



European Doctoral Training Support in Micro/Nano-electronics-2

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Course catalogue 1

Deliverable D1.8 Course catalogue 2 : History, overview,
level of coverage of identified needs, scholarship statistics

Work Package 1 – EURO-DOTS platform operation and
course portfolio management

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Abstract :

In this Deliverable the course list is presented as of December 2014.

Coverage of identified needs is included as well as statistics on scholarships.

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1. History and overview

We have offered **132** EURO-DOTS labeled courses in the time frame of 2011 to 2014, treating **61** different topics/themes. For 2014 we had **40** courses scheduled. Table 1 gives an overview of topics and new courses from 2011 to 2014. Figure 1 below shows the distribution of courses over the years 2011 to 2014, with a concentration of courses offered during summer. The final course lists for 2011 to 2014 is in tables 2-5. In Fig 2 the number of courses per country for the period 2013 – 2014 is shown, showing that 10 countries have offered courses.

Courses	New topics	Sessions
2011	11	14
2012	26	45
2013	13	33
2014	11	40
Total	61	132

Table 1. Overview of courses for EURO-DOTS and EURO-DOTS-2

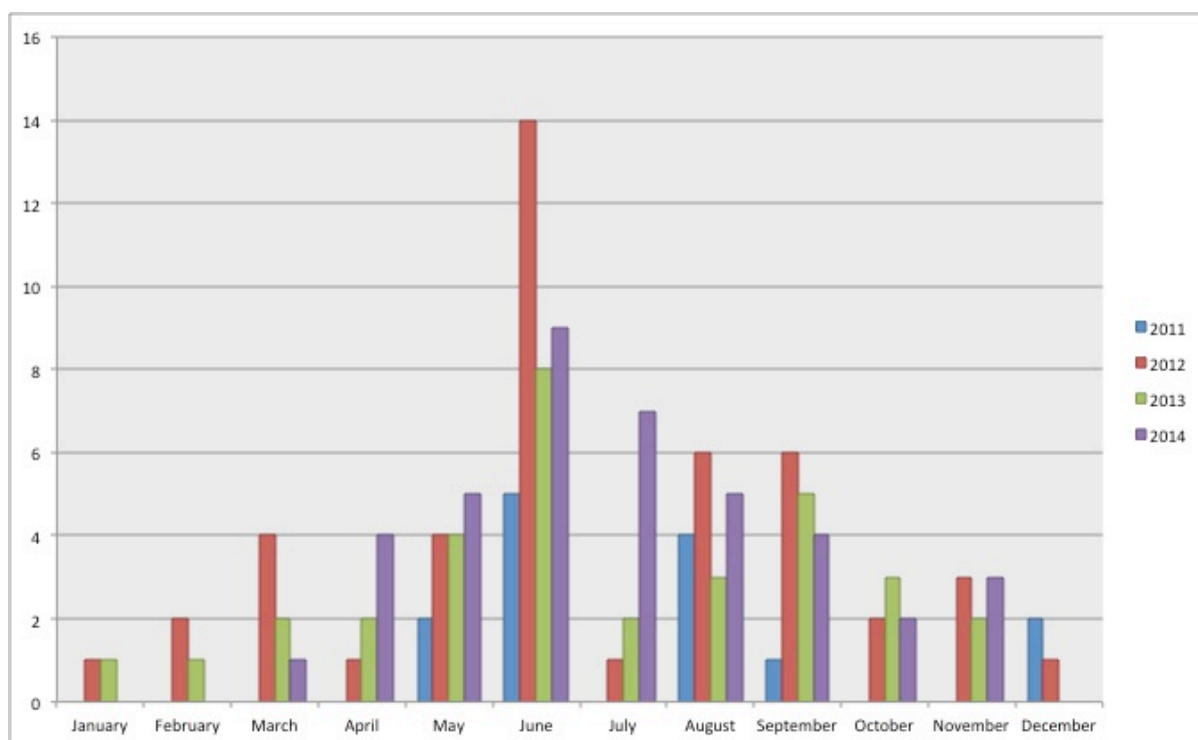


Figure 1. Distribution of courses over the years 2011 – 2014

#	Dates	Course	Location
1	2-6 May 2011	Nanoscale CMOS Process Technology	Leuven, Belgium
2	23-27 May 2011	IDESA - Advanced Digital Physical Implementation Flow	Sevilla, Spain
3	20-24 June 2011	RF Analog IC Design	Lausanne, Switzerland
4	20-24 June 2011	Micro-Power Analog IC Design	Lausanne, Switzerland
5	20-24 June 2011	IDESA - Advanced Analog Implementation Flow	Sevilla, Spain
6	21-23 June 2011	Transistor-level Analog IC Design	Lausanne, Switzerland
7	27-30 June 2011	IDESA - Design for Manufacturability Flow	Mons, Belgium
8	22-26 August 2011	Advanced Analog CMOS IC Design	Lausanne, Switzerland
9	22-26 August 2011	Practical aspects in Mixed-Signal IC Design	Lausanne, Switzerland
10	29 August-2 Sept. 2011	Power Management	Lausanne, Switzerland
11	29 August-2 Sept. 2011	Beyond CMOS	Leuven, Belgium
12	5-9 September 2011	IDESA - Advanced Analog Implementation Flow	Graz, Austria
13	5-9 December 2011	IDESA - Advanced RF Implementation Flow	Graz, Austria
14	12-16 December 2011	IDESA - Advanced RF Implementation Flow	Glasgow, UK

