



STERILE NEUTRINO AT ESS ν SB



Doris Barčot, RBI

WP5+

Annual colaboration meeting

Hamburg , 23.9.2024. – 27.9.2024.



1. ESS & LEMNB

- Probability and flux
- Sensitivity
- Events

2. LEMNB segmented production tunnel

- Flux
- Sensitivity

3+1 scenario :

PMNS matrix update:

$$U_{PMNS}^{4\nu} = R(\theta_{34}, \delta_{34}) R(\theta_{24}, \delta_{24}) R(\theta_{14}, 0) U_{PMNS}^{3\nu}$$

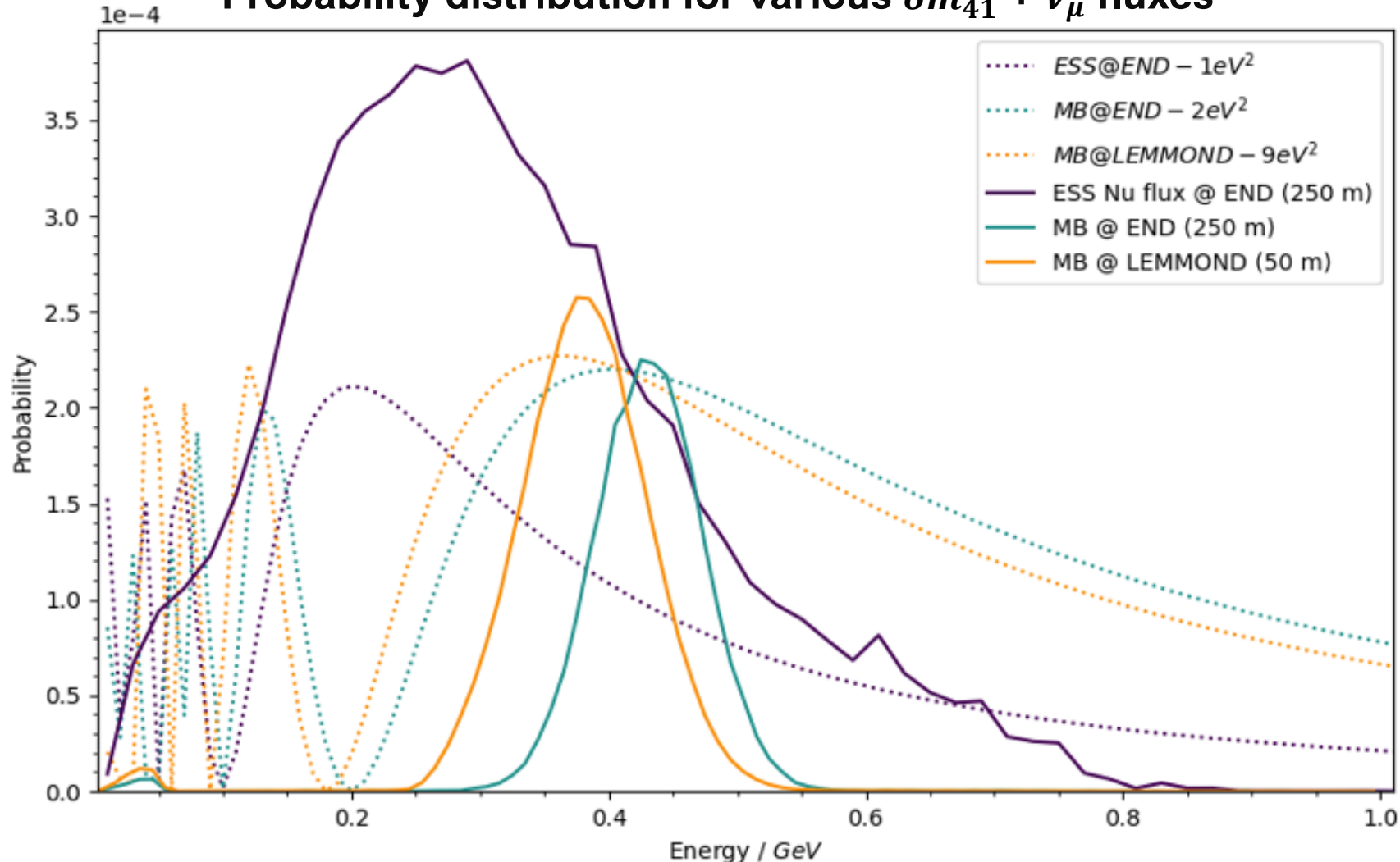


**Transition probability @
app and disapp channel:**

$$P_{\mu e} = s_{24}^2 \sin^2 2\theta_{14} \sin^2 \frac{\Delta m_{41}^2 L}{4 E}$$

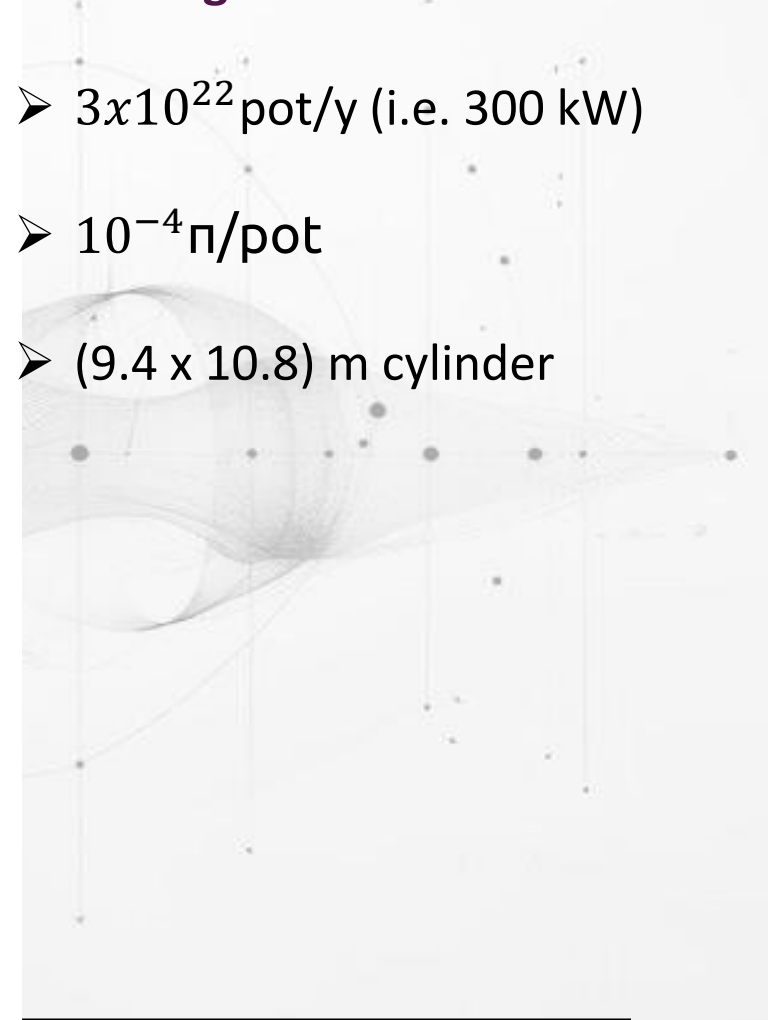
$$P_{\mu\mu} = 1 - \sin^2 2\theta_{24} \sin^2 \frac{\Delta m_{41}^2 L}{4 E}$$

