

FLUX MODEL VERIFICATION FOR SOLID-STATE NUCLEAR POWER

Eric Palmer

Dr. William Charlton

Dr. Austin Lo

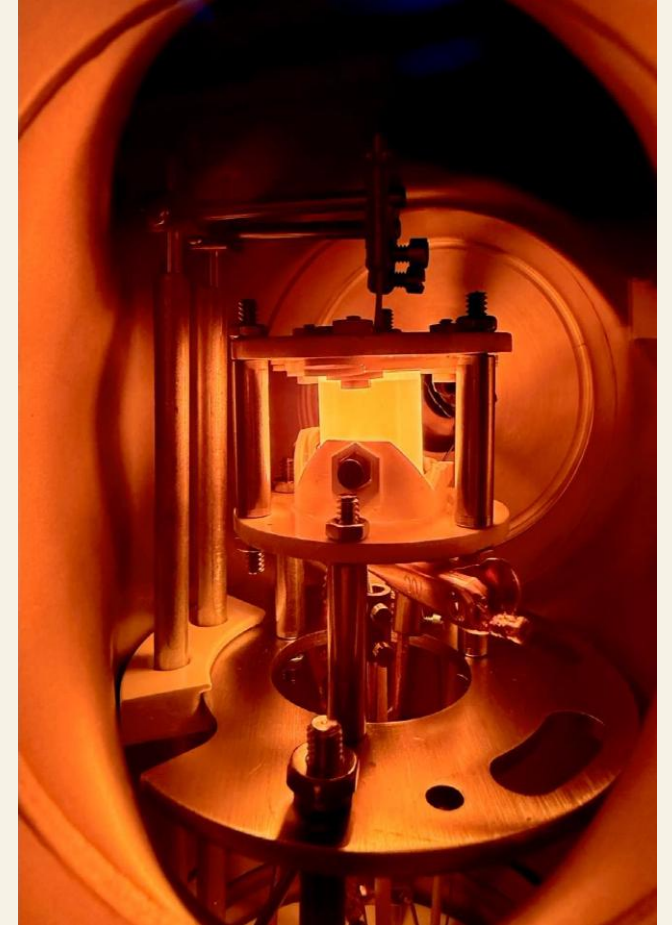
GEN(α)



DIRECT ENERGY CONVERSION FUEL

2 Key Phenomena

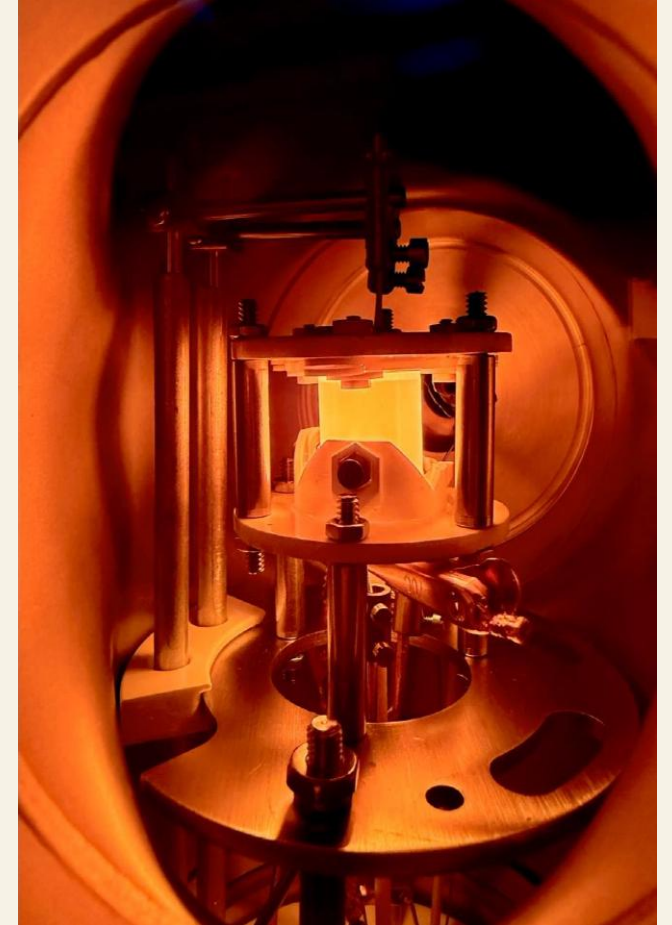
- Plasma diode-type Thermionic Energy Conversion (PTEC)
- Nuclear Low Temperature Plasma (NLTP)



DIRECT ENERGY CONVERSION FUEL

2 Key Phenomena

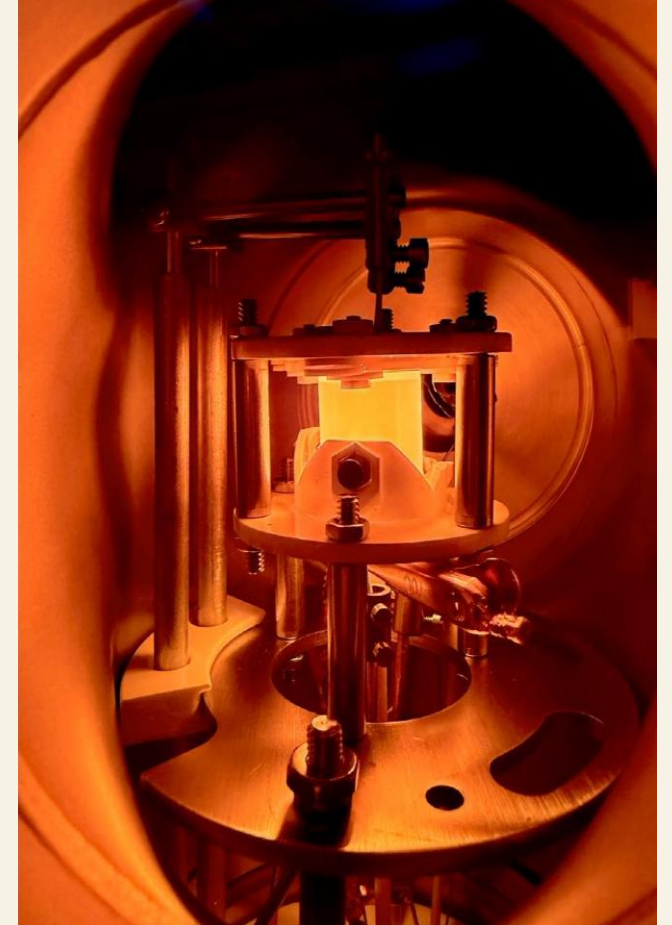
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DIRECT ENERGY CONVERSION FUEL

2 Key Phenomena

- Plasma diode-type Thermionic Energy Conversion (PTEC)
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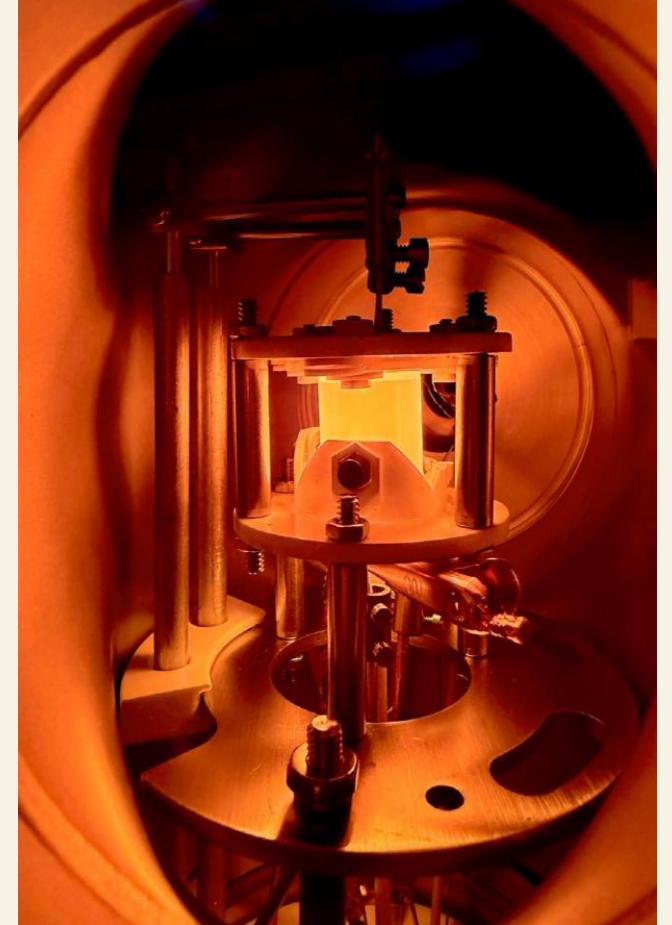
DIRECT ENERGY CONVERSION FUEL

2 Key Phenomena

- Plasma diode-type Thermionic Energy Conversion (PTEC)



Nuclear Low Temperature Plasma
(NLTP)



TEAM

GEN(α)



**Sandia
National
Laboratories**

THE UNIVERSITY OF
TEXAS
AT AUSTIN

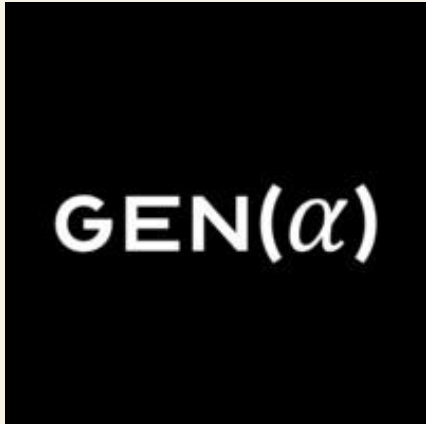
**Additional
Contractors**

Plasma M&S

**Nuclear M&S +
TRIGA Usage**

**Physical Systems
Implementation**

TEAM

The logo for GEN(alpha) consists of the text "GEN(alpha)" in white, sans-serif font, centered within a solid black square.

GEN(α)



- 
- A blue horizontal bracket with upward-pointing ends, spanning the width of the content area below the logos.
- DUT Model in Reactor Environment
 - Microscale Charged Particle Interactions
 - Cohesive Model for Future Fuel Designs

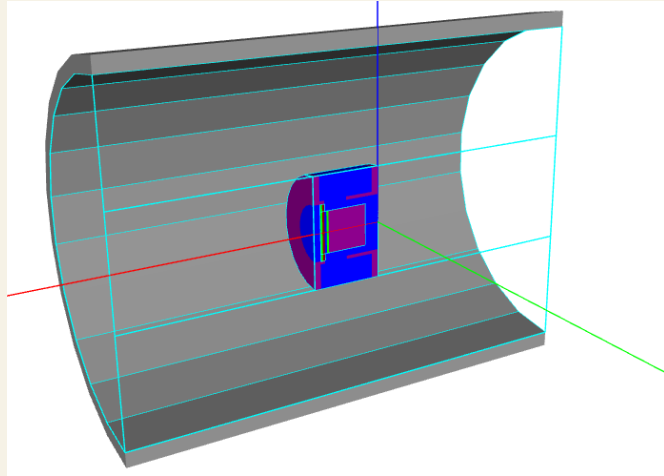
The logo for The University of Texas at Austin, featuring the text "THE UNIVERSITY OF" in a small, orange, serif font, followed by "TEXAS" in a large, orange, serif font, and "AT AUSTIN" in a smaller, orange, serif font below it.

THE UNIVERSITY OF
TEXAS
AT AUSTIN

A blue horizontal bracket with upward-pointing ends, spanning the width of the content area below the list and university logo.

