*Exceptional service in the national interest*

SAND2014-15302PE

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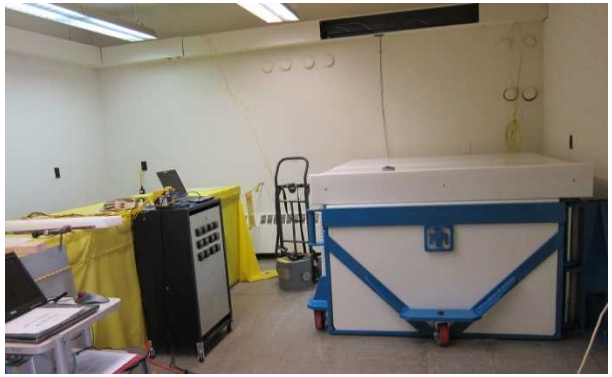

# Photon/Neutron Spectra and Radiation Field Characterization Utilizing Multiple Techniques

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U.S. DEPARTMENT OF ENERGY

National Nuclear Security Administration

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# Instruments

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## Computed Photon Radiography

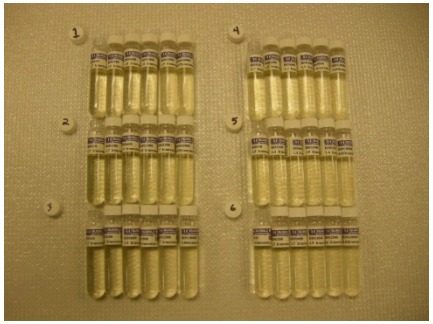

## N-Probe Microspec

## High Purity Germanium Detector


## Foil Activation

S, Ni, Au, & Au (Cd Covered)

## Bubble Dosimeter Spectrometer (BDS) Set



# Measurement Locations

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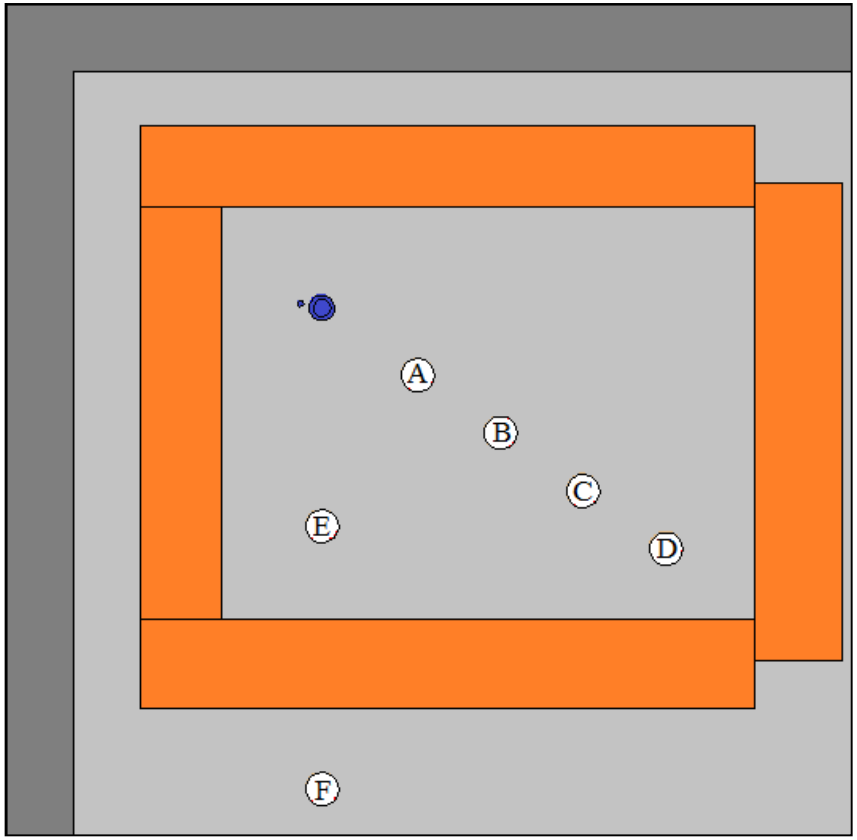
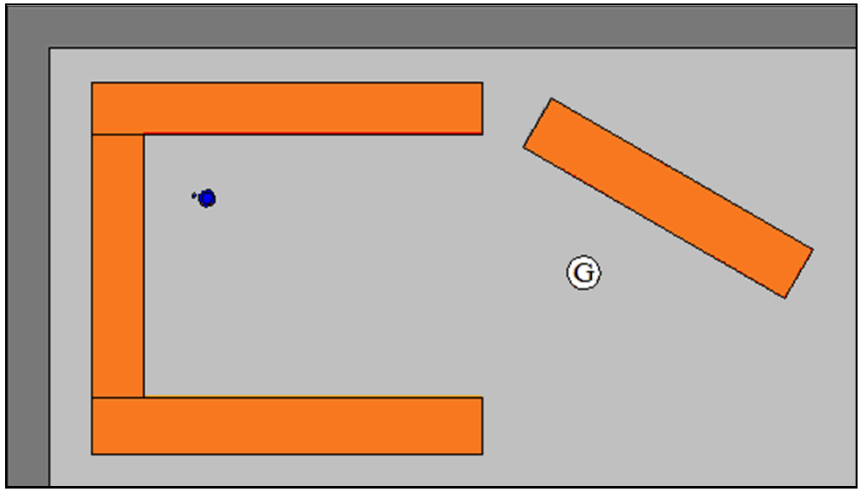
## Door Closed

