

REATOR MULTIPROPÓSITO BRASILEIRO - RMB



CONTENT

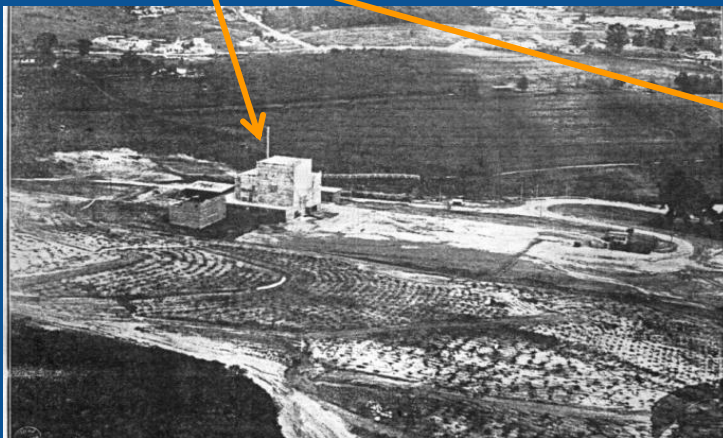
1. The RMB Project
2. Project Status:
 - Project management
 - Site
 - Licensing
 - Project Highlights

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

2013: IPEN/CNENSP



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**

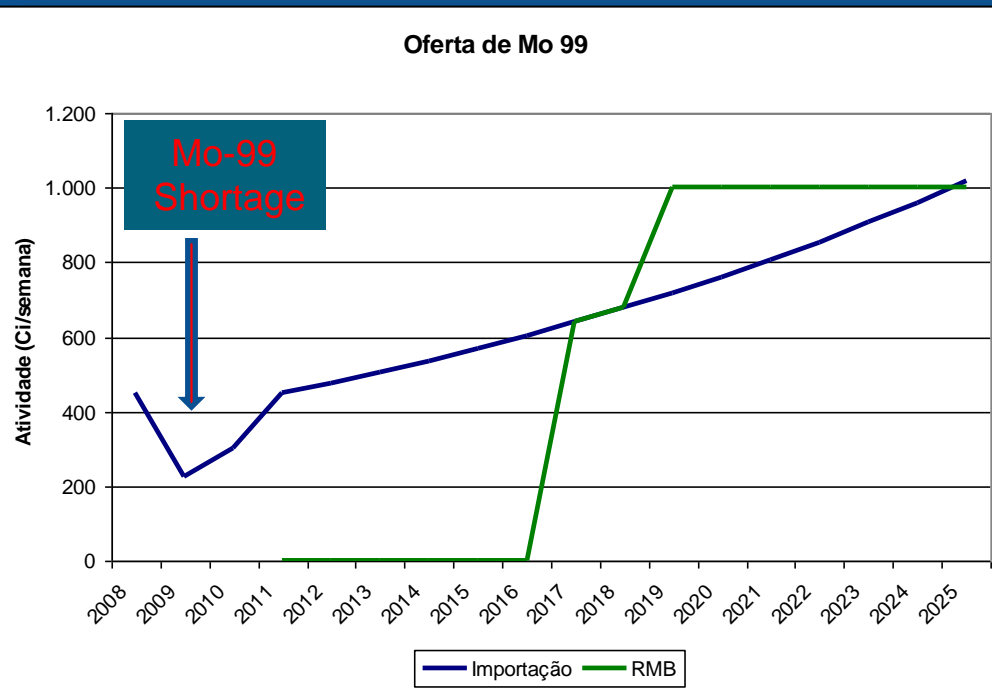
RADIOISOTOPE PRODUCTION

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

RADIOISOTOPE PRODUCTION



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

- **Radioisotope for Injectable Radiopharmaceuticals**
 - ❖ $^{99}\text{Mo}/^{99\text{m}}\text{Tc}$, ^{131}I , ^{51}Cr , ^{153}Sm , ^{177}Lu , ^{166}Ho , ^{90}Y , ^{188}W , ^{32}P
 - ✓ ^{99}Mo obtained by LEU target irradiation and processing
 - ✓ 1000 Ci/week (Today 450 Ci/week imported by IPEN)
- **Radioisotope for Brachtherapy**
 - ❖ ^{125}I , ^{192}Ir
- **Radioisotope for Industry**
 - ❖ ^{192}Ir , ^{60}Co
- **Tracers**
 - ❖ ^{203}Hg , ^{131}I , ^{82}Br

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 application

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

NEUTRON BEAM LABORATORY

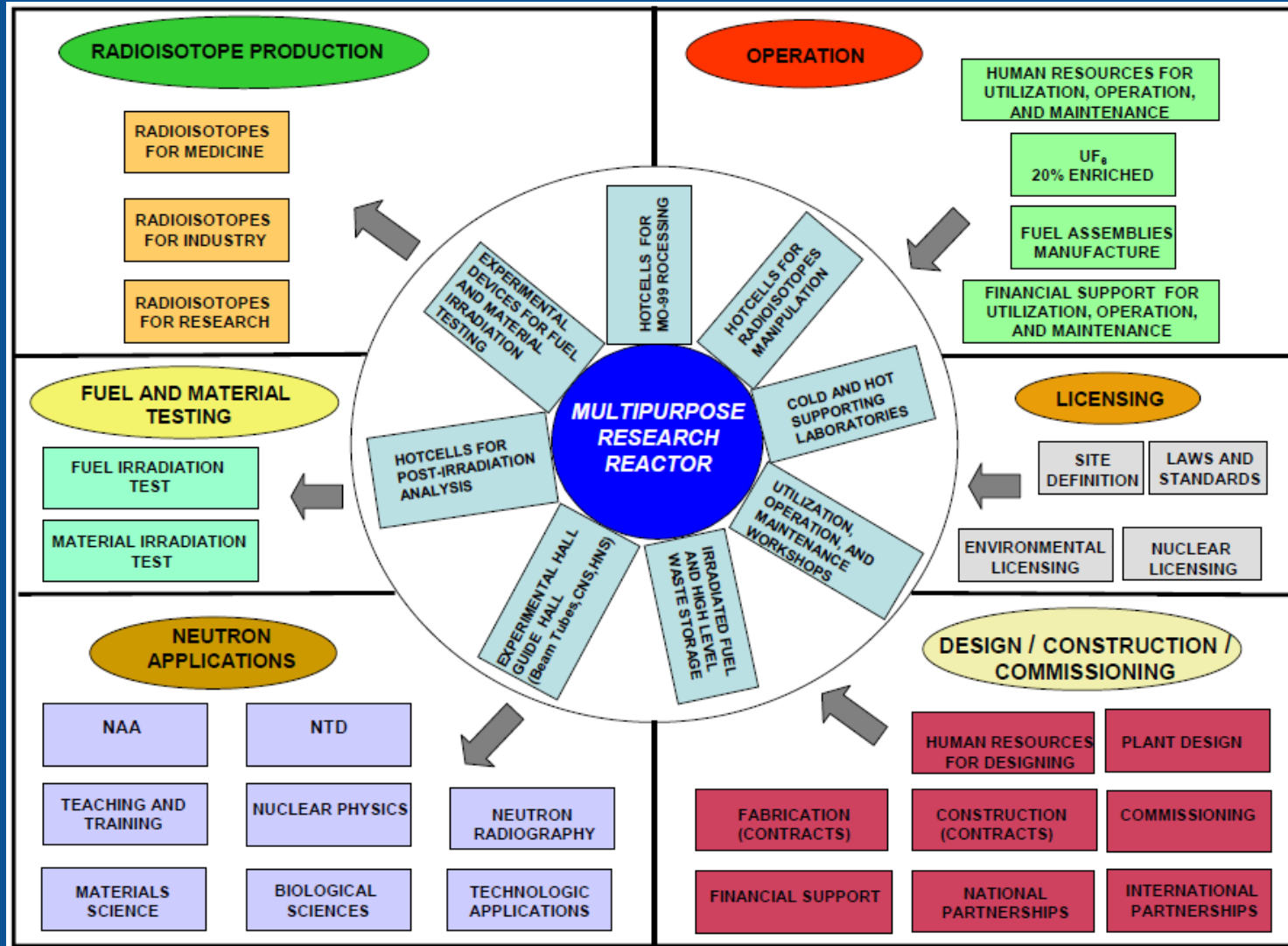
RMB Objectives

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 positively to S&T&I in Brazil

