



Research Reactors in Argentina

Juan Pablo Ordóñez, INVAP
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Research Reactors

- Many different types:
 - Different uses
 - From Watts to hundreds of MW
 - From tens to hundreds of million dollars
 - Different layouts
 - Different fuels
 - Different coolants, temperatures and pressures
 - Most important, different uses!

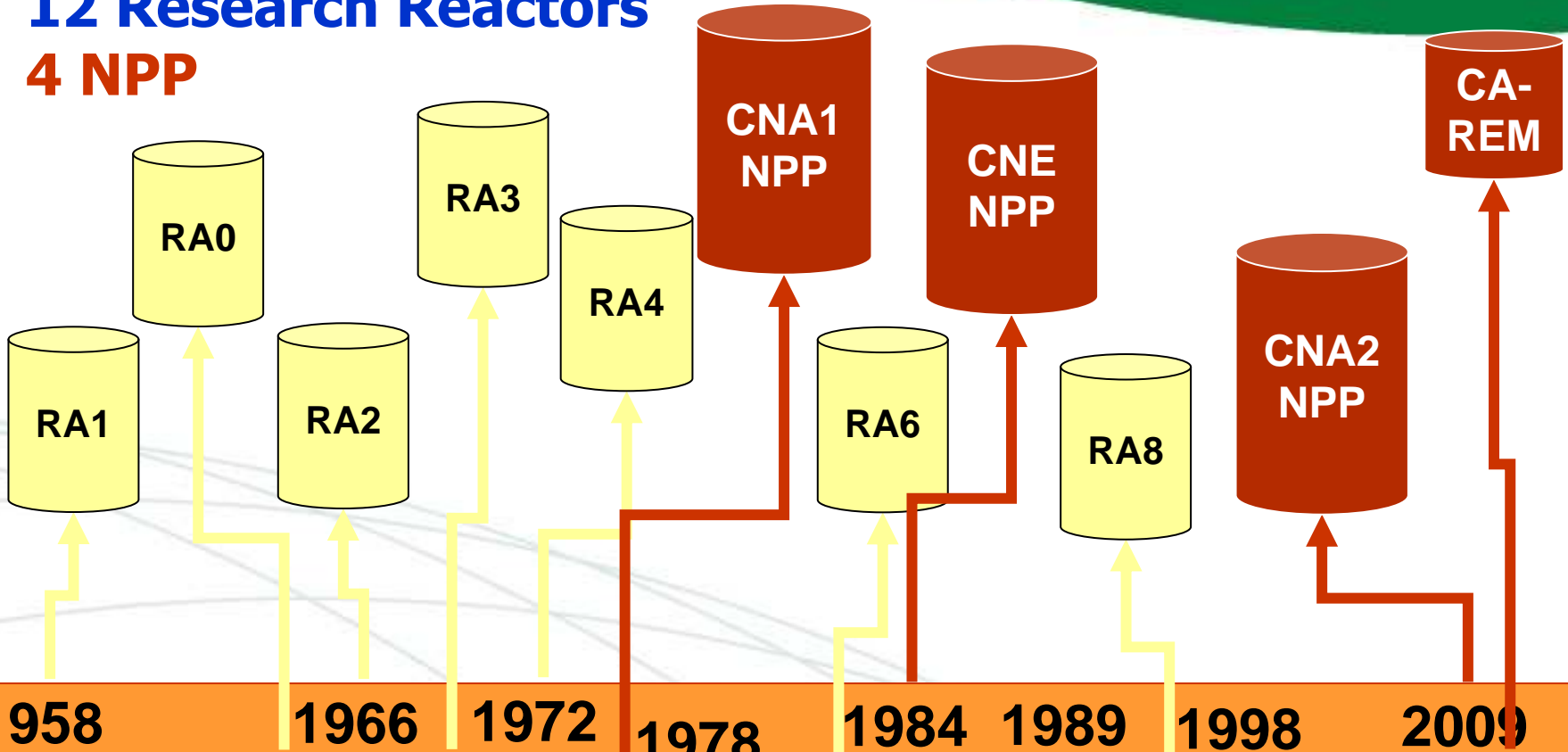
Uses of Research Reactors

- Education and training
- Single purpose:
 - Radioisotope production
 - Beam research
 - Material testing
- Multipurpose:
 - RI production and/or beams and/or material testing
- Prototypes, including critical facilities

