

Westinghouse Non-Proprietary Class 3

LTR-NRC-08-18 NP-Enclosure

**Final Presentation Slides for the Gray Rod Topical
Report Pre-Submittal Meeting
(Non-Proprietary)**

Westinghouse Electric Company
P.O. Box 355
Pittsburgh, Pennsylvania 15230-0355

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Enhanced Rodlet Design for the Gray Rod Cluster Assembly (GRCA)

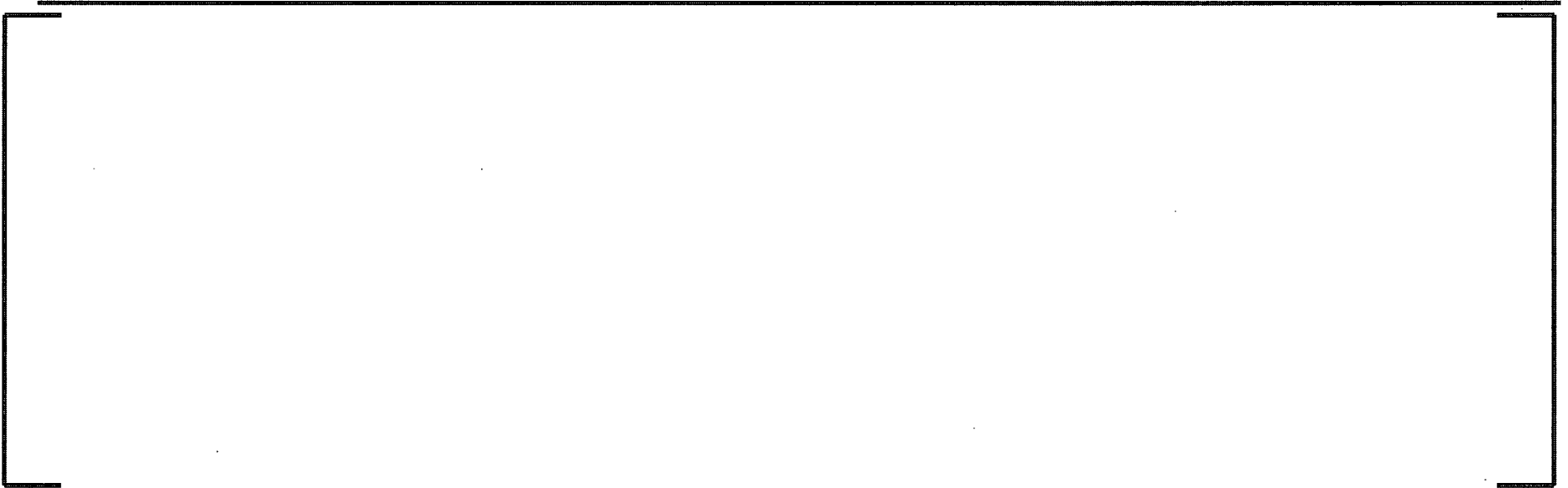
Westinghouse/NRC Pre-Submittal Meeting
White Flint, Md.
March 27, 2008

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Agenda

- Purpose
- Background
- GRCA Design Overview
- Nuclear Physics Considerations
- Materials and Irradiation Considerations
- Mechanical and Thermal Requirements
- Summary
- Next Steps

Purpose and Scope



a, c

Background

AP1000 Control And Shutdown Bank Locations

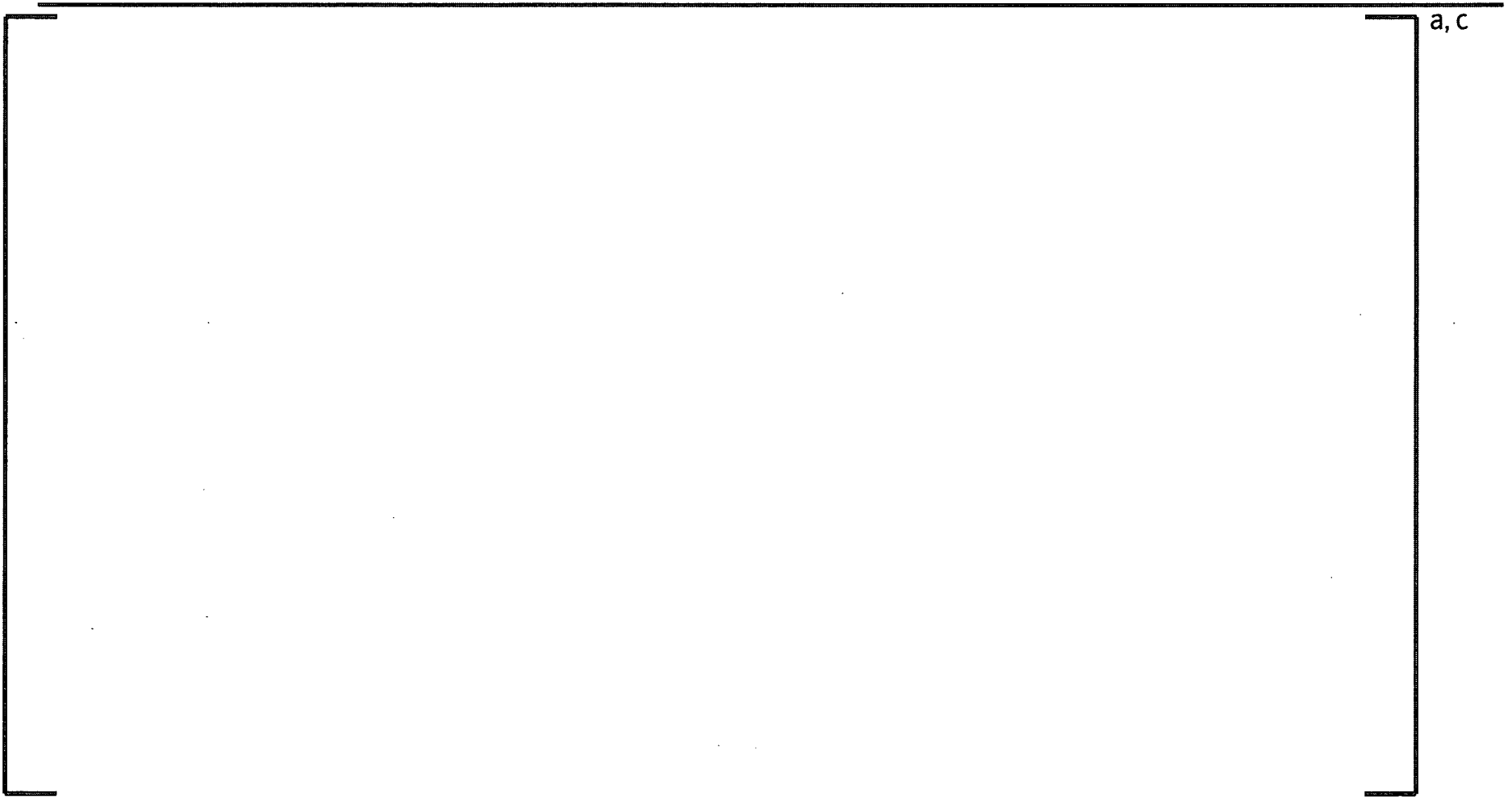


Controls Rods (RCCAs) are different from Gray Rods (GRCA)