Nuclear Modeling

TEAM

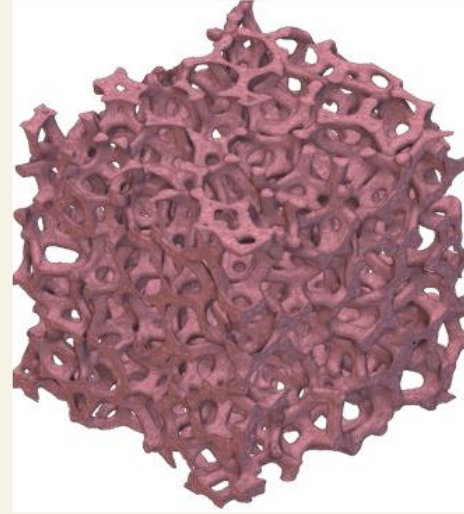
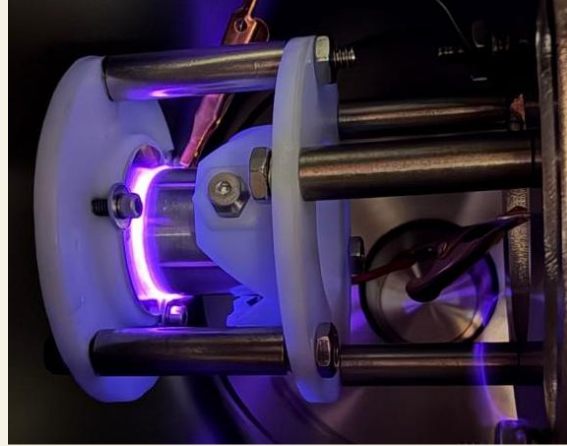


- **DUT Model in Reactor Environment**
- Microscale Charged Particle Interactions
- Cohesive Model for Future Fuel Designs

THE UNIVERSITY OF
TEXAS
AT AUSTIN

Nuclear Modeling

TEAM

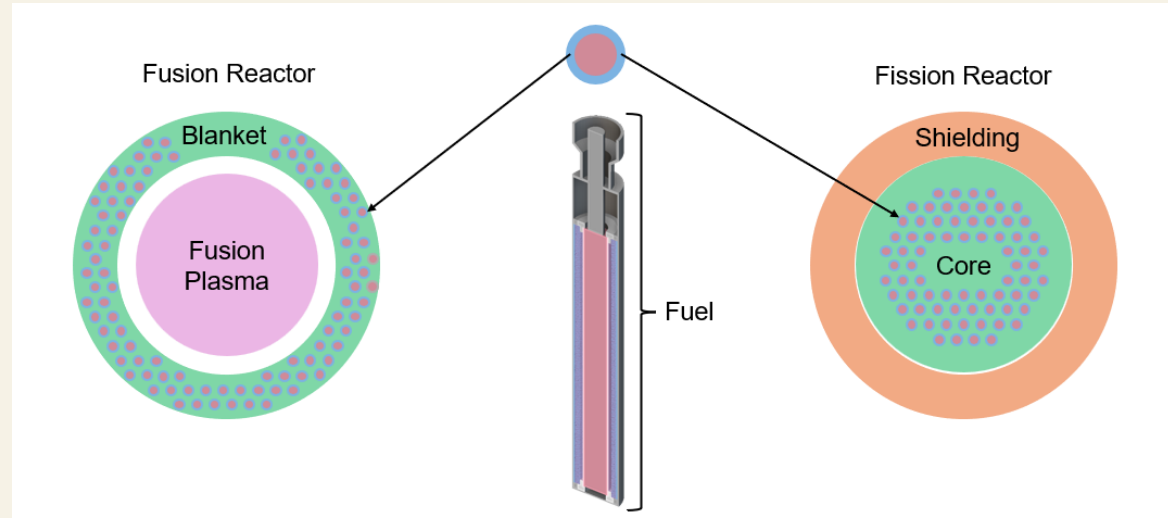


- DUT Model in Reactor Environment
- **Microscale Charged Particle Interactions**
- Cohesive Model for Future Fuel Designs

THE UNIVERSITY OF
TEXAS
AT AUSTIN

Nuclear Modeling

TEAM

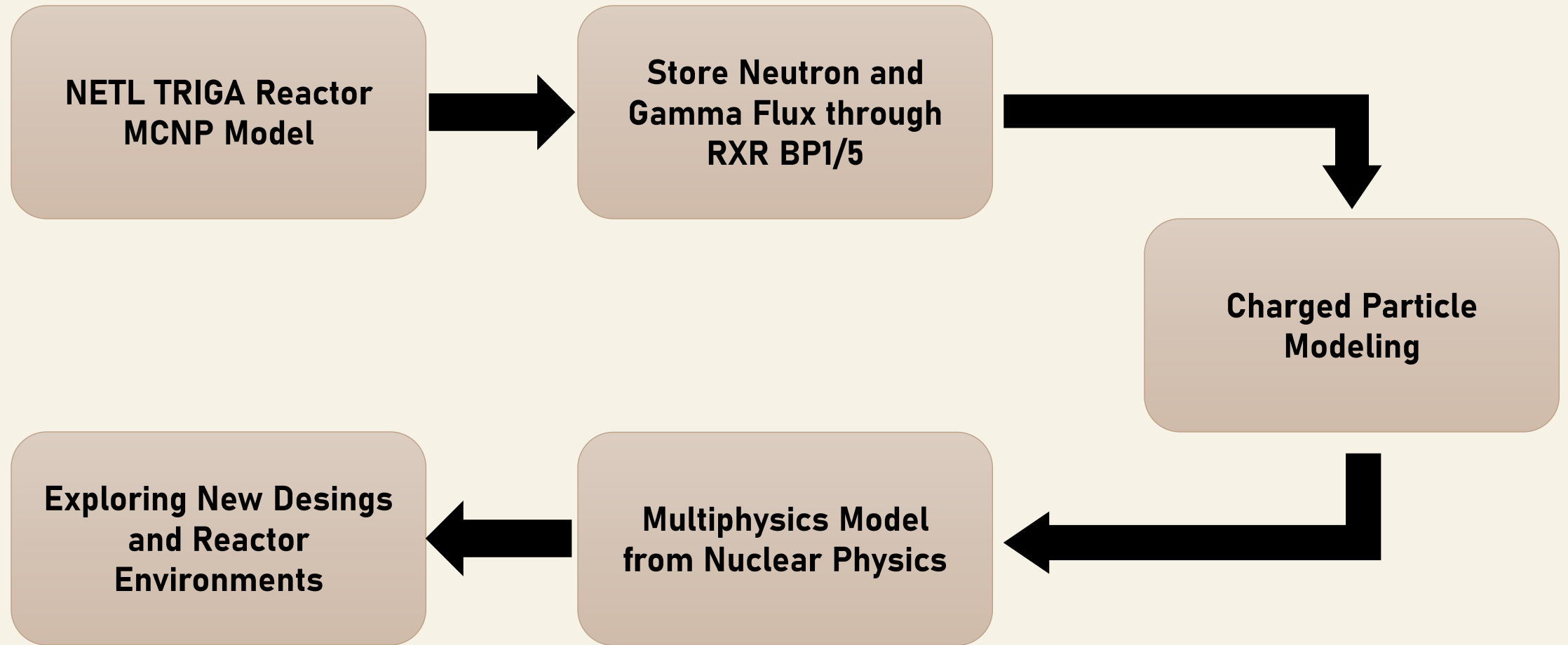


- DUT Model in Reactor Environment
- Microscale Charged Particle Interactions
- **Multiphysics Model for Future Fuel Designs**

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AT AUSTIN

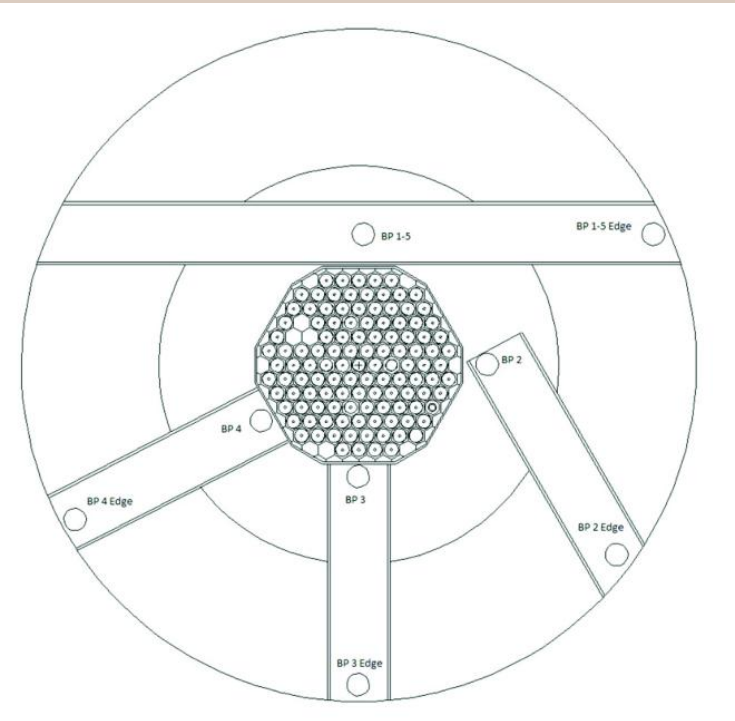
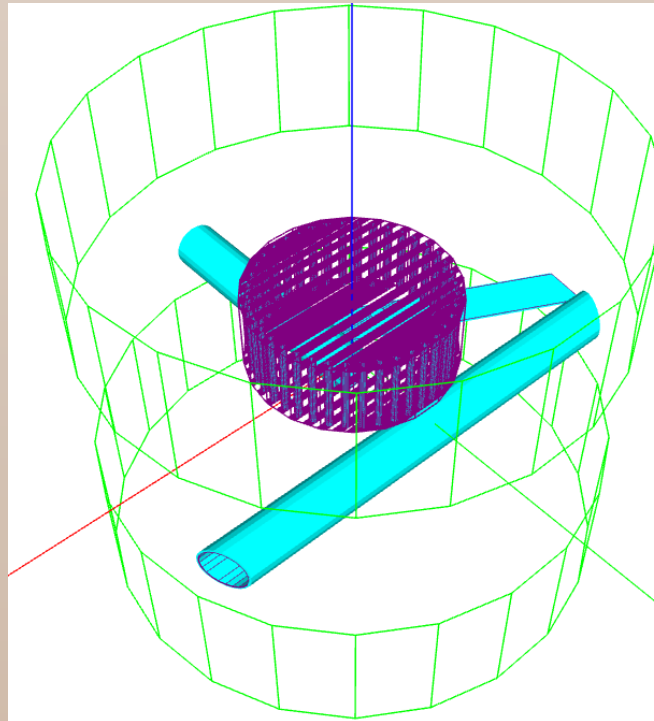
Nuclear Modeling