12 Research Reactors

4 NPP

IN ARGENTINA



1958

1966

1972

1978

1984

1989

1998

2009

1965

1968

1974

1982

1988

1997

2005

2010

EXPORTS



PERU



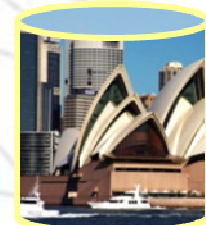
PERU



ALGERIA



EGYPT



AUSTRALIA

INCAP

Critical Assemblies in Argentina

	RA-0	RA-2	RA-4	RA-8
POWER (W)	1	1	1	10
TYPE	TANK	TANK	HOMOGENEOUS	TANK
UTILIZATION	TEACHING AND TRAINING	RA-3 FACILITY	TEACHING AND TRAINING	CAREM FUEL TEST
FUEL	UO ₂	UAL	UO ₂	UO ₂
FUEL ELEMENT	RODS	MTR	POLIETHYLENE PLATES	RODS
ENRICHMENT (%)	20	90	20	1.8 AND 3.4
EXC. REACTIVITY	0.40 \$	-----	0.4 \$	NOT DEFINED
STATUS	OPERATIONAL	DECOMMISSIONED	OPERATIONAL	EXTENDED SHUTDOWN
PLACE	UNIVERSITY - CORDOBA	CONSTITUYENTES ATOMIC CENTRE	UNIVERSITY- ROSARIO	PILCANIYEU ATOMIC CENTRE
CRITICALITY	1970	1966-1983	1971	1998

Research reactors in Argentina

	RA-1	RA-3	RA6
POWER (Kw)	40	10 000	1 000
TYPE	TANK	TANK	TANK
UTILIZATION	RESEARCH, TRAINING, BNCT, MATERIAL TEST	RADIOIS. PRODUCTION, RESEARCH, AxA	RESEARCH, TRAINING, AxA, BNCT
FUEL	UO2	UO2, USI3	UO2
FUEL ELEMENT	RODS	MTR	MTR
ENRICHMENT	20	20	90
RECTIV. EXCESS	1.5 \$	8 \$	2 \$
STATUS	OPERATIONAL	OPERATIONAL	OPERATIONAL
PLACE	CONSTITUYENTES ATOMIC CENTRE	EZEIZA ATOMIC CENTRE	BARILOCHE ATOMIC CENTRE
CRITICALITY	1958	1967	1982

RP-0 Critical Assembly

Location: Lima, Perú

Use: training, basic research,

Main characteristics:

10 W, pool type, MTR fuel, H₂O

In operation since 1978 with rod fuel;
changed in 1991 to MTR fuel



NUR Research Reactor

Location: Alger (Algeria)

Use: training, basic
research, neutron
activation analysis,
neutron radiography,

Main characteristics:

1000 kW, pool type, MTR
fuel, H₂O

In operation since 1989



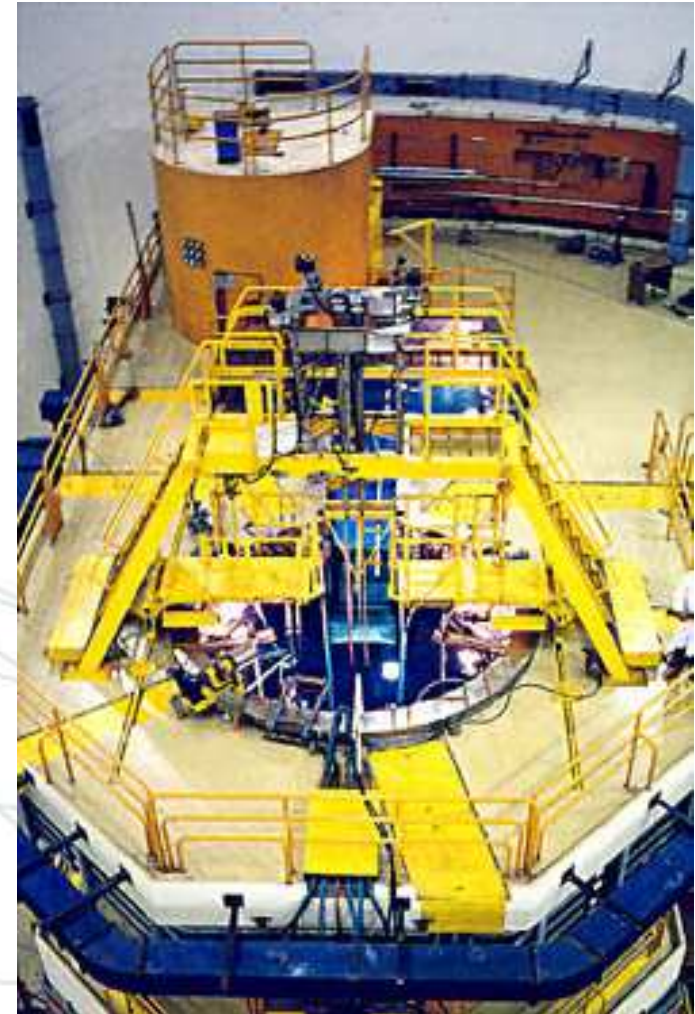
RP-10 Research Reactor

Location: Huarangal, Perú

Use: training, basic research,
activation analysis,
neutron radiography,
radioisotope production

Main characteristics:
10000 kW, pool type, MTR

In operation since 1989



ETRR-2 Multipurpose Reactor (Egypt)

International Bid -5 firms

Power = 22 MW

Operating since 1998

Radioisotope Production, R&D,
Training, Industrial Services,
Materials Testing



1998: The largest turn-key industrial export -paid in cash- in Argentina's history

ETRR-2 Multipurpose Reactor (Egypt)