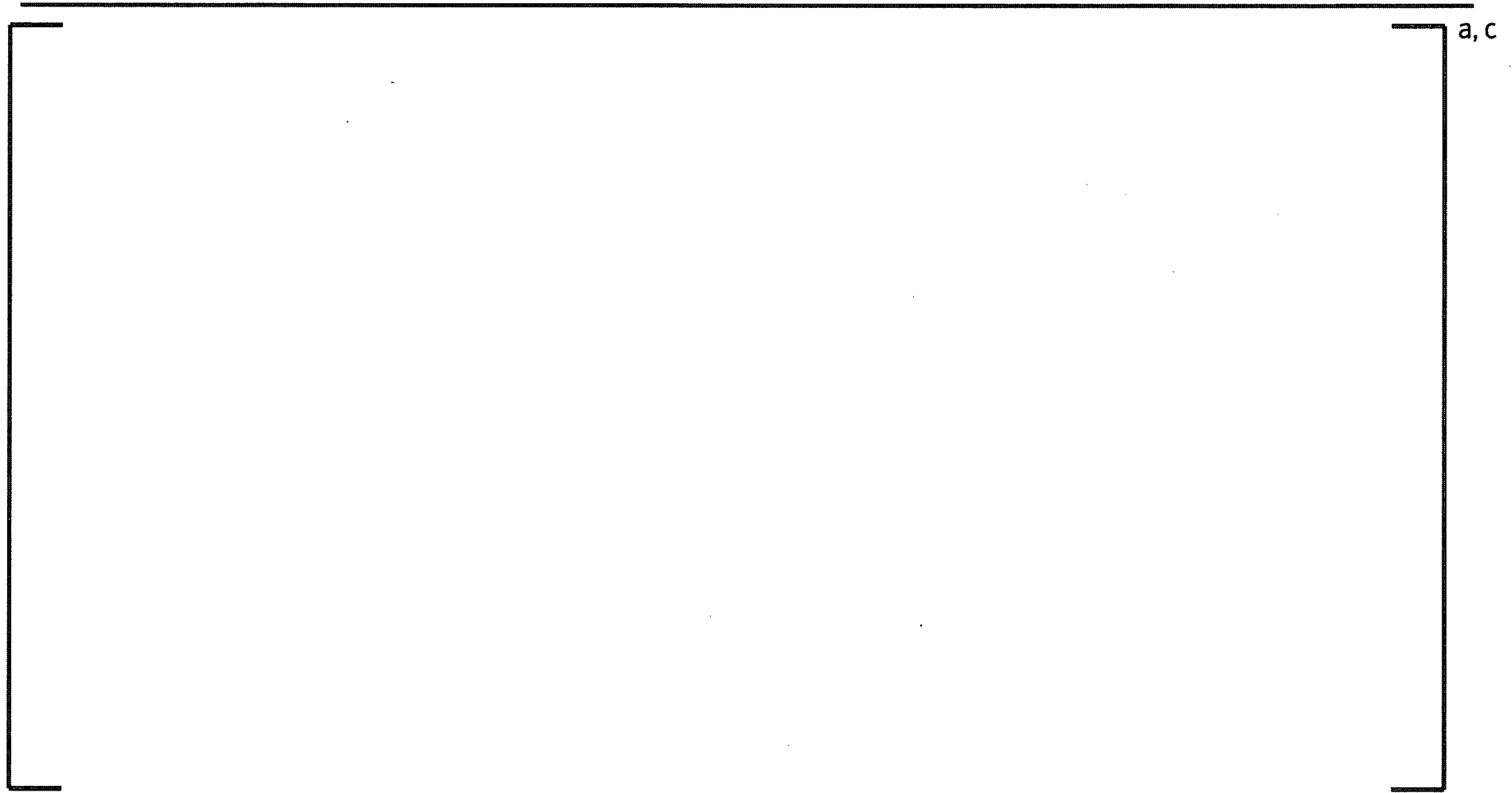


a, c

GRCA Design Evolution



Advanced GRCA Design



Gray Rod Cluster Assembly (GRCA) Design



GRCA rodlet assembly features



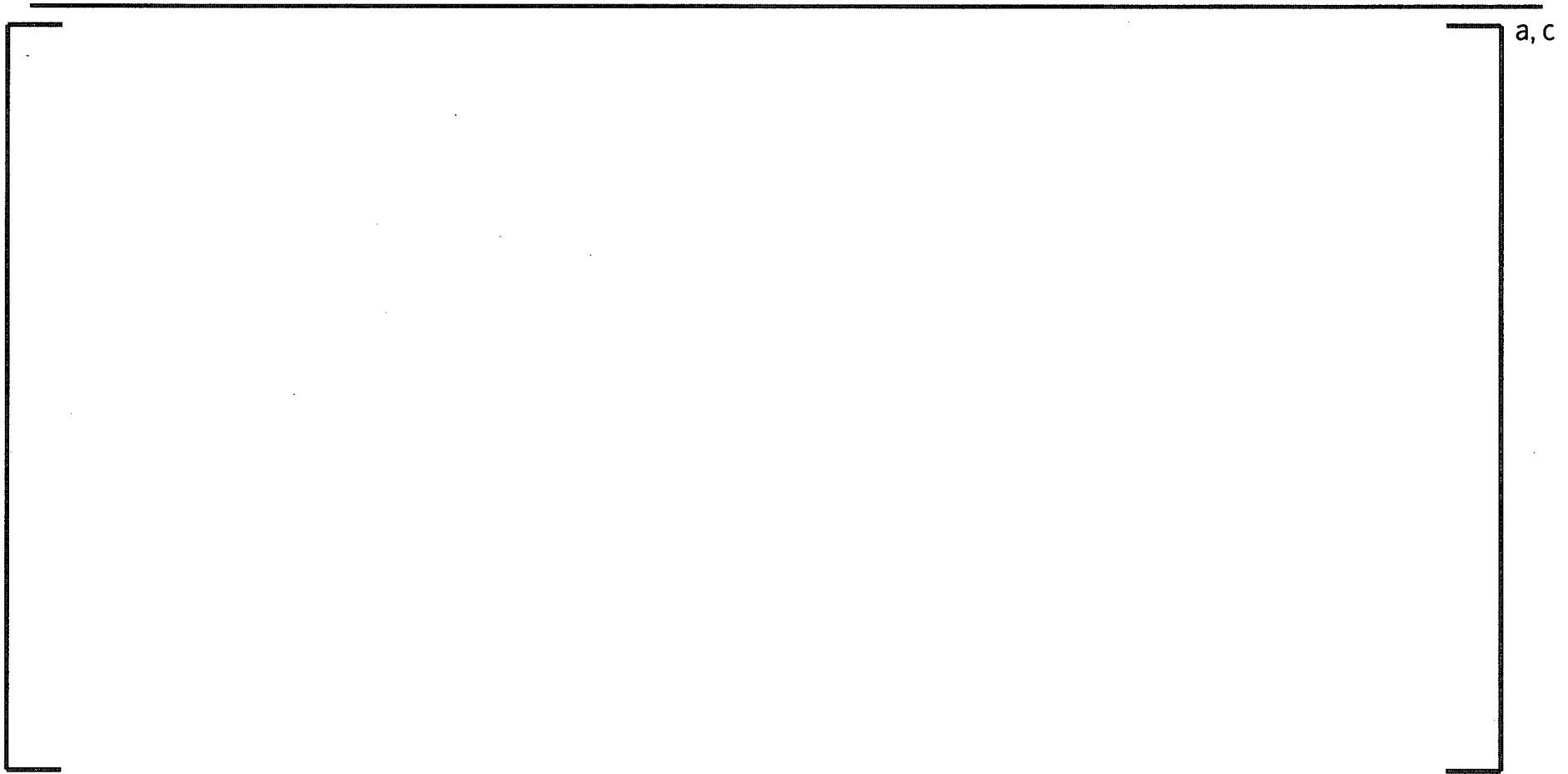
a, c