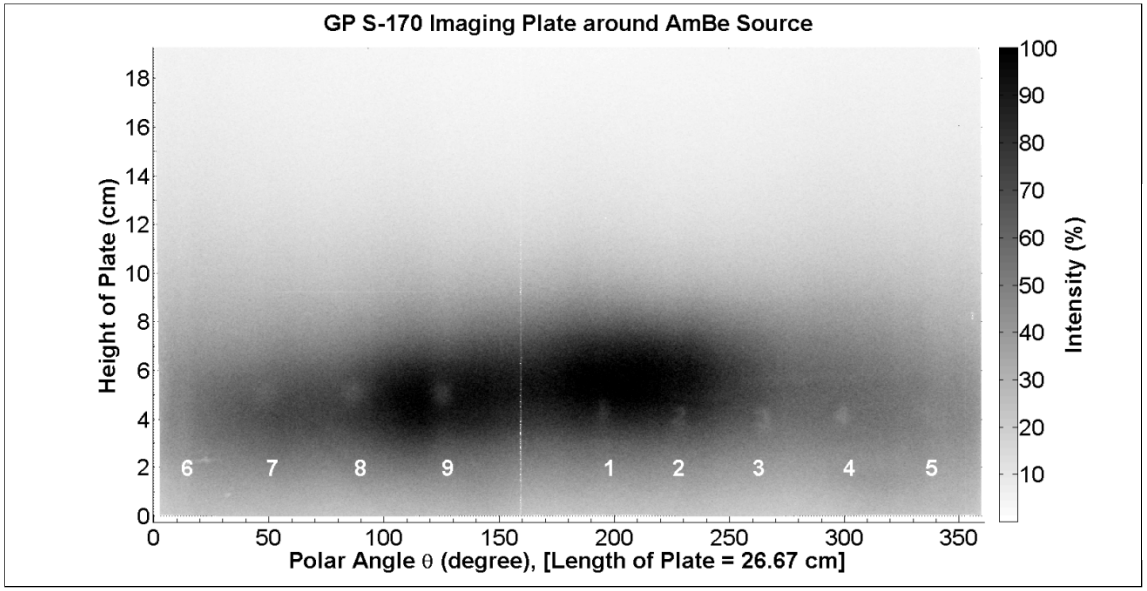


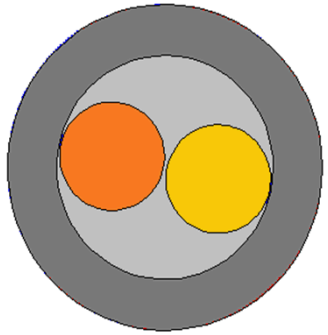

## Door Open

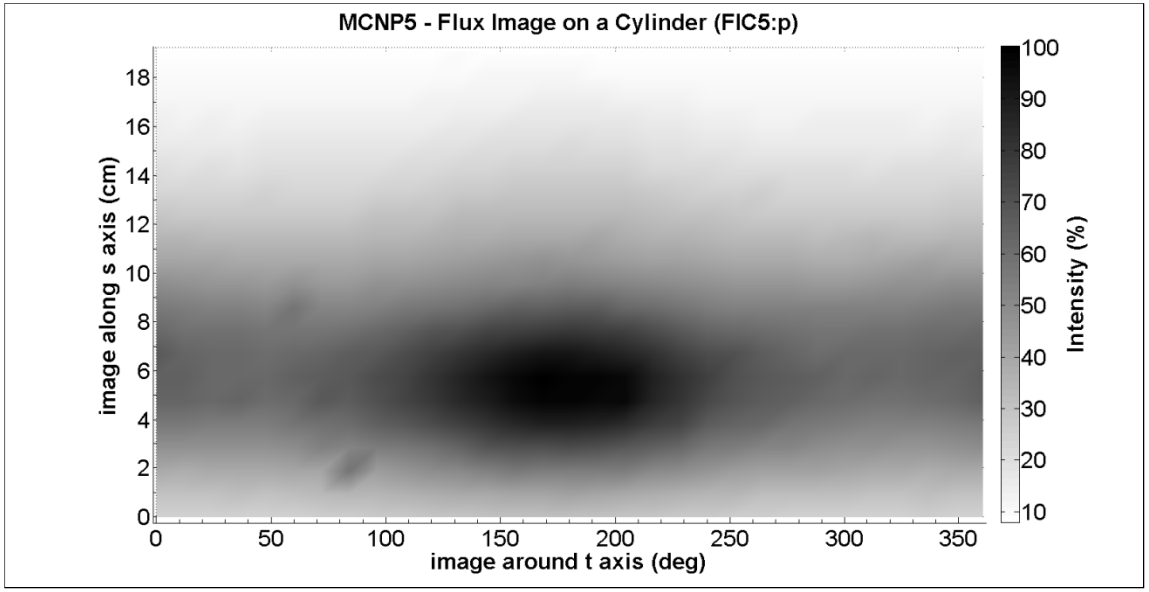



| Location | Distance from Source Center (cm) | Detection Method |
|---|---|---|
| A | 30 | Activation Foils/ Bubble Detectors |
| B | 61 | Bubble Detectors |
| C | 91 | Bubble Detectors |
| D | 122 | Bubble Detectors/ Microspec |
| E | 61 | Bubble Detectors |
| F | 145 | Microspec |
| G | 183 | Microspec/ HPGe Detector |

