REATOR MULTIPROPÓSITO BRASILEIRO - RMB

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2014 LAS/ANS SYMPOSIUM

"Small Modular Reactors for Nuclear Power"

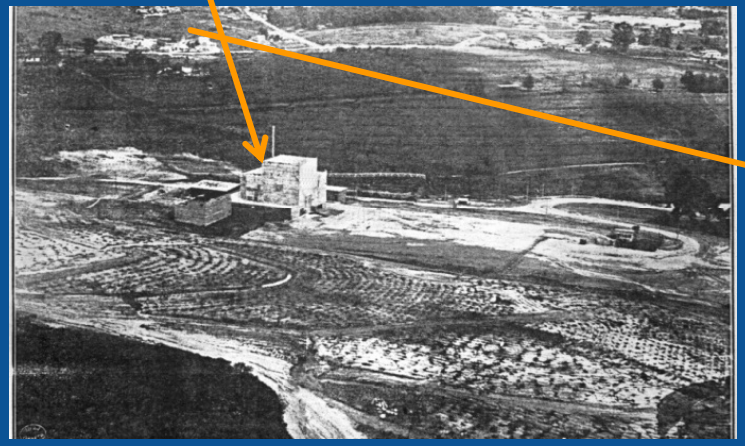
CONTENT

1. The RMB Project
2. Project Status:
   - Project management
   - Site
   - Licensing
   - Project Highlights

RESEARCH REACTORS IN BRAZIL

Name	Utilization	Power	Site	Startup	Type
IPEN/MB-01	Critical facility – PWR Core analysis	100 W	IPEN/CNEN-SP São Paulo	1988	Open Core - Pin Type
ARGONAUTA	Research -Education	500 W	IEN/CNEN-RJ Rio de Janeiro	1965	Argonaut
IPR-R1	Research -Education	100 kW	CDTN/CNEN-MG Belo Horizonte	1960	TRIGA MARK-I
IEA-R1	Research Radioisotope Production	5 MW (2MW)	IPEN/CNEN-SP São Paulo	1957	Reator MTR Piscina Aberta

1957 : IEA → 2014: IPEN/CNENSP



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WHY A NEW RESEARCH REACTOR ?

- **The RMB will provide Brazil with a key infrastructure to national development activities of the nuclear sector in the areas of social, strategic, industrial, scientific and technological development and application .**

- **Structuring project.**

RMB MAIN FUNCTIONS

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

RADIOISOTOPE PRODUCTION

RMB Objectives

Social Application

- National autonomy in producing radioisotopes for application in medicine, industry, agriculture and environment
- Emphasis on Mo-99 production for Tc-99m provision to the nuclear medicine application
- To support the increase of the nuclear medicine application in benefit of the society

RMB is a key factor for the supply of $^{99}Mo/^{99m}Tc$ to the nuclear medicine application in Brazil

Nuclear Fuel and Materials Irradiation Testing

RMB Objectives

Strategic and Industrial Application

To generate national capacity for testing and qualifying:

- nuclear fuels for power reactors
- new nuclear fuels for research reactors
- materials for nuclear reactors apllication

RMB is a key factor for the autonomous development of nuclear fuel and materials for reactor application

NEUTRON BEAM LABORATORY

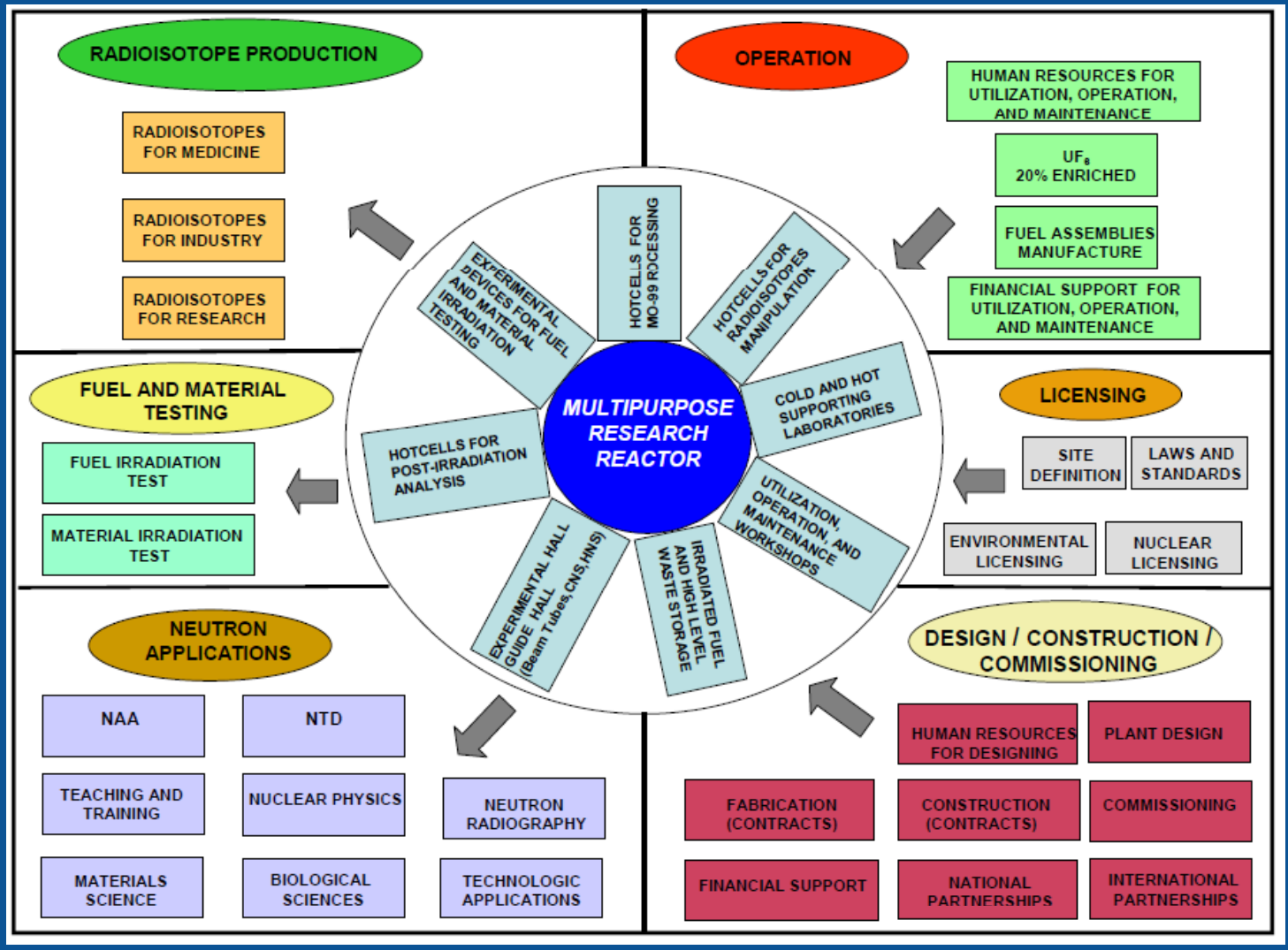
RMB Objectives

Scientific and Technological Development

- To increase the national capacity in R&D in nuclear techniques applications
- To have a Neutron Activation Analysis Laboratory available for the scientific and technical community
- To create a National Laboratory for Neutron Beam Utilization in complement to the National Laboratory of Synchrotron Light (LNLS)

RMB will contribute strongly to S&T&I in Brazil

RMB PROJECT SCOPE



RMB PROJECT MANAGEMENT

- Project managed by the Research and Development Directorate of the Brazilian Nuclear Energy Commission (DPD-CNEN)
- Scope and preliminary design, licensing process managing 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 and detailed design, manufacturing, construction, assembling and their management will be carried out by national and international companies.
- Project technically supported by Brazilian Academy
- Project Cost estimation of US$ 500 million
- Project time span of at least 6 years after the first contract signature and availability of funds. (2013)

RMB PROJECT STATUS

- CNEN Institutes technicians developed the conceptual engineering design of the reactor systems and main facilities.
- Basic engineering design of systems, buildings and infrastructure of the RMB (except basic engineering design of pure nuclear systems and components). Brazilian company INTERTECHNE contract under development.
- Brazil-Argentina Agreement (CNEN-CNEA) for common basic engineering design of the RMB and RA-10 (pure nuclear part). OPAL reactor in Australia as a reference. Argentinean company INVAP contract under development.
- Environmental licensing process started. Term of Reference for EIA approved by IBAMA. EIA done by Brazilian Company MRS. EIA under analysis of IBAMA. Three public hearings done.
- Nuclear licensing process started. Site Evaluation Report is under analysis by DRS/CNEN.