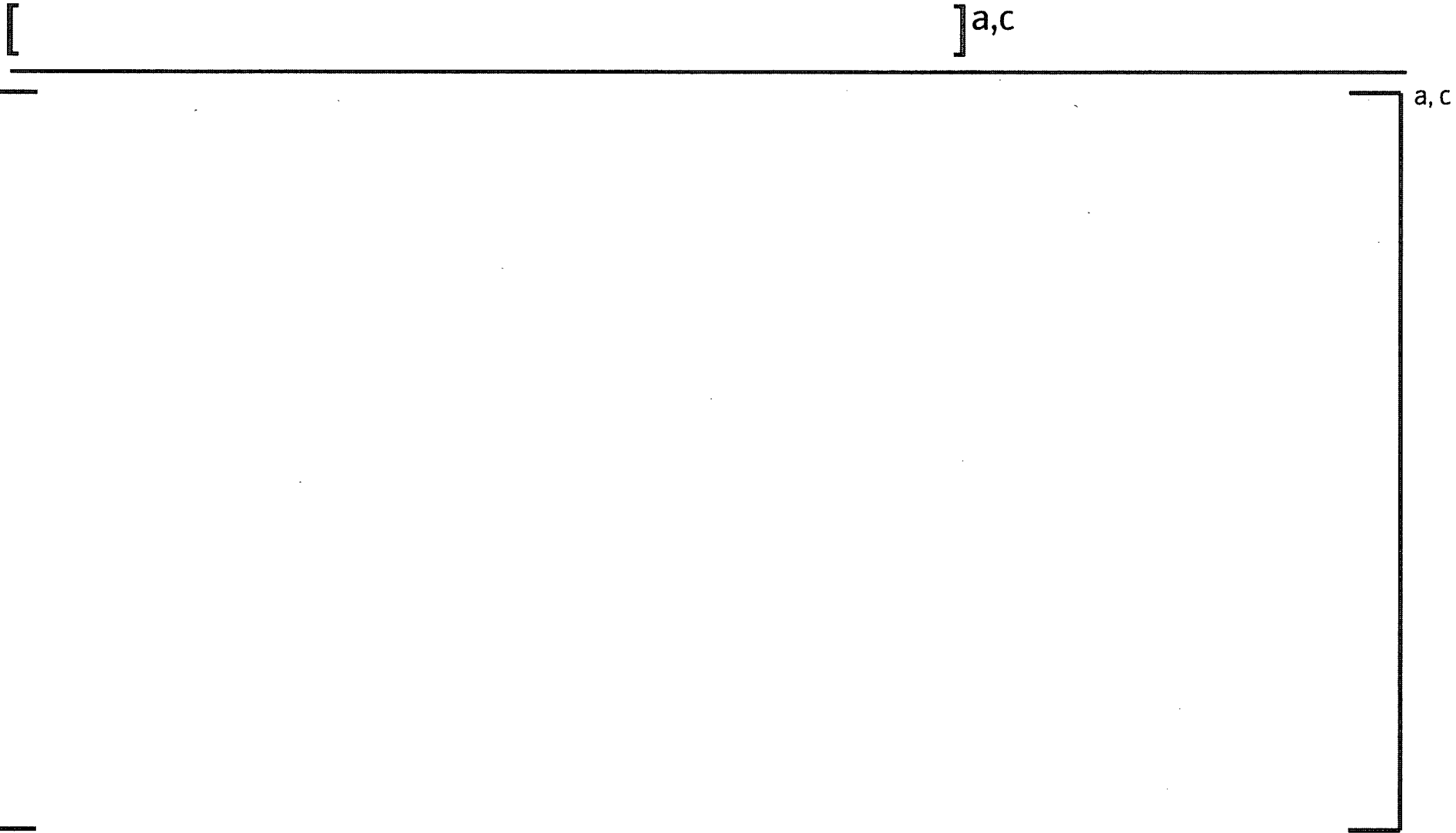
Nuclear Evaluations

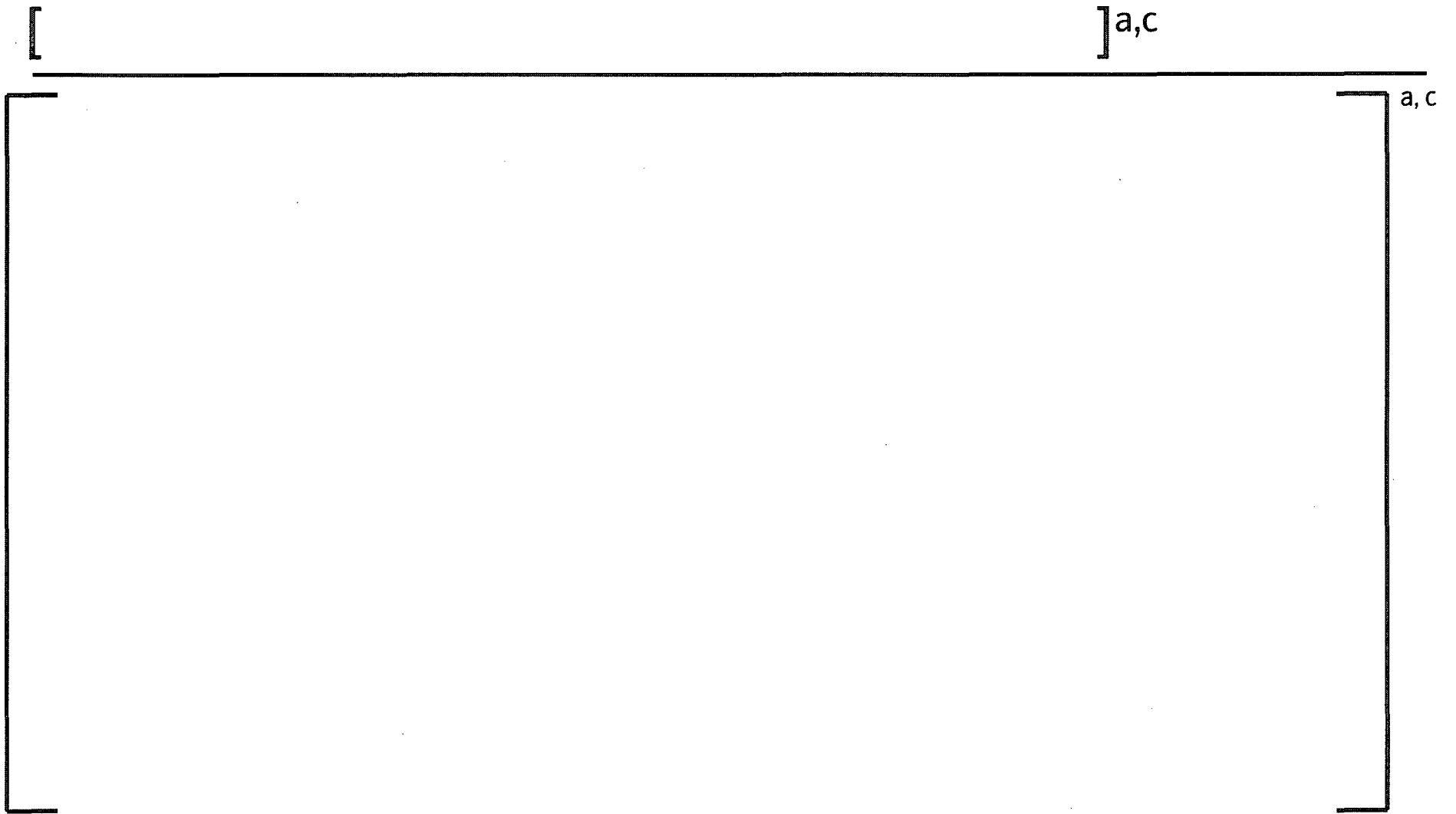
Nuclear Evaluations of []^{a,c} Rodlet

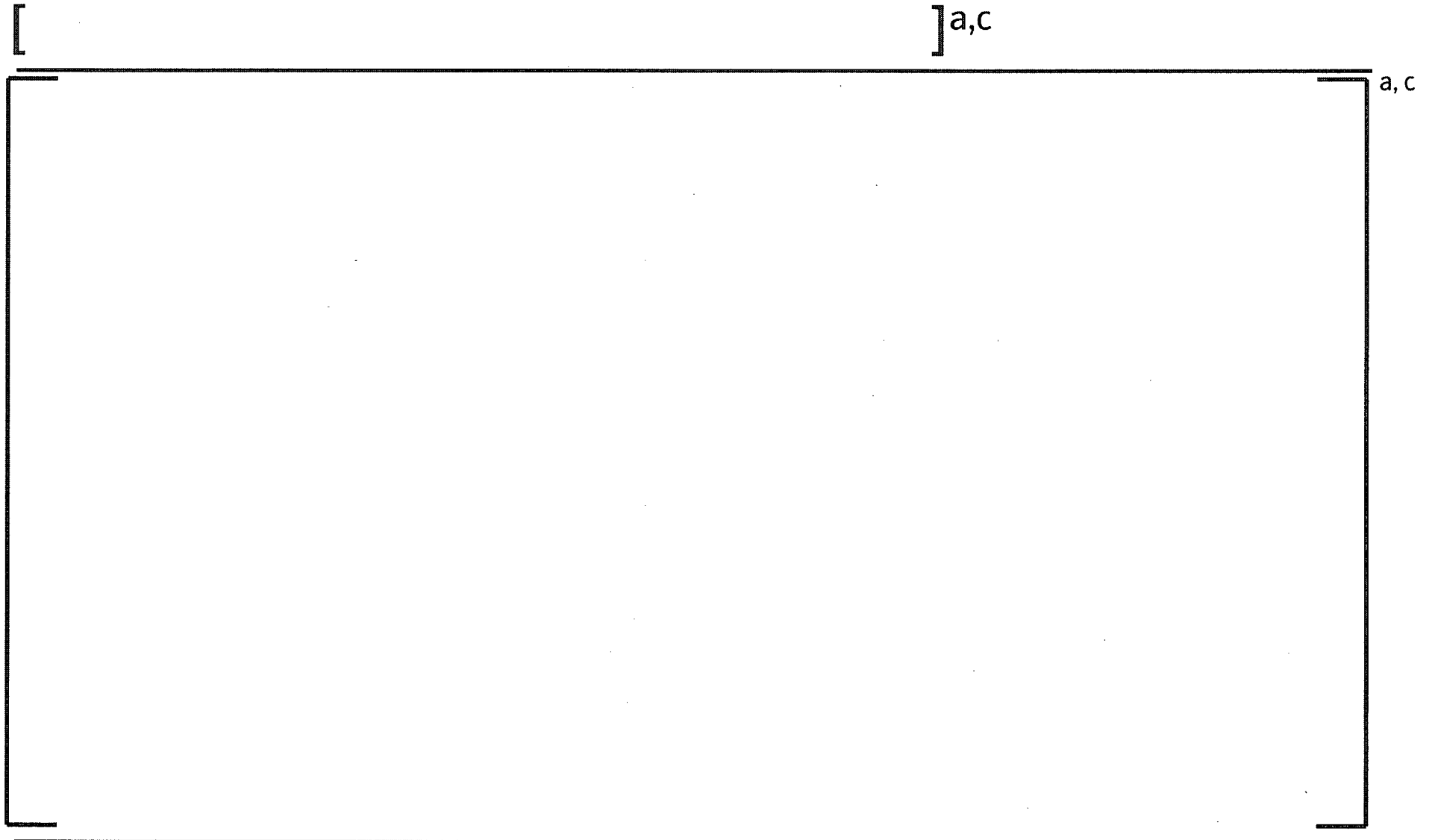


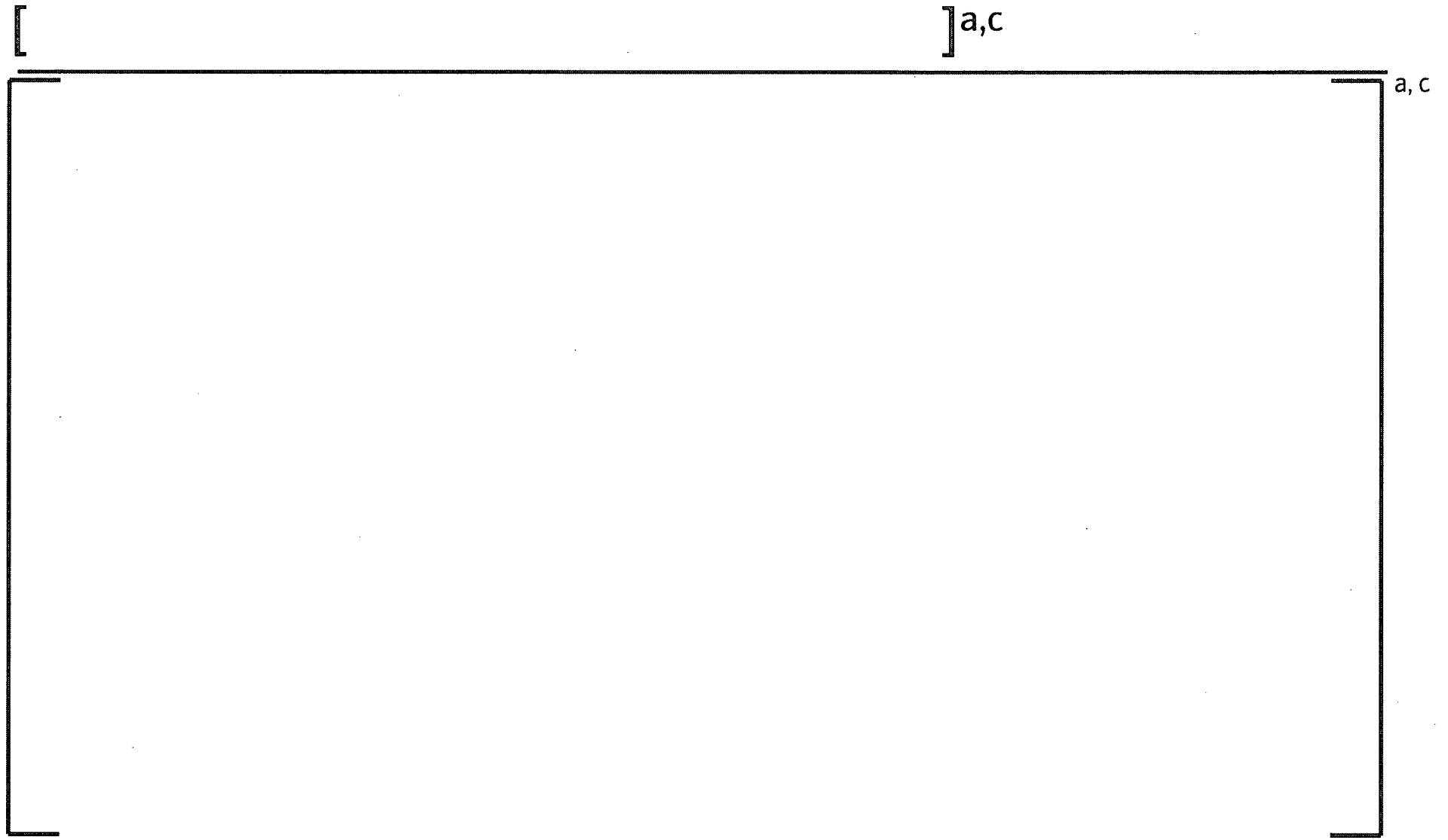
Nuclear Methods



