SCHEDULE AND STATUS OF IRRADIATION EXPERIMENTS – A. F. Rowcliffe, M. L. Grossbeck, and J. P. Robertson (Oak Ridge National Laboratory)

OBJECTIVE

To provide an updated summary of the status of irradiation experiments for the neutron-interactive materials program.

SUMMARY

The current status of reactor irradiation experiments is presented in tables summarizing the experimental objectives, conditions, and schedule.

PROGRESS AND STATUS

Currently, the program has three irradiation experiments in reactor; and 6 experiments in the planning or design stages. Postirradiation examination and testing is in progress on 18 experiments.

Summary of Reactor Irradiation Experiments

Experiment	Lead Lab	Collaborators	Responsible Person	Major Objectives	Materials	Temperature °C	Dose (dpa) or fluence	Irrad. Start	Irrad. Finish	Status
EBR-II, Reactor, ANL, Idaho Falls, ID										
COBRA 1A1	PNL	ORNL, ANL, MONBUSHO	M.L. Hamilton	Tensile and fatigue prop., Charpy impact, fracture toughness, TEM	Austenitic and ferritic steels, Fe-alloys, V, Be, low act. materials, Cu alloys, Ti-Al, SiC, C-C comp.	370, 500, 600	9	Nov-92	Apr-93	
COBRA 1A2	PNL	ORNL, ANL, MONBUSHO	M.L. Hamilton	Tensile and fatigue prop., Charpy impact, fracture toughness, TEM	Austenitic and ferritic steels, Fe-alloys, V, Be, low act. materials, Cu alloys, Ti-Al, SiC, C-C comp.	370, 400, 800	33	Nov-92	Sep-94	
X530	ANL		H. Tsai, H.M. Chung	He-effects, swelling, Charpy impact, fracture toughness, tensile prop.	V alloys	370	5	Aug-94	Sep-94	
High Flux Isotope Reactor, ORNL, Oak Ridge, TN										
HFIR-CTR-60	ORNL		S.J. Zinkle	Flexure bars, TEM, indentation disks	Isotopically tailored ceramics	100-600	2.4E+26 n/m2	Dec-94	Aug-95	
HFIR-CTR-61	ORNL		S.J. Zinkle	Similar to HFIR-CTR-60			7.20E+26	Dec-94	Aug-97	
HFIR-JP-9	ORNL	JAERI	P.J. Maziasz/ J.E. Pawel	He effects by isotopic tailoring, tensile prop., TEM	Austenitic and ferritic steels	300-600	57	Jul-90	Apr-94	
HFIR-JP-10	ORNL	JAERI	P.J. Maziasz/ J.E. Pawel	He effects by isotopic tailoring, tensile prop., TEM	Austenitic and ferritic steels	300-600	17	Jul-90	Sep-91	
HFIR-JP-11	ORNL	JAERI	P.J. Maziasz/ J.E. Pawel	Similar to HFIR-JP-10			17	Jul-90	Sep-91	
HFIR-JP-12	ORNL	JAERI	P.J. Maziasz/ J.E. Pawel	Similar to HFIR-JP-9			57	Jul-90	Apr-94	
HFIR-JP-13	ORNL	JAERI	P.J. Maziasz/ J.E. Pawel	Similar to HFIR-JP-10			17	Jul-90	Sep-91	
HFIR-JP-14	ORNL	JAERI	P.J. Maziasz/ J.E. Pawel	He effects by isotopic tailoring, tensile prop., TEM	Austenitic and ferritic steels	300-600	34	Jul-90	Sep-92	