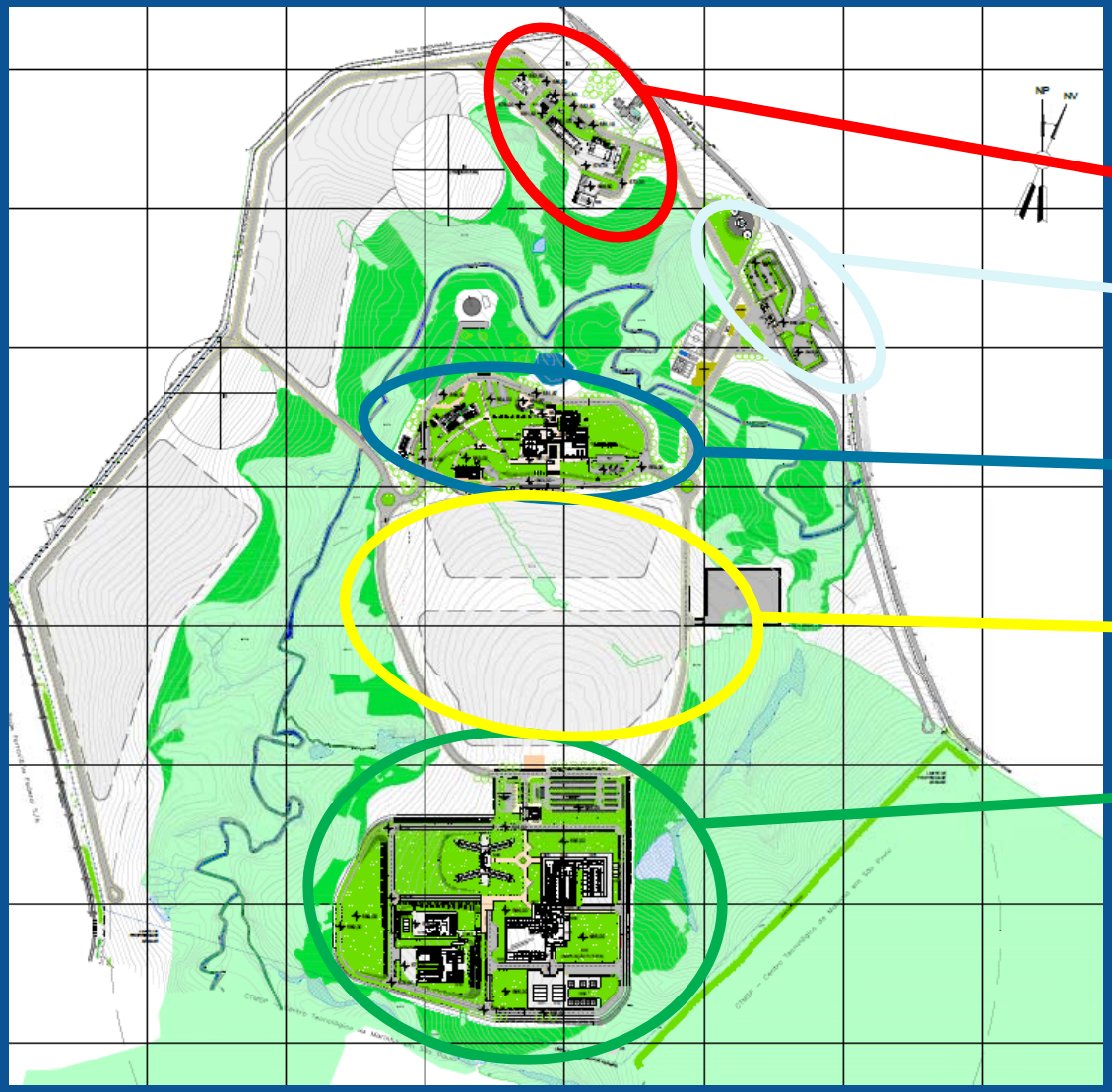
RMB SITE

Distâncias: (Rota / Linear)
Iperó / São Paulo (140 Km / 109 Km)
Iperó / Sorocaba (50 Km / 39 Km)

N

RMB SITE

RMB SITE



- Site Services
- Main Entry Area
- Educational and Administrative Area
- Future extension
- Nuclear Research and Production Area

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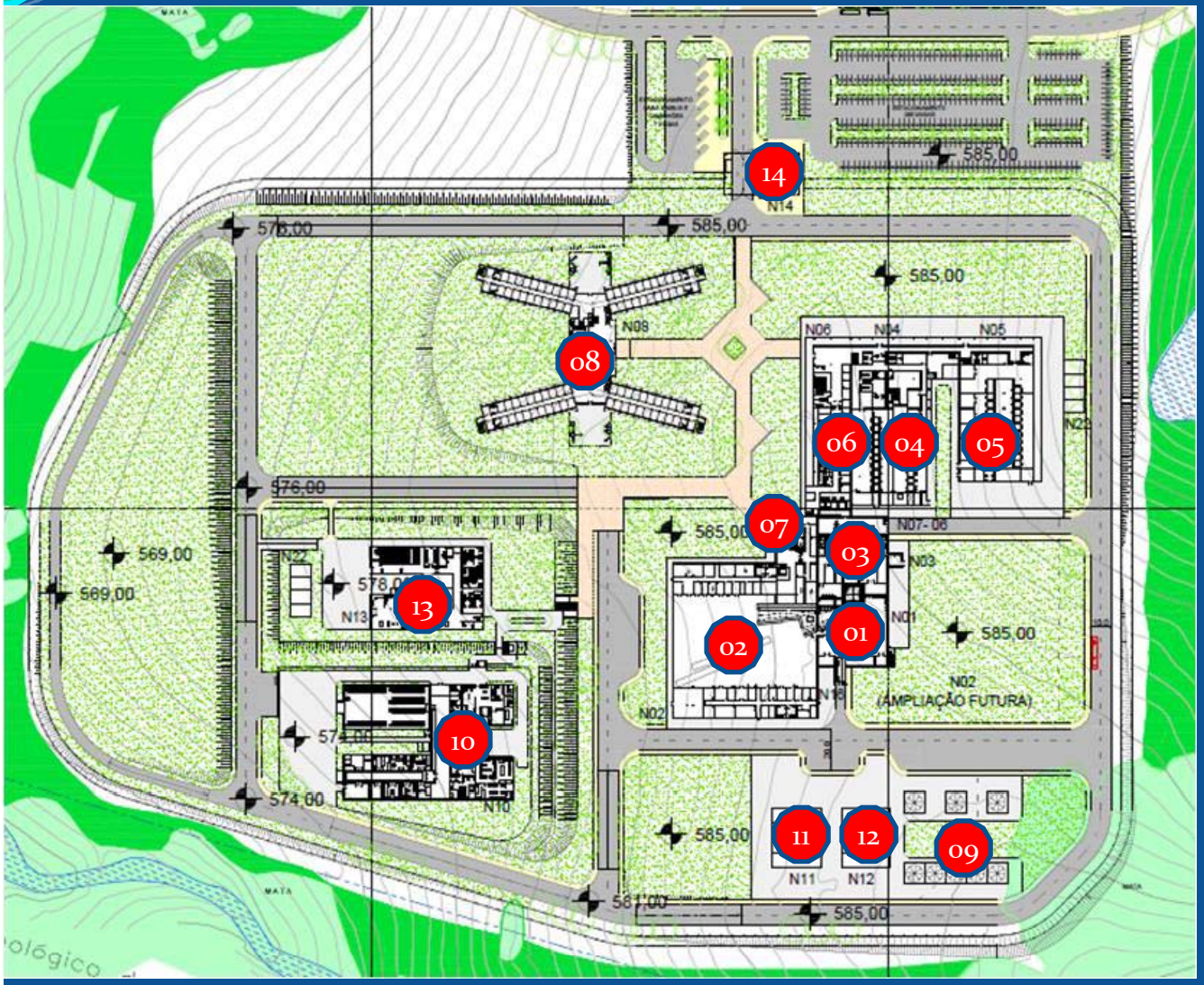