Table 2. List of courses for 2011

#	Dates	Course	Location
1	30 Jan - 3 Feb 2012	IDESA - Advanced Digital Physical Implementation Flow	Wuppertal, Germany
2	6-10 February 2012	IDESA - Advanced Analog Implementation Flow	Mons, Belgium
3	13-17 February 2012	IDESA - Advanced Analog Implementation Flow	Karnten, Germany
4	3-9 March 2012	Winter School on Organic Electronics - Self-Assembly and Hybrid Devices	Graz, Austria
5	12-16 March 2012	Nanometer CMOS IC's	Leuven, Belgium
6	12-16 March 2012	STIMESI - MEMS design and prototyping	Leuven, Belgium
7	20-23 March 2012	IDESA - Design for Manufacturability Flow	Glasgow, UK
8	16-20 April 2012	Complex Analysis of Advanced Micro-/Nano-electronic Structures	Bratislava, Slovakia
9	7-11 May 2012	Nanoscale CMOS Process Technology	Leuven, Belgium
10	7-11 May 2012	STIMESI - MEMS design and prototyping	Bucharest, Roumania
11	21-25 May 2012	Bioelectronics	Grenoble, France
12	28 May - 1 June 2012	Nano-scale MOS transistors: Semi-classical modeling and applications	Udine, Italy
13	4-8 June 2012	Developments in clean room and practical applications of silicon nanowires and devices	Rennes, France
14	4-8 June 2012	IDESA - Advanced RF Implementation Flow	Leuven, Belgium
15	11-15 June 2012	Micro and nanotechnology applications: Fabrication and nanocharacterization	Lille, France
16	11-15 June 2012	Silicon Thin Film Transistors on Transparent and Flexible Substrate	Rennes, France
17	11-15 June 2012	Advanced Microscopy	Grenoble, France
18	11-15 June 2012	Gas sensors : Chemical synthesis and integration of nano-objects for micro-electronic applications	Toulouse, France
19	18-22 June 2012	Europhot	Toulouse, France
20	18-22 June 2012	MOSFET on Thin Si Diaphragm as a Pressure Sensor	Rennes, France
21	25-29 June 2012	IDESA - Advanced Analog Implementation Flow	Graz, Austria
22	25-29 June 2012	STIMESI - Tronics and MultiMEMS MEMS Processes	Barcelona, Spain
23	25-29 June 2012	Micro-Power Analog IC Design	Lausanne, Switzerland
24	25-29 June 2012	RF Analog IC Design	Lausanne, Switzerland
25	25-29 June 2012	High Performance Data Converters	Lausanne, Switzerland
26	25-29 June 2012	Cryptographic Engineering	Lausanne, Switzerland
27	9-13 July 2012	MOSFET fabrication and characterization	Grenoble, France
28	20-24 August 2012	Advanced Verification	Leuven, Belgium
29	28-31 August 2012	Fifth Device Modelling Sinano School	Bertinoro, Italy
30	27-31 August 2012	Advanced Analog CMOS IC Design	Lausanne, Switzerland
31	27-31 August 2012	Practical Aspects of micro-signal IC Design	Lausanne, Switzerland
32	27-31 August 2012	Power Management	Lausanne, Switzerland
33	27-31 August 2012	Advanced Delta Sigma Converters Design	Lausanne, Switzerland
34	3-7 September 2012	Beyond CMOS	Leuven, Belgium
35	3-7 September 2012	IDESA - Advanced Analog Implementation flow	Lausanne, Switzerland
36	10-14 September 2012	IDESA - Advanced RF Implementation Flow	Berlin, Germany
37	18-21 September 2012	IDESA - Design for Manufacturability	Leuven, Belgium
38	24-28 September 2012	An Introduction to Electromagnetic compatibility of Integrated Circuits	Toulouse, France
39	24-28 September 2012	Nanocrystals Inside : Fabrication of NMOS memory devices with silicon nanocrystals embedded in an ultra thin SiO ₂	Toulouse, France
40	8-12 October 2012	Introduction to micro and nanotechnologies, atomic force microscopy and e-beam direct writing lithography	Paris, France
41	22-25 October 2012	Electrical Characterization of Semiconductor Materials and Devices	Grenoble, France
42	5-9 November 2012	IDESA - Advanced Digital Physical Implementation flow	Delft, The Netherlands
43	5-9 November 2012	ePIXfab Silicon Photonics Course	Frankfurt, Germany
44	20-23 November 2012	IDESA - Design for Manufacturability	Marseille, France
45	3-7 December 2012	IDESA - Advanced Analog Implementation flow	Leuven, Belgium