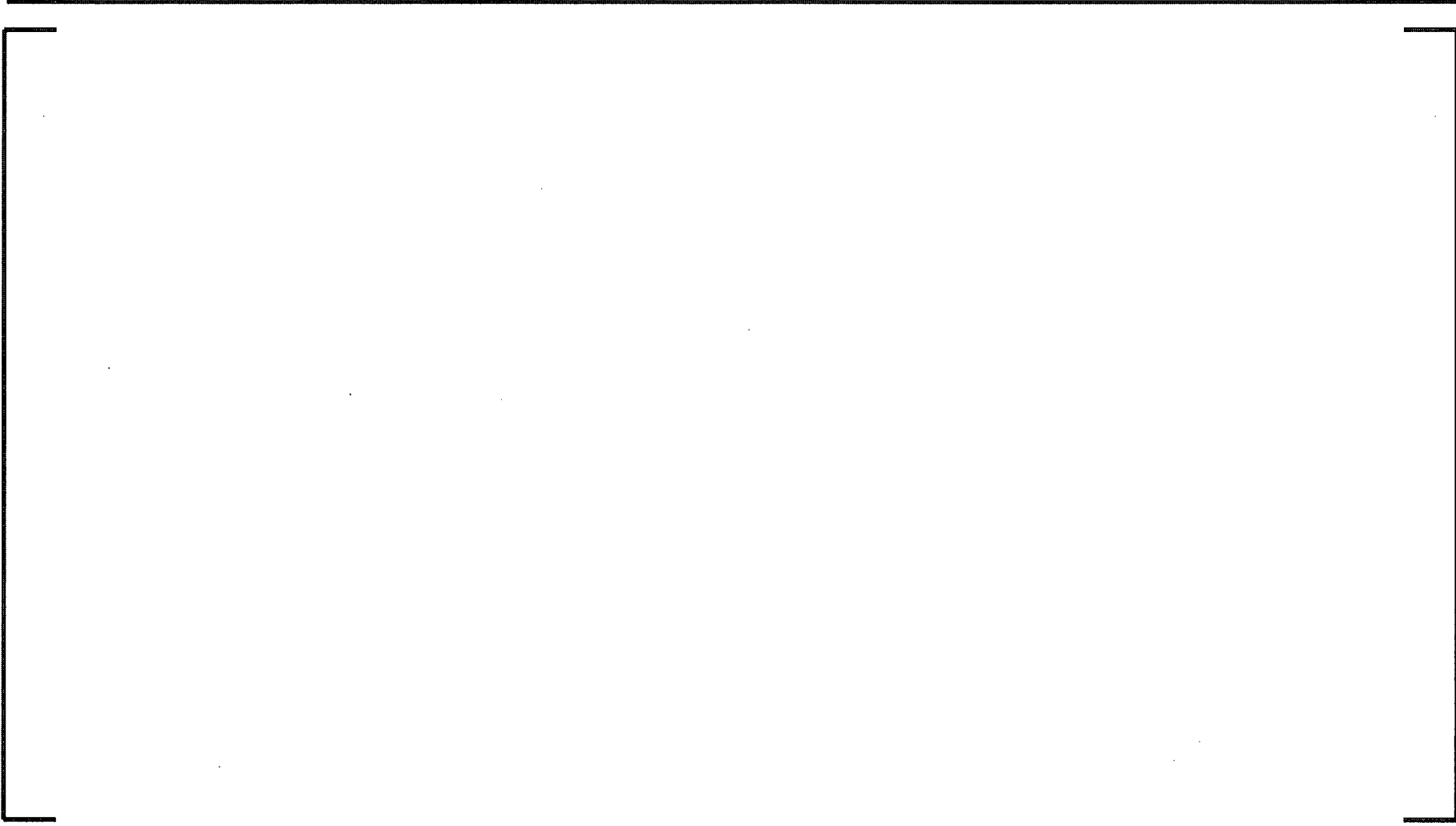




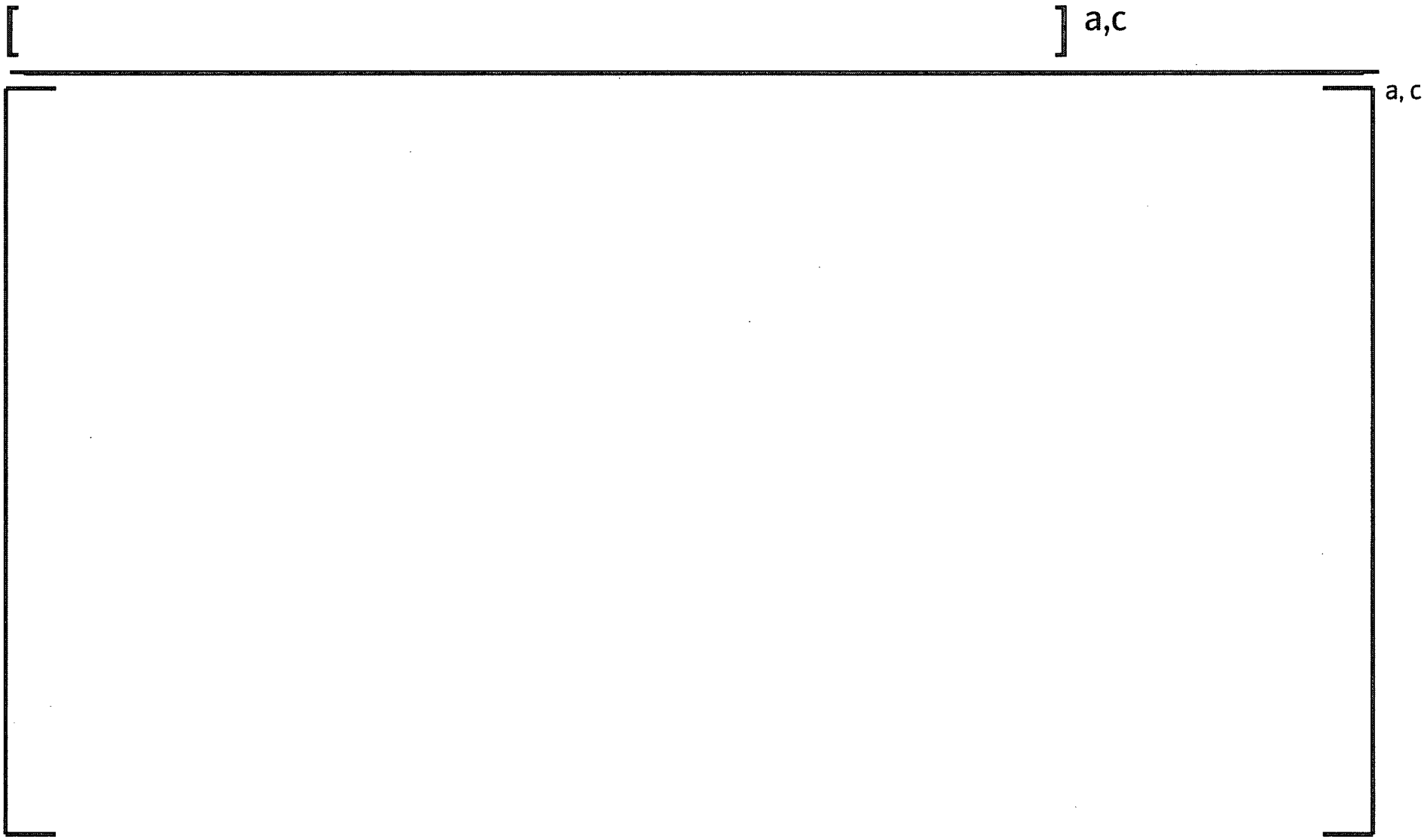




GRCA Rod Worth (Unit Assembly) vs Time



a, c



Conclusion



a, c

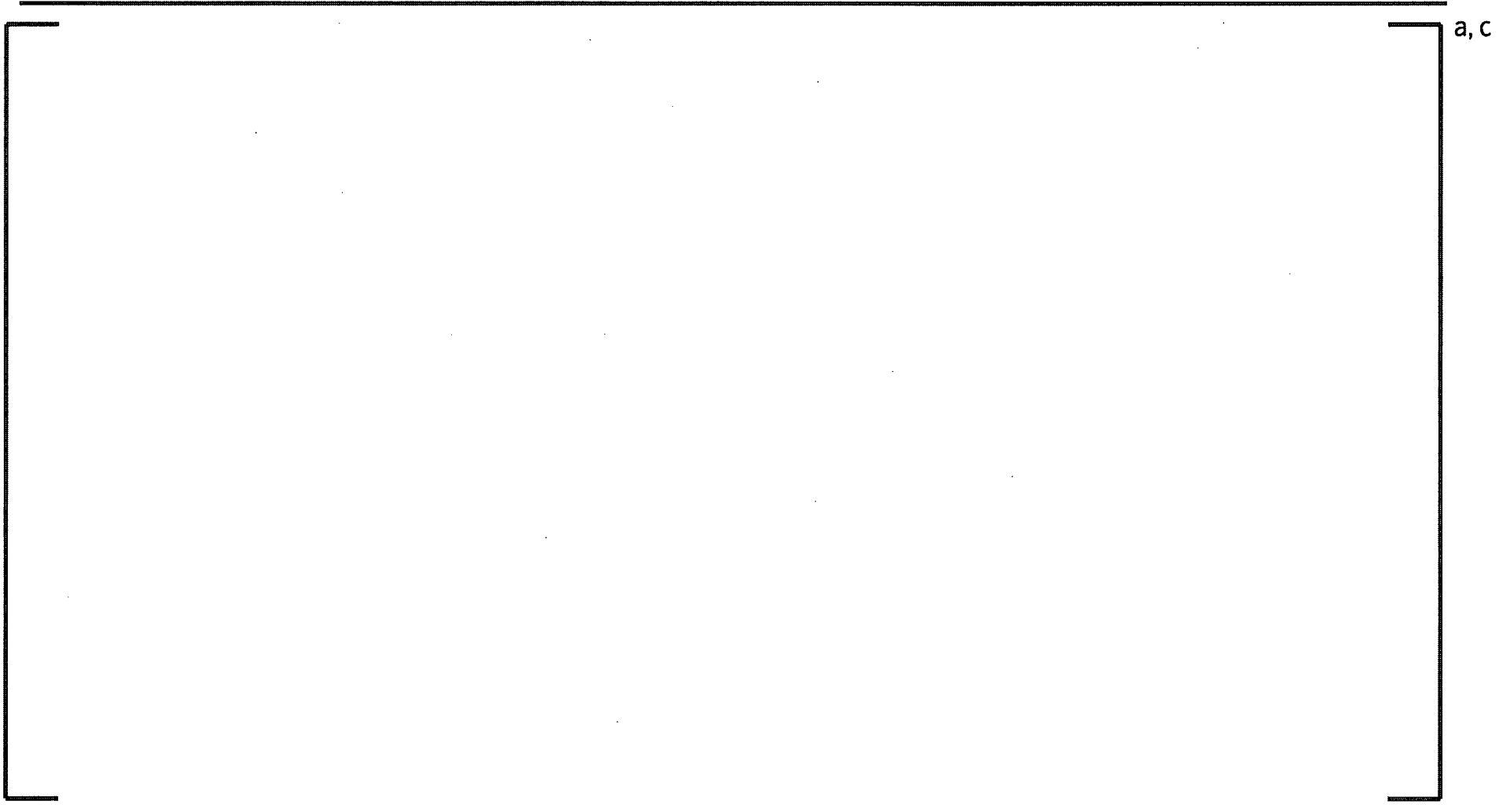
Material Properties and Radiation Effects

