

# Nuclear Technology Program IPEN/USP



Innovations in Nuclear Technology - 2012

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## A Short Profile of IPEN



**The Institute for Nuclear and Energy Research – IPEN is an institution owned by the Government of São Paulo State, associated to the University of São Paulo and supported and operated technical and administratively by the Brazilian Nuclear Energy Commission – CNEN.**



## A Short Profile of IPEN

**IPEN was created in 1956 with the main purpose of performing research and development in the area of nuclear energy and its applications.**

**The main facilities include:**

- **The nuclear research reactor IEA-R1m which reached critically operation in 1957 – and recently, upgraded to operate at 5 MW – used for neutron diffractometry, material irradiation and production of radioisotopes.**
- **Two electron accelerators for industrial applications.**
- **Two cyclotron accelerators for radioisotopes production.**
- **Cobalt irradiators.**
- **Chemical and isotope analysis laboratories.**

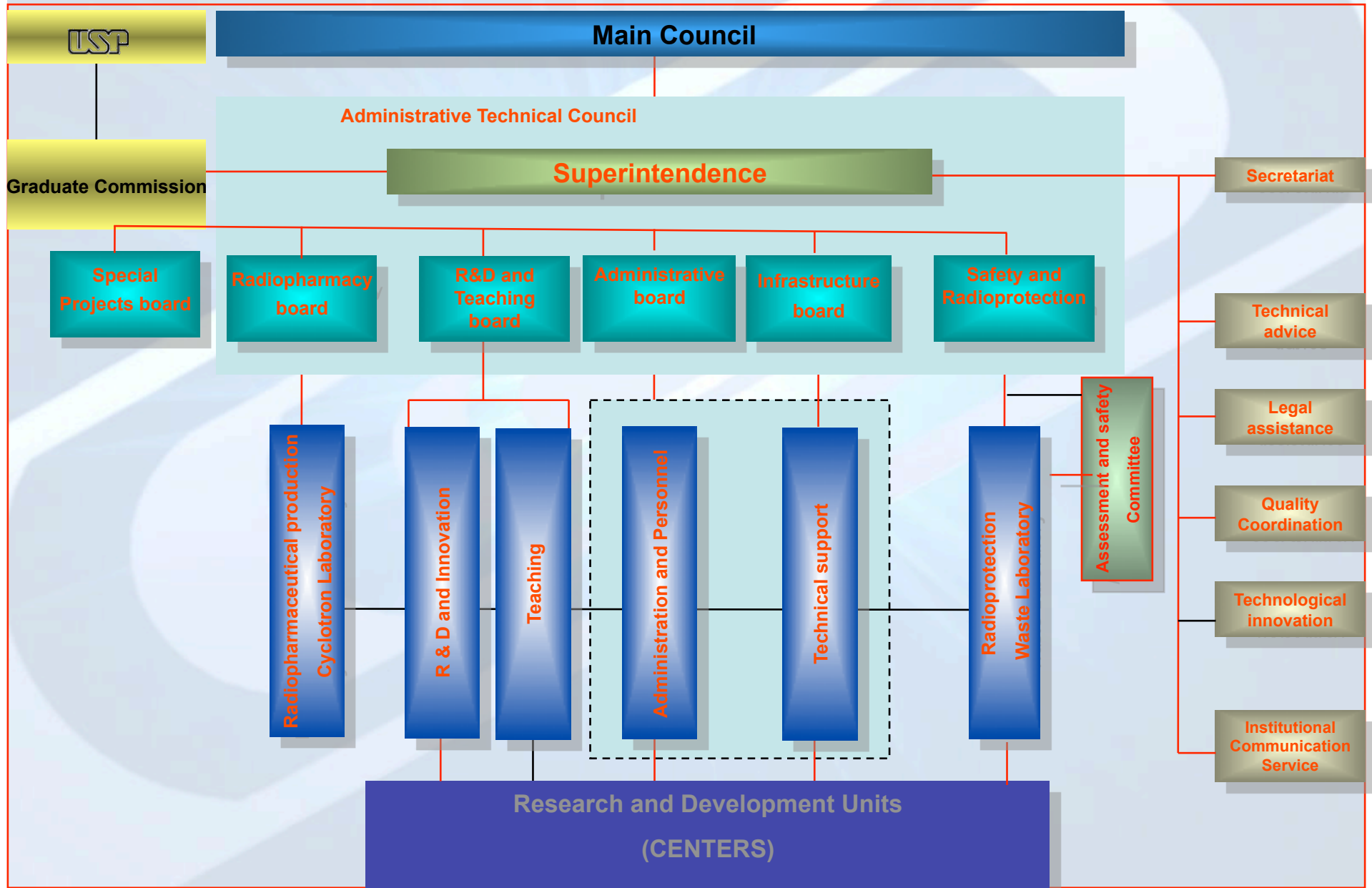
**It is located at the *campus* of University of São Paulo in an area of nearly 500,000 square meters and its staff is of 971 persons, 25% with Post Graduate degree (2011).**