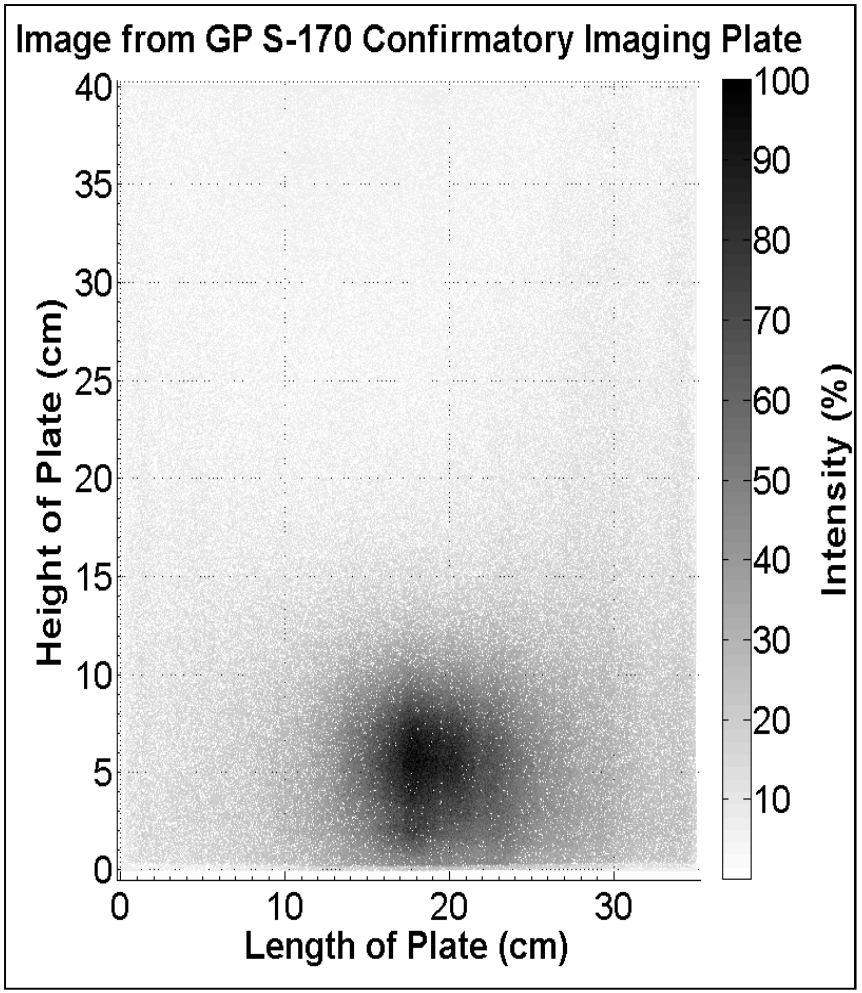
# Radiography Results

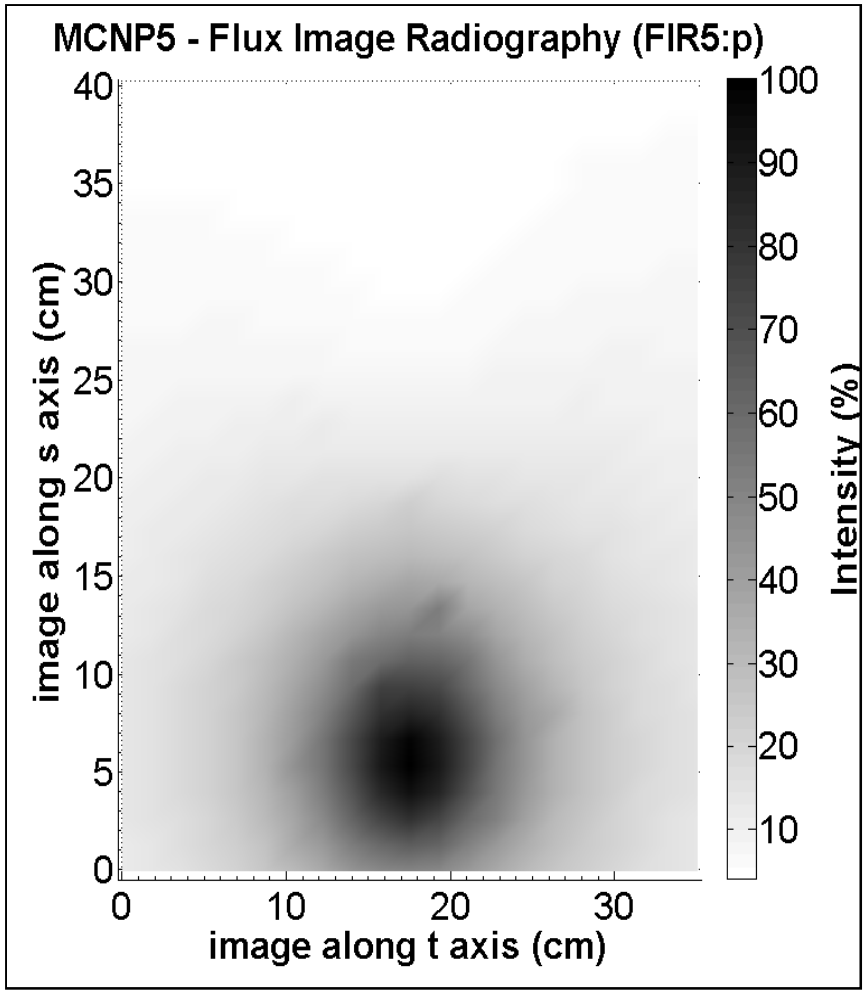




# Radiography Results



# Gold Foil Results

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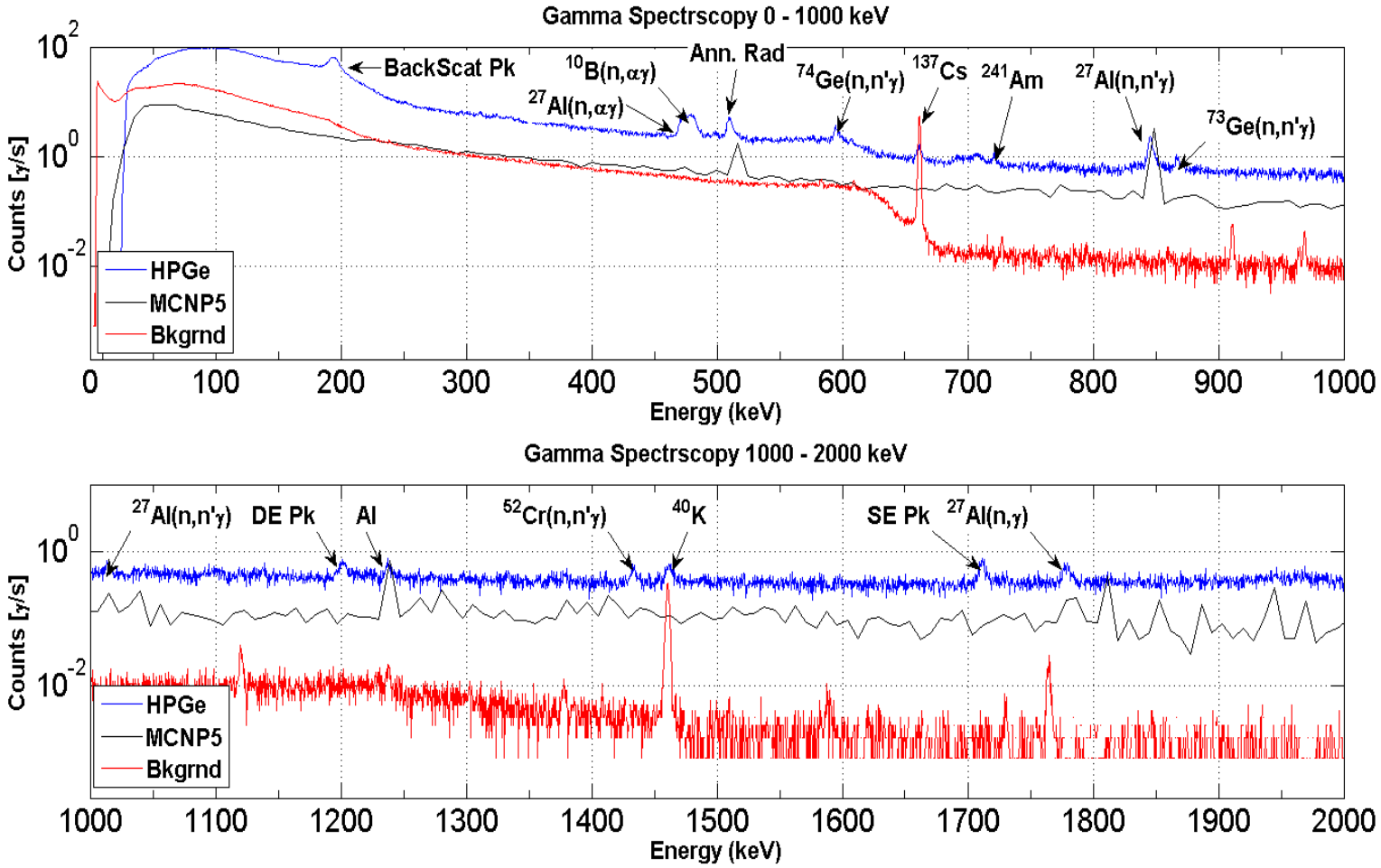
| Foil Method | Neutron Flux Density (n/cm2/s) | |
|---|---|---|
| | Experiment | MCNP5 |
| Nickel | X | X |
| Sulfur | X | X |
| Gold (E<0.5 eV) | 620 ± 40 | 740 ± 22 |