N01 – Reactor Building
N02 – Neutron Guide Bldg
N03 – Spent Fuel Bldg
N04 – Hot Cells and Labs for RI production
N05 – Hot Cells and Labs for Material testing
N06 – Radiochemistry Labs
N07 – Operation Offices
N08 – Researchers Offices
N09 – Cooling Towers
N10 – Waste Management Bldg
N11,N12 – Substation and Diesels
N13 – General Workshops
N14 – Access control

Nuclear Research and Production Area

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Nuclear Research and Production Area

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Nuclear Research and Production Area

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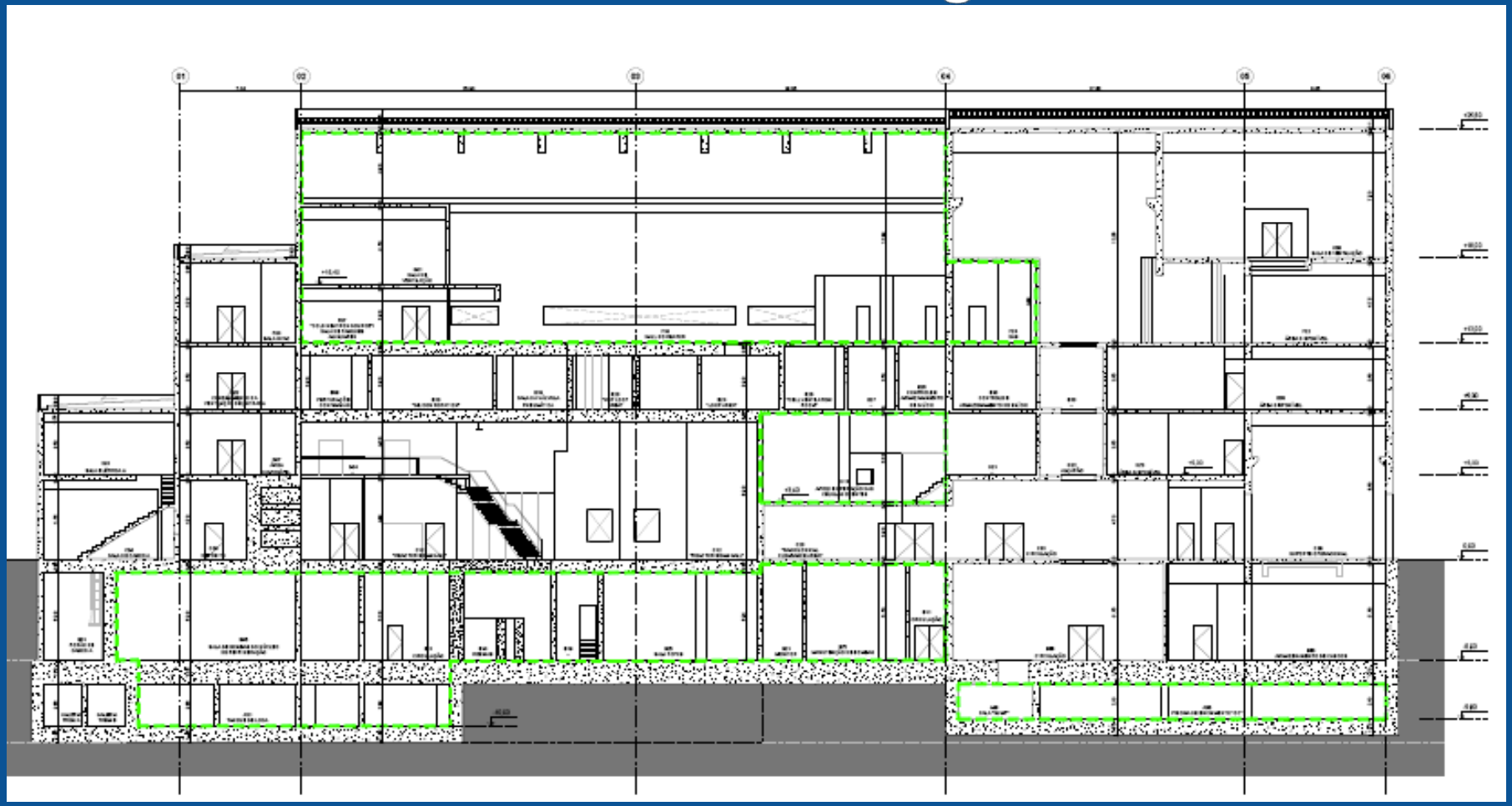
Core Design Features

- Thermal Power: 30 MW
- Fuel Assemblies: LEU – MTR
- Core configuration: 5 x 5 grid with 23 FAs and 2 in-core irradiation positions
- Control Rods: 6 Hf plates (3 per Guide Box)
- Core Cooling: 3100 m^3/h upward direction

RMB PROJECT HIGHLIGHTS

South – North Building Section



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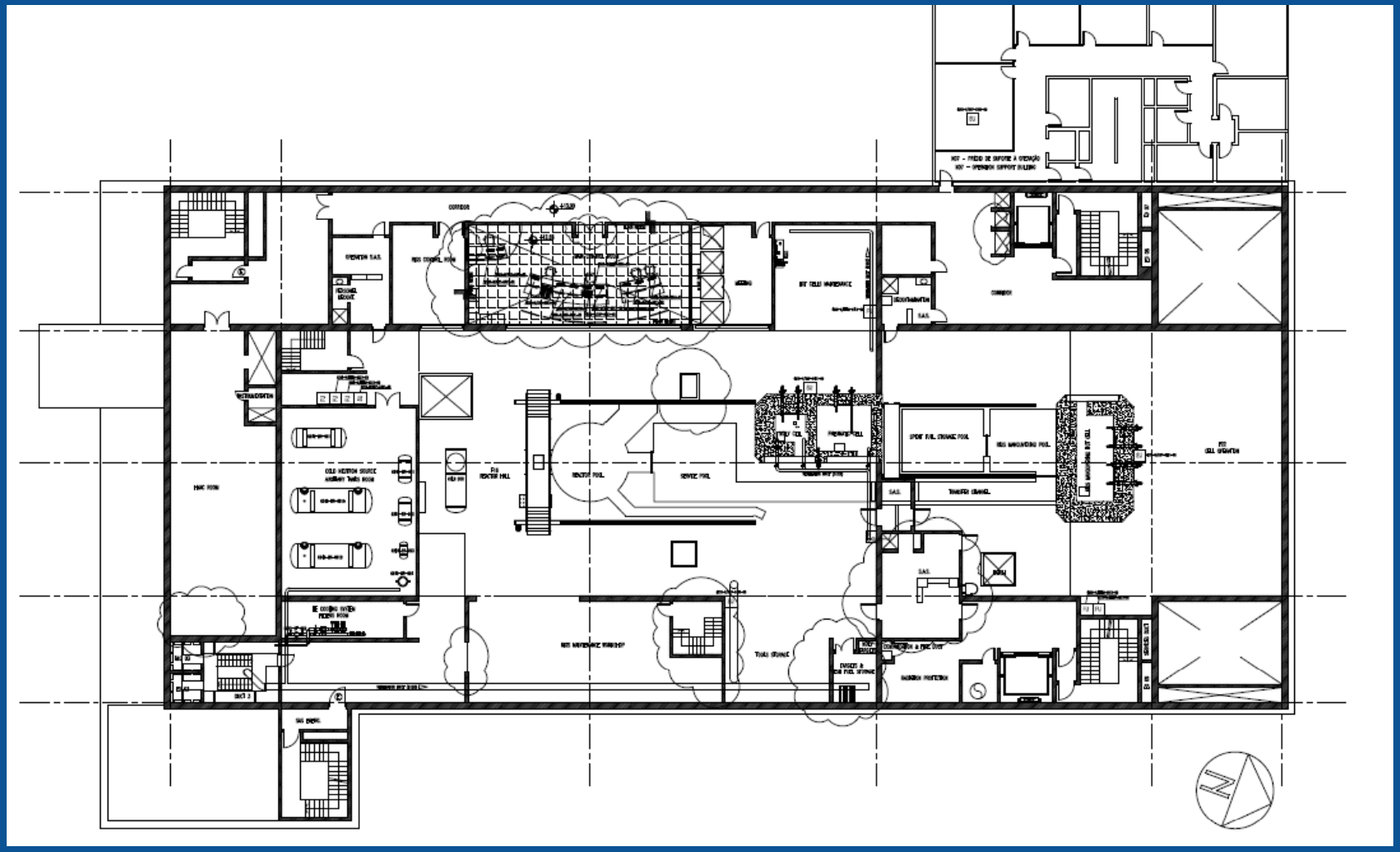
RMB PROJECT HIGHLIGHTS