MODELING AND SIMULATION



MODELING AND SIMULATION

**NETL TRIGA Reactor
MCNP Model**

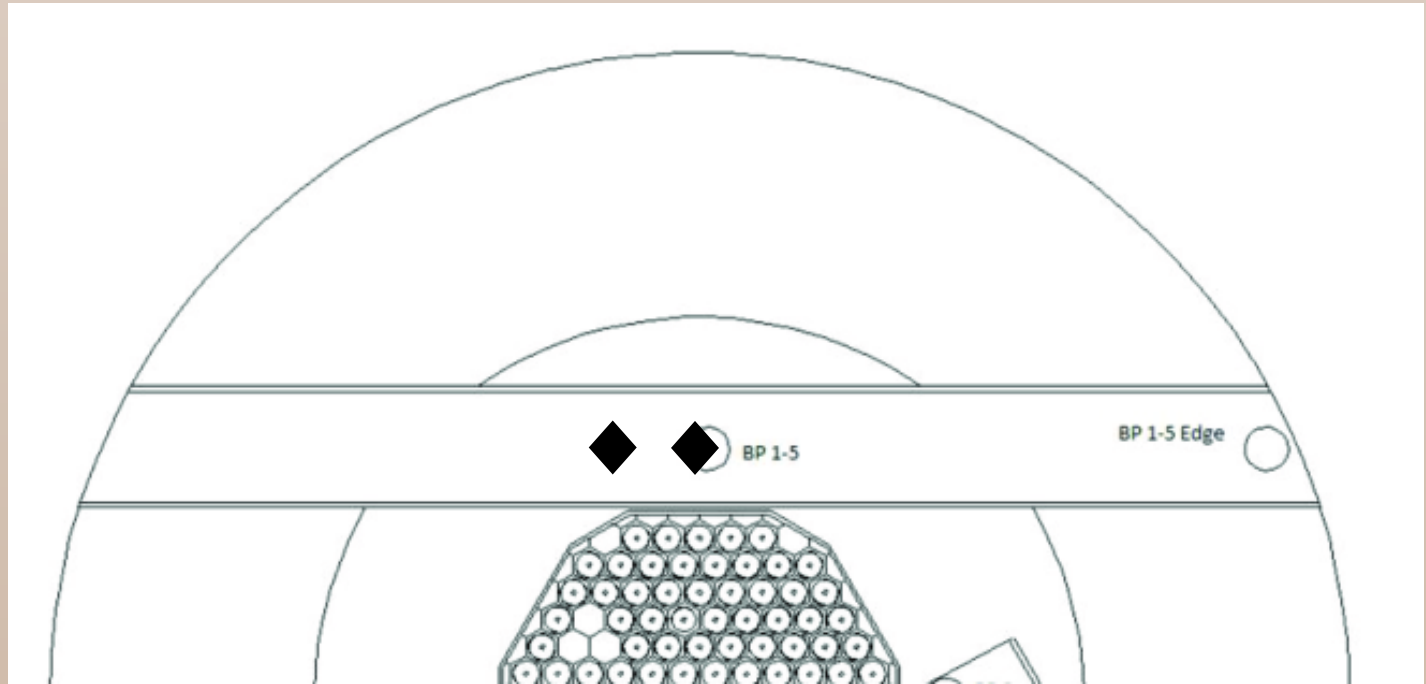


**Exploring New Designs
and Reactor
Environments**

MODELING AND SIMULATION

**NETL TRIGA Reactor
MCNP Model**

**Exploring New Designs
and Reactor
Environments**

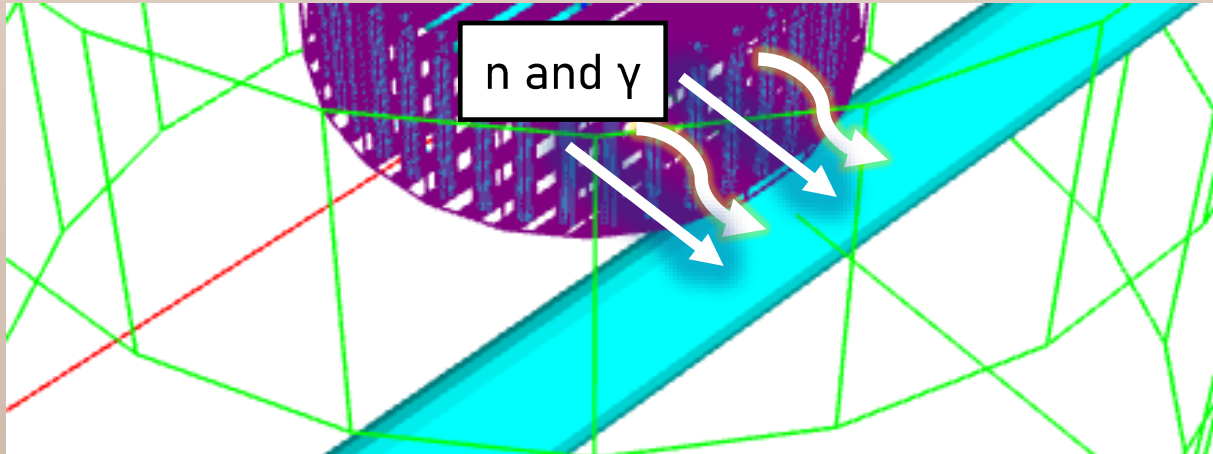


MODELING AND SIMULATION

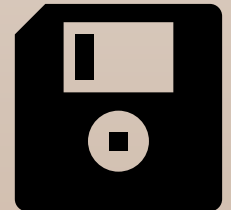
NETL TRIGA Reactor
MCNP Model

Store Neutron and
Gamma Flux through
RXR BP1/5

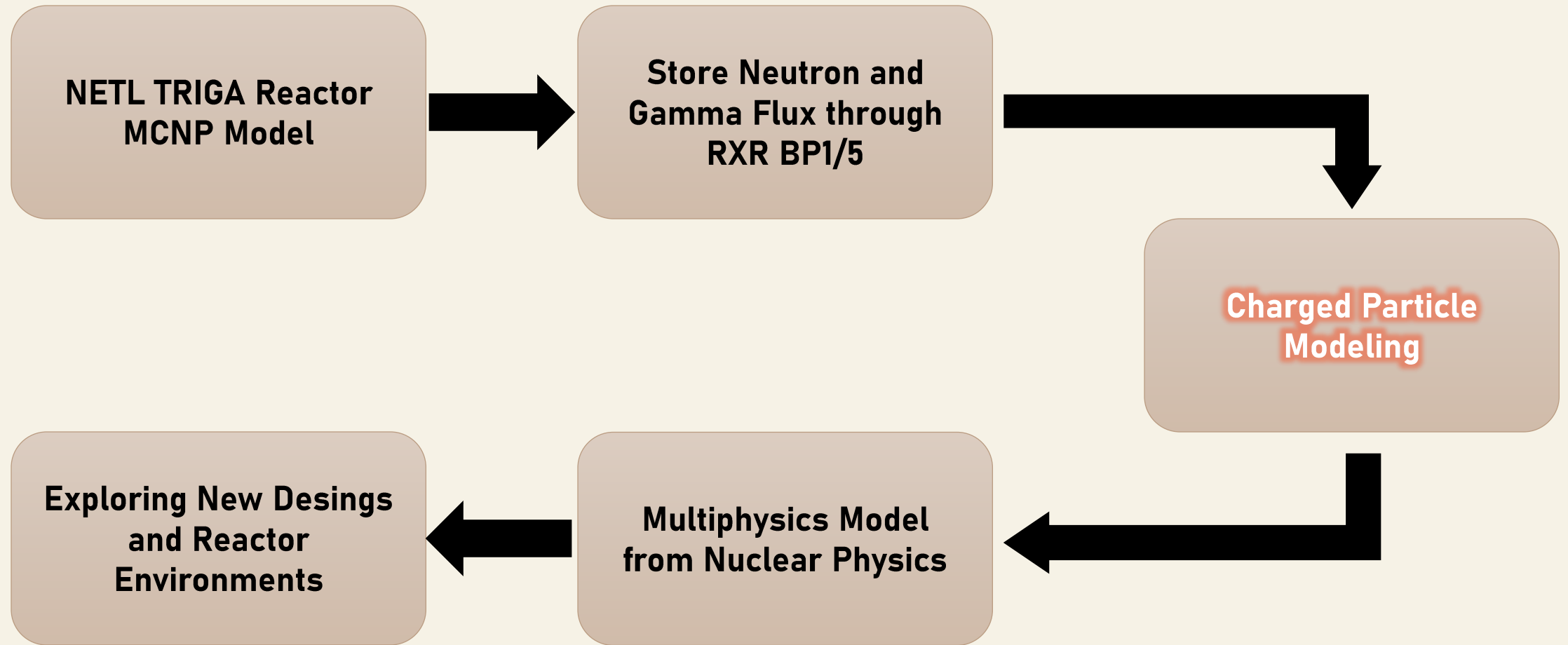
Charged Particle



