The Advanced Test Reactor Capabilities and Experiments

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Irradiation Test Programs

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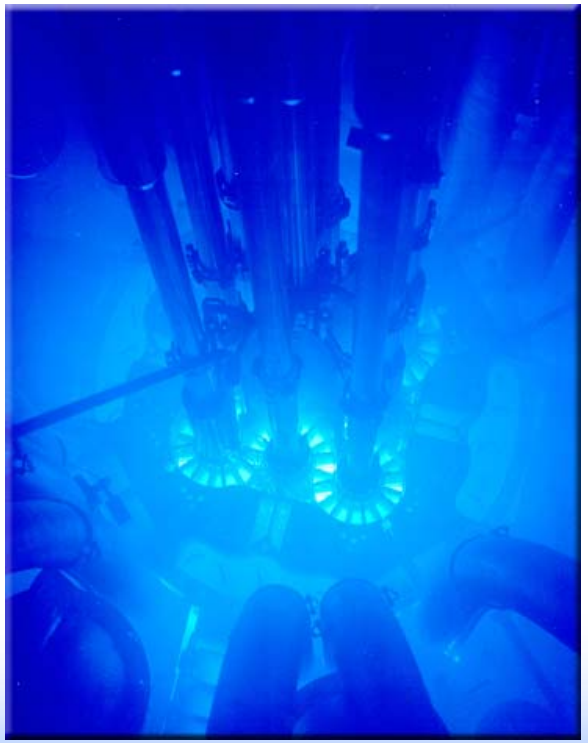

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ATR Vessel & Internals

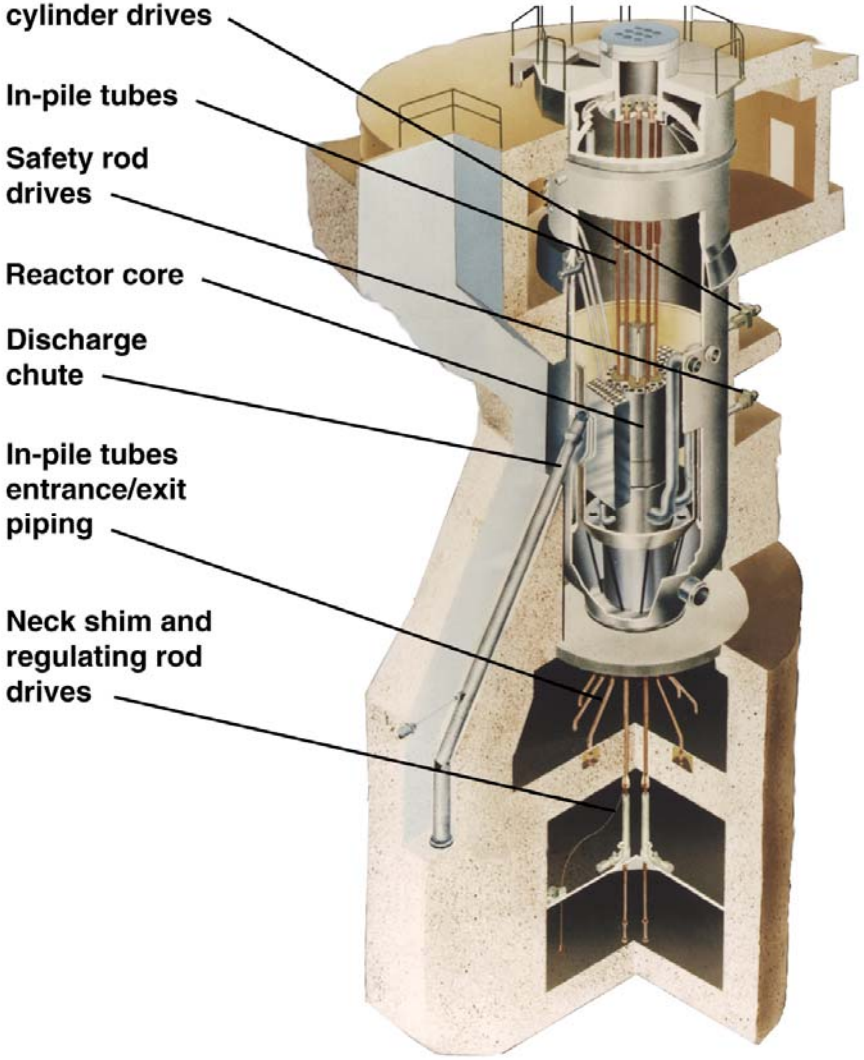
Reactor Type
Pressurized, light-water moderated and cooled; beryllium reflector

