

Agenda of ORNL-UTK-UKY-LU zoom meeting

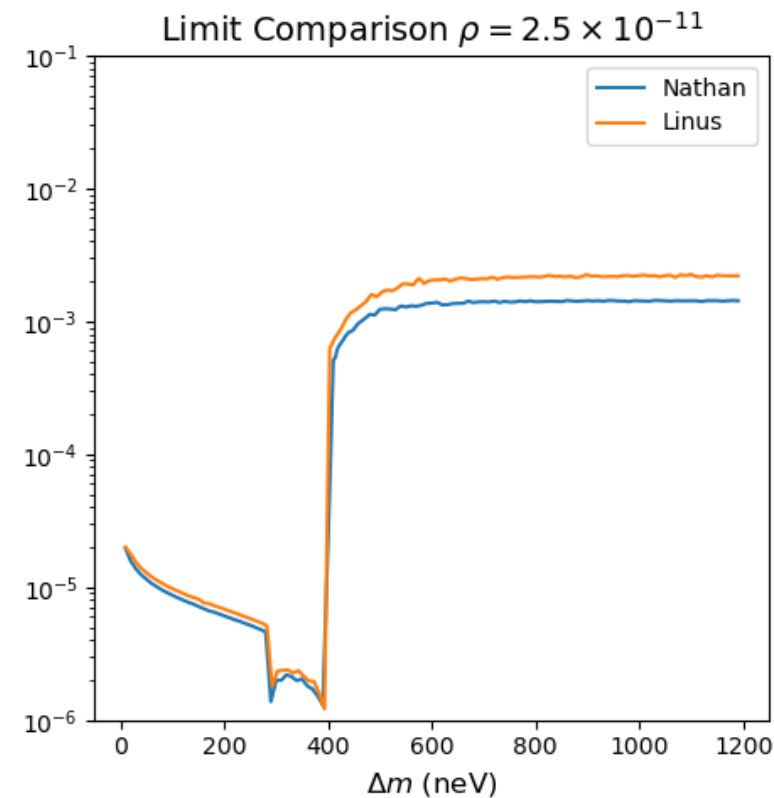
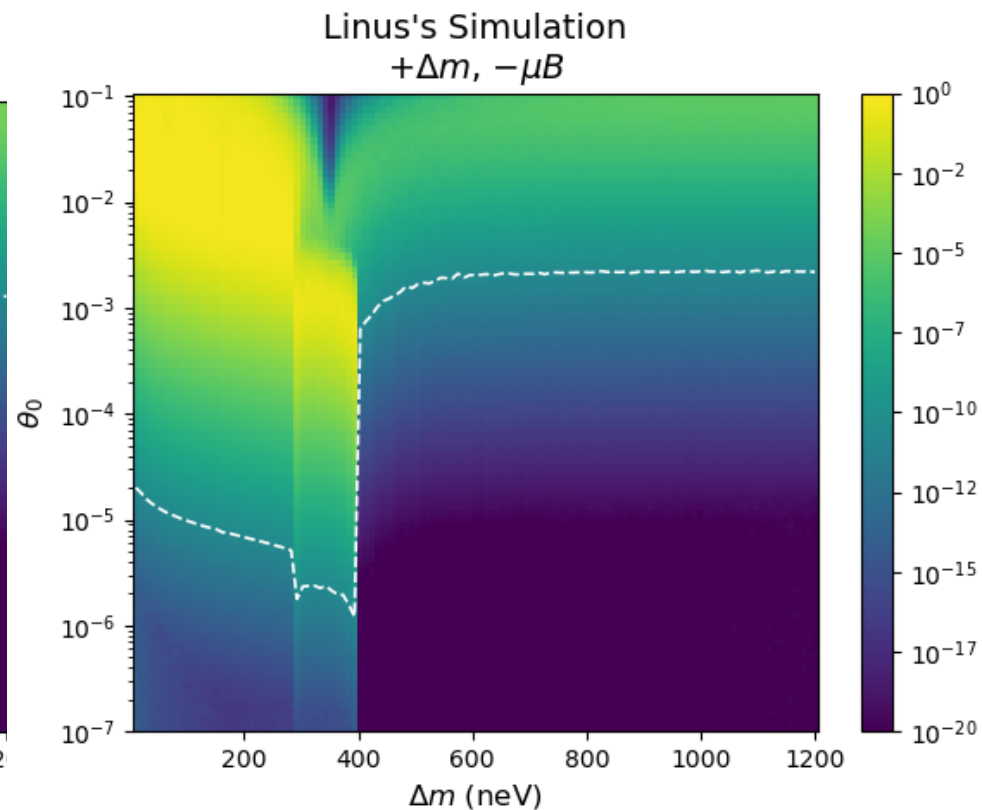
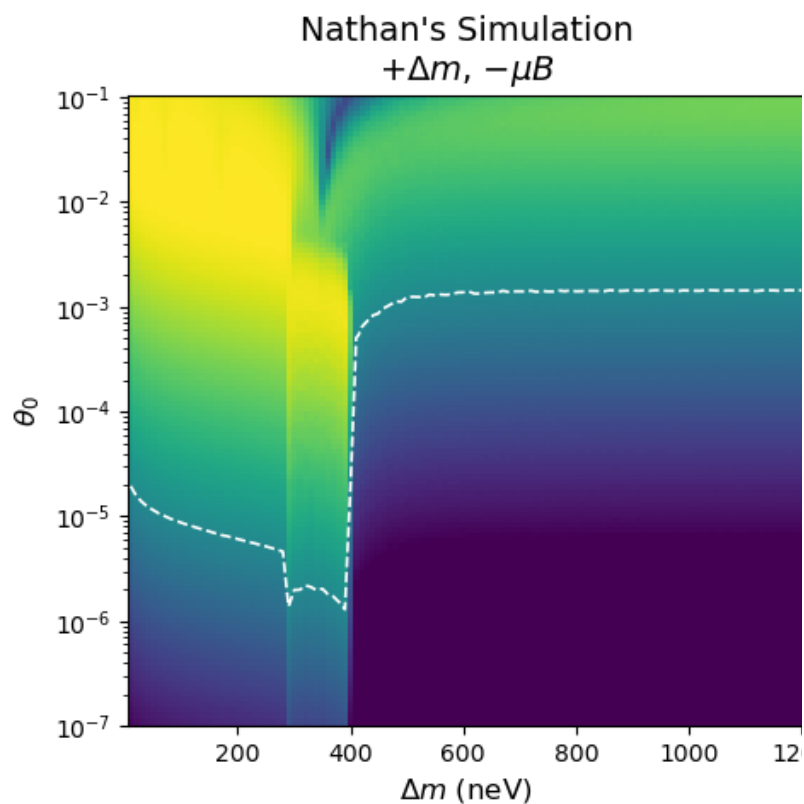
March 10, 2026, at 3:30 PM EST

- Please, send your presented slides for INDICO posting
<https://indico.phy.ornl.gov/event/994>

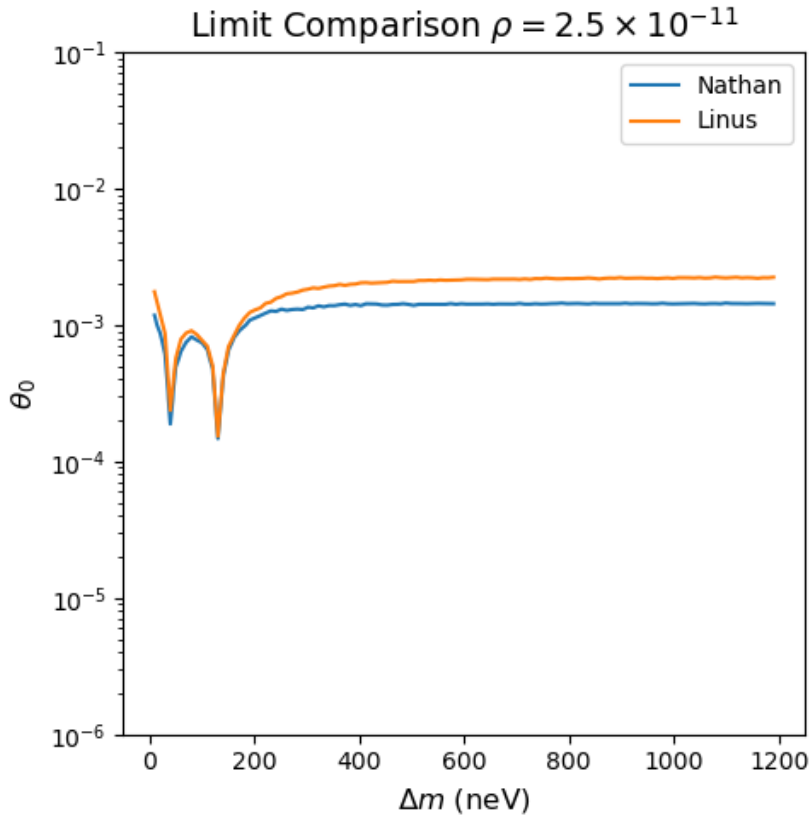
Agenda:

- | | | |
|-------------------|--------|---|
| 1. Nathan & Linus | 10 min | Calculations progress for the PRD paper |
| 2. Yuri & John | 10 min | Discussion of available space for additional absorber between two magnets |
| 3. Yuri | 10 min | GP-SANS detector efficiency for high energy > 1 eV neutrons |
| 4. Evan | 10 min | Conservative summary of μ Shielding factors from UT prototype |
| 5. Charlie | 10 min | Borated Poly and other absorbers for fast neutrons in nTMM experiment |
| 6. Linus | 10 min | Update on LU developments |
| 7. AOB | | |