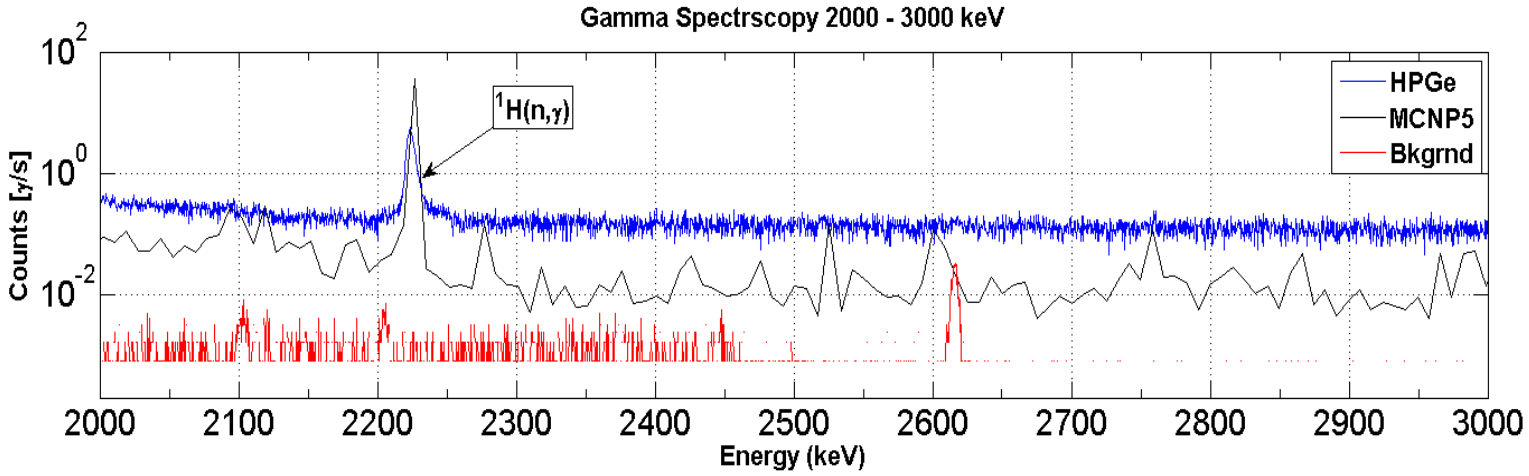
*Errors Quoted at 1σ (68% CI)