Table 3. List of courses for 2012

#	Dates	Course	Location
1	14-18 January 2013	IDESA - Advanced RF Implementation flow	RAL, UK
2	4-8 February 2013	IDESA - Advanced Analog Implementation flow	RAL, UK
3	5-8 March 2013	IDESA - Design for Manufacturability flow	Heidelberg, Germany
4	24-28 March 2013	ePIXFab Full Training	Eindhoven, The Netherlands
5	8-12 April 2013	Nanometer CMOS ICs	Leuven Belgium
6	16-18 April 2013	22nd Workshop on Advances in Analog Circuit Design	Grenoble, France
7	13-17 May 2013	Nanoscale CMOS Process Technology	Leuven Belgium
8	20-24 May 2013	Nano-scale MOS transistors: Semi-classical modeling and applications	Udine, Italy
9	27-31 May 2013	Reliability of micro-electronics assemblies	Bordeaux, France
10	27-31 May 2013	Developments in clean room and practical applications of silicon nanowires and devices	Rennes, France
11	3-7 June 2013	Advanced Scanning Probe Microscopies	Grenoble, France
12	10-14 June 2013	Micro and nanotechnology applications: Fabrication and nano-characterization	Lille, France
13	10-14 June 2013	Silicon thin film transistors on transparent and flexible substrate	Rennes, France
14	17-21 June 2013	Bioelectronics	Grenoble, France
15	24-28 June, 2013	PLLs: Advanced Techniques	Lausanne, Switzerland
16	24-28 June 2013	RF Analog IC Design	Lausanne, Switzerland
17	24-28 June 2013	High-Performance Data Converters	Lausanne, Switzerland
18	24-28 June 2013	MOSFET fabrication and characterization	Grenoble, France
19	1-5 July 2013	Micro-Power Analog IC Design	Lausanne, Switzerland
20	26-30 August 2013	Advanced Analog CMOS IC Design	Lausanne, Switzerland
21	26-30 August 2013	Practical Aspects of Mixed-Signal IC Design	Lausanne, Switzerland
22	26-30 August 2013	Power Management	Lausanne, Switzerland
23	2-6 September 2013	Beyond CMOS	Leuven Belgium
24	9-13 September 2013	Nanocrystals Inside : Fabrication of NMOS memory devices with si nanocrystals embedded in an ultra thin SiO2	Toulouse, France
25	23-27 September 2013	"Gas sensors" : Chemical synthesis and integration of nano-objects for micro-electronic applications	Toulouse, France
26	23-27 September 2013	Nanotechnology for health	Leuven, Belgium
27	23-27 September 2013	An Introduction to Electromagnetic compatibility of Integrated Circuits	Toulouse, France
28	1-4 October 2013	IDESA - Design for Manufacturability flow	Leuven Belgium
29	14-18 October 2013	Advanced Verification	Leuven Belgium
30	14-18 October 2013	Introduction to micro and nanotechnologies, atomic force microscopy and e-beam direct writing lithography	Paris-Sud, Orsay, France
31	14-18 October 2013	Combo Test Training Course	Montpellier, France
32	5-8 November 2013	IDESA - Advanced Digital Physical Implementation flow	Leuven Belgium
33	18-22 November 2013	ePIXFab silicon photonics training	Grenoble, France

