



Future

October 21-25, 2019 - Santos, SP,
Brazil



ENAN+ENFIR+ENIN: Round Table

RMB - A Structuring and Technological Drag
Project for the Nuclear area : The Reactor Design

José Augusto Perrotta

DPD/CNEN

Maria Lucia Tavares Lim

AMAZUL

Marcelo Barrera

INVAP

Alexandre Gromann de Araujo Goes

DRS/CNEN



RMB

Reator
Multipropósito
Brasileiro

Tecnologia Nuclear a Serviço da Vida

October 2019



MINISTÉRIO DA
CIÊNCIA, TECNOLOGIA,
INOVAÇÕES E COMUNICAÇÕES



Why a New Research Reactor?



➤ The RMB will provide Brazil with a **key infrastructure** to national development activities of the nuclear sector for development and application in the areas of:

➤ **Social application,**

➤ Strategic and industrial,

➤ scientific and technological development.

➤ **Structuring project.**

RMB Main Objectives

- **Radioisotope Production for Medical and Industrial Applications**
- **Fuel and Materials Irradiation Testing**
- **Neutron Beam National Laboratory**
- **NAA National Laboratory**
- **Education and Training**

Responsibilities

Ministério da Ciência Tecnologia Inovações e Comunicações

Owner

Comissão Nacional de Energia Nuclear - CNEN

Project
Responsible

Diretoria de Pesquisa e Desenvolvimento - DPD



Partnership

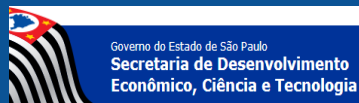
AMAZUL

Amazônia Azul Tecnologias de Defesa S.A.