+ 13.00 m level



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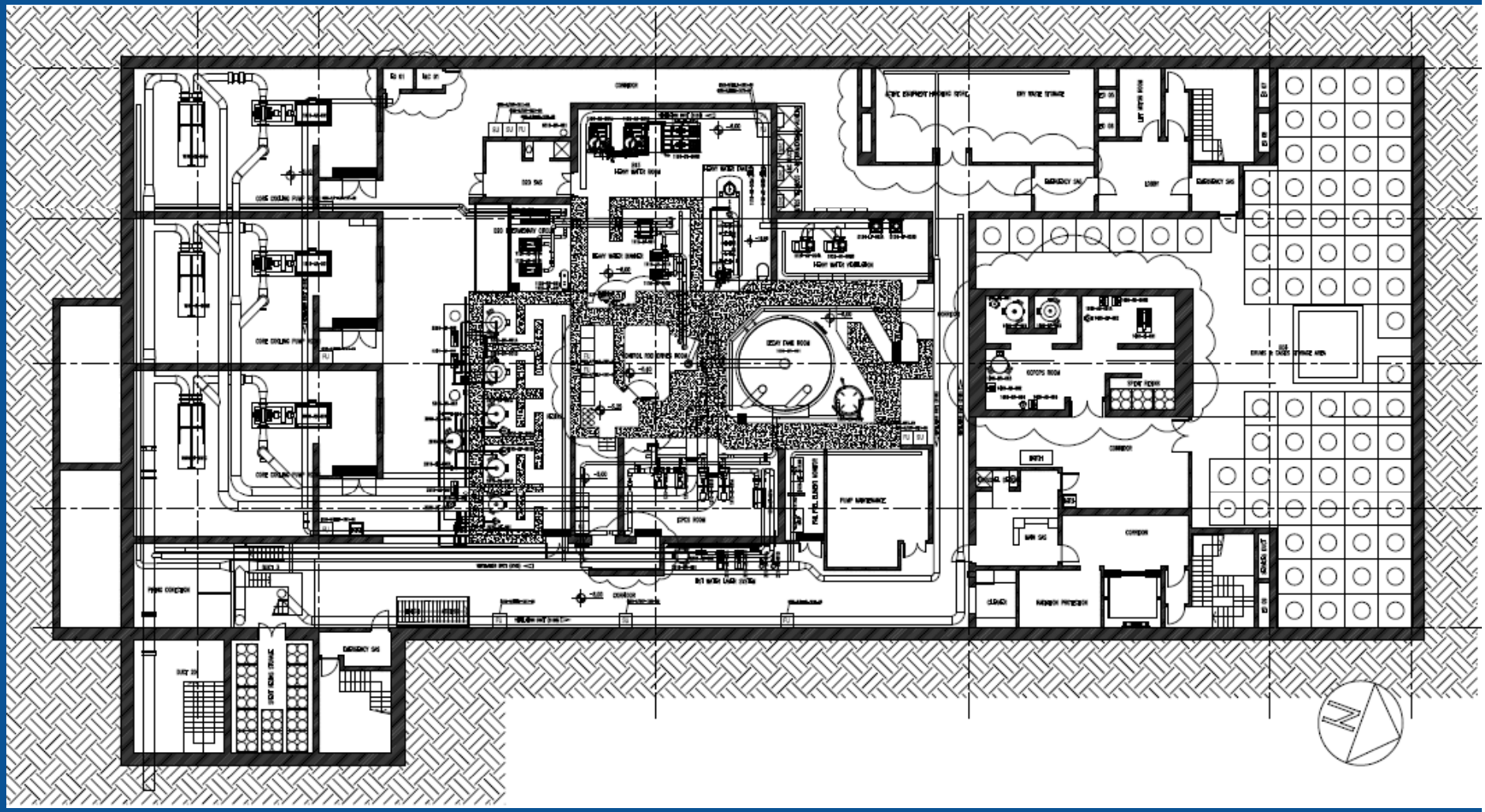
RMB PROJECT HIGHLIGHTS

- 6.00 m level



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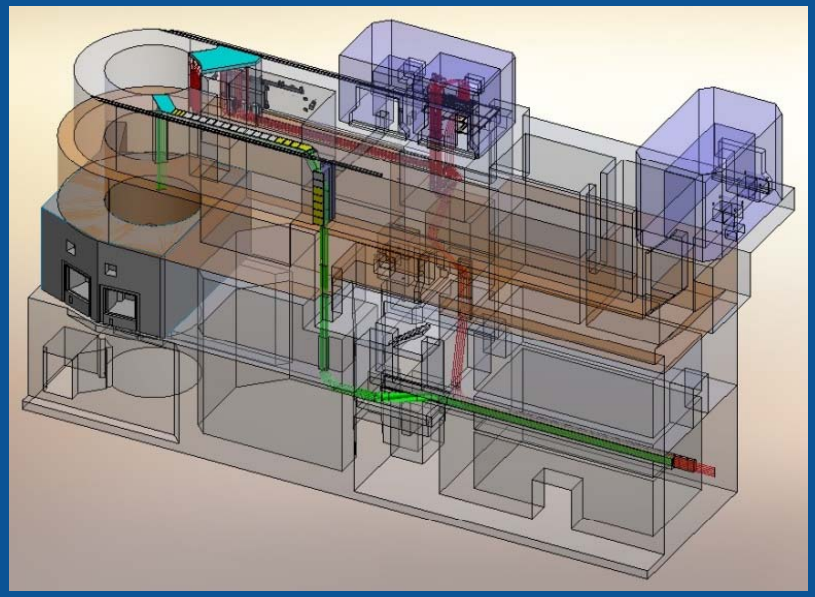
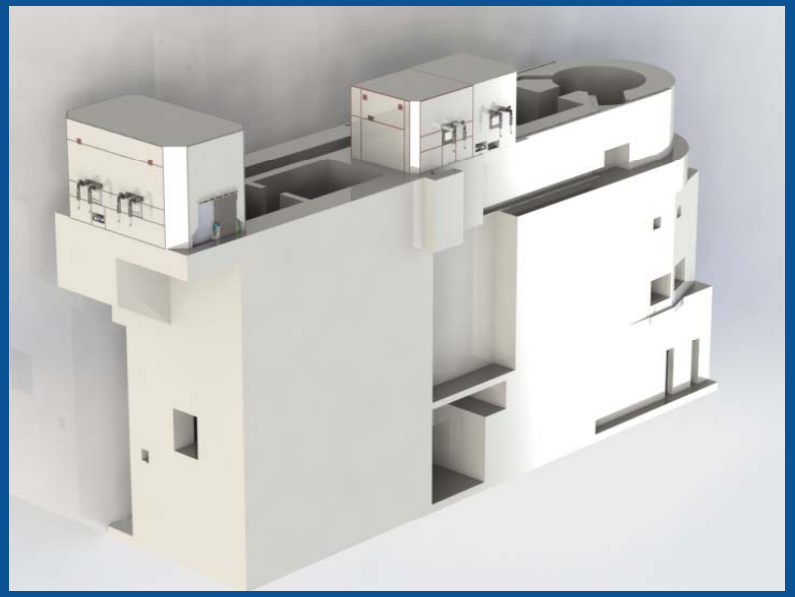
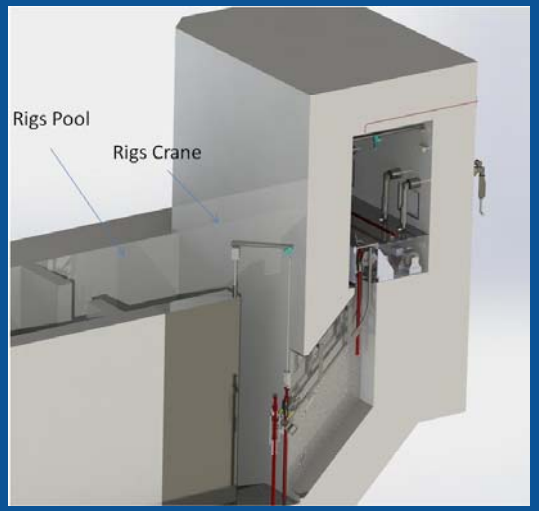




