IBN Iniciativa Brasileira de Nanotecnologia | Finep Inovação e Pesquisa | CNPq Conselho Nacional de Desenvolvimento Científico e Tecnológico | Ministry of Science, Technology and Innovations | Pátria Amada Brasil Governo Federal

BRICS RUSSIA | 2020

2nd meeting of the BRICS Working Group on Photonics October 13 - 15, 2020

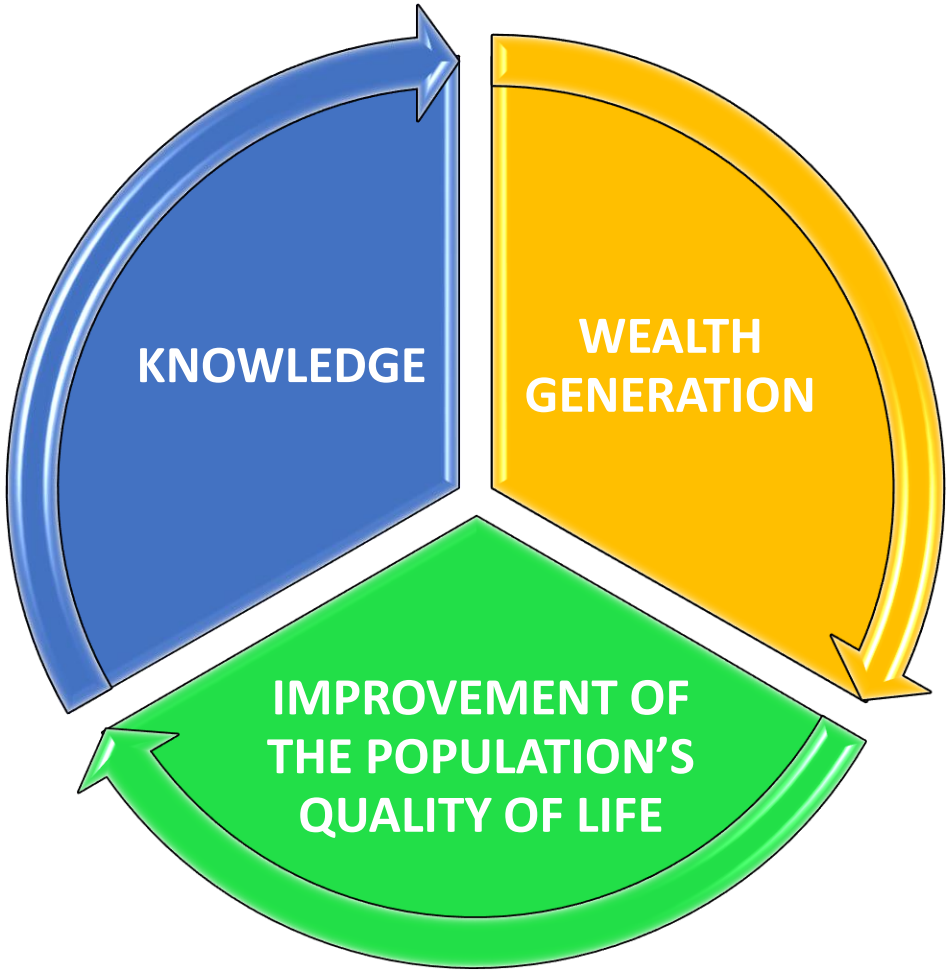
Brazilian Initiatives of Photonics

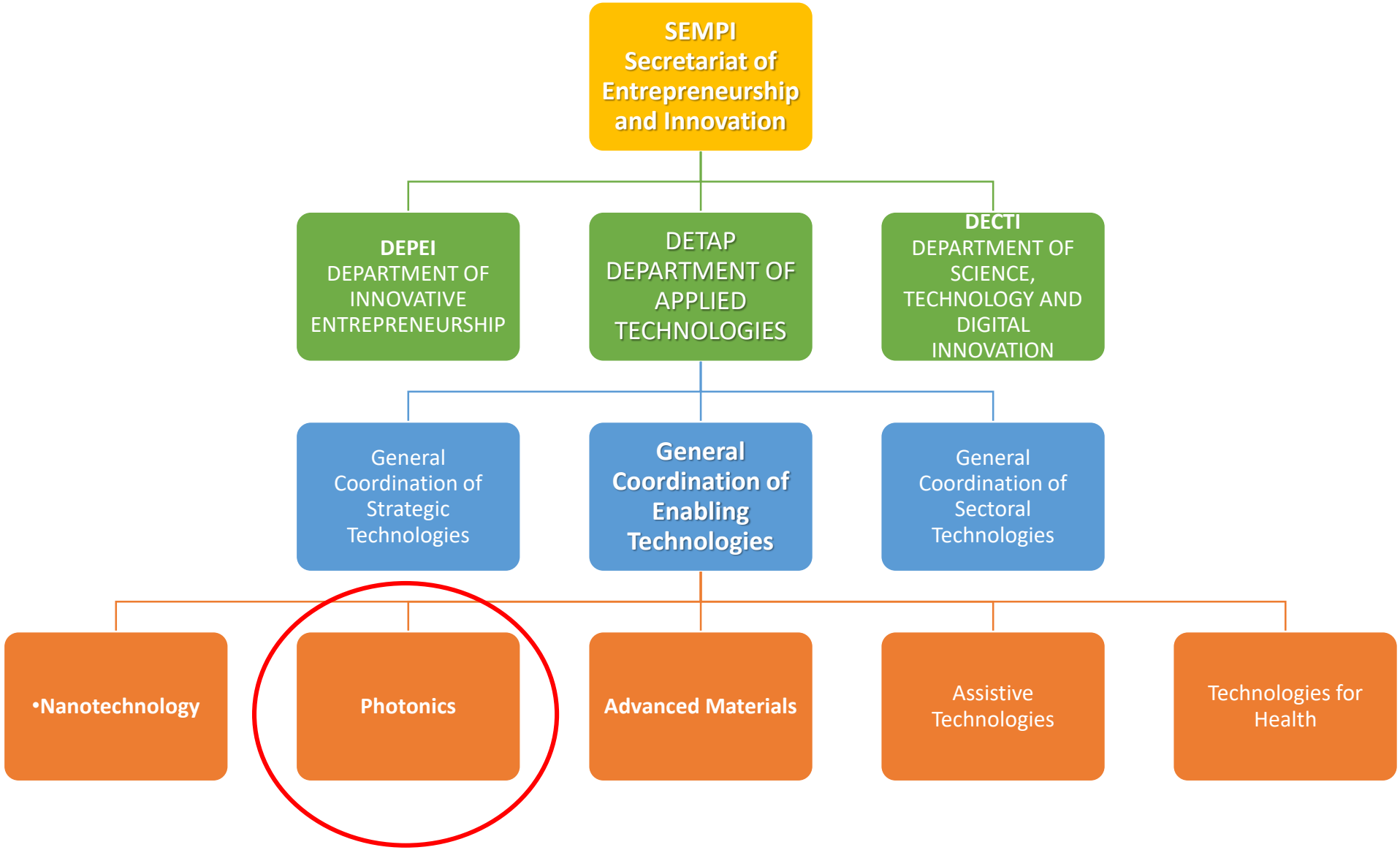
Dr. Felipe Silva Bellucci

General Coordinator of Enabling Technologies – CGTH/MCTI

Department of Applied Technologies - DETAP
Secretariat of Entrepreneurship and Innovation - SEMPI
Ministry of Science, Technology and Innovations of Brazil – MCTI

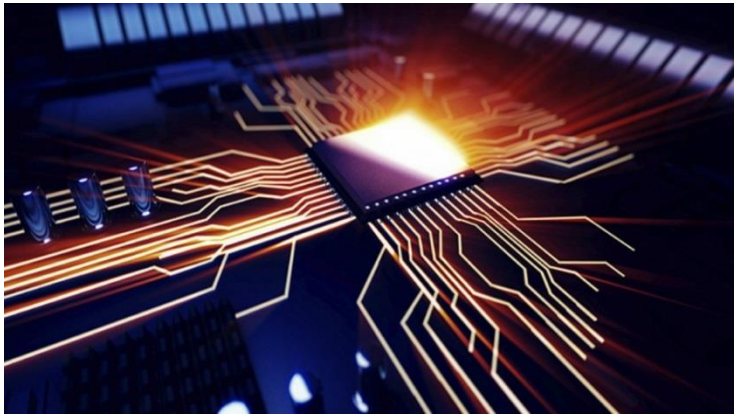
MINISTERIAL MISSION




SEMPI
Secretariat of Entrepreneurship and Innovation
DEPEI
DEPARTMENT OF INNOVATIVE ENTREPRENEURSHIP
DETAP
DEPARTMENT OF APPLIED TECHNOLOGIES
DECTI
DEPARTMENT OF SCIENCE, TECHNOLOGY AND DIGITAL INNOVATION
General Coordination of Strategic Technologies
General Coordination of Enabling Technologies
General Coordination of Sectoral Technologies
•Nanotechnology
Photonics
Advanced Materials
Assistive Technologies
Technologies for Health

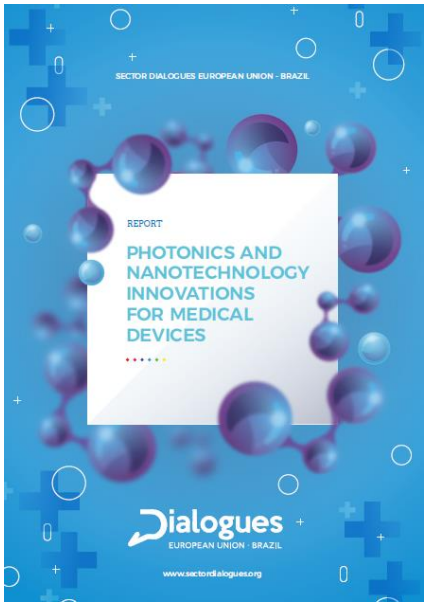