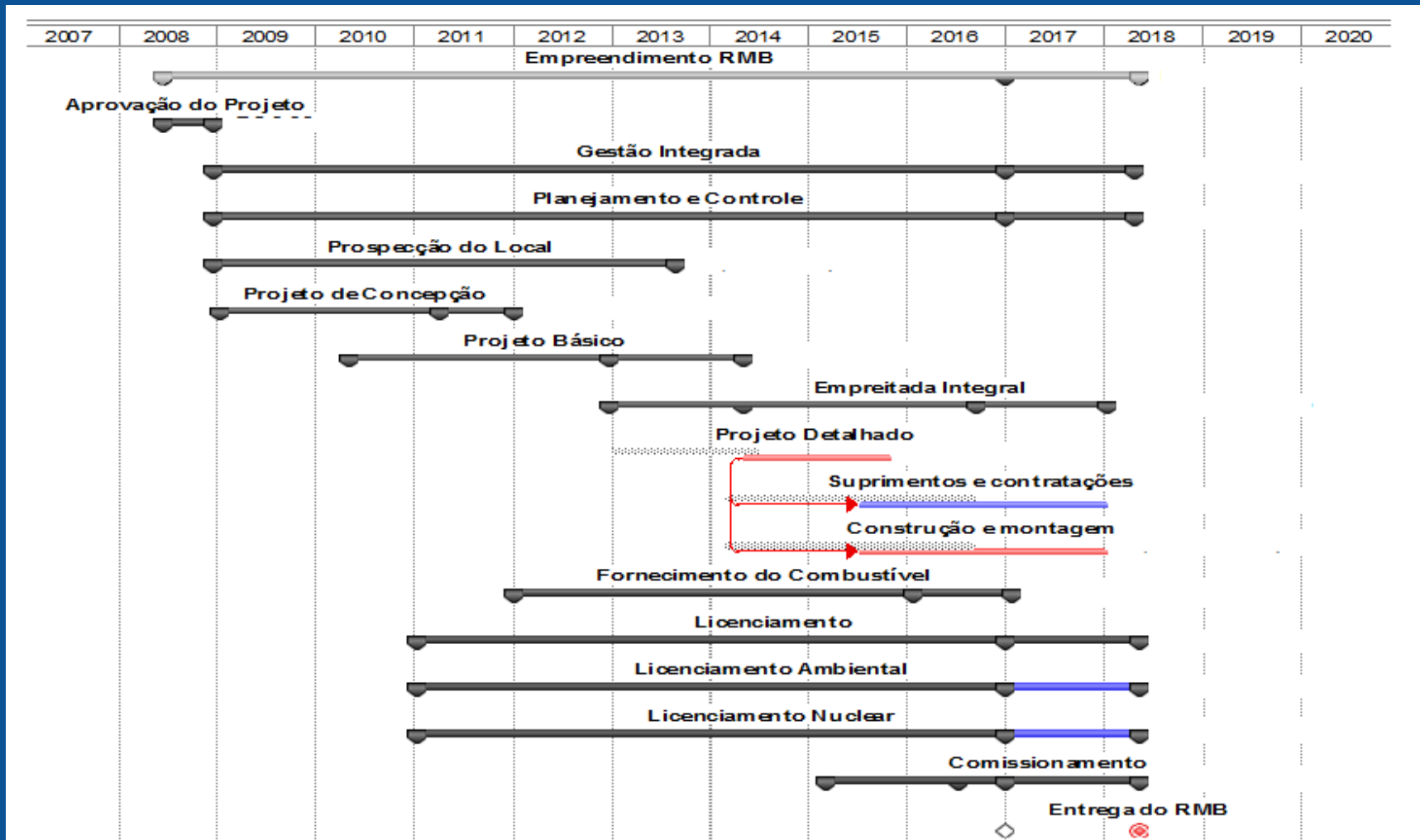
RMB PROJECT SCOPE



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 MANAGEMENT



RMB PROJECT STATUS

- CNEN Institutes technicians developed the conceptual engineering design of the reactor systems and main facilities.
- R\$ 30 million allocated by the MCTI (FNDCT- FINEP) to contract the basic engineering design of systems, buildings and infrastructure of the RMB (except basic engineering design of pure nuclear systems and components). Work contract under development. Brazilian company INTERTECHNE (70%).
- 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. R\$ 20 million allocated by the MCTI (FNDCT- FINEP) in addition to the first application. INVAP contract under development (45%).
- Environmental licensing process started. Term of Reference for EIA/RIMA approved by IBAMA. EIA/RIMA done by Brazilian Company MRS. EIA/RIMA under analysis of IBAMA. Public hearings done.
- Nuclear licensing process started. Site Report is under analysis by DRS/CNEN.

RMB PROJECT STATUS



SECRETARIA DE PLANEJAMENTO E INVESTIMENTOS ESTRATÉGICOS COMISSÃO DE MONITORAMENTO E AVALIAÇÃO DO PLANO PLURIANUAL

RESOLUÇÃO Nº 10, DE 1º DE MARÇO DE 2011

A Comissão de Monitoramento e Avaliação do Plano Plurianual 2008-2011 - CMA instituída pela Portaria MP nº 66, de 1º de abril de 2009, no uso das competências que lhe são conferidas pelo inciso V do art. 1º e art. 8º do Anexo I da Portaria MP nº 183 de 7 de julho de 2009, e de acordo com decisão exarada pelo Plenário da 10ª reunião ordinária, resolve:

Art. 1º Aprovar o parecer da Câmara Técnica de Projetos de Grande Vulto - CTPGV, favorável à viabilidade técnica e socioeconômica do projeto Implantação do Reator Multipropósito Brasileiro, unidade responsável Comissão Nacional de Energia Nuclear (processo 0008/2010), no valor total de R\$ 850.000.000,00 (referência-agosto de 2010).

Art. 2º O órgão proponente somente poderá dar início à execução do presente projeto desde que sua programação orçamentária no Plano Plurianual e nos Orçamentos Anuais sejam suficientes para assegurar a adequada e contínua execução, nos termos do que estabelece o art. 45 da Lei Complementar nº 101, de 2000, e o inciso I do § 1º do art. 17 do Decreto nº 6.601, de 2008, conforme parágrafo único do art. 1º da Resolução CMA/MP nº 2, de 2009.

Art. 3º Esta resolução entra em vigor na data de sua publicação.

DÉBORA NOGUEIRA BESERRA
Secretária Executiva
Substituta

RMB Project recognized to be included in the planned budget of the government for 2012-2015 period.

Action 12P1 – **R\$ 400 million**



RMB PROJECT STATUS

Licensing



RMB PROJECT STATUS

Environmental Licensing – Public Hearings

Nº 173, sexta-feira, 6 de setembro de 2013

Diário Oficial da União - Seção 3

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Ministério do Meio Ambiente

INSTITUTO BRASILEIRO DO MEIO AMBIENTE
E DOS RECURSOS NATURAIS RENOVÁVEIS

EDITAIS

O Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis - IBAMA toma público que recebeu e aceitou o Estudo de Impacto Ambiental e respectivo Relatório de Impacto Ambiental (EIA/RIMA) referentes ao licenciamento ambiental das obras de implantação do Reator Multipropósito Brasileiro - RMB, processo nº 02001.007021/2010-51 . E, também, a quem interessar, que no período de 45 (quarenta e cinco) dias, a contar da data de publicação deste edital, poderá ser solicitada Audiência Pública, conforme determina a Resolução CONAMA nº 009, de 03 de dezembro de 1987. Informa-se que as seguintes audiências públicas serão realizadas nos seguintes locais: dia 22 de outubro de 2013, a partir das 19:30h, no Polo Cultural da Secretaria de Educação, Cultura e Esporte do Município de Iperó - Rua Luiz Rossi, 107, Jardim Irene / Iperó/SP; dia 23 de outubro de 2013, a partir das 19:30h, no Auditório da Fundação de Desenvolvimento Cultural de Sorocaba - FUNDEC - Rua Brigadeiro Tobias, 73, Centro / Sorocaba/SP; dia 24 de outubro de 2013, a partir das 19:30, no Auditório do Instituto de Pesquisas Energéticas e Nucleares - IPEN - Av. Prof. Lineu Prestes, 2242, Cidade Universitária / São Paulo/SP.

Ainda em atendimento ao disposto na Resolução CONAMA Nº 009/87, toma-se público que se encontra à disposição, para consulta, nos locais a seguir relacionados, cópia do Estudo de Impacto Ambiental - EIA e respectivo Relatório de Impacto Ambiental - RIMA do referido empreendimento: IBAMA/SEDE - SCEN, Av. L4 Norte, Trecho 02, Edifício Sede do IBAMA, Bloco "A", Sala 09, Brasília/DF; Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio) - EQSW, 103/104, Bloco "C", Complexo Administrativo, Setor Sudoeste, Brasília/DF; Superintendência do IBAMA em São Paulo - Alameda Tietê, nº 637 Jardim Cerqueira César, São Paulo/SP; Companhia de Tecnologia de Saneamento Ambiental - CETESB - Avenida Prof. Frederico Hermann Junior, nº 345, prédio 12, 1º andar, Pinheiros, São Paulo/SP; Superintendência do Instituto Do Patrimônio Histórico e Artístico Nacional (IPHAN) em São Paulo - Av. Angélica, nº 626, Santa Cecília, São Paulo/SP, CEP: 01.228-000; Floresta Nacional Ipanema - Caixa Postal 217 - Centro, Araçoiaba da Serra/SP, CEP 18190-970; Secretaria de Meio Rural, Ambiente e Turismo - Av. Santa Cruz, 355, Jardim Santa Cruz, Paço Municipal, Iperó/SP; Secretaria do Meio Ambiente - Rua Campos Sales, 850, Pinheiros, Sorocaba/SP; Centro Tecnológico da Marinha em São Paulo - CTMSP - Estrada Sorocaba - Iperó, km 12,5.