Hot Cells



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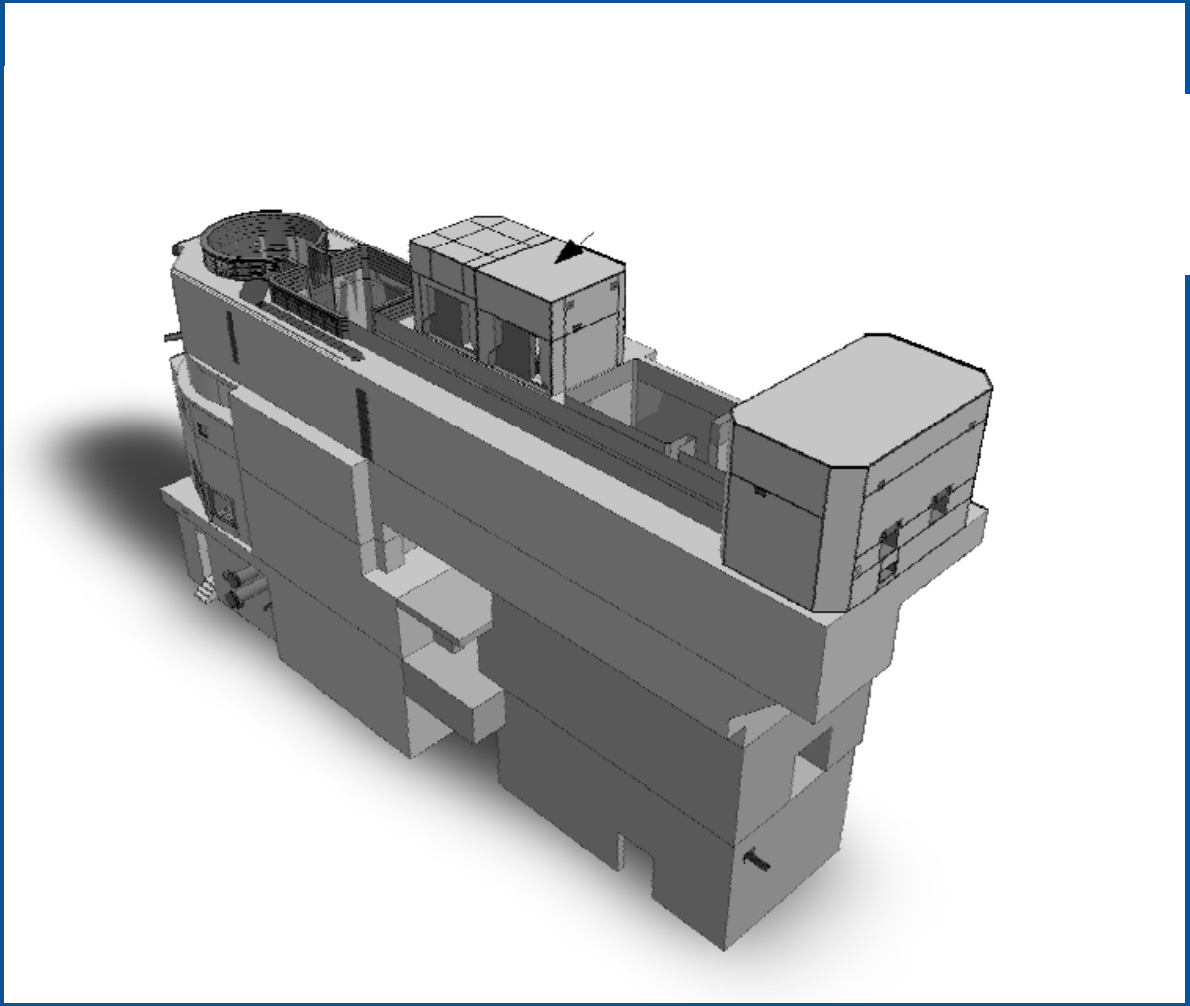
RMB PROJECT HIGHLIGHTS

Reactor Block and Embedded Components



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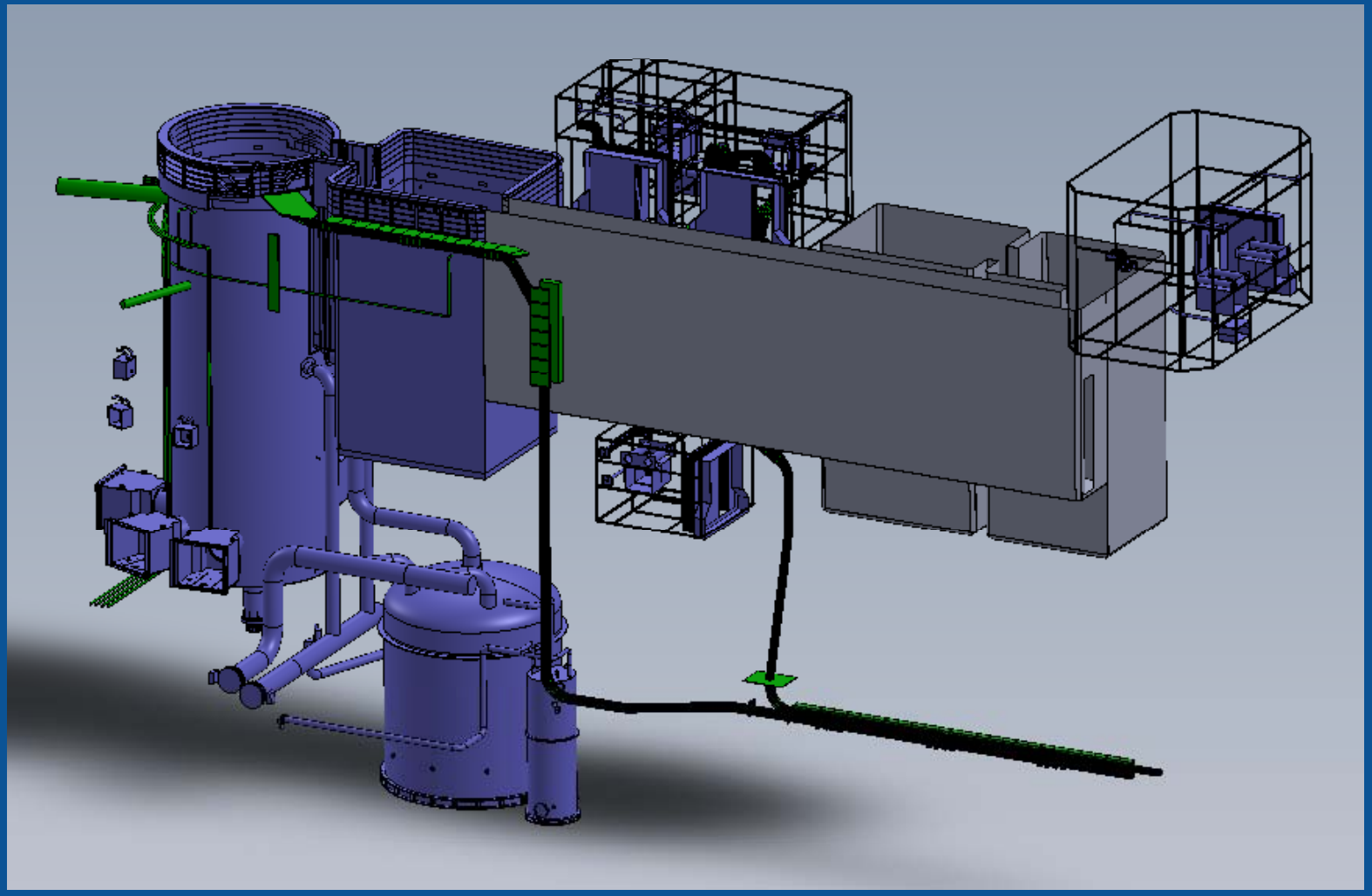
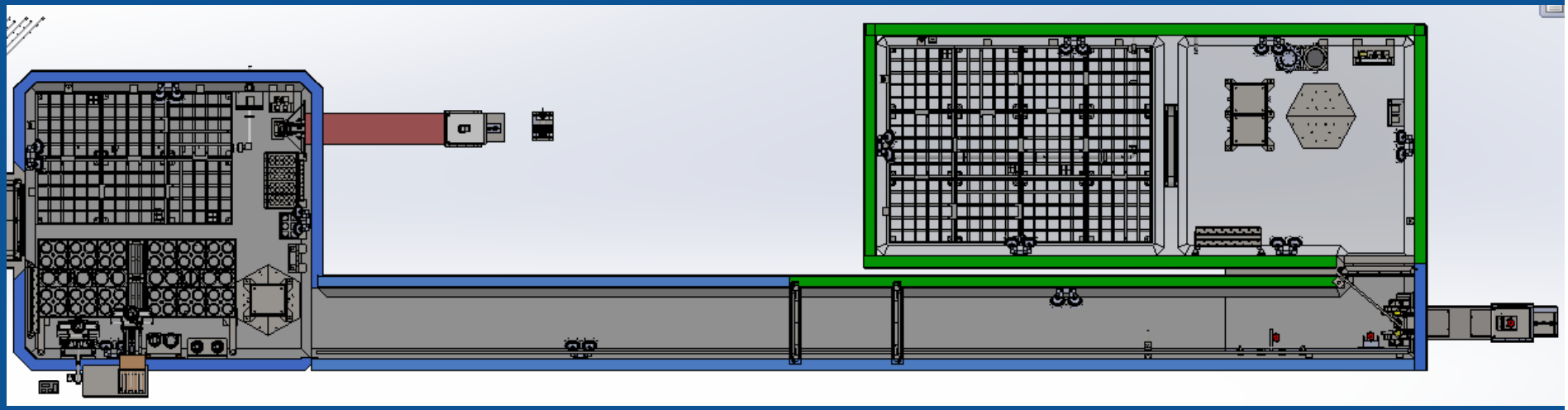
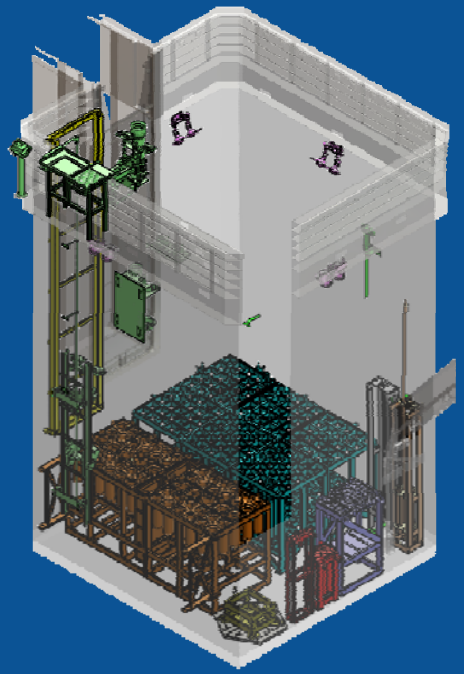