# Gamma Spectroscopy Results



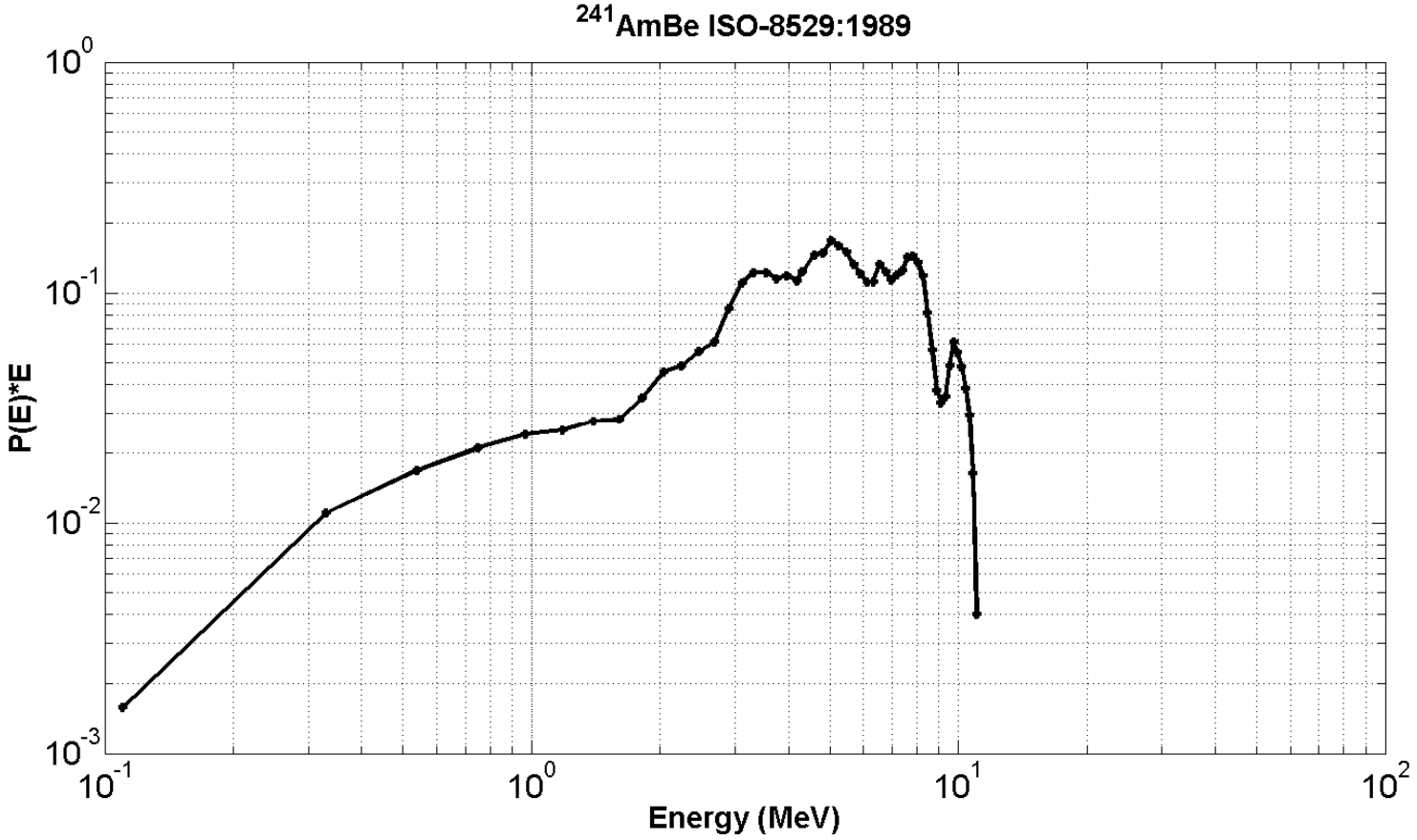

*MCNP5 does not include Am-241 gamma contribution

# Gamma Spectroscopy Results

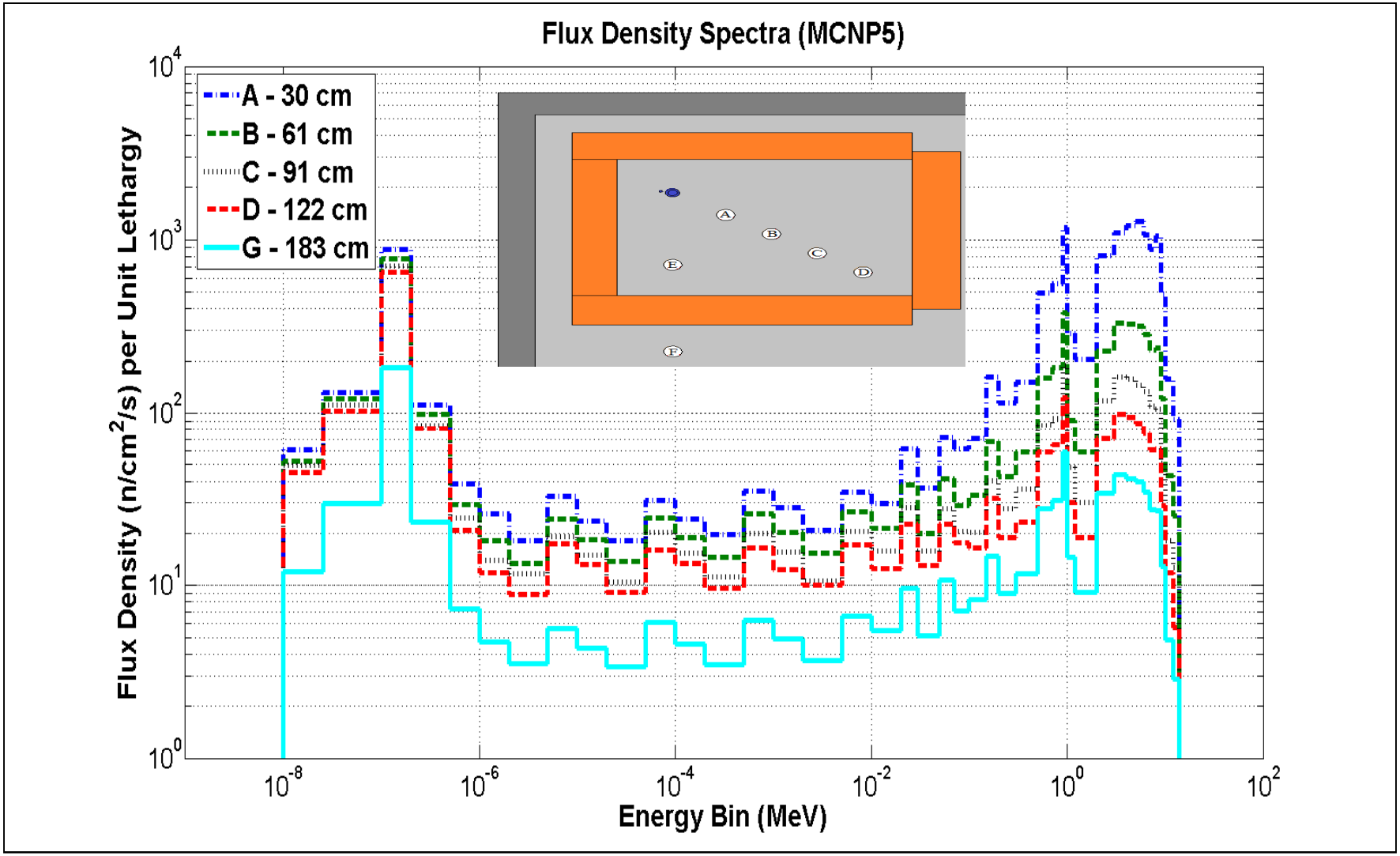



*MCNP5 does not include Am-241 gamma contribution

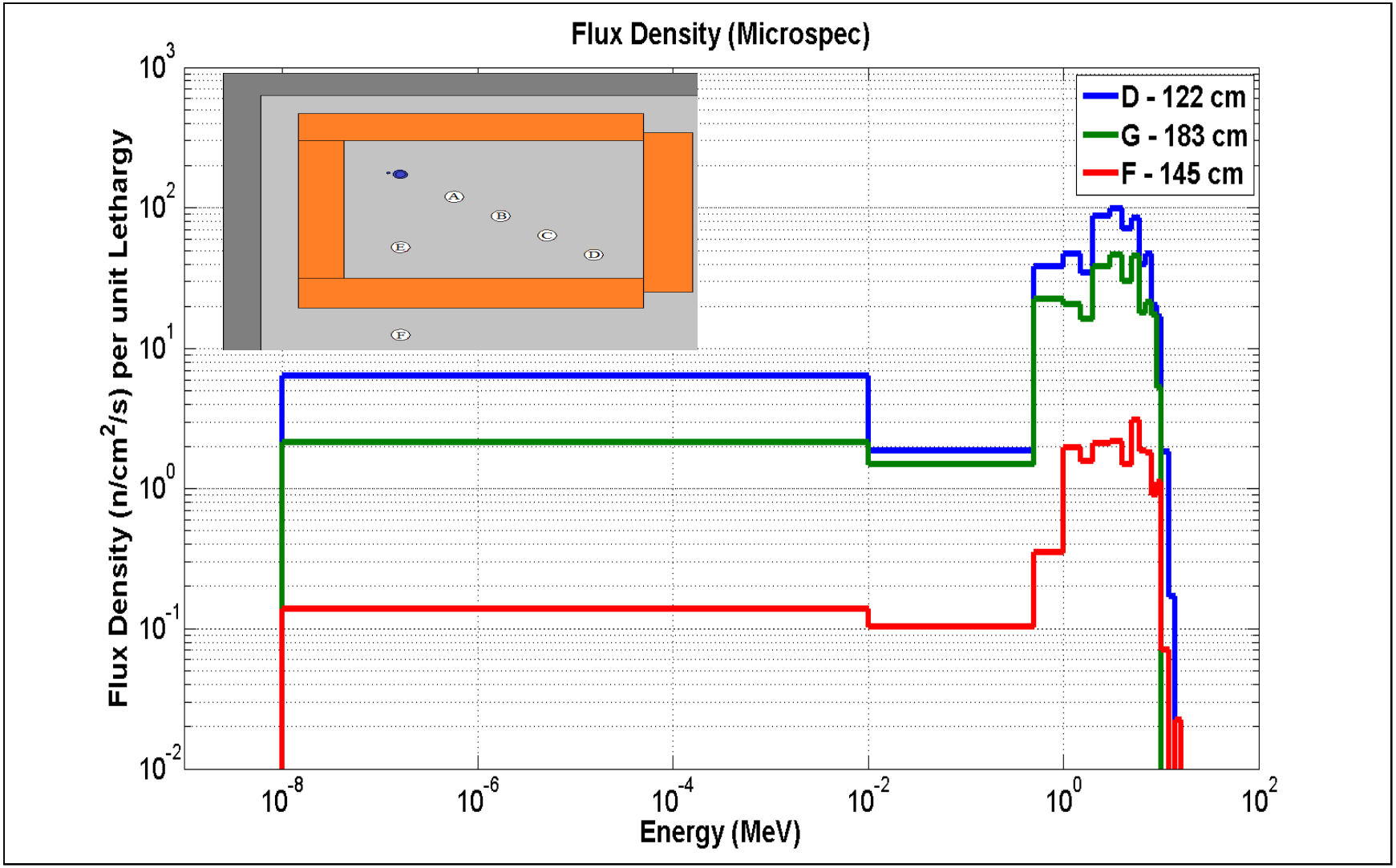
# Theoretical Neutron Spectrum



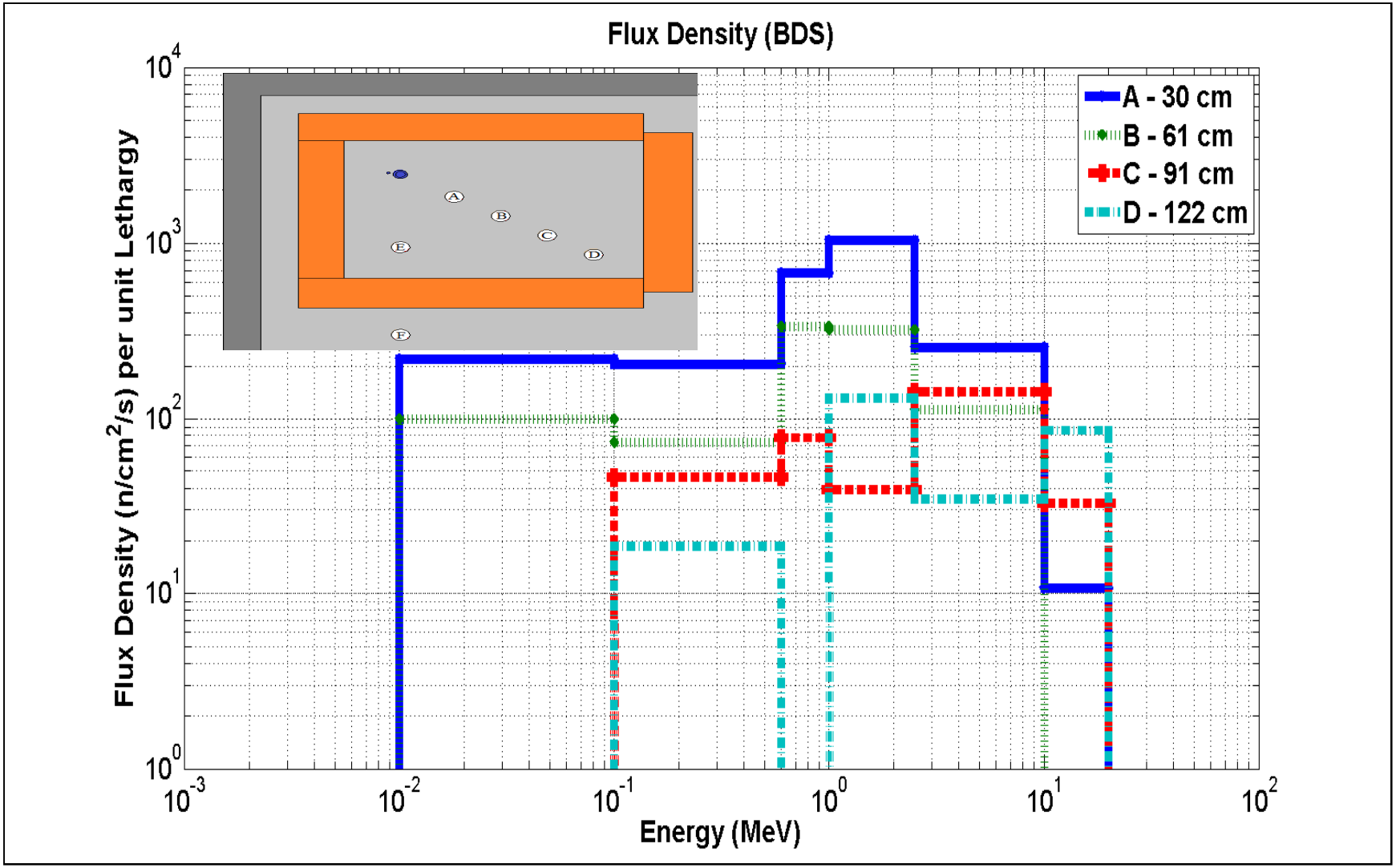