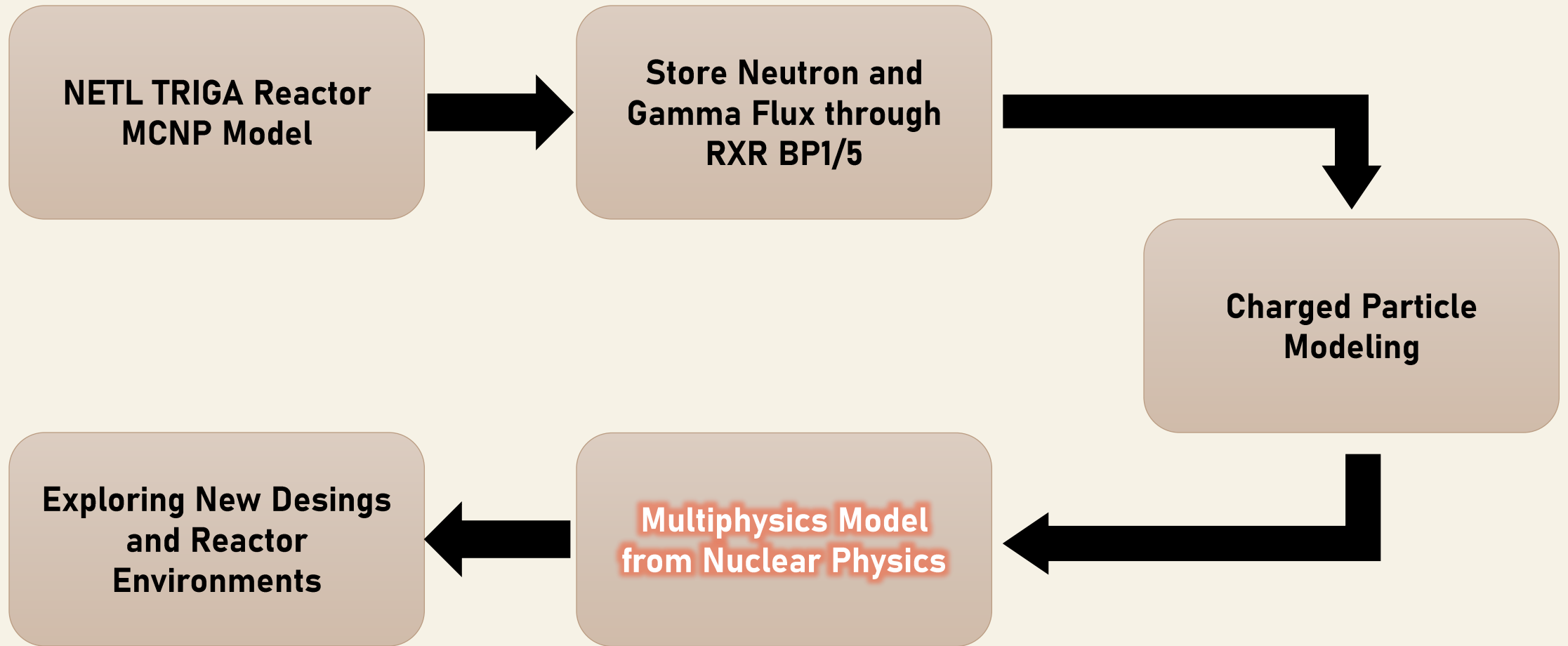
"RSSA" File
Stores Flux
Through BP1/5



MODELING AND SIMULATION



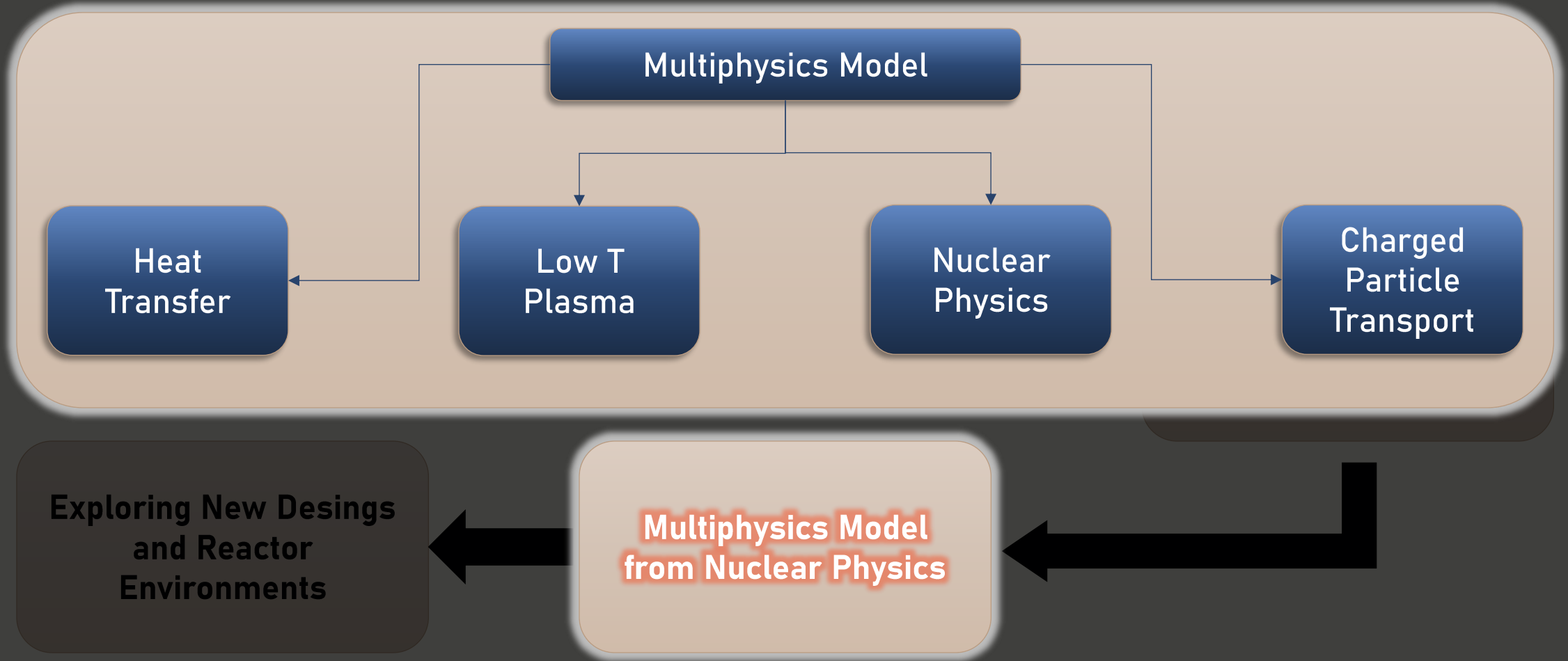
MODELING AND SIMULATION



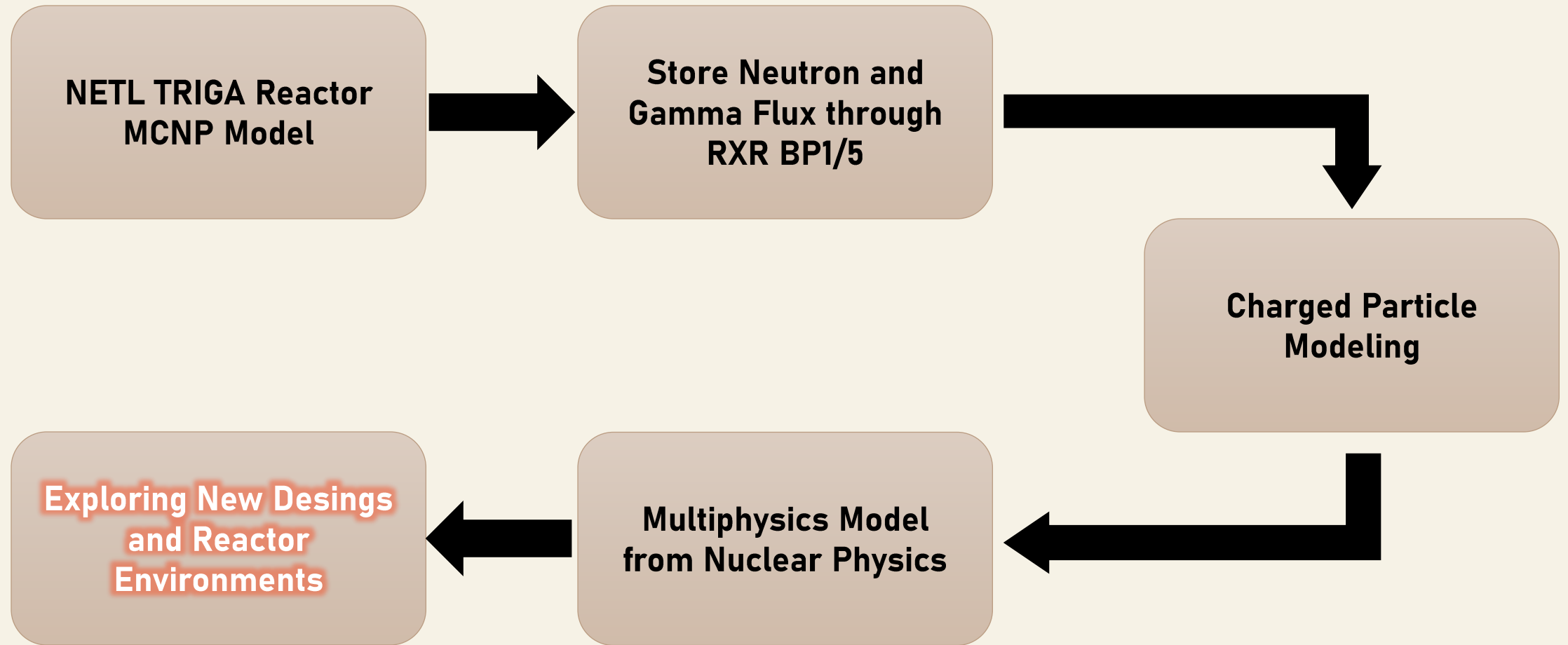


**Review
next slide
with Austin
before Full
Submission**

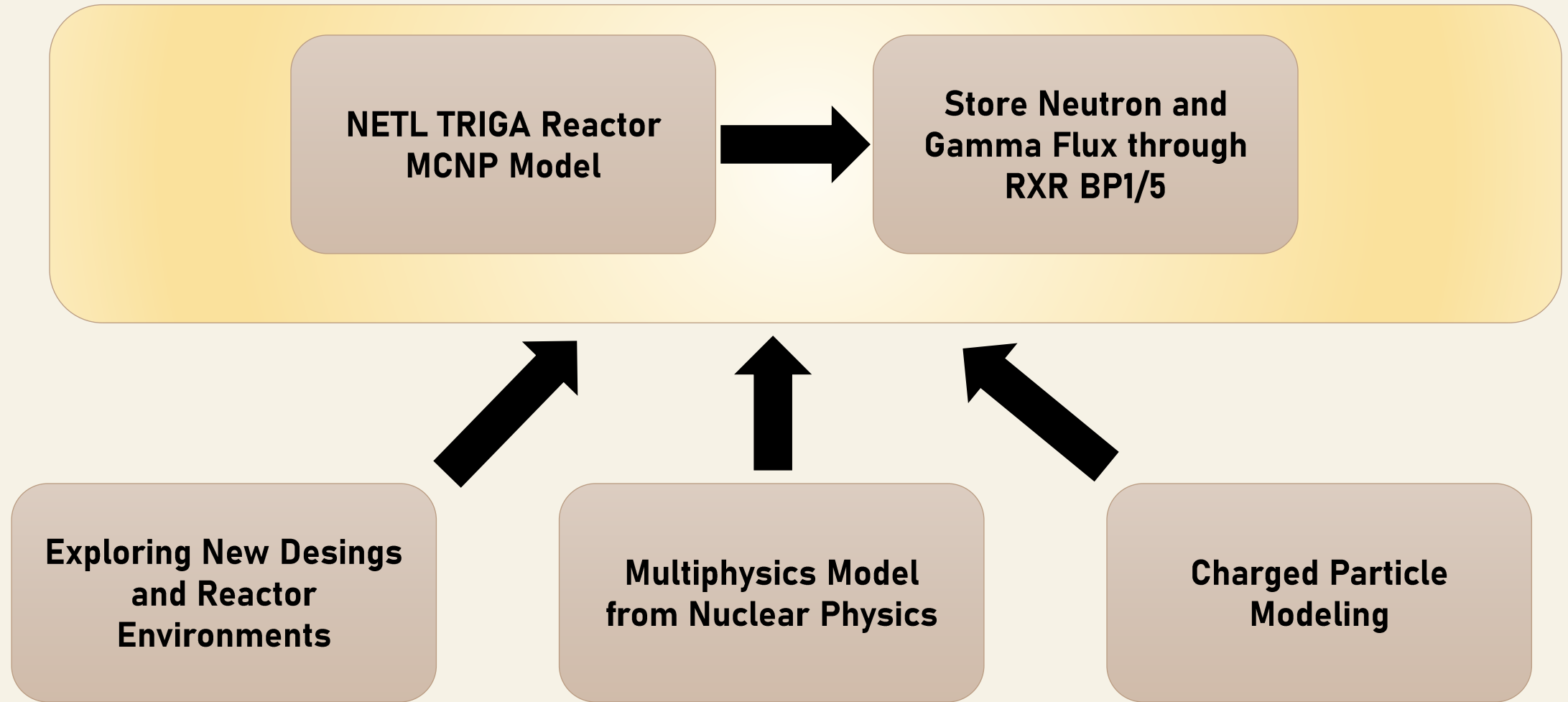
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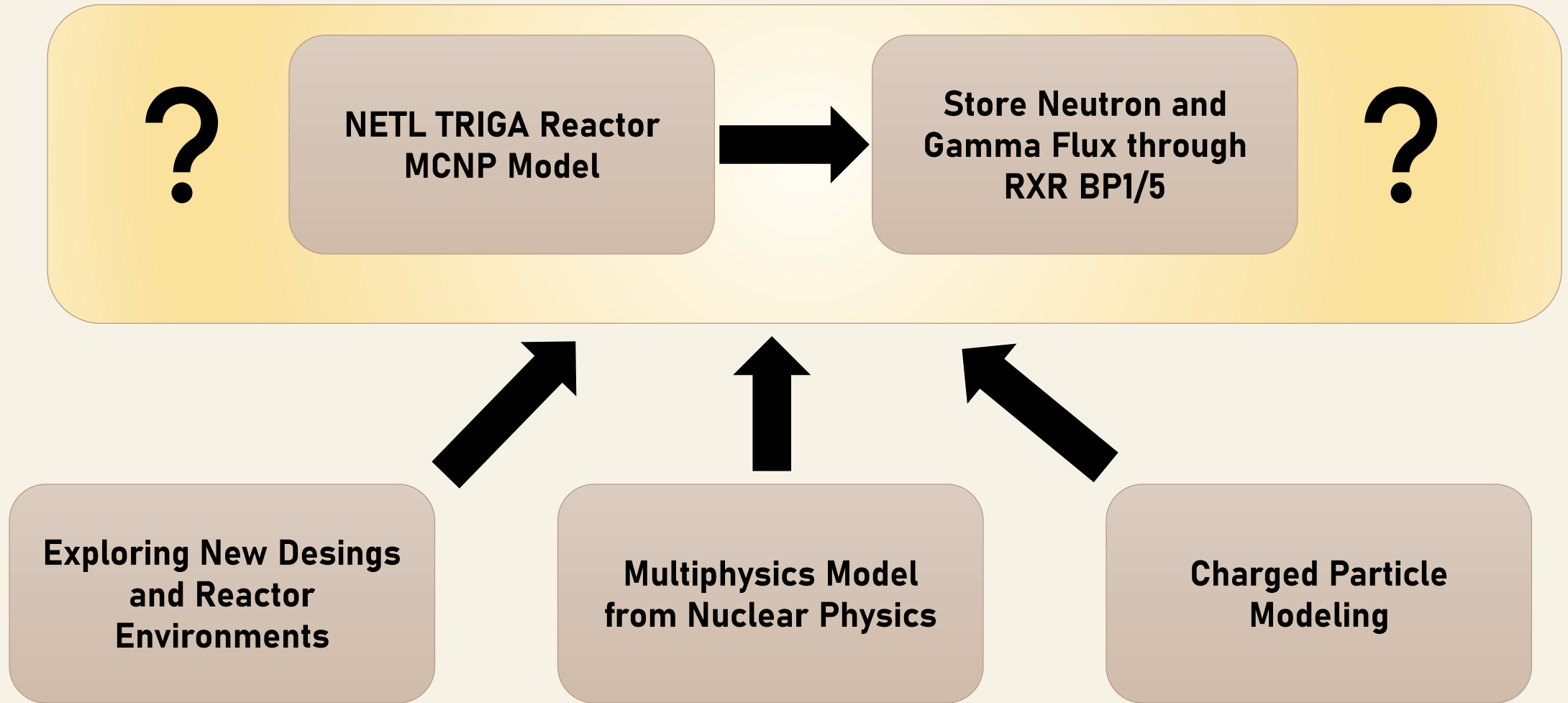
MODELING AND SIMULATION



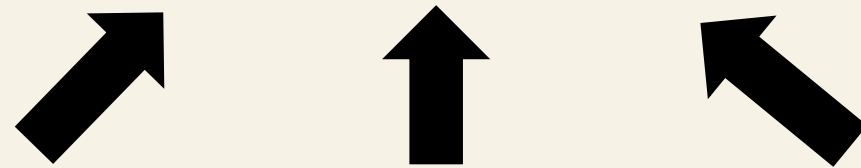
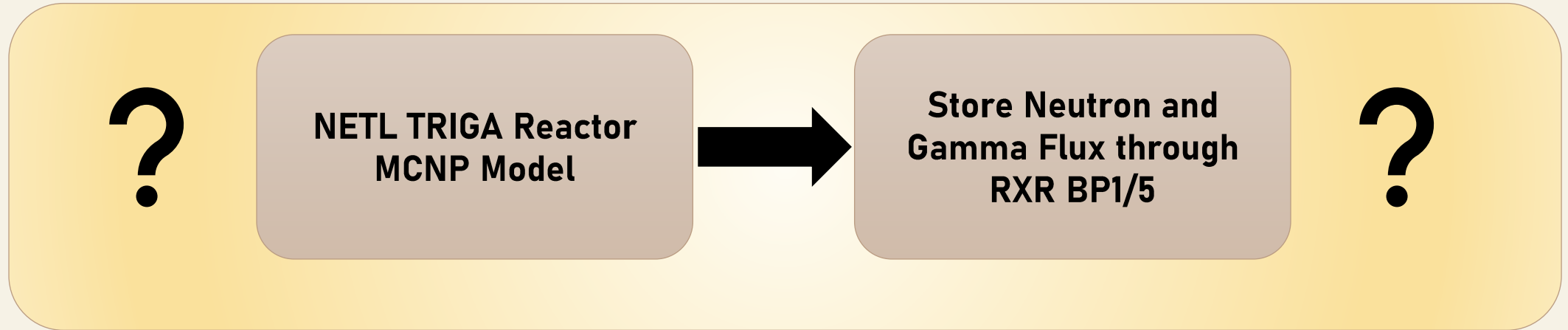
MODELING AND SIMULATION