RMB PROJECT HIGHLIGHTS

Pools





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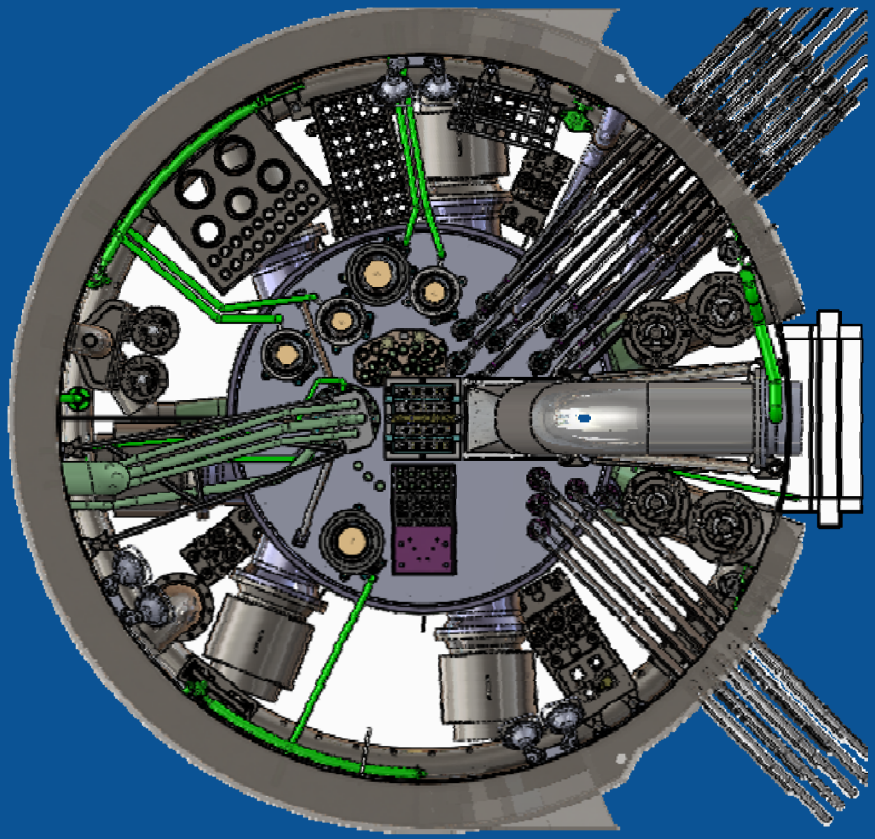
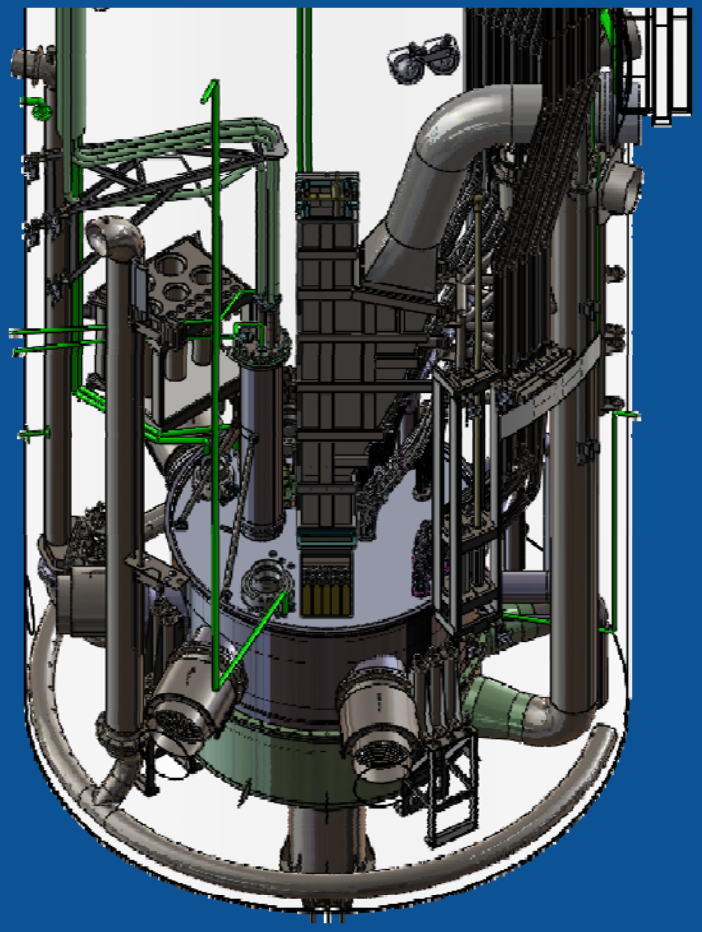
RMB PROJECT HIGHLIGHTS

