**SCHEDULE AND STATUS OF IRRADIATION EXPERIMENTS** – A. F. Rowcliffe and M. L. Grossbeck (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 two irradiation experiments in reactor; and 8 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 | |

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-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

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|---|---|---|---|---|---|---|---|---|---|---|
| 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 | Oct-97 | Dec-98 | |
| HFIR-JP27 | ORNL | JAERI | L.L. Snead | Fracture, TEM | Intermetallics, SiC | 500-800 | 10 | Oct-97 | Jan-98 | |
| HFIR-JP28 | ORNL | JAERI | L.L. Snead | Fracture, TEM | SiC | 500-800 | 10 | Sep-97 | Mar-98 | |
| HFIR-P3-6 | ORNL | MONBUSHO | K. R. Thoms | Varying Temperature | TBD | 400-600 | 5 | May-97 | Apr-98 | |
| **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 | |

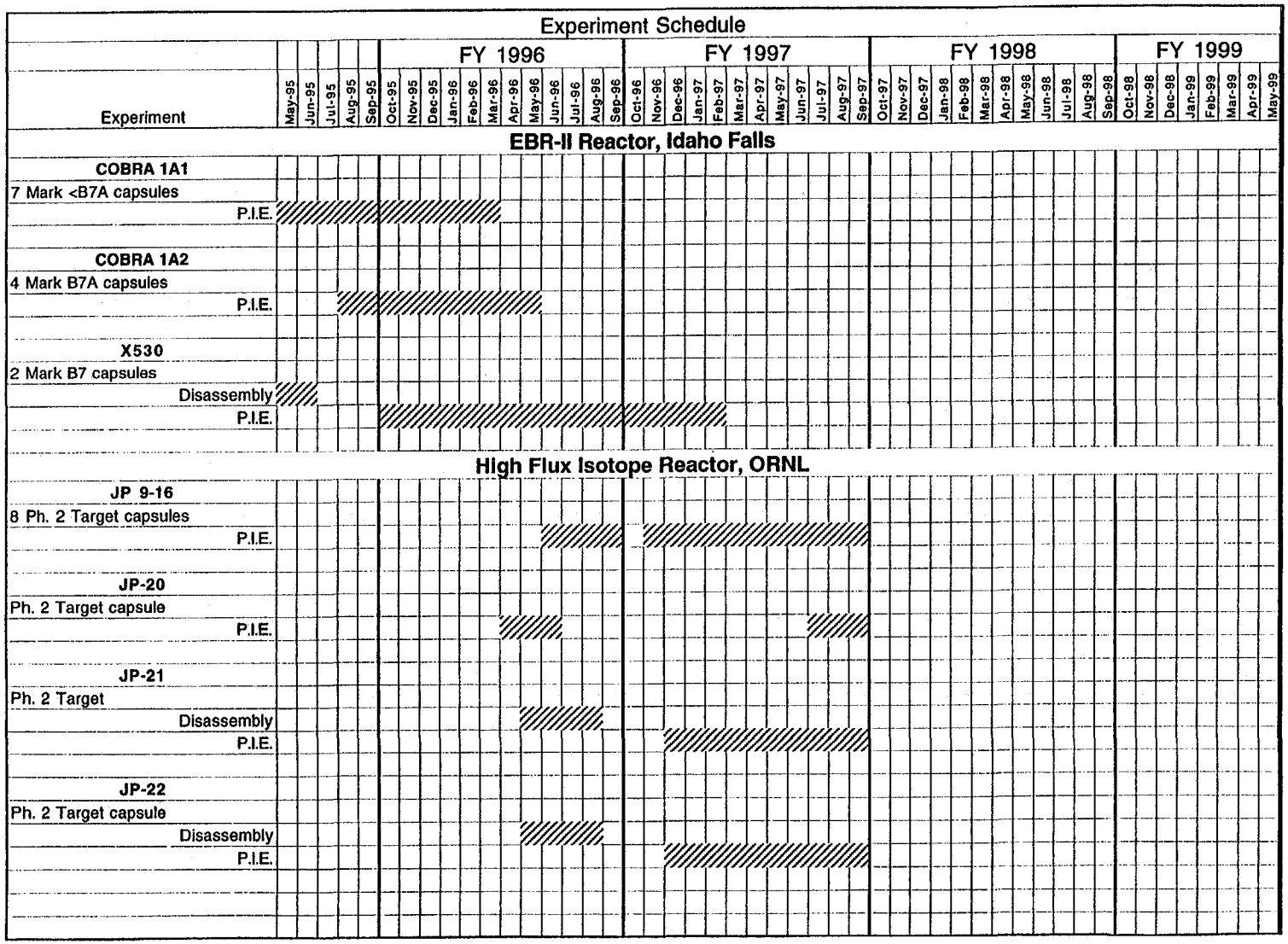
Summary of Reactor Irradiation Experiments

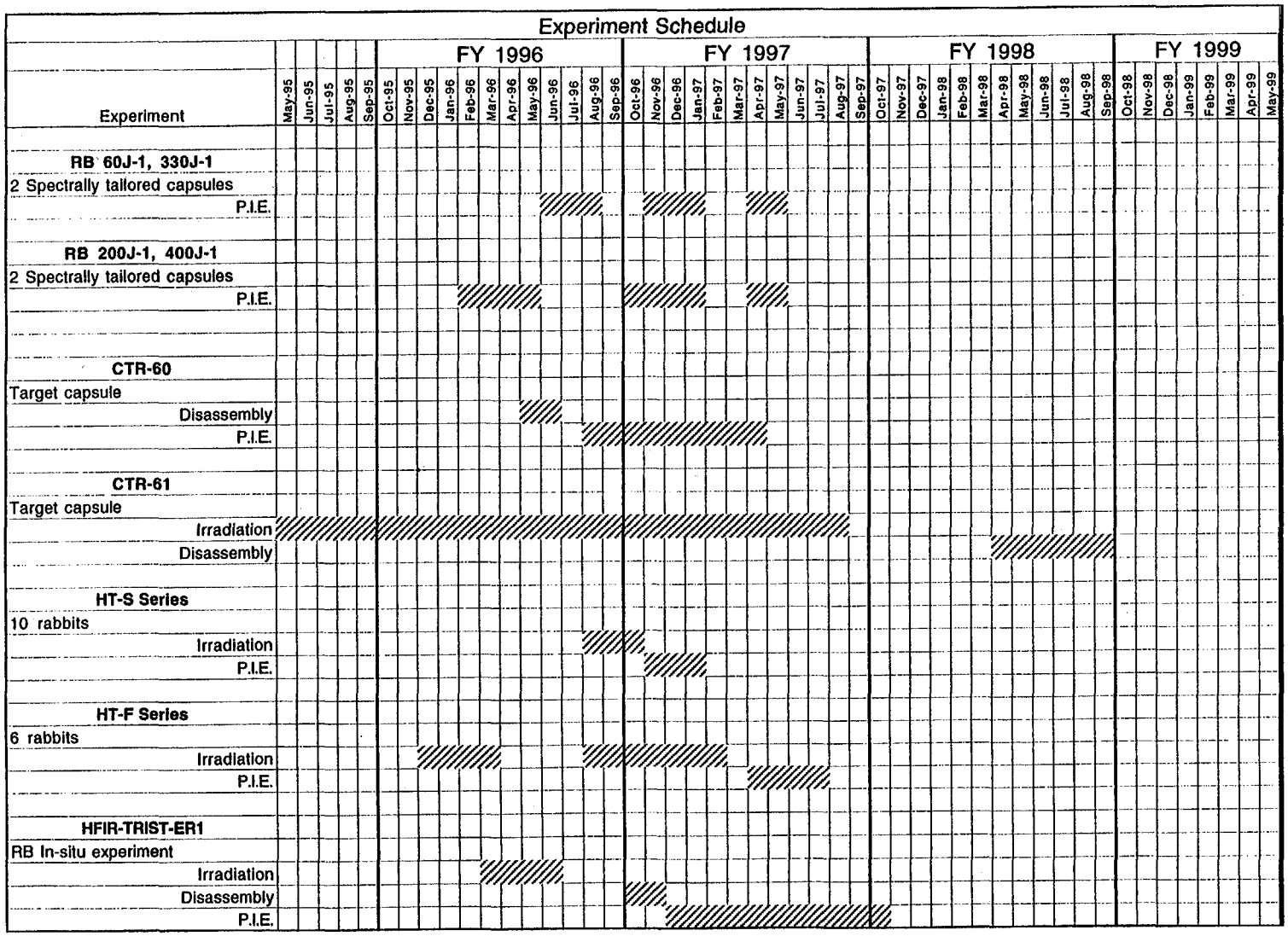
