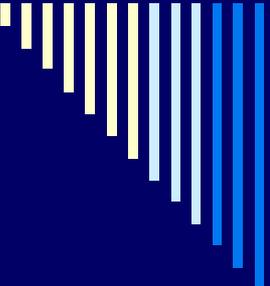


Materials Irradiation within Nuclear Science and Technology Division

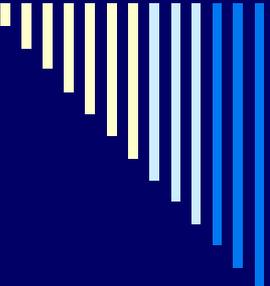
**NSTD advisory group meeting
3/15 – 3/16 2006**





ORNL has extensive materials irradiation experience

- 50 years experience in design, assembly, and operation of irradiation experiments
- On-site reactor (High Flux Isotope Reactor)
- Experiments designed for other reactors
 - Advanced Test Reactor at Idaho National Laboratory
 - Ford Nuclear Reactor at University of Michigan
 - High Flux Reactor at Petten, The Netherlands
 - Oak Ridge Research Reactor at ORNL



NSTD Designs, Fabricates, and Operates Irradiation Experiments, Integrates Experiments with Reactor Operations, and Performs Data Analysis

□ External Sponsors Include

- DOE and Japanese Fusion Energy Programs**
- DOE Fissile Materials Disposition Program**
- DOE Generation IV Reactor Program**
- DOE Naval Reactors**
- US Nuclear Regulatory Commission**



NSTD Operates Two Major Facilities to Support Irradiation Programs

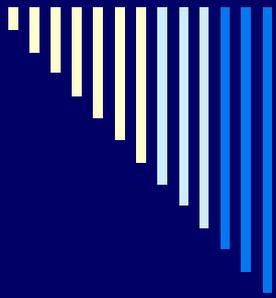
□ Materials Irradiation Facility

- Monitor and control of experiment conditions real time during irradiation at ORNL High Flux Isotope Reactor
- Web based interface allows PIs to view experiment progress

□ Capsule Assembly Laboratory

- Facilities for assembling and performing acceptance testing of irradiation experiments
- Integrated welding facility
- Vacuum test equipment
- Hydro-test equipment
- Test pit for acceptance testing of long experiments





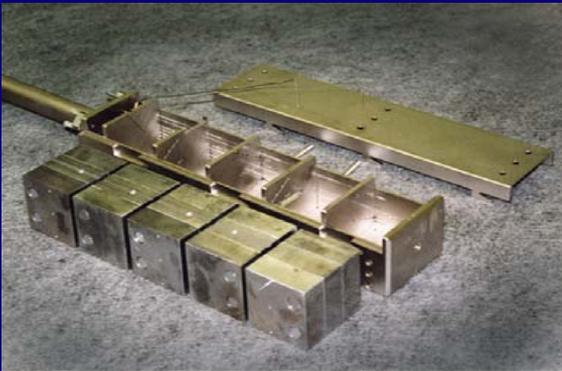
Multiple Experimental Formats are Used

Rabbits

Small scale and
“inexpensive”
Located in the
HFIR flux trap



Reusable experiment designs



Target capsules

Larger scale either instrumented or uninstrumented
Located in the HFIR flux trap

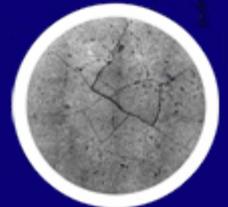


RB capsules

Large scale instrumented capsules
Located in the HFIR removable reflector region



Fuel irradiation



Advanced CAD and thermal modeling tools used for experiment design

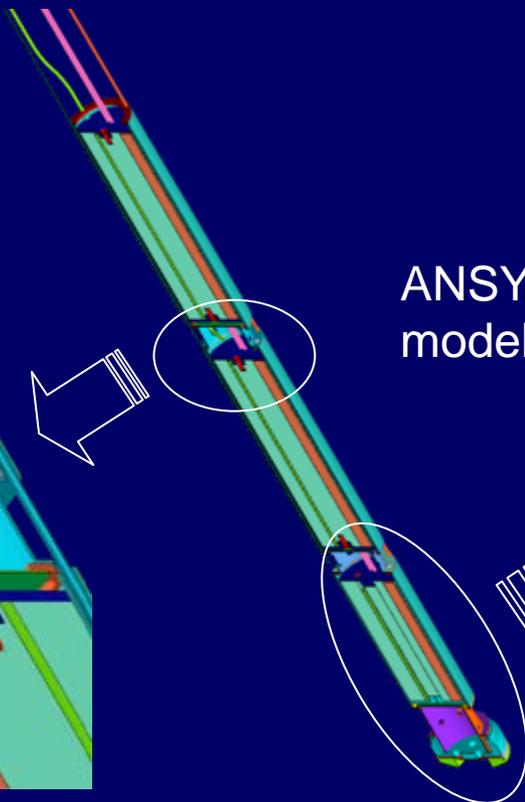
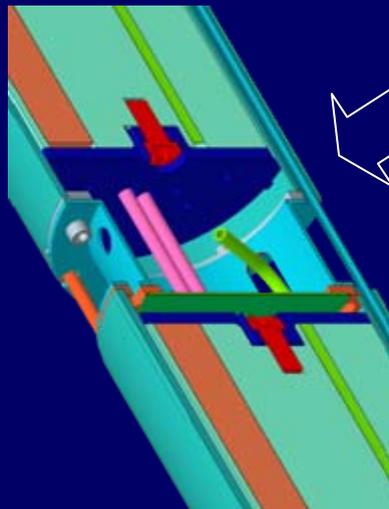
- Pro/Engineering CAD software used to develop 3-D models
- ANSYS Multi-physics analysis code used for thermal design