A BRIEF HISTORY OF PHOTONICS IN BRAZIL

- In Brazil, photonics began its development in the telecommunications sector in the 1960s. Allied to a strong academic structure, research began to develop in the area of Optical Communication.
- Photonics has been among the actions of the General Coordination of Enabling Technologies (CGTH), as an Enabling Technology since 2017.



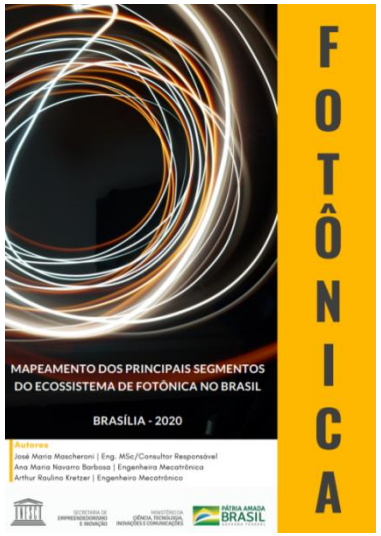
- Governance of Photonics at the Brazilian Ministry of Science, Technology, Innovation and Communications (MCTIC): General Coordinator of Enabling Technologies;
- MCTI has an **Advisory Committee of Phonics (CCFOTO),** Presidential Decree n° 10.138, November, 28th, 2019, aiming to contribute to the elaboration of Public Polices

A BRIEF HISTORY OF PHOTONICS IN BRAZIL



- Sectorial Dialogue Brazil-EU: "Innovation on Photonics and Nanotechnology for Medical Devices" in the scope of "Information Society Dialogue", between 2017 and 2018. This project brought together the efforts from Brazilian and European Union partners in projects and initiatives that combined Nanotechnology and Photonics for the development of intelligent diagnostic and therapeutic medicine equipment and systems.

