistica: Città Ambiente Paesaggio	Edificio B8 - 0.6
		Edificio B8 - 0.7
	Progettazione dell'Architettura *(in inglese)*	Edificio B8 - 0.7
	Urbanistica: Città Ambiente Paesaggio + Progettazione dell'Architettura	Edificio B8 - 1.2
	Presentazione test Architettura* + prova di ammissione per Urbanistica	Edificio B8 - 1.1
DESIGN Campus Bovisa Durando	Design della Comunicazione	Edificio B2 - 1.9
	Design degli Interni	Edificio B2 - 1.1
	Design della Moda	Edificio B2 - 2.8
	Design del Prodotto Industriale	Edificio B2 - 2.1
	Presentazione Test Design	Edificio B8 - 1.1
INGEGNERIA Campus Bovisa La Masa - Lambruschini	Ingegneria Aerospaziale	Edificio B12 - L.01
		Edificio B12 - L.02
	Ingegneria per l'Ambiente e il Territorio	Edificio B15 - LM.6
	Ingegneria dell'Automazione	Edificio BL27 - 03
	Ingegneria Biomedica	Edificio B12 - L.07
		Edificio B12 - L.08
	Ingegneria Chimica	Edificio B15 - LM.1
	Ingegneria Civile	Edificio BL27 - 08
	Ingegneria Civile per la Mitigazione del Rischio	Edificio BL28 - 1.2
	Ingegneria Edile e delle Costruzioni	Edificio B15 - LM.3
	Ingegneria Edile - Architettura	Edificio B15 - LM.4
	Ingegneria Elettrica	Edificio BL27 - 01
	Ingegneria Elettronica	Edificio B12 - L.06
	Ingegneria Energetica	Edificio B12 - L.03
	Ingegneria Fisica	Edificio BL27 - 04
	Ingegneria Gestionale	Edificio BL27 - 05
		Edificio BL27 - 06
		Edificio BL27 - 07
	Ingegneria Informatica *(+ orientamento Telecomunicazioni)*	Edificio B12 - L.13
	Ingegneria Matematica	Edificio BL27 - 02
	Ingegneria dei Materiali e delle Nanotecnologie	Edificio B15 - LM.5
	Ingegneria Meccanica	Edificio BL28 - AULA
	Ingegneria Nucleare *(corso di Laurea Magistrale)*	Edificio BL28 - 1.1
	Ingegneria della Produzione Industriale	Edificio BL28 - 1.2

Ricorda che:

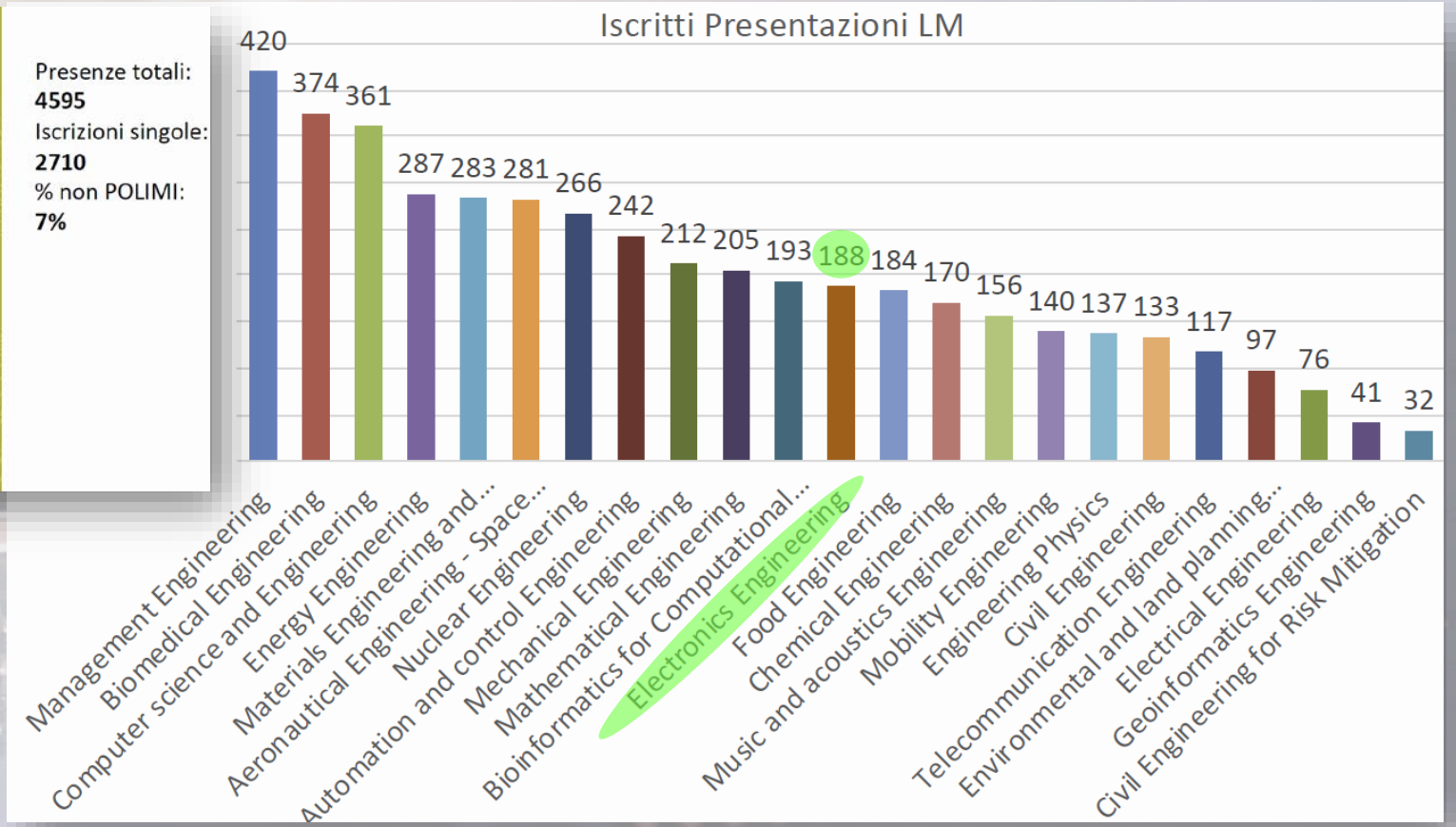
-puoi accedere alle presentazioni solo se ti sei iscritto

-devi presentarti 20 minuti prima dell'inizio di ogni presentazione al *punto iscritti*, indicati alle pagine successive, dove i ragazzi dello staff verificheranno la tua registrazione tramite QR code, che hai ricevuto via mail

CORSO PRESENTATO	TOTALE UDITORI/GIORNATA
Ingegneria Aerospaziale	2.113
Ingegneria Biomedica	2.018
Ingegneria Chimica	1.006
Ingegneria dei Materiali e delle Nanotecnologie	806
ingegneria della Produzione Industriale	189
Ingegneria dell'Automazione	1.122
Ingegneria Elettrica	251
Ingegneria Elettronica	775
Ingegneria Energetica	1.074
Ingegneria Fisica	964
Ingegneria Gestionale	2.081
Ingegneria Informatica+Orientamento Telecomunicazioni	1.821
Ingegneria Matematica	1.057
Ingegneria Meccanica	1.742
Ingegneria Nucleare	410
Presentazione TOL	969

"Presentazioni delle LM" (info day about "Lauree Magistrali")

Presenze totali:
4595
Iscrizioni singole:
2710
% non POLIMI:
7%



Differences among ENGINEERING courses

Some LM are:

- inclusive, INFORMATIVE, TRANSVERSAL, GENERALISTIC, CONNECTING





- seeking, TOOLS, UNFOCUSED, THEORETICAL, MODELLING





- selective, FOCUSED, VERTICAL, PRACTICAL, ENABLING



Max freshmen at the LAUREE

"Scuola 3I"

"Numeri programmati":

180 max at **L ELN**

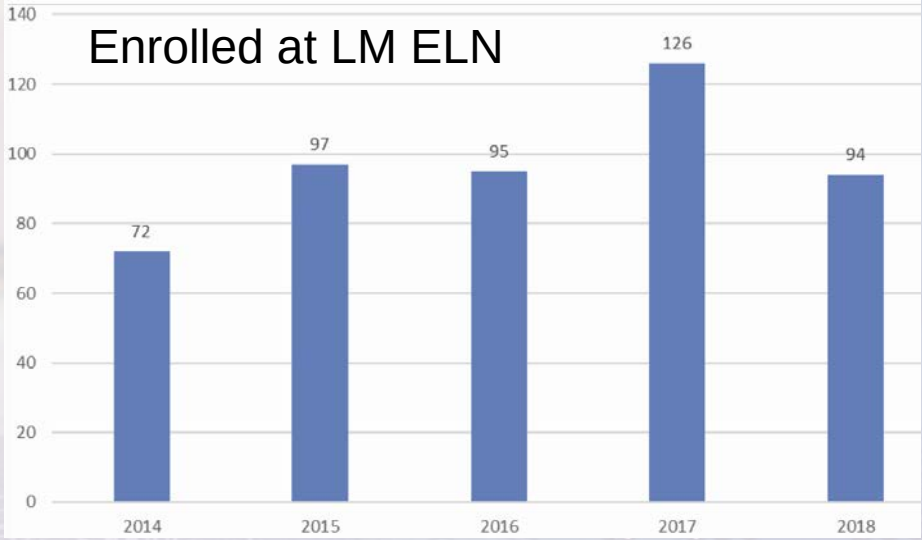
		IMMATRICOLABILI UE	Extra UE	"Marco Polo"	TOTALE
Ingegneria Biomedica	Milano-Leo	480	10	3	490
Ingegneria Gestionale	Milano-Bov	680	15	3	695
	Cremona	120	5	1	125
Ingegneria Matematica	Milano-Leo	340	5	2	345
Ingegneria Fisica	Milano-Leo	180	5	2	185
Ingegneria Chimica	Milano-Leo	220	4	2	224
Ingegneria dei Materiali e delle Nanotecnologie	Milano-Leo	230	10	2	240
Ingegneria Elettrica	Milano-Leo	160	8	2	168
Ingegneria Aerospaziale	Milano-Bov	480	10	3	490
Ingegneria Energetica	Milano-Bov	340	10	3	350
Ingegneria Meccanica	Milano-Bov	600	8	3	608
	Piacenza	130	8	3	138
Ingegneria Elettronica	Milano-Leo	170	10	3	180
Ingegneria Informatica	Milano-Leo	720	15	4	735
	Cremona	120	5	1	125
	IOL	150	0	0	150
Ingegneria dell'Automazione	Milano-Leo	300	10	3	310
Ingegneria della Produzione Industriale	Lecco	150	10	2	160
	TOTALE L	**5570**	**148**	**42**	**5718**

Expected students at the LAUREE MAGISTRALI "Scuola 3I"

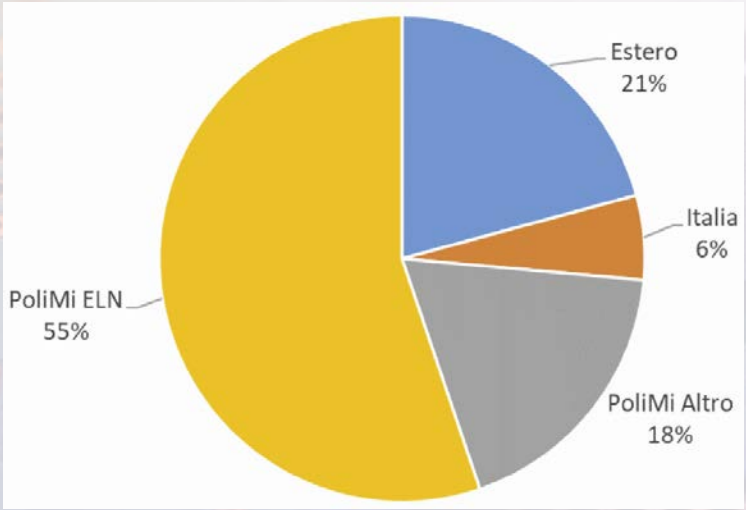
130 new students at **LM ELN**

MAGISTRALE	SEDI	IMMATRICOLABILI UE	Extra UE	Marco Polo	TOTALE
Biomedical Engineering - Ingegneria Biomedica	Milano-Leo	460	40	3	500
Management Engineering - Ingegneria Gestionale	Milano-Bov	600	150	4	750
Engineering Physics - Ingegneria Fisica	Milano-Leo	100	10	2	110
Mathematical Engineering - Ingegneria Matematica	Milano-Leo	190	10	0	200
Chemical Engineering - Ingegneria Chimica	Milano-Leo	130	20	4	150
Ingegneria della Prevenzione e della Sicurezza nell'Industria di Processo	Milano-Leo	60	10	3	70
Electrical Engineering - Ingegneria Elettrica	Milano-Leo	75	75	4	150
Nuclear Engineering - Ingegneria Nucleare	Milano-Bov	60	20	3	80
Materials Engineering and Nanotechnology - Ingegneria dei Materiali e delle Nanotecnologie	Milano-Leo	200	50	4	250
Aeronautical Engineering - Ingegneria Aeronautica	Milano-Bov	200	25	3	225
Space Engineering - Ingegneria Spaziale	Milano-Bov	100	15	3	115
Energy Engineering - Ingegneria Energetica	Milano-Bov	240	40	3	280
	Piacenza	20	20	1	40
Mechanical Engineering - Ingegneria Meccanica	Milano-Bov	330	60	3	390
	Lecco	50	30	3	80
Telecommunication Engineering - Ingegneria delle Telecomunicazioni	Milano-Leo	70	50	3	120
Electronics Engineering - Ingegneria Elettronica	Milano-Leo	100	30	2	130
Computer Science and Engineering - Ingegneria Informatica	Milano-Leo	370	30	0	400
	Como	0	0	0	0
Music and Acoustic Engineering	Milano-Leo	50	10	0	60
	Cremona	30	10	0	40
Food Engineering	Milano-Leo	60	10	0	70
Mobility Engineering	Milano-Leo	60	10	0	70
Automation and Control Engineering - Ingegneria dell'Automazione	Milano-Leo	170	30	0	200
	TOTALE LM	**3725**	**755**	**48**	**4480**

LM ELN / M.S.E.E. enrollment



Origin from L / B.S.