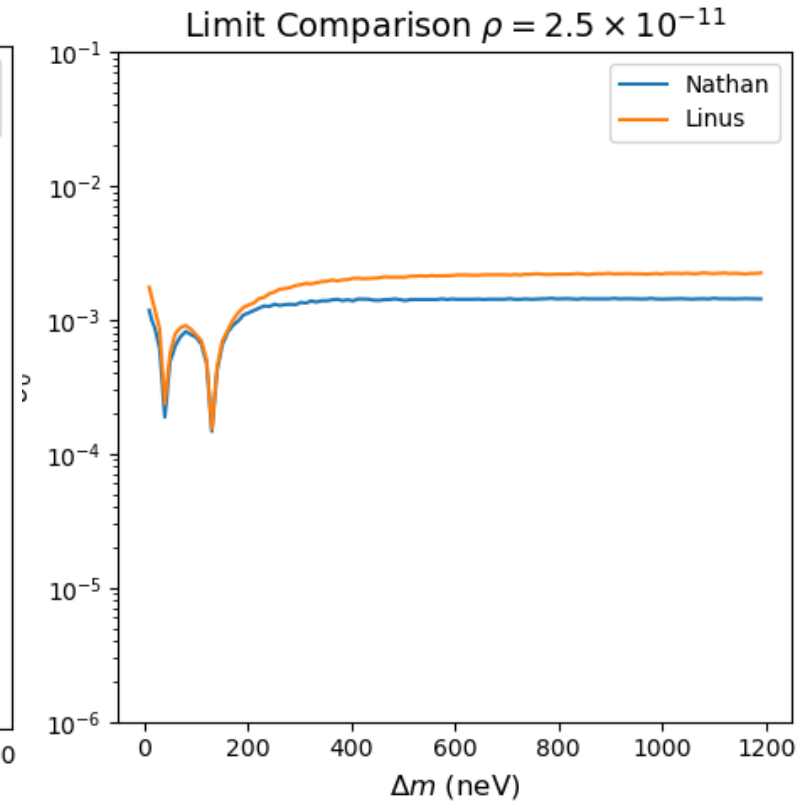
+ Δm , + μB Comparison



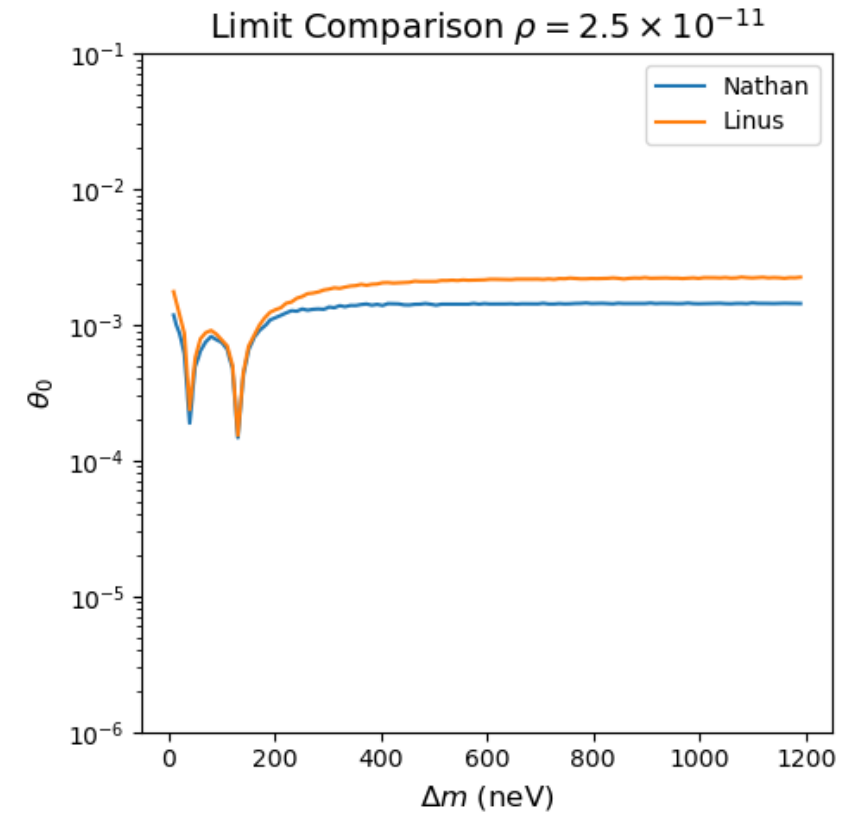
$+\Delta m, -\mu B$: changes performed sequentially (left to right)



0.04mm step size



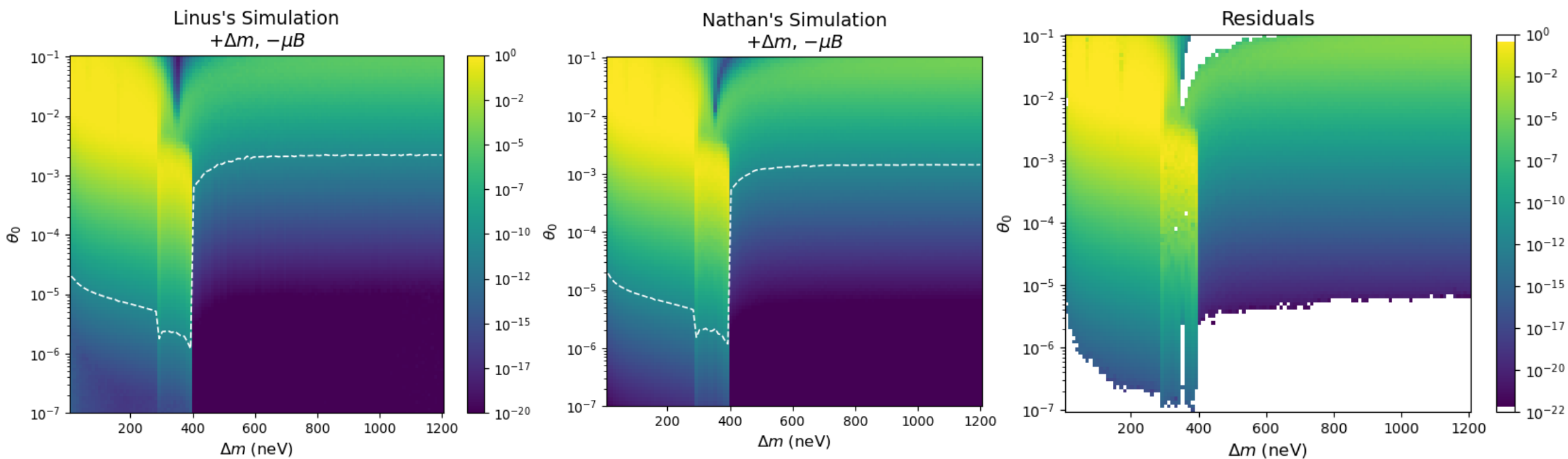
Changed mu to match Kline



200 velocities

+ Δm , + μB : residuals

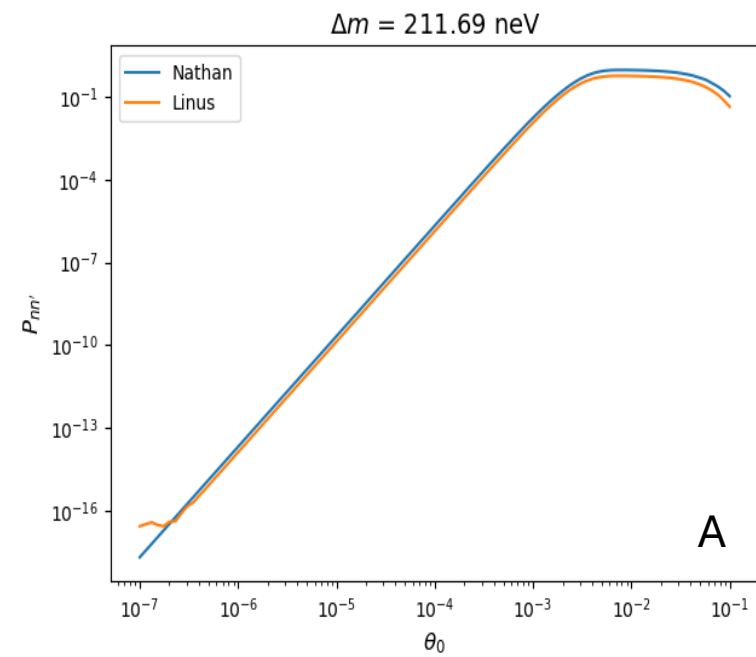
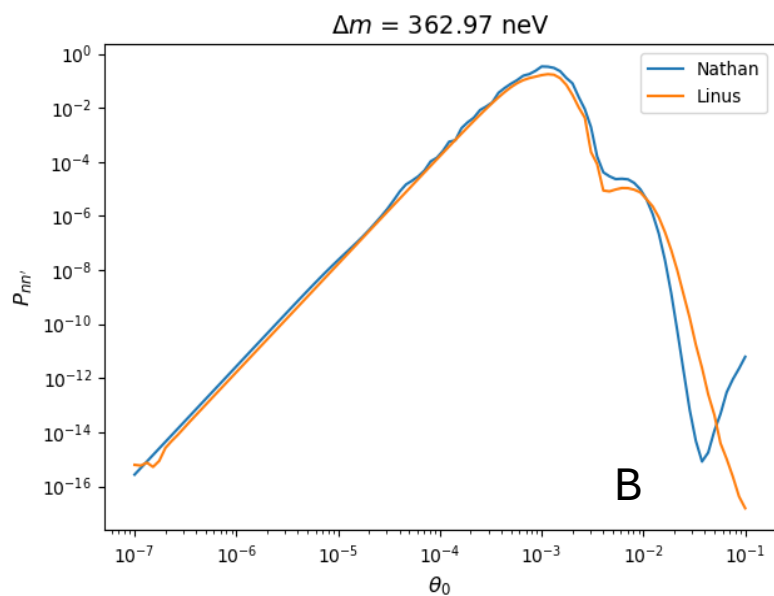
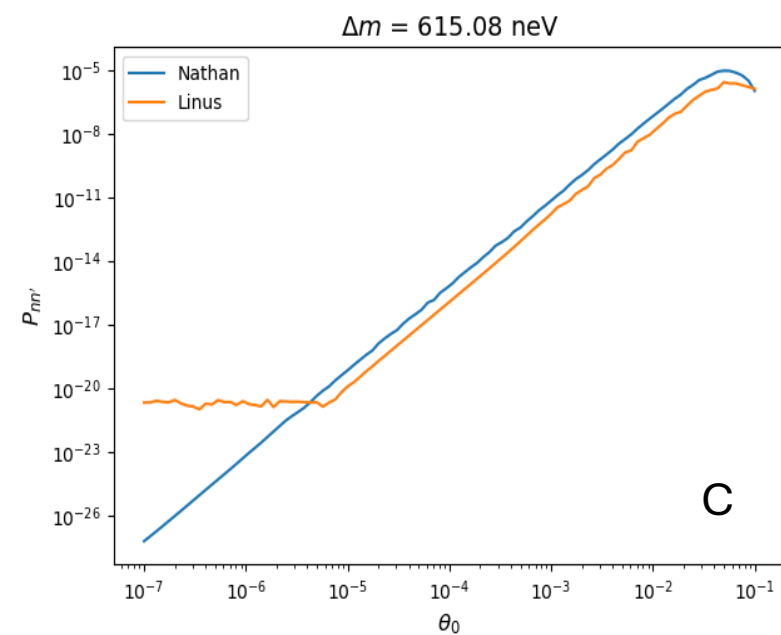
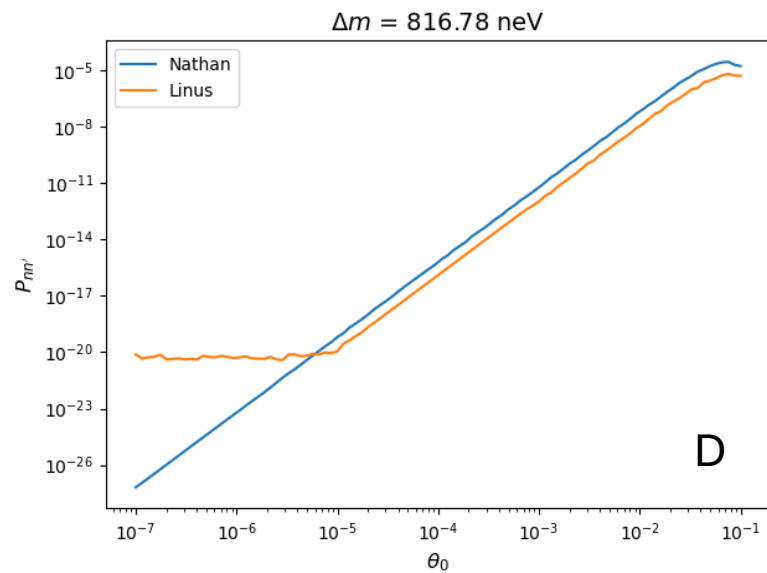
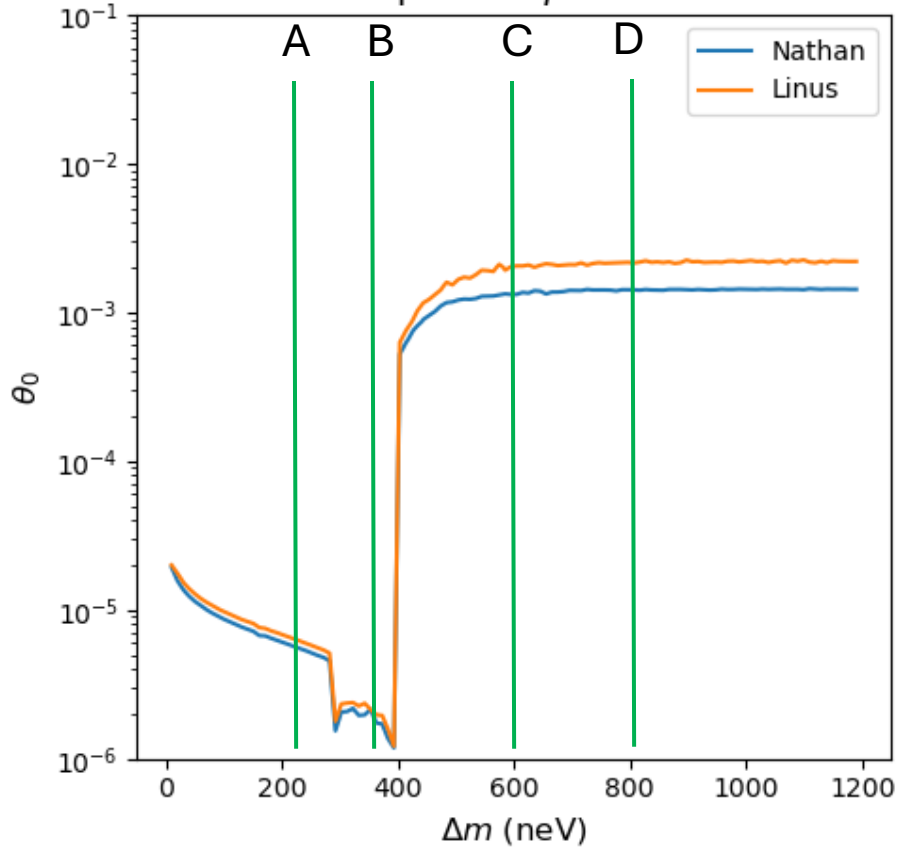
0.02 mm stepsize