- Mapping the main segments of the Photonics ecosystem in Brazil - The study with an analysis on the innovation ecosystems, considering the scientific, technological and business aspects, for the photonics segments: displays; communications; information technology; photovoltaic; medical and life sciences technology; measurement and machine vision; lighting; production technology; defense and security; optical components and systems; and biophotonics.



MAIN DOCUMENTS FOR PHOTONICS IN MCTI

The **National Strategy for Science, Technology and Innovation** (ENCTI 2016-2022): medium-term strategic guidance document for the implementation of public policies in the area of ST&I.

- ENCTI 2016-2022 has 12 Strategic Themes, one of them being the development of **Converging and Enabling Technologies** (Nanotechnology, Biotechnology, Photonics, Advanced Materials, Advanced Manufacturing)

Action Plan of ST&I for Converging and Enabling Technologies

Volume III – Photonics

Action 1

Encourage the process of implementing regional ecosystem integration platforms.

Action 2

Identify national technical capacity

Action 3

Promotion of human resources training

Action 6

Intensification of International Cooperation

Goal: Creating and fostering a collaborative environment between industry, government and academia, combining competencies in science, technology and innovation to promote a complete and sustainable development of the Photonics and the economy in Brazil.

Action Plan of ST&I for Converging and Enabling Technologies
Volume I, II, III and IV – Nano, Adv. Materials, Photonics and Techs for Adv. Manuf.
Link: http://antigo.mctic.gov.br/mctic/opencms/tecnologia/index.html

MAIN AREAS OF PHOTONICS

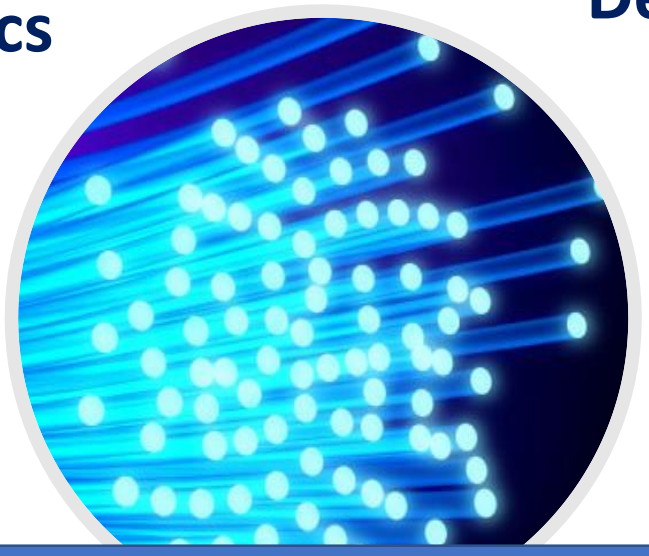
Communications

Quantum Optics

Biophotonics

Manufacturing

Metrology



Defense & Security

Devices

Image

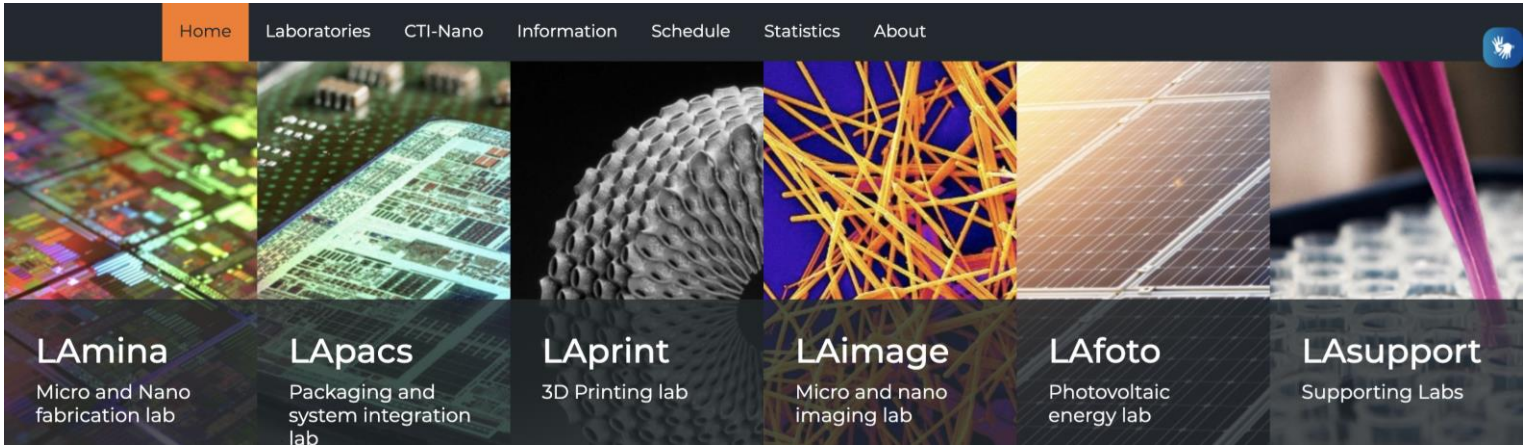
Lighting & Display

Photonics

MCTI has 24 Research Units - Center for Information Technology 'Renato Archer' (CTI)