LM ELN / M.S.E.E. distribution of marks

POLITECNICO MILANO 1863

Corsi Attivi: Sì

Anno: 2015-16, 2016-17, 2017-18

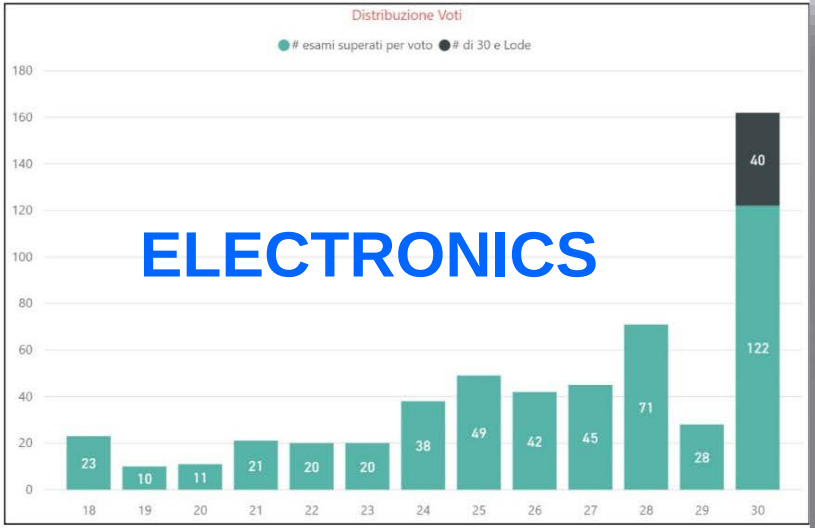
Tipo Corsi: LM

Scuola: ING_3i

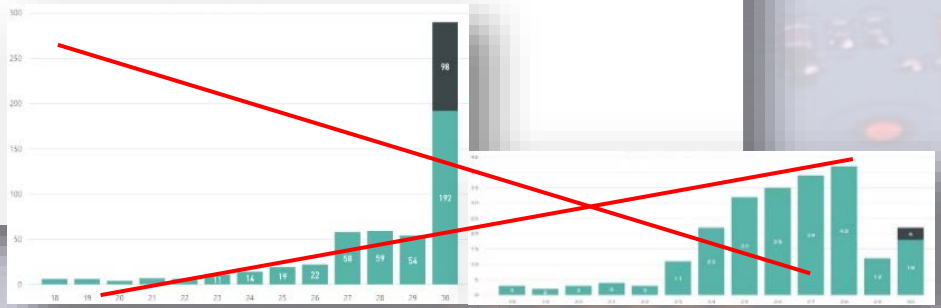
Anno di Corso: 1, 1-2, 2

Corso di Laurea:
- Seleziona tutto
- Aeronautical Engineering - Ingegneria ...
- Automation and Control Engineering - I...
- Biomedical Engineering - Ingegneria Bi...
- Chemical Engineering - Ingegneria Chi...
- Computer Science and Engineering - In...
- Electrical Engineering - Ingegneria Elett...
- Electronics Engineering - Ingegneria Ele...
- Energy Engineering - Ingegneria Energ...
- Engineering Physics - Ingegneria Fisica
- Ingegneria della prevenzione e della sic...
- Management Engineering - Ingegneria ...
- Materials Engineering and Nanotechnol...
- Mathematical Engineering - Ingegneria ...
- Mechanical Engineering - Ingegneria M...
- Music and Acoustic Engineering
- Nuclear Engineering - Ingegneria Nucle...

# di Insegnamenti	39
# di Iscritti all'Esame	1238
di cui superati	500
% di 30 e Lode	8,00
Voto Medio	26,14
Deviazione Standard	3,10



ELECTRONICS



How to enroll to LM ELN

Domanda di ammissione per ≤ 3 diverse LM

Domanda di ammissione a luglio-settembre (I sem) o gennaio-febbraio (II sem)

Si può accedere sia al primo che al secondo semestre

Conoscenza dell'inglese è **pre-requisito obbligatorio**

Commissione valuta e: **SOGLIA SUL VOTO MEDIO**

Who can enroll to LM ELN

Admitted if:

≥ 23 (L ELN)

or

≥ 24.00 (others)

CLM	regola generale	AES	BIO	CHI	MAT	ATM	TLC	ELT	ELN	ENG prof	ENG prop ENG	ENG prop NUC	FIS	GES CR prop	GES CR prof	GES BV prop1	GES BV prop2	GES BV prof	INF MI/CR	INF CR	INF CO/IOL	IPI_PPG	IPI_PPM	MTM	MEC prof BV	MEC prop BV	MEC prop PC	MEC prof PC	CIV	AMB	ICA	DESIGN	ARCH	EDA
AES	21 K:0.5 N1:6	21									21	21														21	21					24	24	
BIO	22		22																													25	25	
CHI	21.5 K:1 N1:6 N2:6			22																												m	m	
MAT	21 K:1 N1:5 N2:7 >30...				21	m	m							m	m	m	m	m	m	m	m									m	m	m	m	
ATM	23 N1:3 N2:6					22																										m	m	
TLC	24 N1:4					21	21		21				21						21	21	21			21										
ELT	22							21																					m	m	m	m	m	
ELN			24			24	24	24	23				24						24					24								m	m	
ENG	25 K:0.5 N1:6 N2:6 >40...	21								21	21	21													21	21	21	21				27	27	
FIS	22				22				22				22																			m	m	
GES	23 K:0.5 N1:5 N2:4.5 ma...													22		22	22					22	22						23	23	23	26	26	23
INF	24																		21	21	21											m	m	
MTM	21.50																							22								24	24	
MEC	25 K:0.5 N1:6	23								23	23	23										23			23	23	23	23				27	27	
MEC LC	25 K:0.5 N1:6	23								23	23	23										23			23	23	23	23				27	27	
NUC		22	22	22	22			22		22			22											22								m	m	
SPA	21 K:0.5 N1:6	21									21	21														21	21		21	21	21	24	24	
SIC																																		

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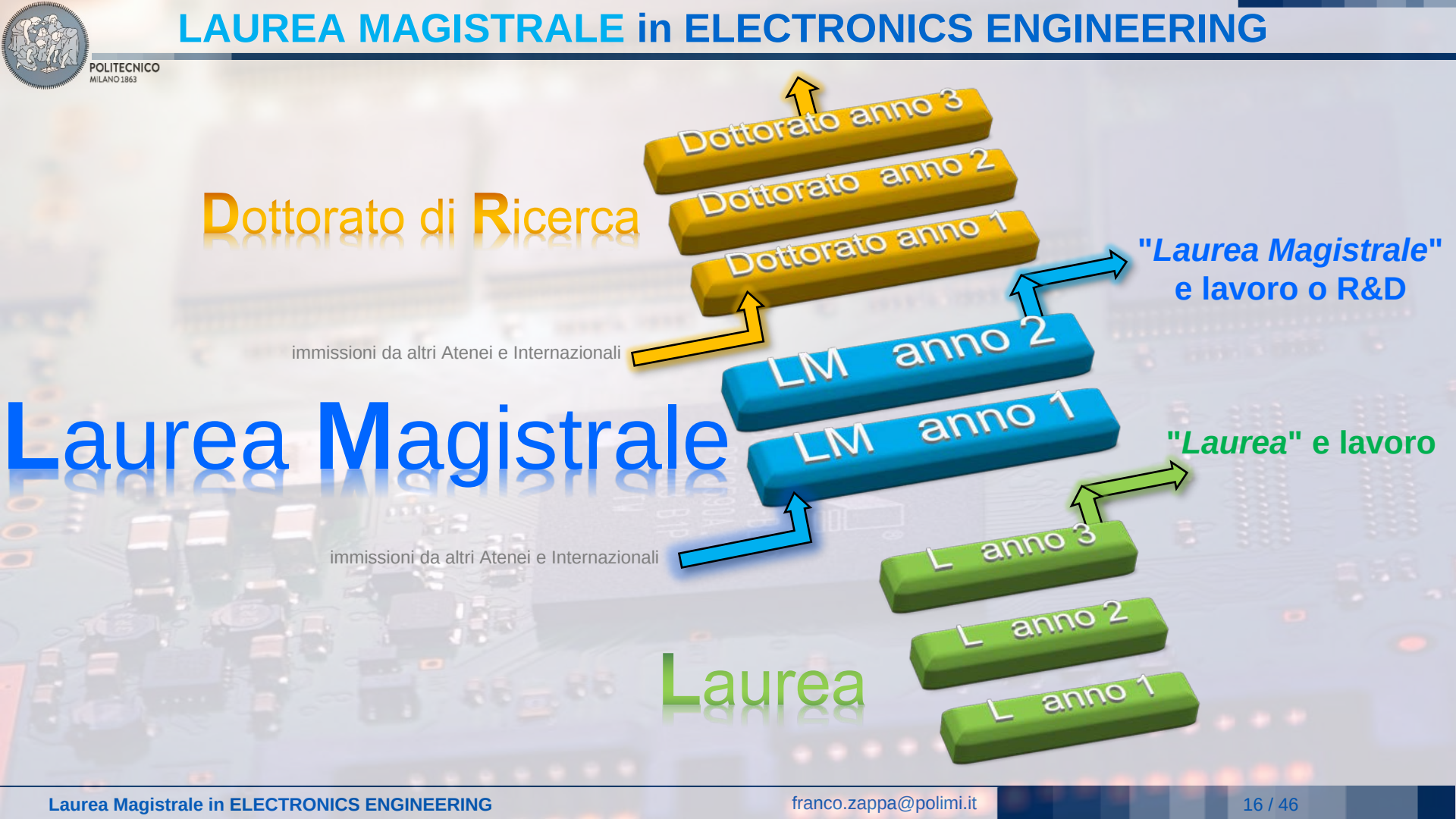

LM ELN / M.S.E.E. teaching programme

www.polimi.it/corsi/corsi-di-laurea-magistrale

2. General presentation of the study programme

The Study Programme in Electronics Engineering prepares the student to conceive, design, innovate, validate and disseminate devices, circuits, apparatuses and complex electronic systems and to integrate them into highly multidisciplinary areas, in the most diversified applications and countless high-tech and consumer world markets.

The Study Programme in Electronics Engineering (ELN) is divided into a first-level three-year Bachelor of Science (*Laurea*, L) degree and a second-level two-year Master of Science (*Laurea Magistrale*, LM) degree, with progressively increasing contents and skills. The *Laurea Magistrale* in Electronics Engineering (LM ELN) is equivalent to the Master of Science in Electronics Engineering (M.S.E.E.).

The aim of the LM ELN is to train and complete professional Electronics Engineers with a broad and robust scientific, technological and engineering know-how, so that they acquire the capability of combining the physical-chemical-mathematical aspects of the most advanced sciences with the technological needs of advanced engineering implementations. The LM ELN provides the skills to create enabling technologies, demonstrate innovative applications, design cutting-edge electronic products and systems, integrate them in the most diverse areas, often expanding toward new markets and scenarios, by inventing new fields, and by improving the quality of everyday life.

Electronics is everywhere around us and it is the irreplaceable and enabling basis of all current and future technologies of the Information, Communication, Control, Automation, Energy and Electricity era. Scientific researches and market developments in electronic technologies are continuous, incessant, and increasingly stimulated by the most diverse and demanding applications. For example, ever-faster microprocessors, with low power consumption, but higher and higher computing power, and increasingly dense memories, without defects and of long endurance and short access time, are the essential electronic constituents of any computer and processing system; without such electronic circuits, artificial intelligence would remain only science-fiction. The ultra-sensitive and miniaturized semiconductor sensors, which continually dialogue with each other and towards the outside world, in the most refined robotic systems and in distributed and ubiquitous networks, are fundamental to acquire the real world's signals, understand them, manage them, control them, and implement actions; without such electronic devices, reality would remain only virtual. Electronic devices, from the simplest consumer products of entertainment and gaming to advanced electronic systems for automation and control, communications, information systems, biomedical instrumentation, equipment for energy generation, storage and distribution, avionics, mechatronics and satellite systems, and so on, have become so fundamental that their existence and performance are taken for granted; without such electronic systems there would be no modern world.