| Experiment | Lead Lab | Collaborators | Responsible Person | Major Objectives | Materials | Temperature °C | Dose (dpa) or fluence | Irrad. Start | Irrad. Finish | Status |
|---|---|---|---|---|---|---|---|---|---|---|
| **BOR-60 Reactor, RIAR, Dimitrovgrad, Russia** | | | | | | | | | | |
| BOR-60-Fusion-1 | 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 | Jan-96 | Mar-96 | |
| SM-2.3 | PNL | SRIAR | D.J. Edwards | Mechanical behavior of bonded materials | Cu alloys/SS, Cu/Be | 100, 250 | 0.2 | Apr-97 | Jun-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
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.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FY 1999
Experiment
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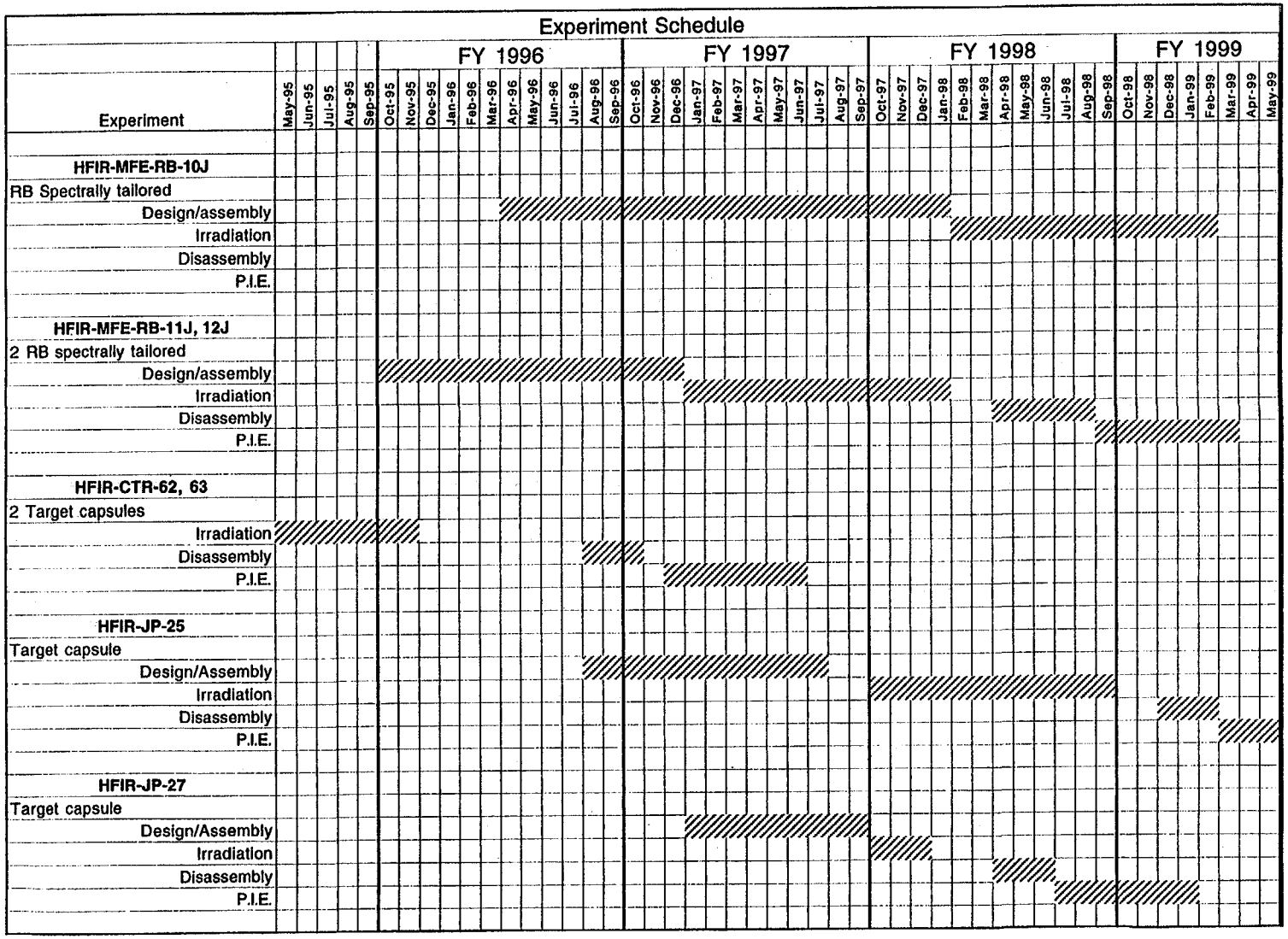
RB 60J-1, 330J-1
2 Spectrally tailored capsules
P.I.E.
RB 200J-1, 400J-1
2 Spectrally tailored capsules
P.I.E.
CTR-60
Target capsule
Disassembly
P.I.E.
CTR-61
Target capsule
Irradiation
Disassembly
HT-S Series
10 rabbits
Irradiation
P.I.E.
HT-F Series
6 rabbits
Irradiation
P.I.E.
HFIR-TRIST-ER1
RB In-situ experiment
Irradiation
Disassembly
P.I.E.


Experiment Schedule
FY 1996
FY 1997