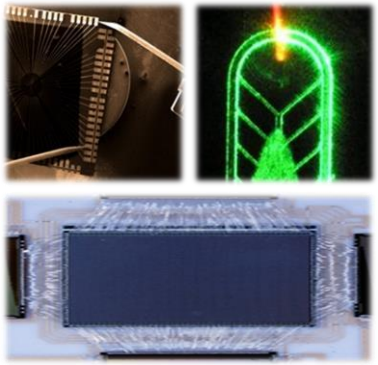
Centro de Tecnologia da Informação Renato Archer

Center for Information Technology 'Renato Archer' (CTI)

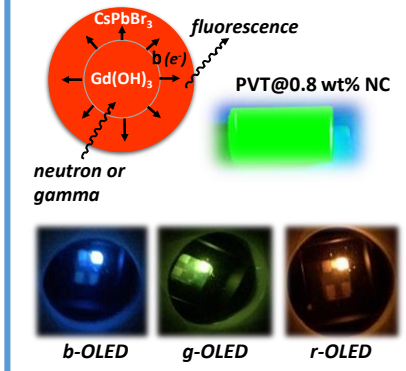


R&D and Innovation Lines @ CTI-Nano

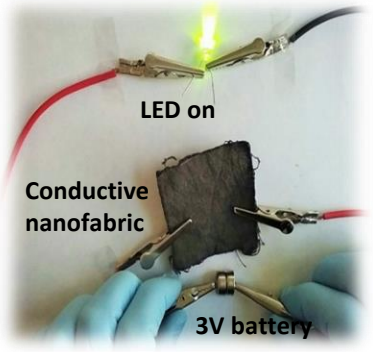
Micro-nanoelectronics, sensors and photonics



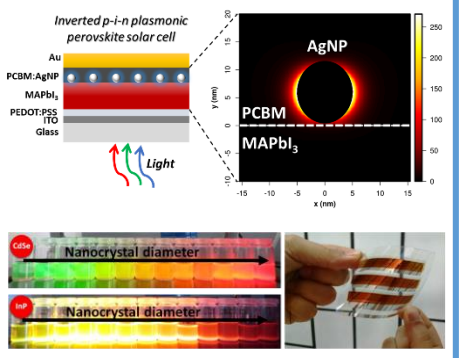
LEDs and Nanoscintilators



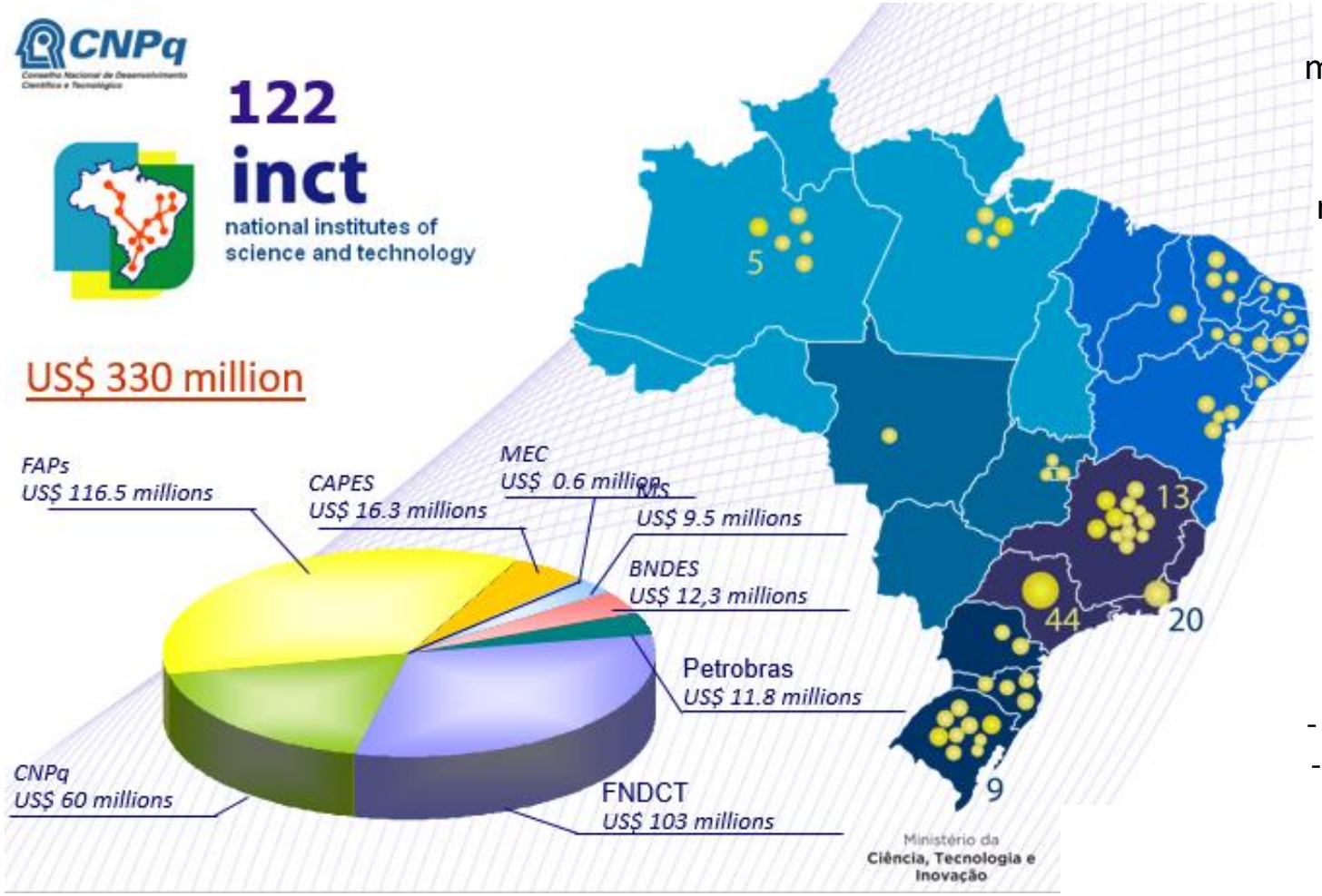
Flexible, wearable and textile electronics



Advanced Photovoltaics



National Institutes of Science and Technology



Goals: to articulate and mobilize researchers around the country; boost both fundamental and applied research to be competitive internationally; stimulate scientific research and technological edge, to promote innovation and entrepreneurship.