Thanks to the success of the LM ELN and the excellence of Electronics Engineers, the design and innovation of electronic devices, electronic circuits, electronic equipment and systems will provide the fundamental building blocks for all areas of modern life, with all its "Smart-" (smart cyber-physical-systems, smart industries, smart manufacturing, smart living, smart mobility, smart lighting, smart cities, smart communities, smart aging, etc.) and "autonomous-" (vehicles, driving, fleet , manufacturing, etc.) features, so invasive in everyday life.

The Master of Science's Electronics Engineer is the inventor of these systems, she/he designs them, develops them, validates them experimentally and eventually installs them into the end-user application. The first task of an Electronics Engineer is to derive models of the physical reality with which his/her electronic systems will interact, to understand, describe, foresee, and verify the interactions with the other mechanical, electrical, energetic, informative, biological, clinical, physical, chemical, nuclear, etc. equipment. It is a refined and multifaceted professional figure, not closed in his world, but oriented to a continuous interaction with the users of these systems. The Electronics Engineer has a propulsive push towards innovation aimed at improving the performance not only of what is electronic-based (e.g., the component, board, instrument, mainframe,

- PROJECTs to train students to put skills into practice;
- CONTESTs between students and with companies.

As shown in the guidelines for the second-level *Laurea Magistrale* in Electronics Engineering, seven courses offer a total of 12 credits of D.I. Action 1; these are indicated in the following tables with the symbol "d.i." and the number of corresponding credits out of the total number of credits assigned to the course (e.g. the "2.0 d.i." of the "Biochip" subject at the second year, out of the 5 credits total).

Furthermore, in the next academic years other forms of D.I., both in the form of Action 1 and Action 2 activities, will be activated, to allow students to acquire other "soft skills", in addition to technological and scientific knowledge, aimed at improving both public speaking and interactive presentation of achieved results (e.g. the progress of on-going studies or projects), organizational skills, team building and effective teamwork interactions.

Code	Act type	SSD	Course Title	Language	Type	Sem	CFU	CFU Group
052427	B	ING-INF/01	ANALOG CIRCUIT DESIGN	EN	M	1	10.0 [1.0 d.i.]	10.0
054654	B	ING-INF/01	ELECTRONIC SYSTEMS	EN	M	1	10.0	10.0
095155	B	ING-INF/01	ELECTRON DEVICES	EN	M	1	10.0	10.0
095162	B	ING-INF/01	MEMS AND MICROSENSORS	EN	M	1	10.0	
095251	B	ING-INF/01	SIGNAL RECOVERY	EN	M	2	10.0	10.0
095264	B	ING-INF/01	DIGITAL INTEGRATED CIRCUIT DESIGN	EN	M	2	10.0	10.0
095274	B	ING-INF/01	RF CIRCUIT DESIGN	EN	M	2	10.0	
054081	B	ING-INF/01	MICROELECTRONIC TECHNOLOGIES	EN	M	2	5.0 [1.0 d.i.]	5.0
054083	B	ING-INF/01	DIGITAL ELECTRONIC SYSTEMS DESIGN	EN	M	2	5.0 [1.0 d.i.]	
--	--	--	Courses to be chosen from Group TAB1	--	--	--	--	5.0

Legend for the "Training Activities" column: "B" are core-course on characterizing Electronics subjects; "C" are side-courses, i.e. not strictly related to Electronics topics. The be more specific, core-courses are those belonging to the specific Scientific Disciplinary Sectors (SSD) "ING-INF / 01 - ELECTRONICS" and also "ING-INF / 02 – Electromagnetic Fields" and "ING-INF / 07 - Electrical Measurements and Electronics".

The 10 credits "ANALOG CIRCUIT DESIGN" core-course provides also 1 credit of Innovative Education (D.I. indicated with "1.0 d.i." in the tables) consisting of lessons delivered with active teaching methods in which the students are asked to answer interactively to questions posed in classroom and at the end of the lessons and by contents addressed in flipped-class mode.

The 5 credits "DIGITAL ELECTRONIC SYSTEM DESIGN" core-course provides 3 credits of D.I. consisting of flipped-class activities with hands-on practice on developmental electronic boards employing configurable electronic FPGA (field-programmable gate-array) devices and on CAD software tools for the synthesis and simulation of programmable digital electronic systems.

The 5 credit "MICROELECTRONIC TECHNOLOGIES" core-course provides 1 credit of D.I. consisting of a multimedia MOOC (Massive Open Online Course) on some microelectronic manufacturing processing for integrated circuits and of guided tours in laboratories and production rooms of a microelectronic industry.

2 Year courses - Track: PSS - ELECTRONICS ENGINEERING

Code	Act type	SSD	Course Title	Language	Type	Sem	CFU	CFU Group
095380	B	ING-INF/01	MIXED-SIGNAL CIRCUIT DESIGN	EN	M	1	10.0	10.0

090918	B	ING-INF/01	POWER ELECTRONICS	EN	M	1	10.0	
--	--	--	Courses to be chosen from Group TAB1	--	--	--	--	10.0
054085	B	ING-INF/01	BIOCHIP	EN	M	2	5.0 [2.0 d.i.]	
095394	B	ING-INF/01	SEMICONDUCTOR RADIATION DETECTORS	EN	M	2	5.0	10.0
090935	B	ING-INF/01	ELECTRONICS DESIGN FOR BIOMEDICAL INSTRUMENTATION	EN	M	2	10.0	
--	--	--	Courses to be chosen from Group TAB2	--	--	--	--	10.0
--	--	--	Courses to be chosen from Group TAB1	--	--	--	--	
090921	--	--	THESIS AND FINAL EXAM	--	V	1	20.0	20.0
090921	--	--	THESIS AND FINAL EXAM	--	V	2	20.0	

The 5 credit "BIOCHIP" course provides 2 credits of D.I., consisting of a multimedia MOOC (Massive Open Online Course) on microelectronic methodologies for manufacturing electronic devices and biochips, and of some activities where students must design a biochip at the POLI-FAB clean-rooms and laboratories.

Courses of the Group TAB1

Code	Act type	SSD	Course Title	Language	Type	Sem	CFU
052471	C	ING-INF/03	ADVANCED DIGITAL SIGNAL PROCESSING	EN	M	1	10.0 [1.0 d.i.]
094790	C	ING-INF/03	RADAR IMAGING	EN	M	1	5.0
096129	C	ING-INF/04	ADVANCED AND MULTIVARIABLE CONTROL	EN	M	2	10.0
083047	C	ING-IND/34	BIOMATERIALS [C.I.]	IT	I	2	10.0
083042	C	ING-IND/34	CELLULAR BIOENGINEERING	IT	M	1	10.0
097589	C	FIS/03	ADVANCED OPTICS AND LASERS	EN	M	1	10.0
095942	C	ING-INF/05	DIGITAL SYSTEMS DESIGN METHODOLOGIES	EN	I	2	10.0
073011	C	ING-INF/06	BIOENGINEERING OF THE MOTOR SYSTEM	IT	M	1	5.0
099282	C	BIO/10	BIOINFORMATICS AND FUNCTIONAL GENOMICS	IT	M	1	5.0
096617	C	FIS/03	PHYSICS OF PHOTOVOLTAIC PROCESSES	EN	M	1	5.0
053351	C	ING-INF/04	MODEL IDENTIFICATION AND DATA ANALYSIS	EN	I	1	10.0
096081	C	FIS/03	QUANTUM OPTICS AND INFORMATION	EN	M	2	5.0
093062	C	ING-INF/04	AUTOMATION AND CONTROL IN VEHICLES	EN	M	2	5.0
054312	C	ING-INF/03	DIGITAL COMMUNICATION	EN	I	1	10.0 [2.0 d.i.]
088949	C	ING-INF/05	ADVANCED COMPUTER ARCHITECTURES	EN	M	2	5.0
090914	C	ING-INF/04	CONTROL OF INDUSTRIAL ROBOTS	EN	M	1	5.0
095907	C	ING-INF/05	EMBEDDED SYSTEMS	EN	I	1	10.0
096660	C	MAT/08	NUMERICAL METHODS IN MICROELECTRONICS	EN	M	2	5.0
052470	C	ING-INF/03	QUANTUM COMMUNICATIONS	EN	M	2	5.0
089480	C	FIS/03	SOLID STATE PHYSICS A	EN	M	2	5.0
096532	C	ING-IND/31	ADVANCED CIRCUIT THEORY	EN	M	2	5.0

In TAB1 there are 5 and 10 credit electives taught in Italian that students can select.

Courses of the Group TAB2

Code	Act type	SSD	Course Title	Language	Type	Sem	CFU
090918	B	ING-INF/01	POWER ELECTRONICS	EN	M	1	10.0

Semesters and exams

"M.S.E.E. degree"

10 cfu (**1** course)
plus **20 cfu THESIS**

60 cfu second year

30 cfu (**4** courses)

30 cfu (**4** courses)

60 cfu first year

30 cfu (**3** courses)

Jun.–Jul. exams
1 March – 15 June
Jan.–Feb. exams
15 September – 20 December
Sep. exams
Jun.–Jul. exams
1 March – 15 June
Jan.–Feb. exams
15 September – 20 Decem

LM ELN / M.S.E.E. courses

in English

100 cfu total in about **12** courses
(25 cfu of choices)

20 cfu of experimental thesis
(at POLIMI labs or internship)

Moreover: **ERASMUS**,
DOPPIA LAUREA

	tipologia	Nome Insegnamento	Sem	CFU	di cui di D.I	CFU Gruppo
1° anno LM ELN	caratterizzante	ANALOG CIRCUIT DESIGN	1	10	1	10
	caratterizzante	ELECTRONIC SYSTEMS	1	10		10
	caratterizzante	ELECTRON DEVICES	1	10		10
	caratterizzante	MEMS AND MICROSENSORS	1	10		
	caratterizzante	SIGNAL RECOVERY	2	10		10
	caratterizzante	DIGITAL INTEGRATED CIRCUIT DESIGN	2	10		10
	caratterizzante	RF CIRCUIT DESIGN	2	10		
	caratterizzante	DIGITAL ELECTRONIC SYSTEMS DESIGN	2	5	3	5
	caratterizzante	MICROELECTRONIC TECHNOLOGIES	2	5	1	
	affine	***Insegnamenti a scelta dal Gruppo TAB1***	--	--		5
2° anno LM ELN	caratterizzante	MIXED-SIGNAL CIRCUIT DESIGN	1	10		10
	caratterizzante	POWER ELECTRONICS	1	10		
	affine	***Insegnamenti a scelta dal Gruppo TAB1***	--	--		10
	caratterizzante	BIOCHIP	2	5	2	10
	caratterizzante	SEMICONDUCTOR RADIATION DETECTORS	2	5		
	caratterizzante	ELECTRONICS DESIGN FOR BIOMEDICAL INSTRUM.	2	10		
	affine	***Insegnamenti a scelta dal Gruppo TAB1 o TAB2***	--	--		10
		THESIS AND FINAL EXAM		20		20

LM ELN / M.S.E.E. elective courses (your own choice)

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	SSD	Denominazione Insegnamento	Sem	CFU	di cui di D.I.
Insegnamenti del Gruppo TAB1	FIS/03	PHYSICS OF PHOTOVOLTAIC PROCESSES	1	5	
	FIS/03	ADVANCED OPTICS AND LASERS	1	10	
	FIS/03	QUANTUM OPTICS AND INFORMATION	2	5	
	FIS/03	SOLID STATE PHYSICS A	2	5	
	ING-IND/31	ADVANCED CIRCUIT THEORY	2	5	
	ING-INF/03	DIGITAL COMMUNICATION	1	10	1
	ING-INF/03	ADVANCED DIGITAL SIGNAL PROCESSING	1	10	1
	ING-INF/03	RADAR IMAGING	1	5	
	ING-INF/03	QUANTUM COMMUNICATIONS	2	5	
	ING-INF/04	CONTROL OF INDUSTRIAL ROBOTS	1	5	
	ING-INF/04	MODEL IDENTIFICATION AND DATA ANALYSIS	1	10	
	ING-INF/04	AUTOMATION AND CONTROL IN VEHICLES	2	5	
	ING-INF/04	ADVANCED AND MULTIVARIABLE CONTROL	2	10	
	ING-INF/05	EMBEDDED SYSTEMS	1	10	
	ING-INF/05	DIGITAL SYSTEMS DESIGN METHODOLOGIES	2	10	
	ING-INF/05	ADVANCED COMPUTER ARCHITECTURES	2	5	
	ING-IND/34	BIOMATERIALI [C.I.]	2	10	
	ING-IND/34	BIOINGEGNERIA CELLULARE	1	10	
	ING-INF/06	BIOINGEGNERIA DEL SISTEMA MOTORIO	1	5	
	BIO/10	BIOINFORMATICA E GENOMICA FUNZIONALE	1	5	
	MAT/08	NUMERICAL METHODS IN MICROELECTRONICS	2	5	