FY 1998
FY 1999
Experiment
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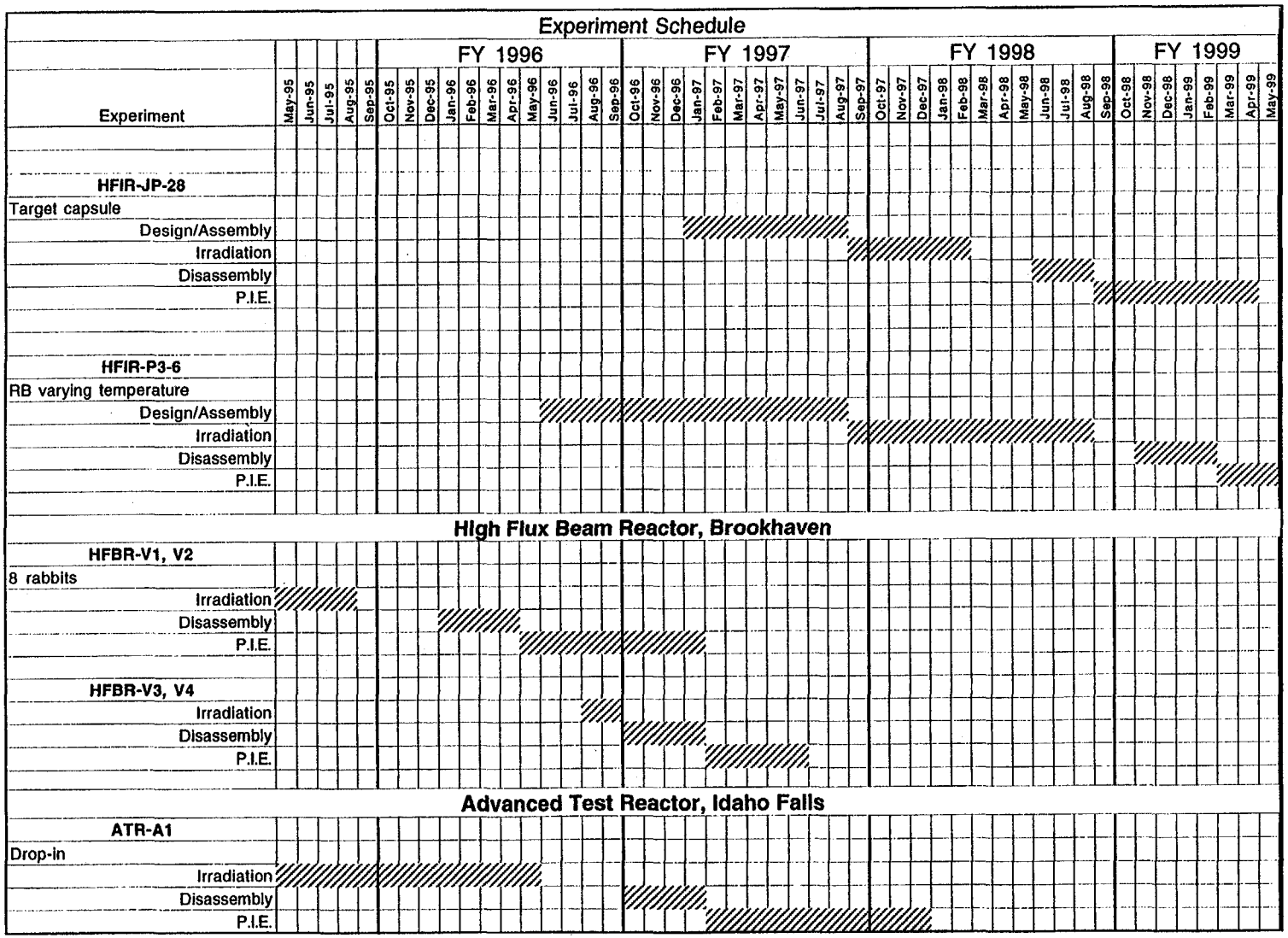
Nov-98
Dec-98
Jan-99
Feb-99
Mar-99
Apr-99
May-99
HFIR-MFE-RB-10J
RB Spectrally tailored
Design/assembly
Irradiation
Disassembly
P.I.E.
HFIR-MFE-RB-11J, 12J
2 RB spectrally tailored
Design/assembly
Irradiation
Disassembly
P.I.E.
HFIR-CTR-62, 63
2 Target capsules
Irradiation
Disassembly
P.I.E.
HFIR-JP-25
Target capsule
Design/Assembly
Irradiation
Disassembly
P.I.E.
HFIR-JP-27
Target capsule
Design/Assembly
Irradiation
Disassembly
P.I.E.