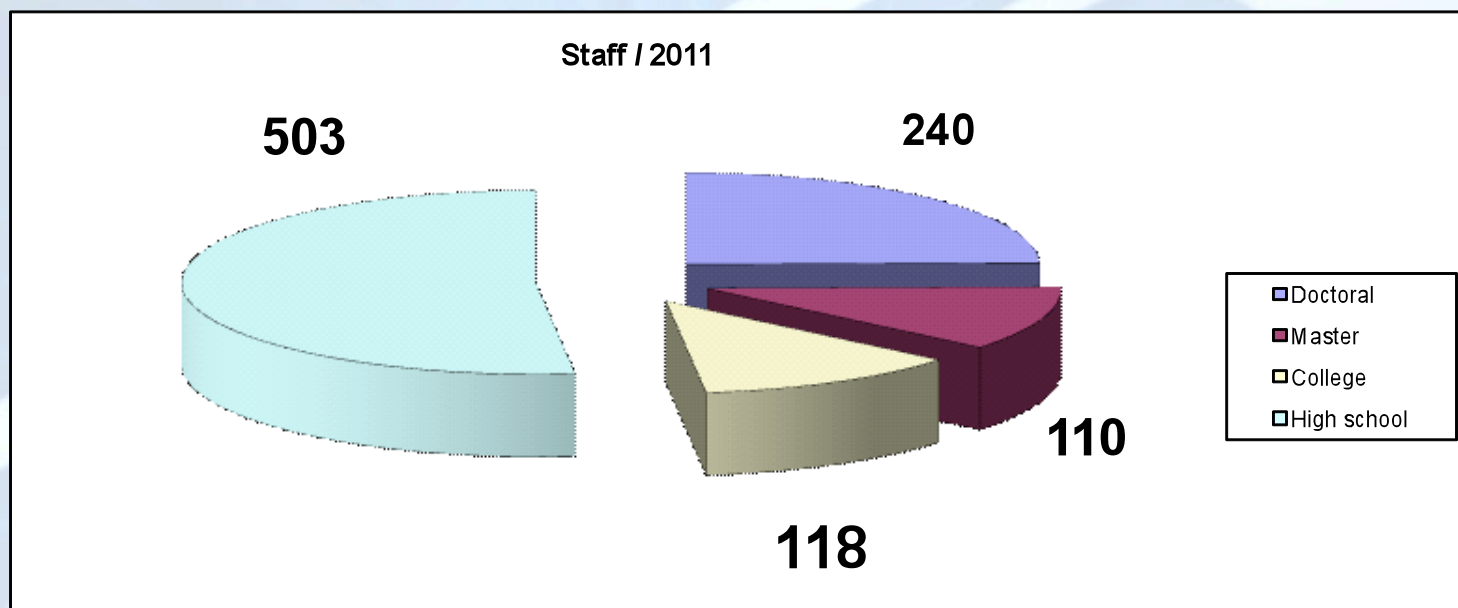
## **The Mission of IPEN**

**Our undertaking is to improve the quality of life of the Brazilian people, producing scientific knowledge, developing technologies and services and training and forming students in nuclear and correlated areas.**