Table 4. List of courses for 2013

#	Date	Course	Location
1	31 March - 4 April 2014	ePIXfab silicon photonics training	Espoo, Finland
2	8-10 April 2014	Advances in Analog Circuit Design	Lisbon, Portugal
3	14-18 April 2014	Nanometer CMOS ICs	Leuven Belgium
4	22-25 April 2014	Design for Manufacturability flow	Leuven Belgium
5	23-25 April 2014	RF Analog Impairments Modeling for Communication Systems	Lausanne, Switzerland
6	12-16 May 2014	Nanoscale CMOS Process technology	Leuven Belgium
7	12-16 May 2014	Smart Sensor Systems	Delft, The Netherlands
8	19-23 May 2014	Reliability of micro-electronics assemblies	Bordeaux, France
9	26-30 May 2014	Nano-scale MOS transistors: Semi-classical modeling and applications	Udine, Italy
10	26-30 May 2014	Integrated magnetoresistive sensors: from material deposition to wafer level testing	Lisbon, Portugal
11	2-6 June 2014	Essential Verification with SystemVerilog and UVM	Leuven Belgium
12	2-6 June 2014	Developments in clean room and practical applications of silicon nanowires and devices	Rennes, France
13	2-6 June 2014	Bioelectronics	Grenoble, France
14	9-13 June 2014	Micro and nanotechnology applications : fabrication and nanocharacterization	Lille, France
15	16-20 June 2014	Nanocrystals Inside: Fabrication of NMOS memory devices with silicon nanocrystals embedded in an ultra thin SiO2	Toulouse, France
16	16-20 June 2014	Silicon thin film transistors on transparent and flexible substrate	Rennes, France
17	23-27 June 2014	Transistor-Level Analog Design	Lausanne, Switzerland
18	23-27 June 2014	PLLs: Advanced Techniques	Lausanne, Switzerland
19	23-27 June 2014	High-Speed Data Converters	Lausanne, Switzerland
20	30 June - 4 July 2014	Digital Test training course	Montpellier, France
21	30 June - 4 July 2014	Low Power Analog Design	Lausanne, Switzerland
22	30 June - 3 July 2014	Continuous-Time Delta Sigma Design	Lausanne, Switzerland
23	30 June - 4 July 2014	Cryptographic Engineering	Lausanne, Switzerland
24	30 June - 4 July 2014	Integrated magnetoresistive sensors: from material deposition to wafer level testing	Lisbon, Portugal
25	30 June - 4 July 2014	MOSFET fabrication and characterization	Grenoble, France
26	7-11 July 2014	Soft Lithography technologies for biotechnology and nanomedicine	Toulouse, France
27	25-29 August 2014	Practical Aspects of Mixed-Signal IC Design	Lausanne, Switzerland
28	25-29 August 2014	Power Management	Lausanne, Switzerland
29	25-29 August 2014	Advanced Analog CMOS IC Design	Lausanne, Switzerland
30	25-29 August 2014	6th SINANO Summer School on Reliability and Variability of electronic devices	Bertinoro, Italy
31	1-5 September 2014	Integrated magnetoresistive sensors: from material deposition to wafer level testing	Lisbon, Portugal
32	1-5 September 2014	Beyond CMOS	Leuven Belgium
33	22-26 September 2014	Gas sensors : chemical synthesis and integration of nano-objects for microelectronic applications	Toulouse, France
34	22-25 September 2014	Nanotechnology for health	Leuven Belgium
35	22-26 September 2014	An introduction to Electromagnetic Compatibility of Integrated Circuits	Toulouse, France
36	7-10 October 2014	Design for Manufacturability flow	Leuven Belgium
37	13-17 October 2014	Combo Test Training Course	Montpellier, France
38	4-7 November 2014	Advanced Digital Physical Implementation Flow	Leuven Belgium
39	24-28 November 2014	ePIXfab silicon photonics training	Cork, Ireland
40	17-21 November 2014	Introduction to micro and nanotechnologies, atomic force microscopy and e-beam direct writing lithography	Paris-Sud, Orsay, France