	SSD	Denominazione Insegnamento	Sem	CFU	di cui di D.I.
Insegnamenti del Gruppo TAB2	caratterizzante	BIOCHIP	2	5	2
	caratterizzante	DIGITAL ELECTRONIC SYSTEMS DESIGN	2	5	
	caratterizzante	DIGITAL INTEGRATED CIRCUIT DESIGN	2	10	
	caratterizzante	ELECTRON DEVICES	1	10	
	caratterizzante	ELECTRONICS AND ELECTROACOUSTIC FOR SOUND ENG.	2	10	
	caratterizzante	ELECTRONICS DESIGN FOR BIOMEDICAL INSTRUM.	2	10	
	caratterizzante	MEMS AND MICROSENSORS	1	10	
	caratterizzante	MICROELECTRONIC TECHNOLOGIES	2	5	1
	caratterizzante	MIXED-SIGNAL CIRCUIT DESIGN	1	10	
	caratterizzante	POWER ELECTRONICS	1	10	
	caratterizzante	RF CIRCUIT DESIGN	2	10	
	caratterizzante	SEMICONDUCTOR RADIATION DETECTORS	2	5	
	caratterizzante	SENSOR SYSTEMS	1	5	3
	caratterizzante	ANTENNAS	2	5	
	caratterizzante	ELECTROMAGNETIC COMPATIBILITY	1	5	
	caratterizzante	MICROWAVE ENGINEERING	2	5	
	caratterizzante	PHOTONIC DEVICES	2	10	
	caratterizzante	RF SYSTEMS	1	10	
	caratterizzante	OPTICAL MEASUREMENTS	1	5	

- proposed choices, among many others

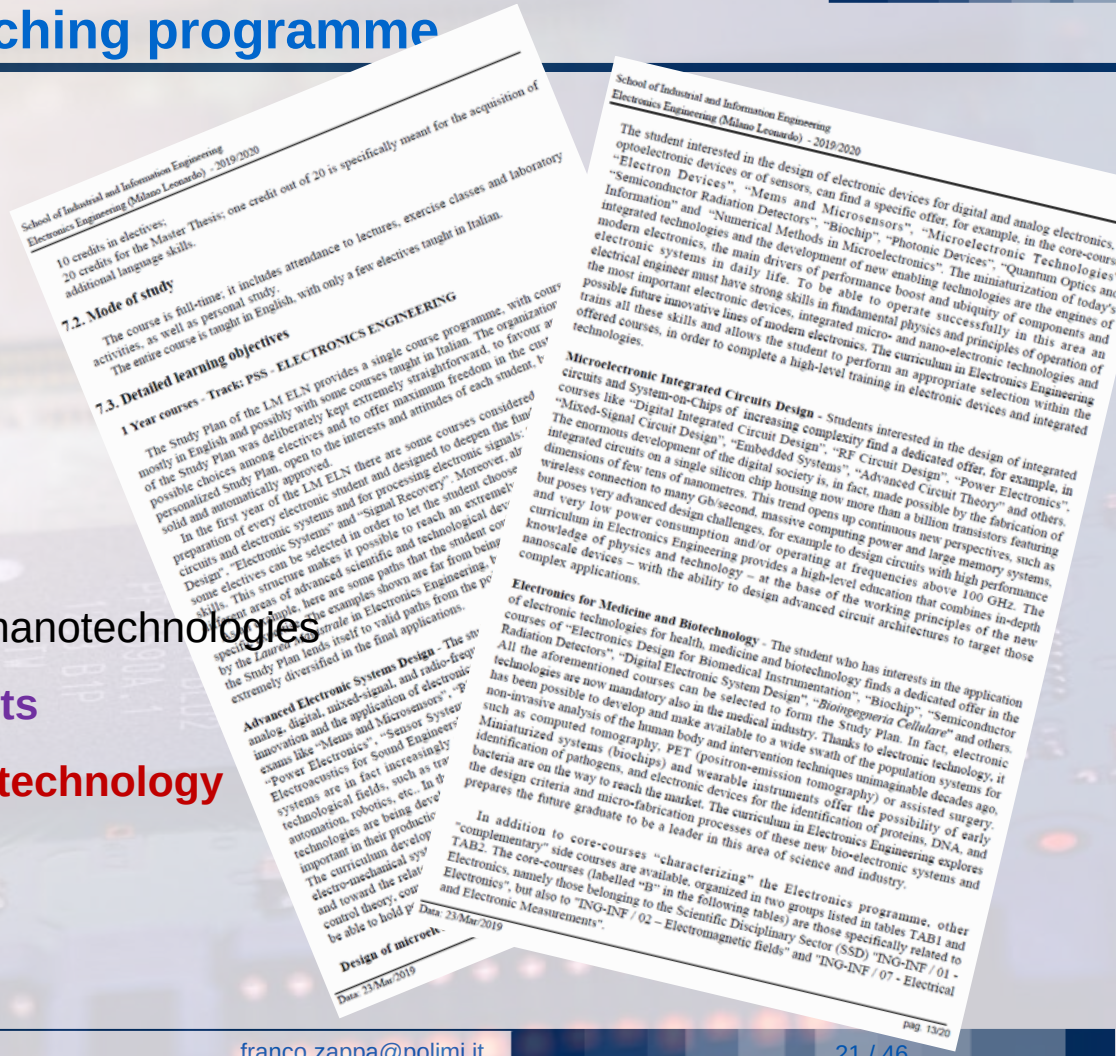
LM ELN / M.S.E.E. teaching programme

Only one track

(**PSS – ELECTRONICS ENGINEERING**)

Examples of paths:

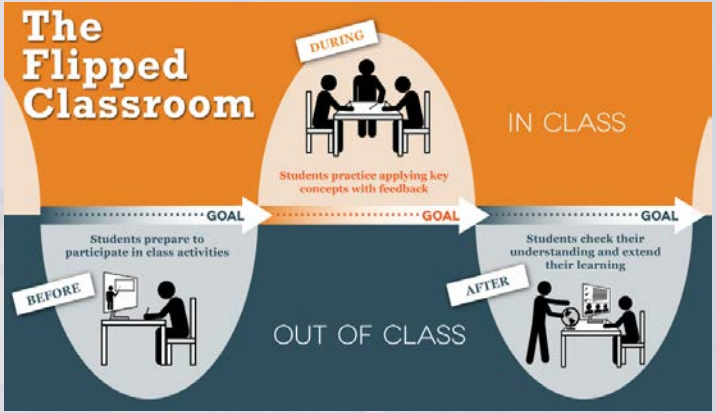
- advanced electronic **systems**
- **devices** for photonics, biochips, nanotechnologies
- microelectronic **integrated circuits**
- electronics for **medicine and biotechnology**



Didattica Innovativa (D.I.) – Innovative Teaching

ACTION 1 – curricolar (gives **credits**):

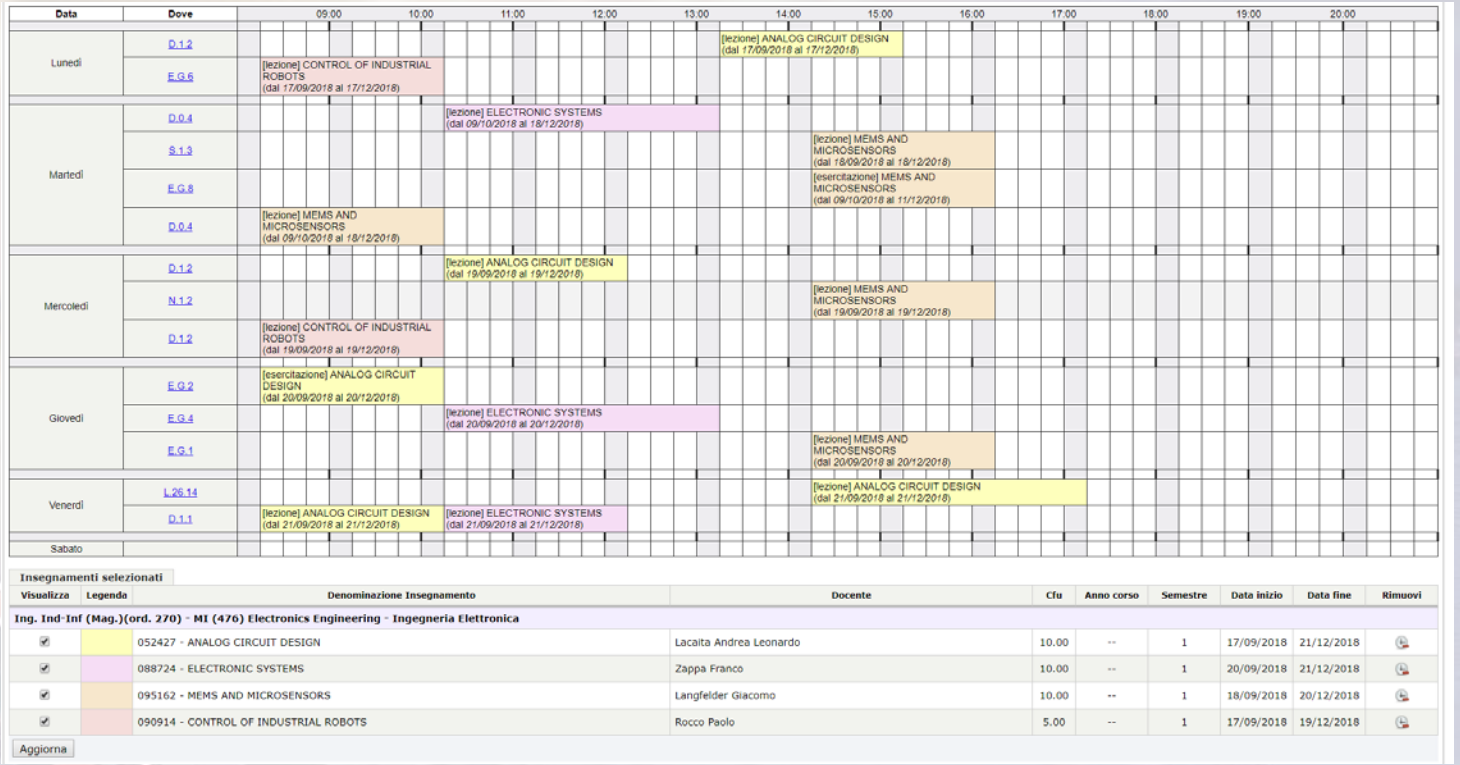
- *soft-skills* with cross-contents
- *flipped-class*
- co-tutoring with companies
- ***M**assive**O**pen**O**nline**C**ourses*, www.pok.polimi.it



ACTION 2 – extracurricolar (just in Diploma Supplement)

- *Kick-starter Workshop* *Public Speaking* *Mnemonic* *Goal Mapping* *Problem solving* *Project Management* *Pitch* *Entrepreneurial mindset* *Efficient Communication*
- Projects for training
- Contest, challenges, entrepreneurship

Example of weekly timetable



Data	Dove	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00
Lunedì	D 1.2						[lezione] ANALOG CIRCUIT DESIGN (dal 17/09/2018 al 17/12/2018)						
	E.G.6	[lezione] CONTROL OF INDUSTRIAL ROBOTS (dal 17/09/2018 al 17/12/2018)											
Martedì	D 0.4			[lezione] ELECTRONIC SYSTEMS (dal 09/10/2018 al 18/12/2018)									
	S 1.3							[lezione] MEMS AND MICROSENSORS (dal 18/09/2018 al 18/12/2018)					
	E.G.8							[esercitazione] MEMS AND MICROSENSORS (dal 09/10/2018 al 11/12/2018)					
	D 0.4	[lezione] MEMS AND MICROSENSORS (dal 09/10/2018 al 18/12/2018)											
Mercoledì	D 1.2			[lezione] ANALOG CIRCUIT DESIGN (dal 19/09/2018 al 19/12/2018)									
	N 1.2							[lezione] MEMS AND MICROSENSORS (dal 19/09/2018 al 19/12/2018)					
	D 1.2	[lezione] CONTROL OF INDUSTRIAL ROBOTS (dal 19/09/2018 al 19/12/2018)											
Giovedì	E.G.2	[esercitazione] ANALOG CIRCUIT DESIGN (dal 20/09/2018 al 20/12/2018)											
	E.G.4			[lezione] ELECTRONIC SYSTEMS (dal 20/09/2018 al 20/12/2018)									
	E.G.1							[lezione] MEMS AND MICROSENSORS (dal 20/09/2018 al 20/12/2018)					
Venerdì	L 26.14							[lezione] ANALOG CIRCUIT DESIGN (dal 21/09/2018 al 21/12/2018)					
	D 1.1	[lezione] ANALOG CIRCUIT DESIGN (dal 21/09/2018 al 21/12/2018)		[lezione] ELECTRONIC SYSTEMS (dal 21/09/2018 al 21/12/2018)									
Sabato													

Insegnamenti selezionati

Visualizza	Legenda	Denominazione Insegnamento	Docente	Cfu	Anno corso	Semestre	Data inizio	Data fine	Rimuovi
Ing. Ind-Inf (Mag.)(ord. 270) - MI (476) Electronics Engineering - Ingegneria Elettronica									
☑		052427 - ANALOG CIRCUIT DESIGN	Lacaita Andrea Leonardo	10.00	--	1	17/09/2018	21/12/2018	
☑		088724 - ELECTRONIC SYSTEMS	Zappa Franco	10.00	--	1	20/09/2018	21/12/2018	
☑		095162 - MEMS AND MICROSENSORS	Langfelder Giacomo	10.00	--	1	18/09/2018	20/12/2018	
☑		090914 - CONTROL OF INDUSTRIAL ROBOTS	Rocco Paolo	5.00	--	1	17/09/2018	19/12/2018	