# INSTITUCIONAL ORGANOGRAM



# Staff distribution

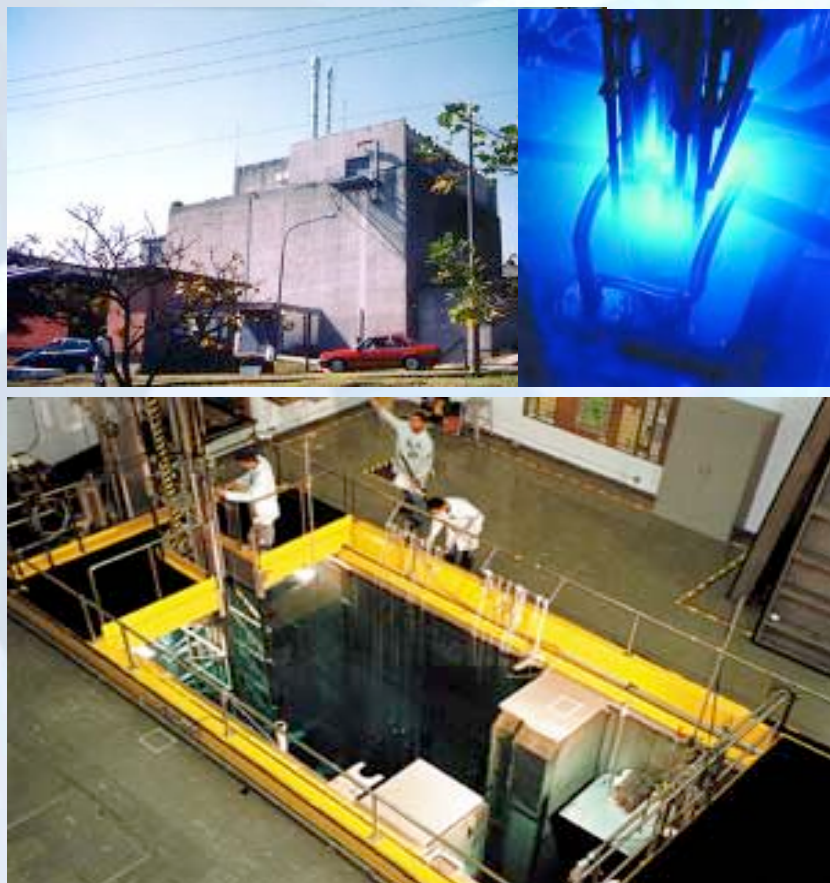




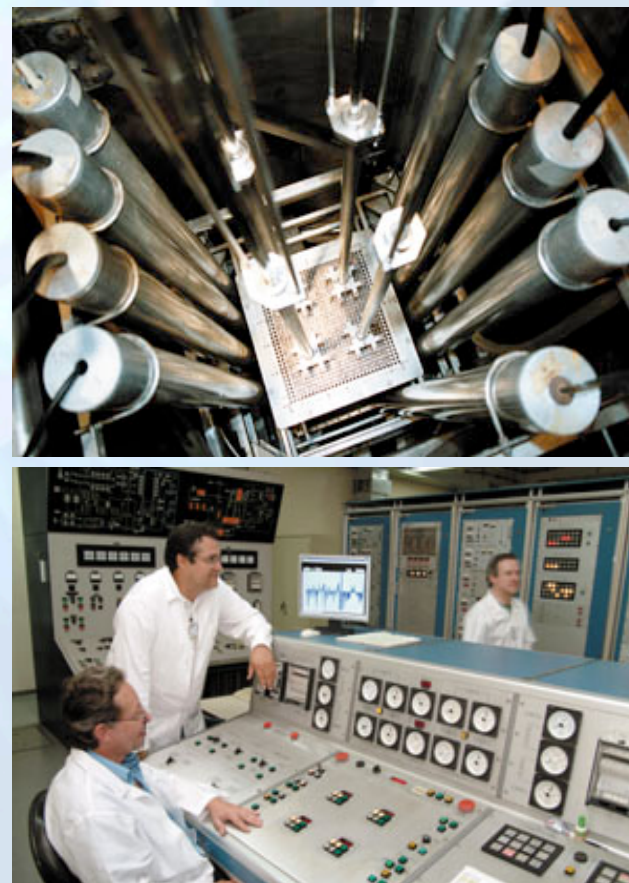
# Main Facilities

## Research reactors

IEA-R1 - 5MW



IPEN-MB.01 - 100 W



# Main Facilities

## Cyclotrons

30 MeV

18 MeV



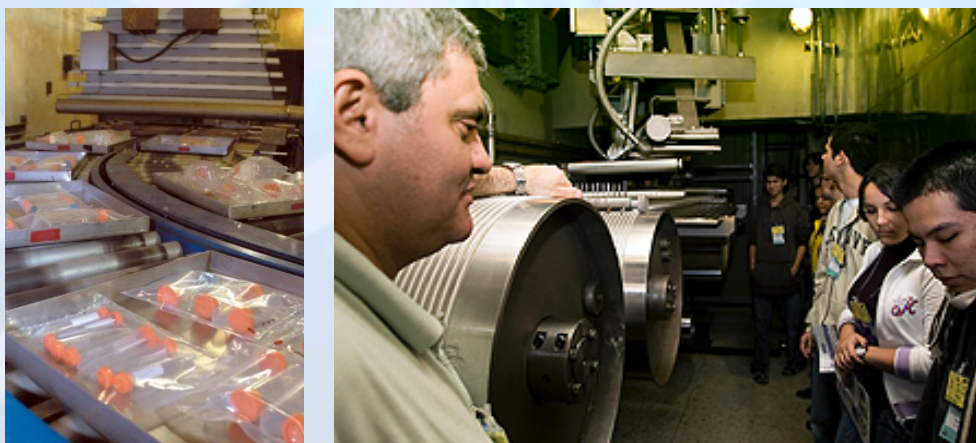


# Main Facilities

## Multipurpose cobalt-60 irradiator



## Electron accelerators



# Teaching at IPEN

**Undergraduate** - elective disciplines

**Graduate**

- Master and Academic Doctoral
- Professional Master (Lasers in Dentistry)

# Nuclear Technology Program IPEN/USP



- Created in 1976
- Association with USP
- Prof. Dr. Rui Ribeiro Franco
- Nuclear Technology Program
  - CTN – Nuclear basic technology and science
  - RNC – Power Nuclear Reactors and  
Nuclear fuel Technology
- Master and Doctoral



## **Nuclear Technology Program (1997)**

- TNA – Nuclear Technology - Applications
- TNM - Nuclear Technology - Materials
- TNR - Nuclear Technology - Reactors

## **Faculty members - 2012**

Permanent: 110

Collaborator: 48

# Elective undergraduate disciplines offered by IPEN's program to the students of the University of São Paulo - USP



Year	Disciplines	Students
2000	9	101
2001	15	191
2002	9	116
2003	13	150
2004	9	122
2005	17	234
2006	16	213
2007	17	282
2008	15	325
2009	15	344
2010	16	333
2011	17	391
2012	16	363

# Graduate – IPEN/USP

## Applicants – English Proficiency

Year	Quantity
2000	180
2001	197
2002	275
2003	420
2004	378
2005	453
2006	389
2007	512
2008	580
2009	645
2010	658
2011	553
2012	575



# Graduate – IPEN/USP

## Students (Dec. 2012)

Type	Quantity
Undergraduate	442
Master	279
Doctoral	238
Pos-Doctoral	37
Total	1069

# Graduate – IPEN/USP

## Graduate program disciplines

Year	Quantity
2005	66
2006	70
2007	87
2008	89
2009	99
2010	89
2011	89
2012	85

# Graduate – IPEN/USP

## Students distribution /area of concentration (Dec. 2012)

Area	Master	Doctorate	Total
Applications	92	100	192
Materials	92	112	204
Reactors	25	26	51
Total	209	238	447



**Scholarship granted by funding agency - 2012**

**Research productivity - 59**

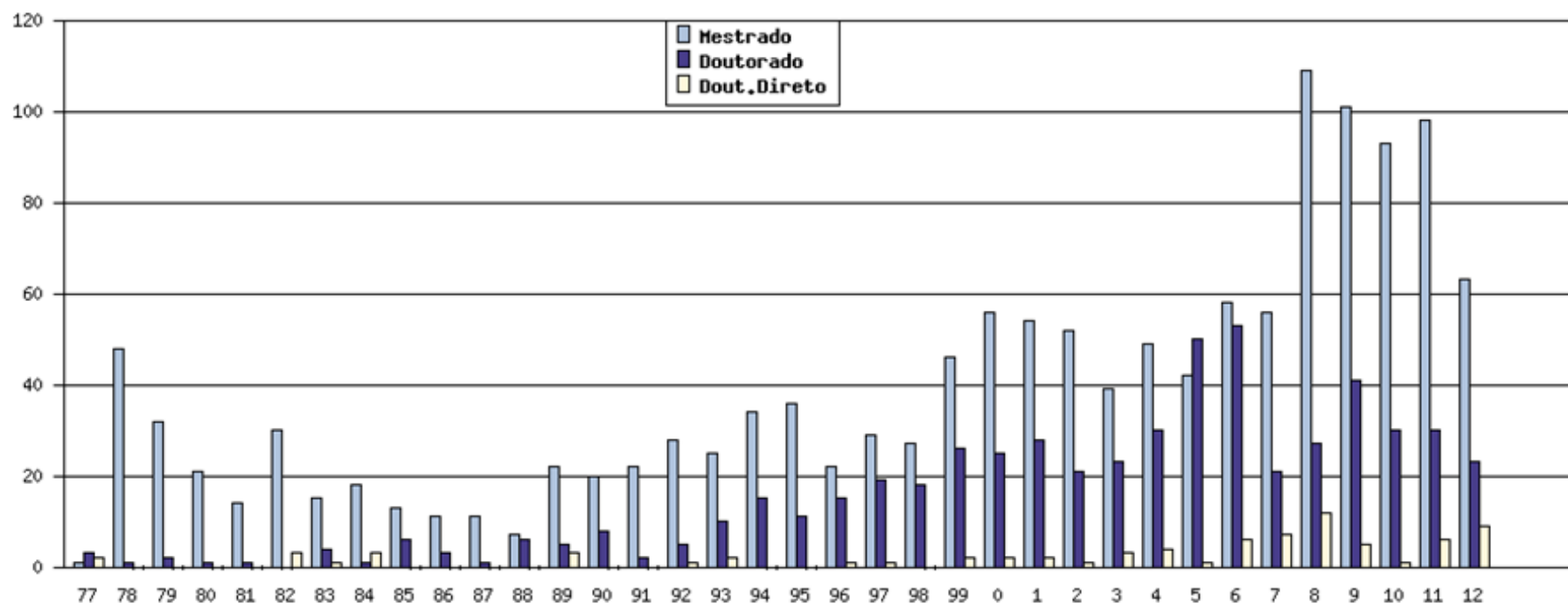
**Technological productivity - 14**

Agency	Doctoral	Master	Undergrad. student	Pos-Doc	Total
CNPq	40	30	88	5	163
CAPES	29	29	0	5	63
FAPESP	13	2	3	3	21
IPEN	8	17	0	1	26
CNEN	13	23	12	0	48
Total	103	101	103	14	243