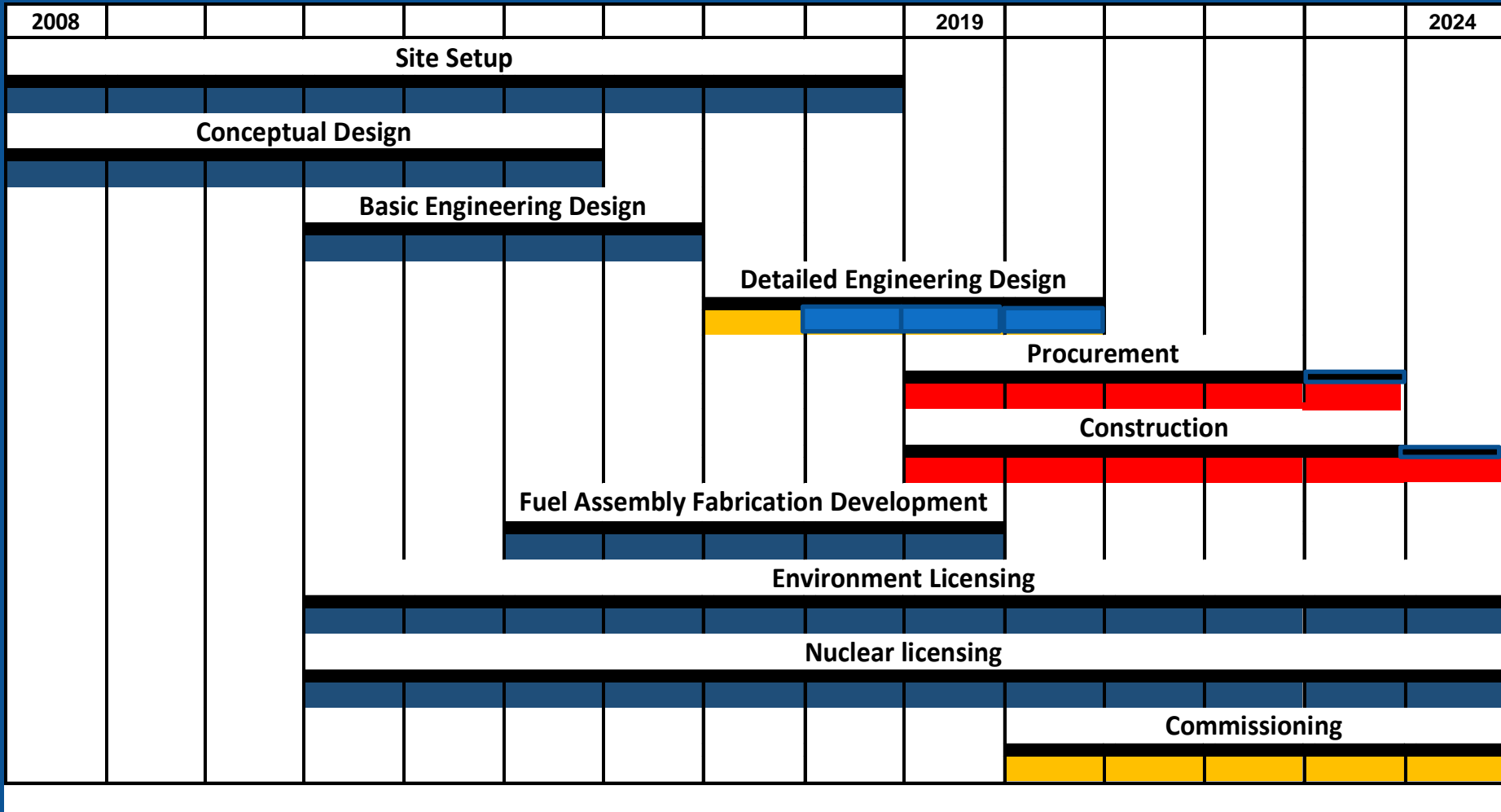
Support



CDPNB - GSI



RMB Project Status



Estimated Cost: US\$ 500 million -- 6 years time span

RMB Project Status



Project Steps	R\$ (million)
Site Setup	14 (SP State); CTMSP 3 (CNEN)
Conceptual Design	2 (CNEN); 1(FNDCT)
Basic Engineering Design	50 (FNDCT)
Detailed Engineering Design	150 (FNDCT)
Fuel Assembly Development and Fabrication	25 (FNDCT)
Nuclear Licensing	CNEN
Environmental Licensing	4 (CNEN)
Procurement	Not defined
Construction	Not defined
Commissioning	Not defined

Estimated Cost: US\$ 500 million -- 11 years since beginning - (PPA -12P1)

Project Management

- Project managed by the Research and Development Directorate of the Brazilian Nuclear Energy Commission (DPD-CNEN)
- Scope and preliminary design, licensing process management and commissioning verification performed by the Research Institutes of CNEN: IPEN, CDTN, IEN, CRCN
- CNEN – CNEA (Argentina) Cooperation Agreement on Reactor Design of RMB and RA-10 based on INVAP / Opal design
- Basic Design – CNEN ; INVAP and INTERTECHNE
- Detailed Design – CNEN; INVAP and AMAZUL
- Manufacturing, construction, assembling and their management will be carried out by National and International Companies.

