
First Seminar on Information Exchange with the Nuclear Energy Agency (NEA)

*CNEN's Headquarters
March 20, 2018 – Rio de Janeiro, Brazil*

Overview of Research Activities at CNEN

Presented by

Orlando J. A. Gonçalves Filho

General Coordinator of Nuclear Science and Technology
Directorate of Research and Development

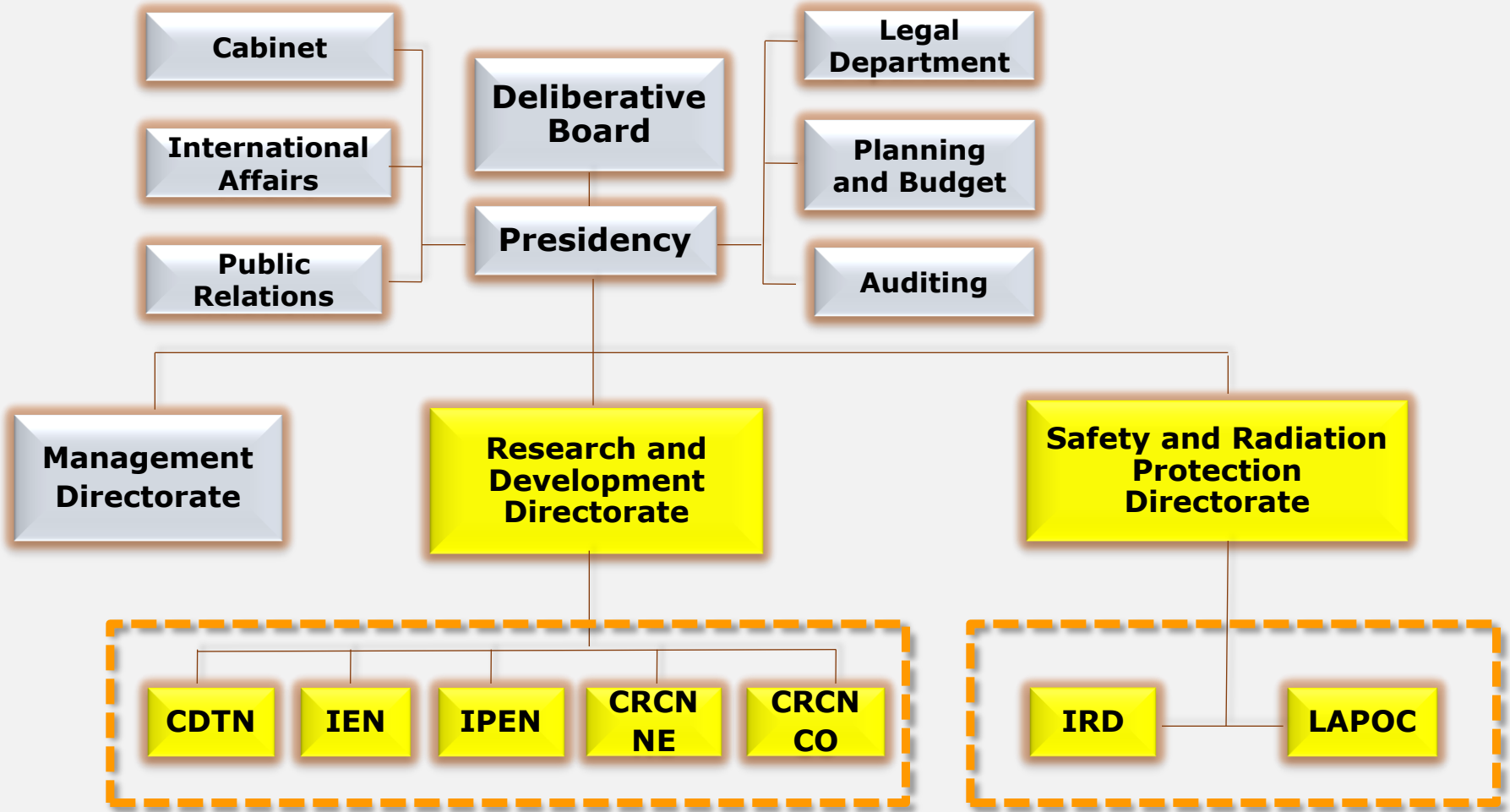
OUTLINE OF PRESENTATION



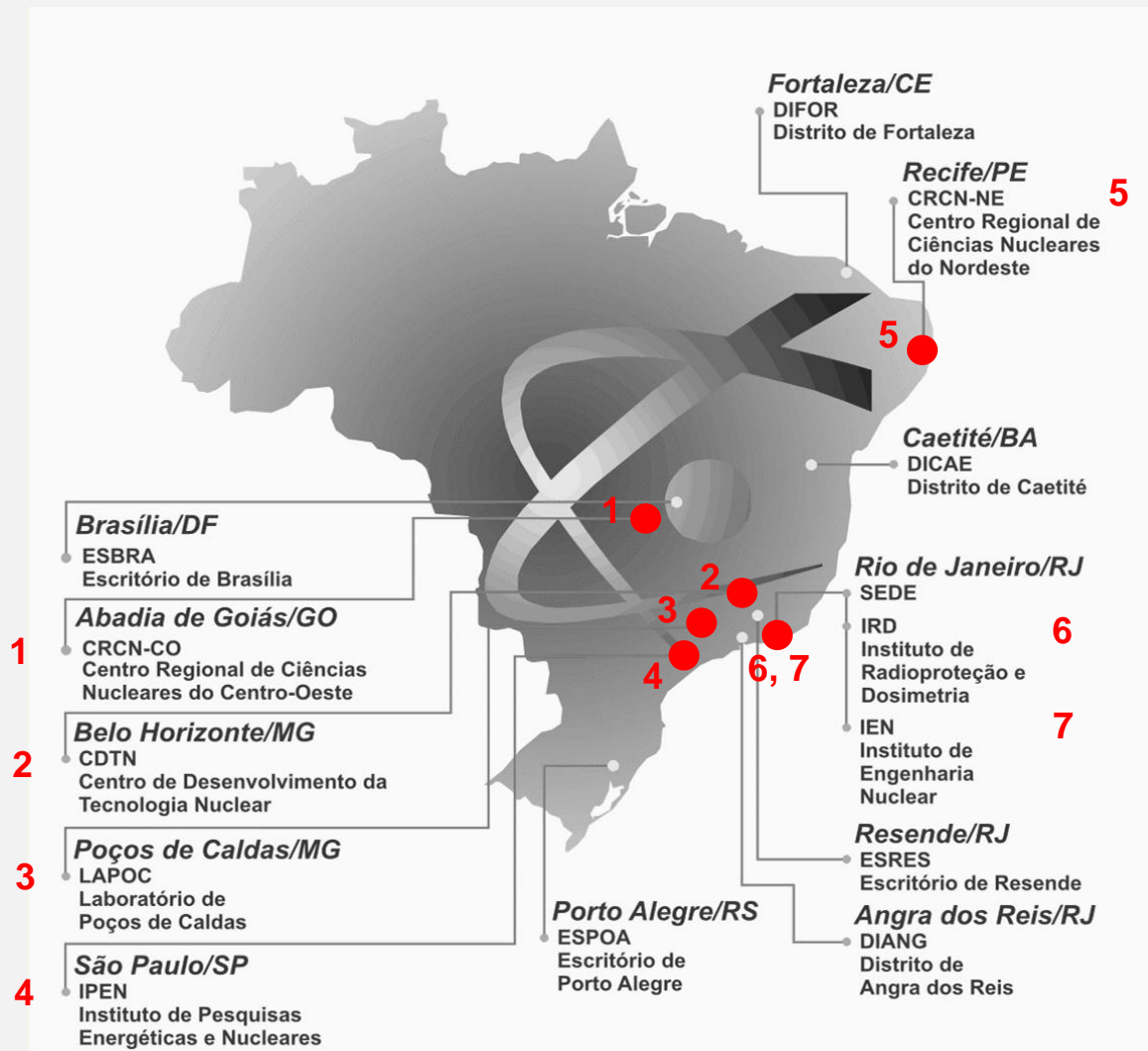
CNEN's

- **Organizational Structure**
- **Major Research Areas**
- **Post-graduate Courses**

CNEN ORGANIZATIONAL STRUCTURE



R&D INSTITUTES GEOGRAPHICAL DISTRIBUTION



SHORT PROFILE OF IPEN (CNEN's largest institute)



IPEN was created in 1956 for
R&D in the area of NE and its applications
Since 1976 associated to USP for Education

IPEN is located at the campus of
the University of São Paulo (USP)
in an area of nearly 500,000 m²

TODAY

- 700 employees (200 PhD)
- Two nuclear research reactors.
- Electron accelerators and Cobalt irradiators for radiation industrial applications.
- Two cyclotron accelerators for radioisotopes production.
- High power laser.
- Laboratories for R&D on Lasers, Fuel Cells and Hydrogen, Biotechnology, Materials, Environmental Sciences, NFC and others.