Reactor Layout





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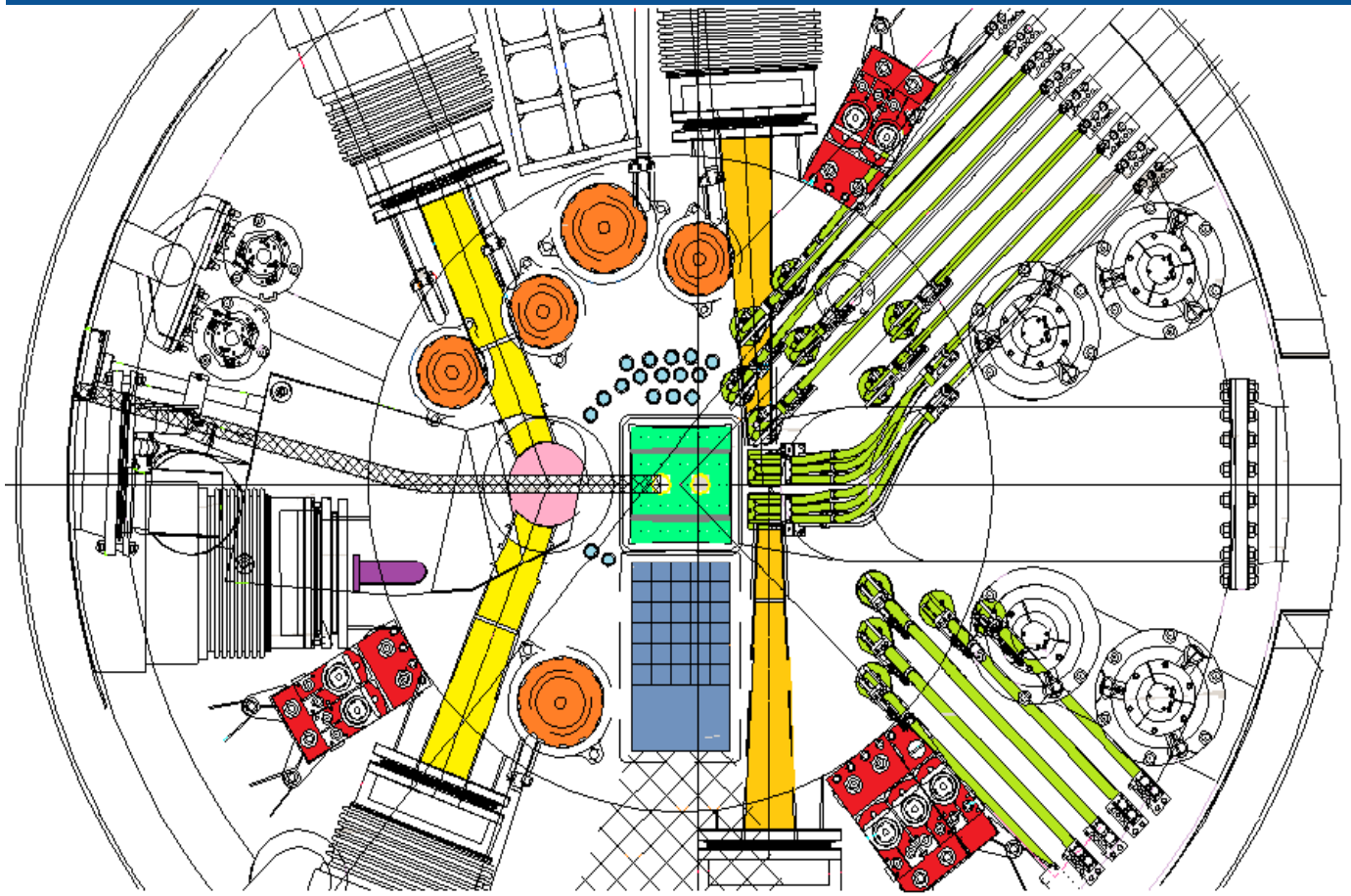
Reactor layout



- Pneumatics
- Silicon
- Cold Neutron Source
- Out of Core Irradiation Facilities
- Cold Neutron Beams
- Thermal Neutron Beams
- Neutrongraphy Beam
- Fuel Irradiation Facility
- Neutronic Detectors

RMB PROJECT HIGHLIGHTS

Reflector Vessel - Irradiation Facilities

NTD Irradiation Positions

Quantity	3	2
Main Dimension	Ø 6”	Ø 8”

Bulk Irradiation Positions

Quantity	17 + 3
Main Dimension	Ø 60mm

Pneumatic Irradiation Positions

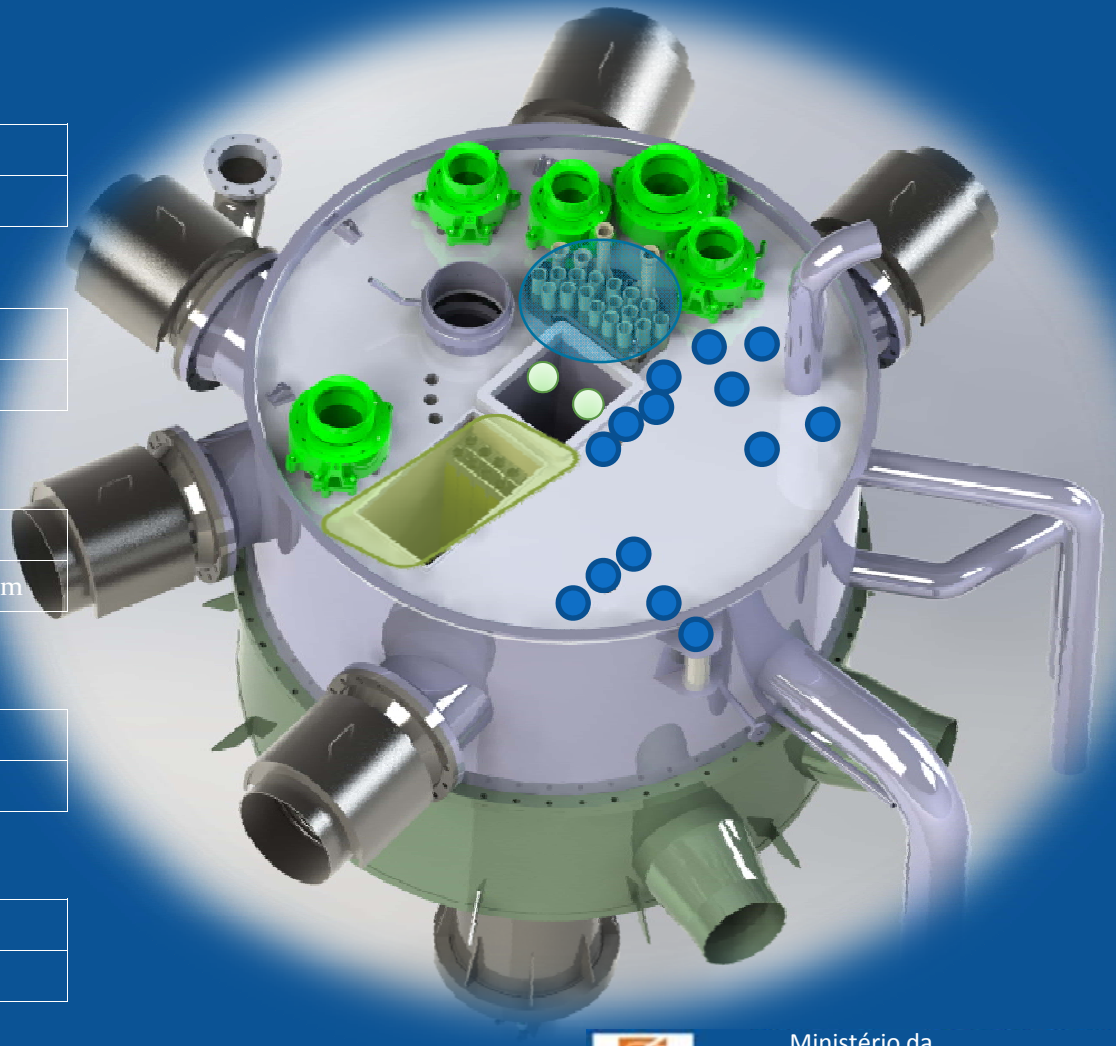
Quantity	14	1
Main Dimension	Ø 110.3mm	110mm x 260mm