Areas:

- Photonics (5)
- Energy (10)
- Eng. and IT (12)
- Hard and Natural Sci. (11)
- Humanities and Social Sci. (10)
- Ecology and Environment (22)
- Nanotechnology (10)
- Health (39)

BRAZILIAN INNOVATION ECOSYSTEM OF PHOTONICS

MCTI has research institutions working in the field of Photonics:

INFO - UFPE

Photonics National Institute for Science and Technology

operates in the field of photonic materials, photonic devices, spintronics, magneto-optics and biophotonics.

FOTONICON – UNICAMP

National Institute of Science and Technology in Photonics for Optical Communications

operates in the area of optical communications, devices, systems and networks.

INCT/INOF – IFSC/USP

National Institute of Science and Technology of Optics and Photonics

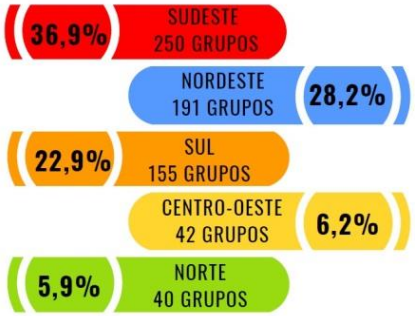
integrates specialists from different fields (physics, chemistry, medical sciences and engineering) to explore new applications in Optics and Photonics.

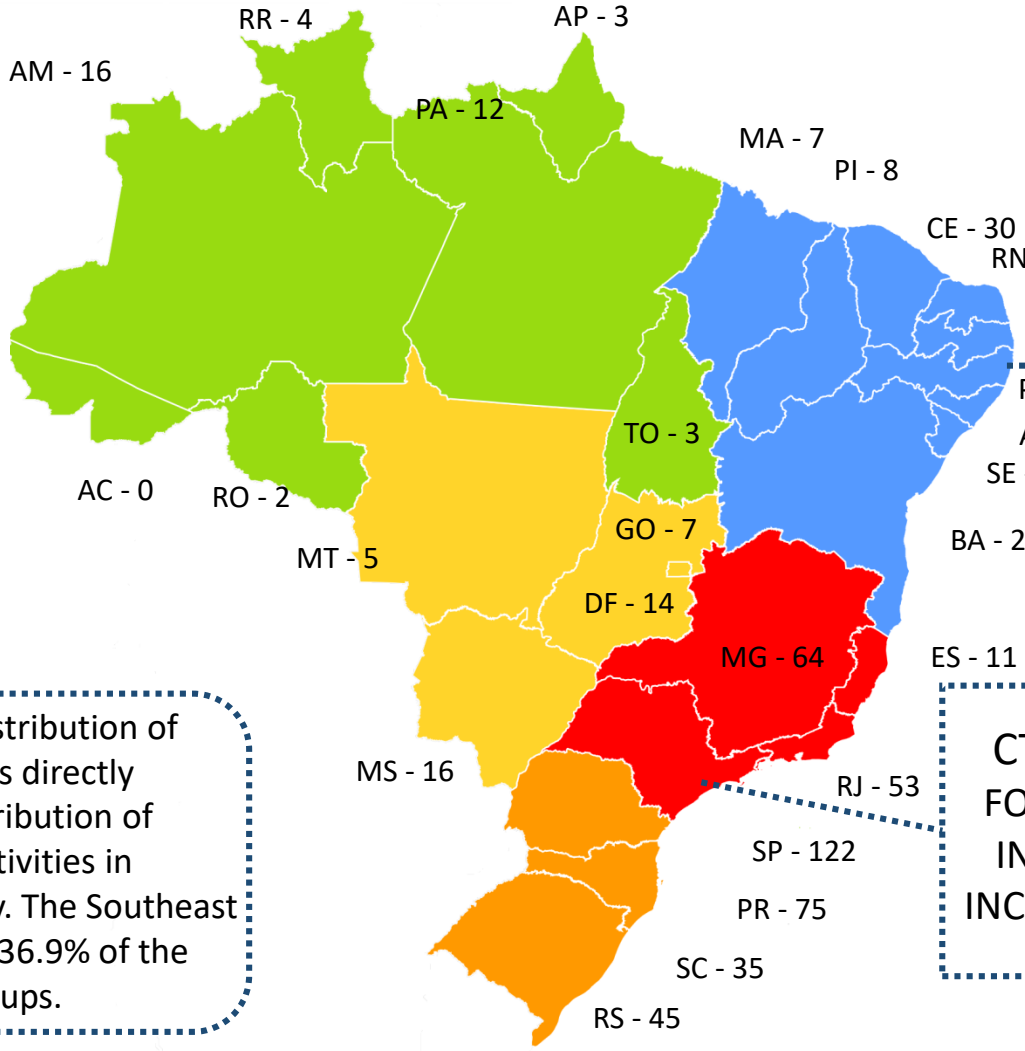
INFABiC – UNICAMP

The National Institute of Photonics Applied to Cell Biology

BRAZILIAN INNOVATION ECOSYSTEM OF PHOTONICS

About 700





INFO/UFPE

The geographical distribution of research groups is directly related to the distribution of segments and activities in Photonics in the country. The Southeast region concentrates 36.9% of the research groups.