MODELING AND SIMULATION



MODELING AND SIMULATION



Flux Model Verification

THIS WORK

1

**Experimental Flux Foil and
Wire Measurements**

2

**Monte-Carlo Simulation of
Flux Foil and Wire
Experiment**

THIS WORK: EXPERIMENTAL

1

**Experimental Flux Foil and
Wire Measurements**

2

**Monte-Carlo Simulation of
Flux Foil and Wire
Experiment**

THIS WORK: EXPERIMENTAL

1

**Experimental Flux Foil and
Wire Measurements**

a) Neutron Flux Spectrum in
MCNP Model of BP1/5

b) Spatial Variance at 0" and
20" From BP1/5 Center

THIS WORK: EXPERIMENTAL

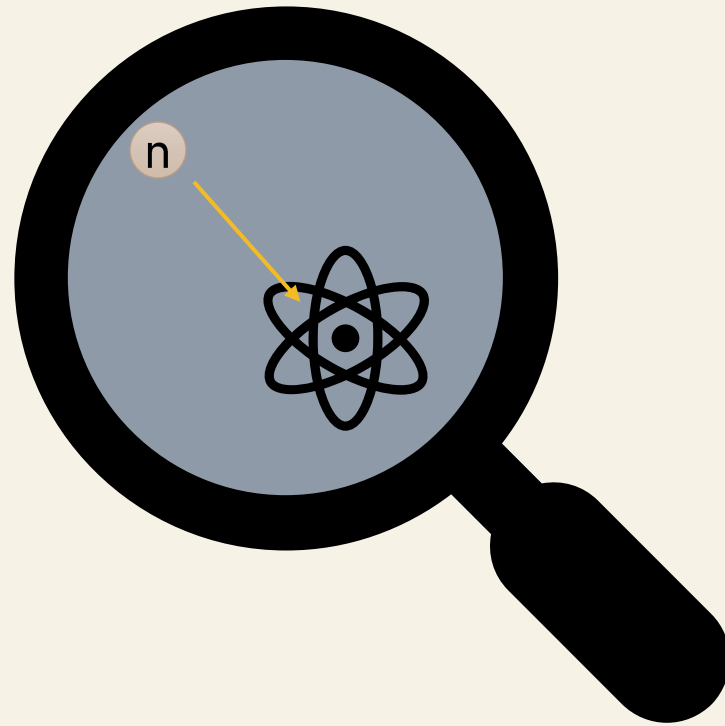
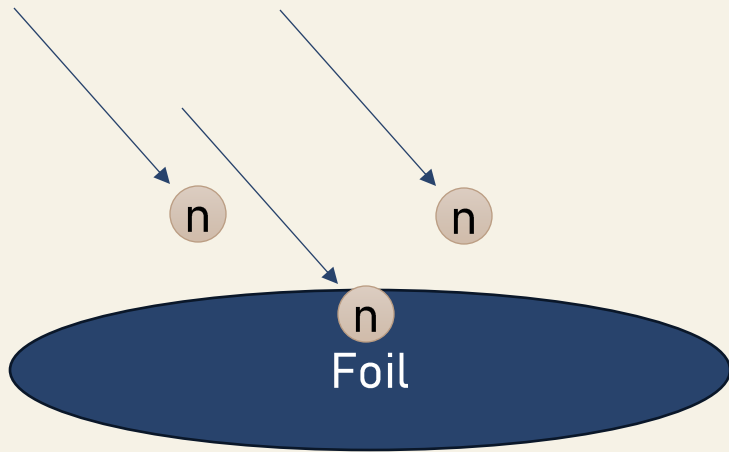
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**Experimental Flux Foil and
Wire Measurements**

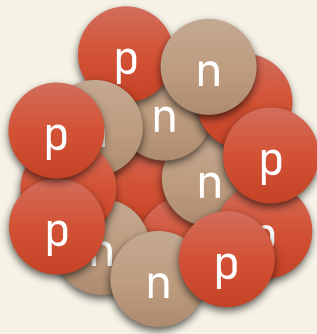
a) Neutron Flux Spectrum in
MCNP Model of BP1/5