# IPEN/USP Graduate Program

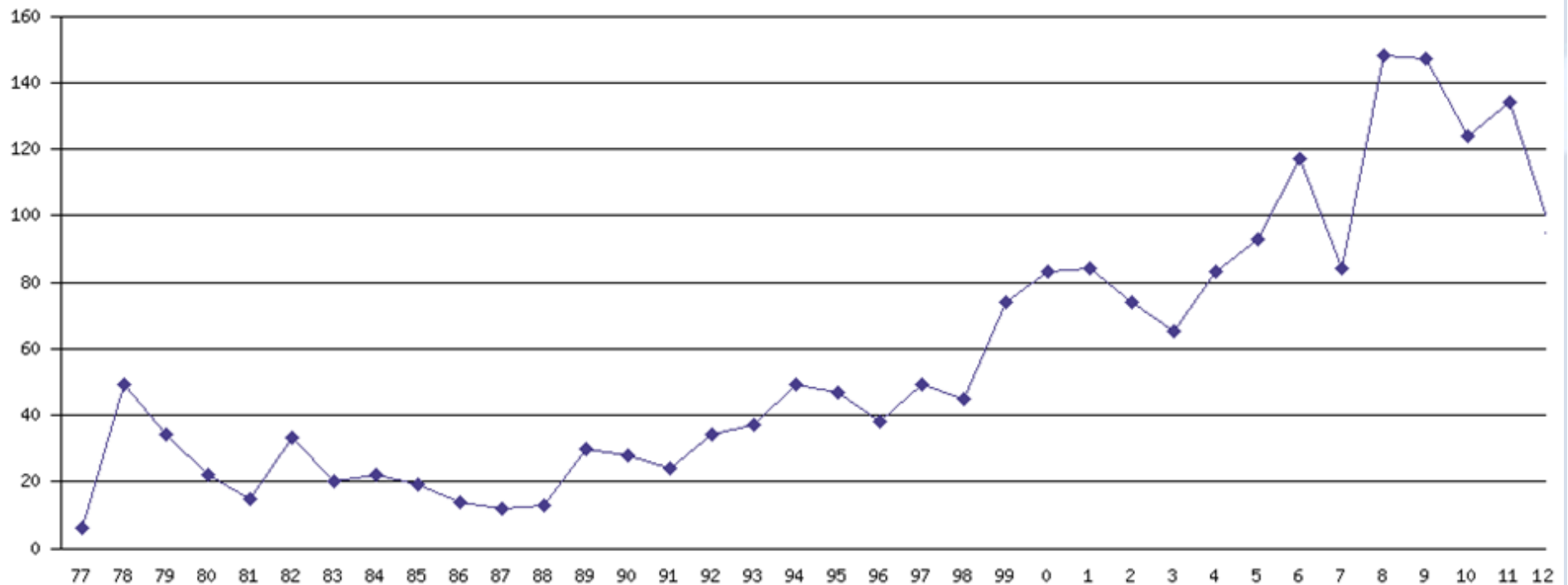
## Degree granted

Titulado - Distribuição por Ano e Nível



# IPEN/USP graduate program (Degrees granted - total)

Titulado - Distribuição por Ano