Material Properties and Radiation Effects

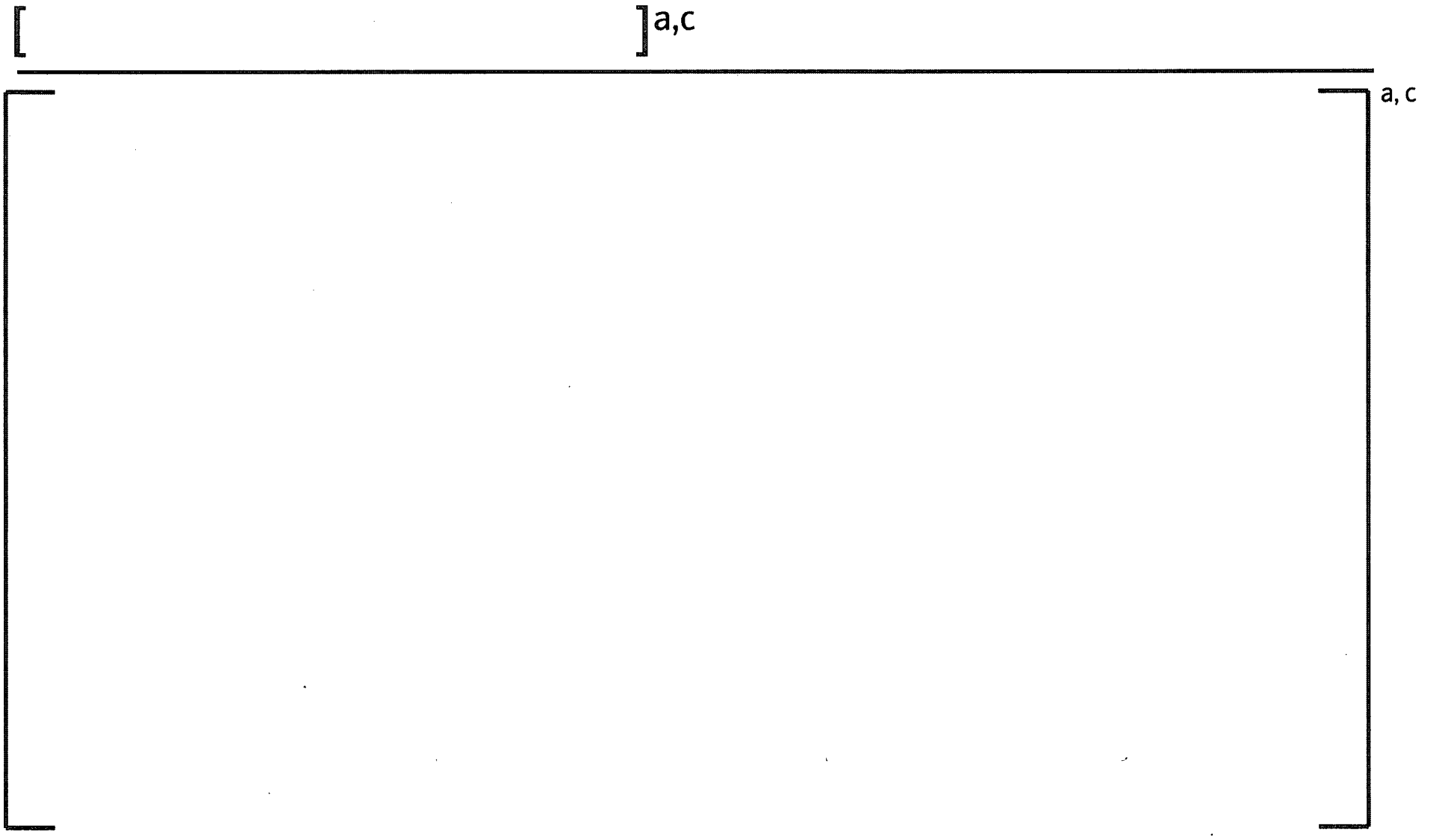


a, c

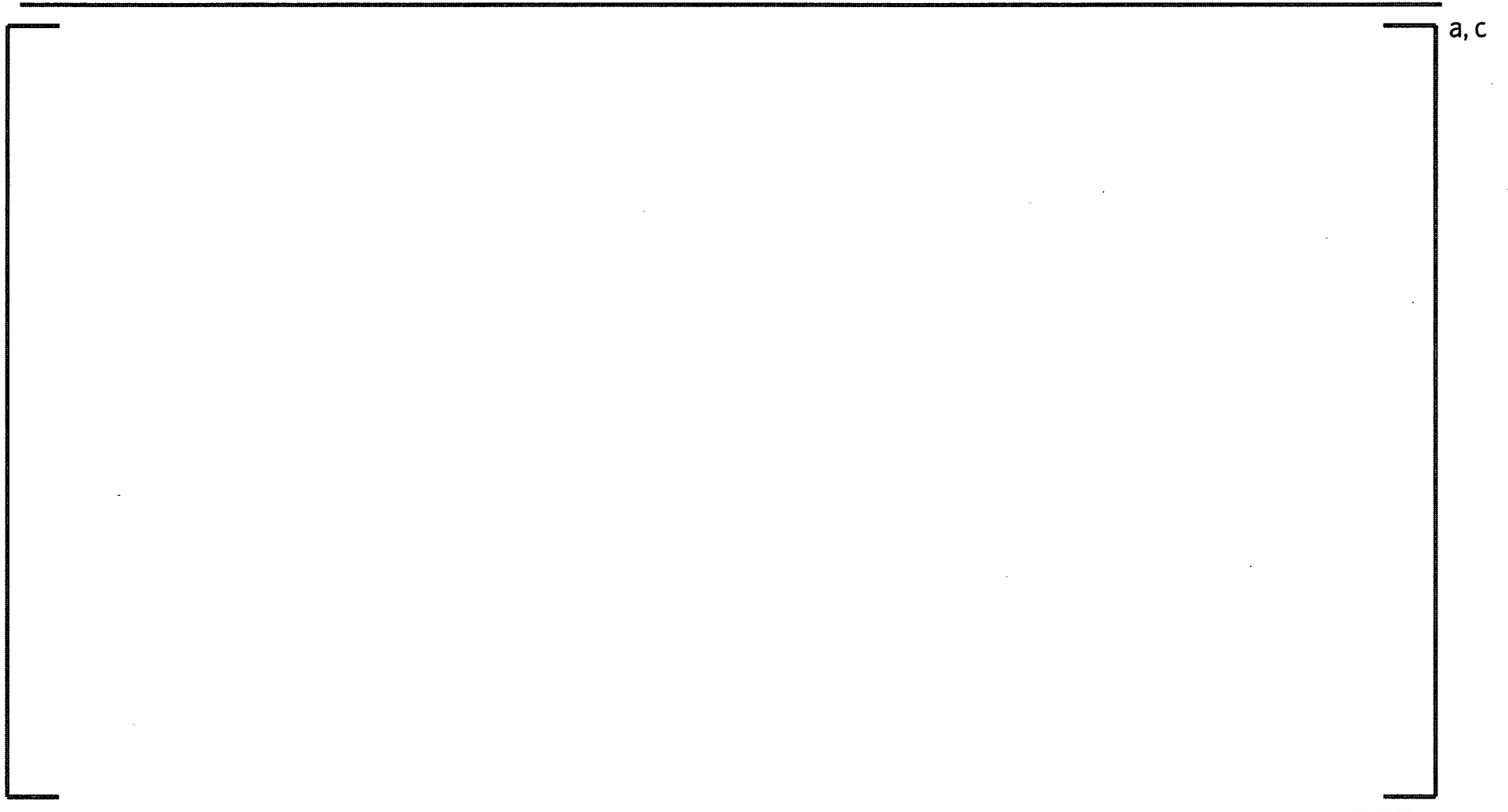
[] a,c



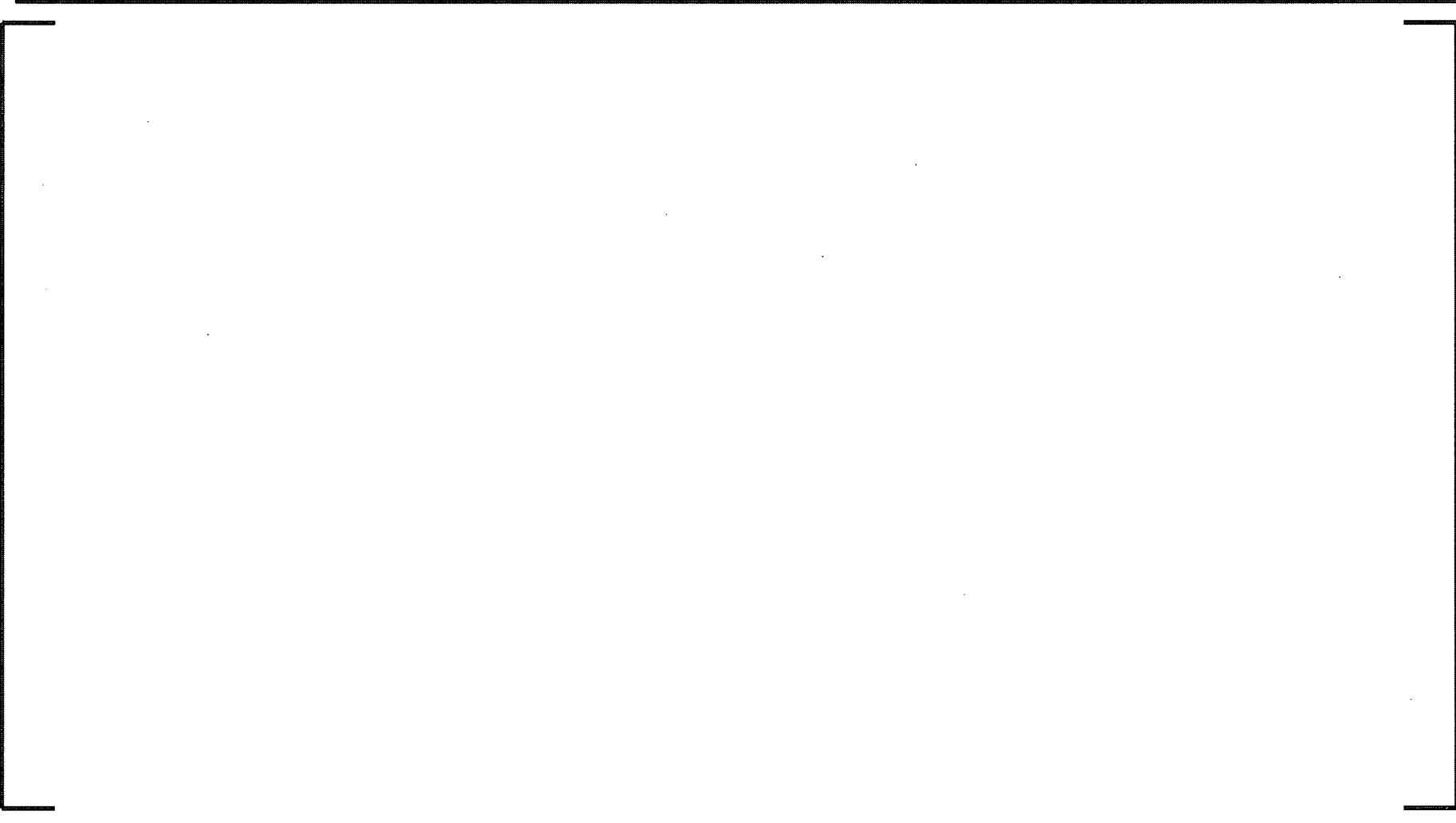
a, c



[] a,c

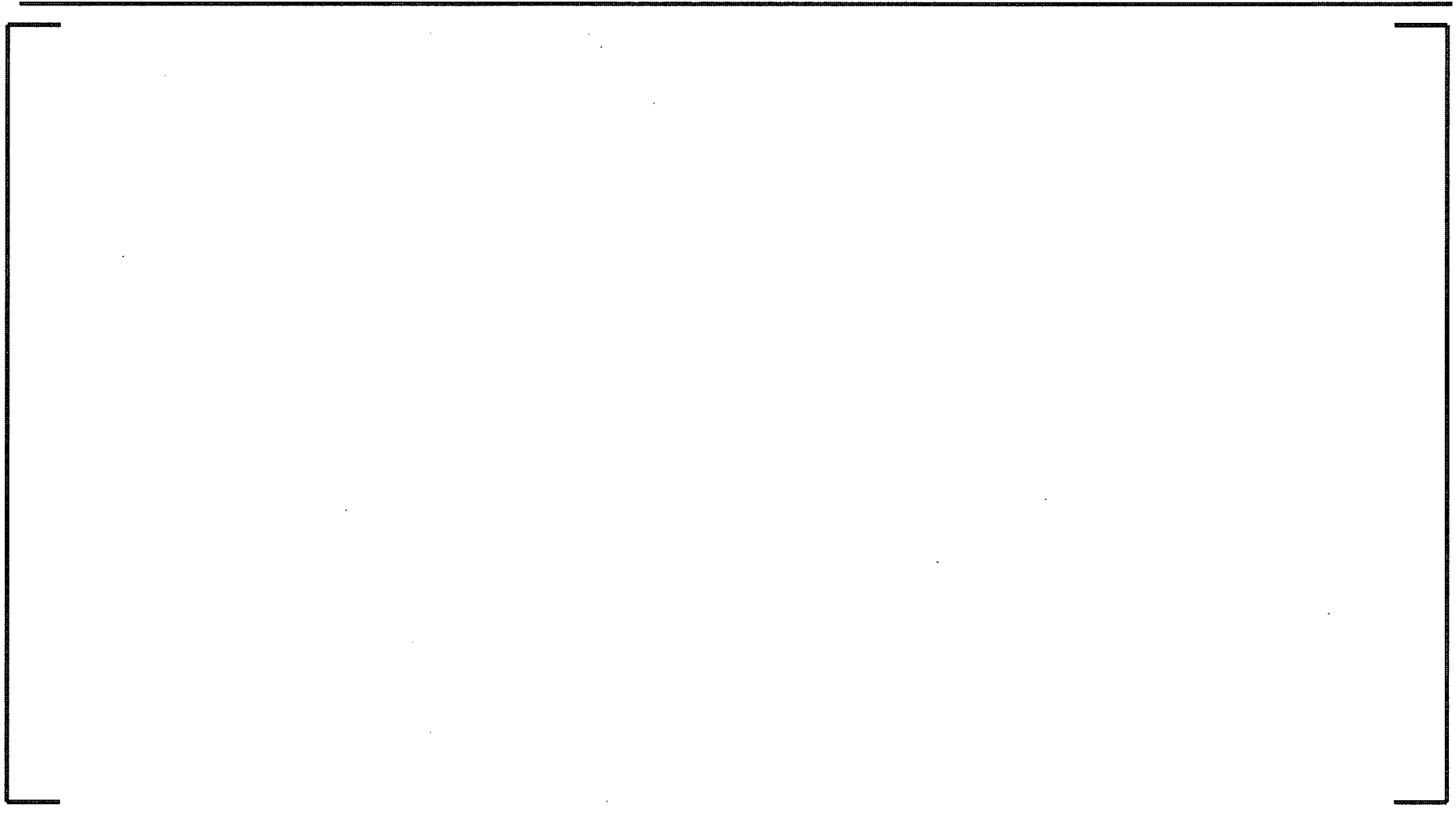


Material Interaction



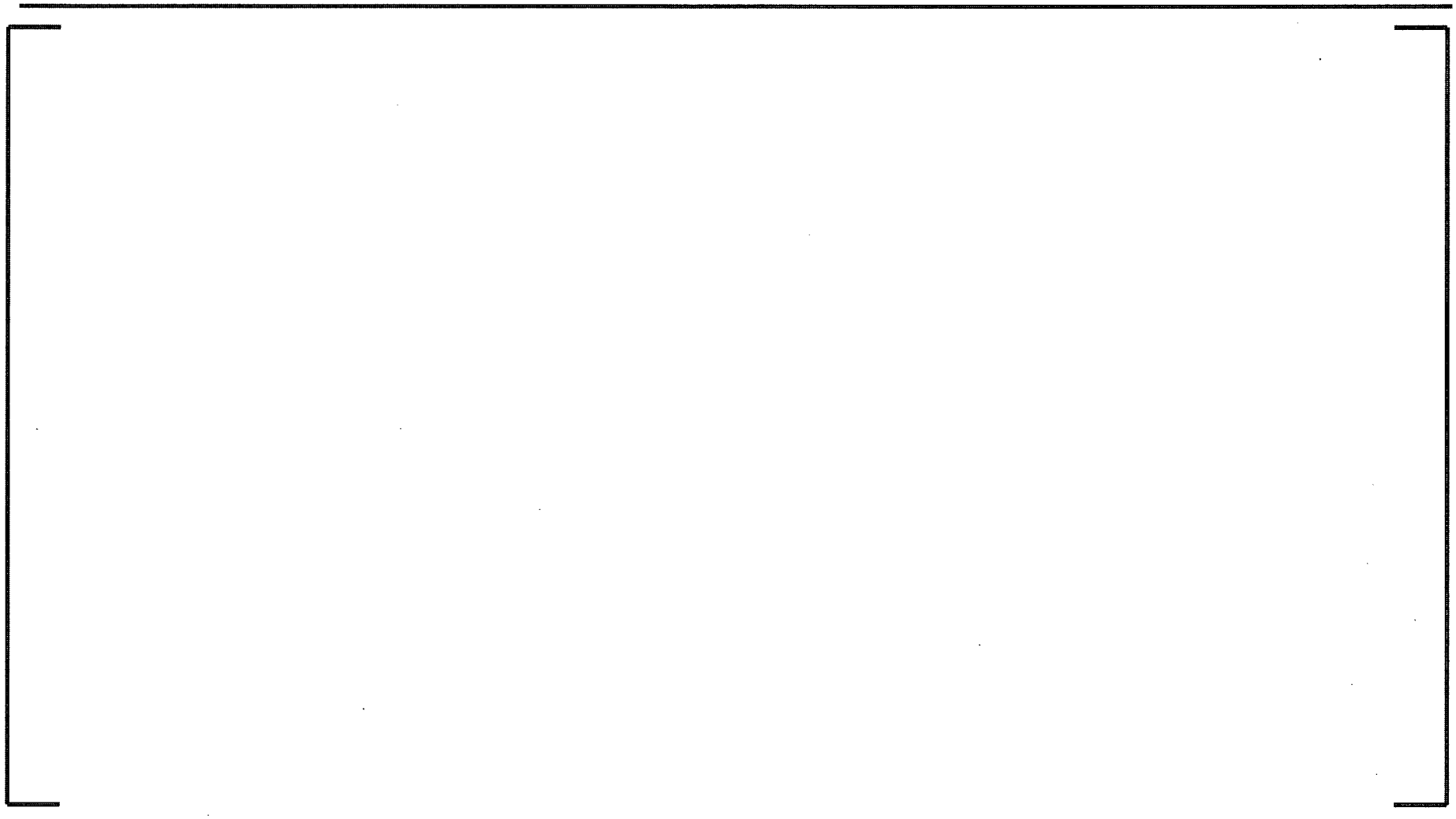
a, c

Corrosion



a, c

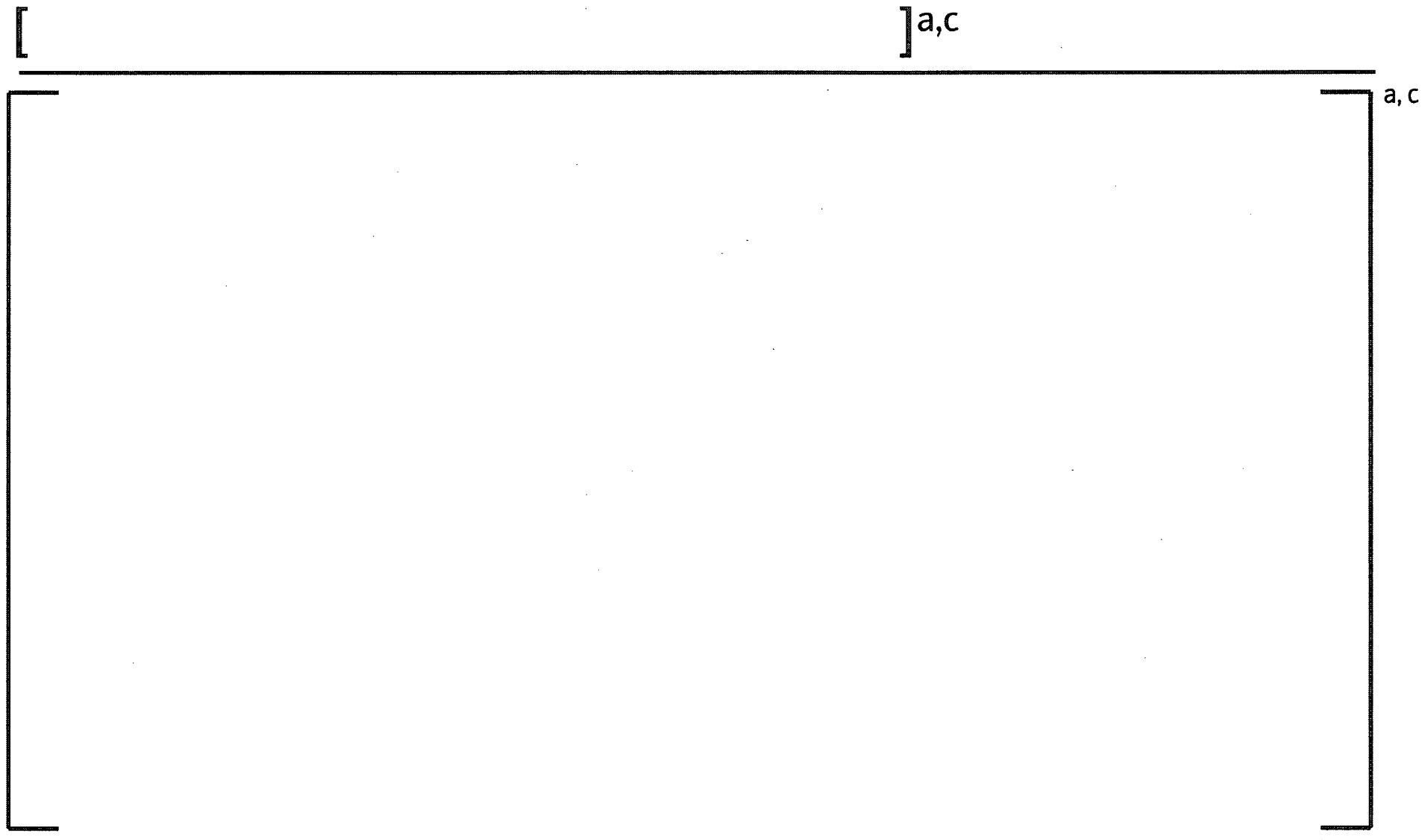
Irradiation Effects

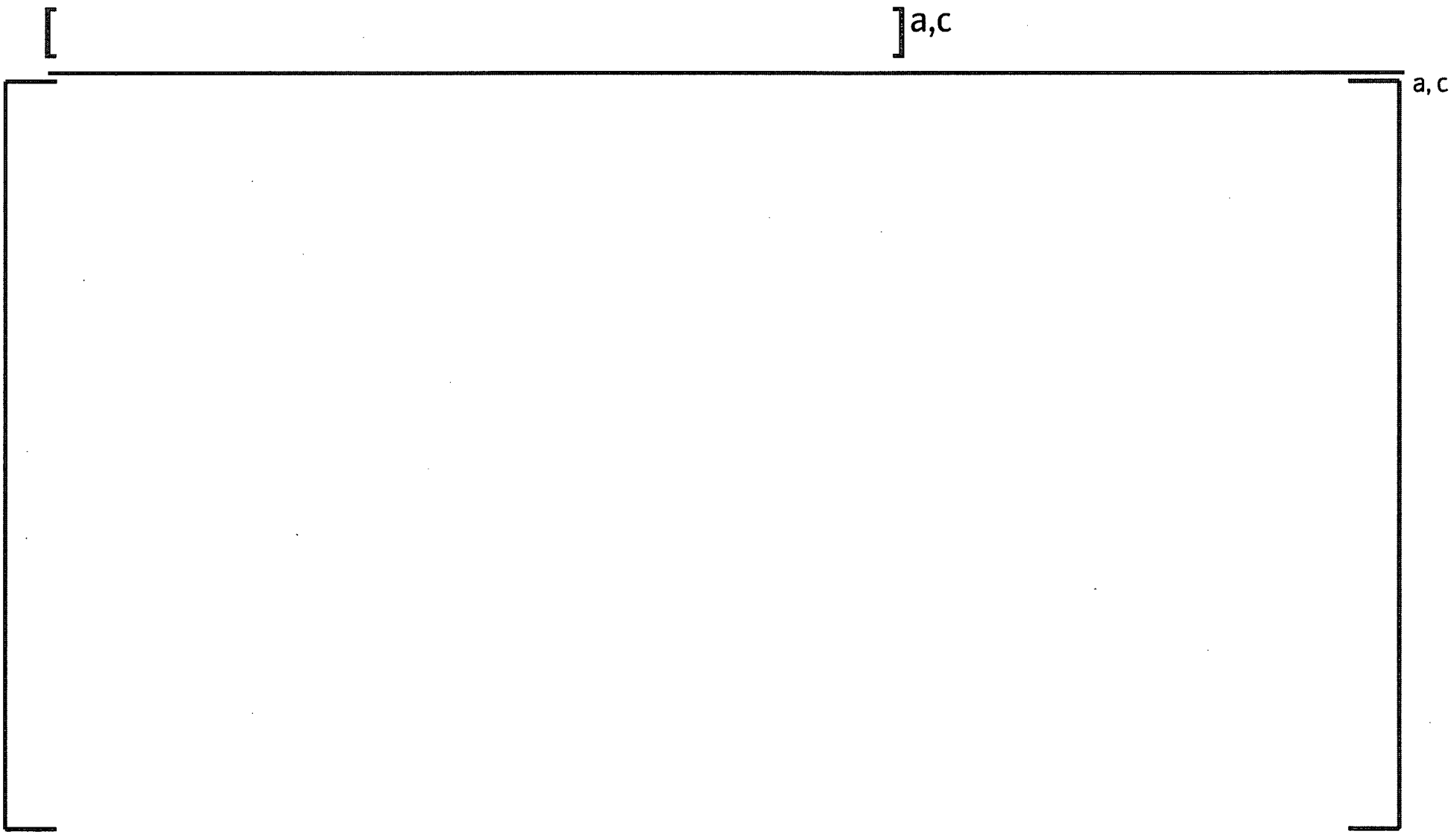