RMB Site in Iperó / SP

Sorocaba

Morro do Araçoiaba

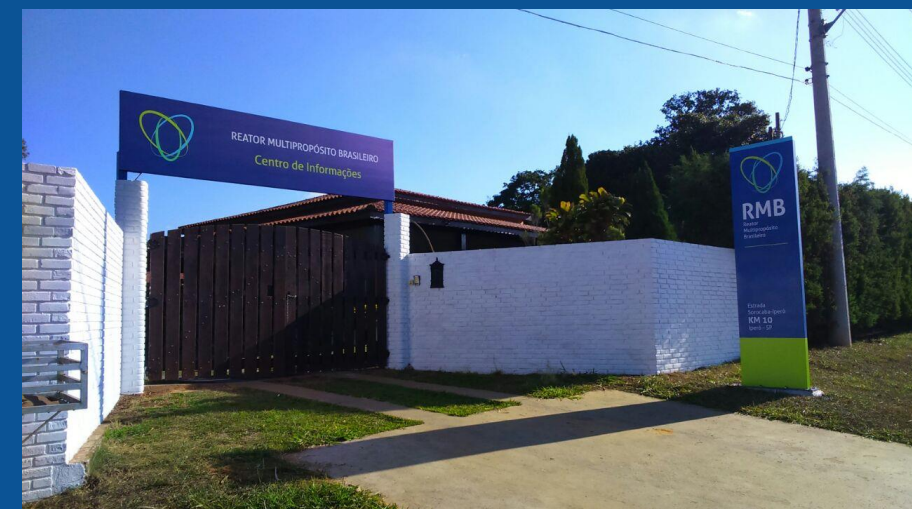
RMB Site

Iperó

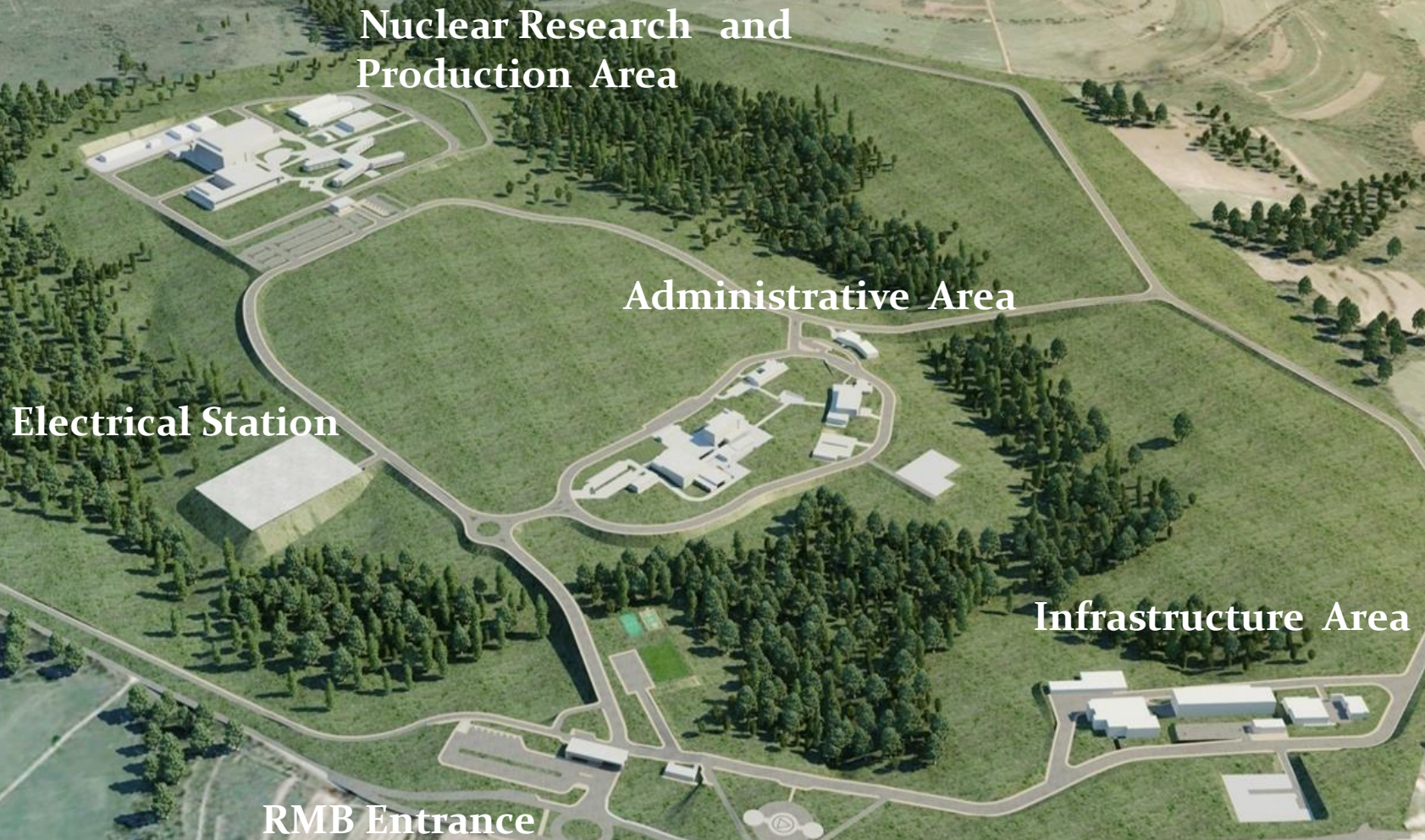
ARAMAR



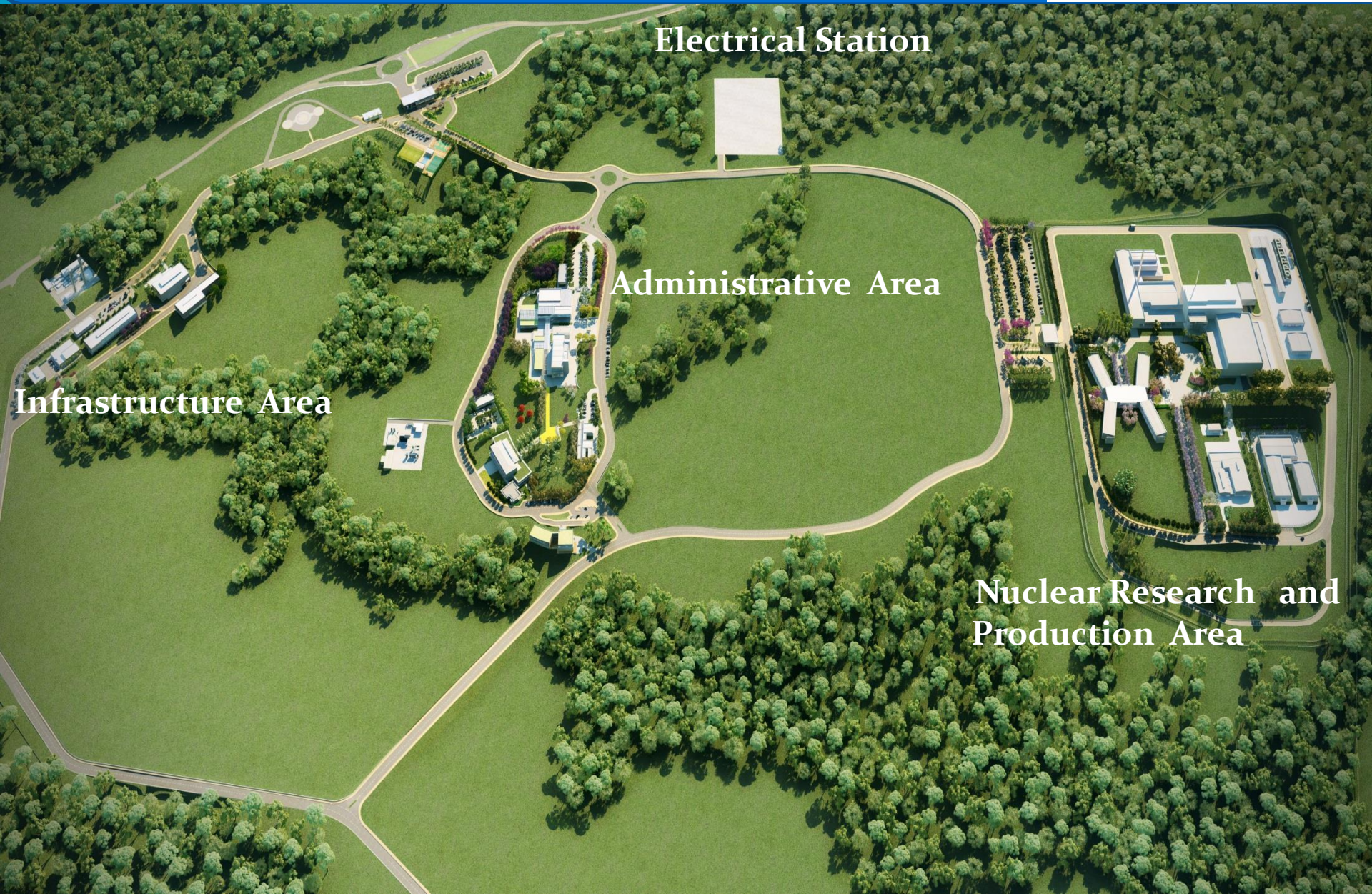
RMB Site in Iperó / SP



Project Master Plan