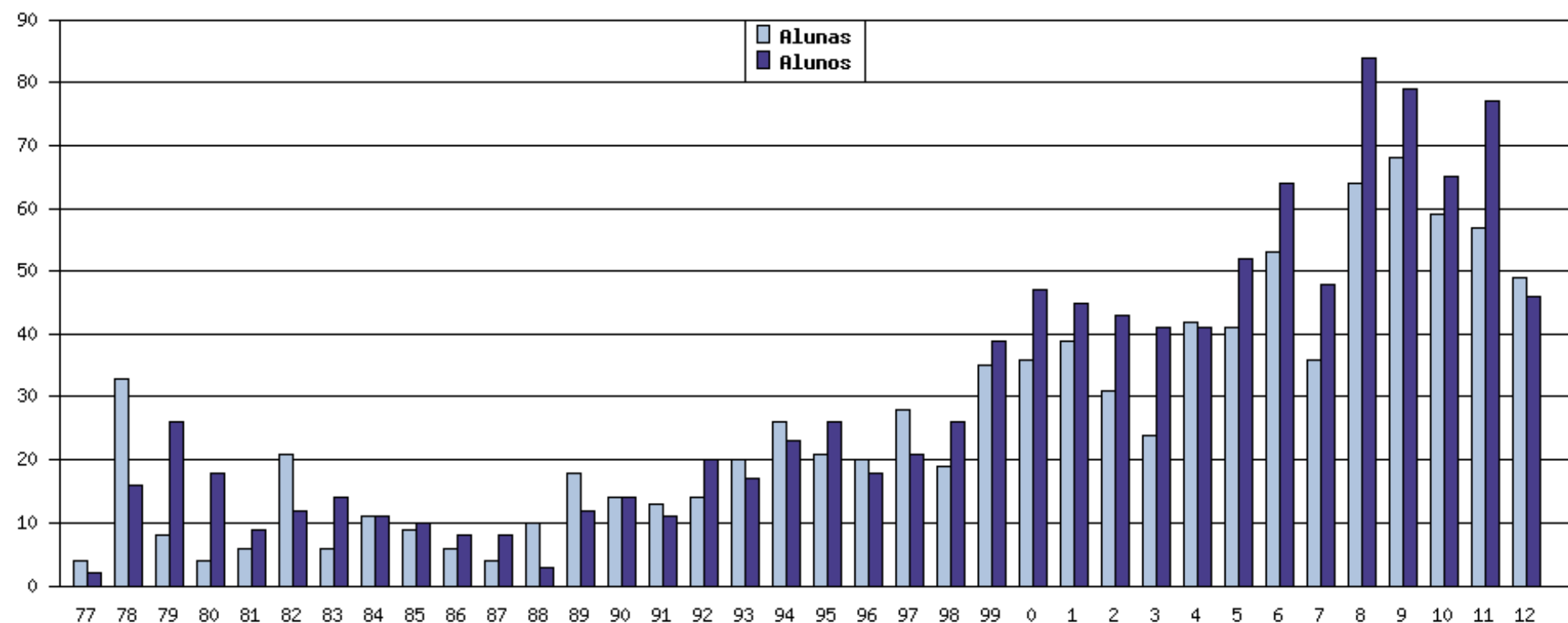




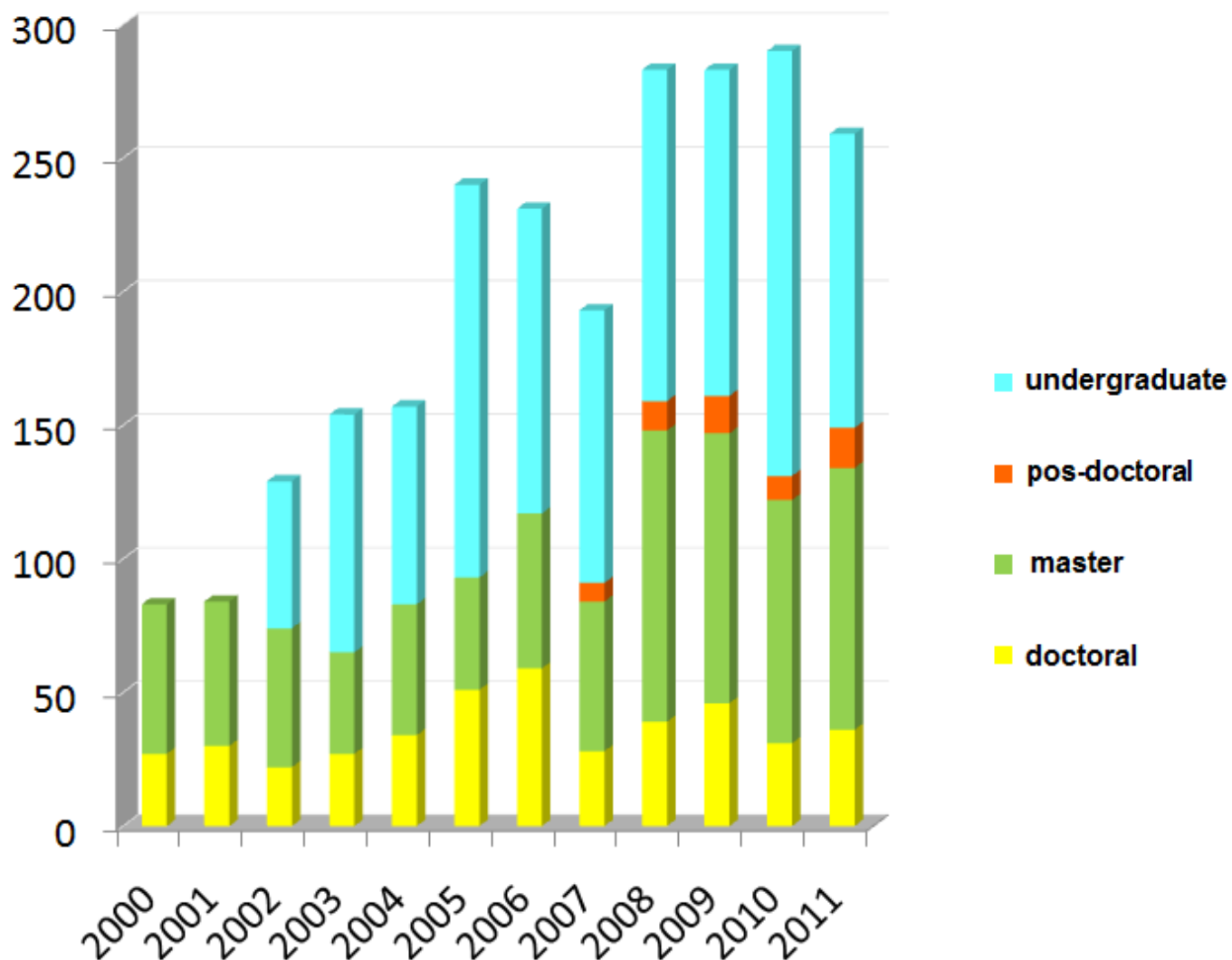
# IPEN/USP graduate program

## Degrees granted (Genre)

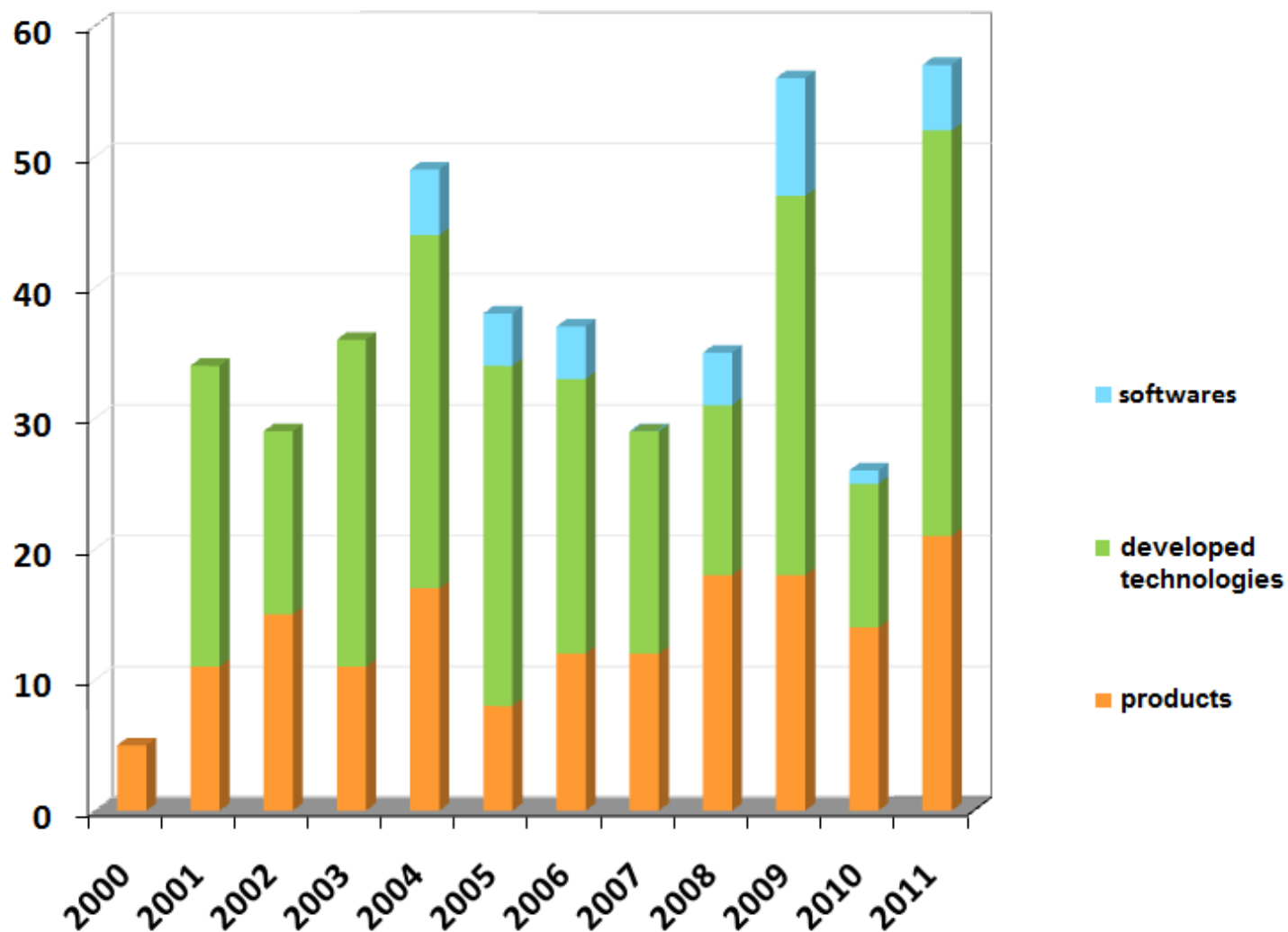
Titulado - Distribuição de Alunas x Alunos por Ano