RMB SITE



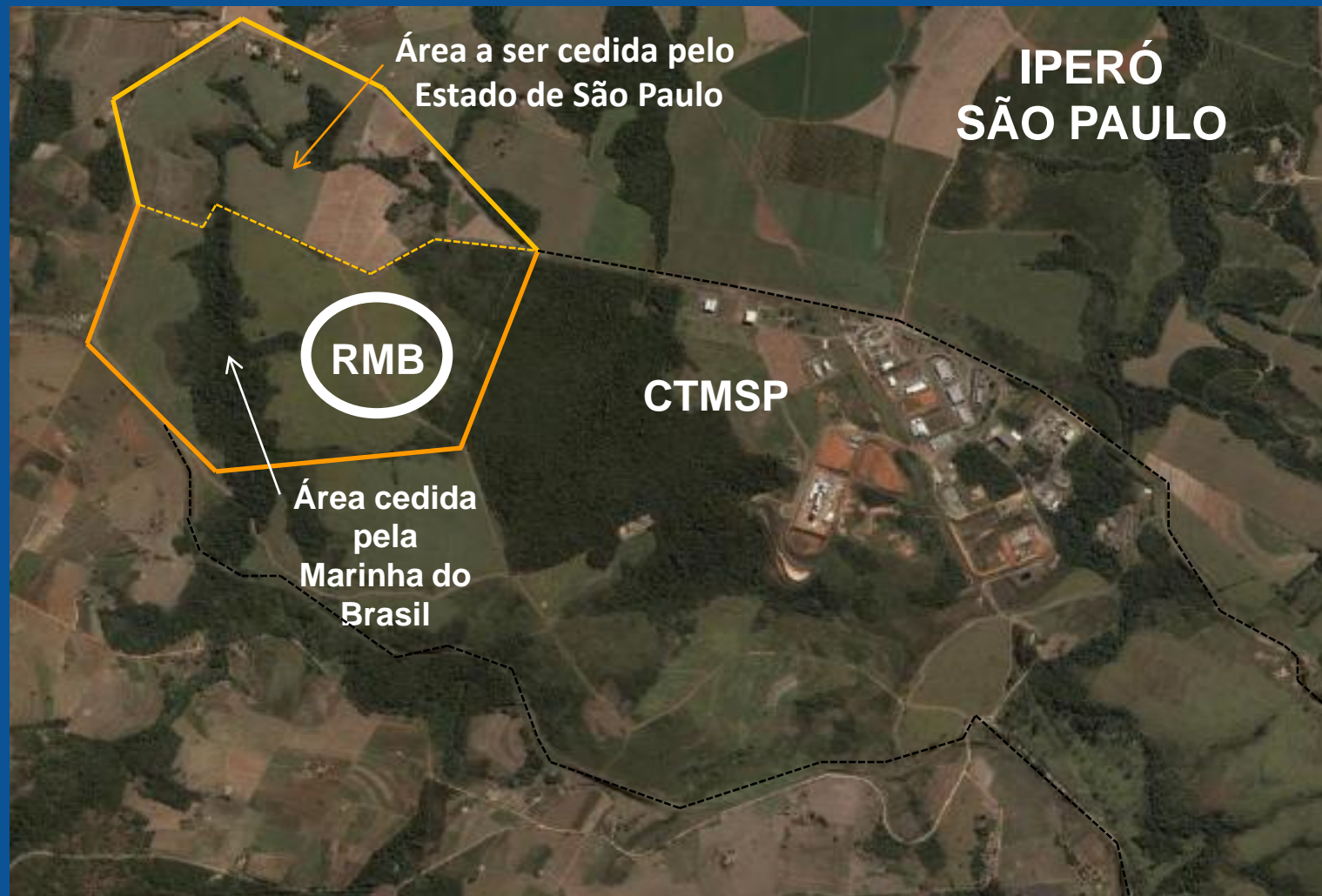
Distâncias: (Rota / Linear)

— Iperó / São Paulo (140 Km / 109 Km)

— Iperó / Sorocaba (50 Km / 39 Km)



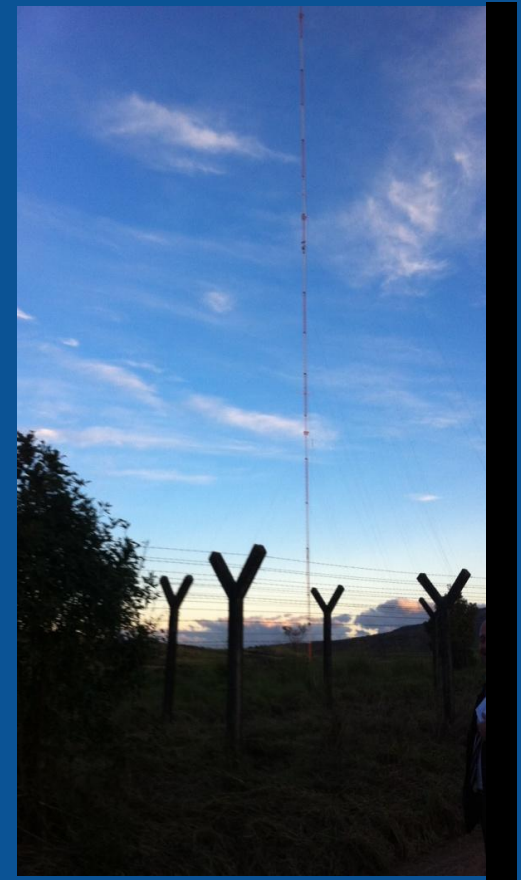
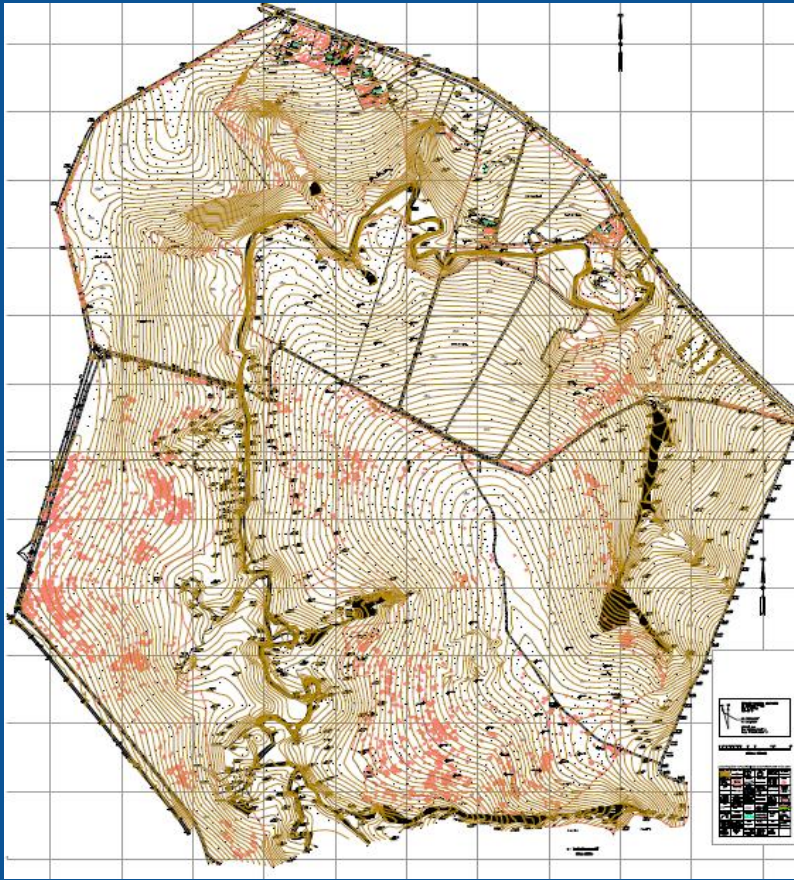
RMB SITE