Project Master Plan



Electrical Station

Administrative Area

Infrastructure Area

Nuclear Research and
Production Area

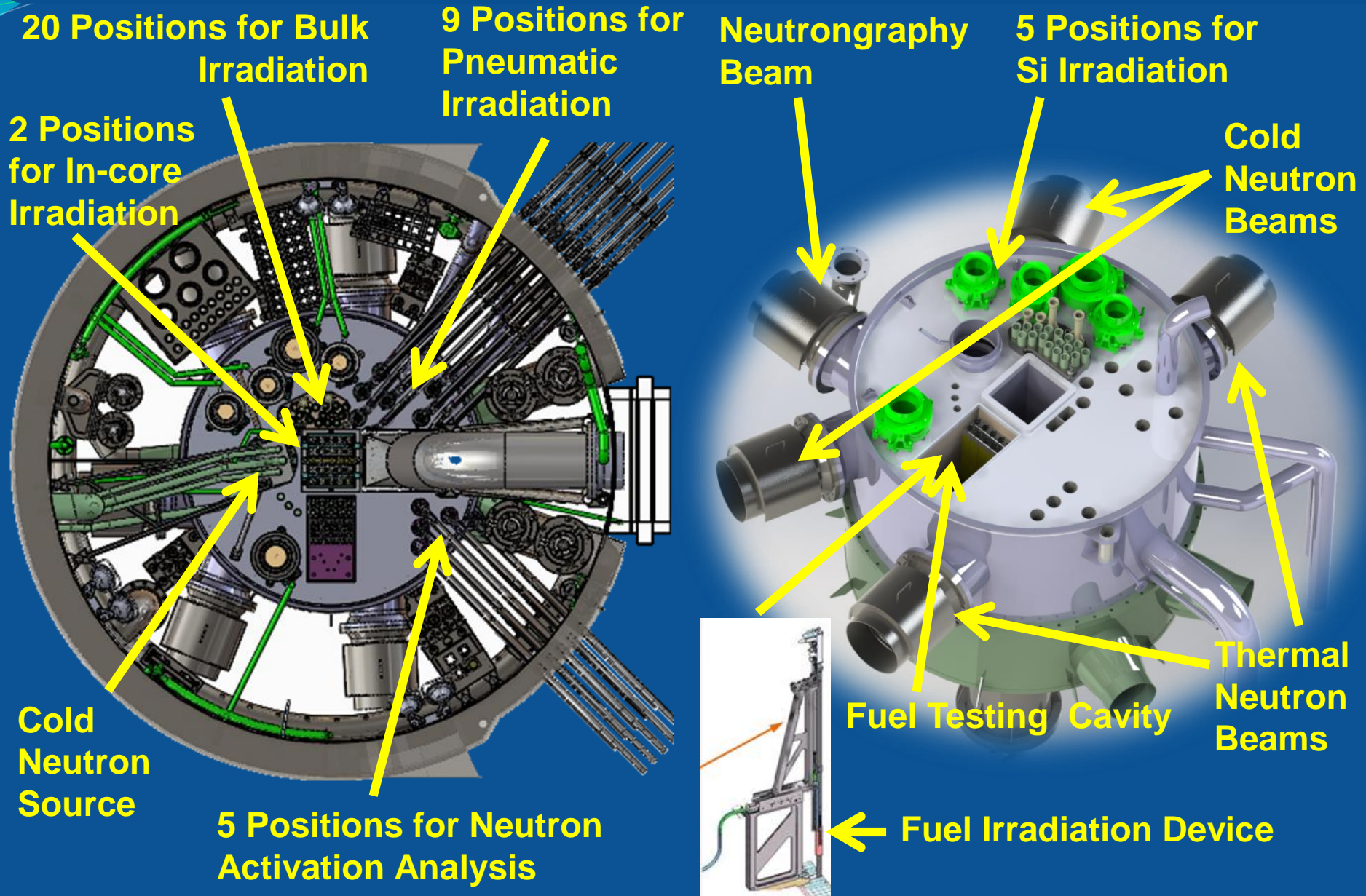
Project Master Plan

Nuclear Research and Production Area