February 1991:
Tender submission

September 1992:
Contract Signed

March 1993:
Start of Civil Works

December 1995:
Tank Installation

September 1996:
Clean Reactor Hall

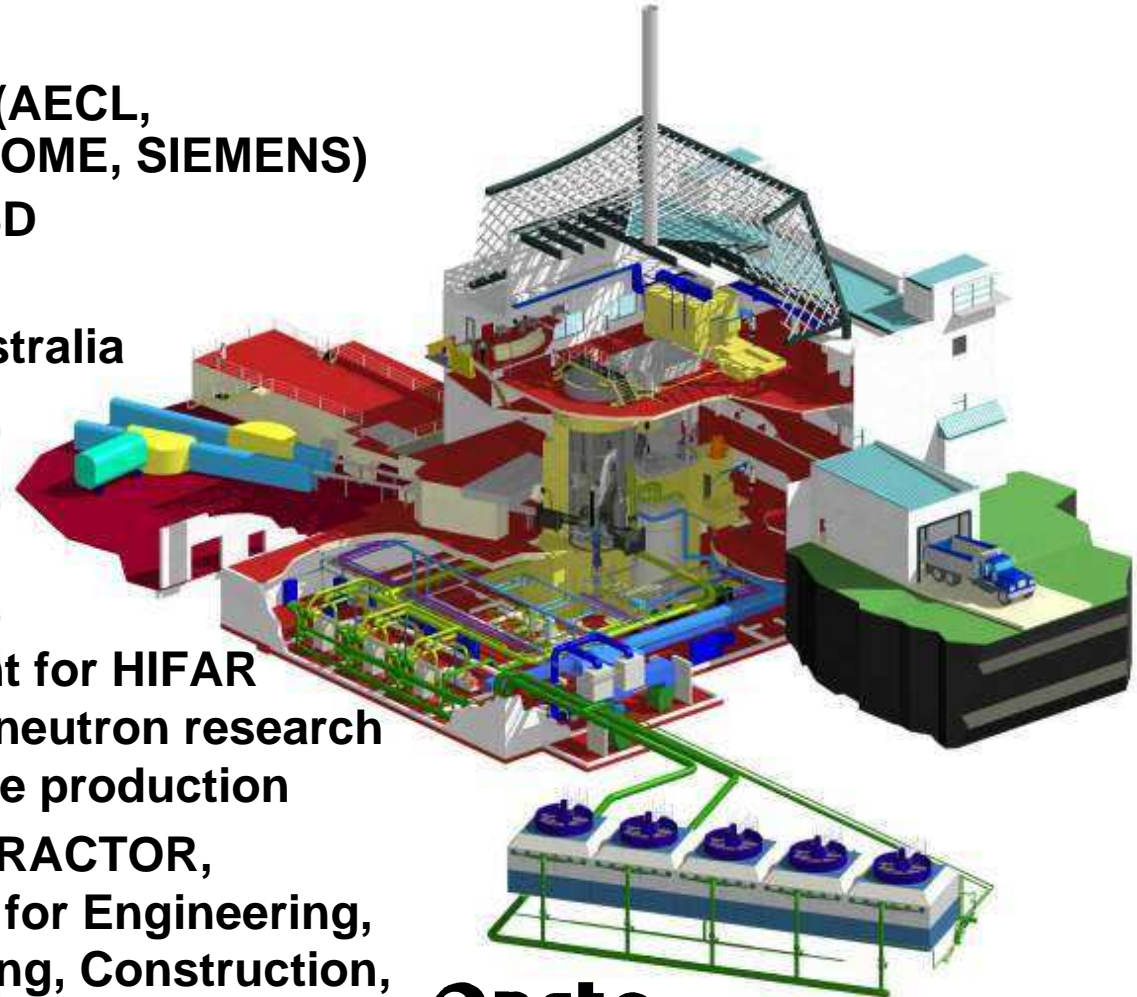
September 1997:
Commissioning

March 11, 1998:
Full Power



Australia - OPAL Project

- **Contract:** July 2000
 - **Award:** Via intl. bid (AECL, TECHNICATOME, SIEMENS)
 - **Budget:** \$200 MM USD
 - **Name:** OPAL
 - **Location:** Sydney, Australia
 - **Power:** 20 MW
 - **Customer:** ANSTO
-
- **Objective:** Replacement for HIFAR
Worldclass neutron research
Radioisotope production
 - **INVAP:** MAIN CONTRACTOR,
responsible for Engineering,
Manufacturing, Construction,
Installation, Commissioning