Reactor Vessel
12 ft diameter, 36 ft high
Stainless steel

Reactor Core
4 ft (diameter & height)
40 fuel elements, high enriched U-235

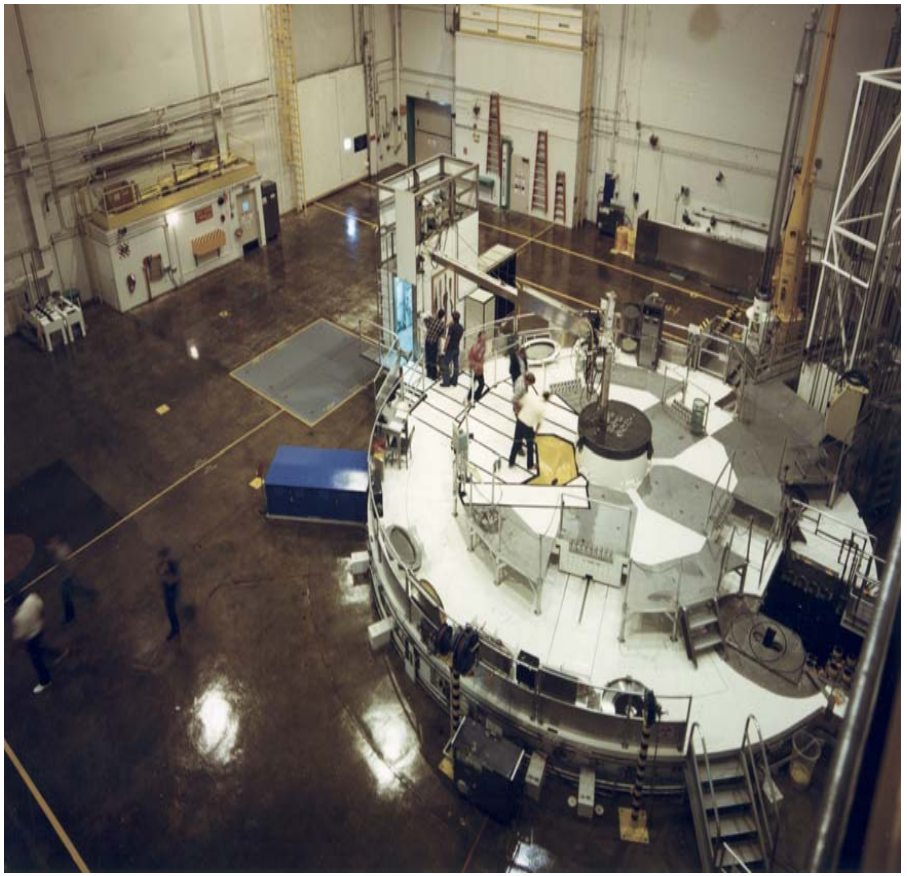
Coolant Temperatures and Pressure
125°F Inlet, 160ºF Outlet
390 psig