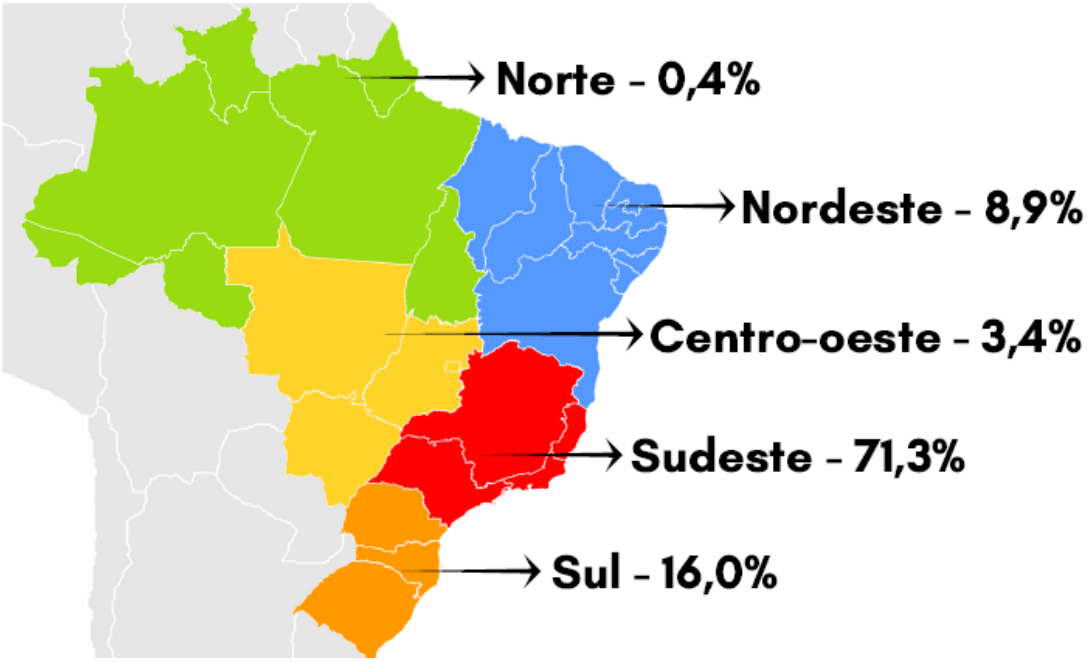
CTI – Renato Archer
FOTONICOM-UNICAMP
INCT/INOF – IFSC/USP
INCT-INFABiC – UNICAMP

SCIENTIFIC ARTICLES

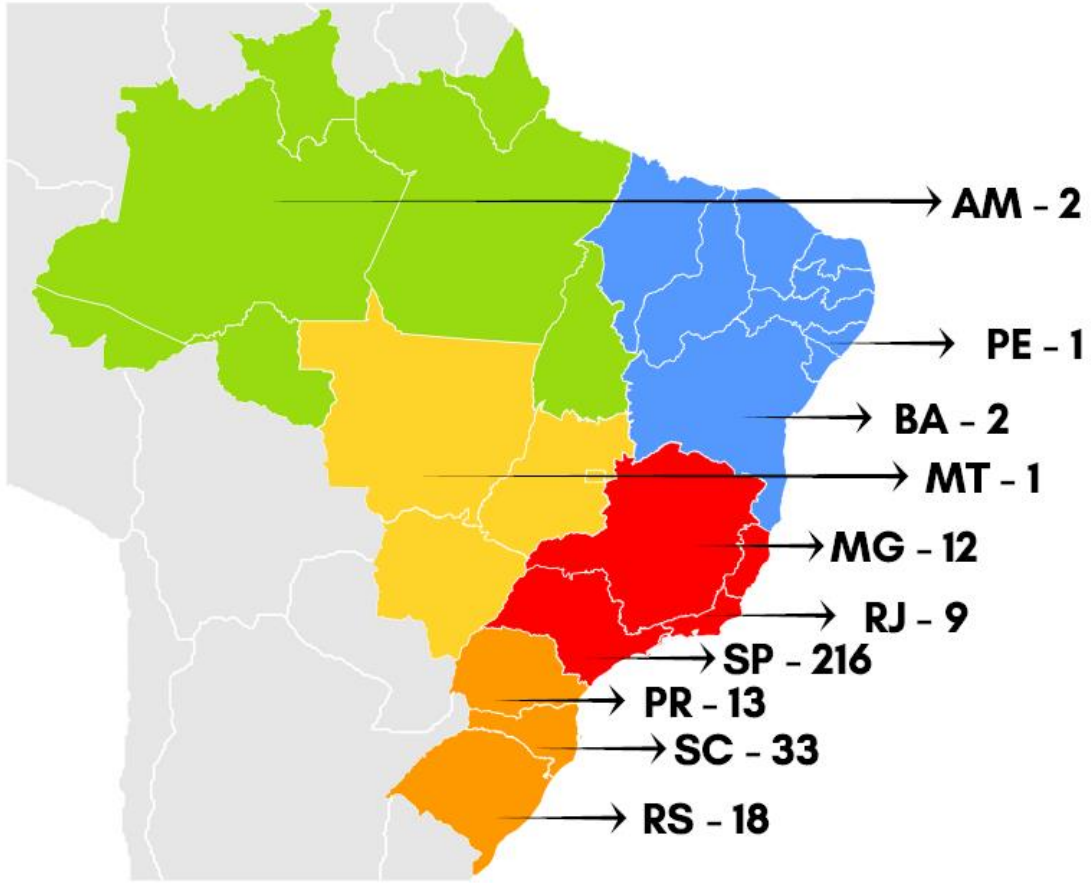
7.381 articles published between 2008 and 2018 for the 11 segments of photonics