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Experiment	Lead Lab	Collaborators	Responsible Person	Major Objectives	Materials	Temperature °C	Dose (dpa) or fluence	Irrad. Start	Irrad. Finish	Status
HFIR-JP-15	ORNL	JAERI	P.J. Maziasz/ J.E. Pawel	Similar to HFIR-JP-9			57	Jul-90	Apr-94	
HFIR-JP-16	ORNL	JAERI	P.J. Maziasz/ J.E. Pawel	Similar to HFIR-JP-10			17	Jul-90	Sep-91	
HFIR-JP-17	ORNL	JAERI	M.L. Grossbeck/ J.E. Pawel	Fracture toughness, tensile prop. TEM	Austenitic and ferritic steels	250-300	3	Dec-91	Feb-92	
HFIR-JP-18	ORNL	JAERI	M.L. Grossbeck/ J.E. Pawel	Fracture toughness, tensile prop. TEM	Austenitic and ferritic steels	60-125	3	Aug-91	Oct-91	
HFIR-JP-19	ORNL	JAERI	M.L. Grossbeck/ J.E. Pawel	Similar to HFIR-JP-18		60-125	3	Aug-91	Oct-91	
HFIR-JP-20	ORNL	JAERI	J.E. Pawel	Tensile Prop., TEM, He effects by isotopic tailoring	Austenitic and ferritic steels	300-600	8	Dec-93	Jun-94	
HFIR-JP-21	ORNL	JAERI	J.E. Pawel	Similar to HFIR-JP-20			18	Dec-93	Apr-95	
HFIR-JP-22	ORNL	JAERI	J.E. Pawel	Similar to HFIR -JP-20			34	Dec-93	Jan-96	
HFIR-JP-23	PNL	MONBUSHO	D.S. Gelles	TEM	Austenitic and ferritic steels, Cu, Mo, V alloys, TiAl	300-600	8	Dec-93	Jun-94	
HFIR-MFE-60J	ORNL	JAERI	J.L. Scott/ M.L. Grossbeck	Spectrally tailored for fusion He prod. Began in ORR as ORR-MFE-6J (6.9 dpa). TEM, Charpy, irrad. creep, tensile and crack growth prop.	Austenitic and ferritic steels, and Ni alloys	60	19 (total)	Jul-90	Nov-92	
HFIR-MFE-330J	ORNL	JAERI	J.L. Scott/ M.L. Grossbeck	Similar to HFIR-MFE-60J. Began in ORR as ORR-MFE-7J (7.4 dpa)		330	19 (total)	Jul-90	Nov-92	
HFIR-MFE-200J	ORNL	JAERI	M.L. Grossbeck/ J.E. Pawel	Similar to HFIR-MFE-60J. Began in ORR as ORR-MFE-6J (6.9 dpa)		200	17 (total)	Nov-92	Jan-95	
HFIR-MFE-400J	ORNL	JAERI	M.L. Grossbeck/ J.E. Pawel	Similar to HFIR-MFE-60J. Began as ORR-MFE-7J (7.4 dpa)		400	17 (total)	Nov-92	Jan-95	
HFIR-HT-S1, -S7	ORNL		L.L. Snead	Thermal conductivity	Various insulators	80-350	0.01-1.0	Jun-95	Aug-95	
HFIR-HT-F Series	ORNL		L. L. Snead	Fiber tensile	SiC	80-800	0.001-1.0	Jan-95	Mar-96	

Summary of Reactor Irradiation Experiments

Experiment	Lead Lab	Collaborators	Responsible Person	Major Objectives	Materials	Temperature °C	Dose (dpa) or fluence	Irrad. Start	Irrad. Finish	Status
HFIR-TRIST-ER1	ORNL	MONBUSHO/ JAERI	S.J. Zinkle	In-situ electrical conductivity	Al2O3	450	3E+25 n/m2	Apr-96	Jun-96	
HFIR-MFE-RB-10J	ORNL	JAERI	J.E. Pawel	Tensile, fracture	Vanadium, 316LN-1G, J316	200, 500	5	Feb-98	Feb-99	
HFIR-MFE-RB-11J	ORNL	MONBUSHO/ JAERI	M. L. Grossbeck	Tensile, fracture, TEM	Low activation ferritics, V alloys, SiC	300	5	Feb-97	Feb-98	
HFIR-MFE-RB-12J	ORNL	MONBUSHO/ JAERI	M. L. Grossbeck	Tensile, fracture, TEM	Low activation ferritics, V alloys, SiC	500	5	Feb-97	Feb-98	
HFIR-CTR-62	ORNL	JAERI	R.L. Klueh	Charpy impact and He effects	Reduced act. and conventional ferritic steels	300, 400	13	Apr-95	Dec-95	
HFIR-CTR-63	ORNL	JAERI	R.L. Klueh	Charpy impact and tensile, TEM, He effects	Reduced act. and conventional ferritic steels	300, 400	13	Apr-95	Dec-95	
HFIR-JP25	ORNL	JAERI	R.L. Klueh	Tensile, fracture, TEM	Low activation ferritics	300, 500	20	Apr-98	Jun-99	
HFIR-JP27	ORNL	JAERI	L.L. Snead	Fracture, TEM	Intermetallics, SiC	500-800	10	Apr-98	Jul-98	
HFIR-JP28	ORNL	JAERI	L.L. Snead	Fracture, TEM	SiC	500-800	10	Mar-98	Sep-98	
HFIR-P3-6	ORNL	MONBUSHO	A. L. Qualls	Varying Temperature	TOS	400-600	5	Feb-98	Feb-99	
High Flux Beam Reactor, Brookhaven National Laboratory										
HFBR-ISEC-3	ORNL		L.L. Snead	In-situ electrical	WESGO Al2O3	450	1.5	Jul-95	Sep-95	
HFBR-V1	ORNL		L.L. Snead	Tensile, fracture	V-4Cr-4Ti	75, 150, 225	0.4	May-95	Jun-95	
HFBR-V2	ORNL		L.L. Snead	Tensile, fracture	V-4Cr-4Ti	75, 225, 300, 375	0.4	Jul-95	Aug-95	
HFBR-V3	ORNL		L.L. Snead	Tensile, fracture	V-4Cr-4Ti	160, 265, 315, 420	0.4	Aug-96	Sep-96	
HFBR-V4	ORNL		L.L. Snead	Tensile, fracture	V-4Cr-4Ti	105-505	0.1	Aug-96	Sep-96	
Advanced Test Reactor, Idaho Falls										
ATR-A1	ANL	MONBUSHO	D.L. Smith	Tensile, fracture toughness, TEM, creep	Vanadium alloys	200, 300	5	Dec-95	May-96	