1 dm value : $+\Delta m, +\mu B$

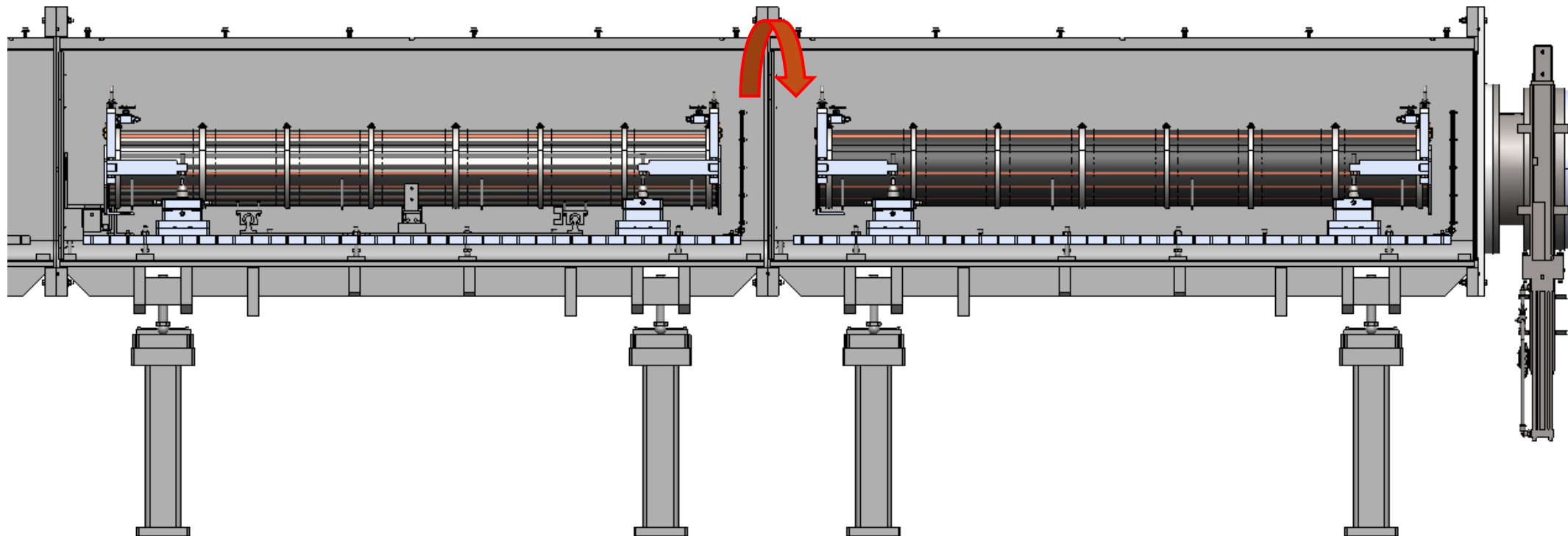
0.02 mm stepsize

Limit Comparison $\rho = 2.5 \times 10^{-11}$



How much space is available for additional absorber between two magnets ?

- We can keep 3.5 mm Cd, but move it to upstream side of box 8
- Downstream side space in box #7 can be available for insertion of slab of borated poly
- How large is this space for top insertion? 10 cm?
- It seems that borated poly is vacuum compatible.



GP-SANS detector efficiency for high energy > 1 eV neutrons

Eur. Phys. J. Plus (2020) 135:577
<https://doi.org/10.1140/epjp/s13360-020-00600-8>


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Regular Article



Verification of He-3 proportional counters' fast neutron sensitivity through a comparison with He-4 detectors

He-3 and He-4 proportional counters' fast neutron sensitivity and evaluation of the cosmic neutron fluxes at ESS

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$n - {}^3\text{He}$ cross sections for (n,p) and elastic scattering, Range 10^{-5} eV to 12 MeV

Macroscopic cross sections provided for 10 atm ${}^3\text{He}$ – like in GP-SANS detector
With detector threshold ~ 0.2 MeV transition between (n,p) and ES is introduced

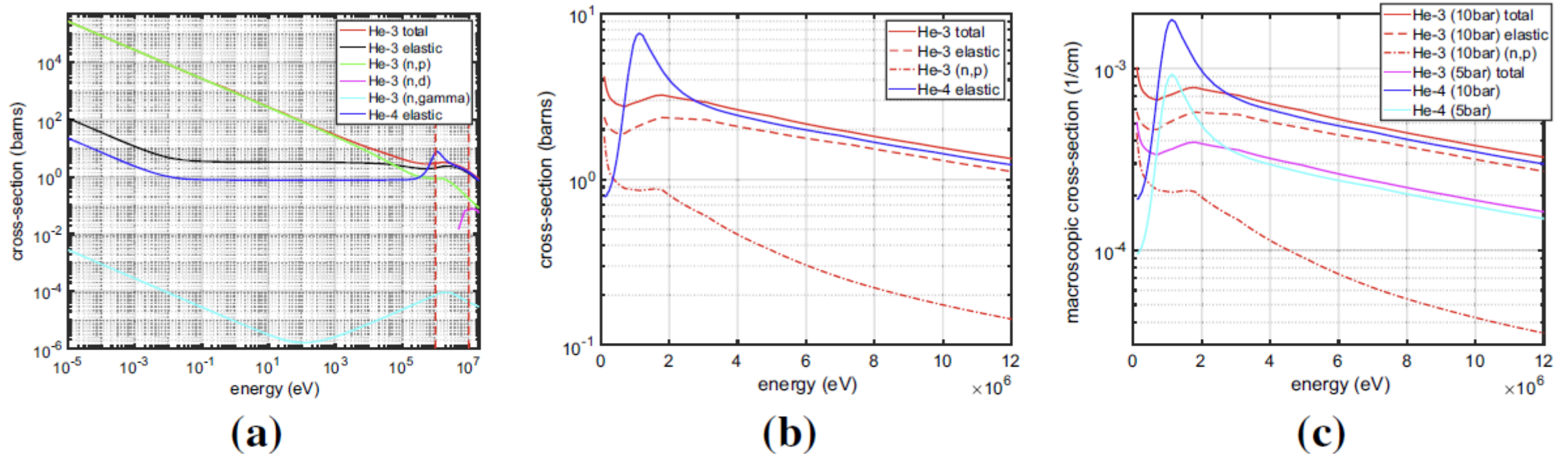
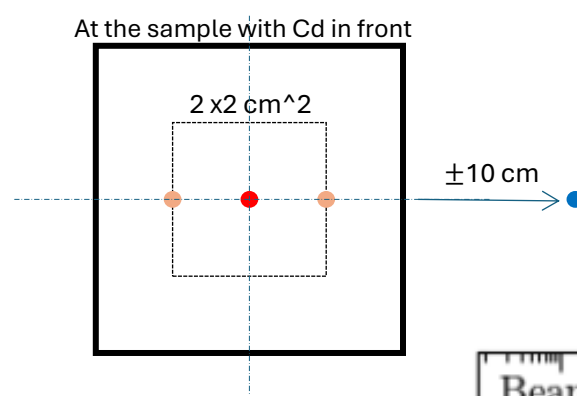