Aggiorna

- about 24 h of **LESSONS** and **EXERCISE CLASSES**
- about 3 h of **LABS**
- some free time for lunch, relax, study, enjoy

1. what is ELECTRONICS
2. ELECTRONICS compared to others
3. Laurea Magistrale / Master of Science in **ELECTRONICS ENG**
4. expertizes, skills, employment opportunities
5. research labs in ELECTRONICS
6. further info

LM ELN / M.S.E.E. objectives

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component

device

physics

chemistry

mathematics

system

circuit

prototype

product

apparata

LM ELN / M.S.E.E. acquired expertize and skills

- spot — what to solve and how
- define — specs, requirements, constraints, costs, pros/cons
- select — design methodologies and technologies
- **design** — electron devices
- **develop** — integrated circuits, electronic boards, mixed systems
- **exploit** — sensors, actuators, µP, FPGA, DSP, … at best
- **integrate** — elettronics into applications (atm, bio, ene, mec, inf, tlc …)
- **validate** — through instrumentation
- **manage** — "ilities" in plants and systems (reliability, manufacturability, testability …)
- **profit**

LM ELN / M.S.E.E. employment opportunities

- **microelectronics** for semiconductors / integrated circuits
- **high-tech industries** (mechatronics, avionics, energy, automotive, space…)
- **companies** for smart electronics (infotainment, telecomm, computers…)
- **industrial automation** and **robotics** for manufacturing
- **infrastructures** for communications / networks / cloud / grid
- **R&D** genetics / pharmacology / medicine
- **start-up** & **spin-off** companies
- **consultancy** and **entrepreneurship**
- **public/private scientific/technological organizations**

- **… Ph.D.**

POLIMI ranking for ELECTRONICS

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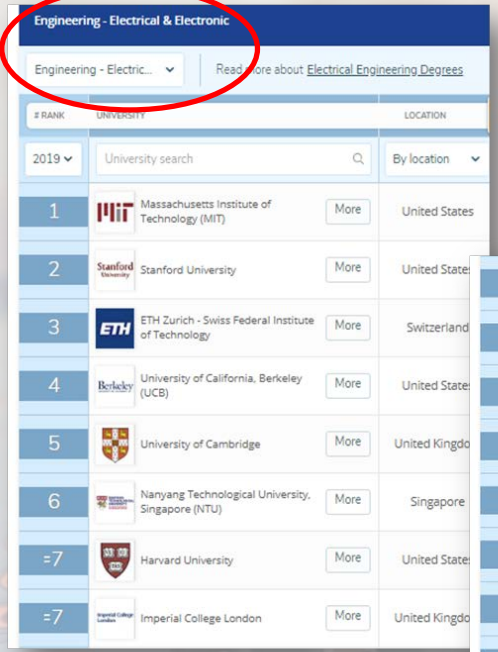
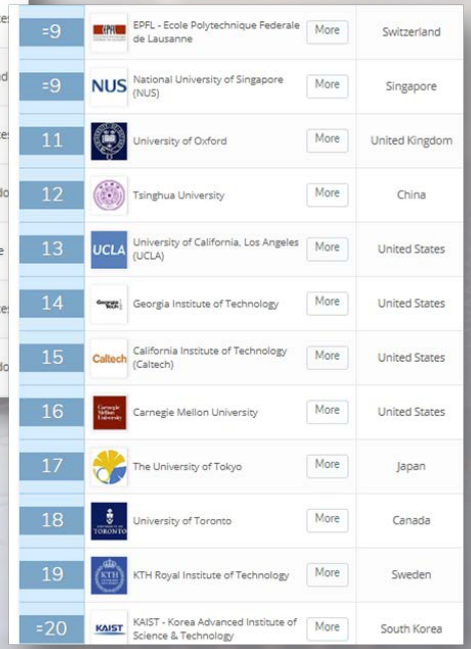
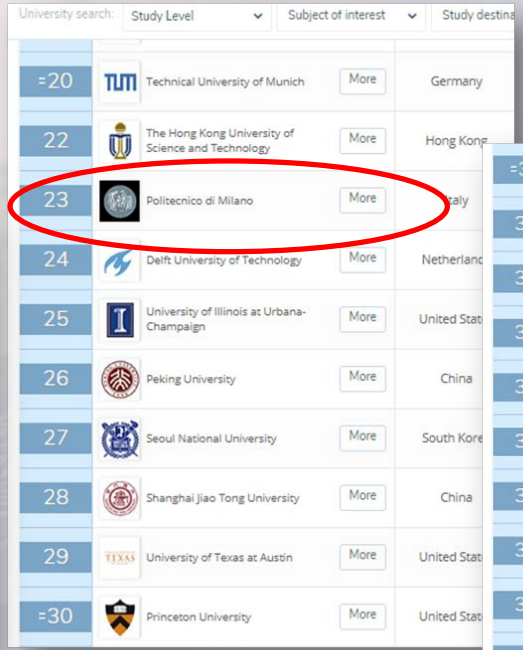
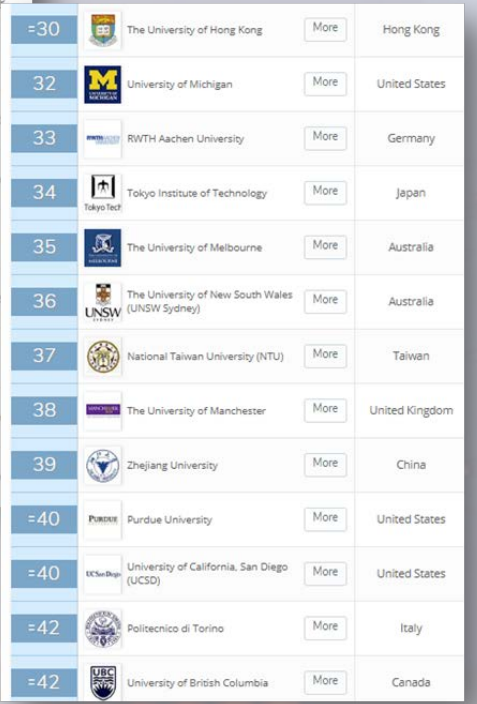
QS TOPUNIVERSITIES









Employment rates of LM ELN al POLIMI

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POLITECNICO MILANO 1863 English CareerService

News & Tools | Info stage | Offerte di lavoro e stage | Aziende | Candidati | Incontri con le aziende | Registra Azienda | Login

CARATTERISTICHE DELLA
PROFESSIONE DI INGEGNERE ELETTRONICO
A CINQUE ANNI DAL TITOLO

Retribuzione mensile netta	Utilizzo elevato, nel lavoro, delle competenze acquisite all'università
1.914 €	62,7%

Rapporto 2018 ALMALAUREA

occupati

94,6%

in quanto tempo

90,3%	9,7%
Entro 6 mesi*	7-12 mesi

* inclusi i laureati che hanno trovato un impiego contestualmente alla laurea

retribuzione mensile netta

€ 1.647

dove lavorano

Italia 88,6%
Estero 11,4%

12,5% *italiani che lavorano all'estero*
100% *stranieri che lavorano in Italia*

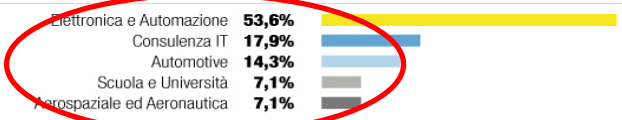
dimensione aziendale

+500 addetti 37,1%
50-499 addetti 25,7%
1-49 addetti 37,2%

contratti

Tempo indeterminato	60%
Tempo determinato	8,6%
Apprendistato	22,8%
Stage	0%
Altro	8,6%
Autonomo	0%

settori occupazionali (top 5)



Elettronica e Automazione	53,6%
Consulenza IT	17,9%
Automotive	14,3%
Scuola e Università	7,1%
Aerospaziale ed Aeronautica	7,1%

1. what is ELECTRONICS
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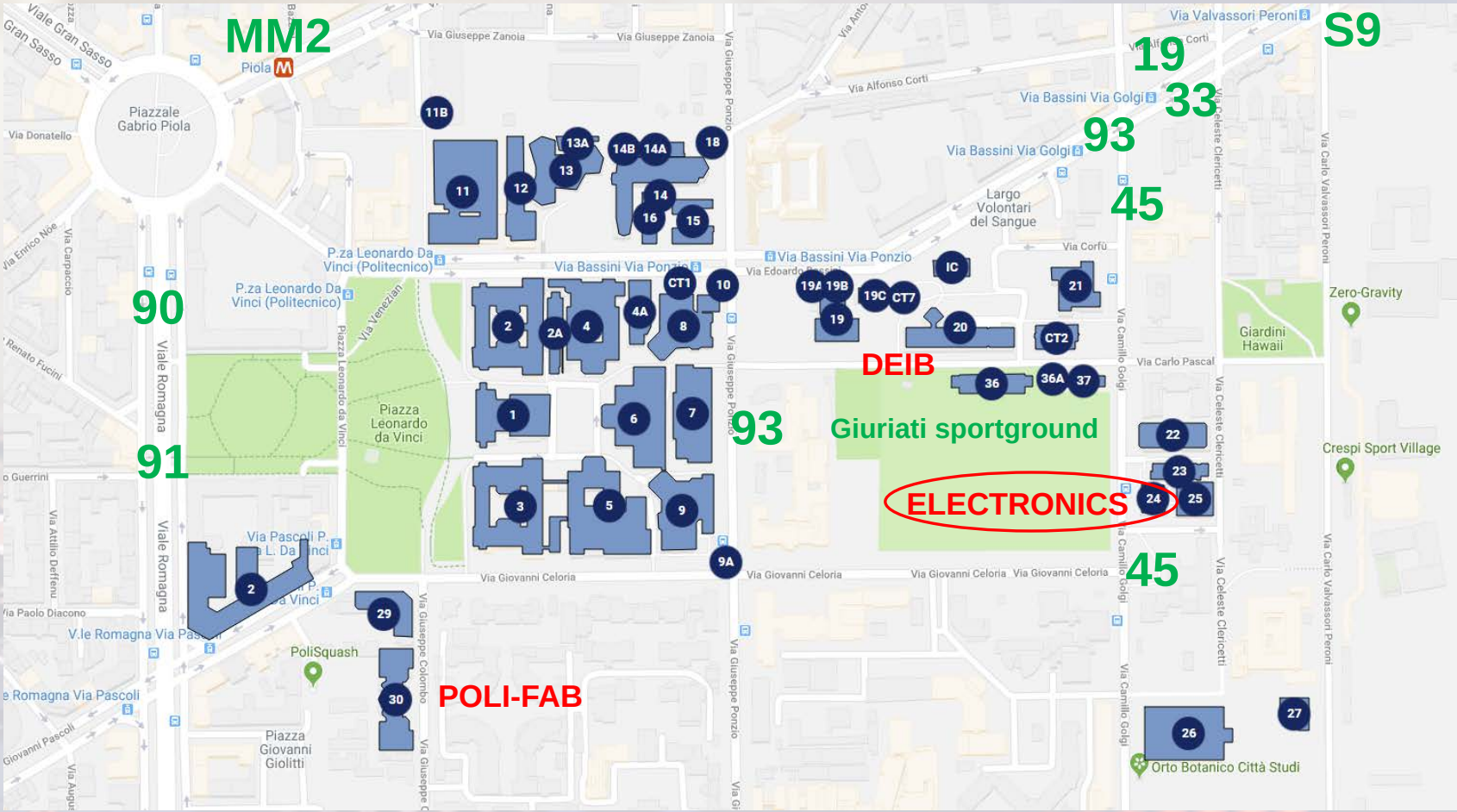
6. further info

Where is ELECTRONICS at POLIMI

MM2 MM2



R&D in ELECTRONICS @ polimi

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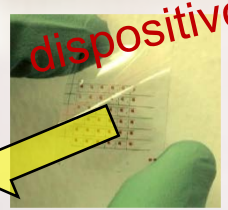
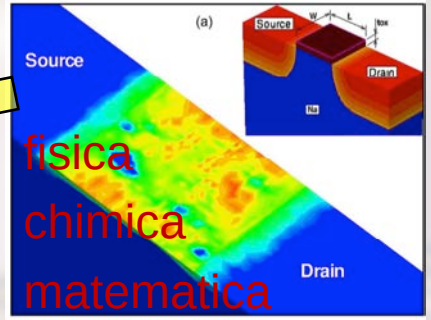
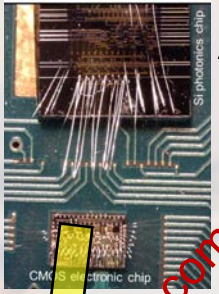
dispositivo