b) Spatial Variance at 0" and
20" From BP1/5 Center

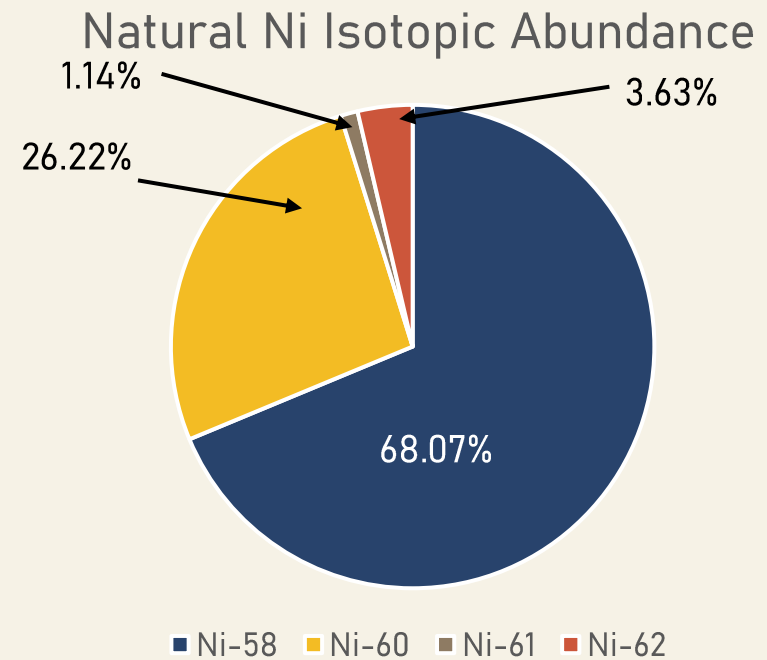
FLUX FOILS AND WIRES



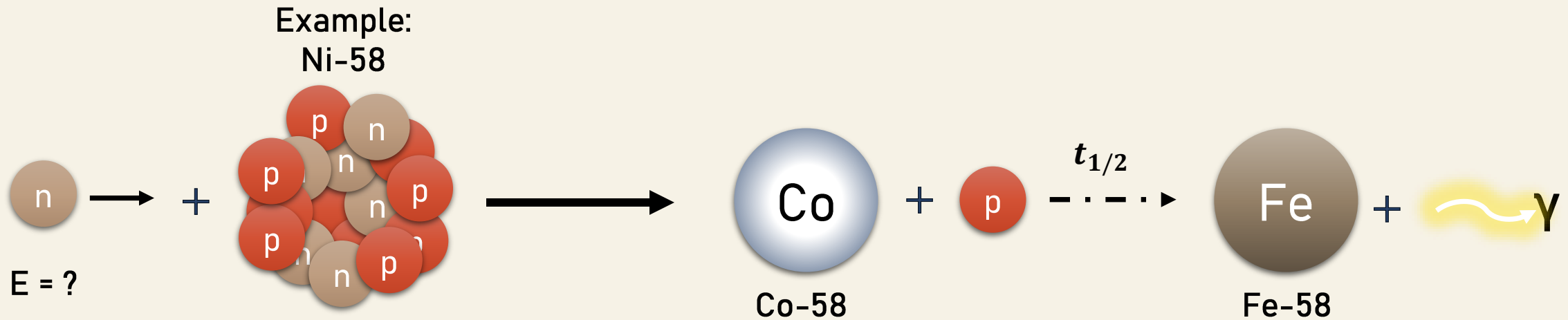
FLUX FOILS AND WIRES



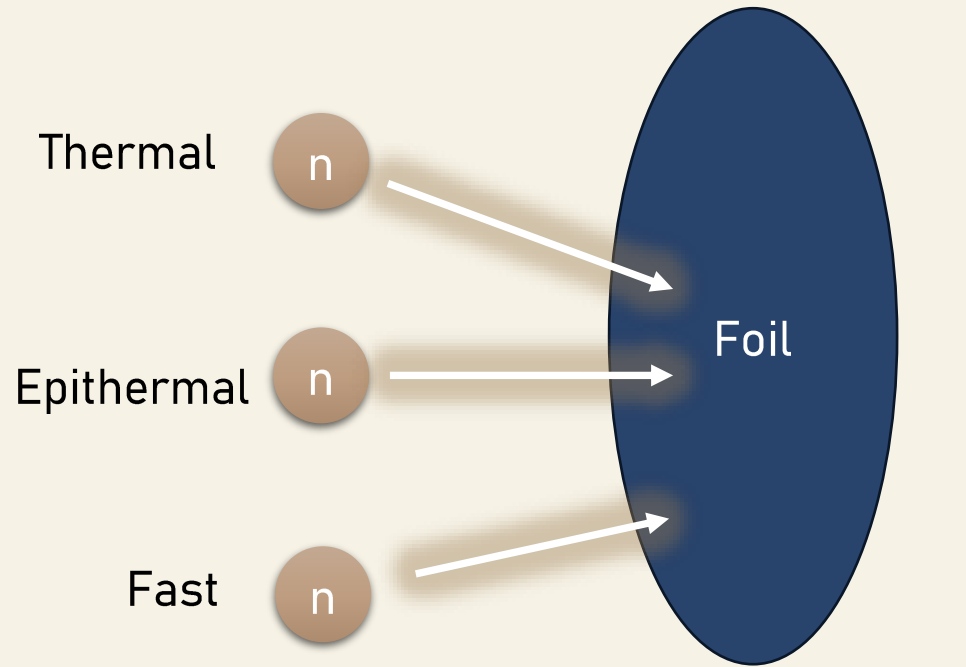
Ni
A = 28



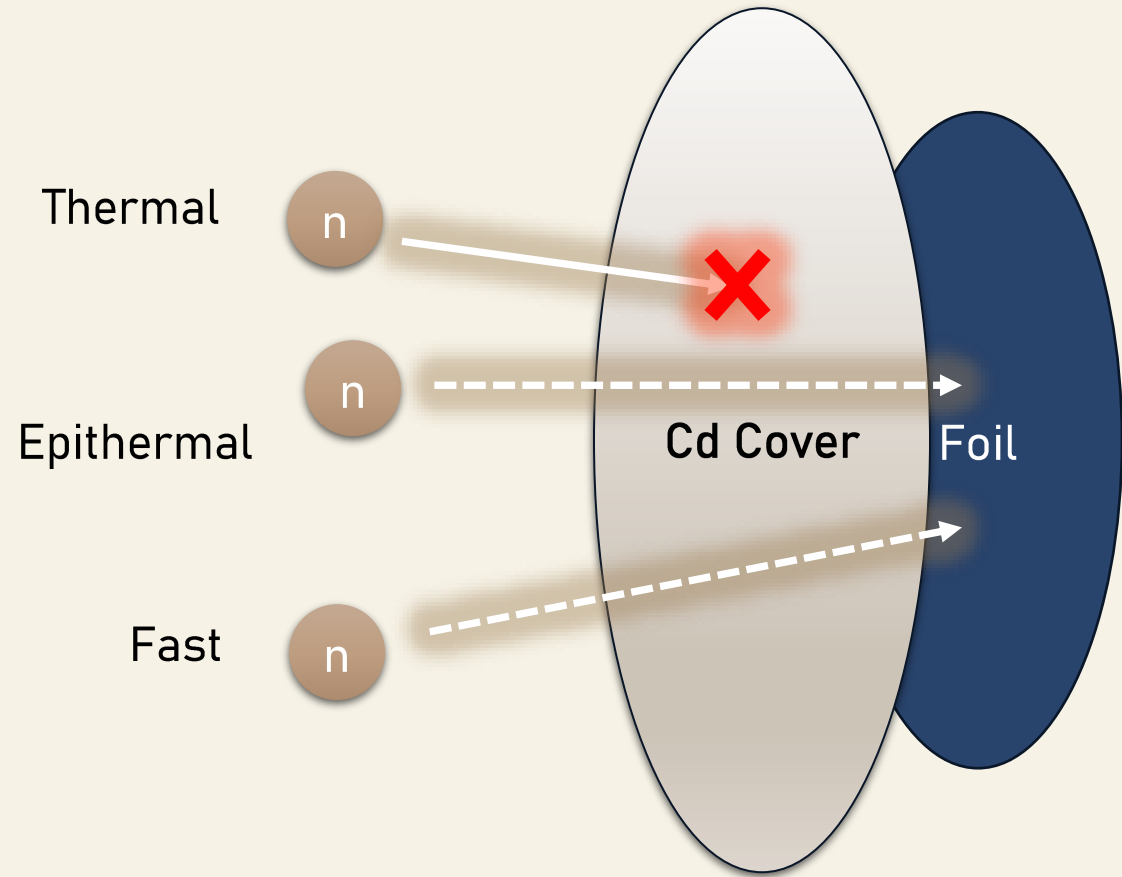
FLUX FOILS AND WIRES

 $t_{1/2}$ 

FLUX FOILS AND WIRES



Full Neutron Spectrum



Only Epithermal and Fast Neutrons

METHODOLOGY

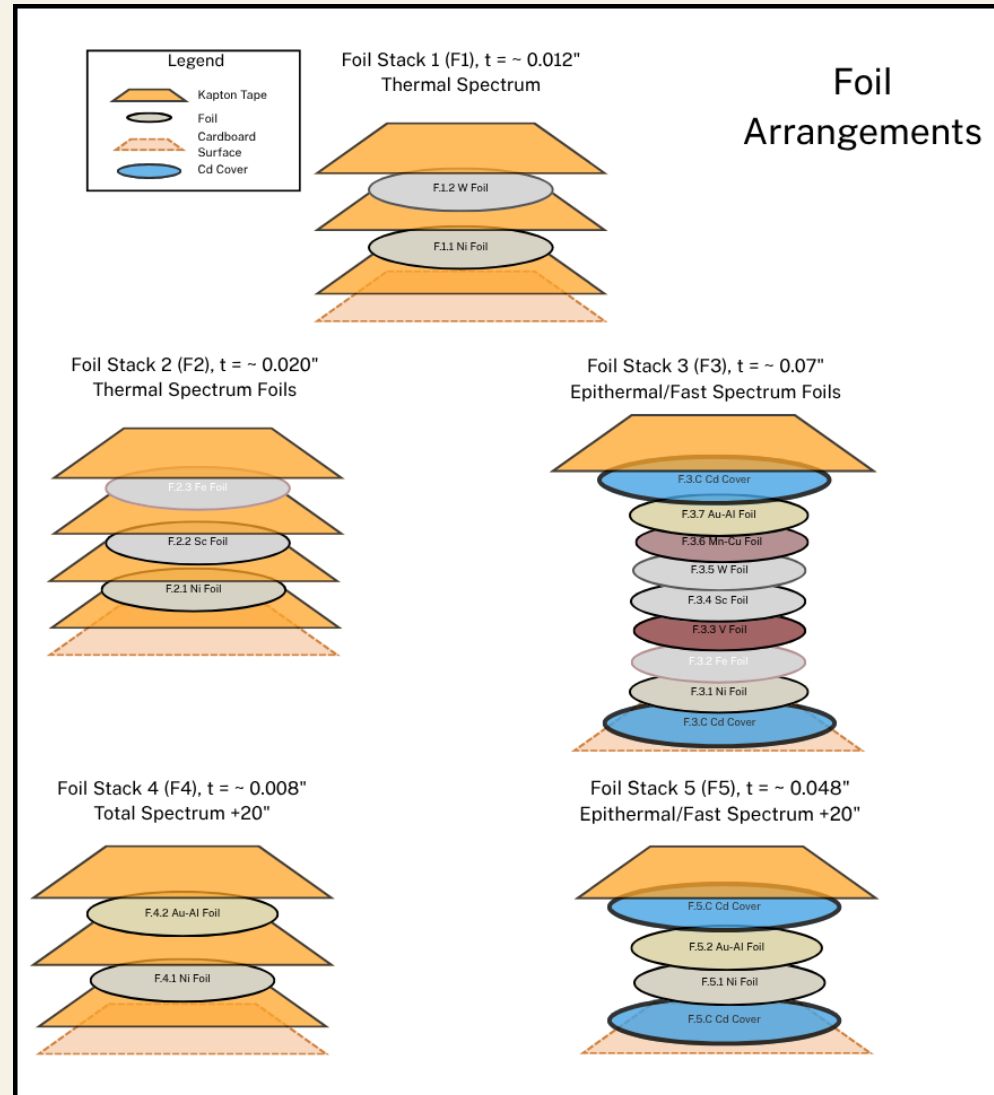
1

**Physical Experiment with
Flux Foils and Wires**

2

**Computational Model of
Physical Experimental
Setup Using MCNP “RSSA”**

METHODOLOGY



METHODOLOGY

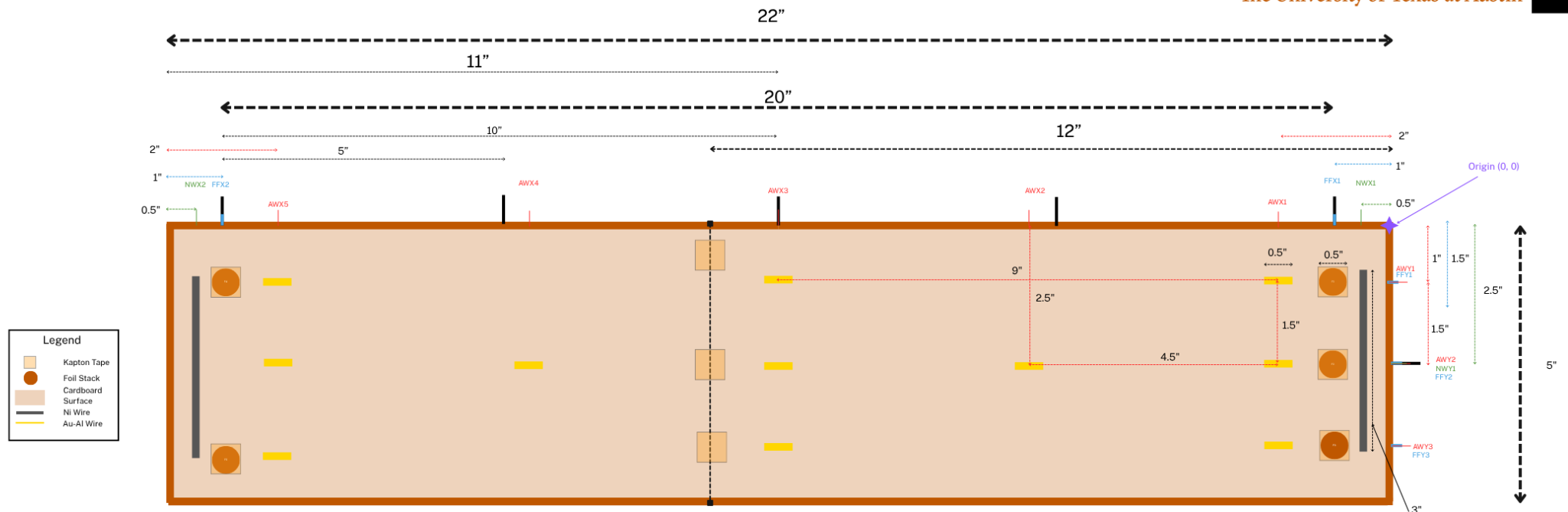
Version 7.0
UTD 7-23-26

Experimental Apparatus Diagram



TEXAS
The University of Texas at Austin

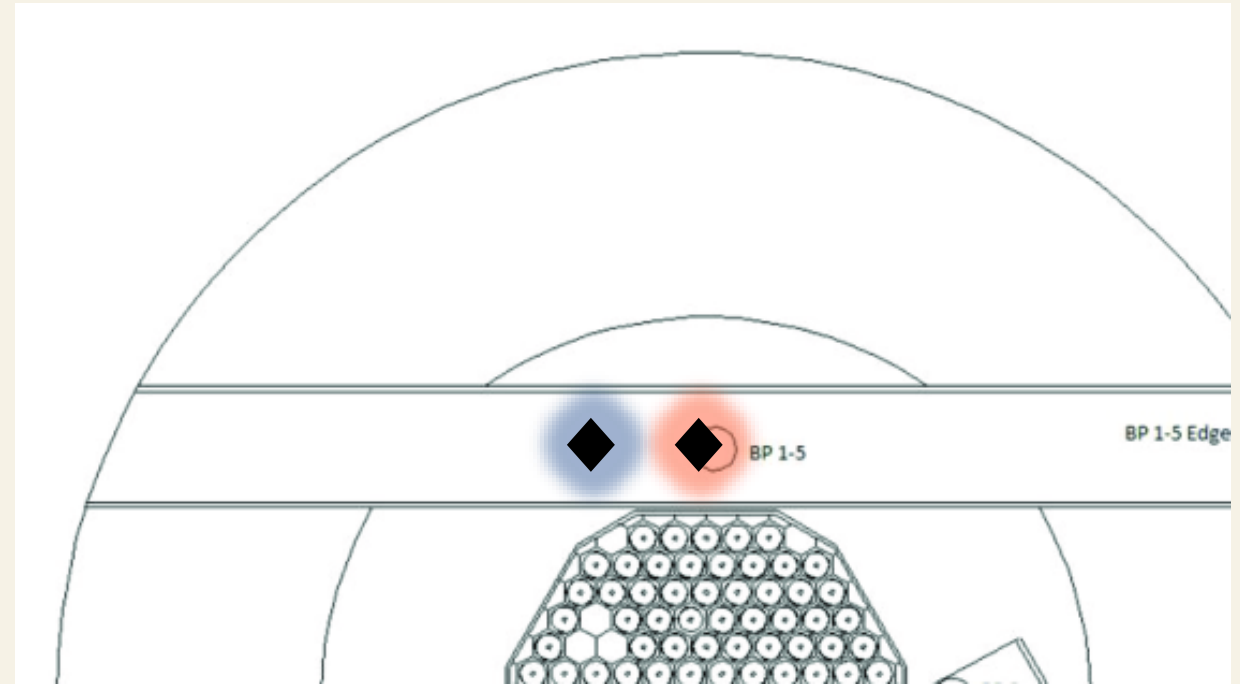
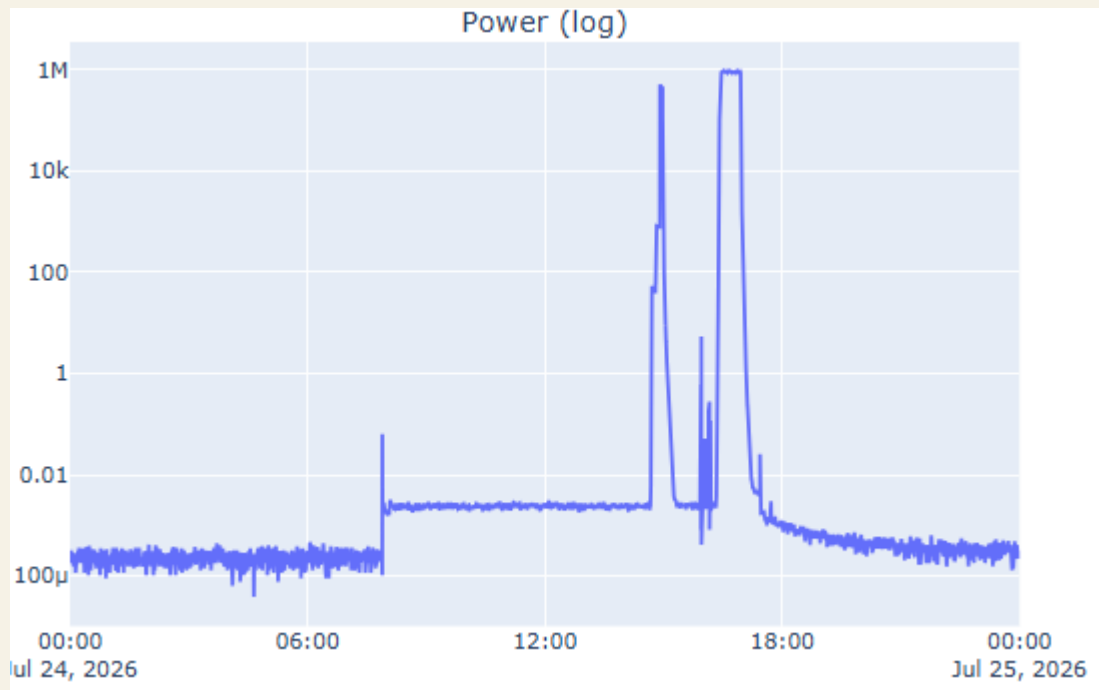
GEN(α)