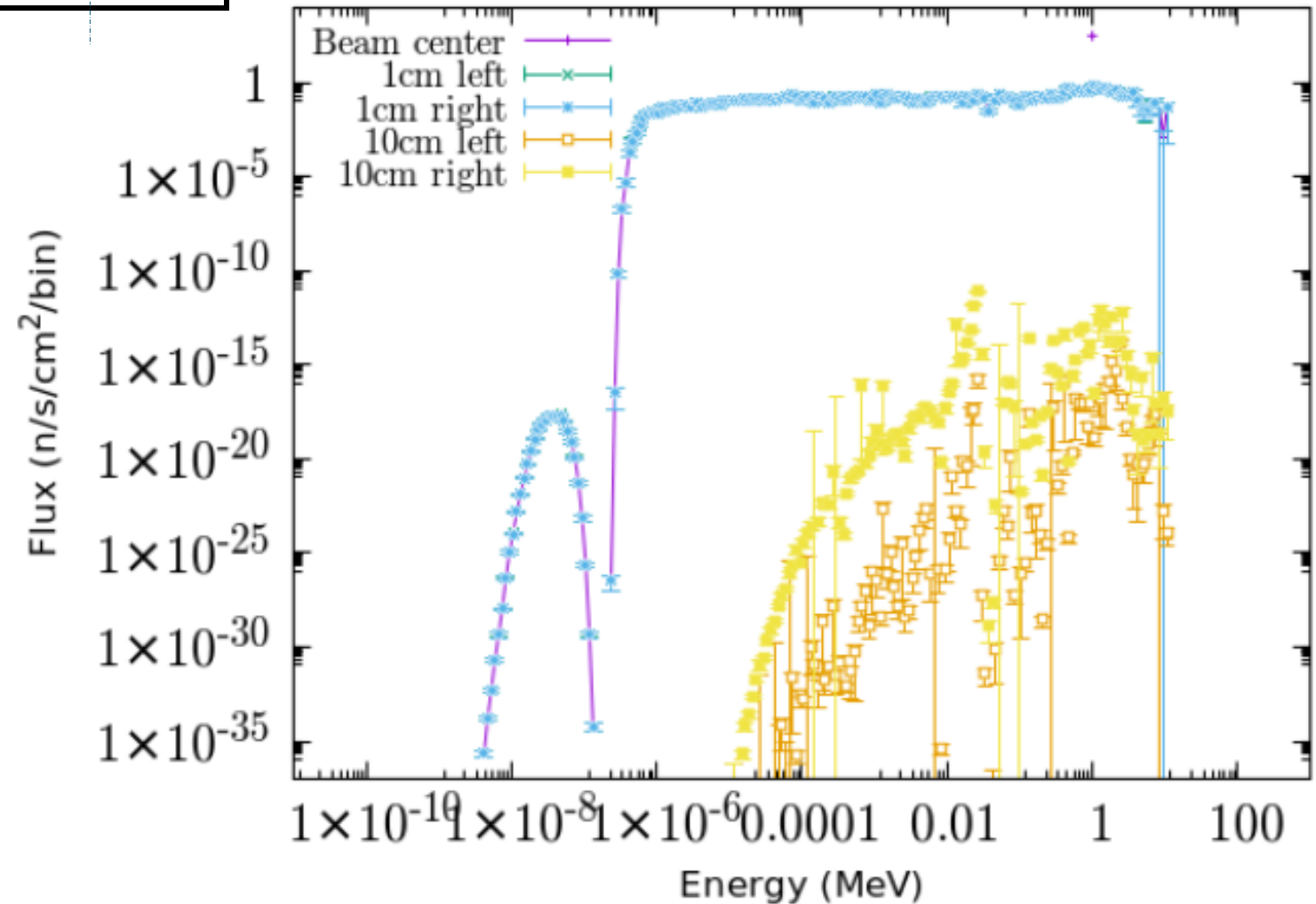
Fig. 1 **a** Cross section for various processes of a neutron interacting with either Helium-3 or Helium-4 nuclei. **b** Same as **a** in the neutron energy range 0-12 MeV. **c** Macroscopic cross sections for 5 and 10 bar of Helium-3 or Helium-4 in the energy range 0–12 MeV. From [66,67]

Range and binning should match calculations of Kyle Grammer

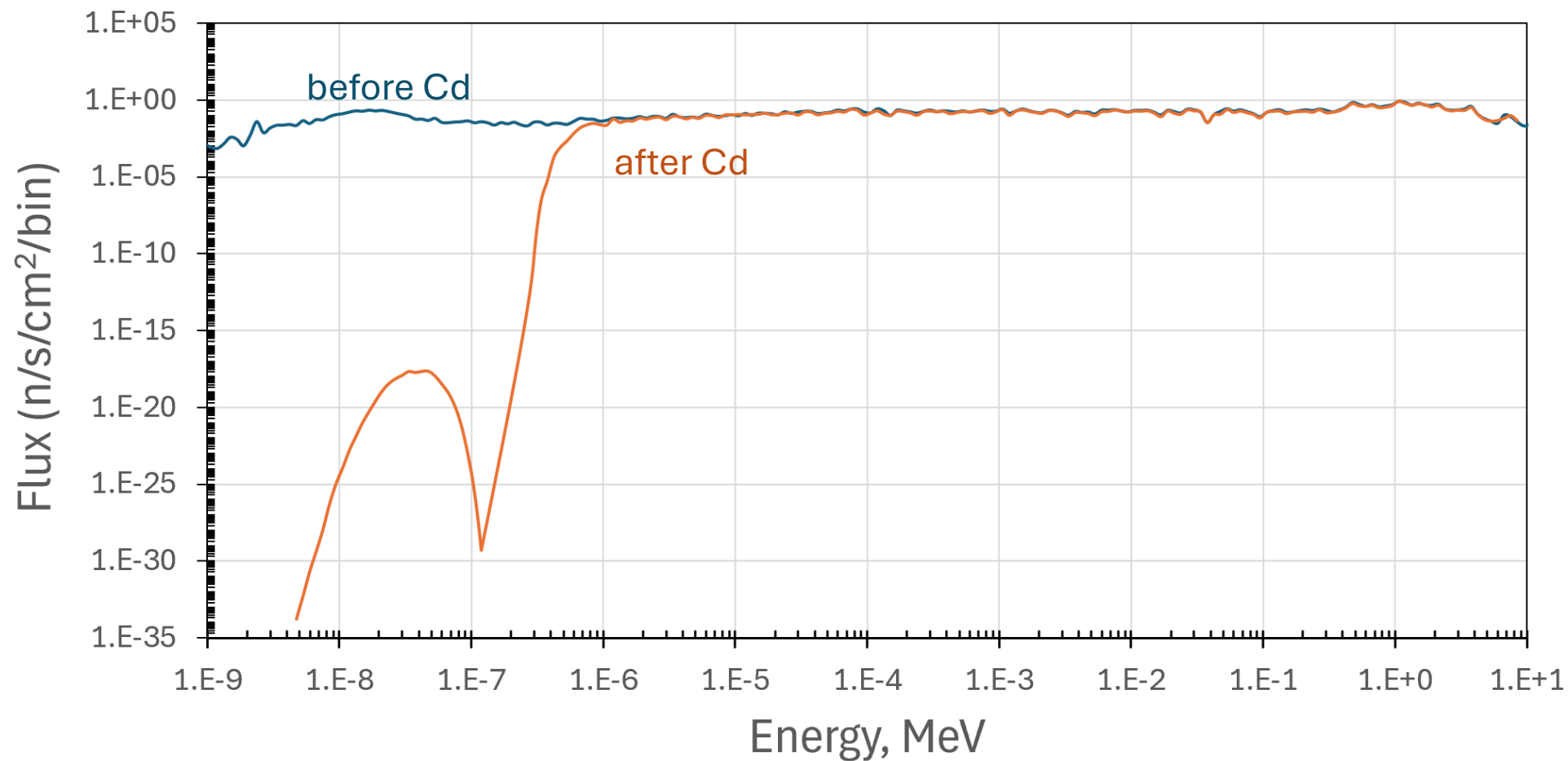


GP-SANS flux through 3.5mm Cd

- Absolute units for flux !
- Bin size (uniform in Log_{10}) 1/20 of a decade
- Flat fast n spectrum 0.5 eV to 8.6 MeV
- Attenuation of 3.5 mm Cd $>0.5 \text{ eV}$ is not significant
- there is a halo of fast neutrons to $\pm 10 \text{ cm}$
- Total fluence $\sim 400 \text{ n/s}$ through $4 \times 4 \text{ cm}^2$ after Cd (without detector efficiency)