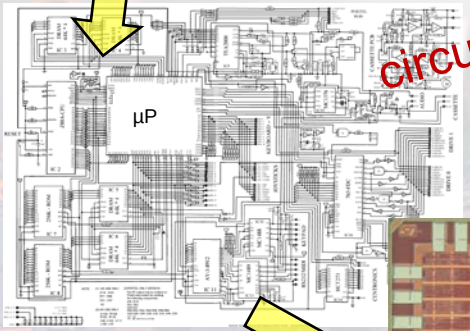


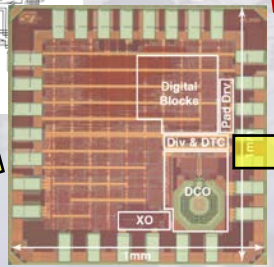


componente



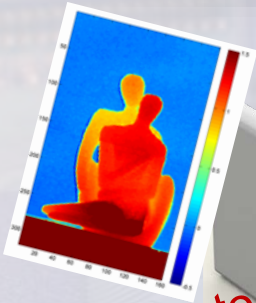
circuito

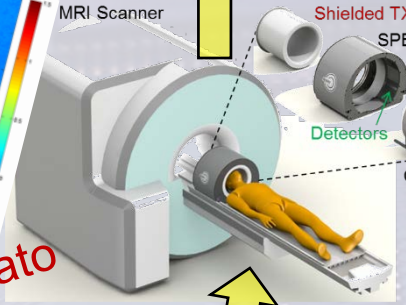




prototipo

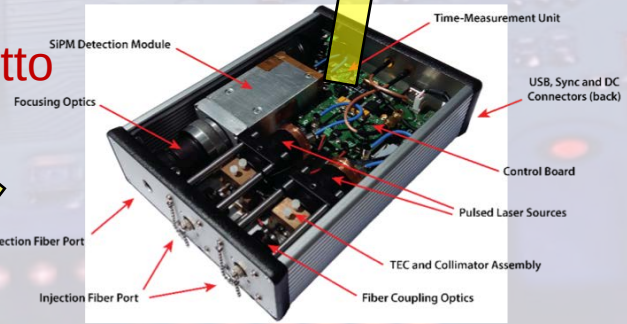
sistema



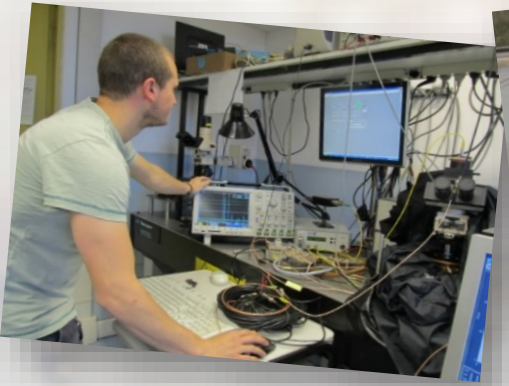


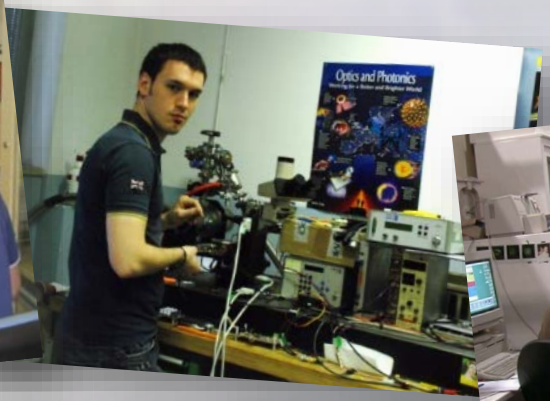
apparato

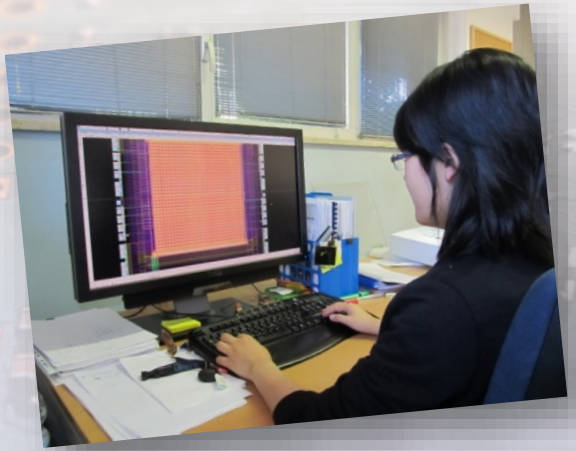
prodotto



ELECTRONICS laboratories at POLIMI



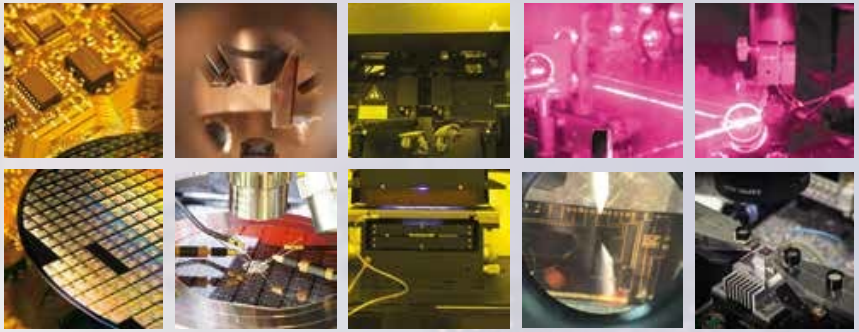




Microelectronic processing at POLIMI: POLI-FAB

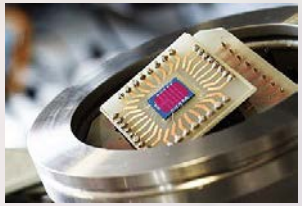
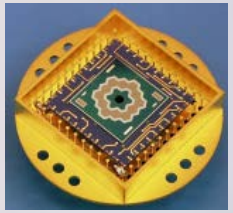
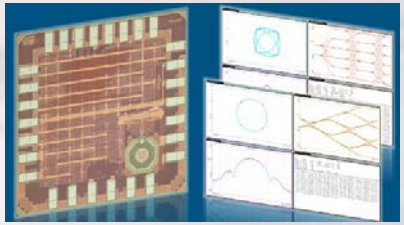
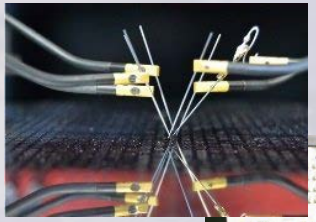
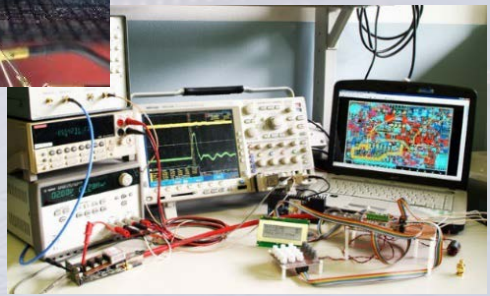
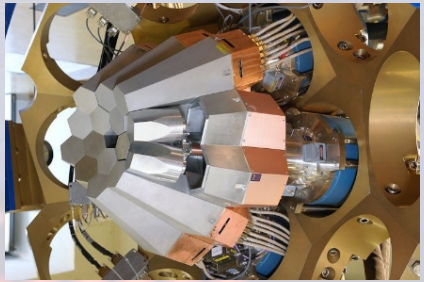
polifab
POLITECNICO DI MILANO

www.polifab.polimi.it



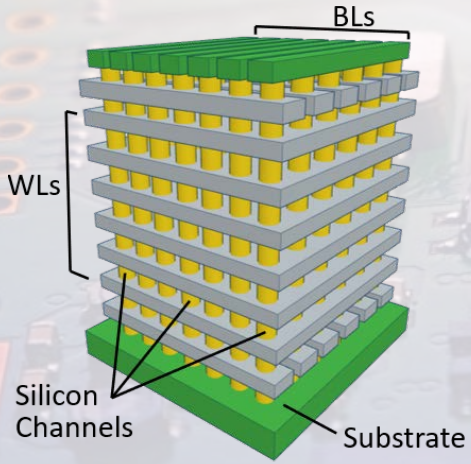
ELECTRONICS research & development at POLIMI

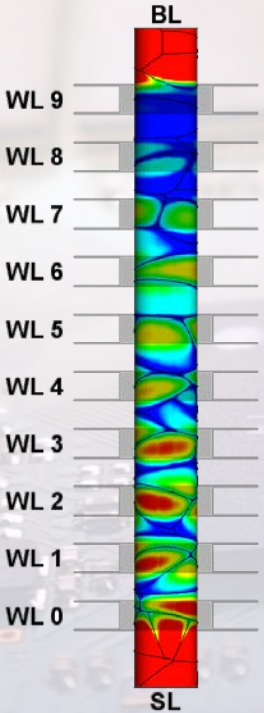
- Nano-electronics devices
- Electronic circuits design
- Digital systems
- Smart microsensors and microsystems
- Single-photon detectors and applications
- Radiation detectors and applications

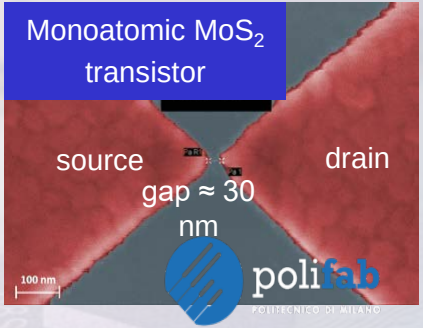
ELN R&D at POLIMI: Nano-electronic devices