Peak Flux
-5 x 10^{14} n/cm^2-sec fast
- 1 x 10^{15} n/cm^2-sec thermal



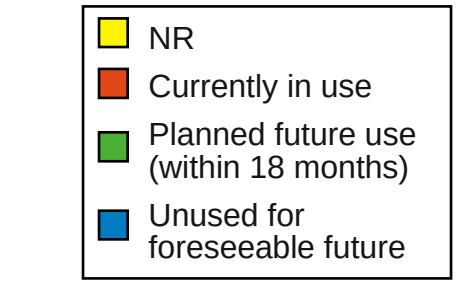
ATR Operations

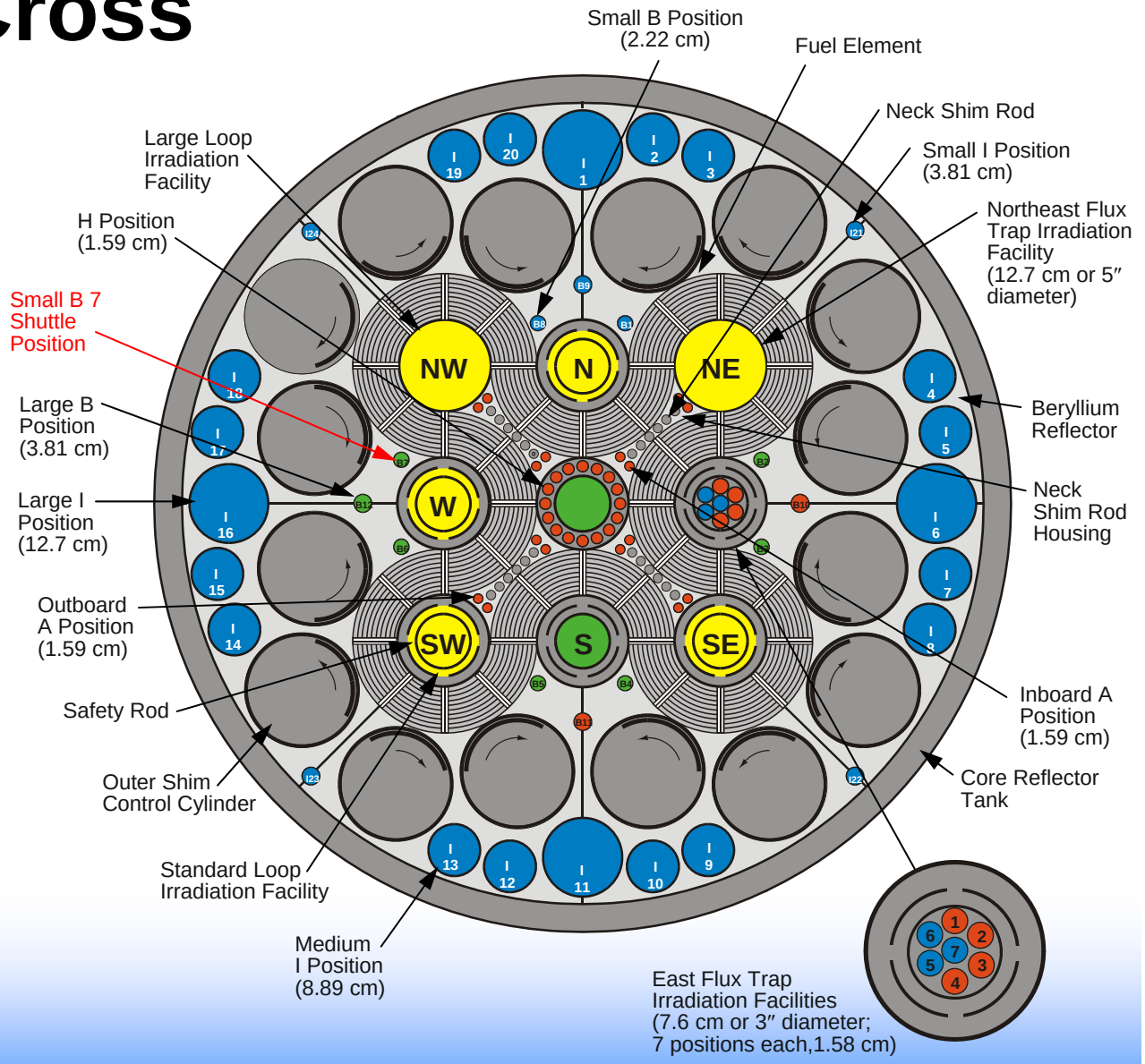
- Operating Cycles
  - Standard operating cycle is 6 to 8 weeks
  - Occasionally short high power cycles of 2 weeks
  - Standard reactor outages are 1 or 2 weeks
  - Operations for approximately 270 days per year
- Core Internals Changeout every 7 to 10 years