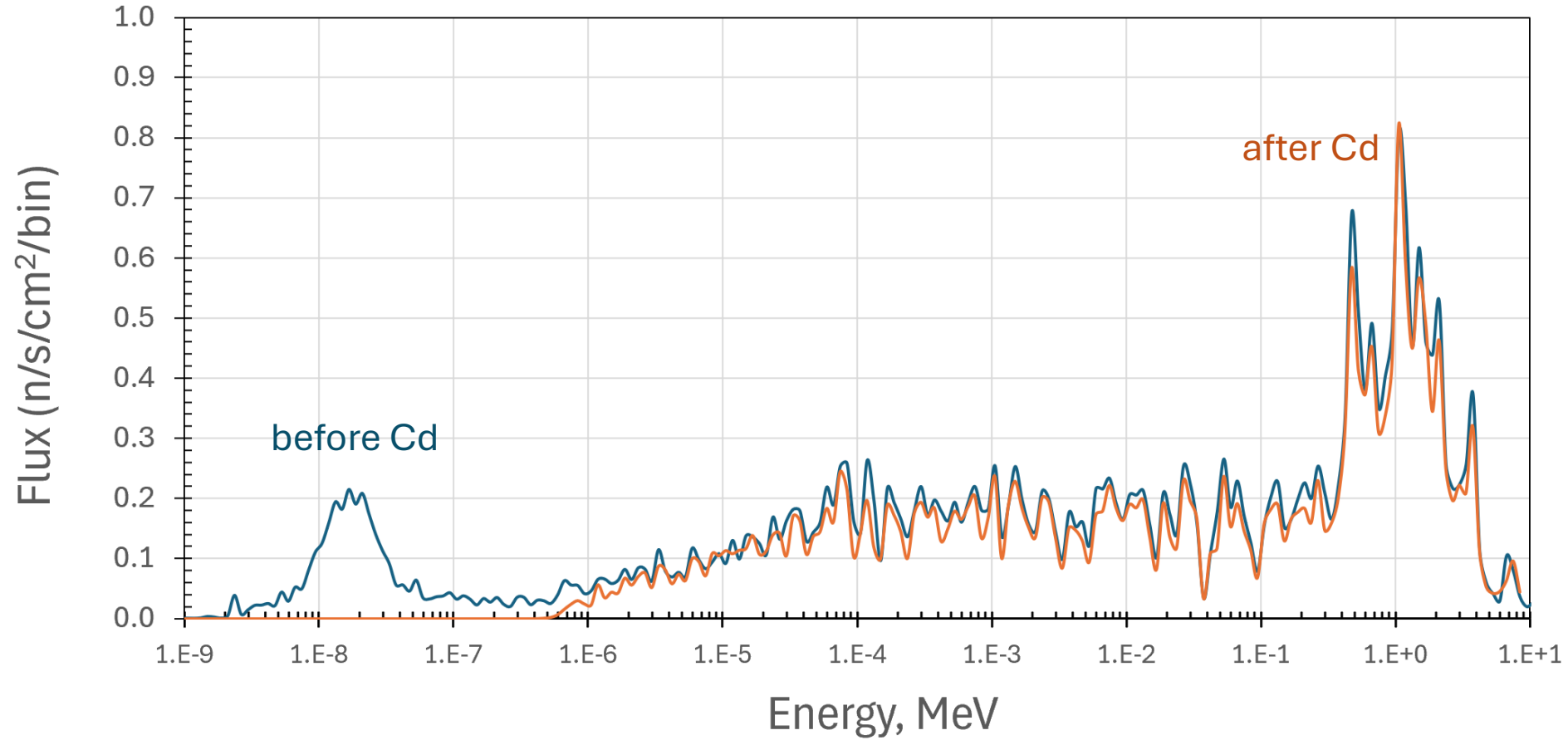


Flux of neutrons scattered from 3m reflector optical filter at the position of GP-SANS sample as reconstructed from Kyle's digital files



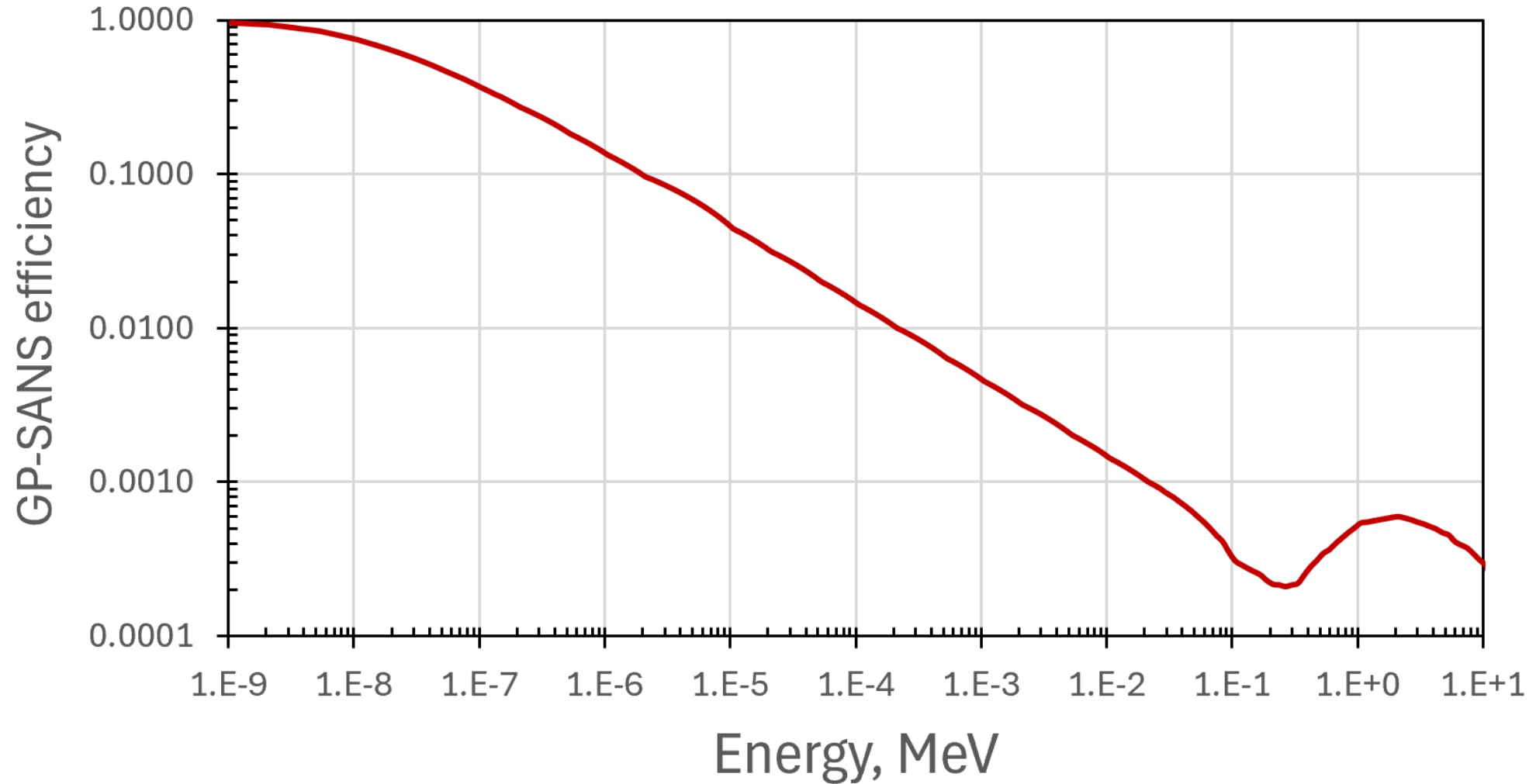
Total fluence ~ 400 n/s through 4x4 cm² after Cd (without detector efficiency)

Same flux spectrum in linear vertical scale



Reconstructed efficiency in the same bins as Kyle's simulation data

Efficiency - Reconstructed from paper



- Since fluence 400 n/s after Cd absorber is calculated by Kyle, this can be used for attenuation calculations by Charlie.
- So far Charlie used for Geant 4 uniform energy spectrum from 0 to 10 MeV
- In the future, she will use Kyle spectrum with logarithmic bins transformed to energy bins
- Then bin-by-bin spectrum will be corrected by detector efficiency and normalized to 400 n/s
- For bench comparison, Carolyn is calculating from 2025 data
 - Fast peak counts after Cd absorber (regular runs)
 - counts with + additional BN absorber (30 min run)
 - counts with one shutter closed
 - counts with both shutters closed

Neutron Absorption Simulations Update

By Charlotte Snow

University of Denver

March 6, 2026

Simulation Settings Updates:

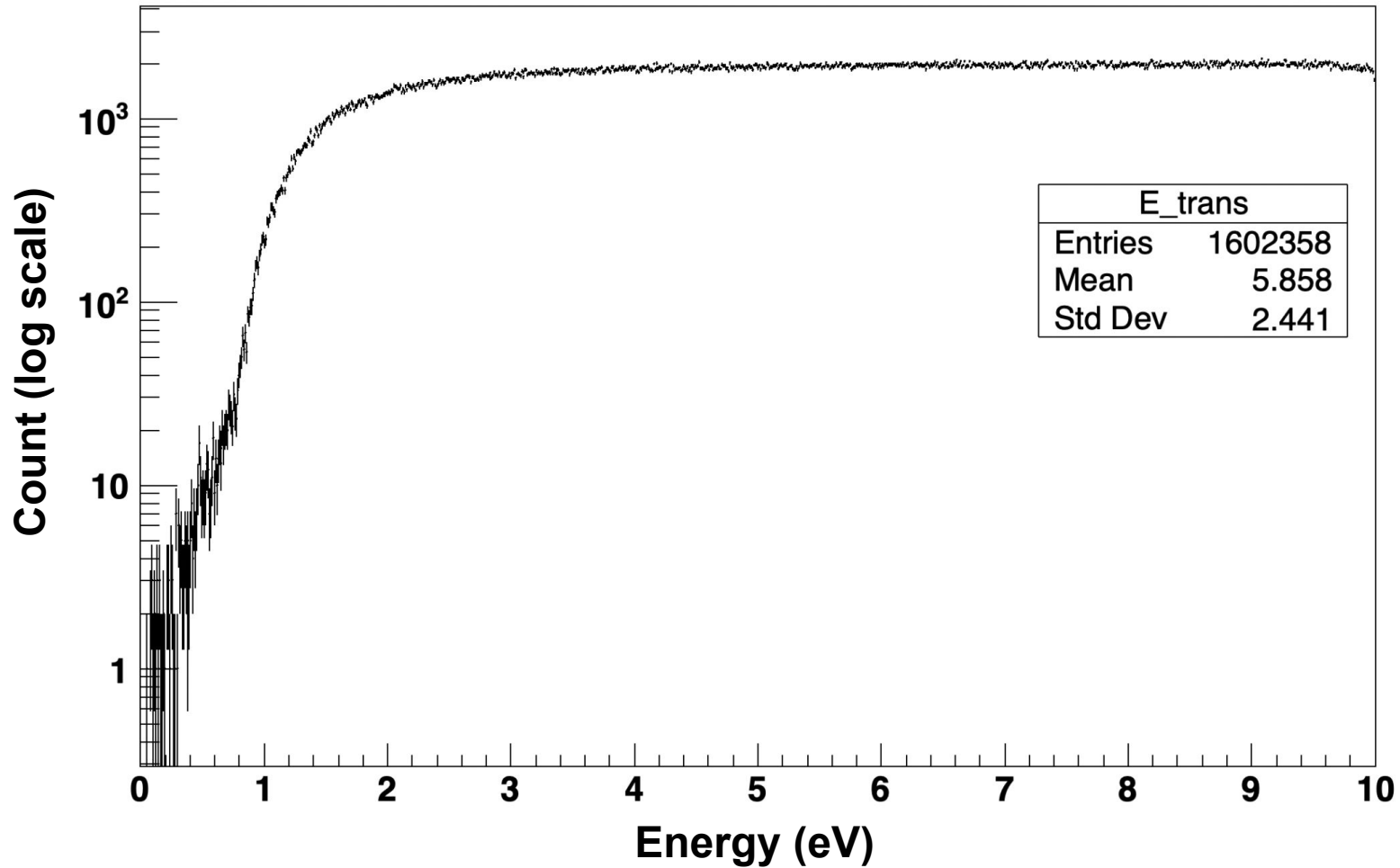
Note: Every simulation was performed in a world of G4_Galactic.