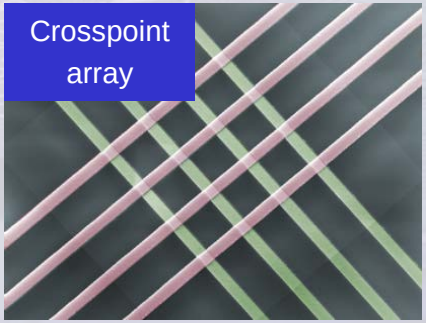
3D memory characterization and modeling

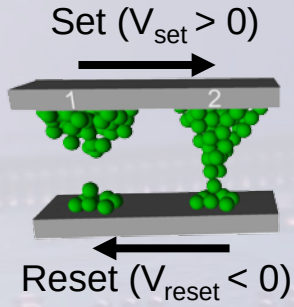


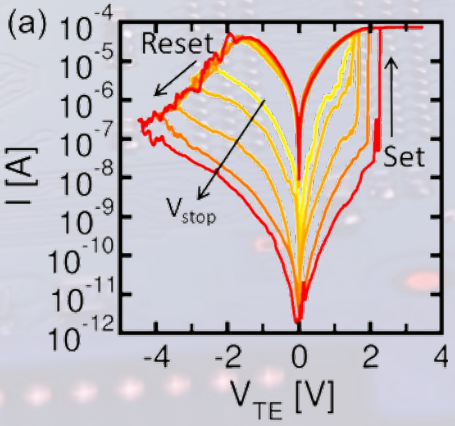


Emerging device fabrication, char. and modeling



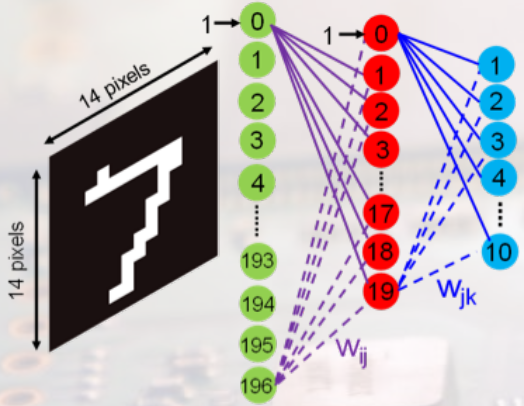


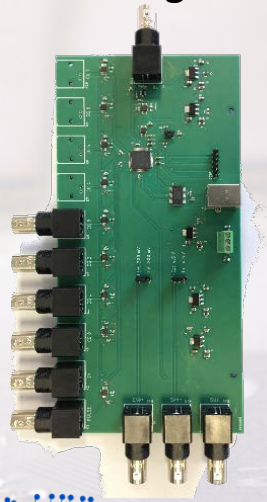


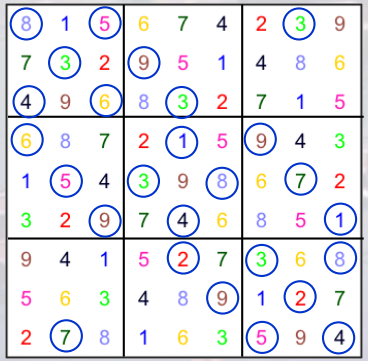


ELN R&D at POLIMI: Nano-electronic devices

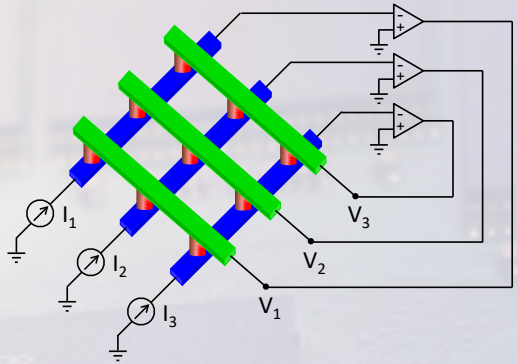
Neural networks and machine learning

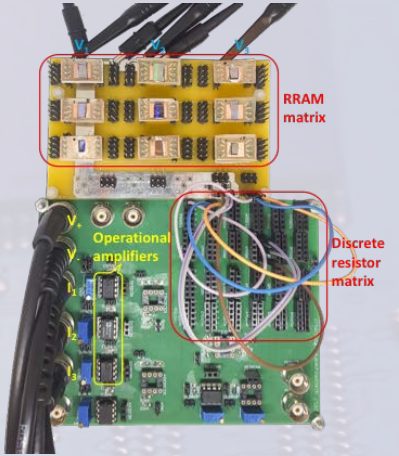


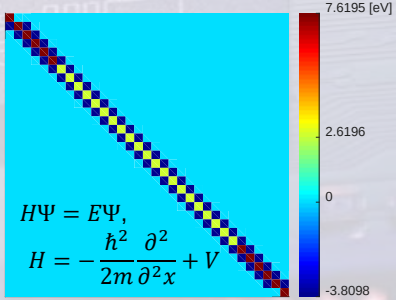


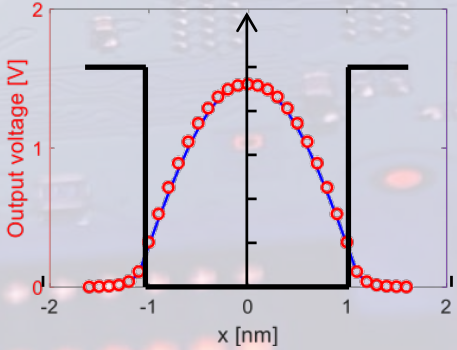


In-memory computing



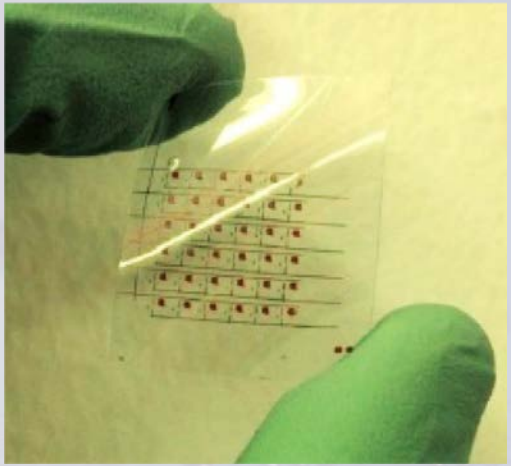


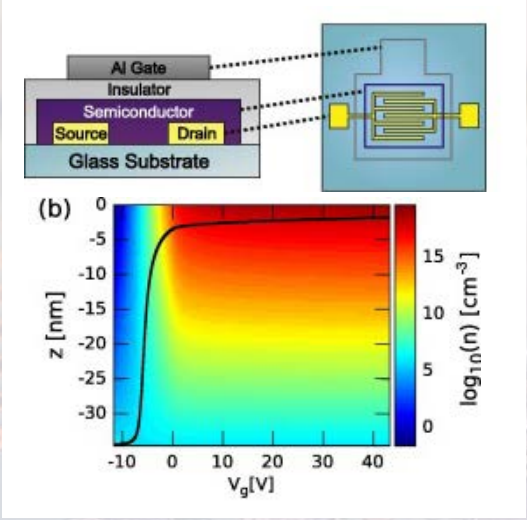




ELN R&D at POLIMI: Printed and flexible Electronics

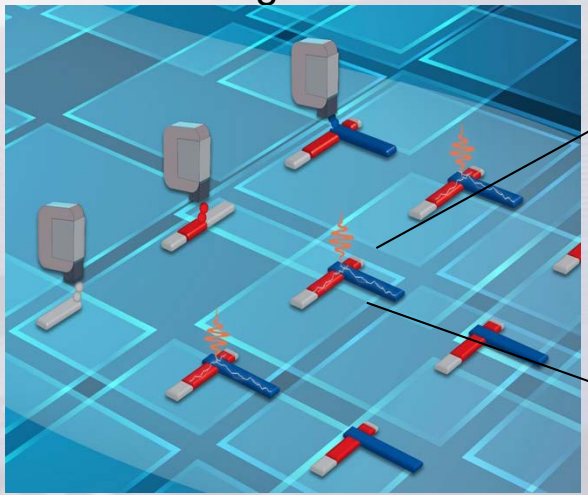
Printed, Large Area Imager

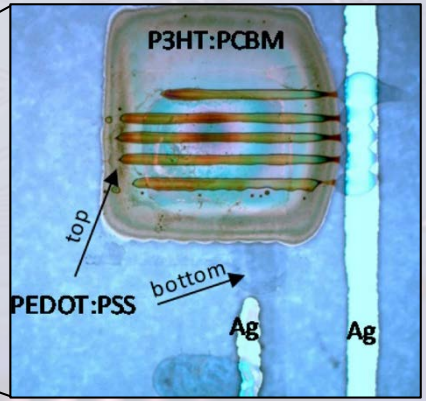




Organic semiconductors:
device modeling and simulation

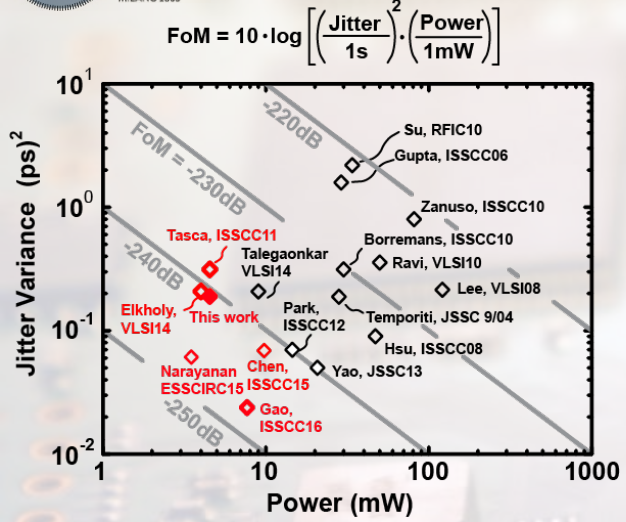
Organic semiconductors:
image sensor …





…single pixel

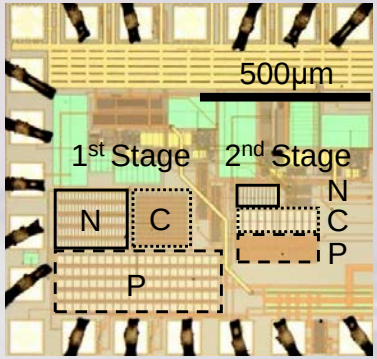
ELN R&D at POLIMI: Electronic circuit design

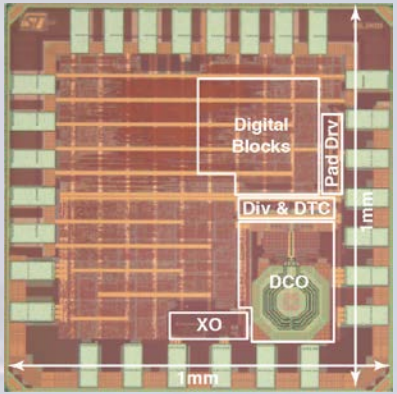


Fundamental limits of Phase Locked Loops (PLLs)

RF frequency synthetizers (1-30 GHz) for wireless applications (WiFi, LTE, 5G, IoT)

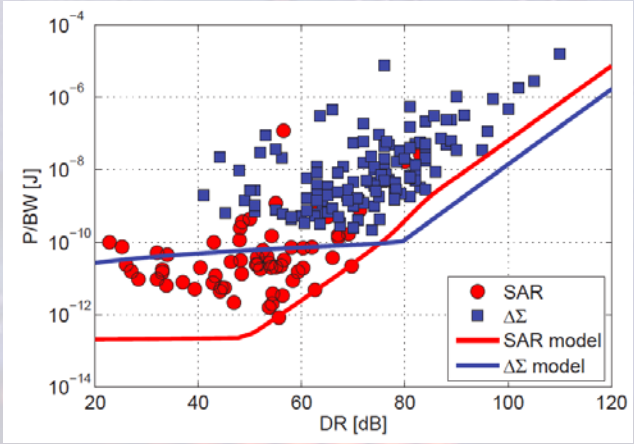
digitally-assisted analog design





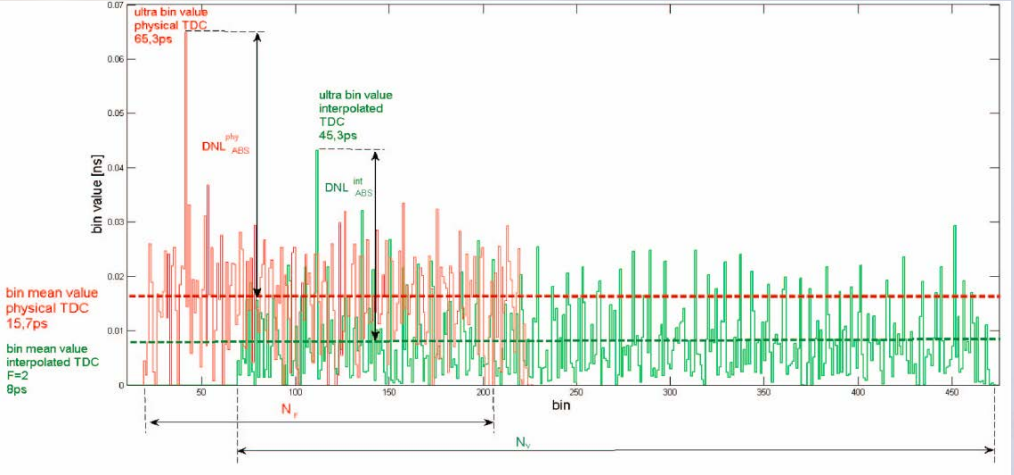
Fundamental power limits of SAR and ΔΣ Analog-to-Digital Converters

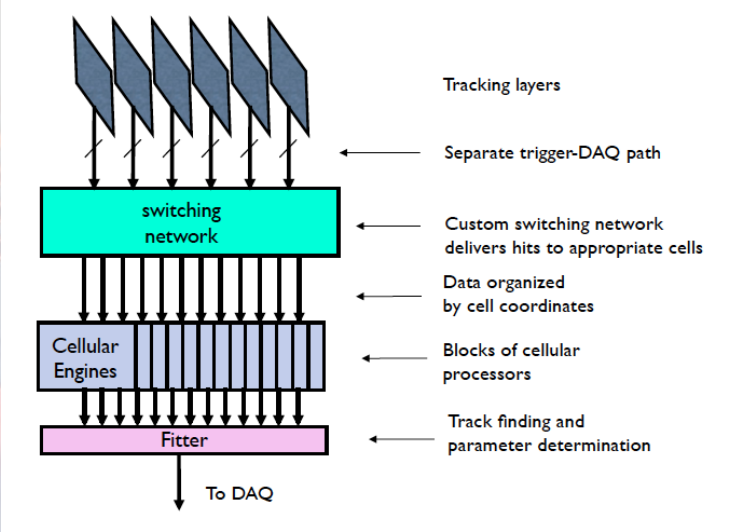
analog and mixed-signal (analog/digital) electronics for low-noise signal detection of MEMS sensors



ELN R&D at POLIMI: Digital electronic systems

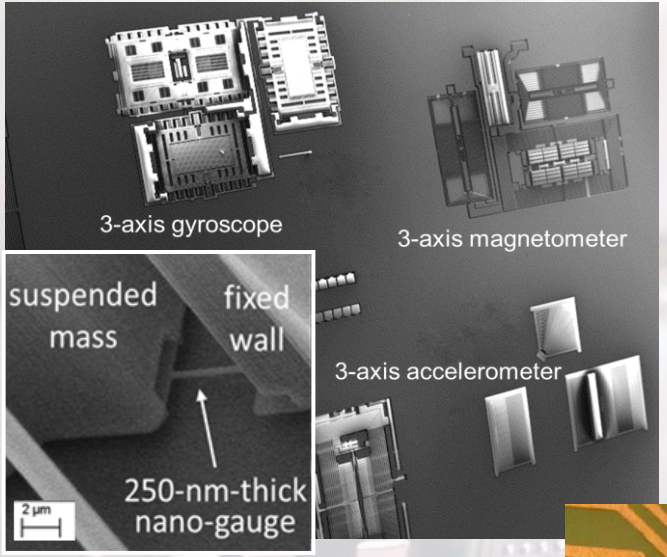
Digital real-time general-purpose processor for high performance timing of events (for nuclear science to medical imaging, for audio and video signal processing)



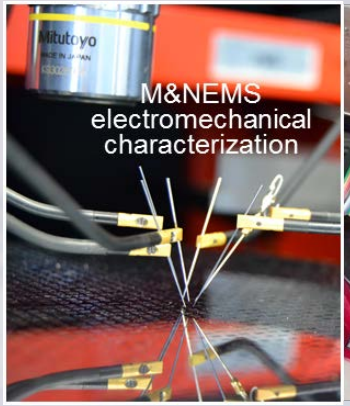


Digital processing architectures for System-on-Chip characterized by high performance, flexibility, scalability, low power and low cost

