PROSPECT at the High Flux Isotope Reactor (HFIR)

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HFIR conceived as multi-purpose reactor with a focus on transplutonium isotope production.

1958
U.S. Atomic Energy Commission (AEC) decides to design HFIR

1965
HFIR Goes Critical

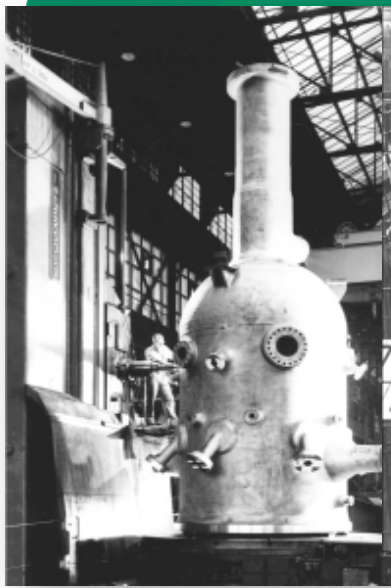
1966
HFIR Operates at full power of 100MW

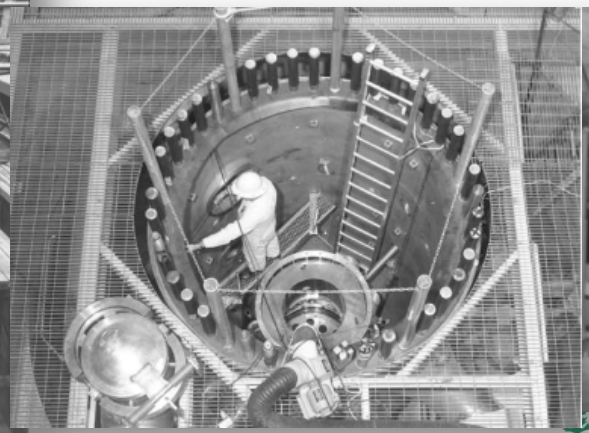
1986
Reactor Vessel embrittlement appeared worse than anticipated, thus began a 2 ½ year shutdown to investigate improvement options

1989
HFIR is restarted at 85MW, extending the vessel life to 2040

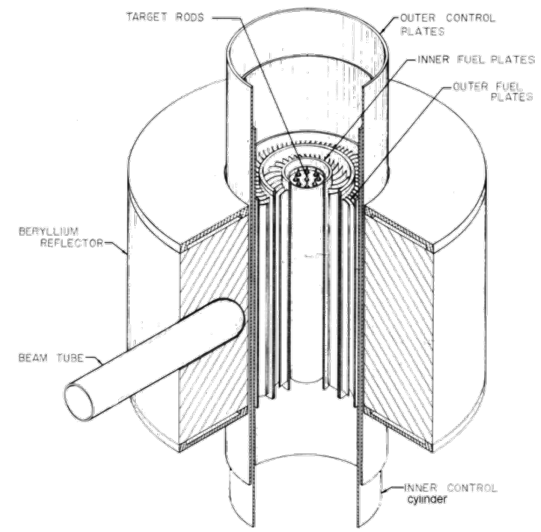
2007
HFIR is restarted after a shutdown for installation of a Cold Source and many system upgrades.

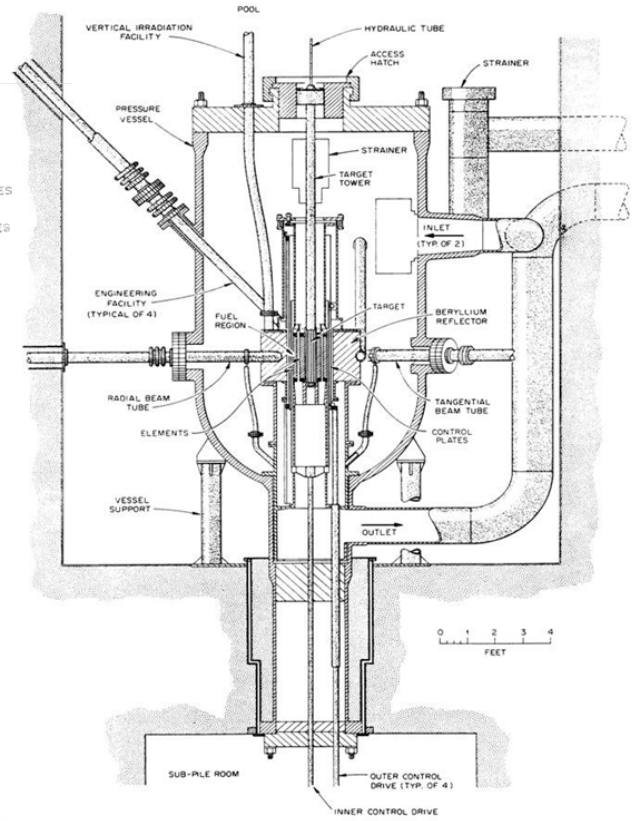
Today
HFIR currently operates at 85MW with a primary mission of neutron scattering research.