- Density: 10^{-25}
- Pressure $3 \cdot 10^{-18}$ Pa
- Temperature: 2.73 K

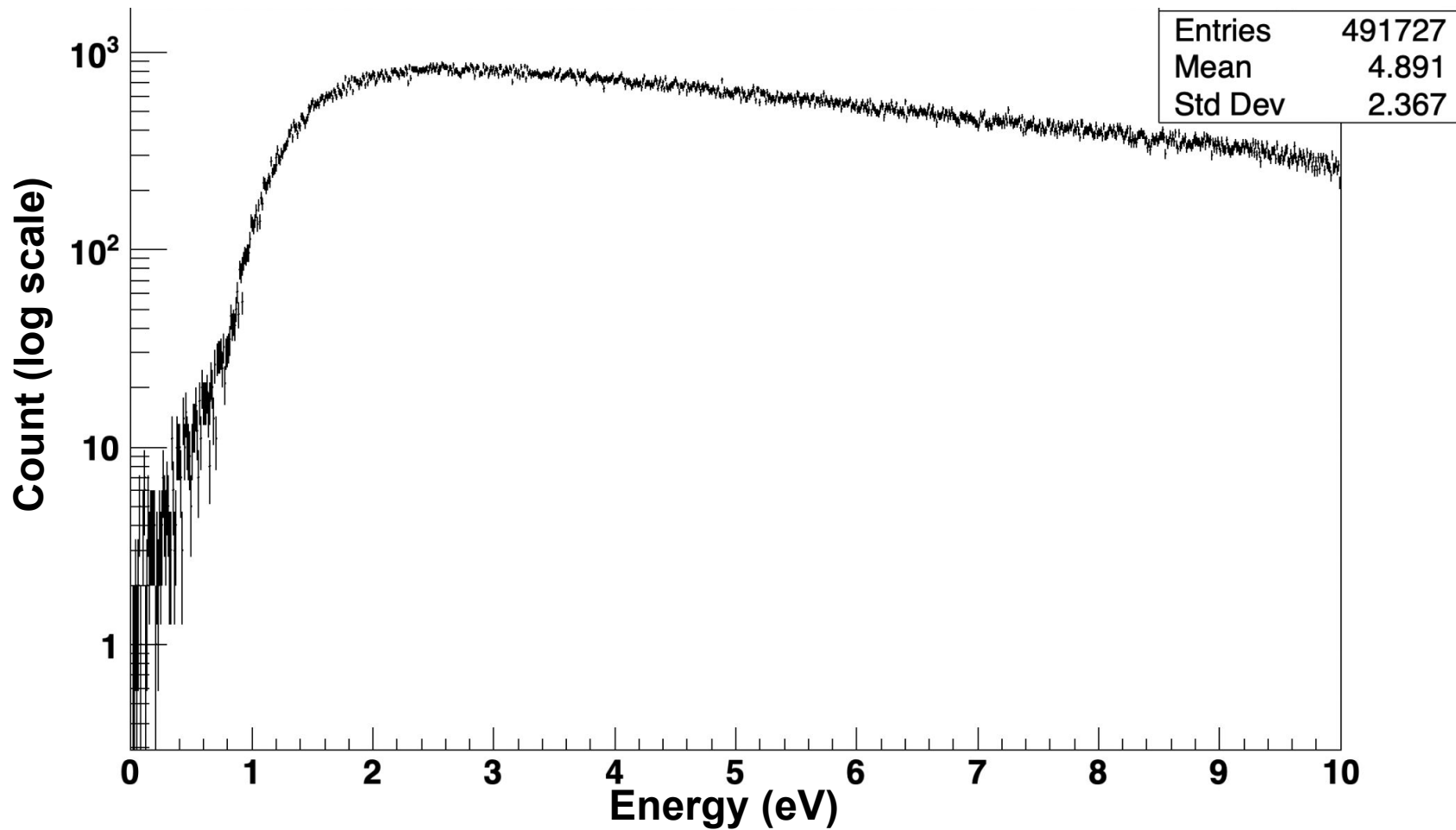
Materials Simulated:

- Cadmium (3.5 mm)
- Cadmium (3.5 mm) + Boron Carbide (B4C) (10 mm)
- Cadmium (3.5 mm) + Boron Nitride (BN) (6.35 mm)
- Borated Polyethylene (BP) (10 mm) + Cadmium (3.5 mm)
- Borated Polyethylene (BP) (50 mm) Cadmium (3.5 mm)

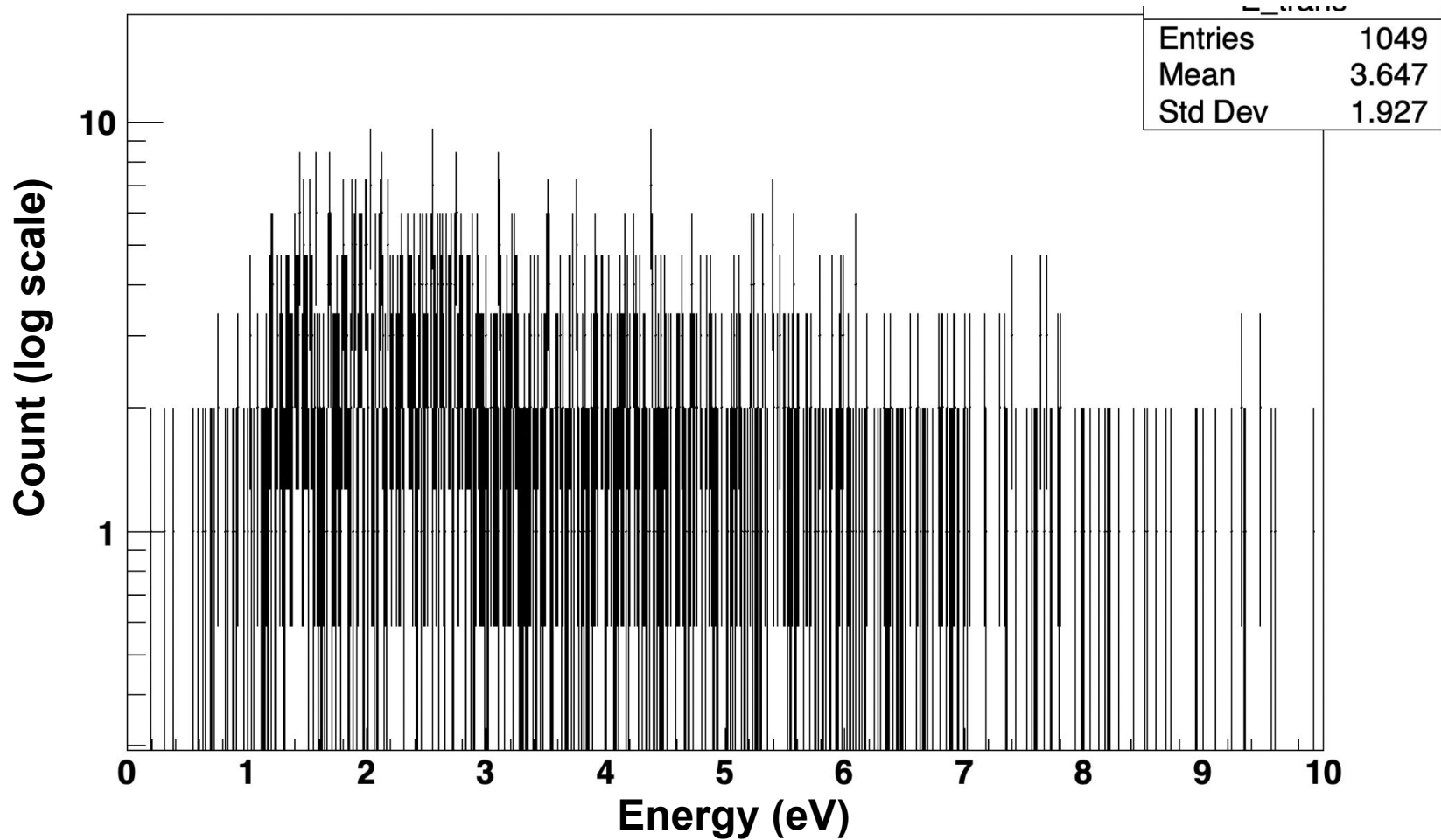
Cd (3.5 mm) Transmitted Neutron Energy



BP (10 mm) + Cd (3.5 mm) Transmitted Neutron Energy



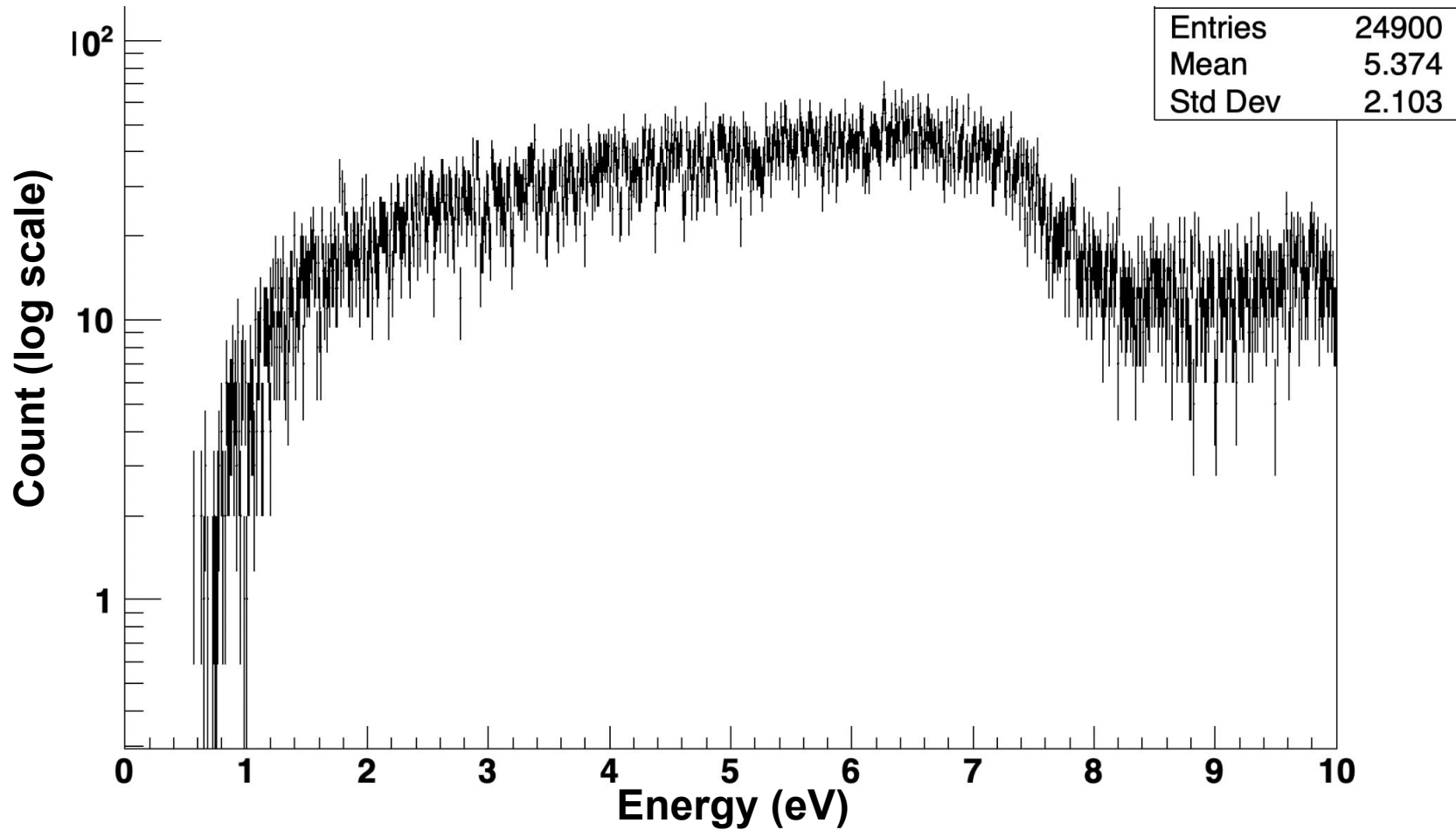
BP (50 mm) + Cd (3.5 mm) Transmitted Neutron Energy