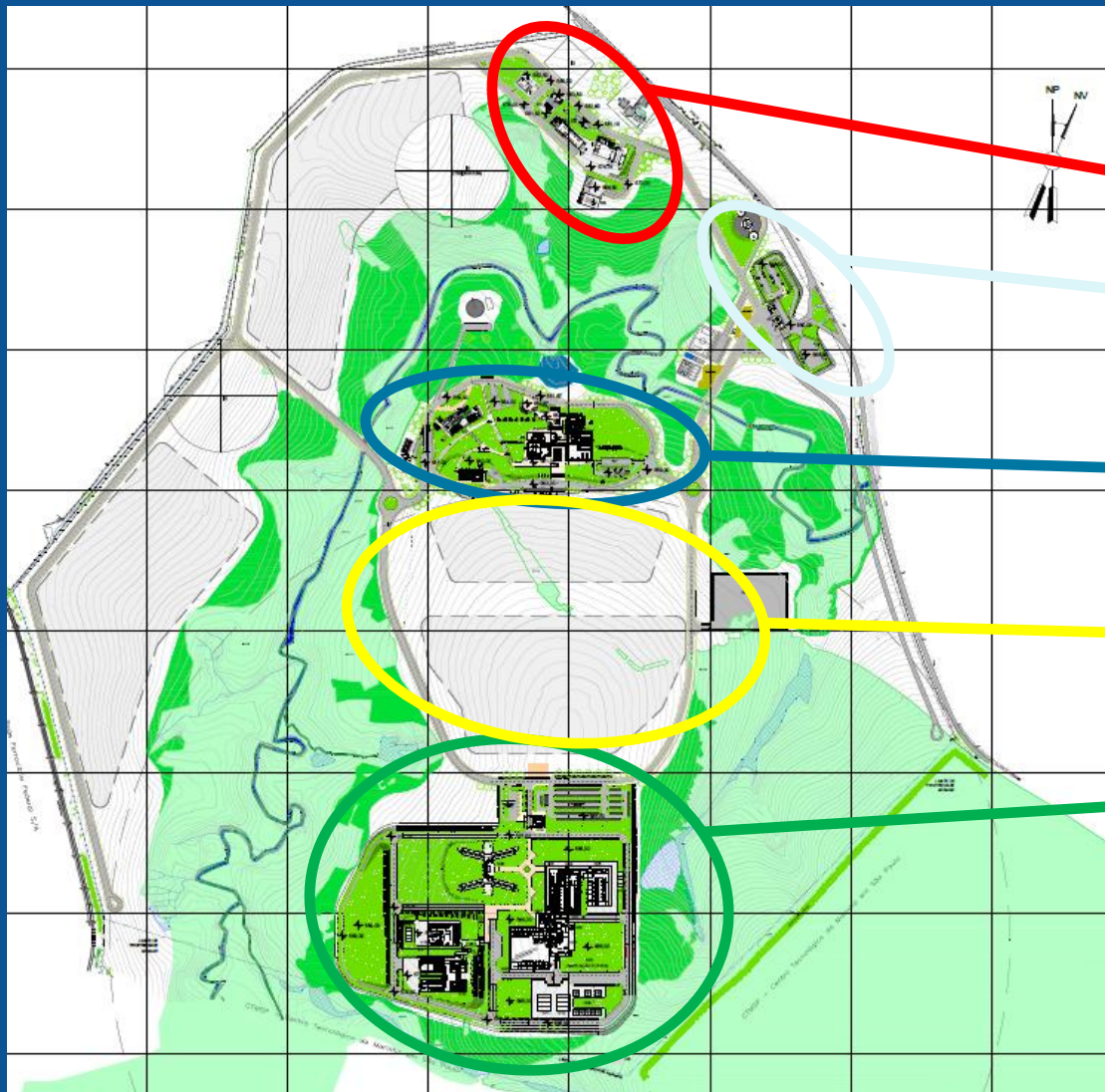
RMB SITE



RMB SITE WORKS



RMB SITE

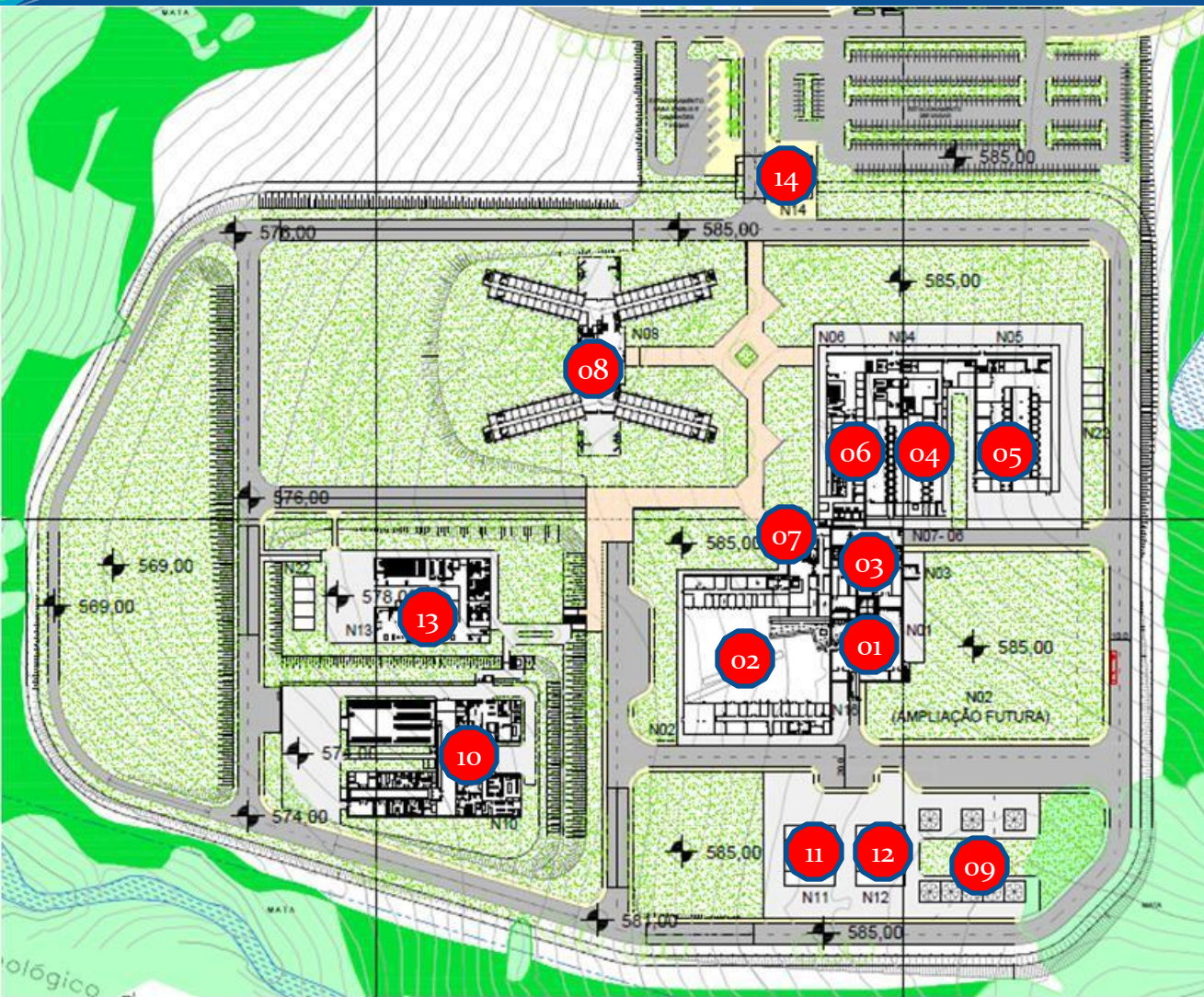


- **Site Services**
- **Main Entry Area**
- **Educational and Administrative Area**
- **Future extension**
- **Nuclear Research and Production Area**