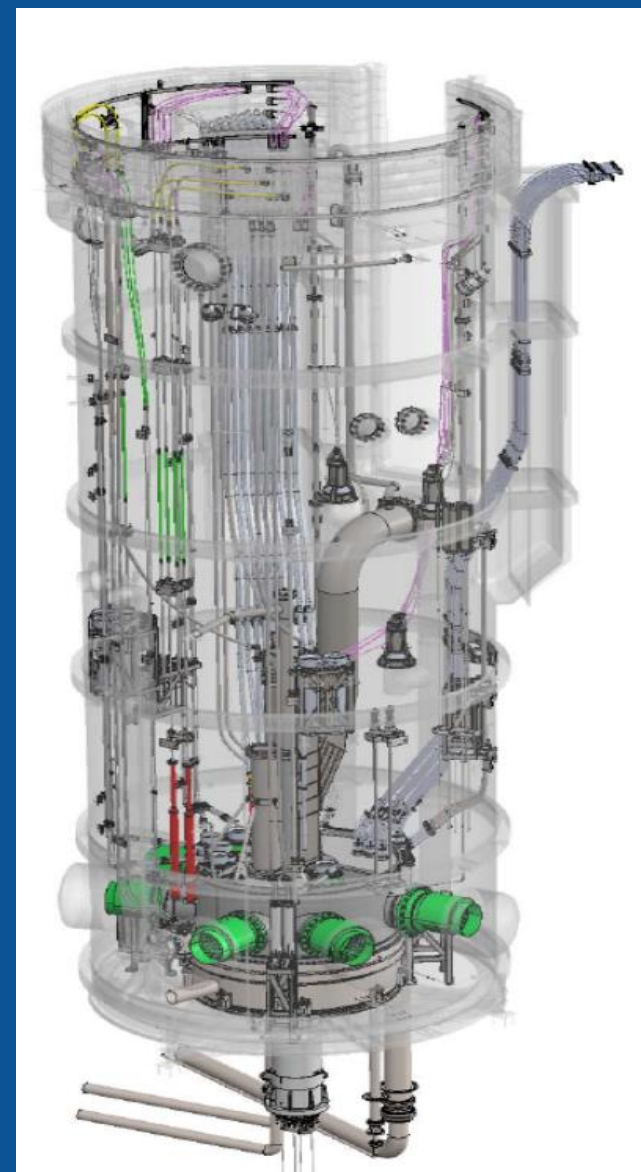
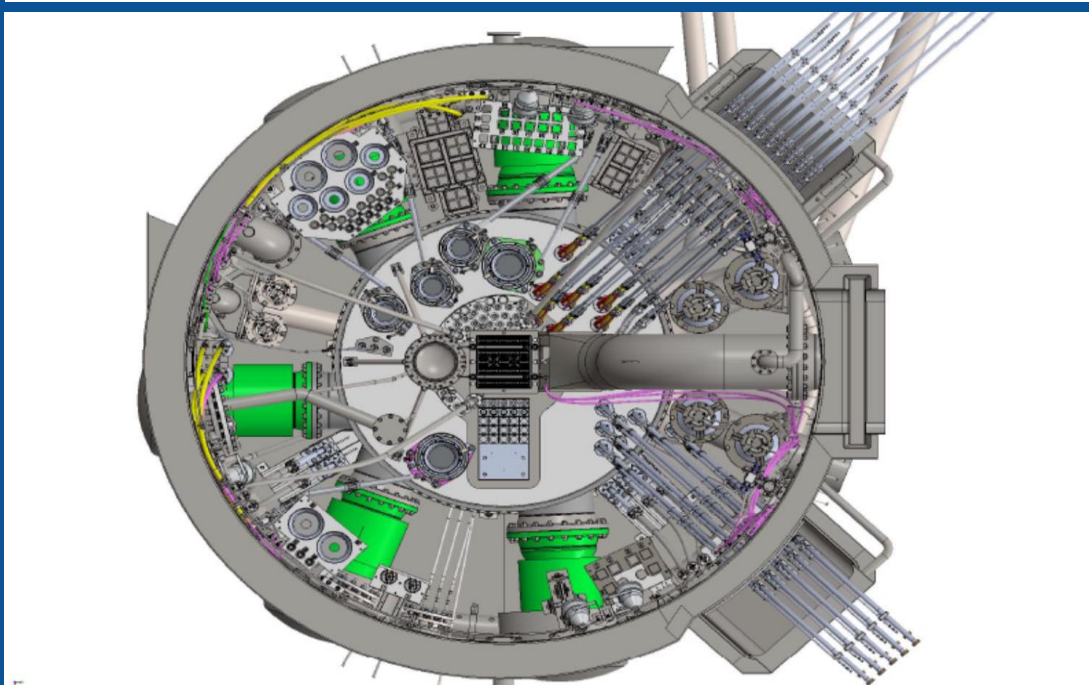
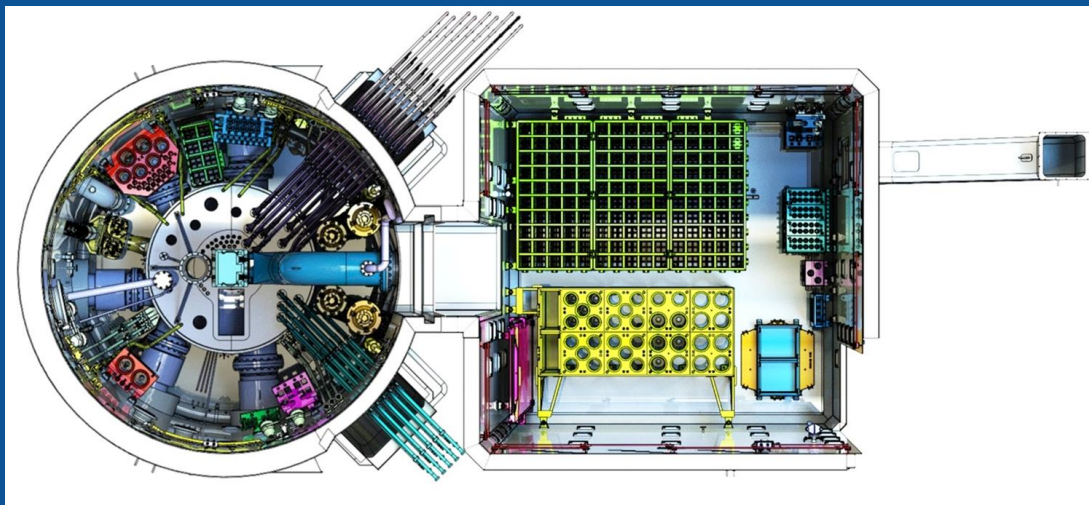


- 1 – NRPA Entrance
- 2 – Researchers Bld.
- 3 – Workshop Bld.
- 4 – Waste Processing and Storage Bld.
- 5 – Electrical Supply Bld.
- 6 – Cooling Towers
- 7 – Reactor Auxiliary Bld.
- 8 – Reactor Bld.
- 9 – Spent Fuel Bld.
- 10 – Post Irradiation Lab.
- 11 – Radioisotope Processing Bld.
- 12 – Radiochemistry Lab.
- 13 – Operator Support Bld.
- 14 – Neutron Beam Lab.