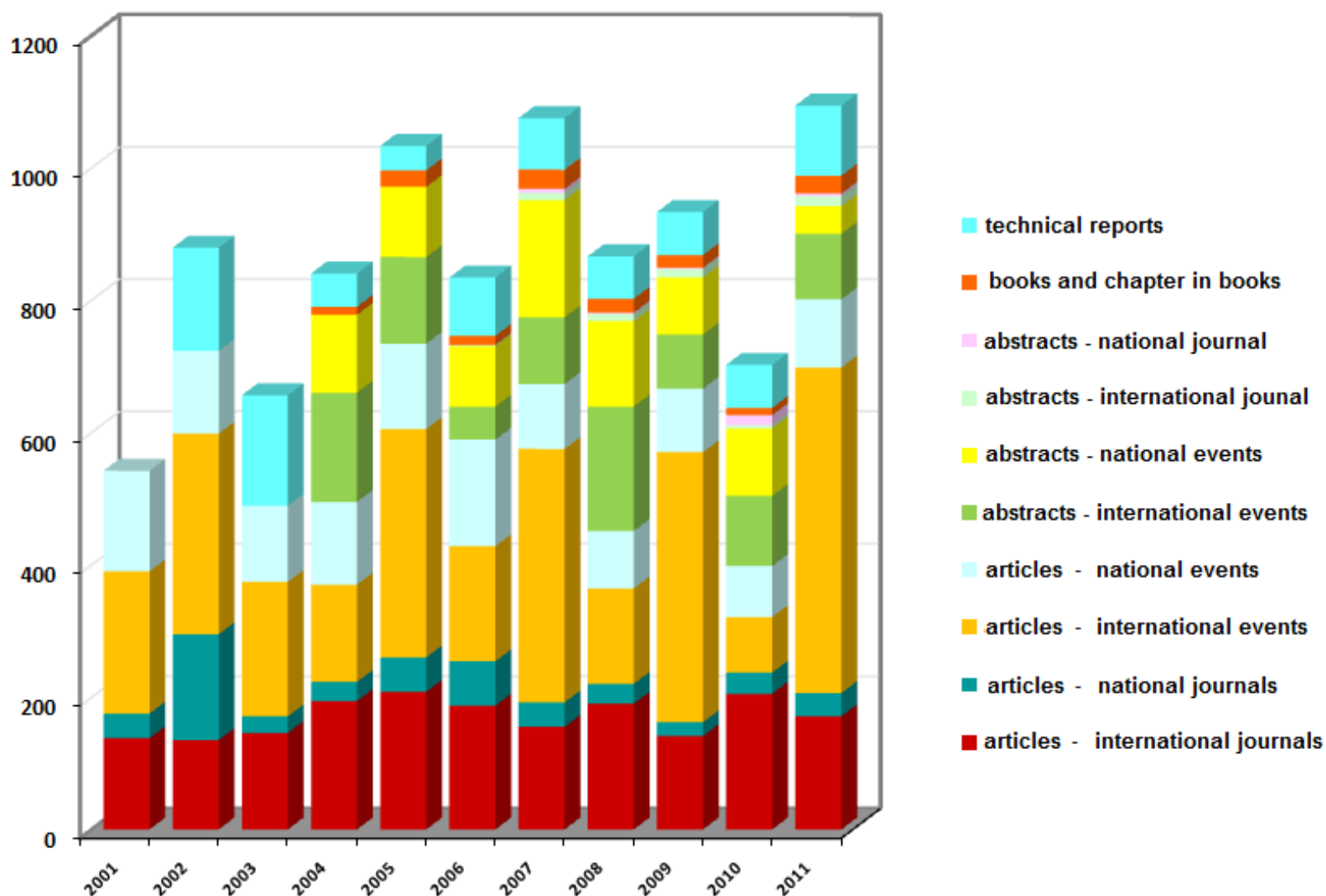
# Degree - granted



# Technologies: New and developed



# Scientific Production





# PATENTS EVALUATION NUMBER

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
<b>Patents – Internacional</b>	1	-	-	-	-	1	1	1	1	-	-	-
<b>Patents - Provisional INPI Protocol</b>	-	-	-	-	-	2	2	11	1	-	4	5
<b>Patents - Definite INPI Protocol</b>	2	-	7	7	12	6	4	5	9	1	-	4
<b>Patents Granted</b>	-	-	-	1	-	-	-	-	-	-	-	-
<b>Total</b>	3	-	7	8	12	9	7	17	11	1	4	9