Experiment Schedule
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FY 1997
FY 1998
FY 1999
Experiment
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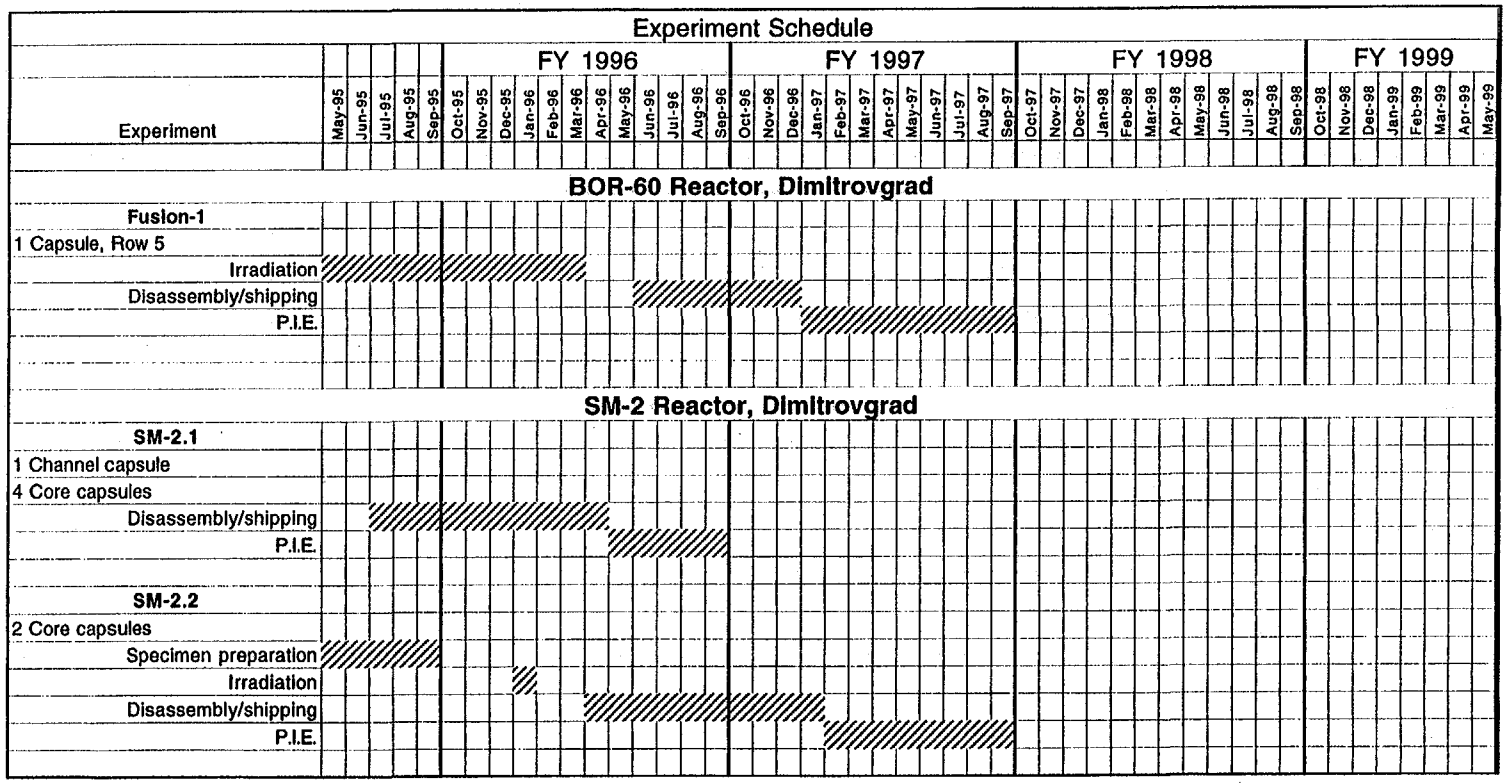
HFIR-JP-28
Target capsule
Design/Assembly
Irradiation
Disassembly
P.I.E.
HFIR-P3-6
RB varying temperature
Design/Assembly
Irradiation
Disassembly
P.I.E.
High Flux Beam Reactor, Brookhaven
HFBR-V1, V2
8 rabbits
Irradiation
Disassembly
P.I.E.
HFBR-V3, V4
Irradiation
Disassembly
P.I.E.
Advanced Test Reactor, Idaho Falls
ATR-A1
Drop-in
Irradiation
Disassembly
P.I.E.


Experiment Schedule
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FY 1997
FY 1998
FY 1999
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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
P.I.E.
SM-2.2
2 Core capsules
Specimen preparation
Irradiation
Disassembly/shipping
P.I.E.