ATR Core Cross Section

77 irradiation positions
- 4 flux traps
- 5 in-pile tubes
- 68 in reflector





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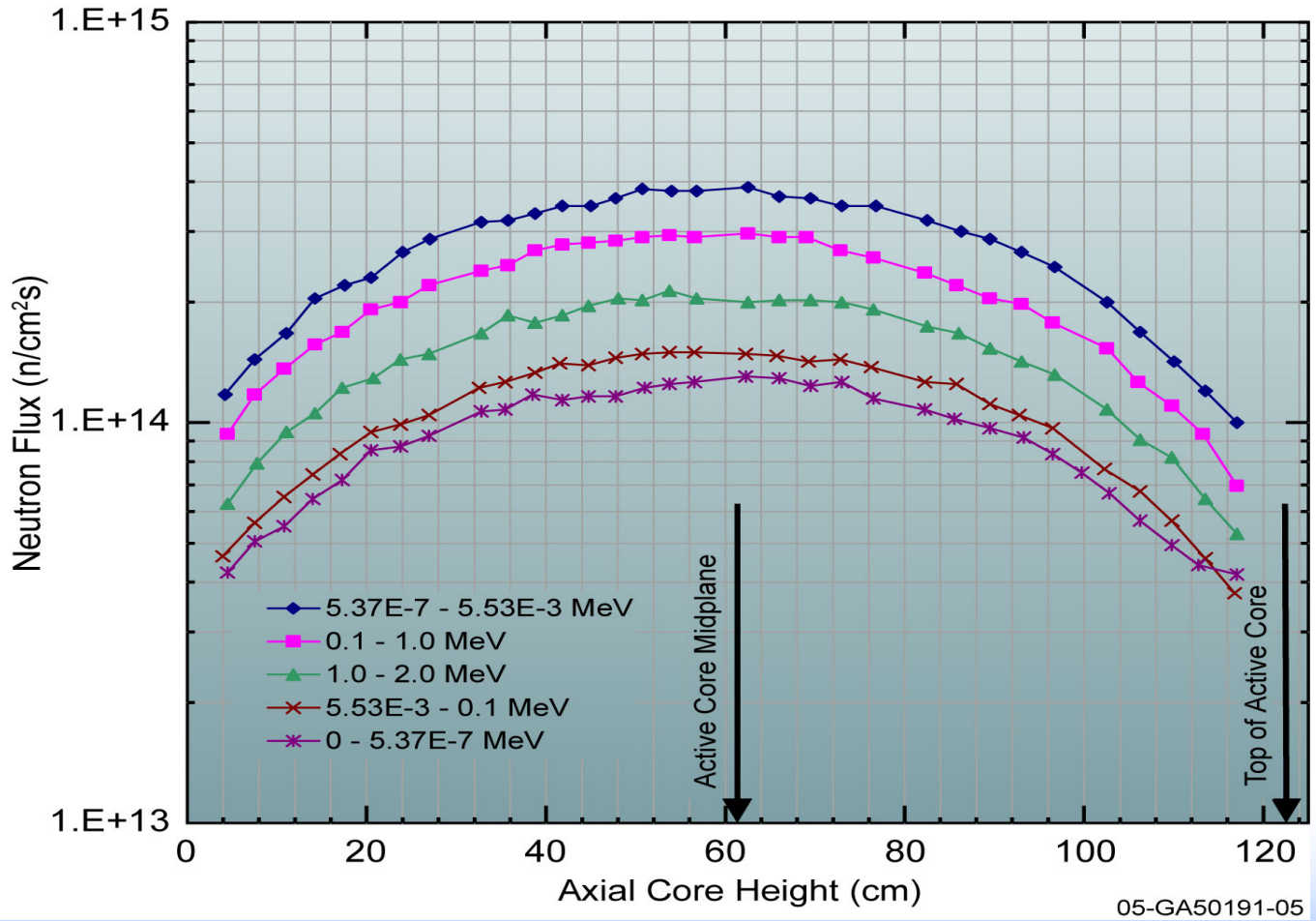
Center Flux Trap Flux Profile (125 MW)



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B-7 Flux Properties

Energy	B-7 Peak Fluxes Flux (n/cm^2-sec)
Thermal (2200 m/sec)	2.77E+14
Fast (>1 MeV)	1.87E+14
Total	7.23E+14

Gamma Heating at Core Mid-Plane (18 MW NW Lobe): 4.2 watt/gram for SST

Current ATR Irradiation Projects

- Advanced Fuel Cycle (AFC)
  - Fuel tests expected to continue through 2010
  - Gas Fast Reactor material tests
- Neptunium tests - Cross Section Data
- Advanced Gas Reactor, Fuel Tests
- RERTR
  - Mini plate
  - Full fuel plate
  - Full element
- Cobalt-60
- Zirconium

Proposed Irradiation Tests

- Next Generation Nuclear Plant, Graphite
- Fuel Qualification for the new ATR Gas Test Loop
- Isotopes
  - Strontium-89
  - Cesium-131
- Plutonium-238 for Radioisotope Power Systems
- Simulation of BWR Conditions for Various Tests
- Material Tests for International Research on Aging and New Reactor Designs