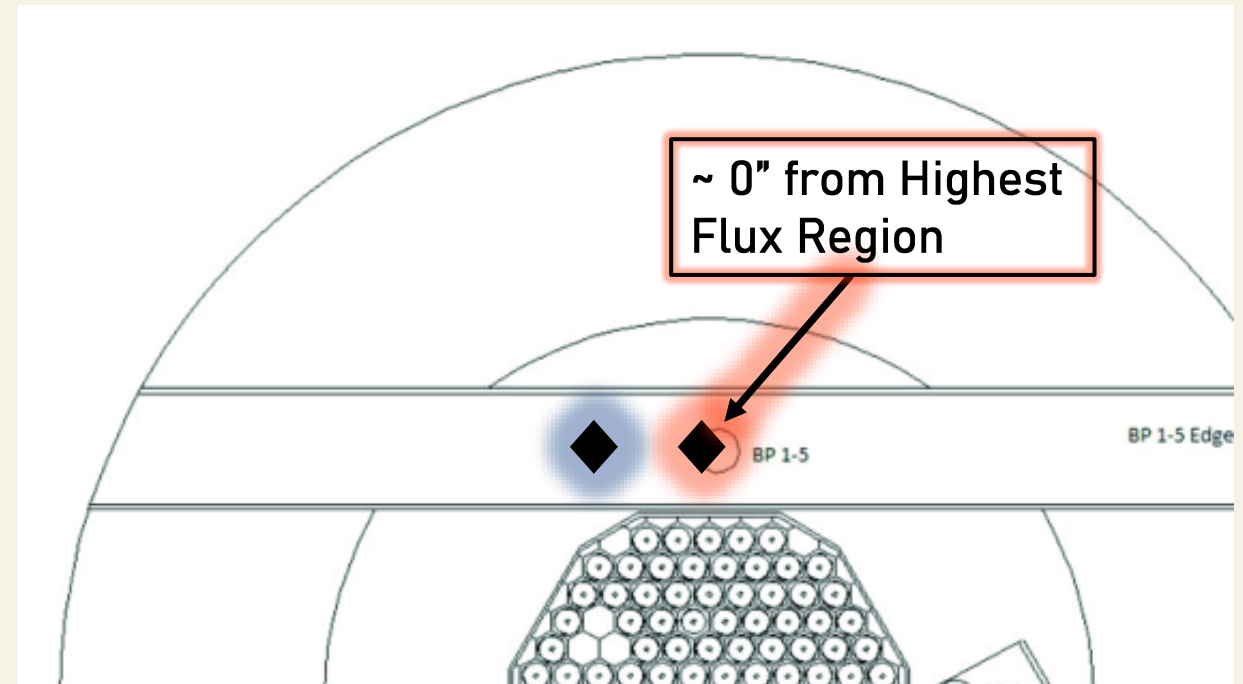
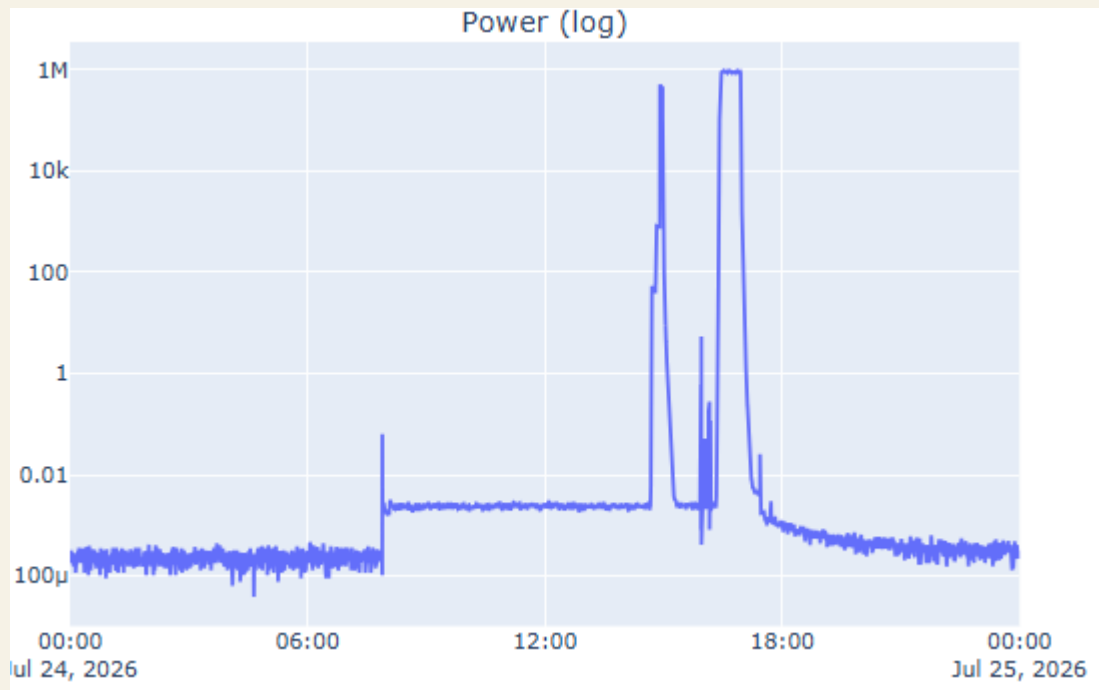
METHODOLOGY - EXPERIMENTAL



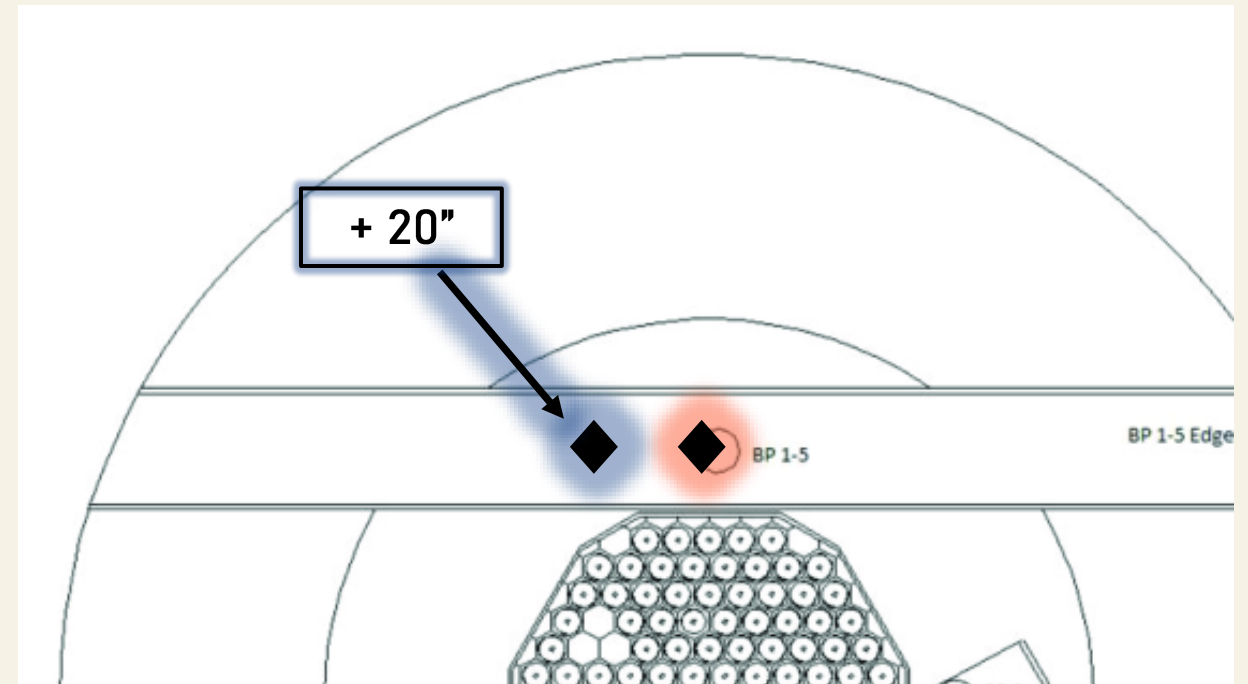
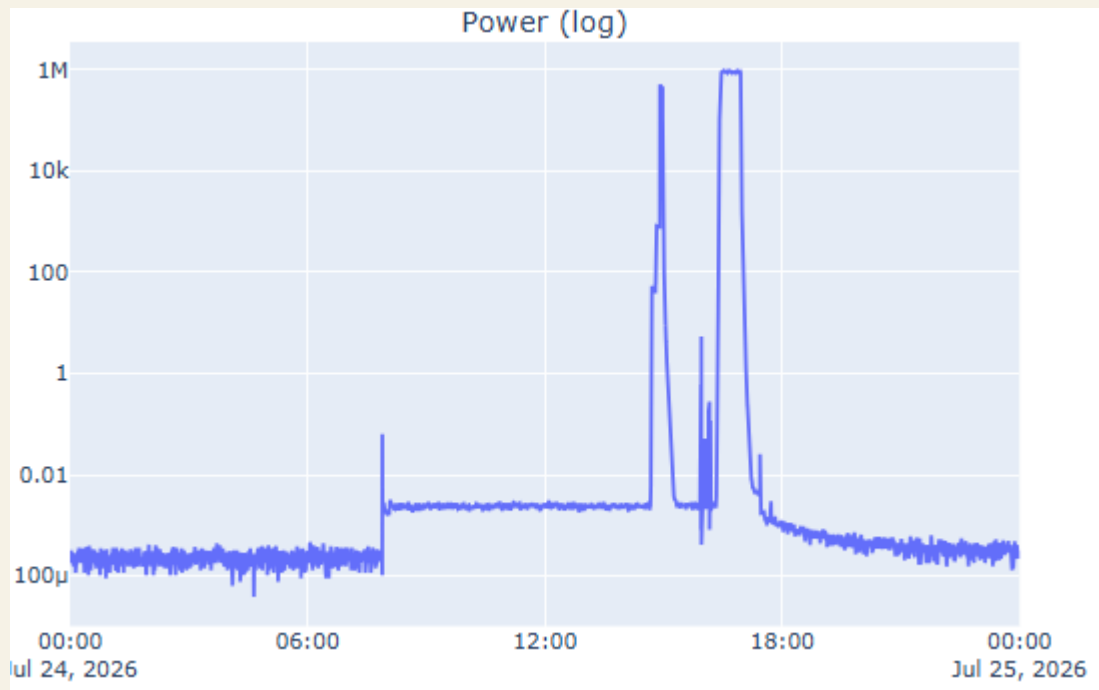
METHODOLOGY - EXPERIMENTAL



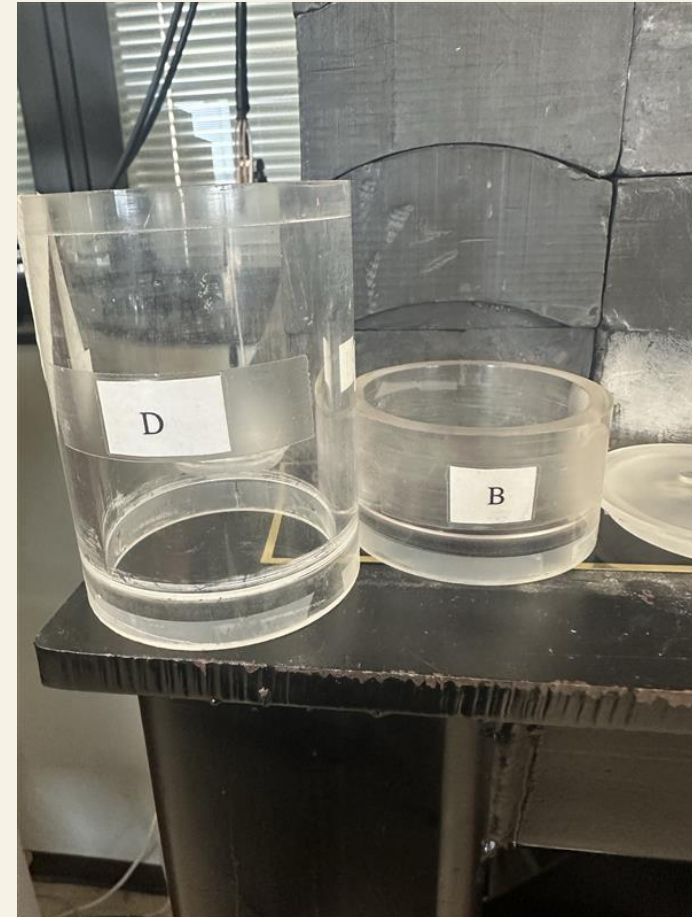
METHODOLOGY - EXPERIMENTAL



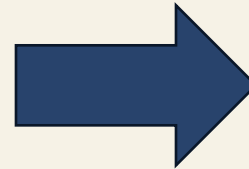
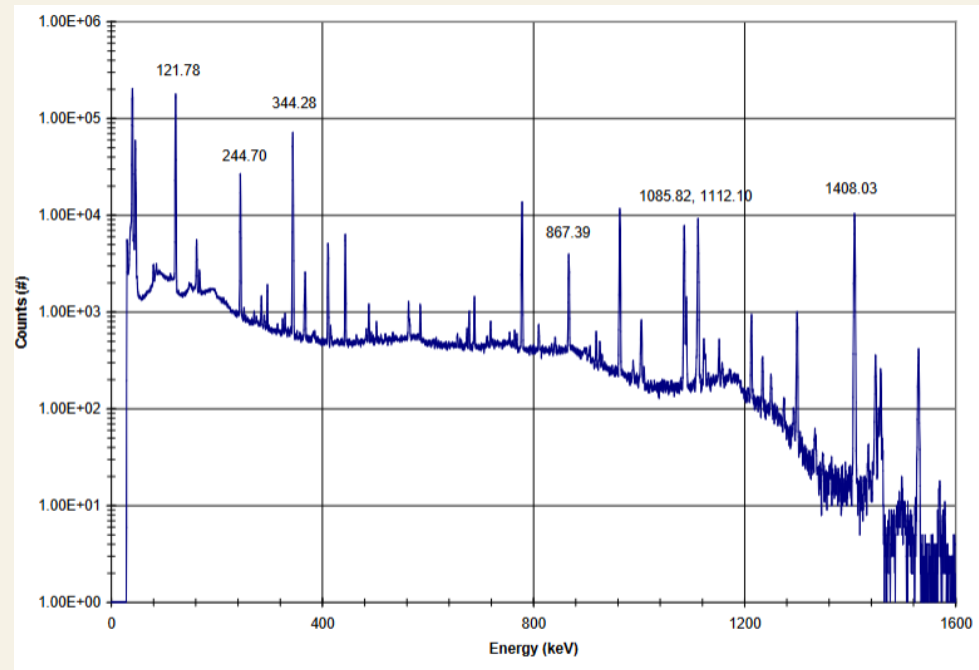
METHODOLOGY - EXPERIMENTAL