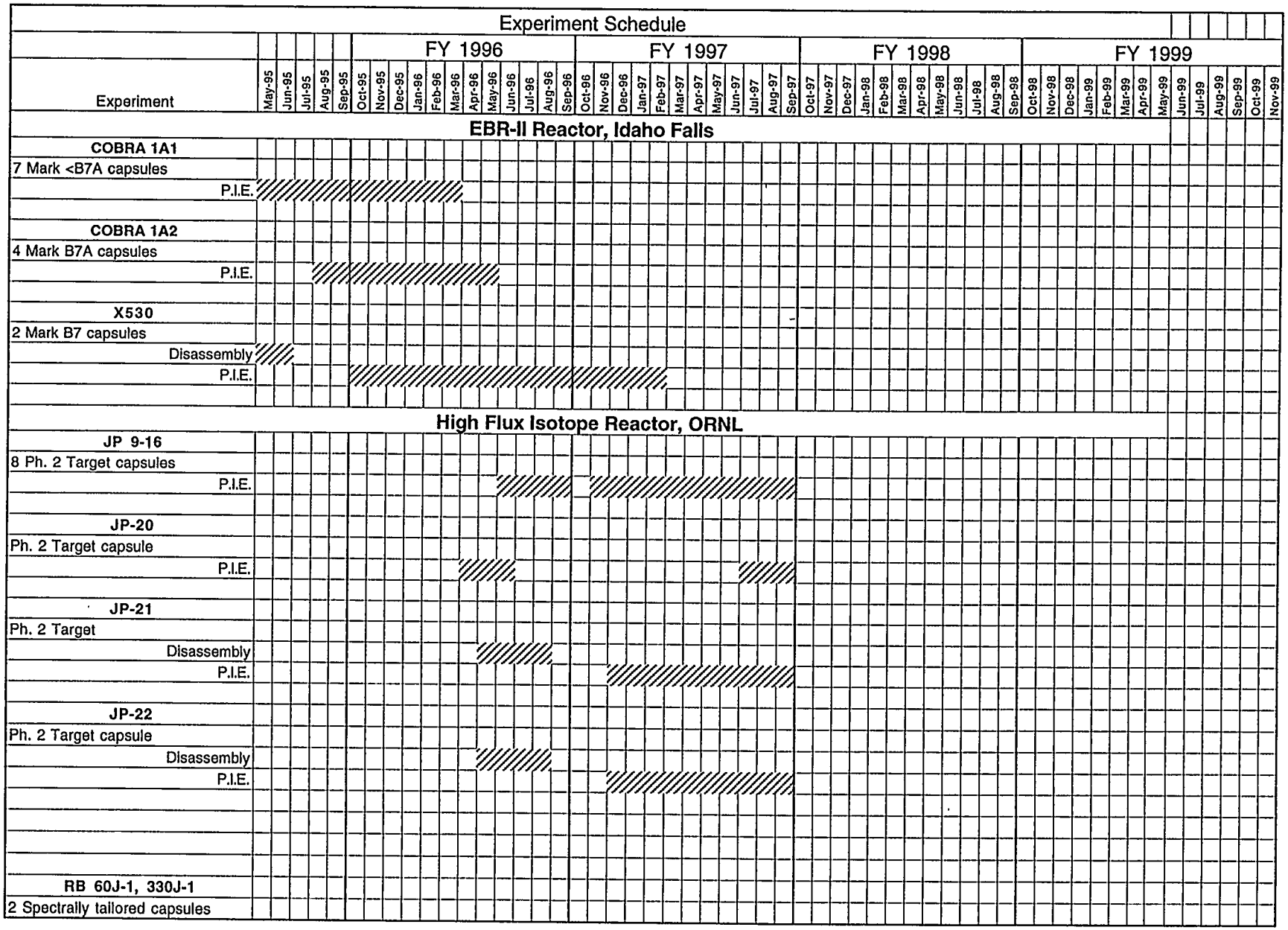
Summary of Reactor Irradiation Experiments