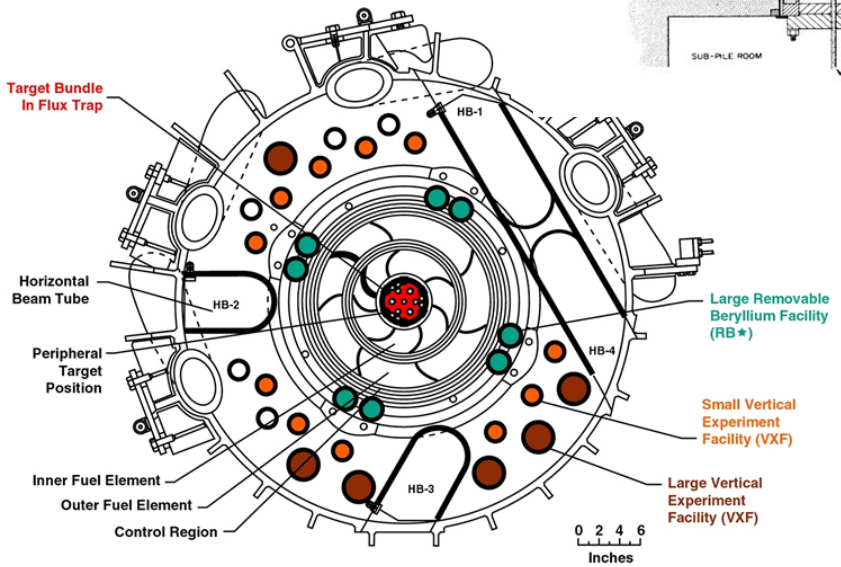




HFIR technical description



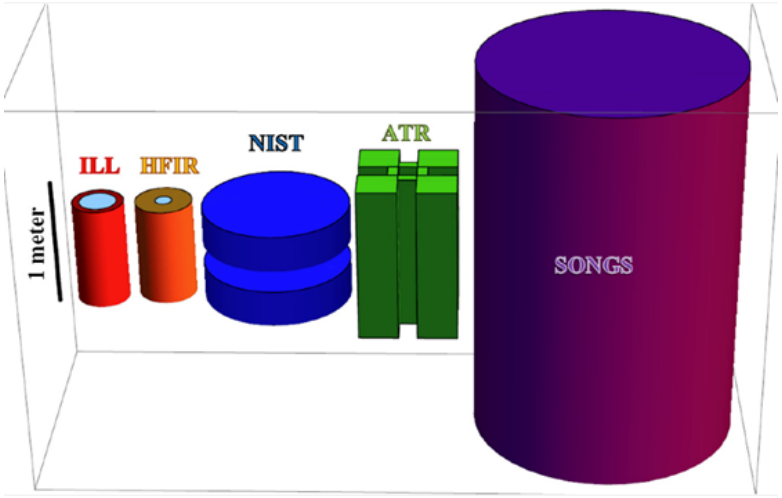


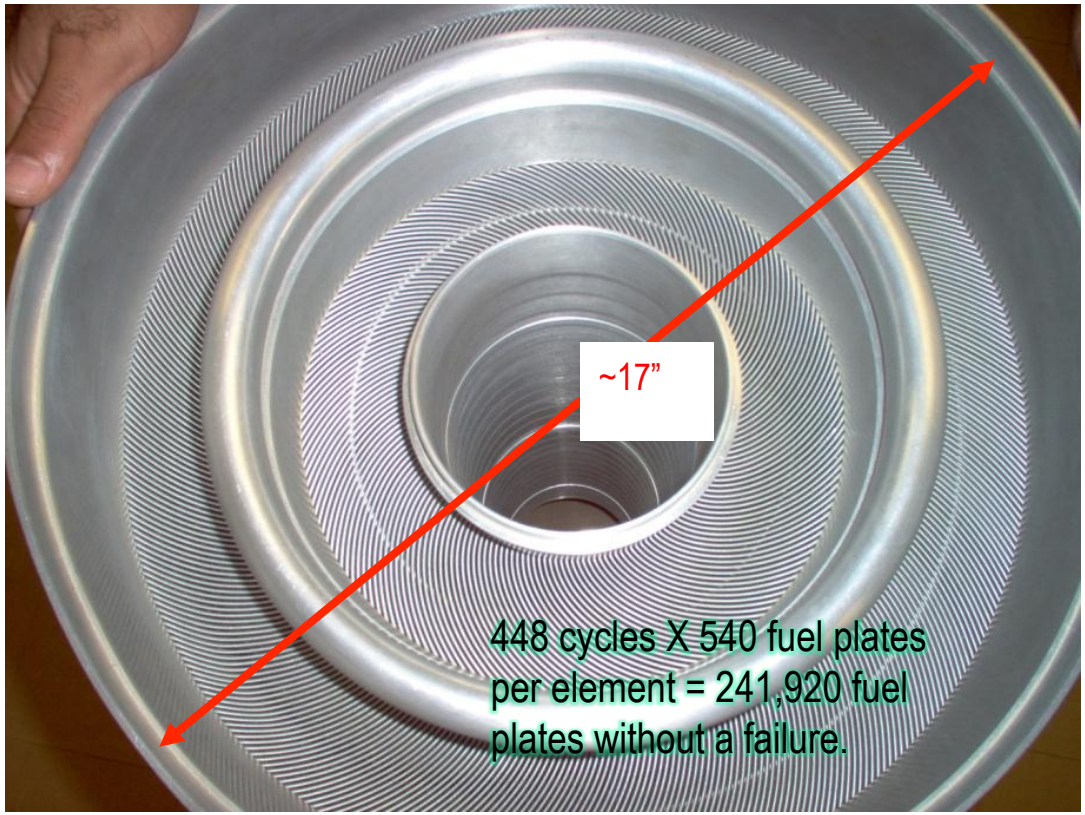


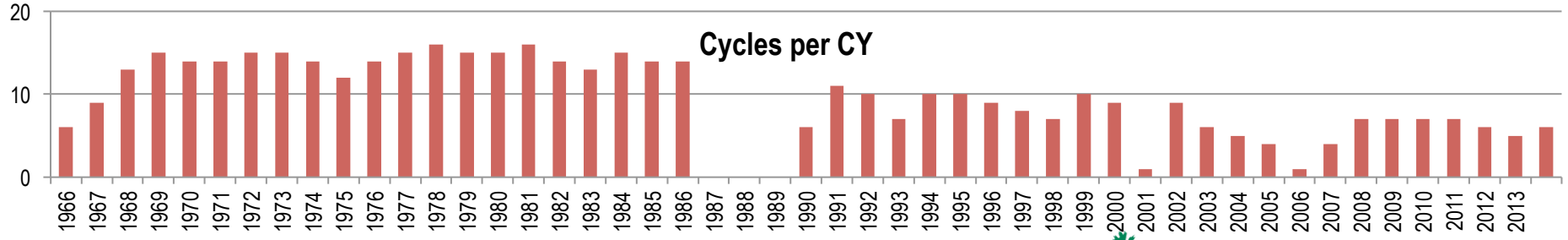
- Annular HEU core (9.5kg@93%)
- 85MW operation +/- 1MW
- 23-26 day cycle, depending on core loading
- 6 cycles/year. Plans for 7
- Next long planned outage (>4mo) estimated in 2023/24.
- Accustomed to arranging a variety of science programs and hosting access for visitors, including FN.
- Primary missions are
  1. neutron scattering (user facility)
  2. isotope production
  3. materials damage testing
  4. nuclear forensics

Advantages of a research reactor (HFIR)

- Compact core with highest power density (peak ~2MW/liter)
- Regular and relatively short on/off cycle (predictable)
- Accustomed to accommodating researchers from around the world (including FN access to facilities)