# MCNP5 Modeling Results



# MicroSpec Results



# Bubble Detector Spectroscopy Results



# Flux Density Tabulated Results

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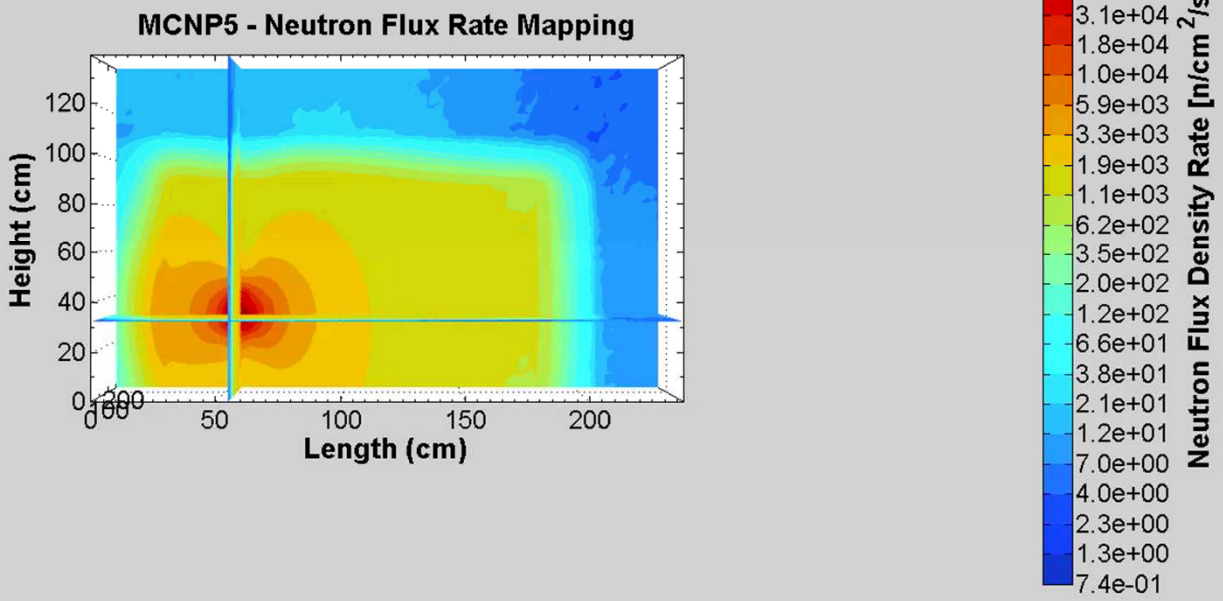
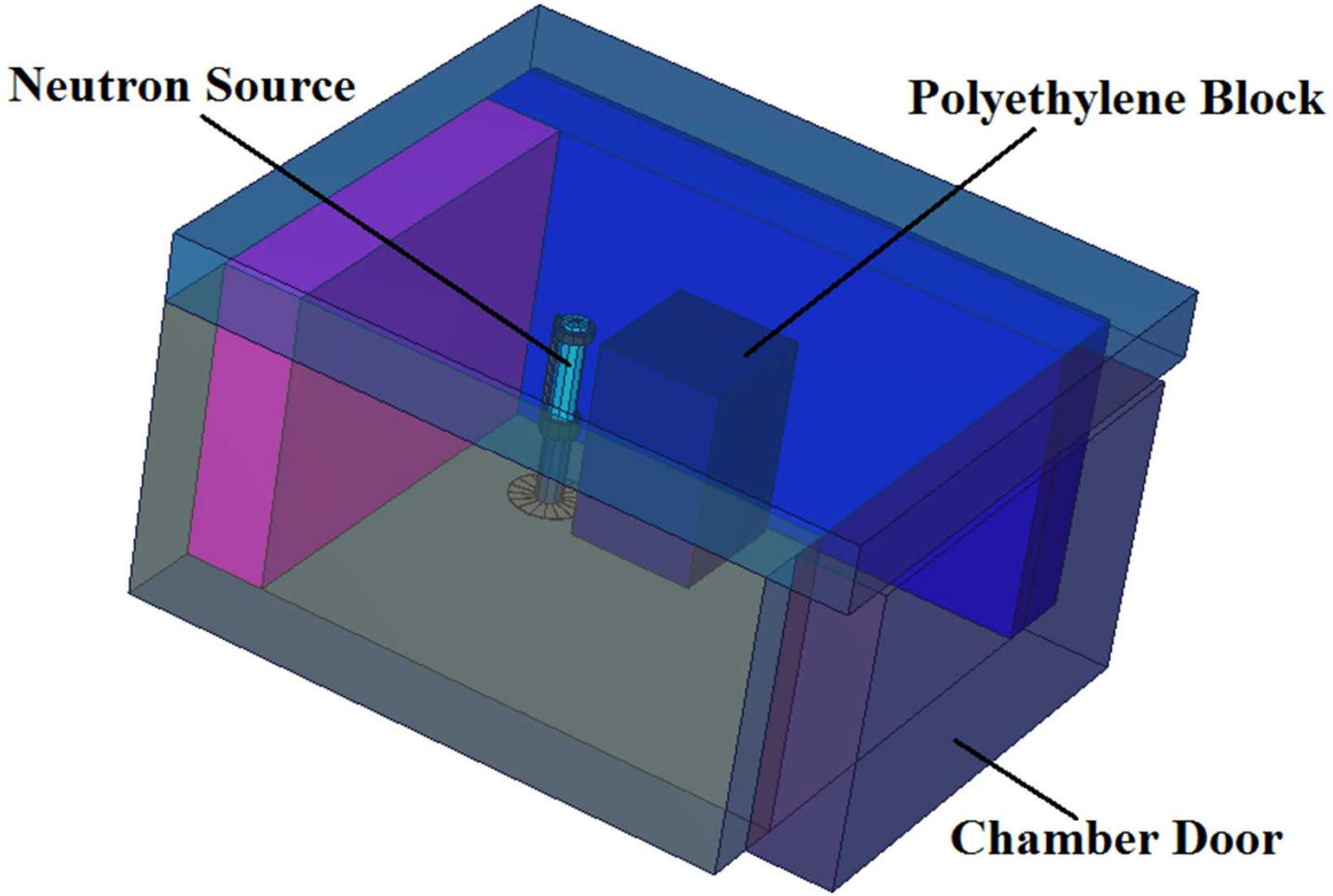
| | | Flux Density - (n/cm2/s) | | | |
|---|---|---|---|---|---|
| | | All Energy | (E>10keV) | (E>10keV) | (E>10keV) |
| Location | Distance (cm) | MCNP | MCNP | Microspec | BDS |
| A | 30 | 3760 | 2550 | | 2500 ± 800 |
| B | 61 | 1815 | 778.5 | | 1000 ± 300 |
| C | 91 | 1326 | 408 | | 380 ± 100 |
| D | 122 | 1110 | 266 | 260 ± 50 | 260 ± 50 |
| G | 183 | 371 | 122.1 | 120 ± 10 | |
| F | 145 | 10.7 | 4.42 | 6.92 ± 0.10 | |
| E | 61 | 1780 | 694 | | 770 ± 160 |

*Errors Quoted at 1σ (68% CI)