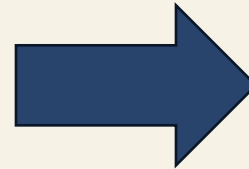
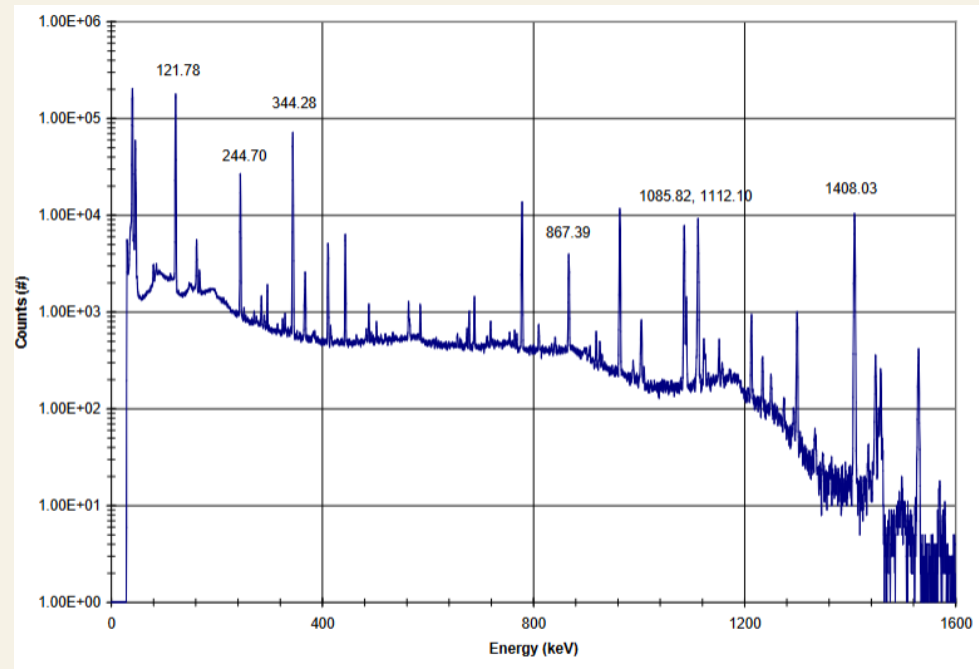
METHODOLOGY - EXPERIMENTAL



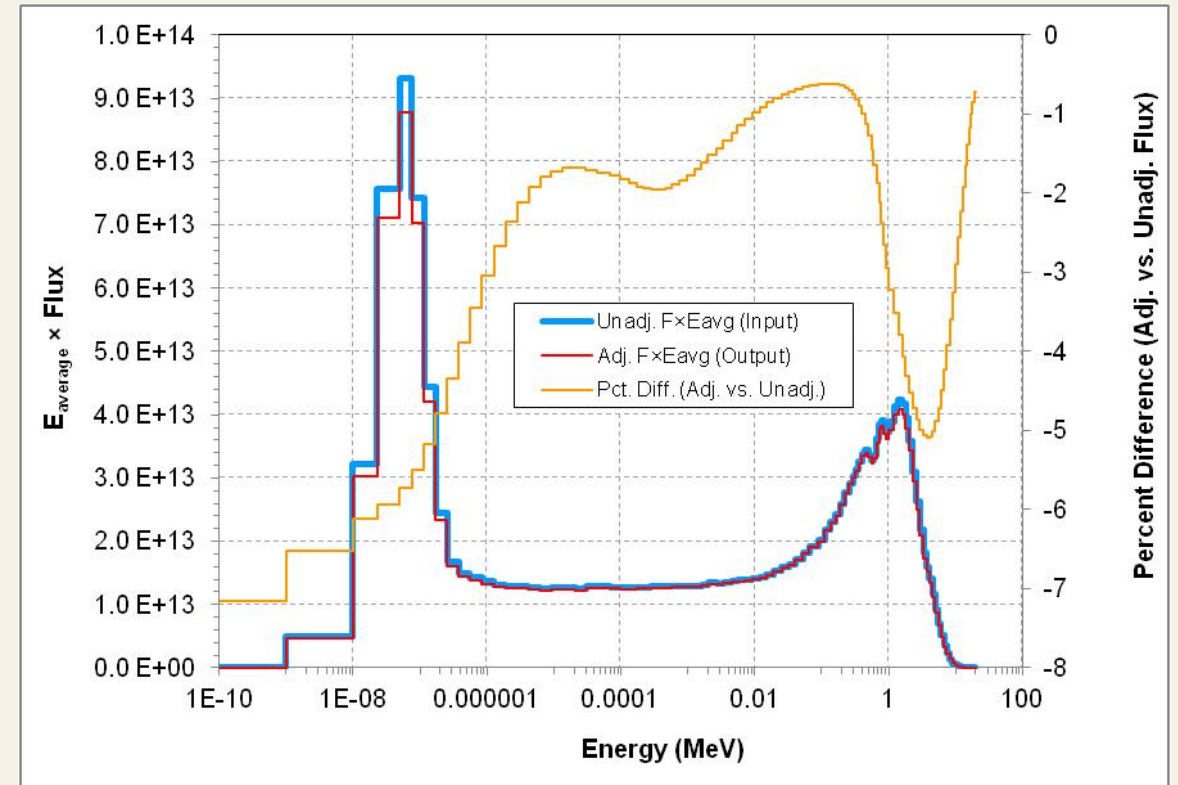
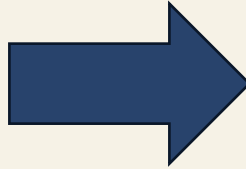
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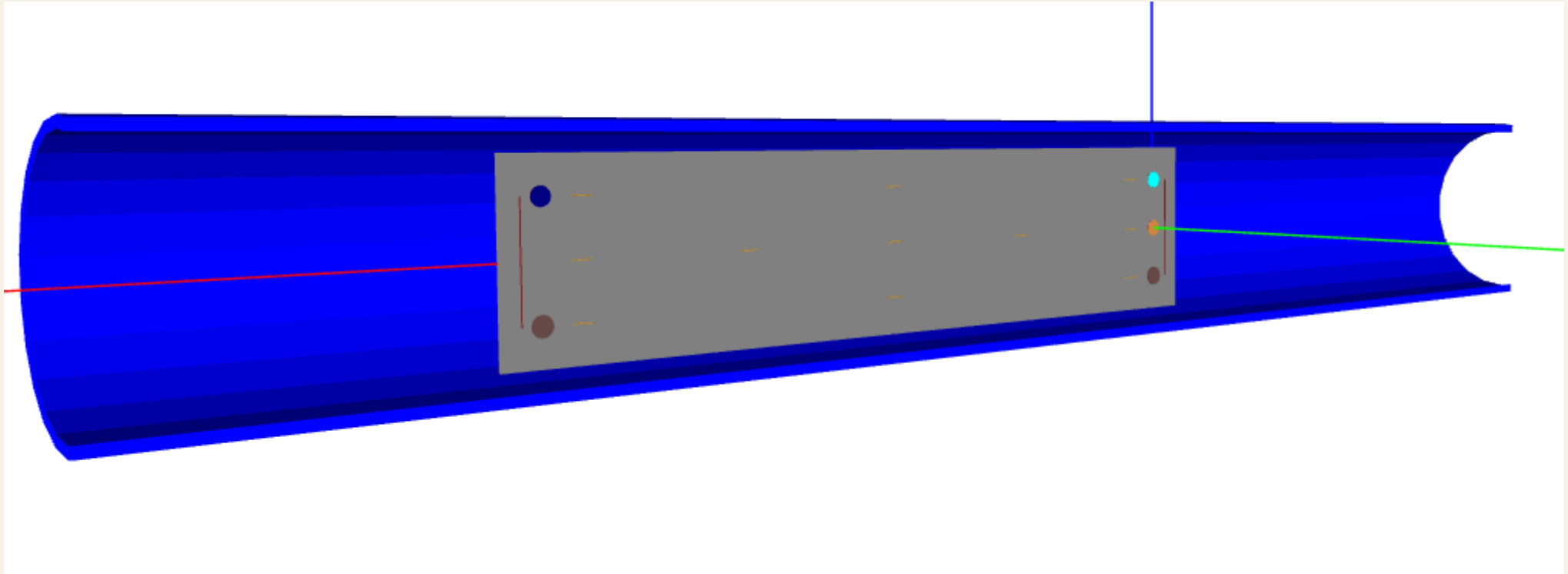
METHODOLOGY - EXPERIMENTAL



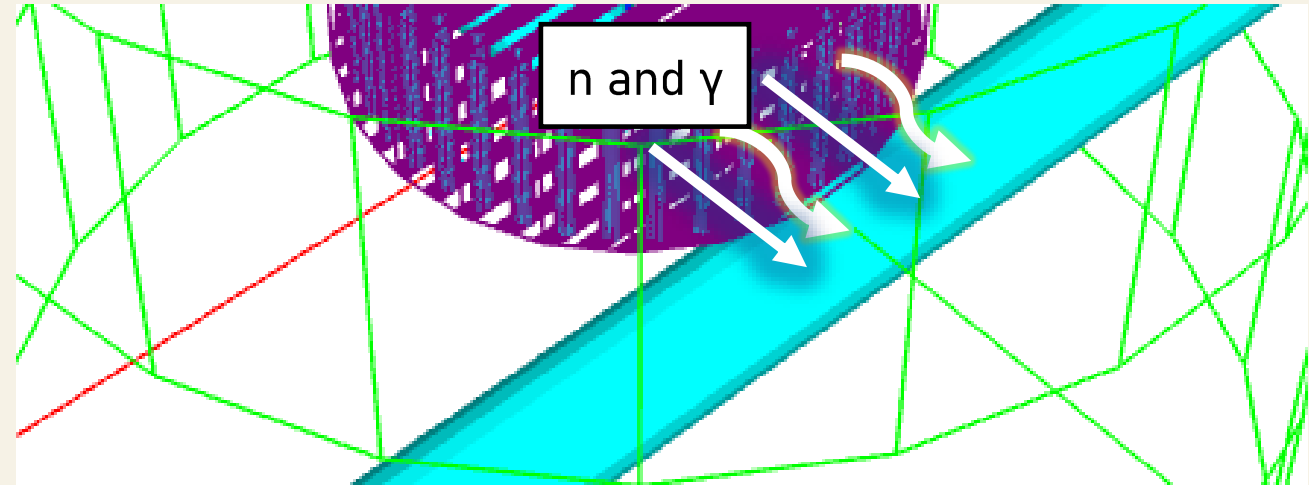
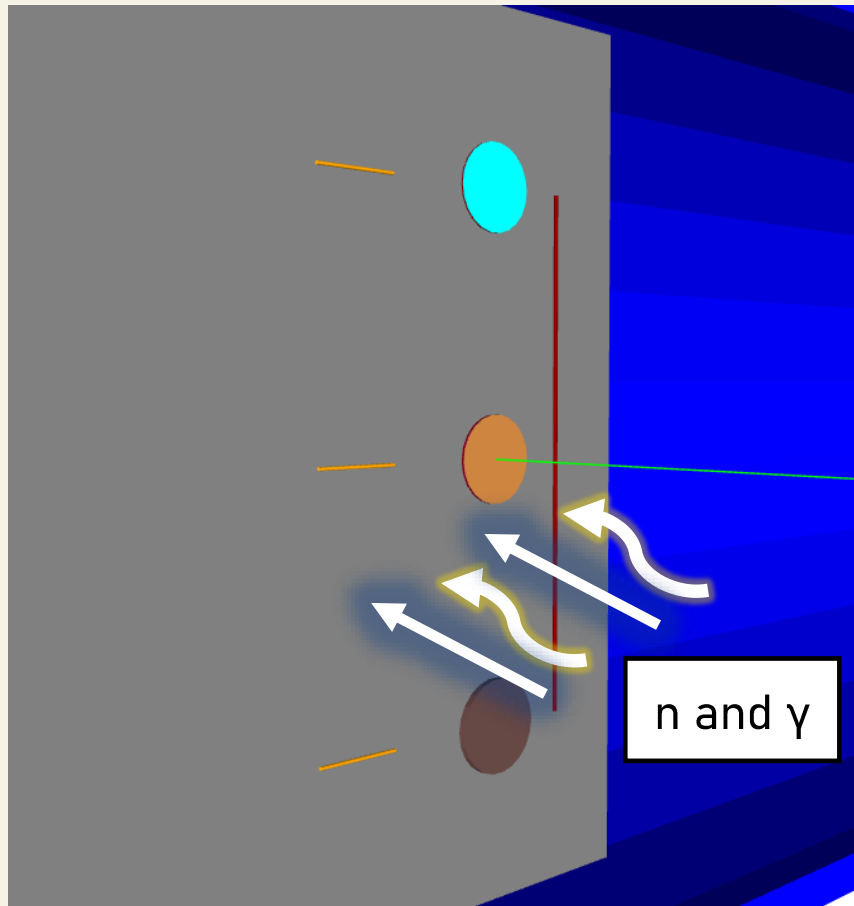
METHODOLOGY - EXPERIMENTAL



METHODOLOGY - COMPUTATIONAL



METHODOLOGY - COMPUTATIONAL



Stored RSSA
Flux

RESULTS - EXPERIMENTAL

RESULTS - COMPUTATIONAL

CONCLUSION

NEXT STEPS