Table 5. List of courses for 2014

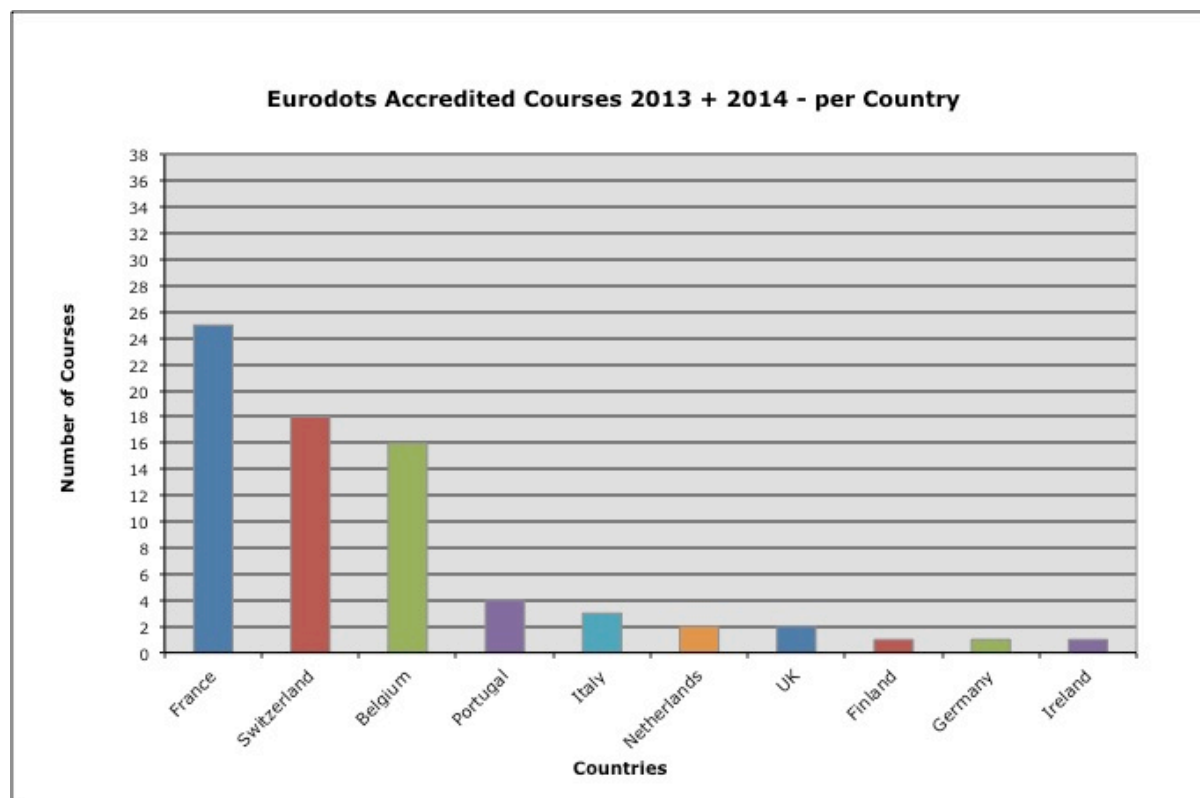


Figure 2. Distribution of courses per country over the years 2013 – 2014

2. Level of coverage of identified needs

The first call for courses distributed 2013 listed the following 11 topics/themes not yet or only partly covered that nevertheless had been identified by industry and academia as being of high importance and high priority :

- 1) **Biomedical electronics & biosensors**
- 2) **Energy harvesting and autonomous applications**
- 3) **High-frequency and mm-wave IC design**
- 4) **Integrated high-voltage, high-power design & technology (GaN, SiC...)**
- 5) **MEMS for RF applications**
- 6) **Nanotechnology for Health**
- 7) **Organic electronics: technology and design**
- 8) **3D integration : technology and design**
- 9) **Ultra Low Power techniques for IC design**
- 10) **Variability effects and their mitigation in advanced technologies**
- 11) **IP management, innovation and valorization (for PhD students)**

Only a few of these themes have remained uncovered at the end of EURO-DOTS. These are the themes 2, 3, 4, 7, 8 and 11. Theme 4 (including at least SiC) was available at KTH, but the course was not in a modular (1 week duration) form. Theme 7 was also envisaged for a course set-up in 2014 by

STUBA but not finalized because of exhaustion of the scholarships. Theme 11 was planned by KTH with the tentative name “Innovation and entrepreneurship in nano- and microelectronics” for the fall of 2014, but was cancelled when the scholarships ran out. The other themes were indeed (fully or partially) covered in courses in 2014. Themes 1 and 5 were partly treated in several courses, Theme 6 was fully covered in a new course, Theme 9 was partly covered by course 21 “Low-Power Analog IC Design” and Theme 10 was largely covered by course 30, the 6th SINANO Summer School. The uncovered or only partially covered themes remain very relevant for future courses. Of course in case of the launch of a new EURO-DOTS phase, a new inquiry on the course needs will be mandatory.

3. Scholarship Statistics

All of the 190 scholarships available in EURO-DOTS 2 have been awarded (222 were applied for but there have been 32 cancellations). Initially 170 scholarships were available in EURO-DOTS-2, but after some travel funding was converted, 190 scholarships were finally offered. Already by July 2014 the maximum available scholarships had been reached, but the final ones were used for courses in October 2014 since students have to apply for scholarships well in advance of the course. Fig 3 and Table 6 shows the distribution over time, and it shows that very likely more scholarships could have been awarded in 2014. The evolution of scholarships roughly follows the offering of courses, see Fig 4 for the entire period 2011 - 2014. The distribution of scholarships per student and course are shown in Fig 5 and 6 respectively. Fig 7 and Table 6 shows that the distribution of scholarships has been fairly even over all courses.

	2011	2012	2013	2014
Number of courses	14	45	33	40
Number of effective scholarships	21	97	102	88
# scholarships/course	1.50	2.16	3.09	2.20
# courses with scholarship	8	29	24	22
% courses with scholarship	57.1	64.4	72.7	55.0