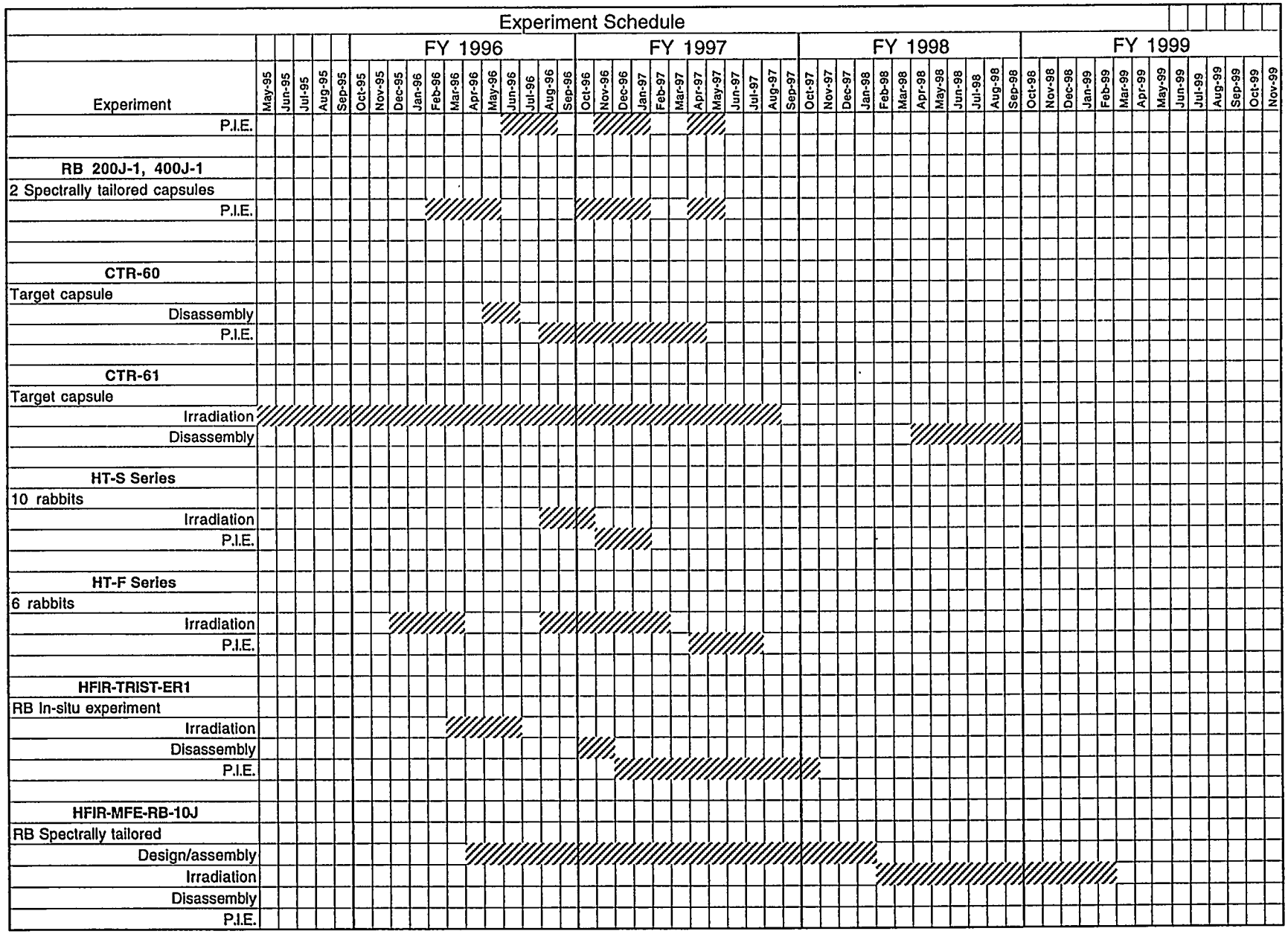
Experiment	Lead Lab	Collaborators	Responsible Person	Major Objectives	Materials	Temperature °C	Dose (dpa) or fluence	Irrad. Start	Irrad. Finish	Status
BOR-60 Reactor, RIAR, Dimitrovgrad, Russia										
BOR-60-Fusion-1	ORNL, ANL	RDIPE, RIAR	A.F. Rowcliffe, D.L. Smith	Mechanical and microstructural properties	V alloys	350-380	10	Jul-95	Mar-96	
SM-2 Reactor, RIAR, Dimitrovgrad, Russia										
SM-2.1	ORNL, PNL	RIAR	S.J. Zinkle	Tensile, electrical, microstructural, and creep properties	Cu alloys	100, 200, 330	1, 5	Dec-93	Feb-94	
SM-2.2	PNL	SRIAR	D.J. Edwards	Mechanical behavior of bonded materials	Cu alloys/SS, Cu/Be	120, 300	0.2	Mar-96	May-96	
SM-2.3	PNL	SRIAR	D.J. Edwards	Mechanical behavior of bonded materials	Cu alloys/SS, Cu/Be	100, 250	0.2	Jul-97	Dec-97	