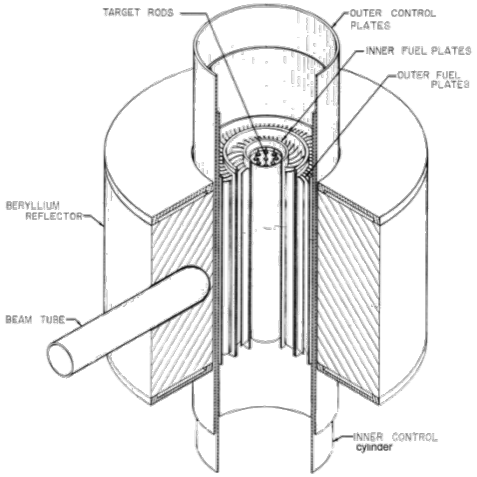


How the nuclear reaction is controlled affects the flux available for irradiations

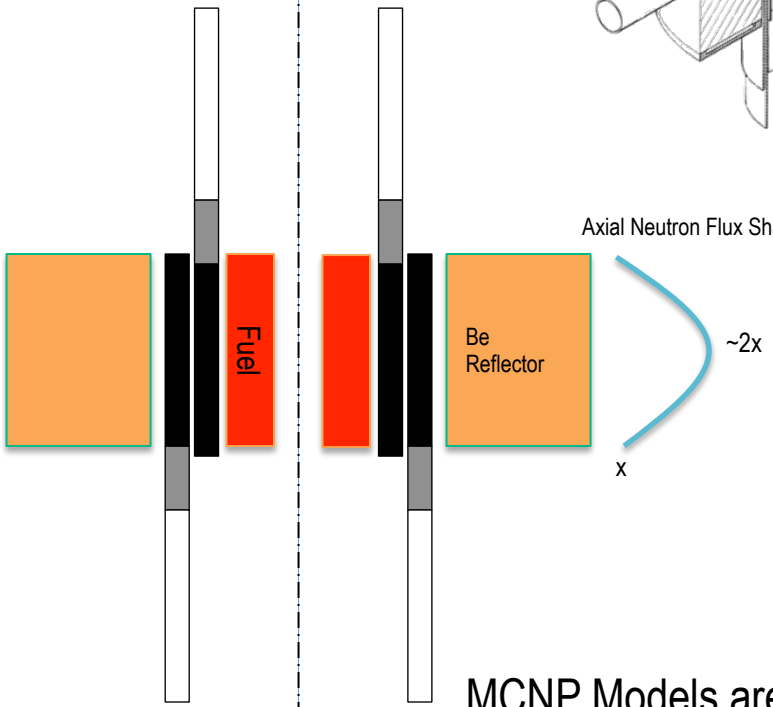
Aluminum – No neutron absorption

Tantalum – Some neutron absorption