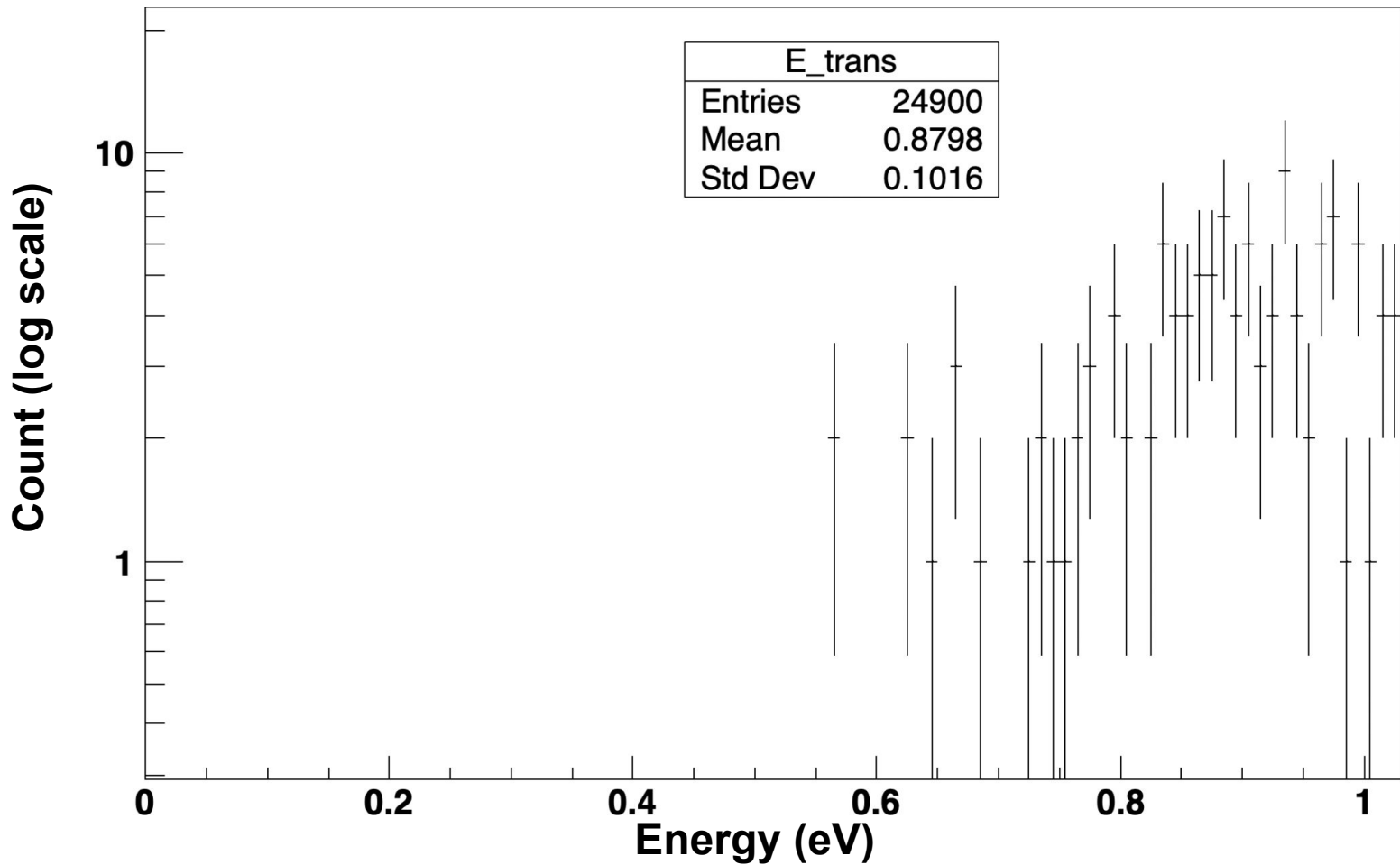
Next Steps

- Simulate shutters

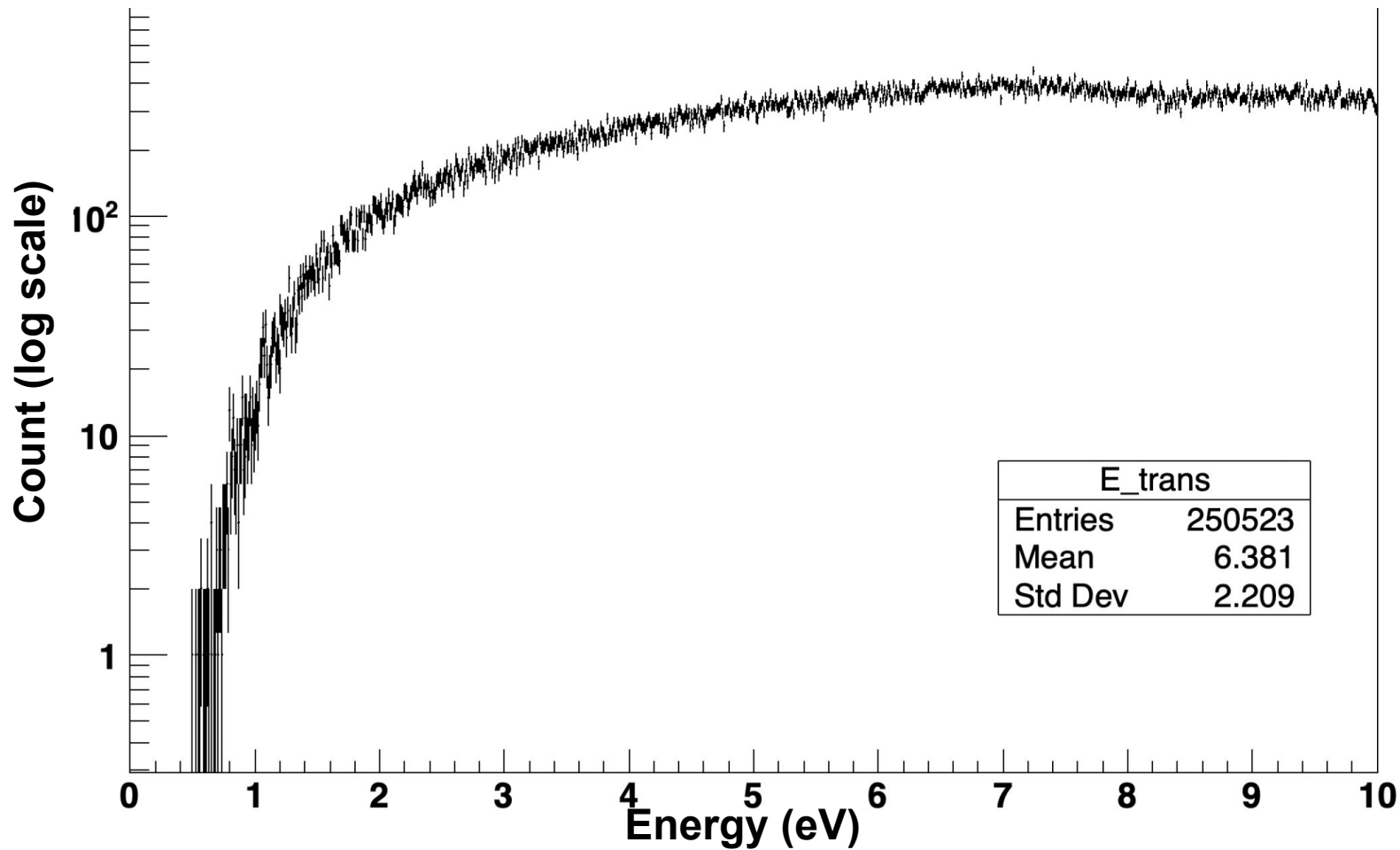
Cd (3.5 mm) + B4C (10 mm) Transmitted Neutron Energy