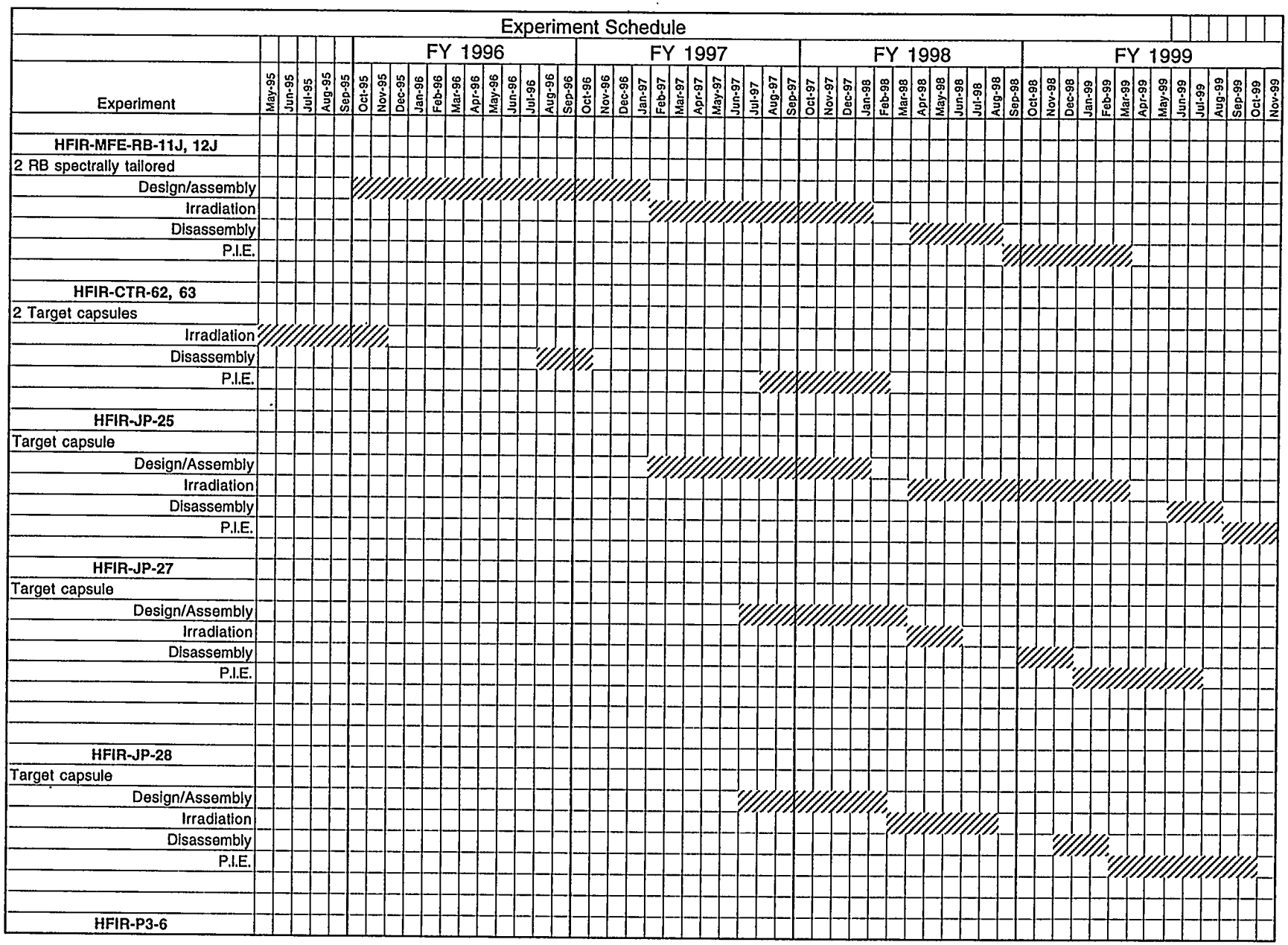
Irradiation complete

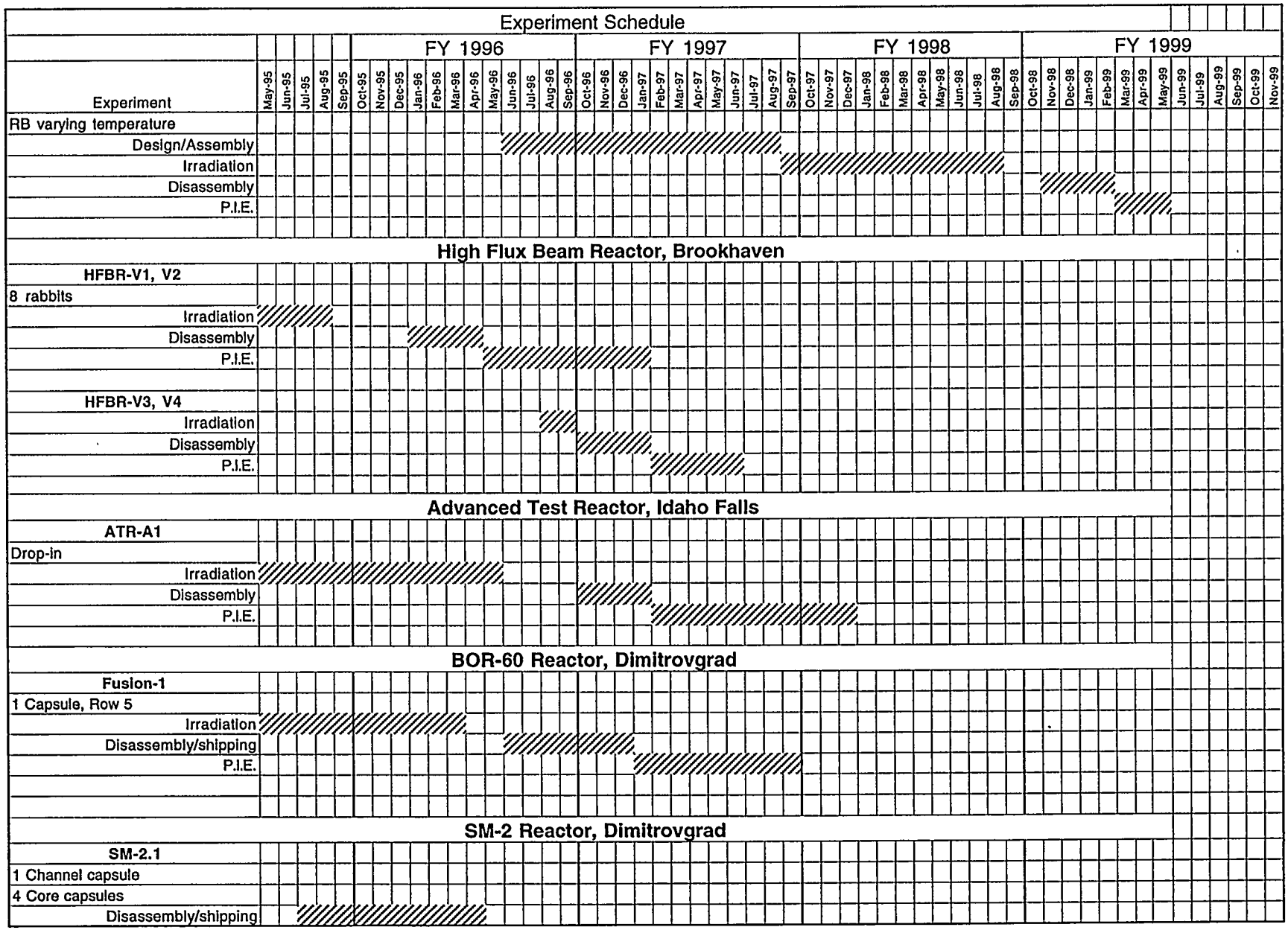
Irradiation in progress

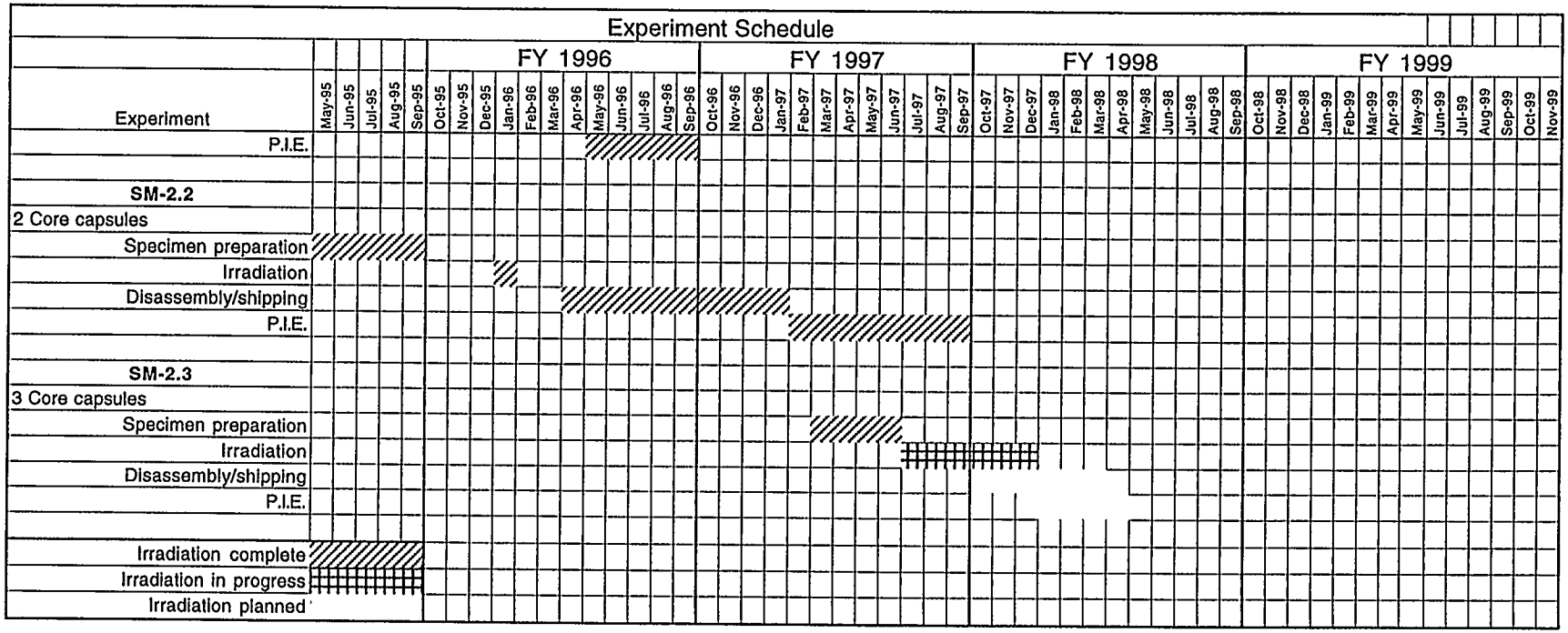
Irradiation planned


Experiment Schedule
FY 1996
FY 1997
FY 1998
FY 1999
Experiment
May-95 Jun-95 Jul-95 Aug-95 Sep-95 Oct-95 Nov-95 Dec-95 Jan-96 Feb-96 Mar-96 Apr-96 May-96 Jun-96 Jul-96 Aug-96 Sep-96 Oct-96 Nov-96 Dec-96 Jan-97 Feb-97 Mar-97 Apr-97 May-97 Jun-97 Jul-97 Aug-97 Sep-97 Oct-97 Nov-97 Dec-97 Jan-98 Feb-98 Mar-98 Apr-98 May-98 Jun-98 Jul-98 Aug-98 Sep-98 Oct-98 Nov-98 Dec-98 Jan-99 Feb-99 Mar-99 Apr-99 May-99 Jun-99 Jul-99 Aug-99 Sep-99 Oct-99 Nov-99