RMB SITE



RMB SITE



Nuclear Research and Production Area

RMB SITE

Nuclear Research and Production Area



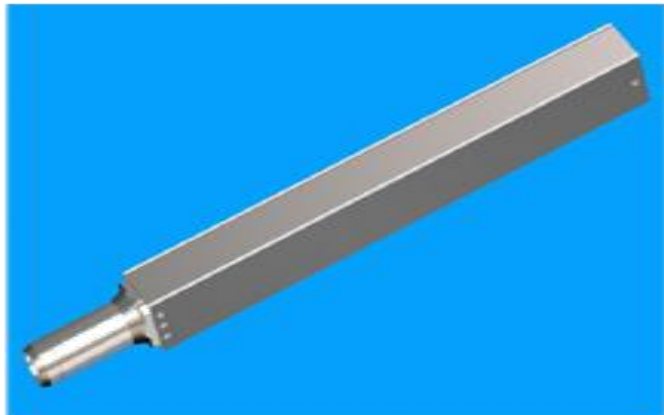
RMB PROJECT HIGHLIGHTS

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 m³/h upward direction

RMB PROJECT HIGHLIGHTS

Fuel Assemblies



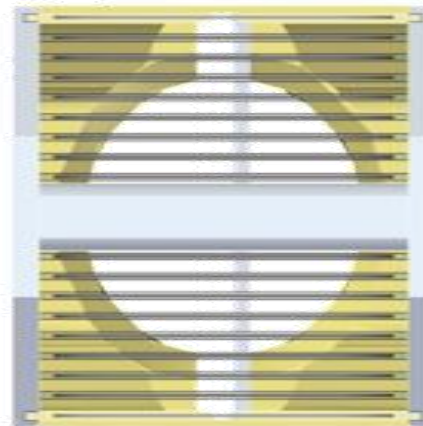
Natural UF_6 –
USEXA / CTMSP

20% Enrichment
 UF_6 – LEI / CTMSP

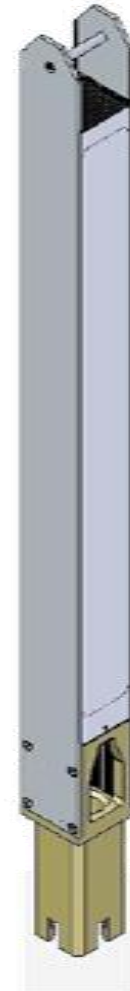
Manufacturing and
Assembling – IPEN



IEA-R1

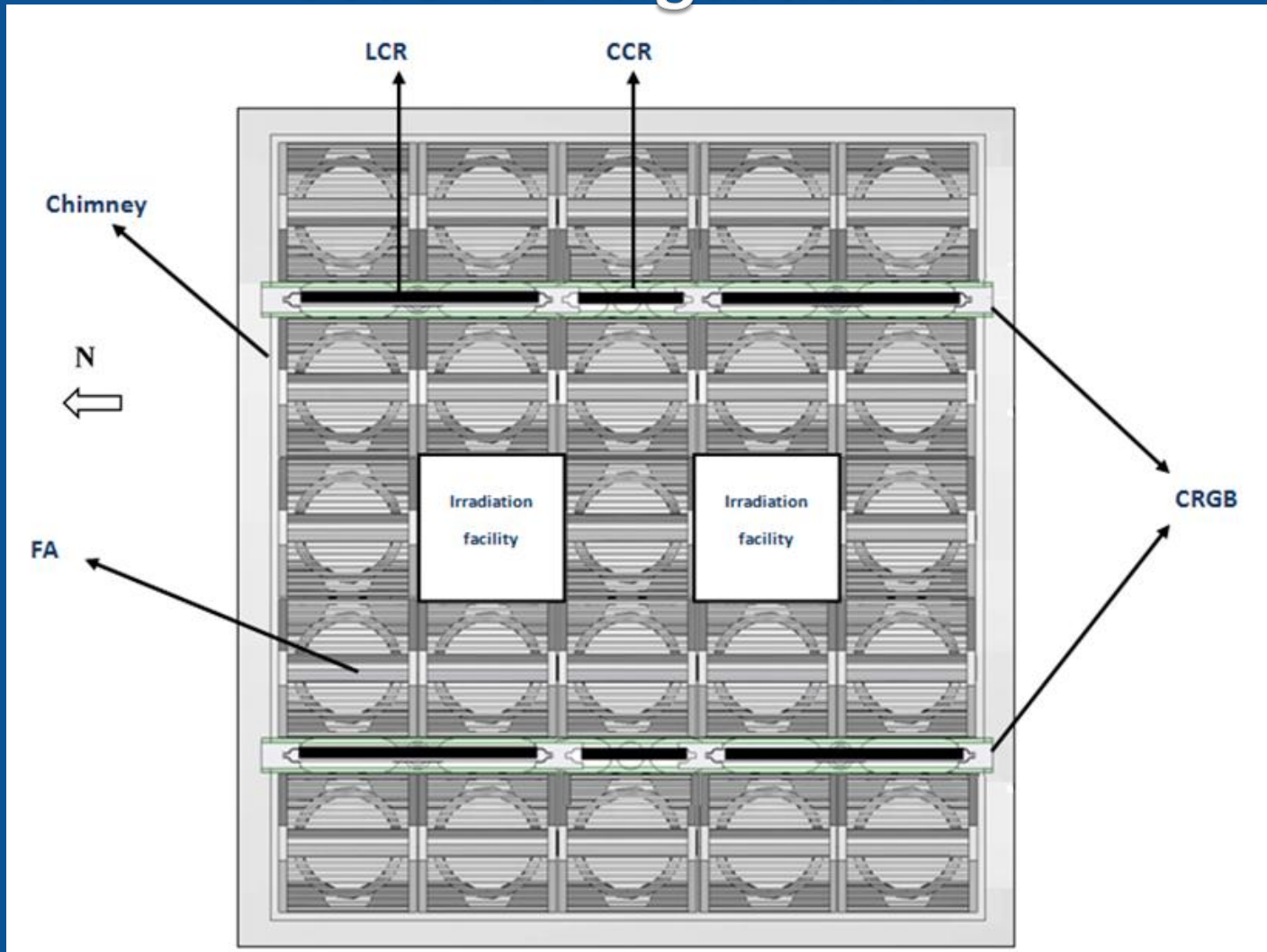


RMB



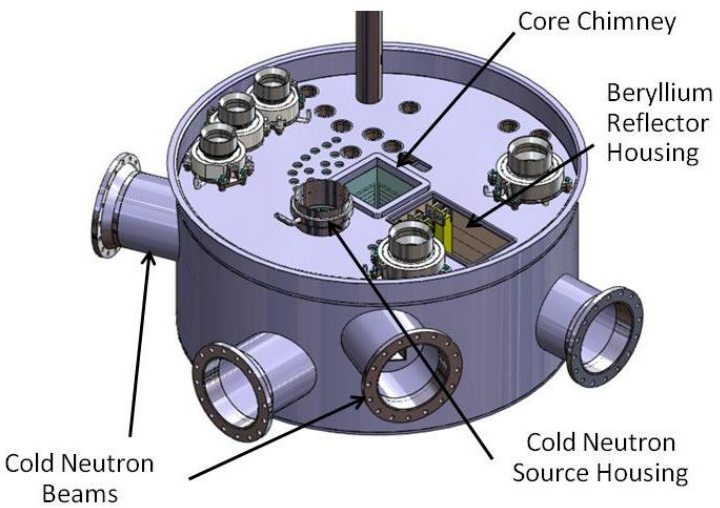
RMB PROJECT HIGHLIGHTS

Core Configuration

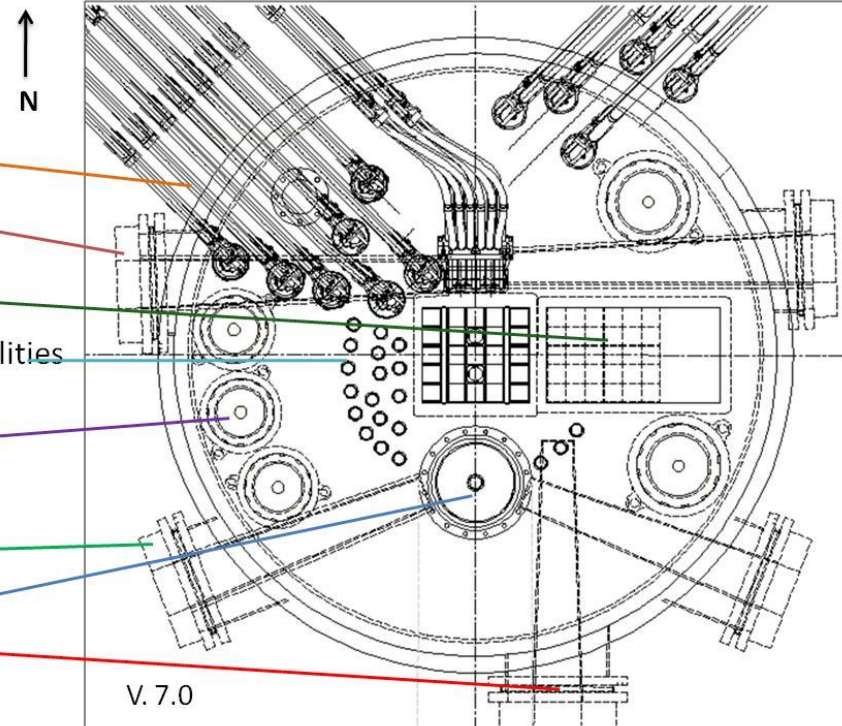


RMB PROJECT HIGHLIGHTS

Reflector Vessel Layout

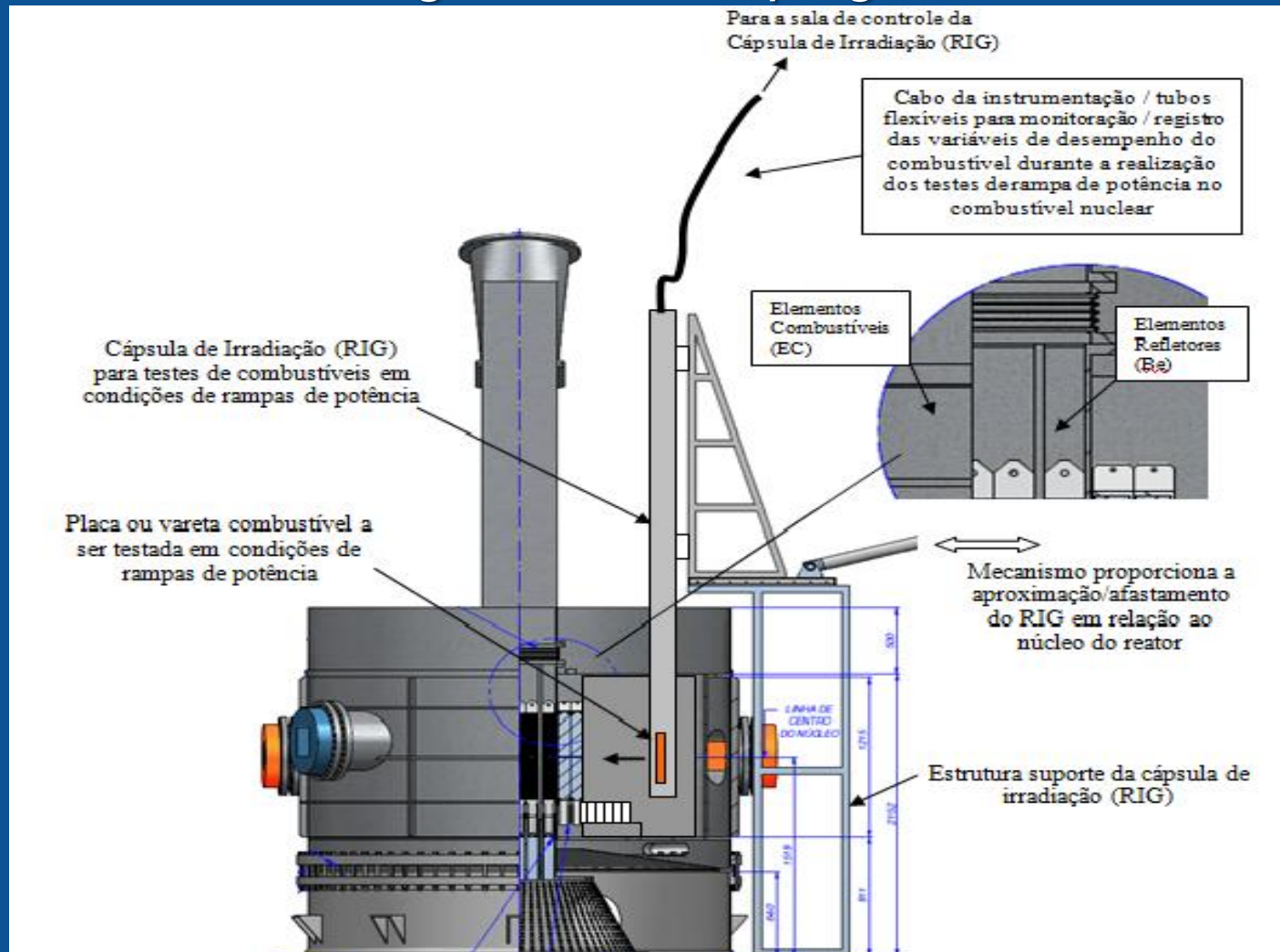


- 13 Pneumatics RIGS
- 2 Thermal Beams
- 1 or 2 Fuel Testing Loop
- 17/20 Bulk Irradiation Facilities
- 5 NTD
- 2 Cold Beams
- 1 Cold Neutron Source
- 1 Neutrography Beam