Table 6. Scholarships per course during 2011 – 2014

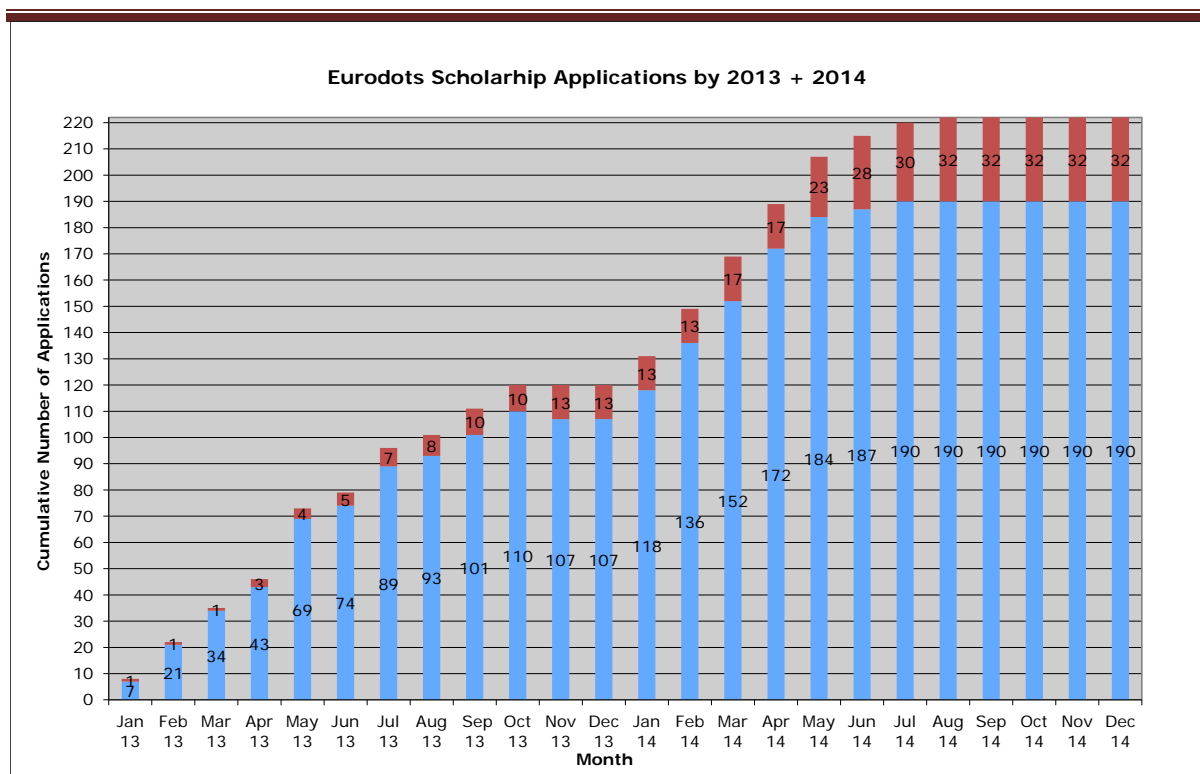


Figure 3. EURO-DOTS Scholarship applications 2013 - 2014.

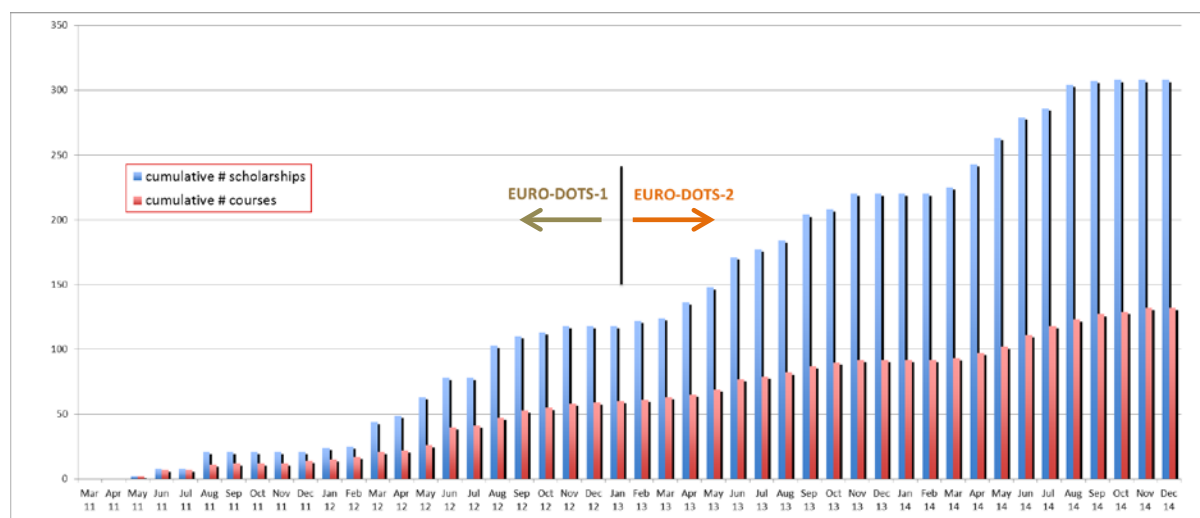


Figure 4. EURO-DOTS Scholarships since start of EURO-DOTS, including 118 awarded in the EURO-DOTS-1 program ending 2012. As more courses were offered and more awareness was created among the PhD students in Europe, more scholarships were granted.