Ansto

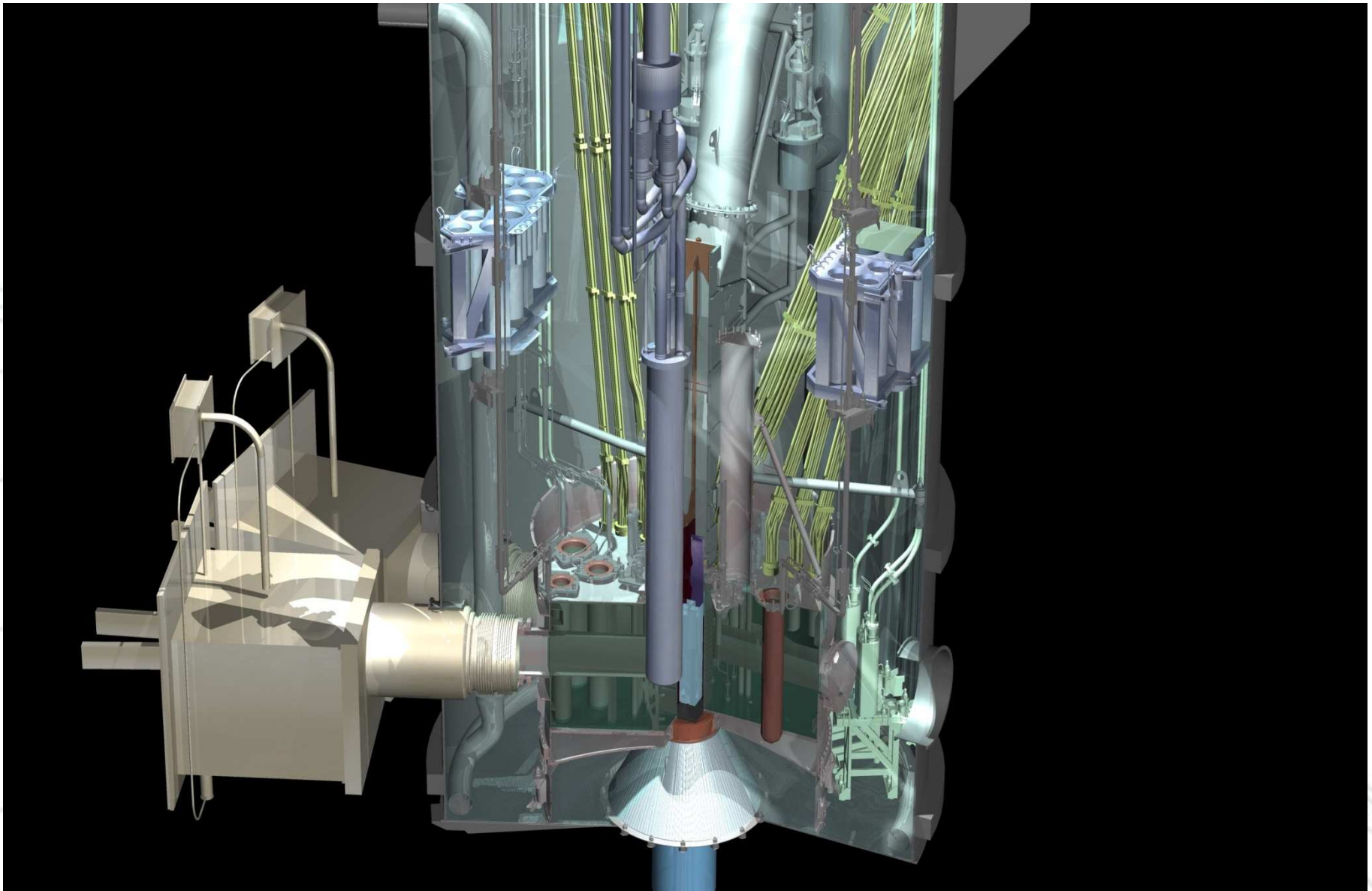


Commercial in Confidence

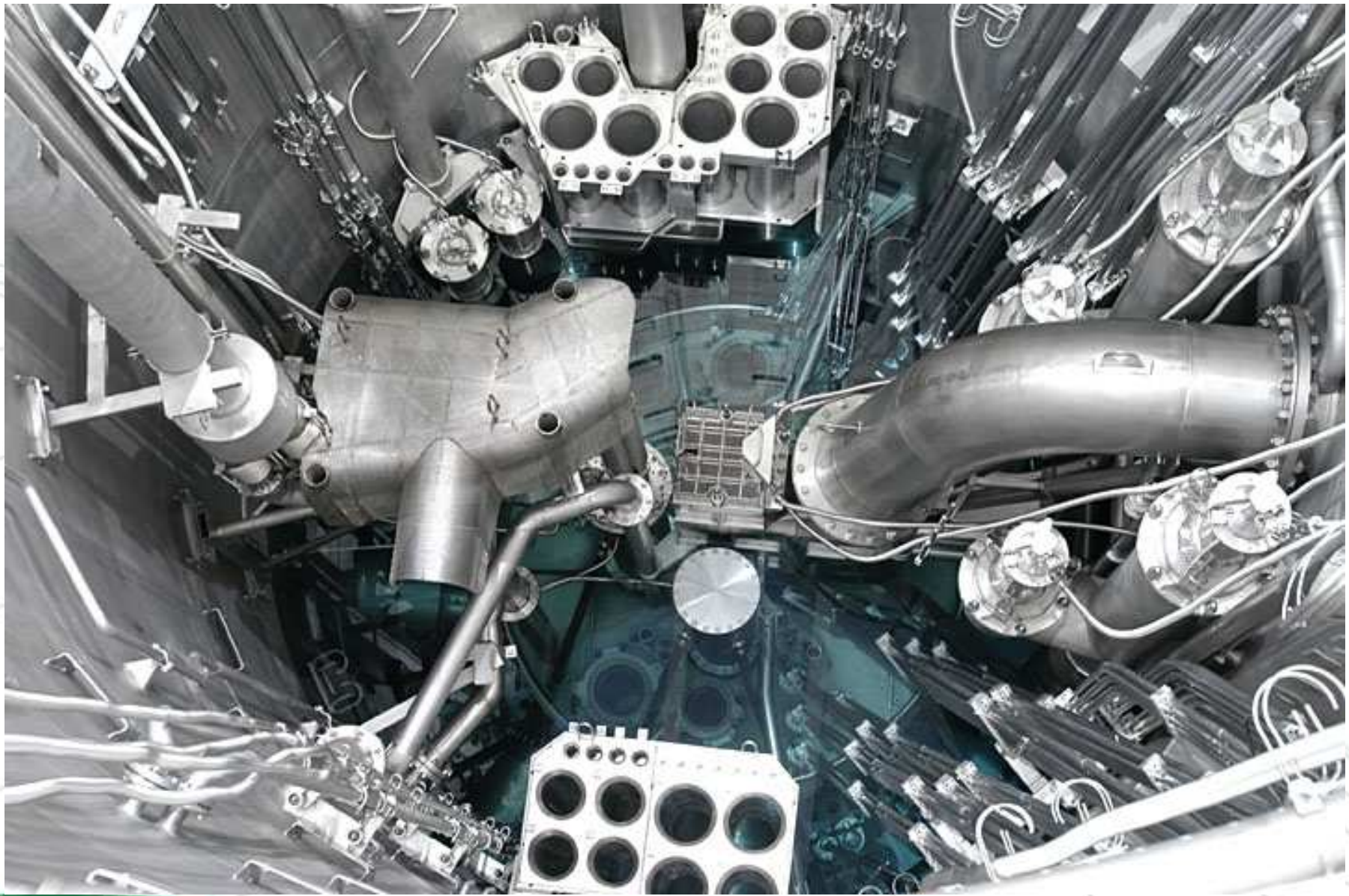
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Australia - OPAL Project