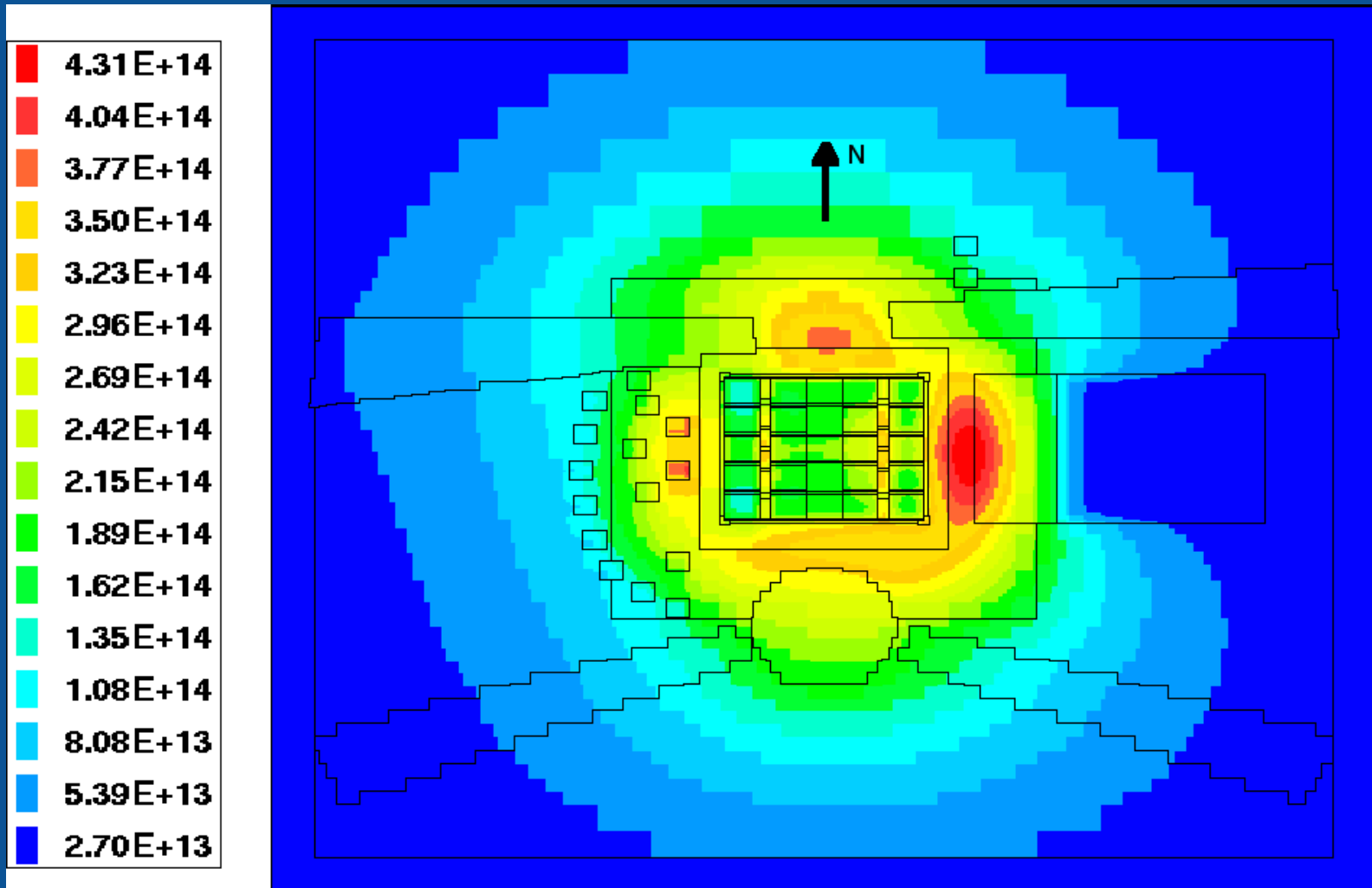
RMB PROJECT HIGHLIGHTS

Fuel Rig Power Ramping Device



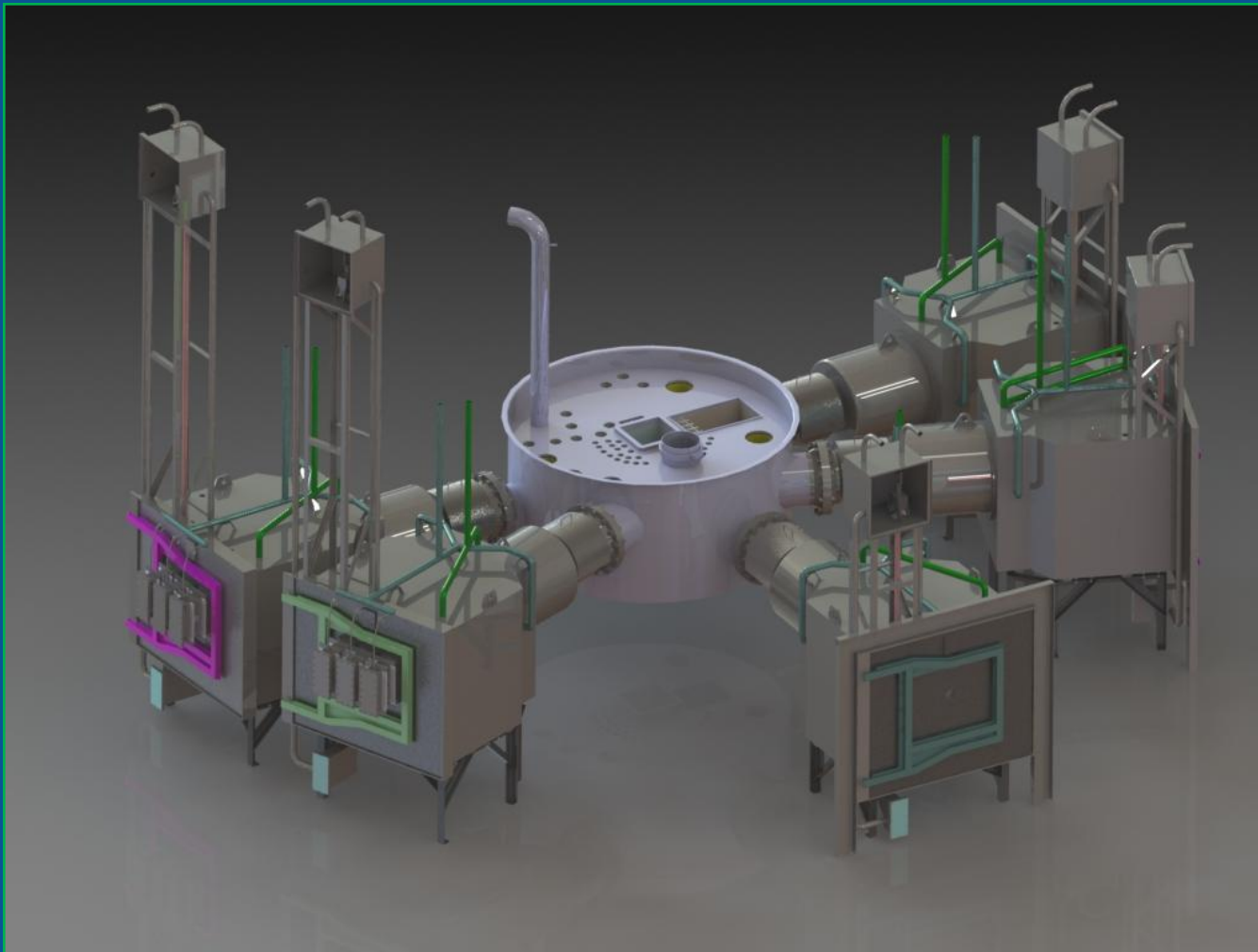
RMB PROJECT HIGHLIGHTS

Thermal flux [n/cm^2s]En <0.625 eV - Midline of active length



RMB PROJECT HIGHLIGHTS

Neutron Beam Shutter

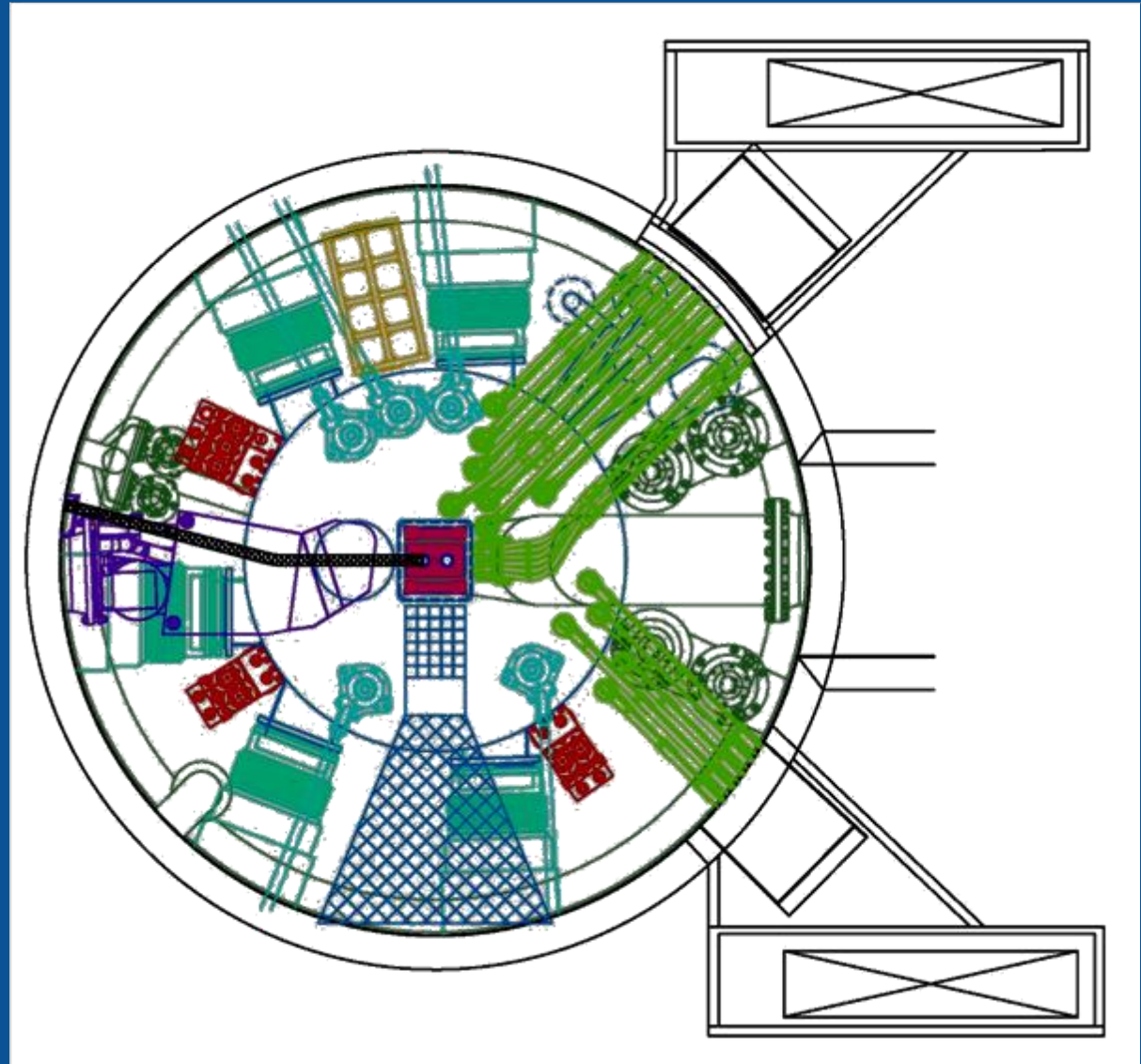


RMB PROJECT HIGHLIGHTS

Reactor Pool

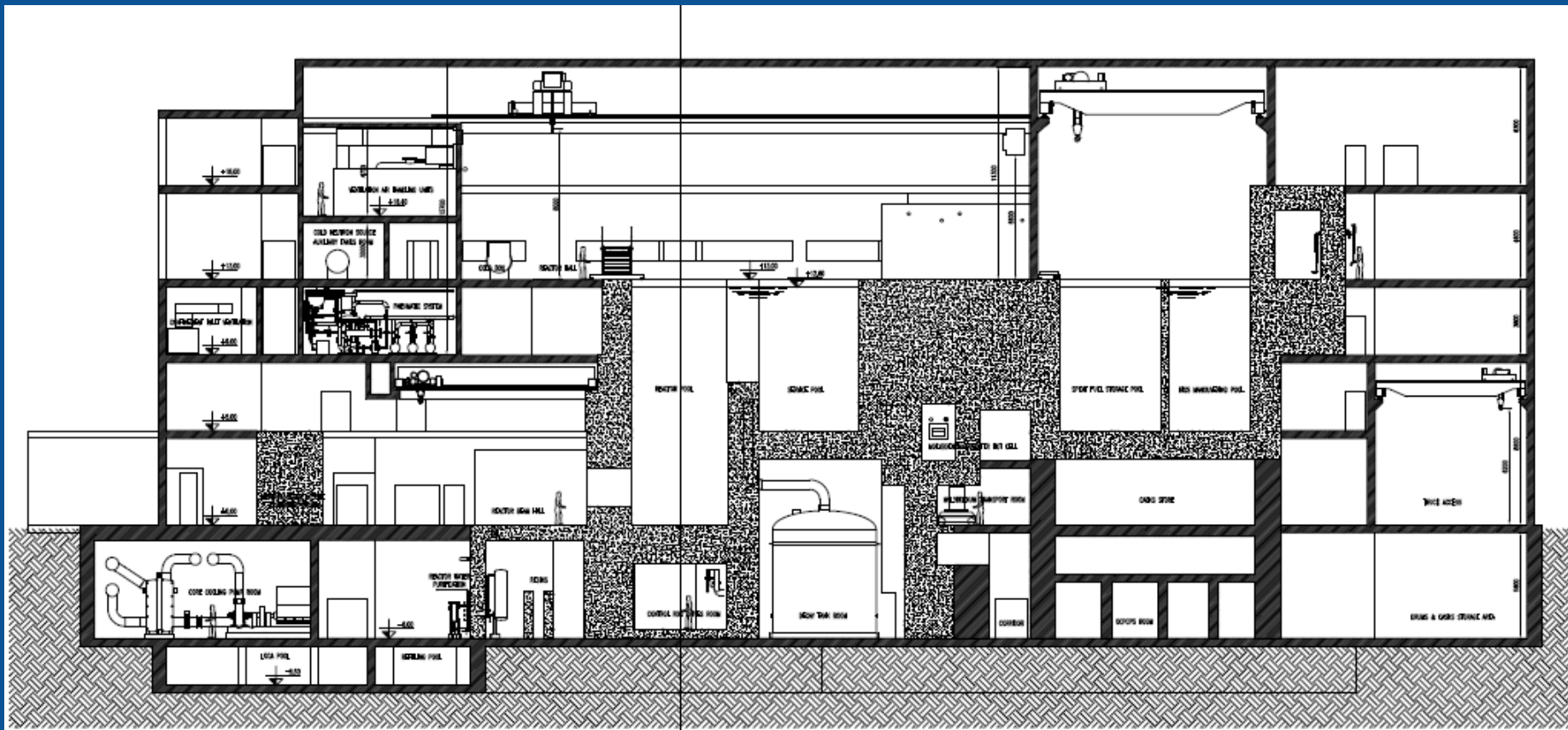