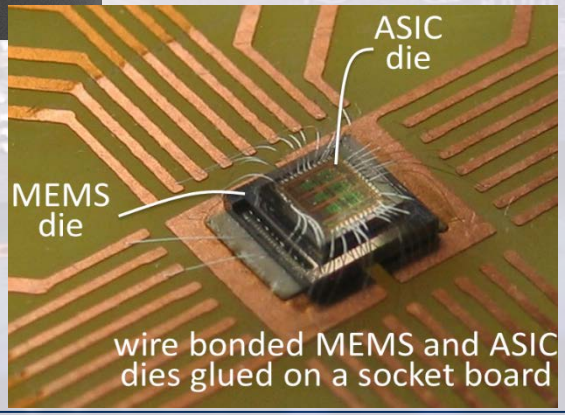
ELN R&D at POLIMI: Smart microsensors and microsystems



Advanced MEMS and NEMS for low-noise, high-stability inertial and magnetic sensors



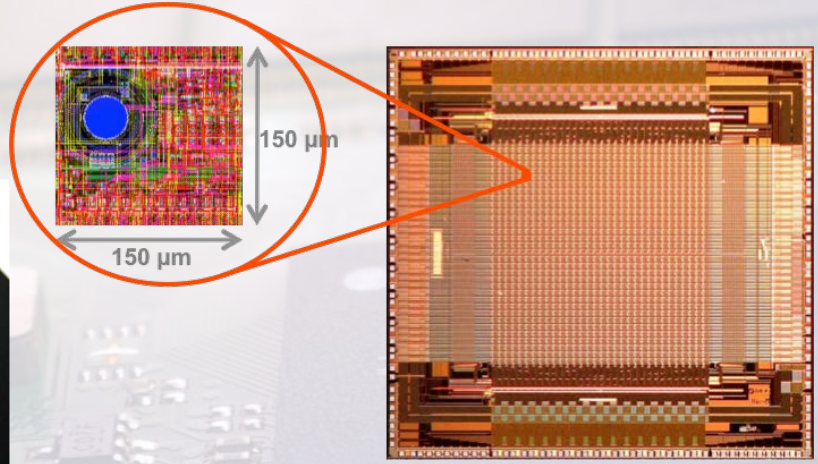
Die-level and wafer-level characterization electronics for MEMS/NEMS and actuators

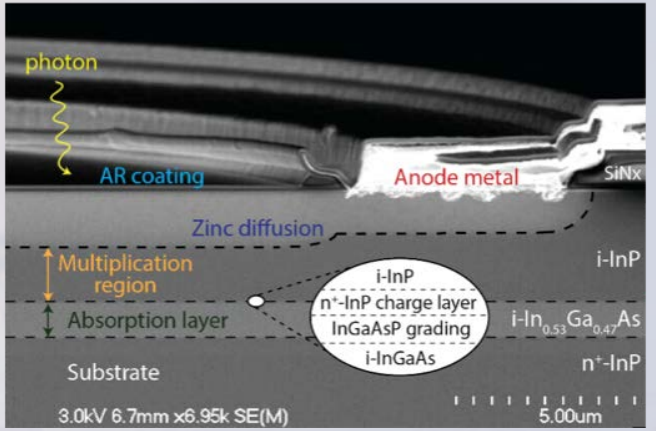


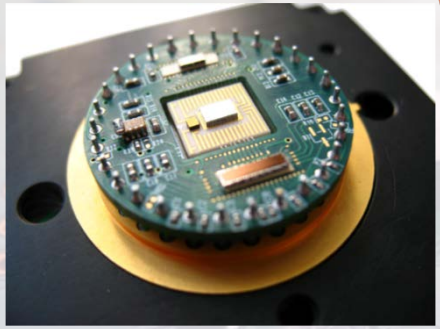
Ultra-low-power, low-noise mixed-signal electronics for sensors in consumer and biomedical applications

ELN R&D at POLIMI: Single-photon detectors and applications

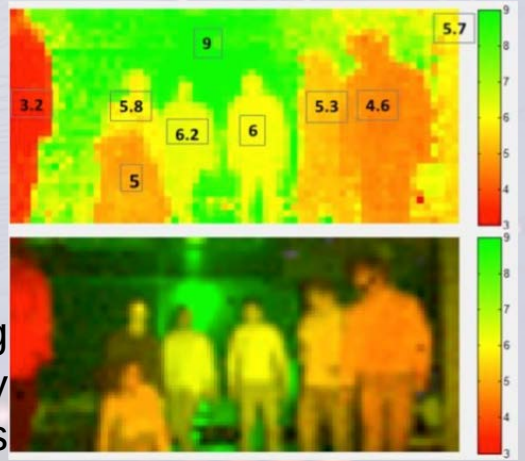
Design, fabrication and characterization of Single Photon Avalanche Diodes (SPAD) in Silicon, CMOS and inGaAs/InP technology







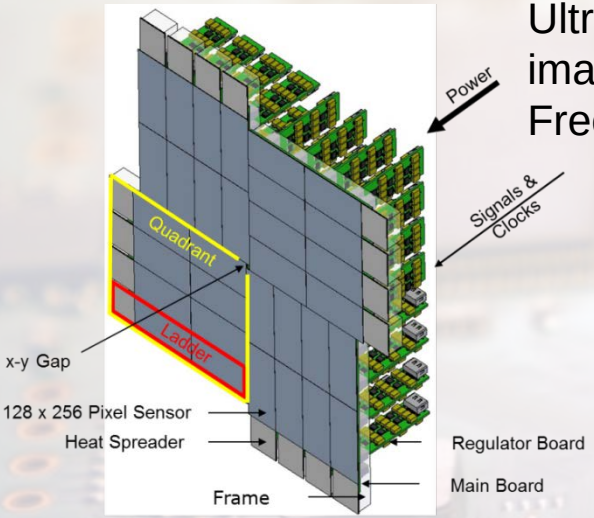
Single molecule spectroscopy for new drugs discovery and for studying Alzheimer and Parkinson



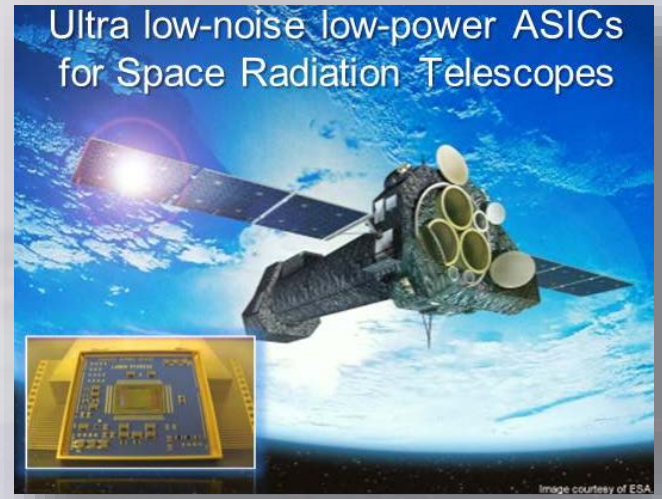
Imagers for 3D photon counting (LIDAR) from automotive safety to deep space explorations

ELN R&D at POLIMI: Radiation detectors and applications

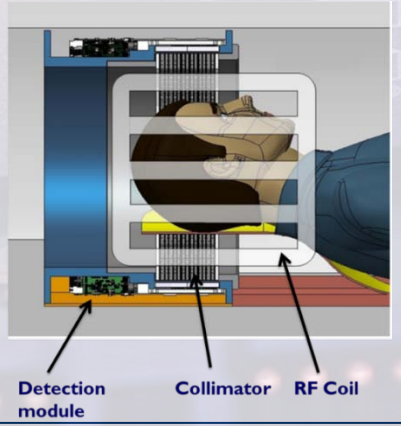
POLITECNICO MILANO 1863

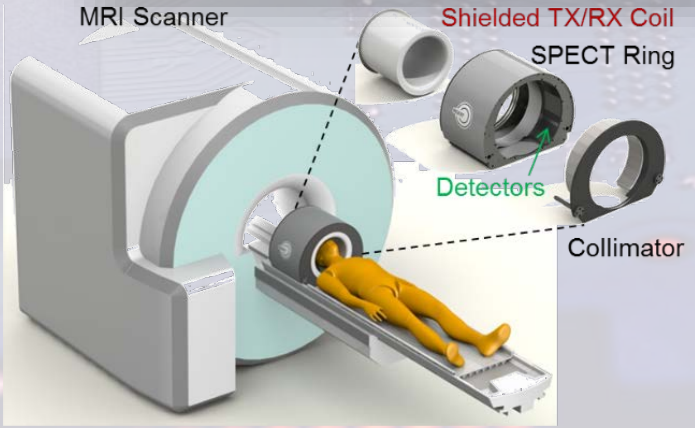


Ultra-fast and large-format X-ray imagers for the European X-ray Free Electron Laser (XFEL)



Ultra low-noise low-power ASICs for X-Gamma Ray Space Telescopes



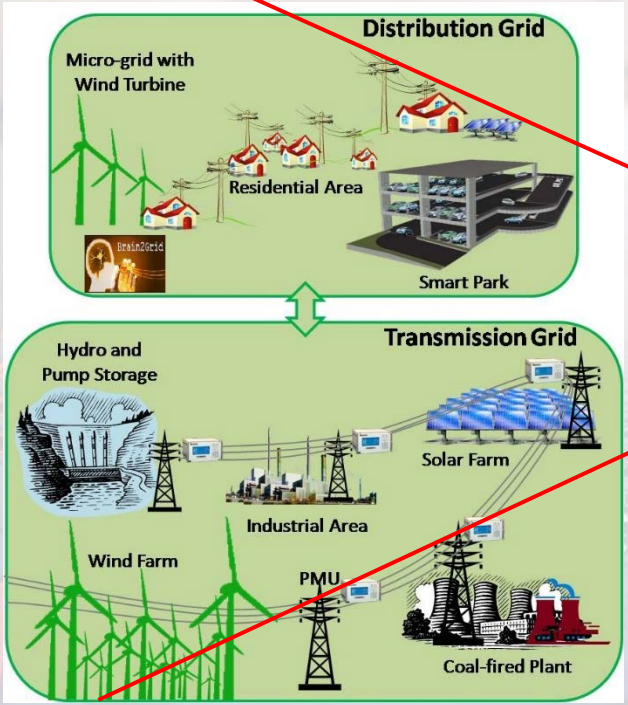


Sensors and ASICs for Multi-modality imaging systems

1. what is ELECTRONICS
2. ELECTRONICS compared to others
3. Laurea Magistrale / Master of Science in **ELECTRONICS ENG**
4. expertizes, skills, employment opportunities
5. research labs in ELECTRONICS
6. further info

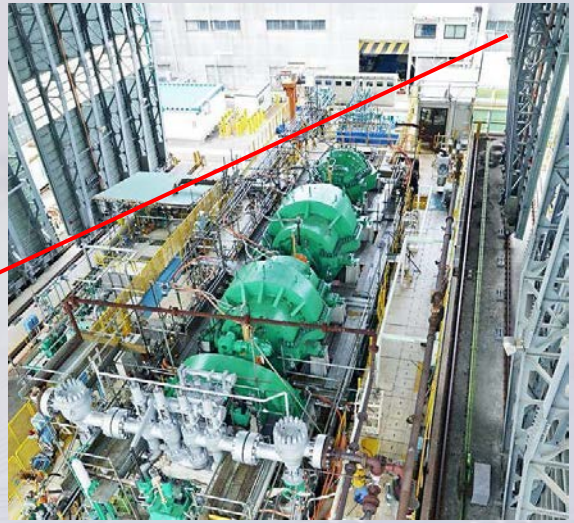
ELECTRONICS is not ELECTRICAL engineering

production, transmission, distribution of electric energy

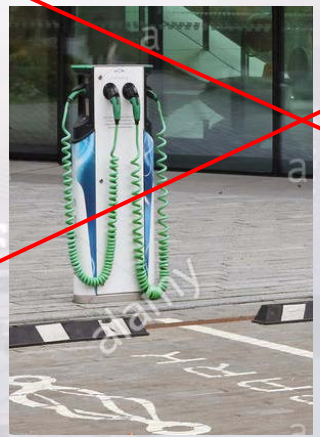


wide-area power-grid

heavy industry



electrical machines

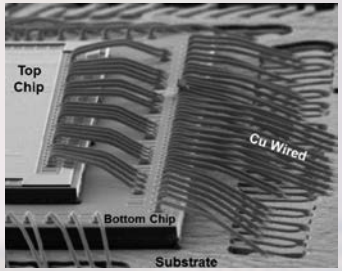


e-vehicles

electric traction

ELECTRONICS is not ELECTRICAL engineering

ELECTRONICS is:



- **low-voltage** (<380 V), **low-current** (<10 A), **low-power** (<1 kW)
- for **ICT** (Information and Communication Technologies)
- for "smart" (instead of powerful) devices and machines
- for **wearable / implantable** devices
- for **personal health / wealth**