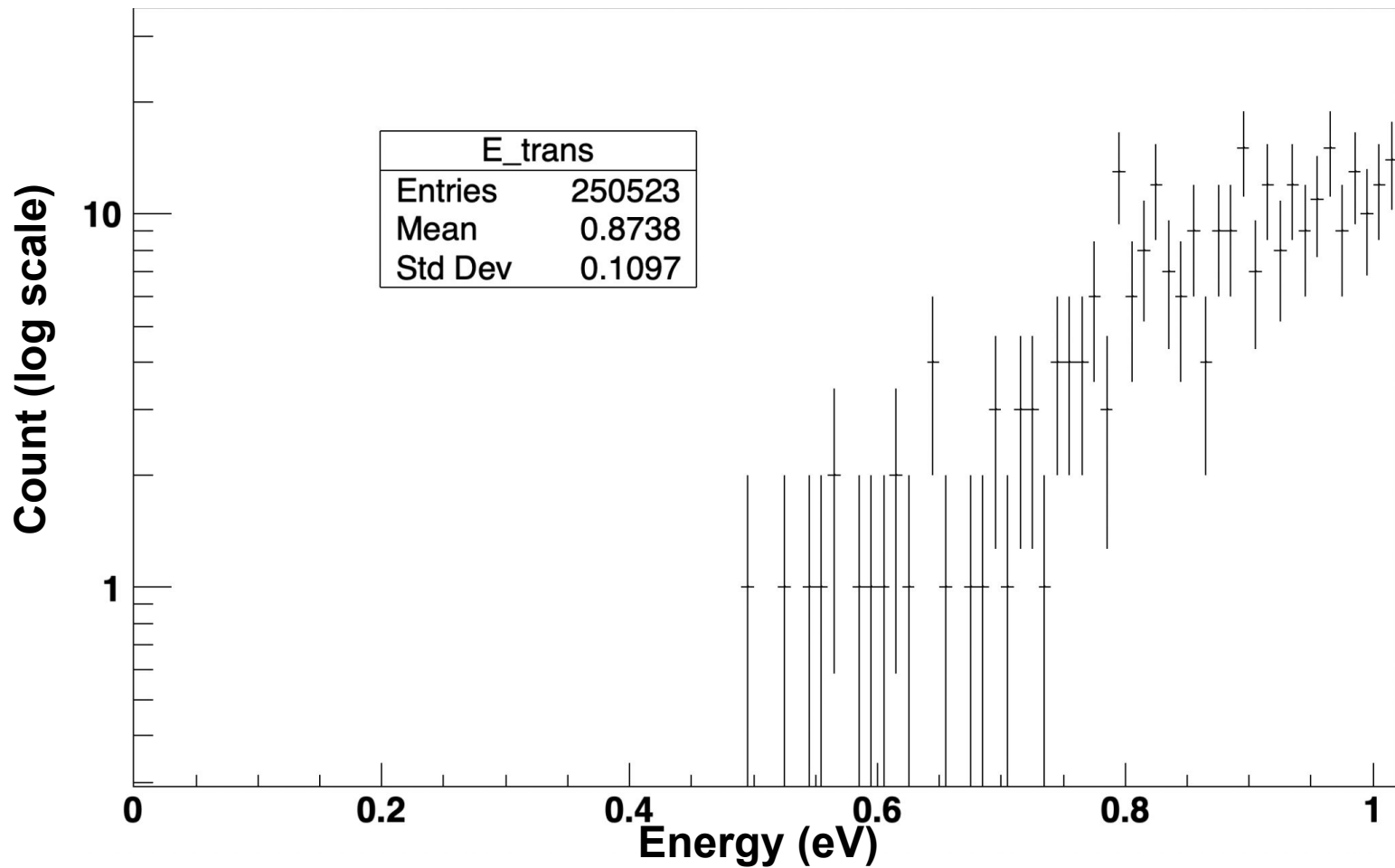
Cd (3.5 mm) + B4C (10 mm) Transmitted Neutron Energy (0-1 eV)



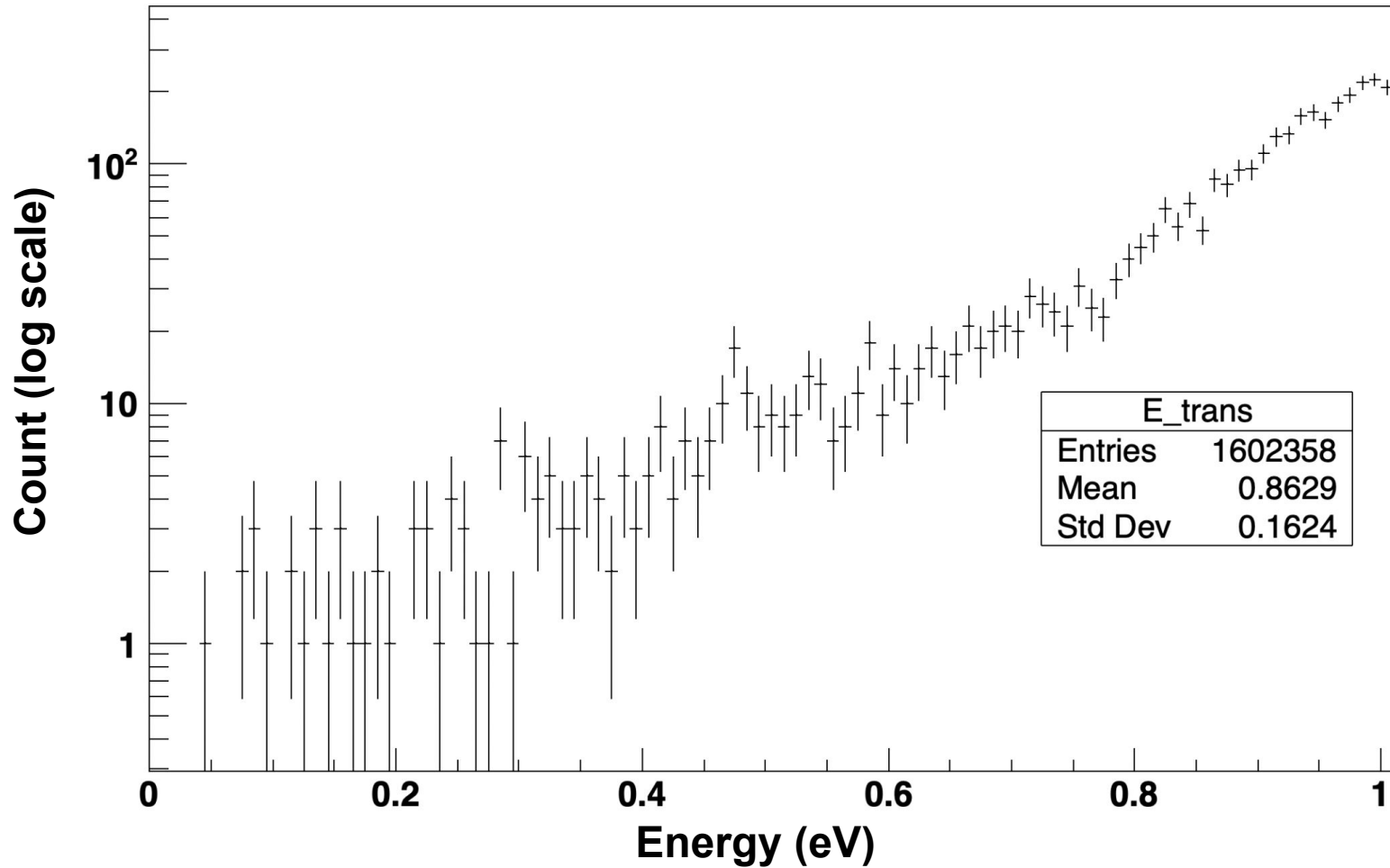
Cd (3.5 mm) + BN (6.35 mm) Transmitted Neutron Energy



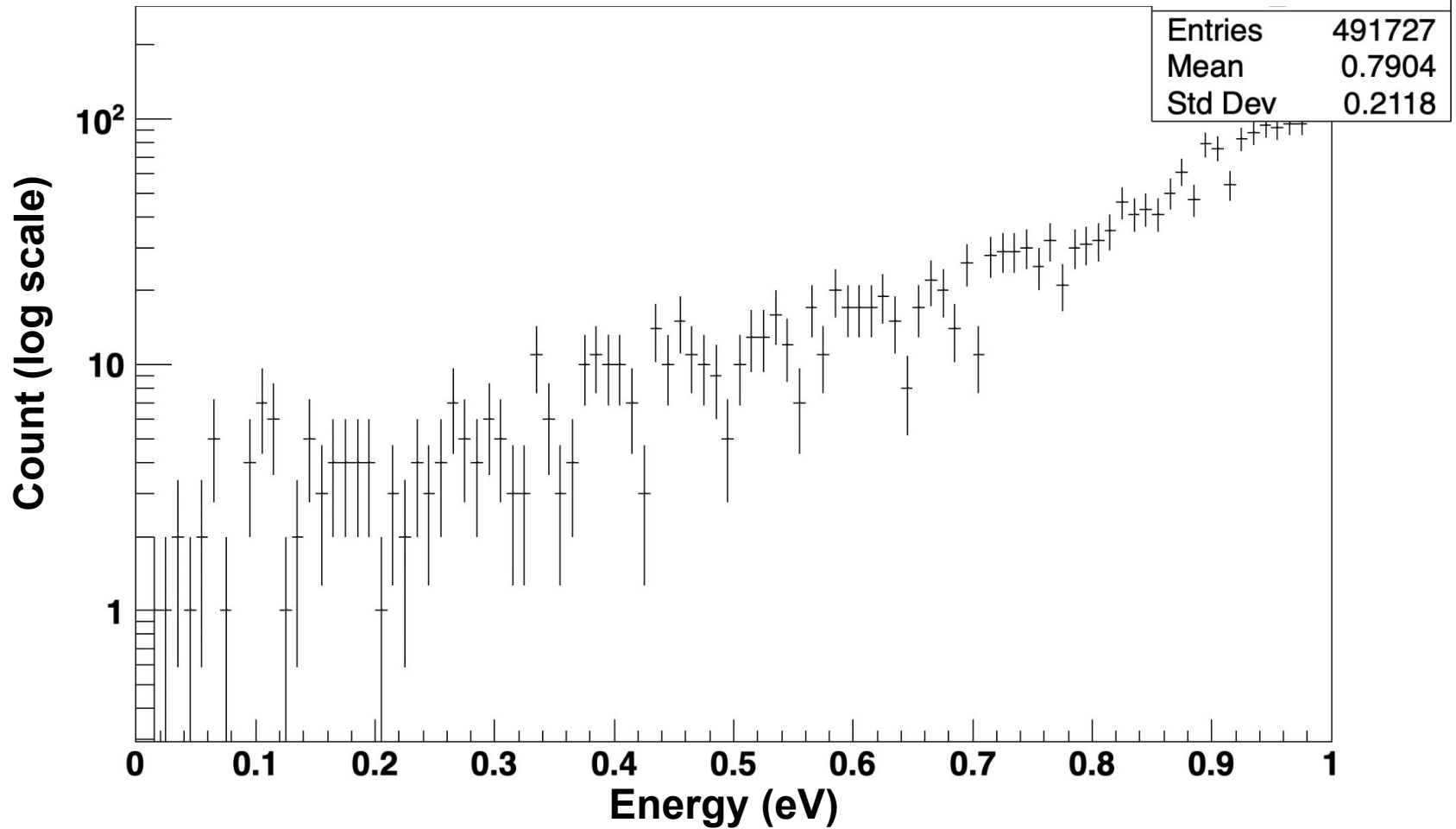
Cd (3.5 mm) + BN (6.35 mm) Transmitted Neutron Energy (0-1 eV)



Cd (3.5 mm) Transmitted Neutron Energy (0-1 eV)



BP (10 mm) + Cd (3.5 mm) Transmitted Neutron Energy (0-1 eV)



BP (50 mm) + Cd (3.5 mm) Transmitted Neutron Energy (0-1 eV)