The Nuclear Technology Program IPEN/USP has reached



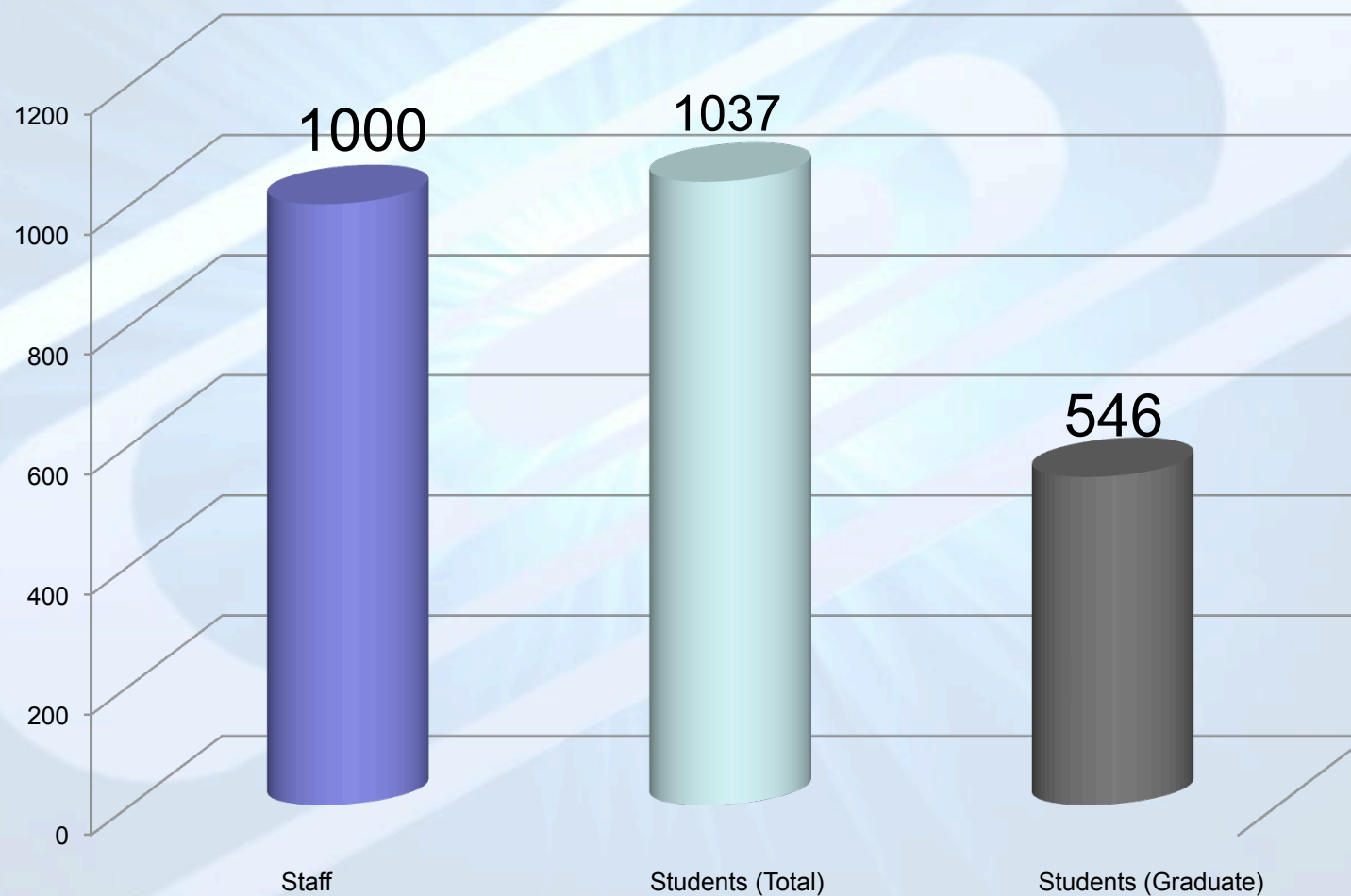
**2,045** granted titles  
**1,402** master **643** doctorate

Year	2005	2006	2007	2008	2009	2010	2011	2012
Master Granted	42	58	56	109	75	93	99	63
Doctorate Granted	51	59	28	39	34	30	30	23
Active Students	384	390	421	439	456	437	439	447
Disciplines Ministered	66	79	87	89	99	89	89	85