Temp in K

Pro E Drawing

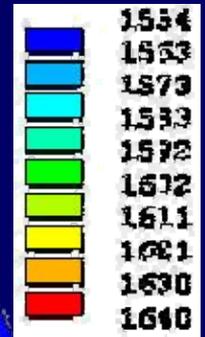
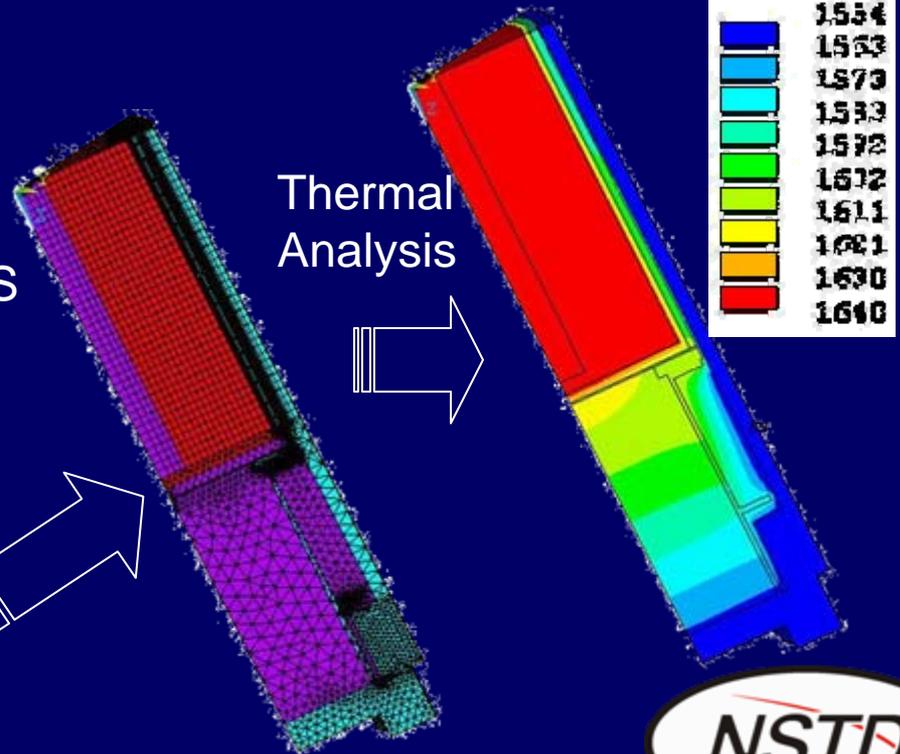
ANSYS thermal Analysis

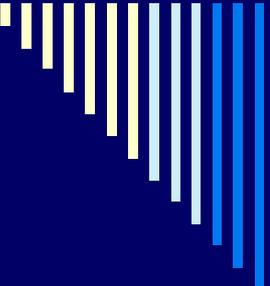
Design Detail



ANSYS model

Thermal Analysis





Capsule Fabrication Process is Unique For Each Capsule Design

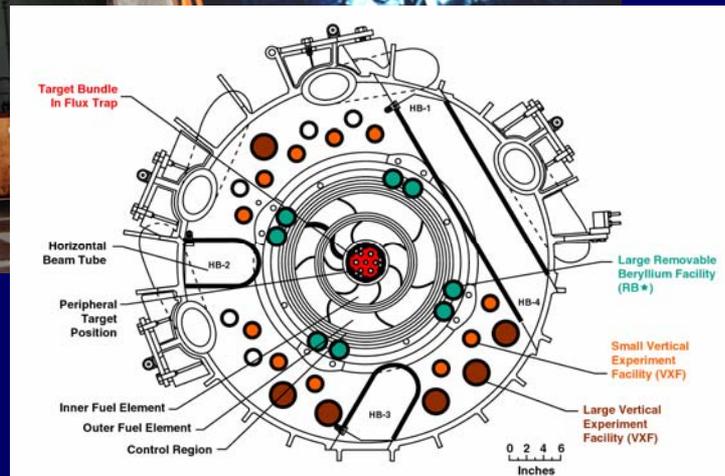
Rabbit capsule with bend bar
specimens for the US Navy