Market segments with a high number of articles/papers published between 2008 and 2018

i. Production Technology: 1234;
ii. Optical Components and Systems: 1088;
iii. Information Technology: 760



NATIONAL MANUFACTURERS OF PRODUTS BASED ON PHOTONICS

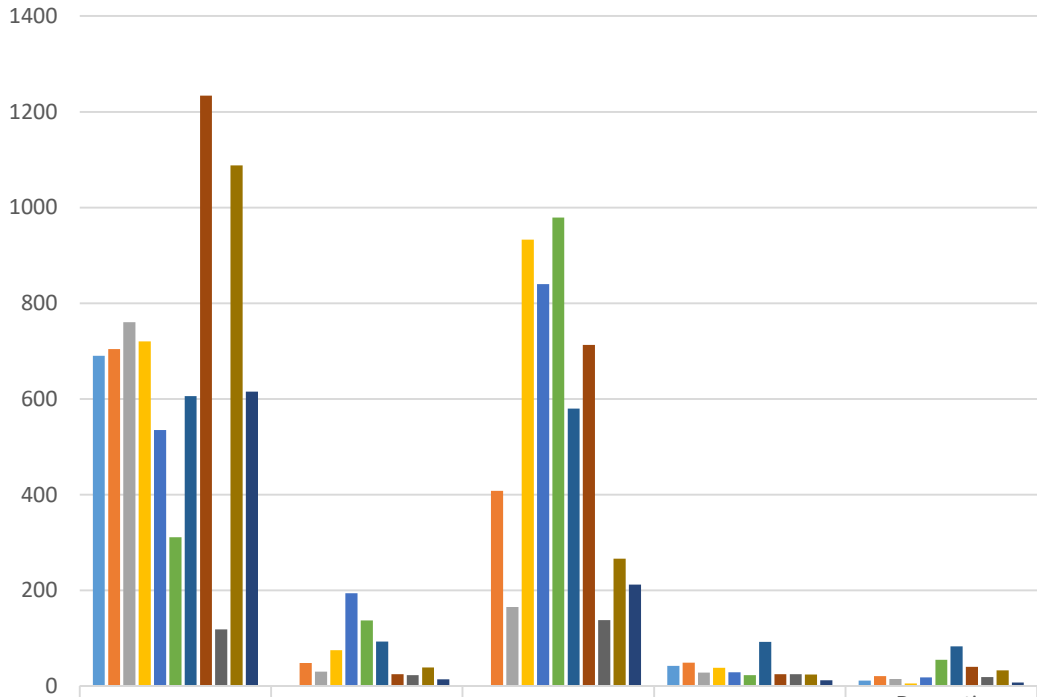


Brazil has about **307** national manufacturers of products based on photonic technologies

- **70.4%** of the manufacturers are in the state of São Paulo.
- **6,528** companies in the chain of products and services related to photonics, including commercial companies, service providers and others.
- **385** foreign companies.

GENERAL PHOTONICS DATA BY MARKET SEGMENTS

- ✓ Total number of Scientific Publication from 2008 to 2018, extracted through WOS;
- ✓ Total number of research groups from 2008 to 2018;
- ✓ Total number of professionals (researchers and students) from 2014 to 2018;
- ✓ Total number of patents published from 2008 to 2018 extracted from WIPO.
- ✓ Total number of national manufacturers extracted in 2020 from surveys directed to the market.



	Paper	Research groups	Professionals	Published Patents	Domestic manufacturers
Display	690	0	0	42	11
Communication	704	48	408	49	21
TIC	760	30	165	28	15
Photovoltaic	720	75	933	38	5
Medical tecnology	535	194	840	29	18
Measuring and machine vision	311	137	979	23	55
Lighting	606	93	580	92	83
Production tecnology	1234	25	713	25	40
Defense and security	118	23	138	25	19
Optical componentes and systems	1088	39	266	24	33
Biophotonics	615	14	212	12	7

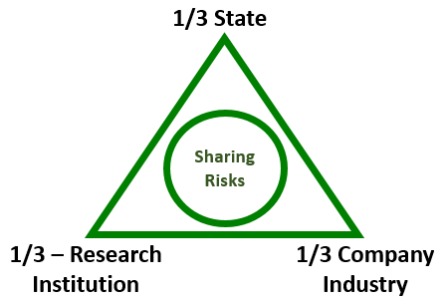
Brazilian Agency for Industrial Research and Innovation