- **NUCLEAR SCIENCE AND TECHNOLOGY**

- Nuclear Physics
- Nuclear Power
- Fuel Cycle
- Safety Analysis
- Others

- **APPLICATIONS OF IONIZING RADIATION**

- Human Health
- Industry
- Agriculture
- Environment

SPECIFIC RESEARCH AREAS (non exhaustive list)



- **Nuclear Engineering** (reactor physics, thermo-hydraulic, structural integrity, safety analysis, ...)
- **Radiation Technology and Metrology**
- **Human Health**
- **Radioisotopes and radiopharmaceuticals**
- **Chemical Technology and Environment**
- **Minerals and Advanced Materials**
- **Lasers**

SPECIFIC RESEARCH AREAS (non exhaustive list)



- **Nanoscience and nanotechnology**
- **Biotechnology**
- **Sustainable Energies**
- **Virtual Reality**

- **NEW RESEARCH AREAS**
- **Regulatory Research – DRS**
- **Nuclear Fusion – DPD**

Nuclear Engineering:

- Nondeterministic method to the analysis of the aging effects in PWR power plant components

Technology Development for Complex Systems:

- A fuzzy model for safety culture assessment

Virtual Reality:

- Use of virtual reality for reading a superheated emulsion detector

SPECIFIC RESEARCH PROJECTS - EXAMPLES



Health:

- Processing of biological tissues by ionizing radiation



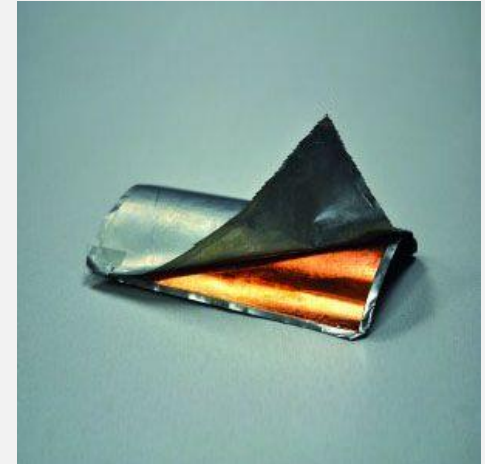
Radiopharmaceuticals:

- Development and validation of pre-clinical tests applied to radiopharmaceuticals



Materials:

- Development an nationalization of the production technology of uranium targets for the future national production of Mo-99/Tc99m



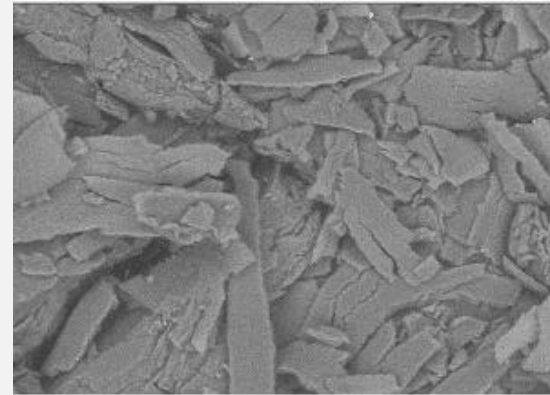
- Preparation of titania and rutile membrane supports for nuclear waste treatment

SPECIFIC RESEARCH PROJECTS - EXAMPLES



Nanotechnology:

- Production of graphene oxide by ionizing radiation. Uses of graphene oxide membrane: cleaning nuclear wastewater, desalination.



Biotechnology:

- Study of the structure and biological activity of recombinant proteins with antitumor activity



Sustainable energies:

- Production of hydrogen from renewables sources through chemical, thermo-chemical and radiolytic processes



Chemical technology and environment:

- Decontamination of uranium effluents via electrochemistry with radiological control.