Future Activities for the ATR

- Next CIC tentatively scheduled for 2013
- Reactivation of Pressurized Water Loop
  - PWR testing
  - Possibly BWR testing
- Installation of hydraulic “rabbit” system
- Fuel fabrication facility equipment upgrades
- Possible “Fast Flux” Loop
- Hot cell use and need determination
  - Reactor Technology Complex - repackaging, dimensions, or new
  - Materials and Fuels Complex - PIE, NDE

Approximate Peak Flux Values for ATR Test Positions at 110 MW_{th} (22 MW_{th} in each lobe)

Position	Diameter (cm/in.)[a]	Thermal Flux (n/cm^2-s)[b]	Fast Flux (E>1 MeV) (n/cm^2-s)
Northwest and Northeast Flux Traps	13.3/5.250	4.4×10^{14}	2.2×10^{14}
Other Flux Traps	7.62/3.000[c]	4.4×10^{14}	9.7×10^{13}
A-Positions			
(A-1 - A-8)	1.59/0.625	1.9×10^{14}	1.7×10^{14}
(A-9 - A-16)	1.59/0.625	2.0×10^{14}	2.3×10^{14}
B-Positions			
(B-1 - B-8)	2.22/0.875	2.5×10^{14}	8.1×10^{13}
(B-9 - B-12)	3.81/1.500	1.1×10^{14}	1.6×10^{13}
H-Positions (14)	1.59/0.625	1.9×10^{14}	1.7×10^{14}
I-Positions			
Large (4)	12.7/5.000	1.7×10^{13}	1.3×10^{12}
Medium (16)	8.26/3.500	3.4×10^{13}	1.3×10^{12}
Small (4)	3.81/1.500	8.4×10^{13}	3.2×10^{12}

a. Position diameter; capsule diameter must be smaller.

b. Average speed 2,200 m/s.

c. East, center, and south flux traps can each contain 7 guide tubes with inside diameters of 1.76 cm (0.694 in.).

ATR Operating and Experiment Schedule

Cycle #/ FY Quarter	140B	141A	142A	142B	143A	143B	144A	144B	145A	145B	146A	146B	147A	147B	148A	148B	FY-11, 1	FY-11, 2	FY-11, 3	FY-11, 4	FY-12, 1
Start Date	12/1/07	1/26/08	3/8/08	6/14/08	08/23/08	11/01/08	01/10/09	03/07/09	05/30/09	08/08/09	10/10/09	12/12/09	01/02/10	02/27/10	05/05/10	07/17/10					
Outage Days	20	7	56	14	14	14	14	28	14	14	14	7	14	35	14	14					
Operating Days	36	35	42	56	56	56	42	56	56	49	49	14	42	42	49	42					
Core Location																					
A1 - A8																					
A-9,10																					
A-11																					
A-12																					
A-13 & A-16																					
A-14 & A-15																					
B1																					
B2			DOE						DOE												
B3, 4, 5, 6																					
B-7					Hydraulic Shuttle Irradiation System																
B-8									DOE												
B-9																					
B-10	DOE									DOE											Until 2018
B-11	DOE		DOE			DOE				DOE						DOE					Until 2012
B-12				DOE						DOE											Until 2018
H1, H2																					
H-3, H-11	N-16 Monitoring Lines																				
H4 - H10																					
H12 - H16																					
I1-I8, I10, I12, I14-I21, I23-I24																					
I9								DOE													
I-11																					
I-13											DOE										
I-22																					Until 2014
CFT-1			DOE												DOE						Until 2019
CFT-2		DOE																			Until 2019
EFT-1	DOE			DOE																	Until 2015
EFT-2	DOE			NSUF																	
EFT-3	DOE																				
EFT-4	DOE							DOE													Until 2015
EFT-5																					
EFT-6																					
EFT-7																					
SFT				DOE				DOE			DOE										Until 2018
1A-NE	NR									DOE			NR								
1D-N	NR																				
1C-W	NR																				
2B-SE	NR																				
2D-SW	NR																				
2E-NW	NR																				

Irradiation Ongoing | Planned & Funded Irradiations | High Probability Future Irradiation | Medium Probability Future Irradiation | Low Probability Future Irradiation

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INL Isotope Processing Capabilities

- INL has extensive radiochemistry and chemical separation expertise
- INL has limited facilities for processing irradiated targets, which include radiochemistry labs, gloveboxes and a shielded hot cell facility
- Currently isotope processing at INL is limited to efforts to demonstrate recovery of ^{225}Ac from excess ^{233}U for a commercial partner