$\varnothing = 5.1 \text{ m}$



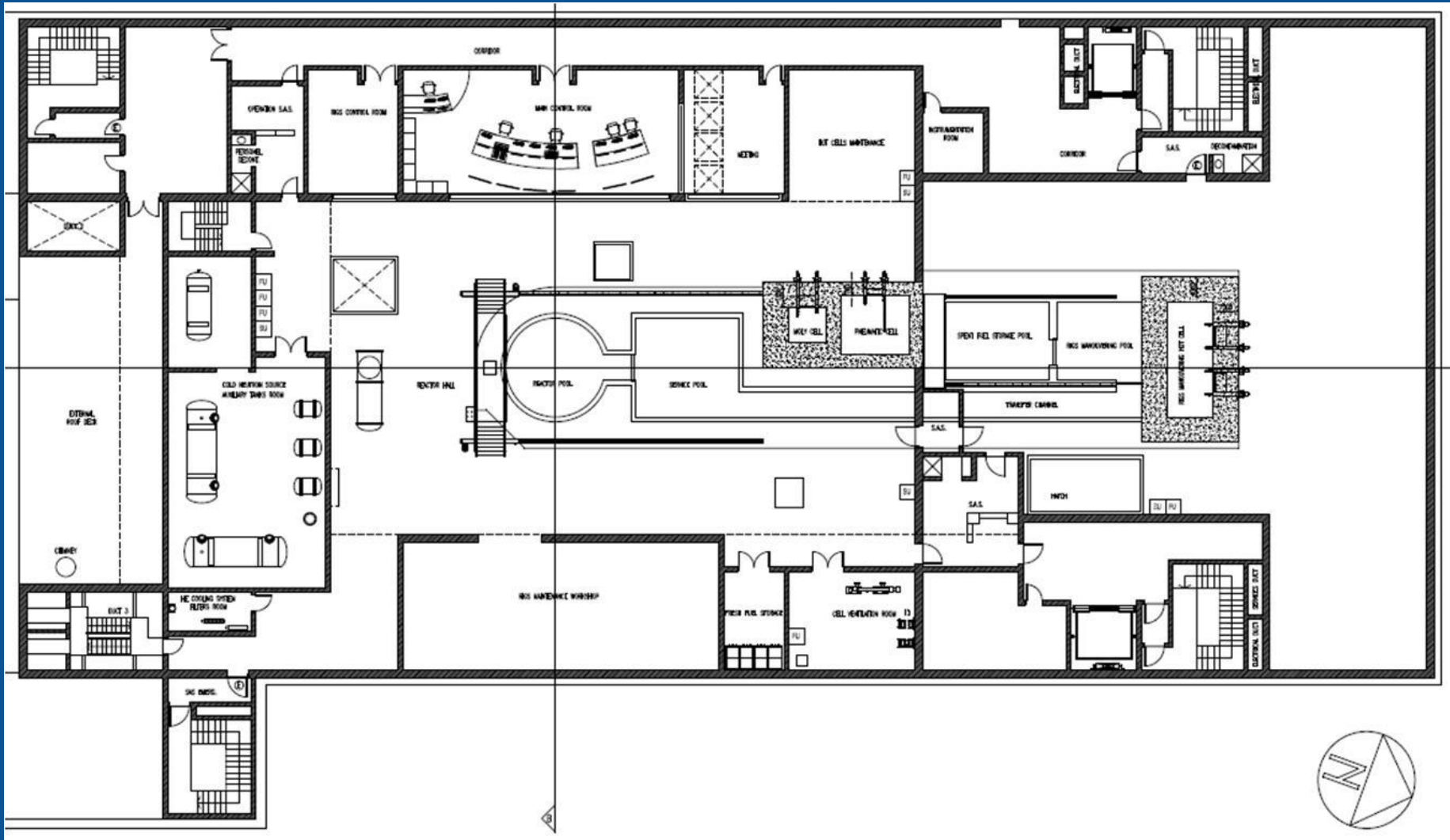
RMB PROJECT HIGHLIGHTS

Reactor Building



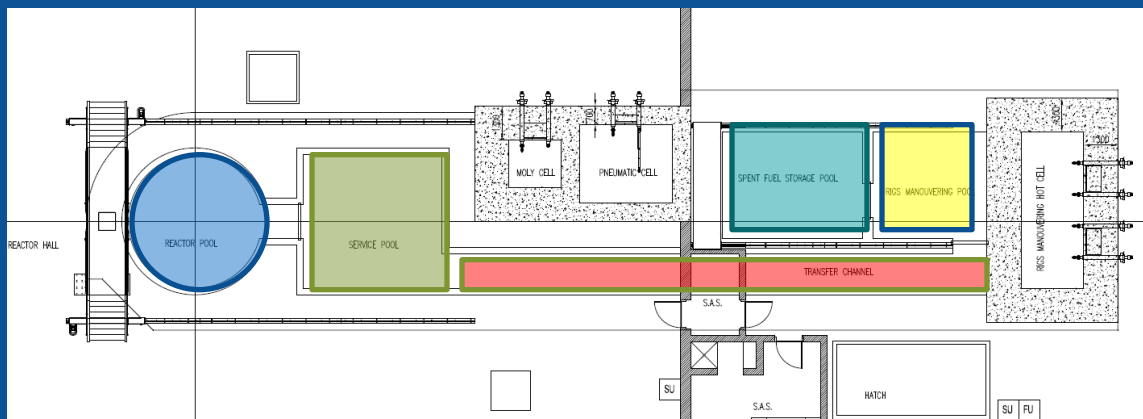
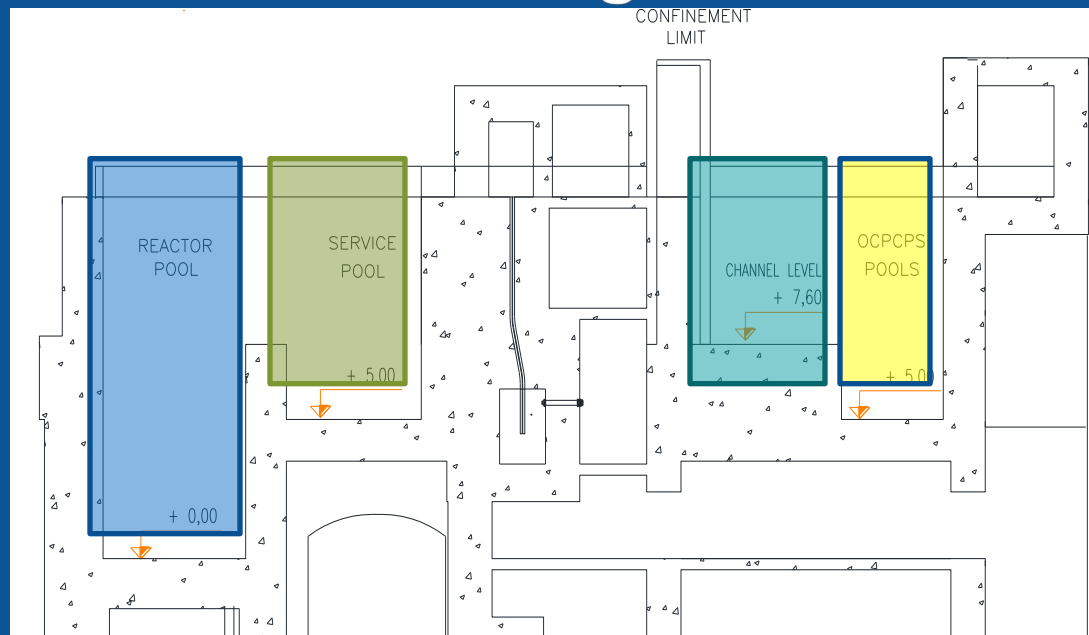
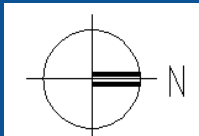
RMB PROJECT HIGHLIGHTS

Reactor Hall Area



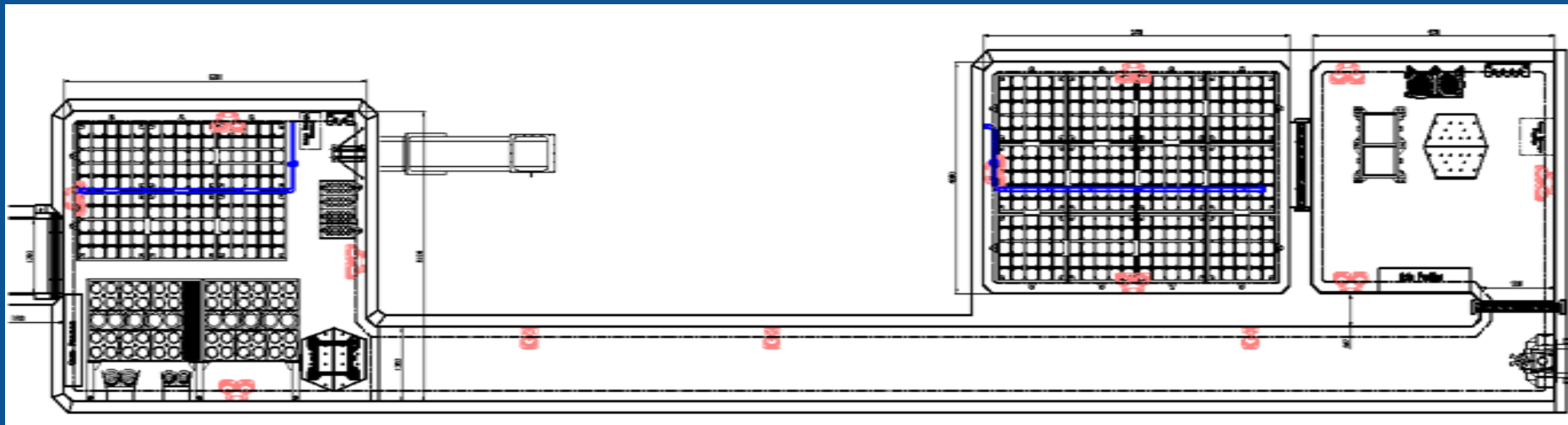
RMB PROJECT HIGHLIGHTS

Pools integration