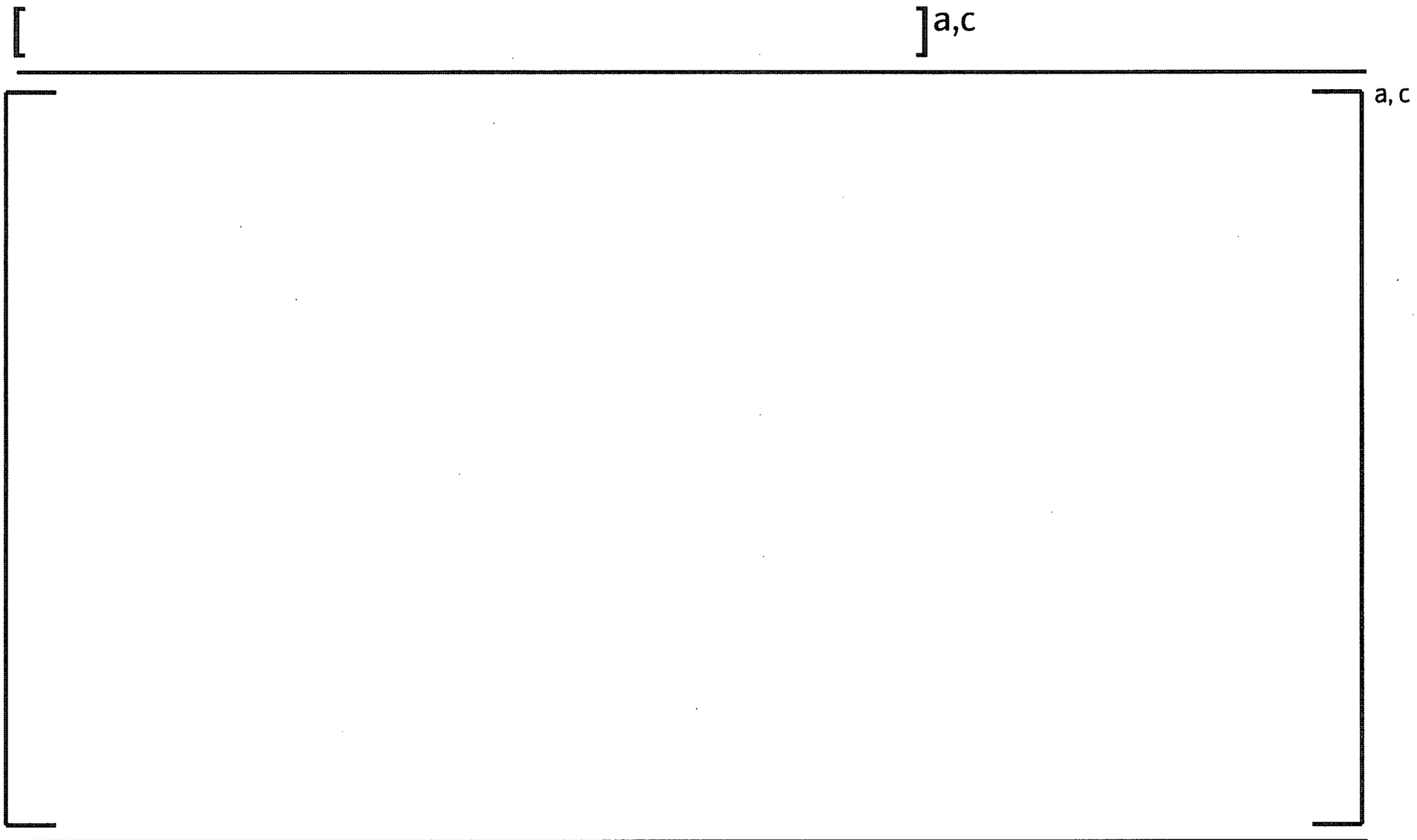
a, c

Nuclear Applications









[

]a,c

Studies
WAPAH
WAPBI
WAPBC
WAPBE
WAPBE
WAPBD
WAPBA
WAPCJ
WAPCG
WAPBJ
WAPAJ
WAPCH
WAPAF
WAPBH
WAPAL

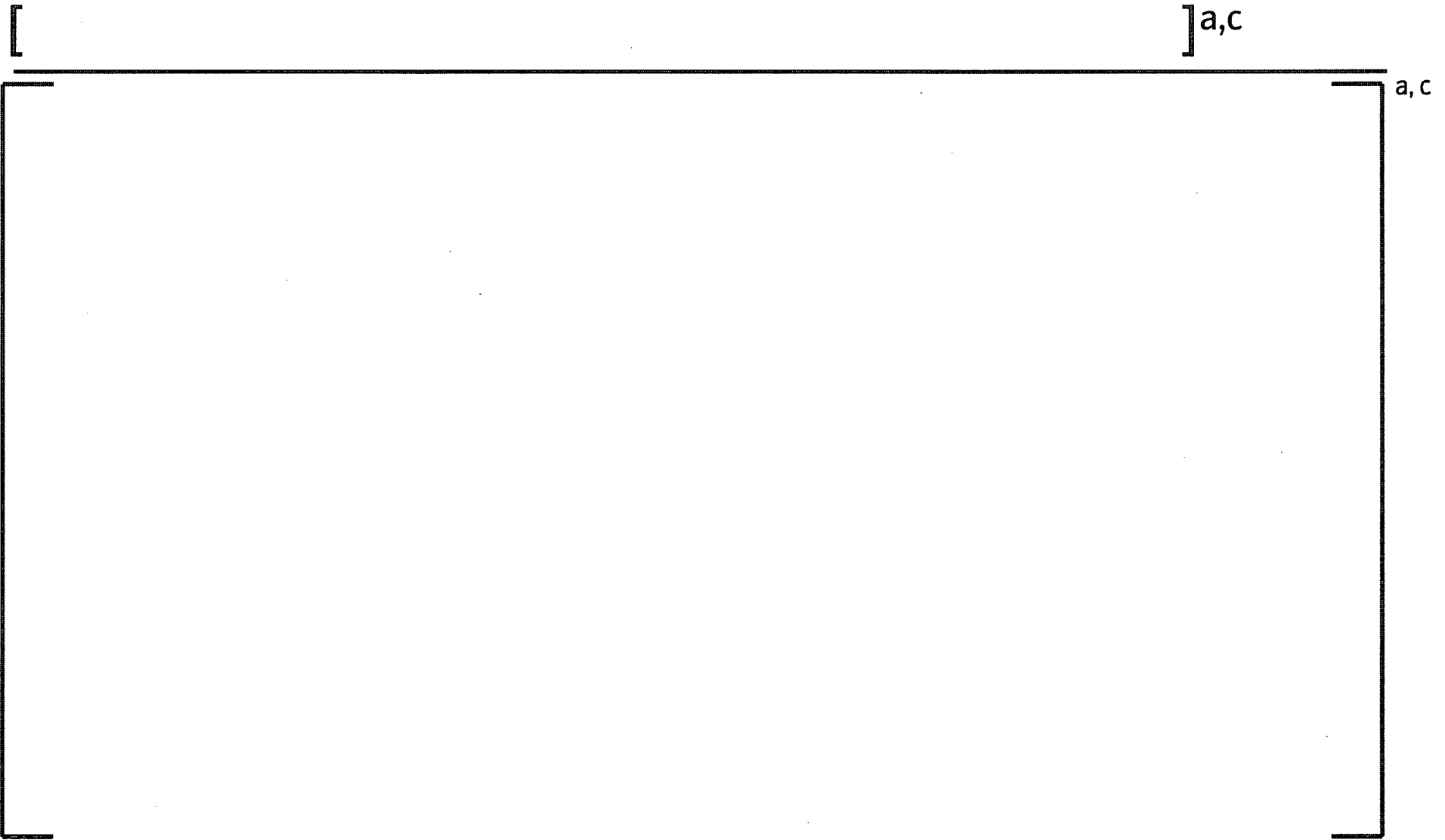
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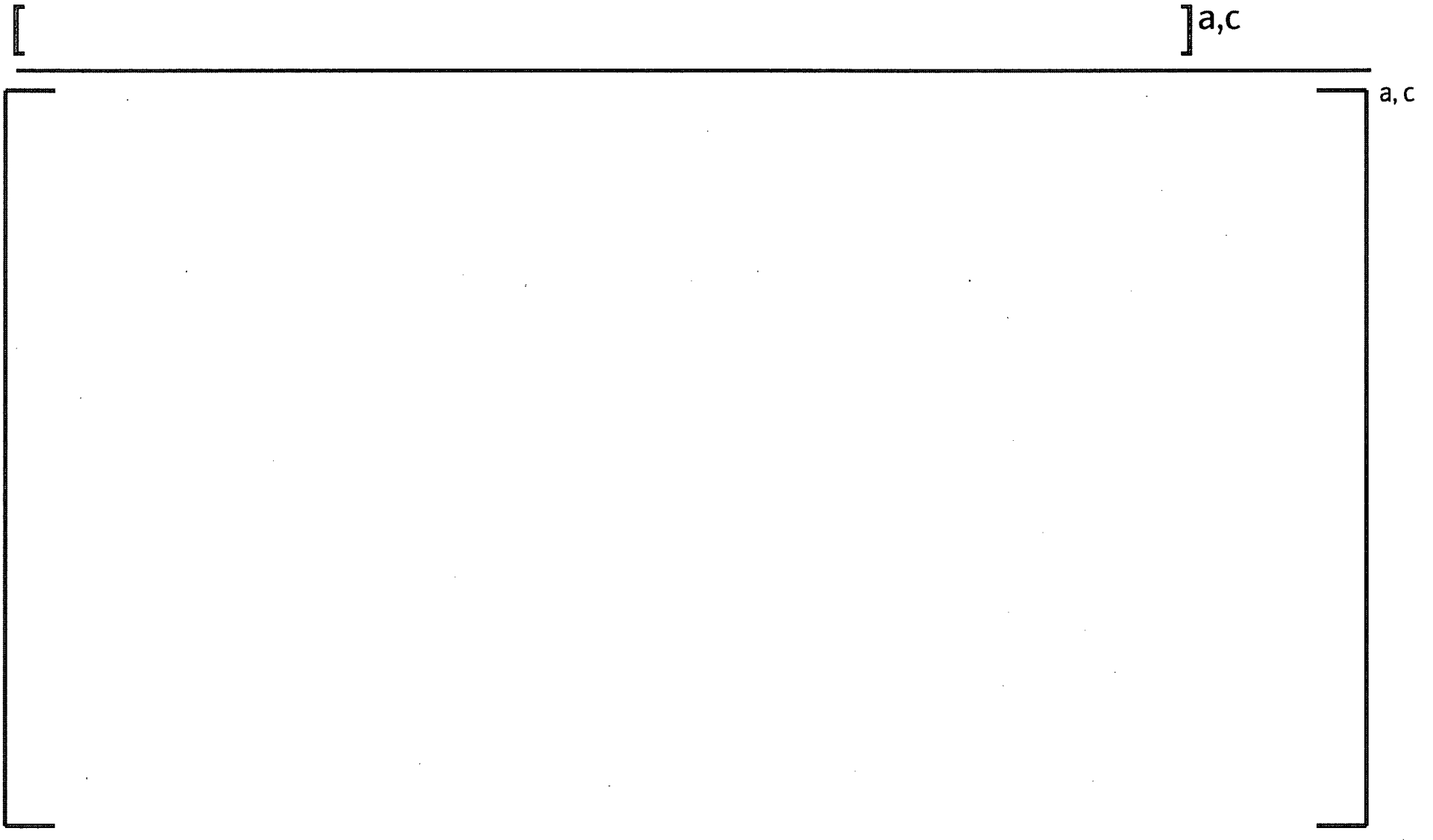
Impact of neutron spectrum on irradiation effects

- All high fluence studies made in fast reactors with harder spectrum than a PWR
- The studies bound the possible Re range from transmutation by thermal and epithermal neutrons
 - Many of the studies included W-Re alloys
 - Transmutation production of Os is inherent in the high fluence studies
- Re and Os produced at GRCA design fluences remain within solubility limits in W
- Experience with W-Re alloys indicates a benefit (swelling) due to transmutation effects