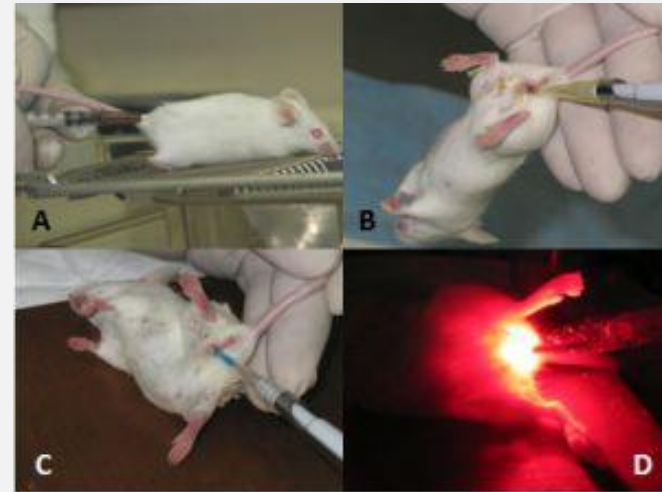


SPECIFIC RESEARCH PROJECTS - EXAMPLES



Lasers:

- Development of processes to study the photodynamic antimicrobial effect



RESEARCH RESULTS – Publications and patents



- Publication in indexed international periodicals

Year	2013	2014	2015	2016	2017
Number	230	343	176	246	221

Average number (period 2013 – 2017): **243/year**

- Request of patent registration (RPR)

Year	2013	2014	2015	2016	2017
Number	10	17	-	12	10

Total number (RPR) in period 1993 – 2017: **172**

RESEARCH RESULTS – Publications



TITLE	IMPACT FACTOR	TITLE	IMPACT FACTOR
NATURE	40.137	Journal of Materials Chemistry C	5.256
Annals of the Rheumatic Diseases	12.811	Oncotarget	5.168
Nature Communications	12.124	Science of the Total Environment	4.900
Applied Catalysis B: Environmental	9.446	Electrochimica Acta	4.798
Applied Energy	7.182	Cement and Concrete Research	4.762
Environment International	7.088	Catalysis Today	4.636
Nanomedicine: Nanotechnology, Biology, and Medicine	5.720	The Journal of Physical Chemistry C	4.536
Artificial Cells Nanomedicine and Biotechnology	5.605	Pharmacological Research	4.480
Atmospheric Chemistry and Physics	5.318	Particle & Particle Systems Characterization	4.474

RESEARCH RESULTS – Innovation



NUMBER OF PARTNERSHIP AGREEMENTS FOR INNOVATION PER RESEARCH INSTITUTE

Research Institute	Year	Up to 2017	Hiring under analysis
CDTN		4	1
CRCN-NE		0	1
IEN		1	0
IPEN		15	2
IRD		0	1
LAPOC		1	0
TOTAL		21	5

POST-GRADUATE COURSES



- **IPEN (SP):** PhD and Master degrees in Nuclear Technology
- **CDTN (MG):** PhD and Master degrees in Radiation, Mineral and Material Science and Technology
- **IRD (RJ):** PhD and Master degrees in Radiation Protection and Dosimetry
- **IEN (RJ):** Master degree in Nuclear Reactor Engineering
- **CRCN-NE (PE):** PhD and Master degrees in Energy and Nuclear Technology

POST-GRADUATE RESULTS



NUMBER OF PROFESSIONALS TRAINED PER RESEARCH INSTITUTE PER YEAR						
Year	2015		2016		2017	
Research Institute	Master	PhD	Master	PhD	Master	PhD
CDTN	20	14	18	10	24	7
CRCN-NE	24	10	12	20	11	15
IEN	10	0	14	0	12	0
IPEN	68	52	66	35	72	30
IRD	12	0	12	3	7	5
Others	4	7	6	5	4	2
Subtotal	138	83	128	73	130	59
TOTAL	221		201		189	

INDICATOR: PROFESSIONAL TRAINED: Number of students post-graduated in CNEN courses added to those post-graduated from other courses with a scholarship from CNEN.

FINAL REMARKS



Thank you for your attention

FINAL REMARKS



Research institutes internet website addresses

CDTN	http://www.cdtn.br
IPEN	http://www.ipen.br
IEN	http://www.iem.gov.br
IRD	http://www.ird.gov.br
CRCN-NE	http://www.crcn.gov.br
CRCN-CO	http://www.crcn-co.cnen.gov.br
LAPOC	http://www.cnenpc.gov.br

Thank you for your attention