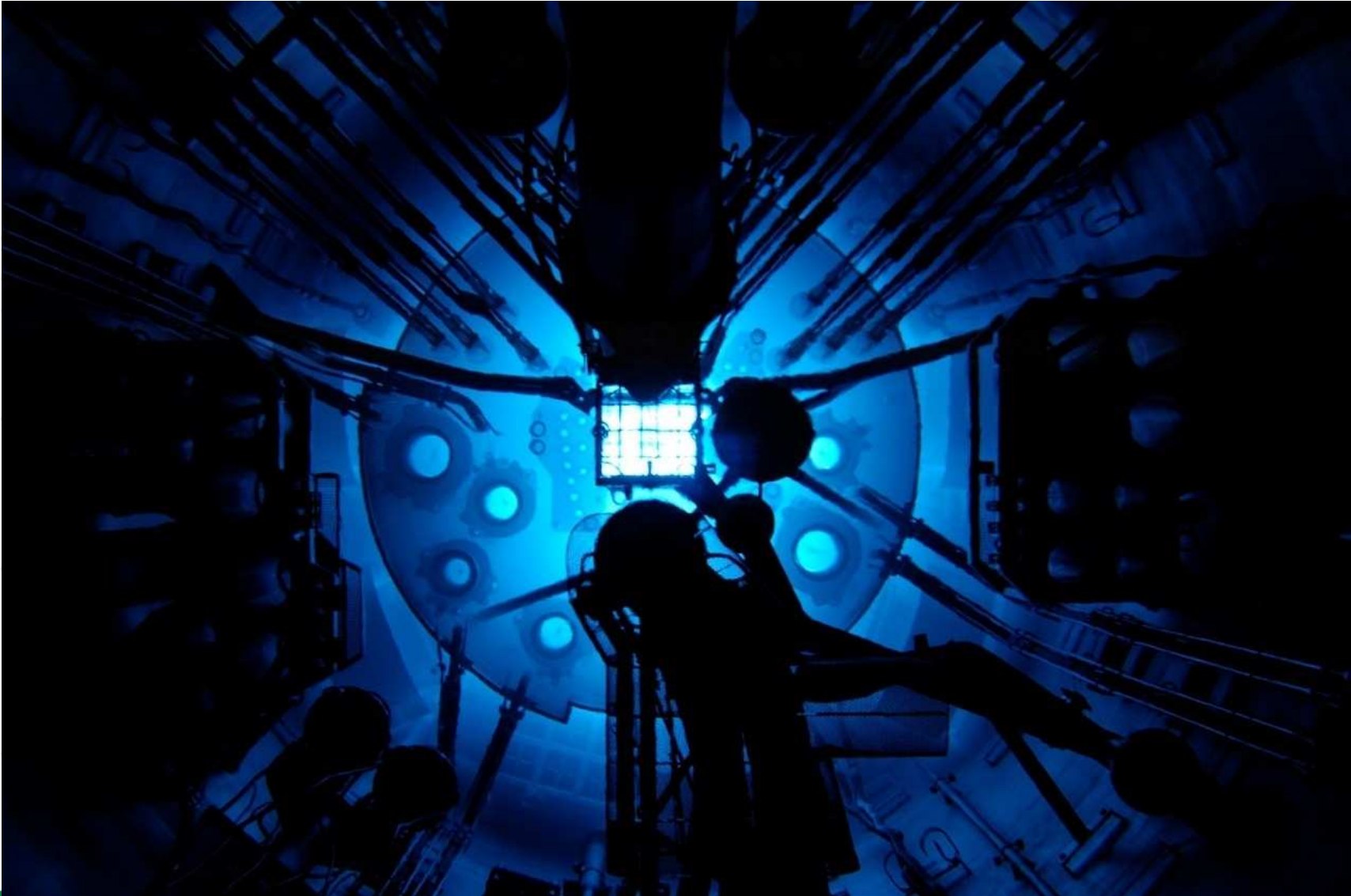




Multipurpose!



November 3, 2006, First Full Power



INVAP

RA-10, the future

- RA-3 is getting old
- Radioisotope production is an on-going business for Argentina
- The government has approved the funding for a new research reactor for RI production, material testing and beam research.
- Argentina and Brazil governments are exploring the idea of building two similar reactors, one in Argentina and one in Brazil.

Other projects

- The interest in research reactor has reborn with the revival of nuclear energy.
- Radioisotope production reactors are old everywhere and need to be replaced.
- Several countries have approached INVAP interested in new research reactors.
- Private investors have shown interest in dedicated radioisotope reactors.