

Summary Information for the Experiment:

UK-JAPAN FAST CRITICAL EXPERIMENTS IN SUPPORT OF MONJU DESIGN. THE ZEBRA MOZART PROGRAMME, PART 2. MZC AND THE CONTROL ROD STUDIES.

1. Experiment Identification Number ZEBRA-LMFR-EXP-003
REAC-RRATE
2. Date **1971 to 1973**
3. Name of Experiment **ZEBRA MOZART Programme Part 2, The MZC Phase.**
 - 3.1. Scope of Experiment
Measurement of the reactivity worths of MONJU Mock-up Control Rods
 - 3.2. Purpose and Phenomena tested:
The reactivity worths of arrays of tantalum and boron carbide control rods of different enrichments and their effects on the reaction rate distributions in the assembly
4. Name or Designation of Experimental Programme:
The MZC Phase of the Zebra Mozart Programme
5. Description of Test Facility:
The Zebra Zero Power Critical Facility
6. Description of Test or Experiment:
 - 6.1. Experimental Configuration
 - 6.1.1. Type of Assemblies
 - 6.1.2. Assembly Details
 - 6.1.2.1. Type
Fast Reactor
 - 6.1.2.2. Fuel
Uranium dioxide/plutonium metal and U/PuO₂
 - 6.1.2.3. Moderators
Sodium, steel
 - 6.1.2.4. Absorbers
Boron and tantalum
 - 6.1.2.5. Critical Mass
794 to 936 kg Pu²³⁹+Pu²⁴¹
 - 6.1.2.6. Core Volume
1800 to 2060 litres
 - 6.1.2.7. Blanket
Natural uranium, sodium and steel
 - 6.1.2.8. Reflectors
Steel
 - 6.1.2.9. Reactivity adjustment
Calibrated control rod and the addition of elements at the core/blanket boundary
 - 6.1.2.10. Other
No other details to note at this stage.
 - 6.1.3. Assembly Variants
Different Arrays of Mockup Control Rods
 - 6.2. Core Lifecycle
BOL
 - 6.3. Experimental Limitations or Shortcomings
Any limitations are discussed in the evaluation section, Section 2.
7. Phenomena Tested
 - 7.1. Description of Results and Analysis

- 7.1.1. Data Measured
 - 7.1.1.1. Kinetics Parameters
Delayed neutron reactivity scale is based on reactor period measurements
 - 7.1.1.2. Reaction rates/ratios
(Measured in the MZA and MZB phase
Capture - ^{238}U
Fission - ^{235}U , ^{238}U and ^{239}Pu)
Reaction rate distribution measurements were made through the control rods and adjacent to them in the MZC phase. These included $\text{Ta}(n,\gamma)$, (both distributions and relative measurements).
 - 7.1.1.3. Reactivity Worth
Intercomparison of reactivity scales, effective delayed neutron, plutonium addition and edge element worth.
Several materials were measured in the MZA and MZB phase.
 - 7.1.1.4. Sample Doppler Reactivity
No measurement
 - 7.1.1.5. Control Rod or Rod Banks Worths
Boron and Tantalum rods in the MZC phase.
 - 7.1.1.6. Gamma heating Distributions
See the shielding experiments (not described in the present documents)
 - 7.1.1.7. Neutron Spectrum
Several different techniques in the MZA phase but not in the MZC phase.
 - 7.1.1.8. Reactor Start-up Measurements
No measurements.
 - 7.1.1.9. Isotopic Measurements
No measurements.
- 7.2. Special Features and Characteristics of Experiment.
 - 7.2.1. Hydrogen Atoms Versus Atoms of Heavy Nuclides Not applicable.
 - 7.2.2. Moderator/Fuel Ratio. Not applicable
 - 7.2.3. Spectral index. See ZEBRA-LMFR-EXP-002
- 7.3. Measurement System and Uncertainties: See appropriate sections.
- 8. Counterpart Experiment/other Related Experiments:
The Zebra MZA and MZB Assemblies, ZEBRA-LMFR-EXP-002.
- 9. Status. Reviews completed.
- 10. References: See the list of references at the end of the document
- 11. Authors/Organisers
 - 11.1. Establishment: The Winfrith Atomic Energy Establishment of the UKAEA, (now Serco-Assurance)
 - 11.2. Staff Involved in Experiment (See list in ZEBRA-LMFR-EXP-002, introductory section)
 - 11.3. Contact John Rowlands, e-mail – rowlandsjl(AT)aol.com
 - 11.4. Reviewers of Compiled Data
Internal Reviewer: Atsushi Zukeran,
Reviewers: Masayuki Nakagawa and Udo K Wehmann.
- 12. Material Available
 - 12.1. Data and Format: Specification of benchmark models for the control rod worth and reaction rate distribution measurements.