Reactor Conceptual Design



Reactor Design

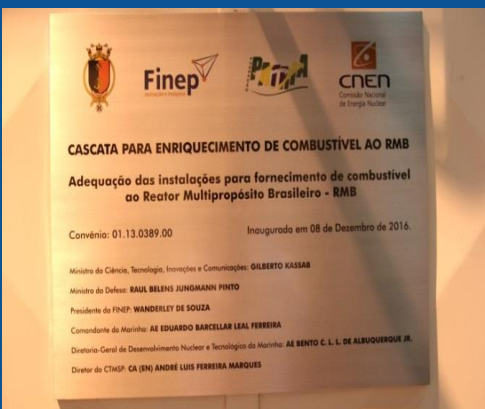


National Capacity for Fuel Assembly Development and Fabrication

- MCTI – FNDCT (FINEP) R\$25 M grant (CNEN – CTMSP)
 - UF₆ supply facility improved (CTMSP)
 - Fuel fabrication facility improved (IPEN/CNEN-SP)
 - Production of 19 plate type fuel core for the IPEN/MB-01 critical facility
- reactor physics laboratory for the RMB project

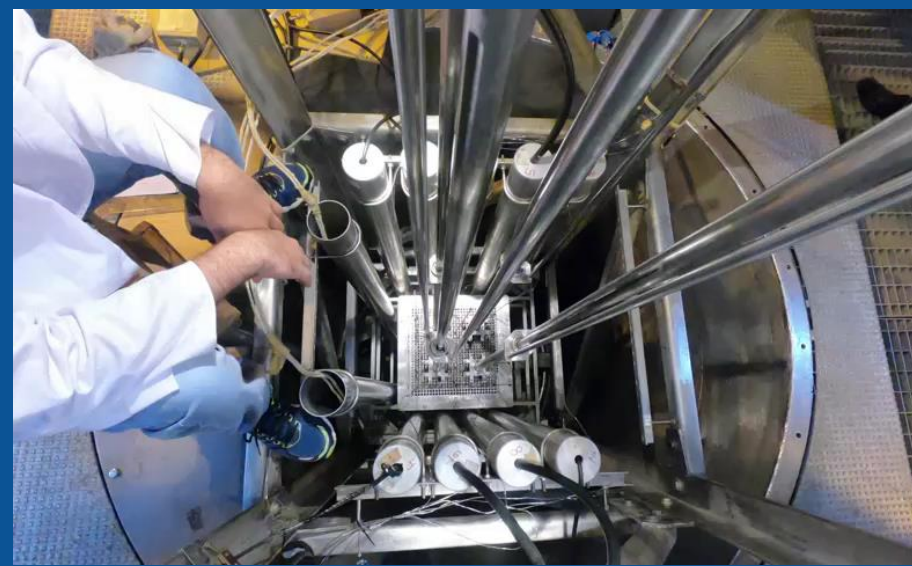
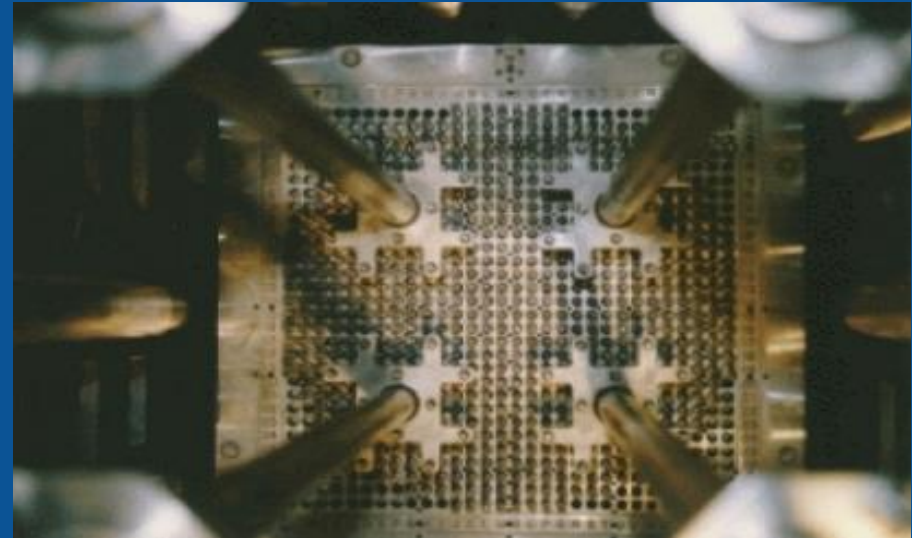
**Isotopic Enrichment Cascade
Inauguration 08/12/2016**