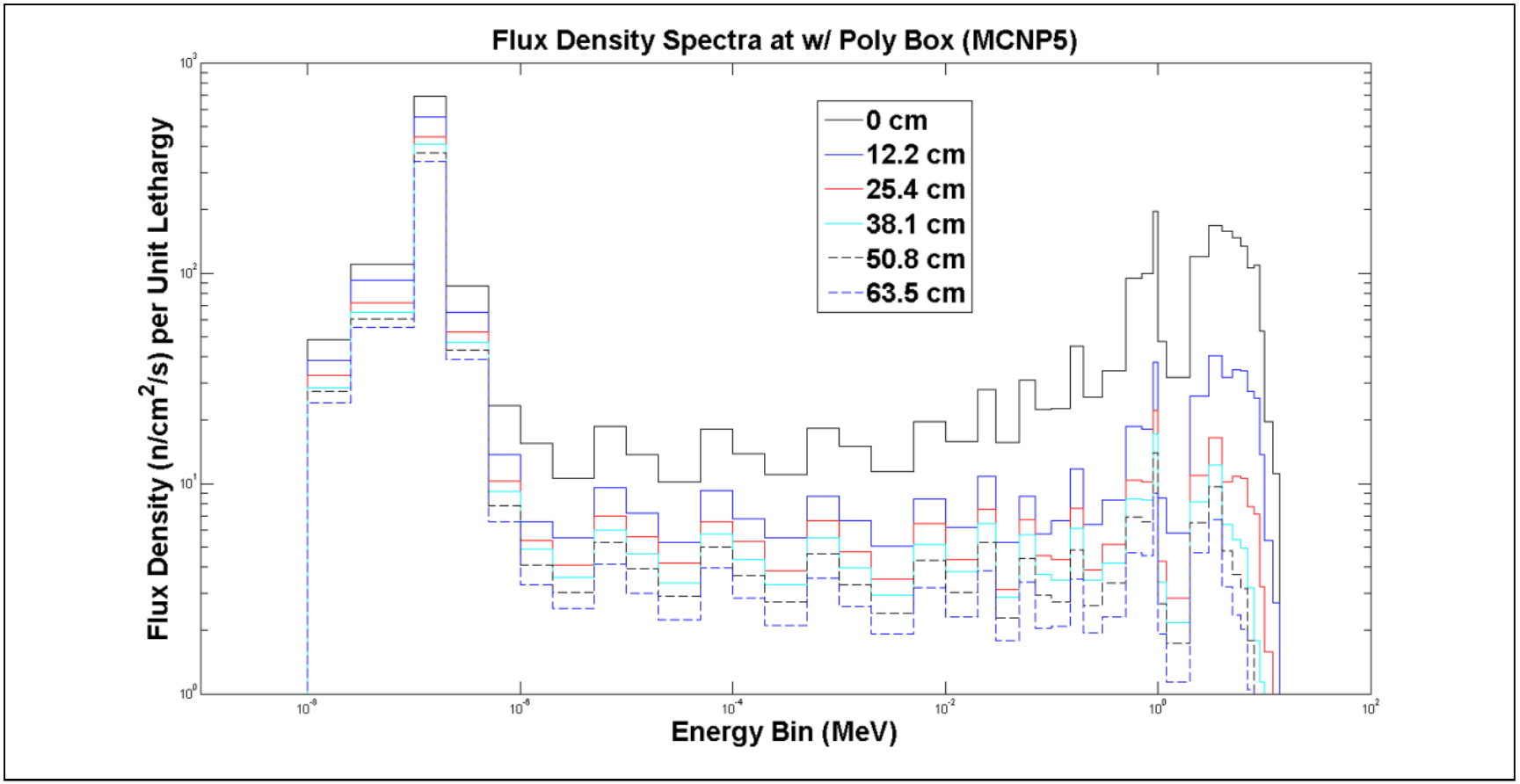
# Flux Density Spatial Distribution



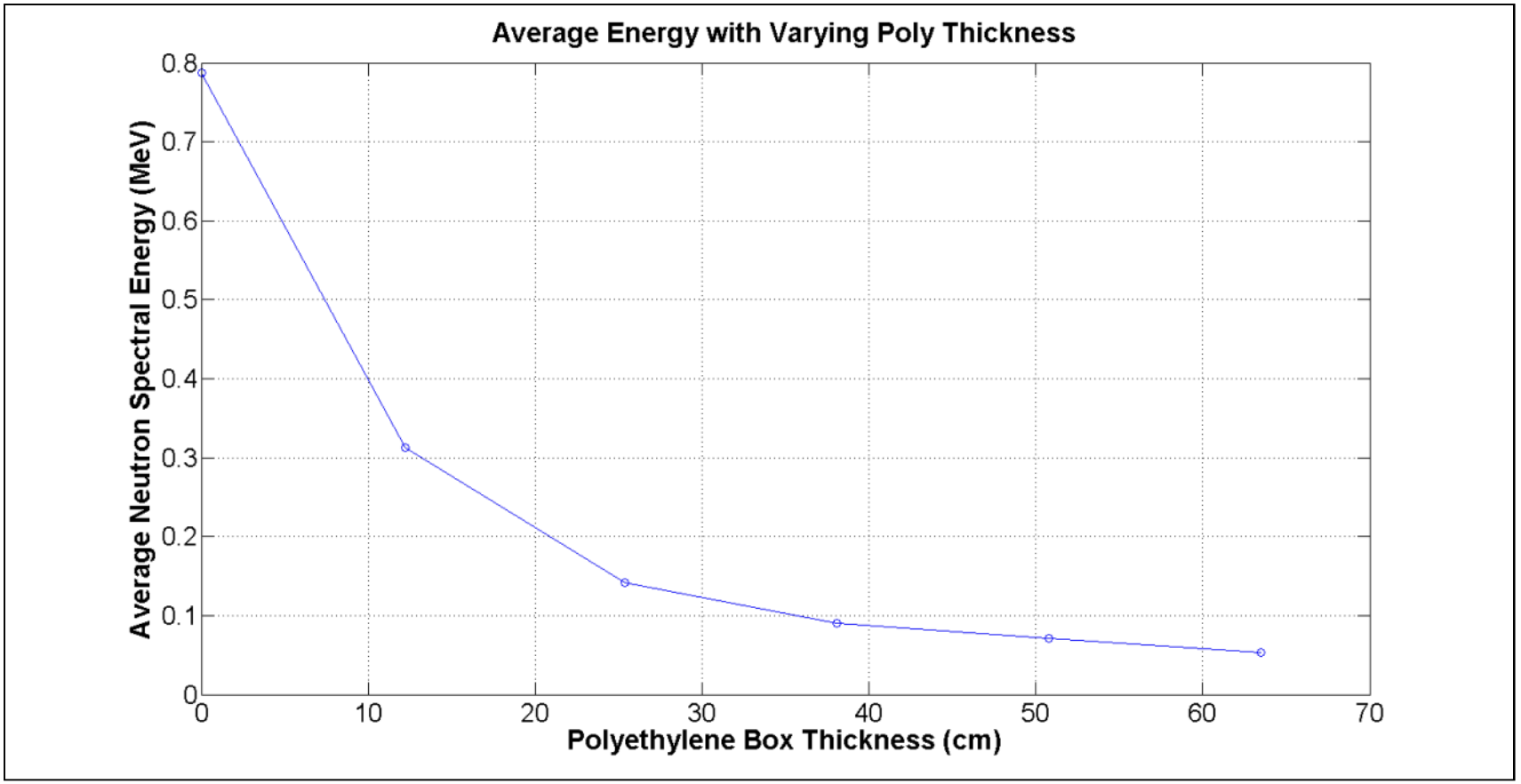
# Parametric Analysis Example



# Thermal Neutron Spectra



# Average Energy in Analysis



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# QUESTIONS