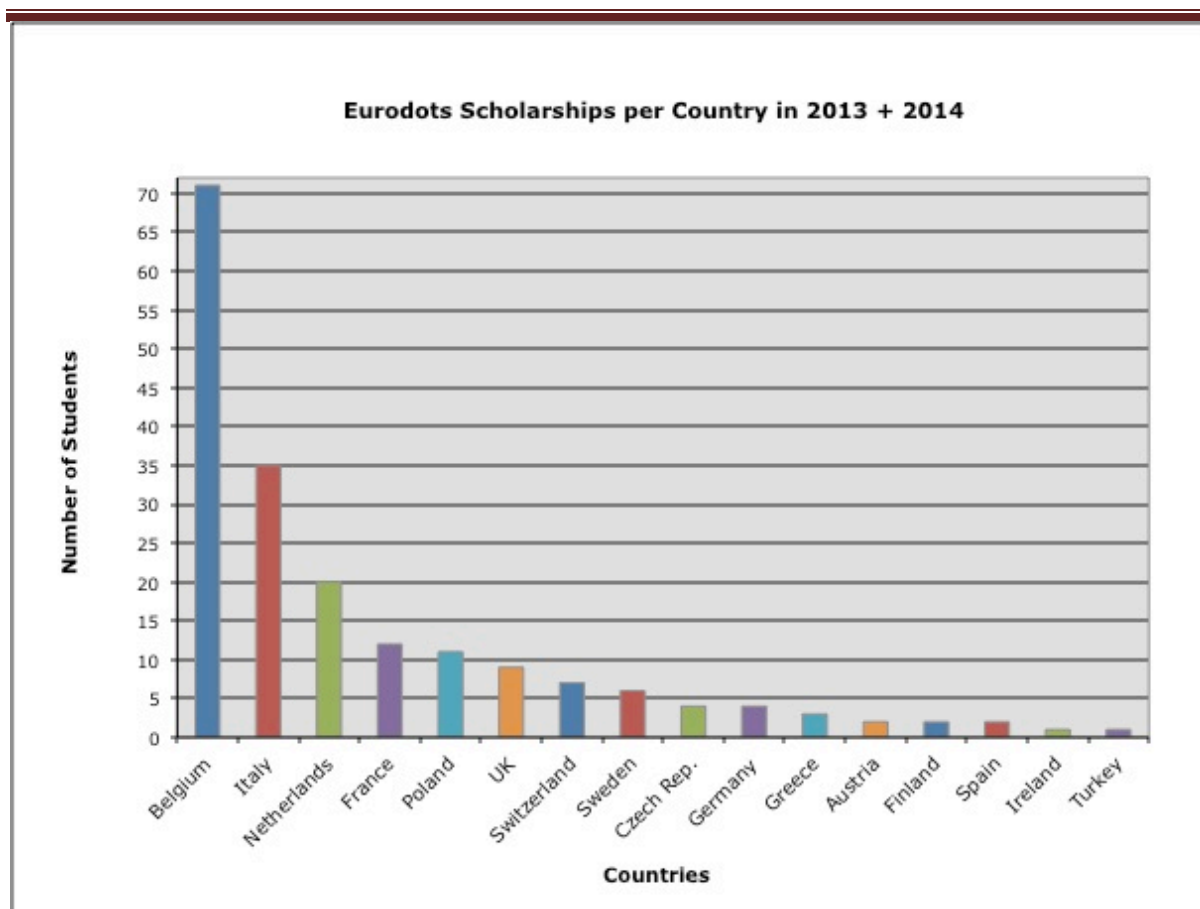


Figure 5. EURO-DOTS Scholarships per country 2013 - 2014.