# Brazilian nuclear graduate programs

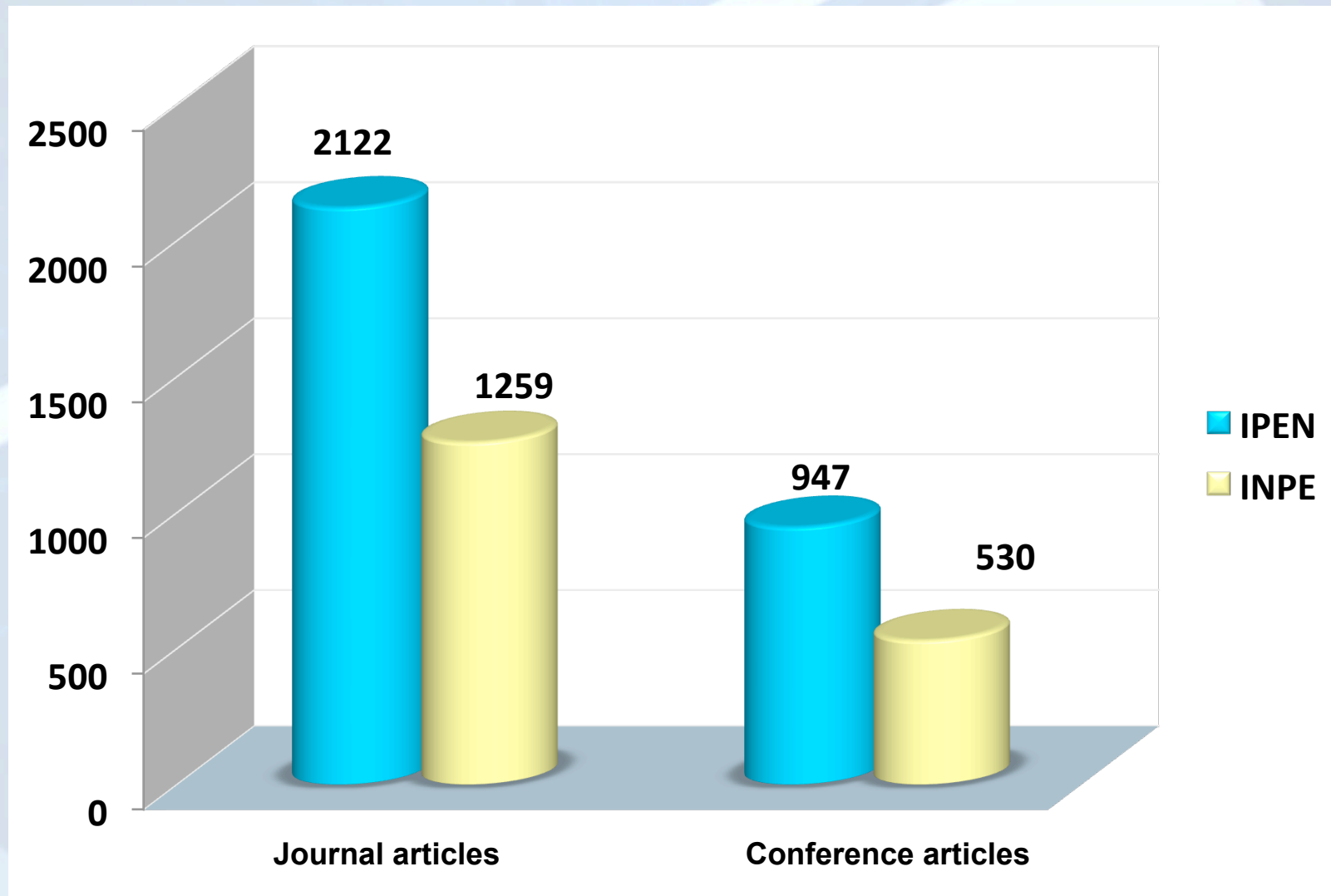
Course	Mast.	Doct.	2003 Grade	2006 Grade	2009 Grade
UFMG	X	X	4	4	4
IME	X		3	3	3
UFRJ	X	X	6	5	6
<b>IPEN/USP</b>	<b>X</b>	<b>X</b>	<b>6</b>	<b>6</b>	<b>6</b>
UFPE/CRCN	X	X	5	5	5
IRD	X		4	4	5
CDTN	X		3	4	4
IEN	X		3	3	3

## staff/students 2009





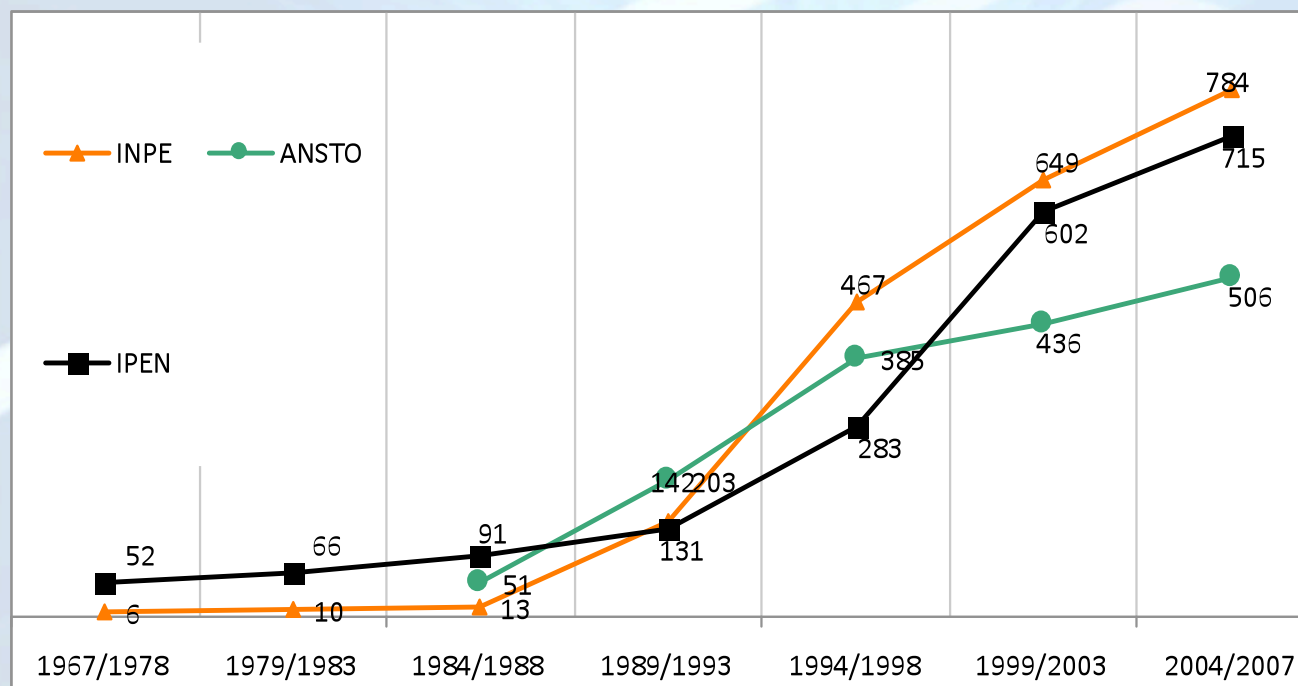
# Comparison IPEN X INPE - Feb. 2012



# Comparison for the number of articles retrieved from



## Web of Science for IPEN, INPE and ANSTO



Total of articles

INPE – 2071

IPEN – 1940

ANSTO - 1581

**ANSTO = Australian Nuclear Science and Technology Organisation**

# Information about IPEN graduate program



- record - number of students enrolled in graduate school in a single year: 158 (2008)
- degree record - Master and Doctorate: 148 (2008)
- second unit of USP in number of publications (2009)
- In 2009 the number of students exceeded the number of active employees
- more than 600 candidates in the program selection (09 e 10)
- record - 391 students - undergraduate courses (2011)
- Annual seminar of basic science for undergraduate students available (live) on the internet (since 2008)
- More than 1000 people in the graduate building per week
- All information available on internet – [www.ipen.br](http://www.ipen.br)
- Posters and other services available for students and researchers on the internet
- Social networks - Twitter

# Graduate Building







**THANK YOU**

Prof. Dr. Delvonei Alves de Andrade

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