**Presentation of the First Fuel Assembly
31/08/2017**



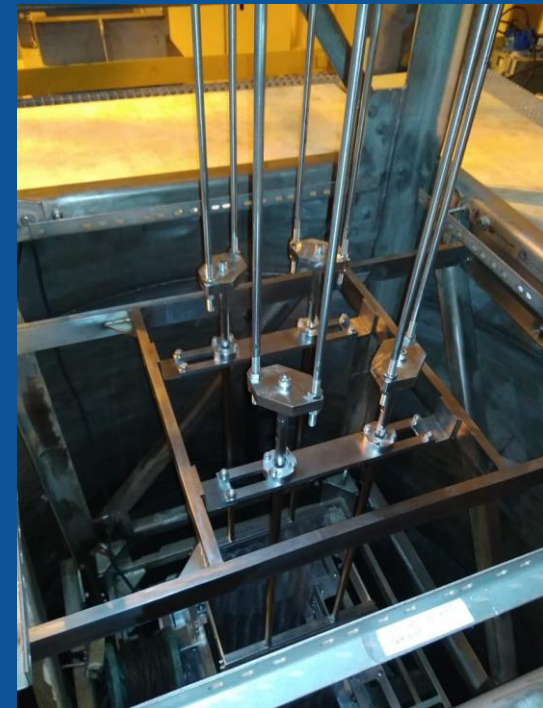
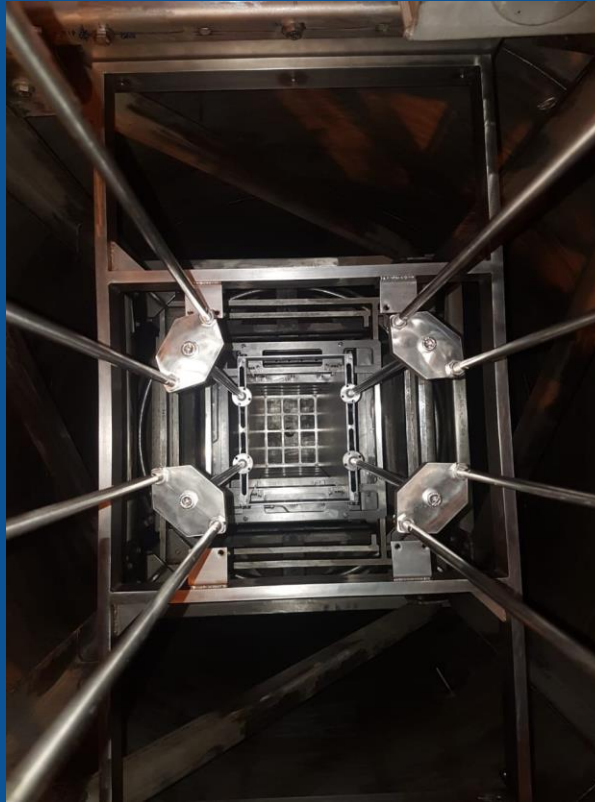
IPEN/MB-01 Reactor

Old Core - Pin Type



IPEN/MB-01 Reactor

New Core - Plate Type



Licensing Steps



Today Status



Nuclear License Steps		Site Approval		Construction License	Nuclear Material Authorization		Initial Operation Authorization	Permanent Operation License
Environmental License Steps		Initial License	Installation License				Operation License	
Design	Conceptual Design							
		Preliminary Design	Detailed Design					
Construction				Conventional Buildings, Systems and Structures				
					Buildings, Systems and Structures related to Nuclear Safety			
Commissioning						Commissioning		
Nuclear License Documents	Site Report	Preliminary Safety Analysis Report		Final Safety Analysis Report			Initial Operation Report	
		Preliminary Security Plan		Final Security Plan			Quality Management Program for Permanent Operation	
Environmental License Documents	Environmental Impact Analysis	Environmental Plans		Environmental Plans Execution Reports				
	Public Hearings	Minor Environmental Issues Solved		All Environmental Issues Solved				

FUTURE NUCLEAR TECHNOLOGY SITE OF IPERÓ

Marinha

- ✓ Tecnologia e Plantas Piloto do Ciclo do Combustível Nuclear
 - ✓ Conversão
 - ✓ Enriquecimento
 - ✓ Reconversão
 - ✓ Produção de Combustível
- ✓ Reator de Potência de Pequeno Porte (LABGENE)
- ✓ Formação de Recursos Humanos para Área Nuclear e Propulsão Nuclear
- ✓ Treinamento de Operadores para Área Nuclear e Propulsão Nuclear



CNEN

- ✓ Reator RMB
- ✓ Laboratório Nacional de Nêutrons
- ✓ Laboratório de Produção de Radioisótopos
- ✓ Laboratório Pós-Irradiação
- ✓ Laboratório Nacional de AAN
- ✓ Laboratório de Fusão Nuclear
- ✓ Laboratório de Aceleradores de Partículas
- ✓ Laboratório de Laser de Alta Potência
- ✓ Centro de Radiofarmácia
- ✓ Centro Integrado para Desenvolvimento de Diagnóstico e Terapia Utilizando Radiação
- ✓ Pós-Graduação em Tecnologia Nuclear
- ✓ Formação de Técnicos para o Setor Nuclear em Saúde

CTMSP / ARAMAR

RMB

Thank you !