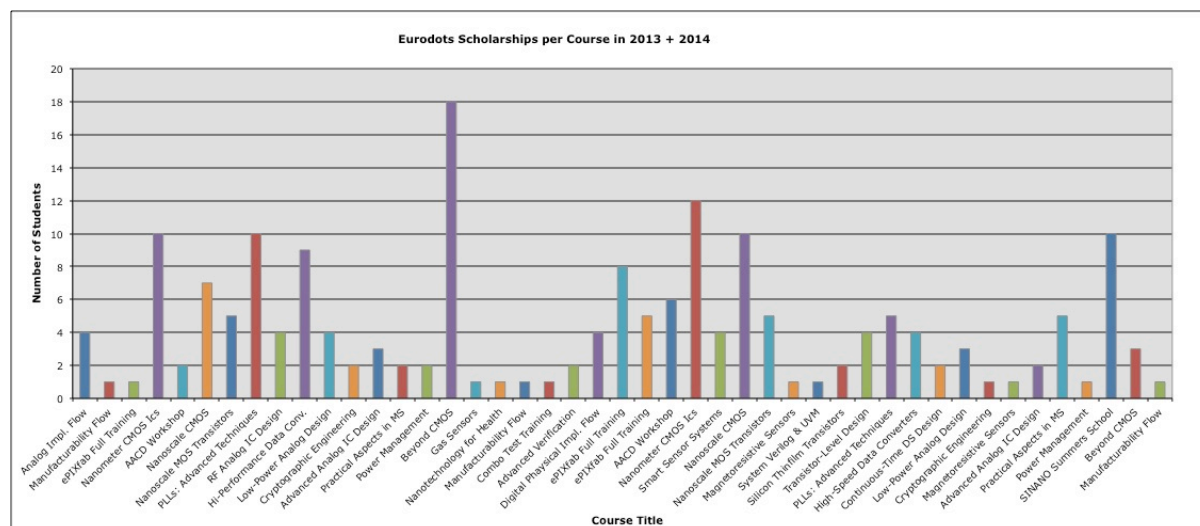


Figure 6. EURO-DOTS Scholarships per course 2013 - 2014.

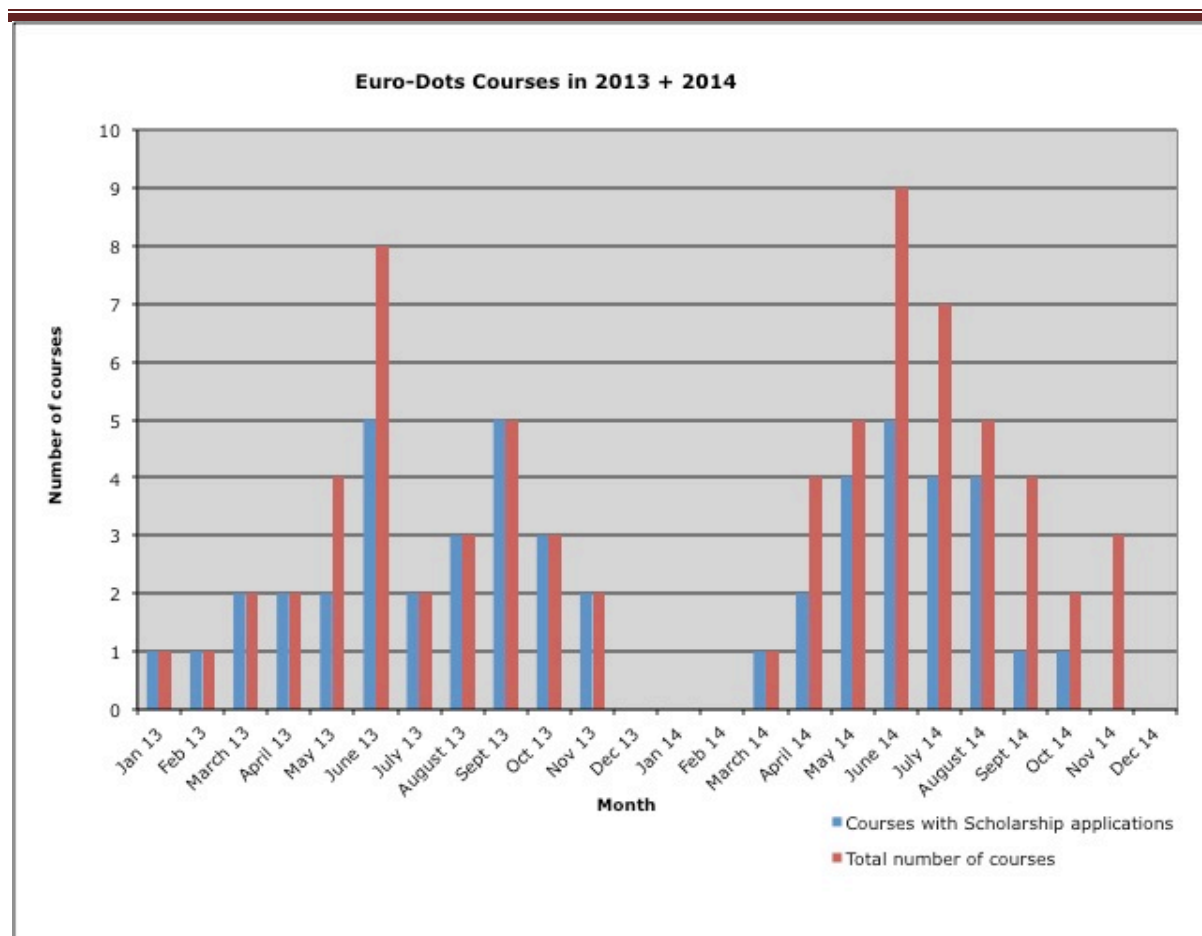


Figure 7. EURO-DOTS Courses with scholarship applications 2013 - 2014.