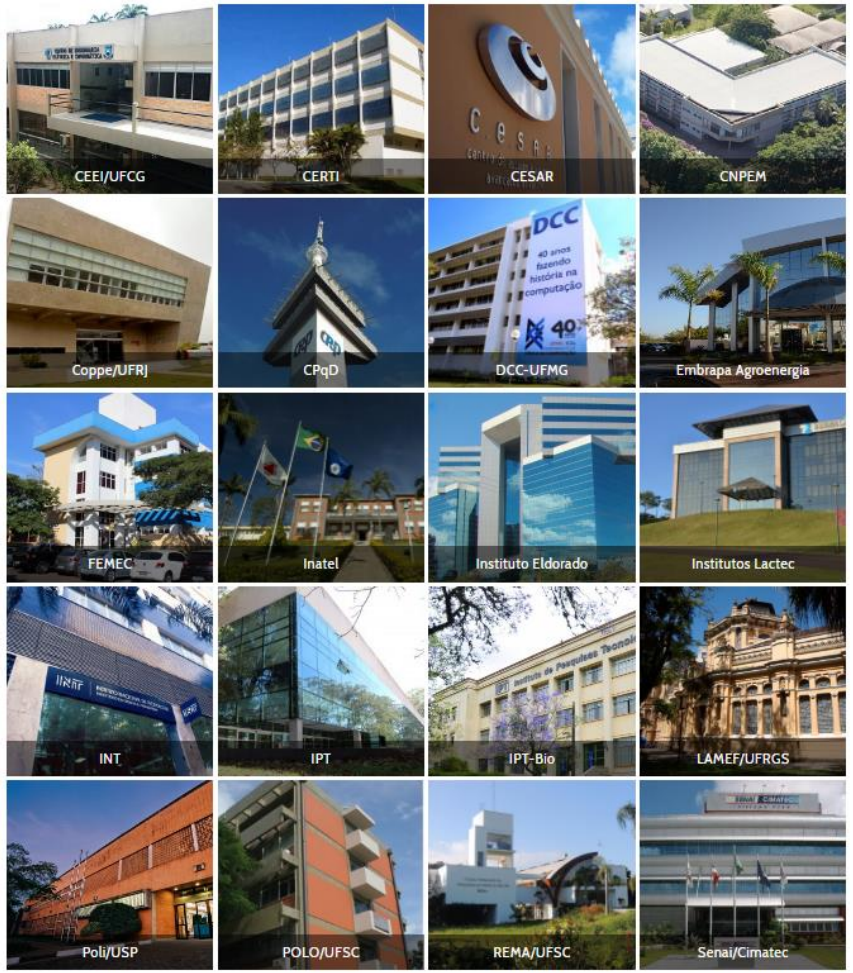
Mission

To contribute to Innovation in Brazilian industry through strengthened **collaboration between industry, universities and research institutes**

To foster the technological development of **new products, processes or business solutions.**

To articulate and promote **cooperation between companies/industry and technological research institutions.**





Differential

- Sharing Risks in 03 parts;
- IP = Research Inst and Company
- Quickly Approval Process.

EMBRAPII

Brazilian Agency for Industrial Research and Innovation

- EMBRAPII Unit of Biophotonics and Instrumentation IFSC-USP (São Carlos-SP): focused on instrumentation and lasers, photonics to agriculture and biotechnology and others;

- EMBRAPII Unit of Advanced Communications (Telecommunications Research And Development Center – CPQD): focused on the area of Devices and Equipment (Photonics), Physical Media (Fibres and Cables), Optical Sensor and others;

- EMBRAPII Unit of Internet and Mobile Computer Equipment (Eldorado Research Institute): dedicated to IT&Telecom, Digital TV Mobile, LED and others; and

- EMBRAPII Unit of Laser Manufacturing (Institute Of Laser Innovation): Refrigeration, Assessment and Certification Technologies, Acoustic Comfort and Energy Efficiency.

EMBRAPII Today*

810 Supported Projects **569** Partner Companies

R$ 1,3 Billion in R&D company projects

Participação EMBRAPII	Participação Empresas	Participação Unidades EMBRAPII
R$ 433,1 Millions	R$ 668,5 Millions	R$ 246,5 Millions
32,1% decreasing companies' risk and cost	49,5% leveraging private investment	18,2%

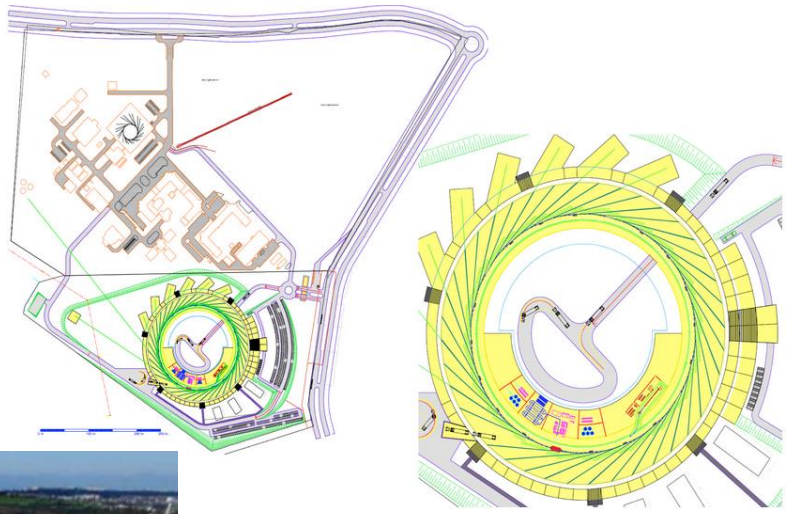
303 Intellectual Property Requests (363 completed projects)

*Data from Nov./2019

Brazilian Center for Research in Energy and Materials (Created in 1987)

Brazilian Synchrotron Light Source Sirius
(4th Generation)

"The most complex and expensive Scientific Project of Brazil – concluded in 2020



Sirius Main Parameters:

- **Only one in the world;**
- **Electrons Energy: 3 GeV;**
- **Circumference: 518 m;**
- **Emittance: 0.28 nm.rad; and**
- **Up to 40 work lines.**

Which Brazil is Thinking for the Future (2021-2025)

- Opportunity 1: We will launch a **Brazilian Initiative on Photonics (IB-Fóton)** and stablish a **National System of Laboratories on Photonics (Sisfóton-MCTI)** next year and they will be able to cooperate with BRICS countries.

- Opportunity 2: Stimulating the technology-based **entrepreneurship, new models of business** and **ICT-companies partnerships** on key enabling technologies aiming to transfer knowledge to the productive sector, to generate new jobs and more incomes; and

- Opportunity 3: Increasing the quality and quantity of specialized **human resources** on key enabling technologies and the BRICS cooperation is an excellent way to achieve this goal.

Thank you!

Felipe Silva Bellucci
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