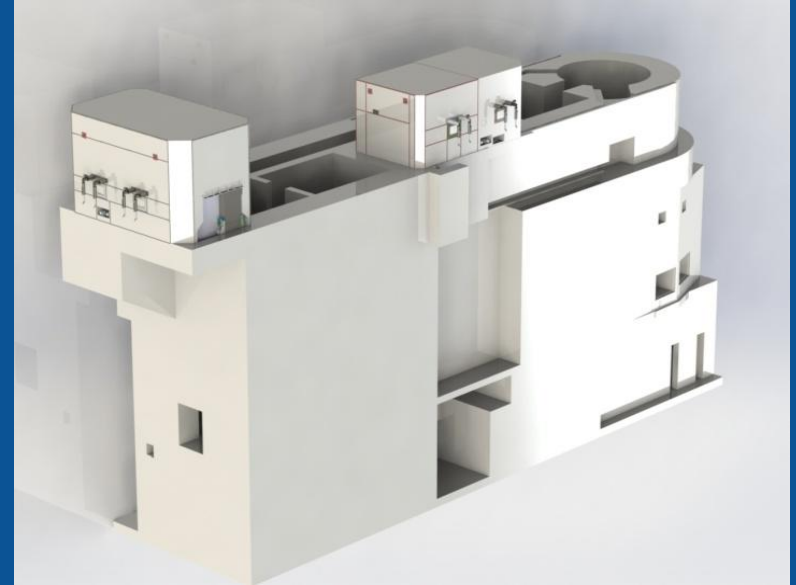
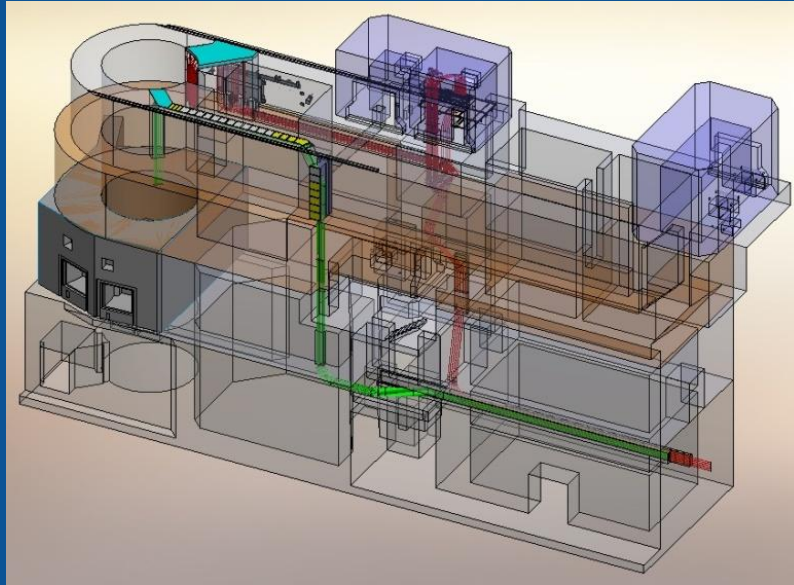
RMB PROJECT HIGHLIGHTS

Delivery Transfer Channel

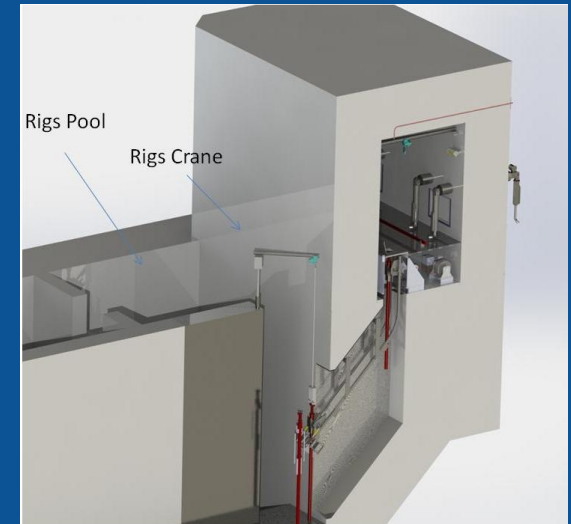


Description	Value
Internal dimensions	20000mm x 1300mm
Internal Height	6400 mm
Maximum water level	5000 mm
Wall thickness	6 mm
Floor thickness	12 mm
Overflow Channel	1
lifetime	50 years

RMB PROJECT HIGHLIGHTS



Hot Cells



THANK YOU