Europium – Strong neutron absorption



23 to 26 day cycle



Shutdown

Cold Clean Critical

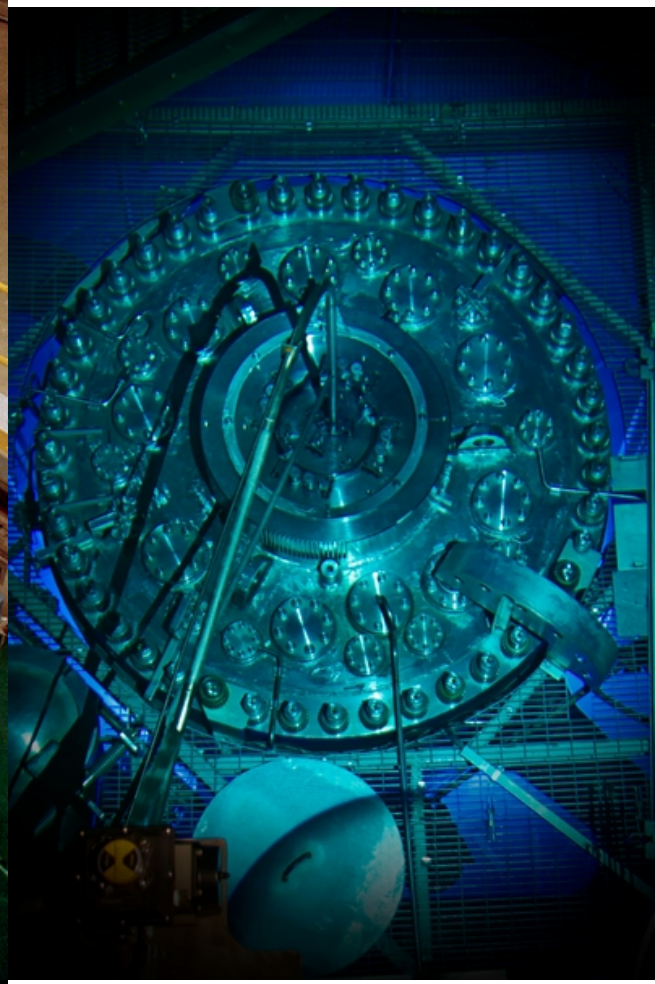
1 Day Later Equilibrium Xenon

Mid Cycle

End of Cycle

MCNP Models are available