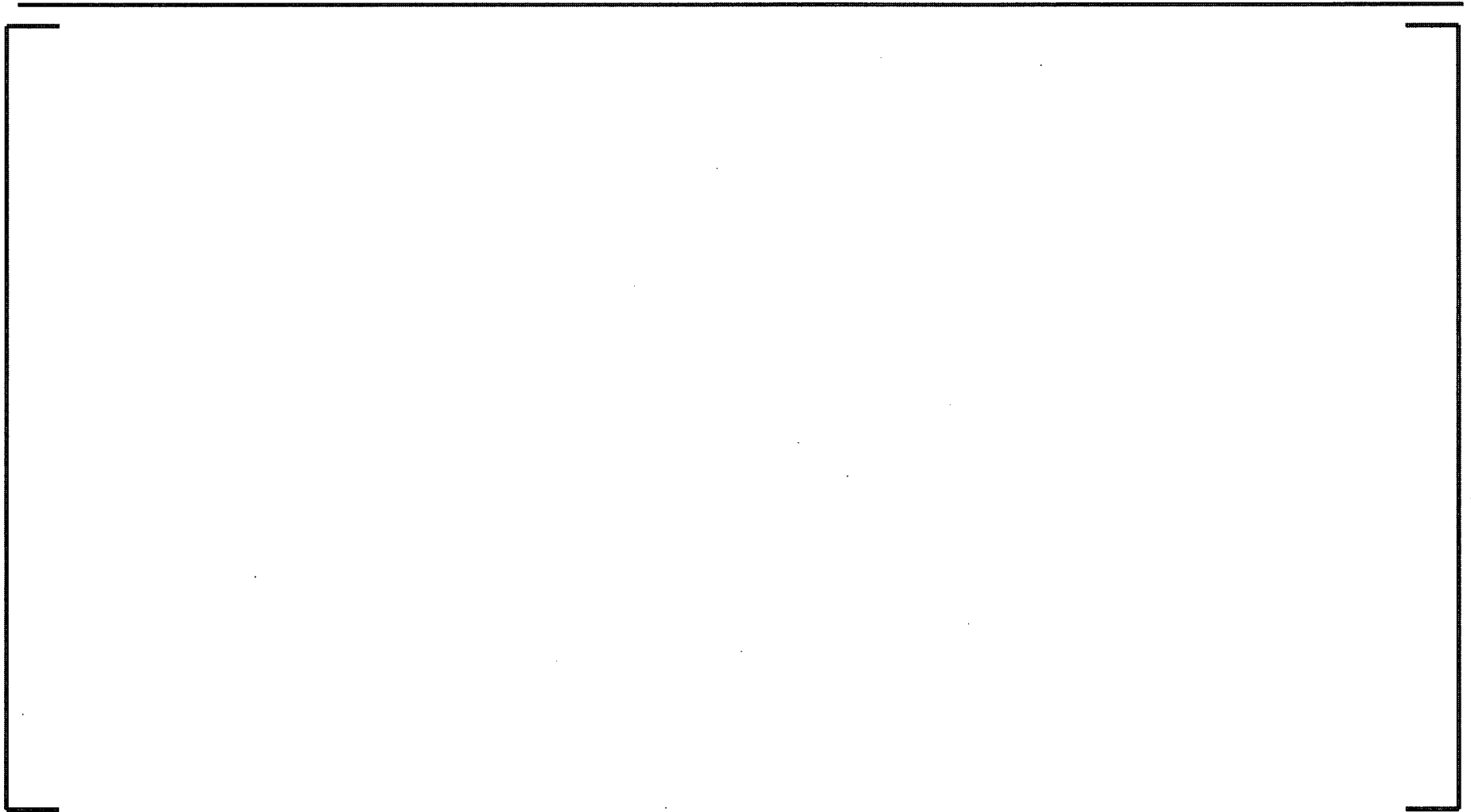
]a,c

a,c





Summary of Materials and Irradiation Effects



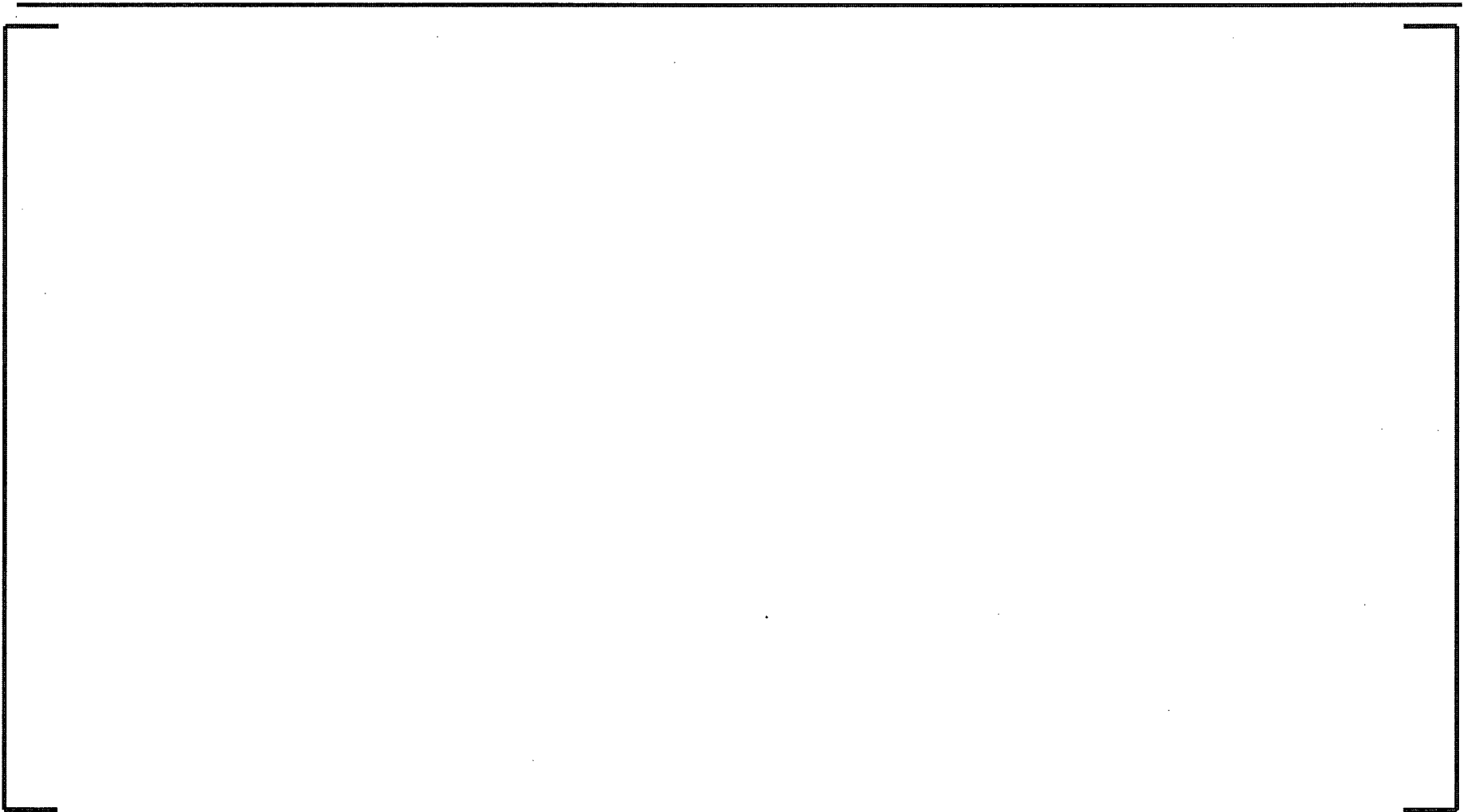
a, c

Mechanical and Thermal Evaluations

Rodlet mechanical requirements

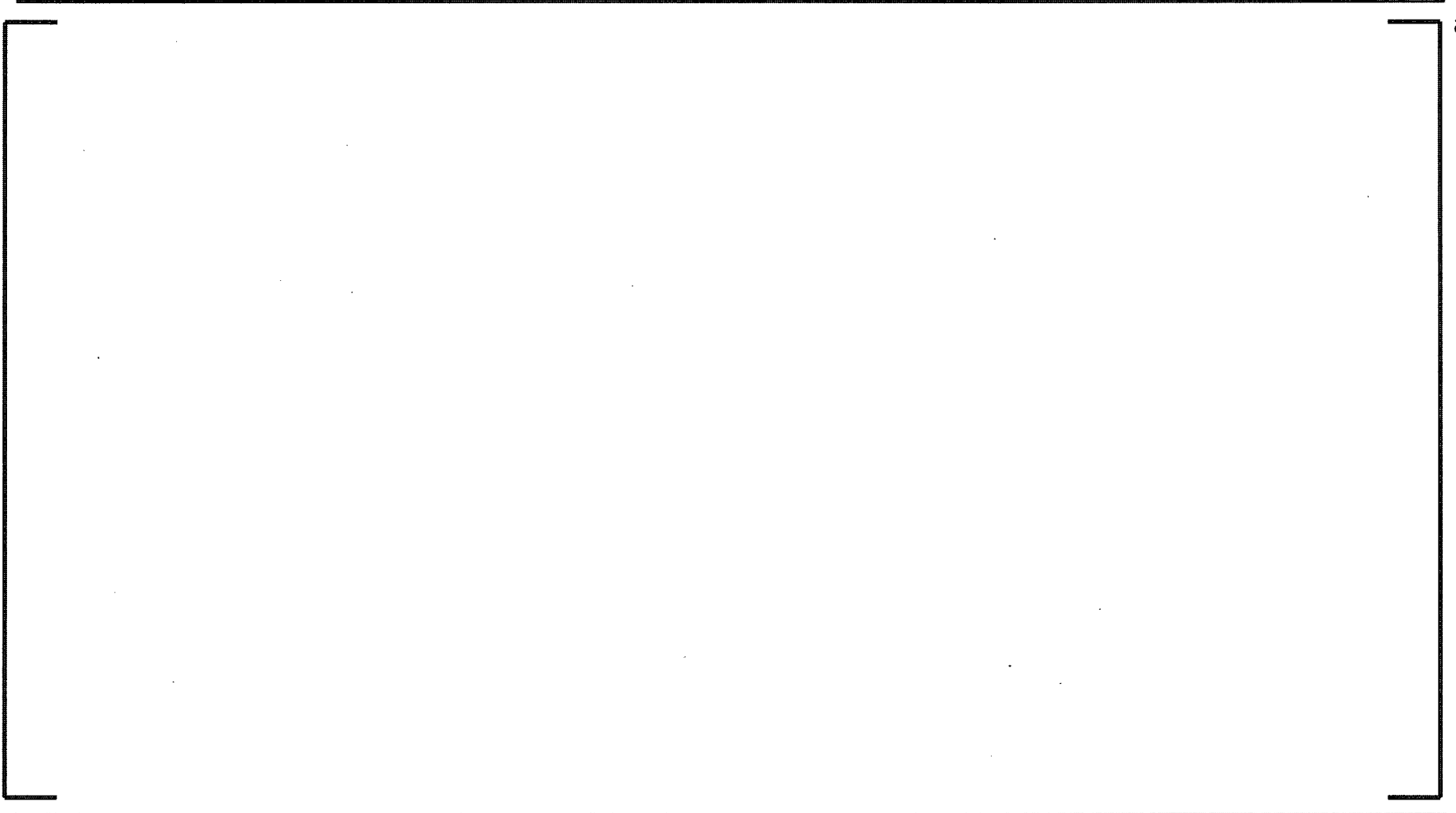
- Rodlet structural integrity requirements are unchanged from the approved design and continue to be met.
- The absorber shall maintain suitable geometry for reactivity control.
- Rodlet envelope dimensions and weight are appropriate for interfacing with mating components.

Mechanical evaluation



a, c

Mechanical evaluation, cont'd



a, c

Thermal-Hydraulic Design Criteria



a, c

Summary

- Topical Report Being Submitted for an Enhanced Rodlet Design for the GRCA using []^{a,c} as the absorber material
- NRC's timely review and approval of the Enhanced GRCA Rodlet Design Topical allow for introduction of this enhanced rodlet design in the initial core for AP1000
- Once approved will be incorporated in the AP-1000 Core Reference Report

Next Steps

- Schedule:

- Topical Pre-meeting March 27, 2008
- Submit Topical to NRC May-June 2008
- Requested Approval May-June 2009