Lithium filled
fusion materials
experiment capsule



Some Experiments Can be Monitored Real Time



M5_17J_A.ODF
MIF-5 MFE-RB-17J 3/1/2006 15:52:48

17J Reactor Pwr 0.32 Mw
Ambient 25.20 Deg C

SECONDARY GAS SUPPLY		PRIMARY GAS		PRI. GAS FLOW	
PT-502 >65	72.38	TE-501	705.00 Deg C	PT-536	36.12
PT-527 >65	46.58	TE-502	700.00 Deg C	FT-536	0.76
PT-528 >65	49.45	TE-503	688.00 Deg C	DIFF	0.8
ZONE A AVG TEMP		ZONE B AVG TEMP		REG. "A" FLOW	
697.67 Deg C		597.67 Deg C		PT-538	41.33
FTCV-506A 0.23		TE-504		PT-538B	40.63
F231 Set 0.00		TE-505		PT-538C	42.54
FTCV-531A -2.19		TE-506		ME-538A	40.74
F231 Set 5.00		TE-508		ME-538B	19.87
PT-508A 47.69		Argon		ME-538C	22.93
FOV-532A OPEN		ZONE C AVG TEMP		ME-538C	24.03
Argon		448.00 Deg C		FT-538	-0.05
FTCV-506B 2.24		TE-507		F2CV-538	-0.00
F231 Set 0.00		TE-508		REGION "A" GAS	
FTCV-531B -1.63		TE-509		PT-556	36.71
F231 Set 0.00		Argon		FT-556	2.29
PT-508B 43.04		Argon		PT-558	34.85
FOV-532B OPEN		Argon		PT-508A	38.94
Argon		Argon		PT-558B	35.88
FTCV-508C 0.15		TE-510A		PT-558C	38.85
F231 Set 0.00		P1-511		ME-558A	5.80
FTCV-531C -0.15		MM-511A		ME-558B	4.58
F231 Set 0.00		76.55		ME-558C	5.91
PT-508C 41.48		MM-511B		FT-558	-0.56
Argon		41.73		F2CV-558	0.00
FTCV-546 -0.03		MM-511C		URBILICAL PRESS	
F231 Set 0.00		-249.98		PDI 570A	10.00
PT-546 49.21		F1-521		PDI 570B	10.00
		-0.51		PDI 570C	10.00
				FT-570	47.68
				F2CV-570(14.0)	14.00



ORNL Irradiation Programs Have Made Significant Contributions to World Knowledge Base of Material's Irradiation Performance

ornl

ORNL/M-408, Rev. 0

OAK RIDGE NATIONAL LABORATORY

MARTIN MARIETTA

HRB-22 Irradiation Phase Test Data Report

F. C. Montgomery
R. T. Acharya
C. A. Baldwin
P. L. Ritzenhouse
K. R. Thoms
R. L. Wallace

MANAGED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

ornl

OAK RIDGE NATIONAL LABORATORY

UNION CARBIDE

ORNL/TM-7298

Characterization and Irradiation Performance of HTGR Biso-Coated Fertile Particles in HFIR Experiments HT-28, -29, and -30

E. L. Long, Jr.
P. Krauszweiser
R. L. Beatty
M. J. Kania
C. S. Morgan, Jr.
C. S. Yust

OAK RIDGE NATIONAL LABORATORY

MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

ORNL/TM-2005/255

Weapons-Derived Mixed Oxide Fuel Test Irradiation Summary

S. A. Hodge
R. N. Morris
L. J. Ott

ORNL/MD-LTR-206

MON Average Power Test 50 GWd/MT FFE: Quick Look

R.N. Morris
C.A. Baldwin
S.A. Hodge
N.H. Fackna

February 2001

Fertile Materials Disposition Program

Notice

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, or any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for any third party's use of the contents of any information, apparatus, or process disclosed in this report, or represents that its use by such third party would not infringe privately owned rights.

ORNL/NUREG/TM-187

Design and Safety Report for Hobbie Capsules

A Series of Zircaloy Creepdown Irradiation Tests

K. R. Thoms
Thao van der Kaas

Prepared for the U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Under Interagency Agreements DOE 40 551-75 and DOE 40 552-75

OAK RIDGE NATIONAL LABORATORY

OPERATED BY UNION CARBIDE CORPORATION FOR THE DEPARTMENT OF ENERGY

OAK RIDGE NATIONAL LABORATORY

MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

ORNL/TM-2002/77

November 2005

Materials Disposition Program

Notice

was prepared as an account of work by an agency of the United States Government. Neither the United States Government nor any agency thereof, or any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for any third party's use of the contents of any information, apparatus, or process disclosed in this report, or that its use by such third party would infringe privately owned rights.

Heavy-Section Steel Irradiation Program's Reusable Irradiation Facilities

D. W. Heatherly
K. R. Thoms
M. T. Hurst
G. E. Giles

April 2005

UT-BATTELLE