Loop Irradiation Area

Quantity	1
Main Dimension	410mm x 750mm

In Core Irradiation Positions

Quantity	2
Main Dimension	Ø 53,6 mm



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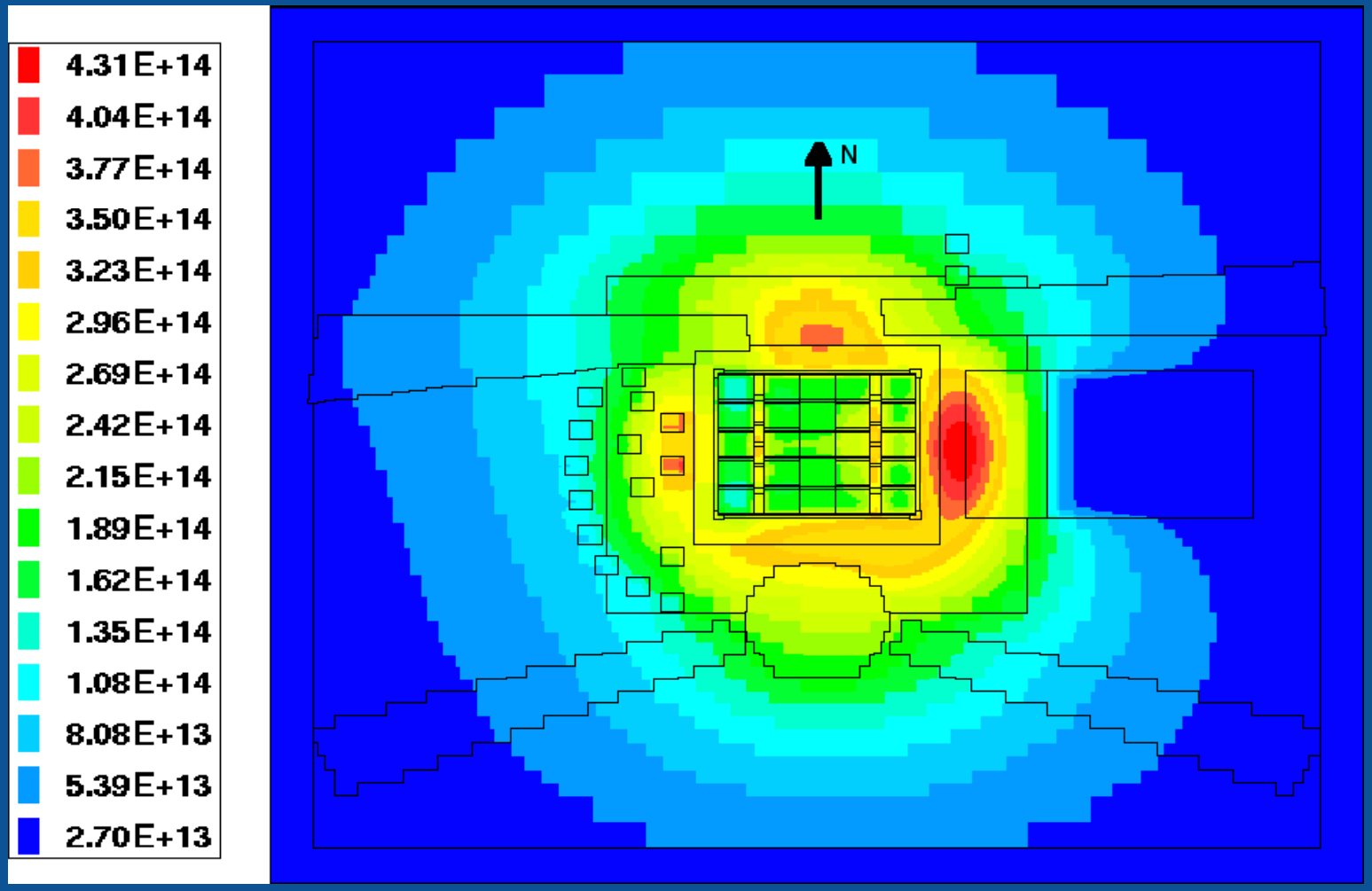
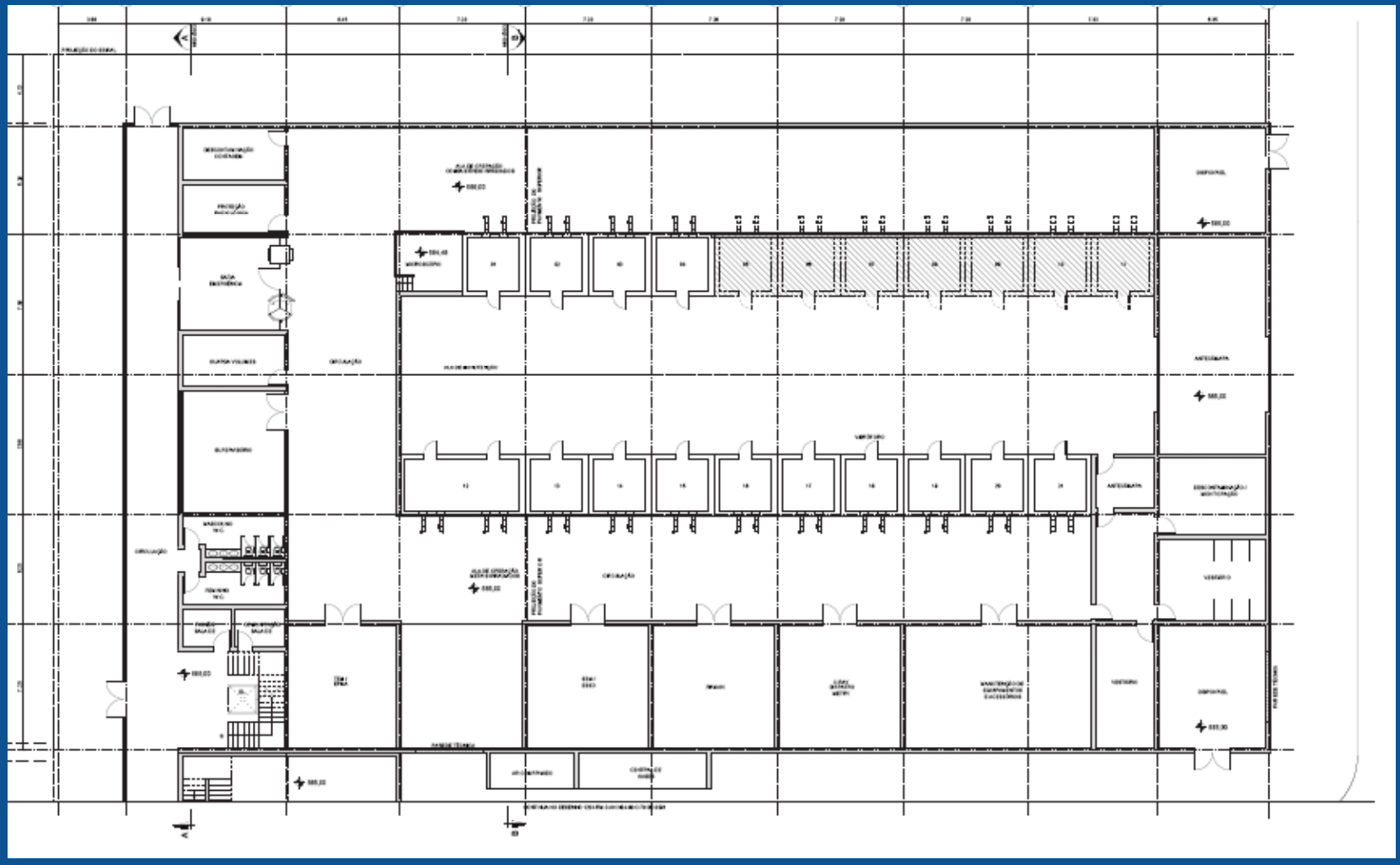
RMB PROJECT HIGHLIGHTS

Thermal flux [n/cm²s]En <0.625 eV - Midline of active length



RMB PROJECT HIGHLIGHTS

Post Irradiation Laboratory



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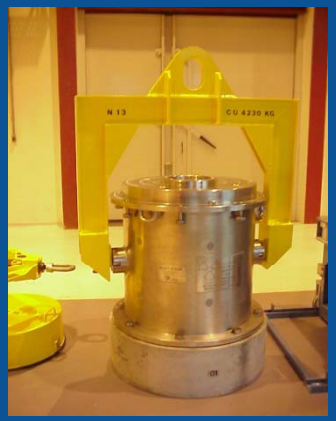

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Thank You