EBR-II Reactor, Idaho Falls
COBRA 1A1
7 Mark <B7A capsules
P.I.E.
COBRA 1A2
4 Mark B7A capsules
P.I.E.
X530
2 Mark B7 capsules
Disassembly
P.I.E.
High Flux Isotope Reactor, ORNL
JP 9-16
8 Ph. 2 Target capsules
P.I.E.
JP-20
Ph. 2 Target capsule
P.I.E.
JP-21
Ph. 2 Target
Disassembly
P.I.E.
JP-22
Ph. 2 Target capsule
Disassembly
P.I.E.
RB 60J-1, 330J-1
2 Spectrally tailored capsules


Experiment Schedule
FY 1996
FY 1997
FY 1998
FY 1999
Experiment
May-95 Jun-95 Jul-95 Aug-95 Sep-95 Oct-95 Nov-95 Dec-95 Jan-96 Feb-96 Mar-96 Apr-96 May-96 Jun-96 Jul-96 Aug-96 Sep-96 Oct-96 Nov-96 Dec-96 Jan-97 Feb-97 Mar-97 Apr-97 May-97 Jun-97 Jul-97 Aug-97 Sep-97 Oct-97 Nov-97 Dec-97 Jan-98 Feb-98 Mar-98 Apr-98 May-98 Jun-98 Jul-98 Aug-98 Sep-98 Oct-98 Nov-98 Dec-98 Jan-99 Feb-99 Mar-99 Apr-99 May-99 Jun-99 Jul-99 Aug-99 Sep-99 Oct-99 Nov-99
P.I.E.
RB 200J-1, 400J-1
2 Spectrally tailored capsules
P.I.E.
CTR-60
Target capsule
Disassembly
P.I.E.
CTR-61
Target capsule
Irradiation
Disassembly
HT-S Series
10 rabbits
Irradiation
P.I.E.
HT-F Series
6 rabbits
Irradiation
P.I.E.
HFIR-TRIST-ER1
RB In-situ experiment
Irradiation
Disassembly
P.I.E.
HFIR-MFE-RB-10J
RB Spectrally tailored
Design/assembly
Irradiation
Disassembly
P.I.E.