NIST, ATR and HFIR are all well modelled

HFIR Reactor Bay & Pressure Vessel



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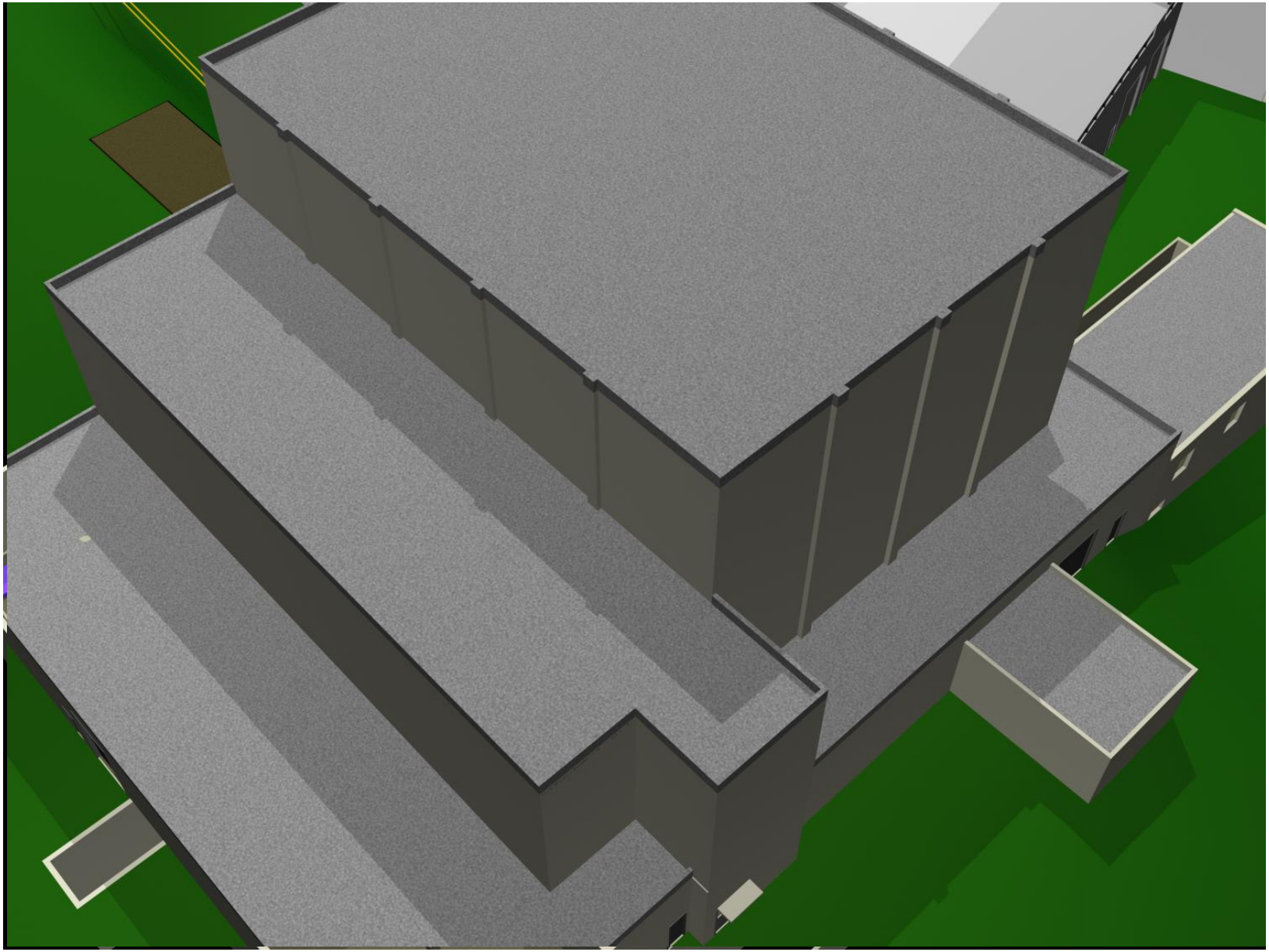
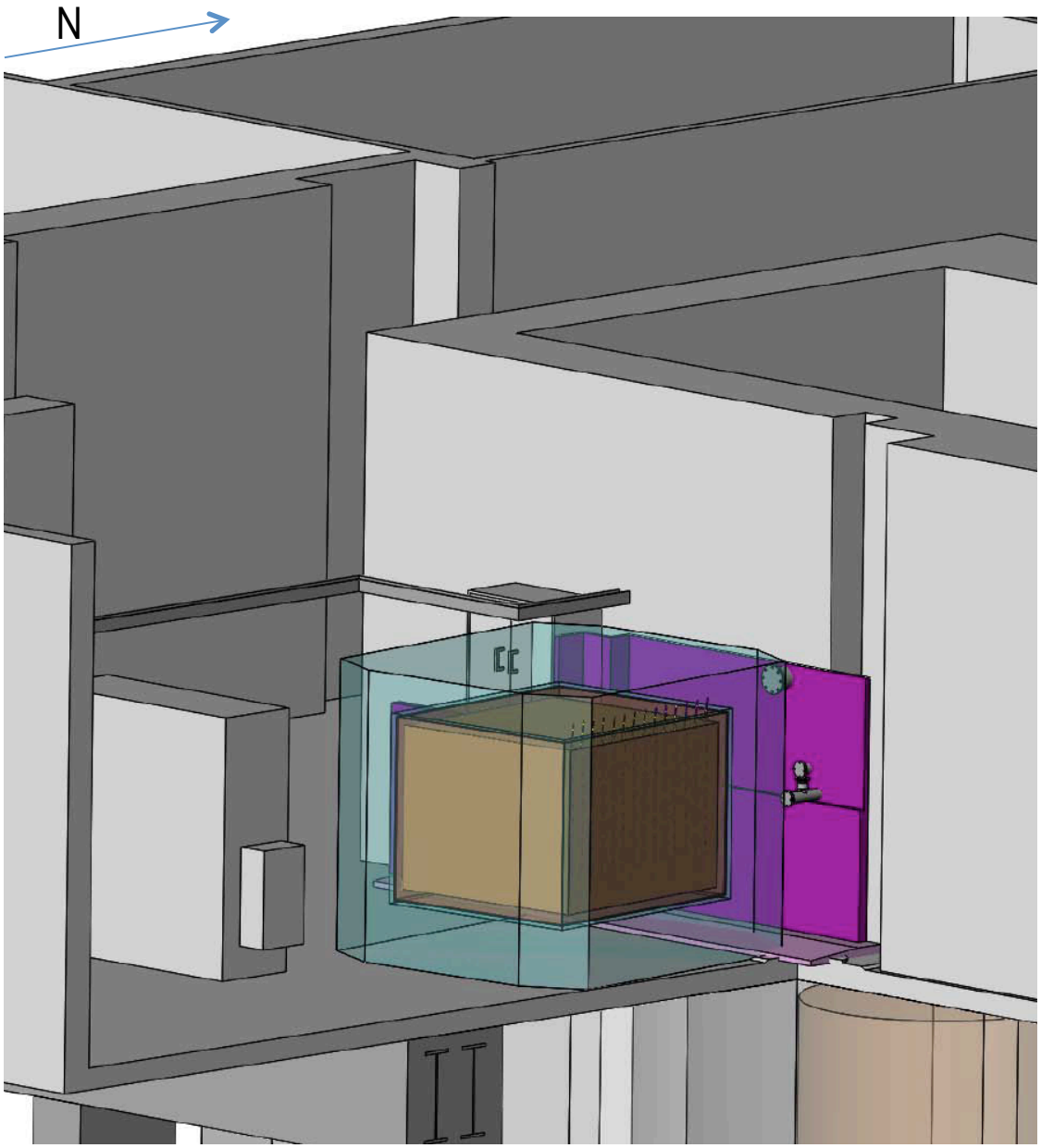
Reactor Building Layout

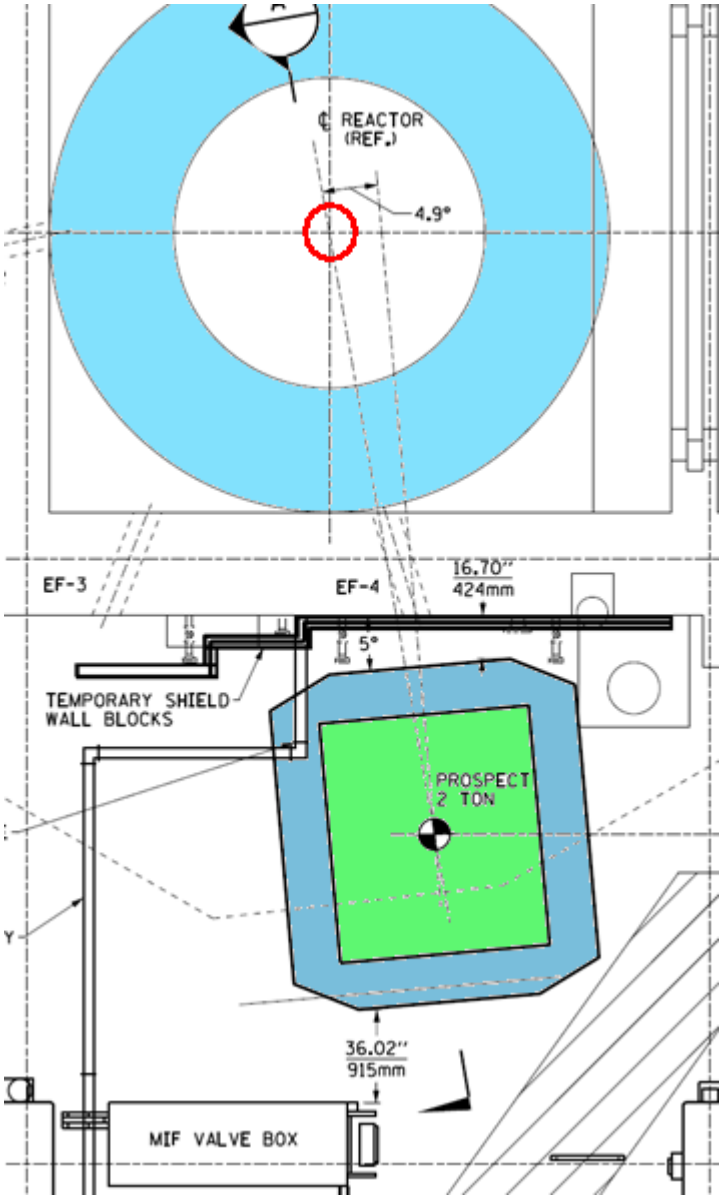


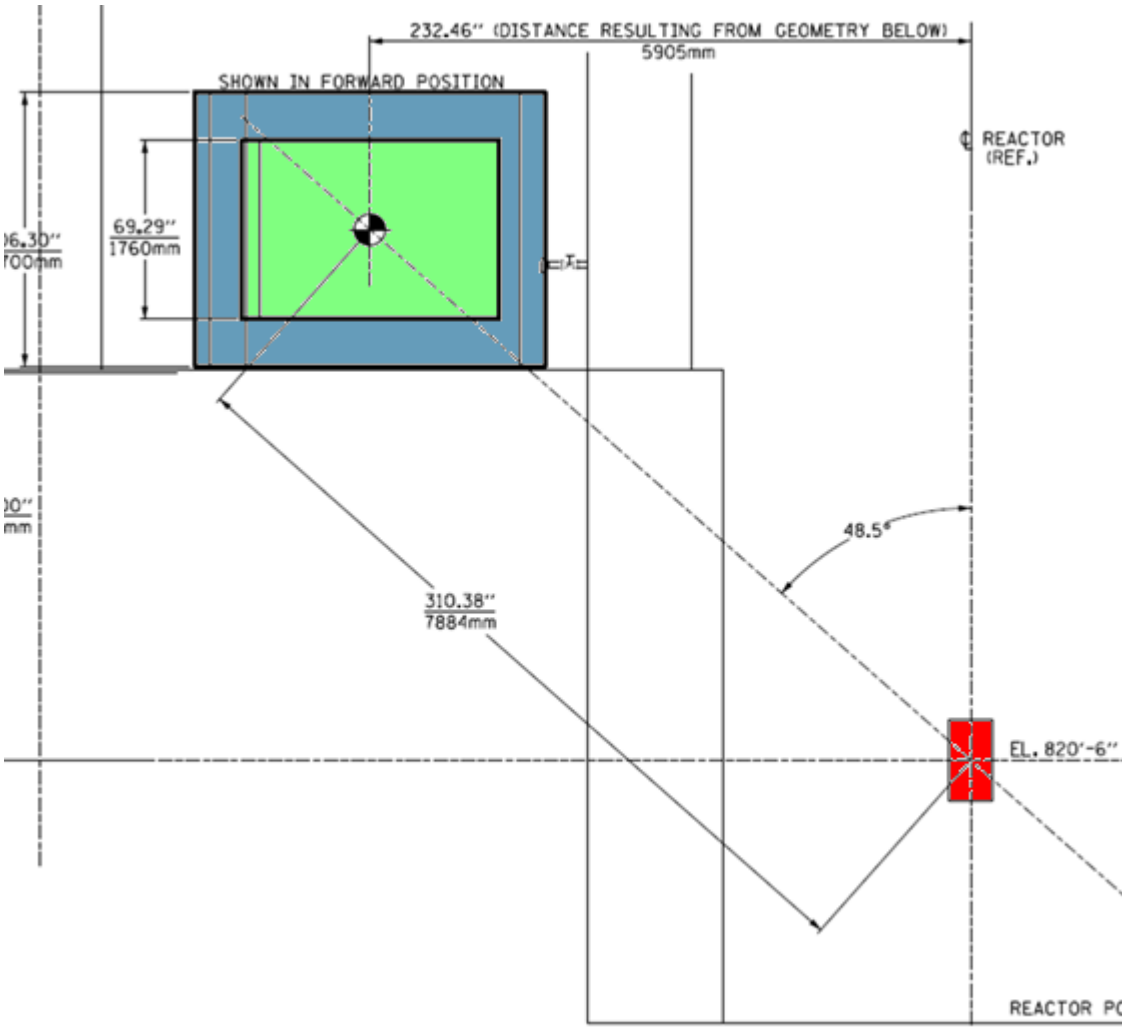
Near Detector Location



- 6-9m Baseline Range
- Intrinsic shielding includes
  - Pool and vessel water (3m)
  - Pool walls (1m concrete)
  - Bioshield (1.3m) under detector
- Overburden includes two 8” concrete floors directly above detector
- Nearby activities include
  - Materials Irradiation Facility (gas mixing and control station)
  - NAA lab (around corner)
  - Cold Source control room (through double doors at end of hall)

Detector location relative to HFIR core





SECTION A-A

										REFERENCE DRAWINGS	NUMBER
										UT-BATTELLE	Oak Ridge National Laboratory
										RESEARCH REACTORS DIVISION	
										operated for the DEPARTMENT OF ENERGY under the GOVERNMENT of the United States of America	
0		SEE DCN 11606								FACILITY H.F.I.R.	BLDG. NO. 7900
NO.		REVISIONS			DESIGNER / TASK LDR	REVIEWER / SAFETY	D.A.S. / C.C. MGR	APPROVED / MAINT MGR	OPS. MGR / DATE	NEUTRINO EXPERIMENTS	
DESIGNER	DATE	SAFETY ANALYST	DATE				APPROVED		DATE	PROSPECT 2 TON	
TASK LEADER	DATE	D.A. SPECIALIST	DATE				MAINT. MGR		DATE	NEAR/FAR POSITIONS	
DESIGN REVIEWER	DATE	CFC CONTROL MGR	DATE				OPERATIONS MGR		DATE	M-11526-0H-018A E REV. 0	

Panoramas of detector area

Advantages of ORNL/HFIR

1. Ease of access (physically and administratively).
2. Facilitation by ORNL-internal collaborations (Physics Division, Research Reactors Division).
3. Existing User Facility (neutron scattering), so processes and procedures exist for adding these experiments with existing Engineering, Safety, Operations, Craft and Radiological Controls staff.
4. Adequate space for fundamental science experiments. Currently hosting several physics experiments, but room for others. (PROSPECT, SoLiD, etc…)
5. Backgrounds are characterized (as are those at NIST and ATR).
6. HFIR MCNP model is mature and available (posted on website).
7. Reliable HFIR operating model. 6-7 cycles per year. Schedule is prepared 3 years in advance. Reliability of startups at HFIR is over 95%.
8. ORNL has been involved with PROSPECT since the inception of the collaboration.