Experiment Schedule
FY 1996
FY 1997
FY 1998
FY 1999
Experiment
May-95 Jun-95 Jul-95 Aug-95 Sep-95 Oct-95 Nov-95 Dec-95 Jan-96 Feb-96 Mar-96 Apr-96 May-96 Jun-96 Jul-96 Aug-96 Sep-96 Oct-96 Nov-96 Dec-96 Jan-97 Feb-97 Mar-97 Apr-97 May-97 Jun-97 Jul-97 Aug-97 Sep-97 Oct-97 Nov-97 Dec-97 Jan-98 Feb-98 Mar-98 Apr-98 May-98 Jun-98 Jul-98 Aug-98 Sep-98 Oct-98 Nov-98 Dec-98 Jan-99 Feb-99 Mar-99 Apr-99 May-99 Jun-99 Jul-99 Aug-99 Sep-99 Oct-99 Nov-99
HFIR-MFE-RB-11J, 12J
2 RB spectrally tailored
Design/assembly
Irradiation
Disassembly
P.I.E.
HFIR-CTR-62, 63
2 Target capsules
Irradiation
Disassembly
P.I.E.
HFIR-JP-25
Target capsule
Design/Assembly
Irradiation
Disassembly
P.I.E.
HFIR-JP-27
Target capsule
Design/Assembly
Irradiation
Disassembly
P.I.E.
HFIR-JP-28
Target capsule
Design/Assembly
Irradiation
Disassembly
P.I.E.
HFIR-P3-6


Experiment Schedule
FY 1996
FY 1997
FY 1998
FY 1999
Experiment
May-95 Jun-95 Jul-95 Aug-95 Sep-95 Oct-95 Nov-95 Dec-95 Jan-96 Feb-96 Mar-96 Apr-96 May-96 Jun-96 Jul-96 Aug-96 Sep-96 Oct-96 Nov-96 Dec-96 Jan-97 Feb-97 Mar-97 Apr-97 May-97 Jun-97 Jul-97 Aug-97 Sep-97 Oct-97 Nov-97 Dec-97 Jan-98 Feb-98 Mar-98 Apr-98 May-98 Jun-98 Jul-98 Aug-98 Sep-98 Oct-98 Nov-98 Dec-98 Jan-99 Feb-99 Mar-99 Apr-99 May-99 Jun-99 Jul-99 Aug-99 Sep-99 Oct-99 Nov-99
RB varying temperature
Design/Assembly
Irradiation
Disassembly
P.I.E.
High Flux Beam Reactor, Brookhaven
HFBR-V1, V2
8 rabbits
Irradiation
Disassembly
P.I.E.
HFBR-V3, V4
Irradiation
Disassembly
P.I.E.
Advanced Test Reactor, Idaho Falls
ATR-A1
Drop-in
Irradiation
Disassembly
P.I.E.
BOR-60 Reactor, Dimitrovgrad
Fusion-1
1 Capsule, Row 5
Irradiation
Disassembly/shipping
P.I.E.
SM-2 Reactor, Dimitrovgrad
SM-2.1
1 Channel capsule
4 Core capsules
Disassembly/shipping


Experiment Schedule
FY 1996
FY 1997
FY 1998
FY 1999
Experiment
May-95 Jun-95 Jul-95 Aug-95 Sep-95 Oct-95 Nov-95 Dec-95 Jan-96 Feb-96 Mar-96 Apr-96 May-96 Jun-96 Jul-96 Aug-96 Sep-96 Oct-96 Nov-96 Dec-96 Jan-97 Feb-97 Mar-97 Apr-97 May-97 Jun-97 Jul-97 Aug-97 Sep-97 Oct-97 Nov-97 Dec-97 Jan-98 Feb-98 Mar-98 Apr-98 May-98 Jun-98 Jul-98 Aug-98 Sep-98 Oct-98 Nov-98 Dec-98 Jan-99 Feb-99 Mar-99 Apr-99 May-99 Jun-99 Jul-99 Aug-99 Sep-99 Oct-99 Nov-99
P.I.E.
SM-2.2
2 Core capsules
Specimen preparation
Irradiation
Disassembly/shipping
P.I.E.
SM-2.3
3 Core capsules
Specimen preparation
Irradiation
Disassembly/shipping
P.I.E.
Irradiation complete
Irradiation in progress
Irradiation planned