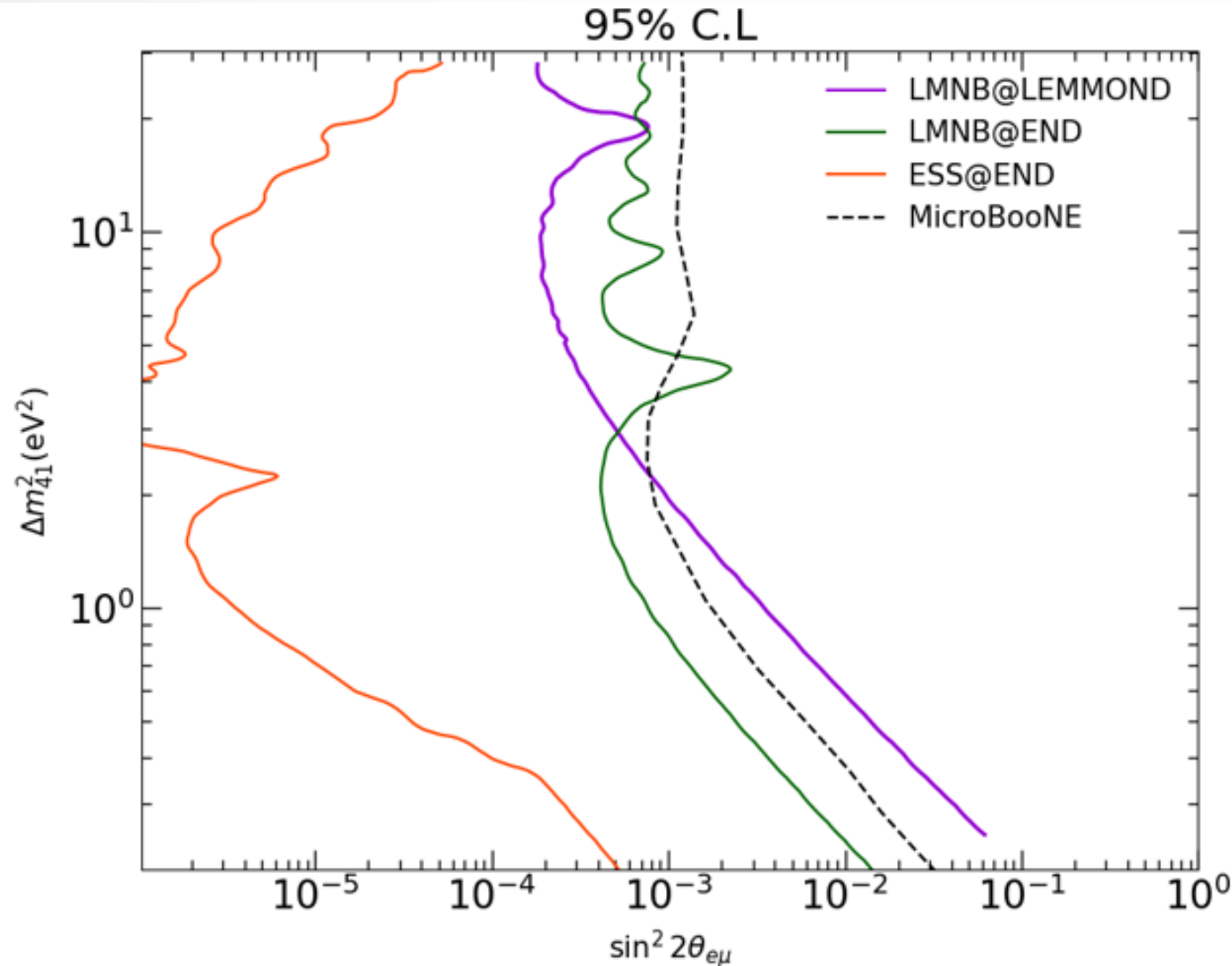
Probability distribution for various $\delta m_{41}^2 + \nu_\mu$ fluxes



Assuming:

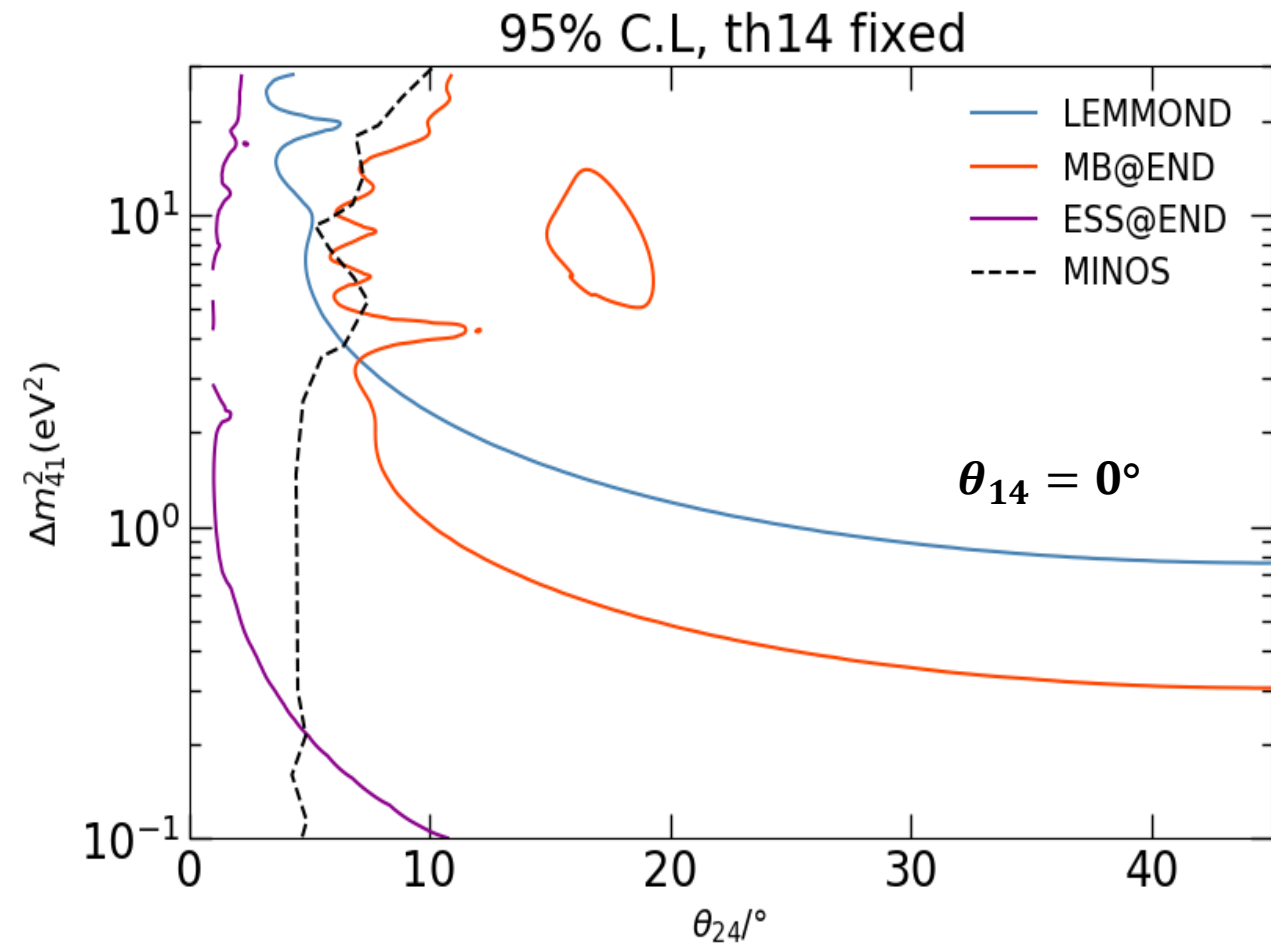
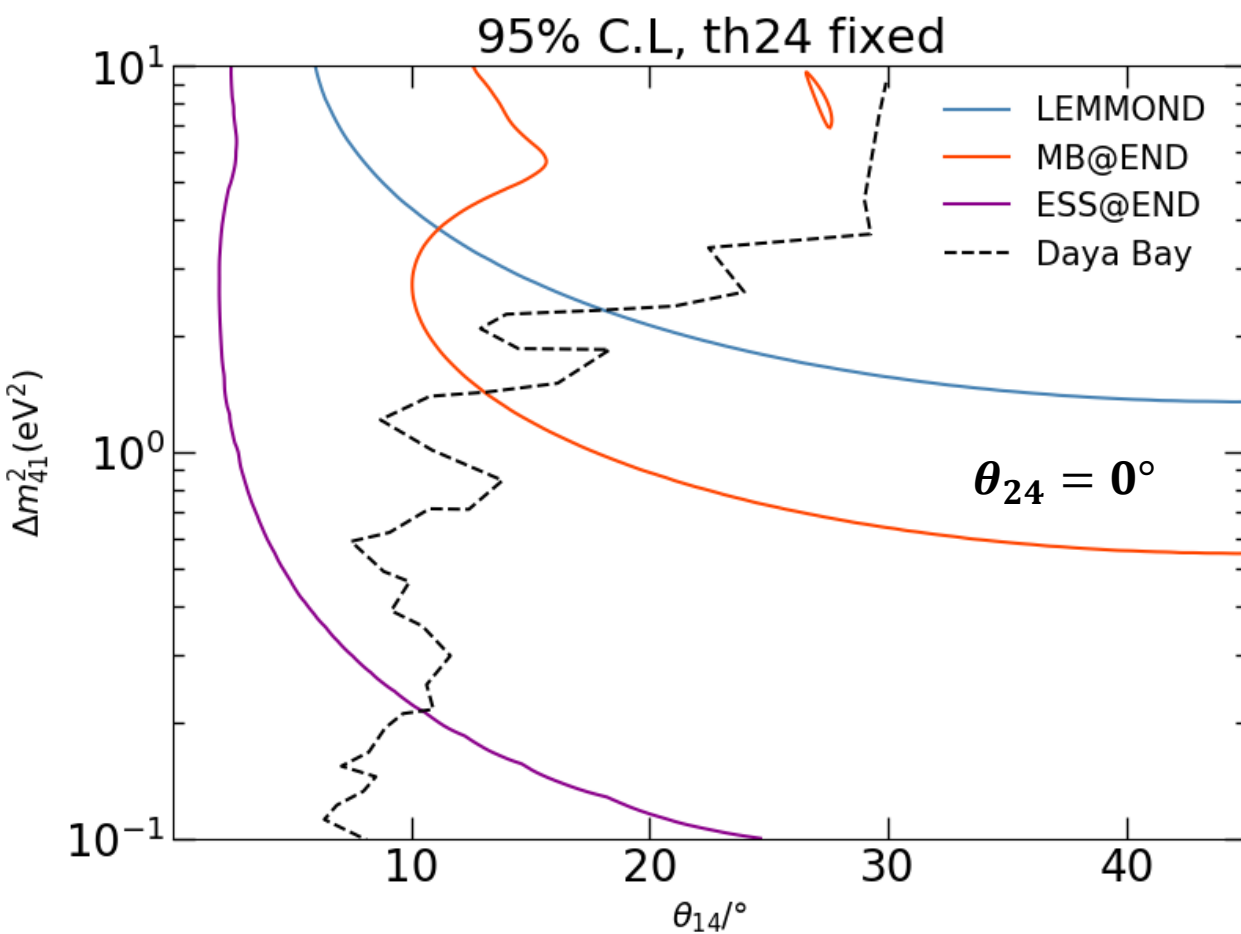
- 3×10^{22} pot/y (i.e. 300 kW)
- 10^{-4} n/pot
- (9.4 x 10.8) m cylinder

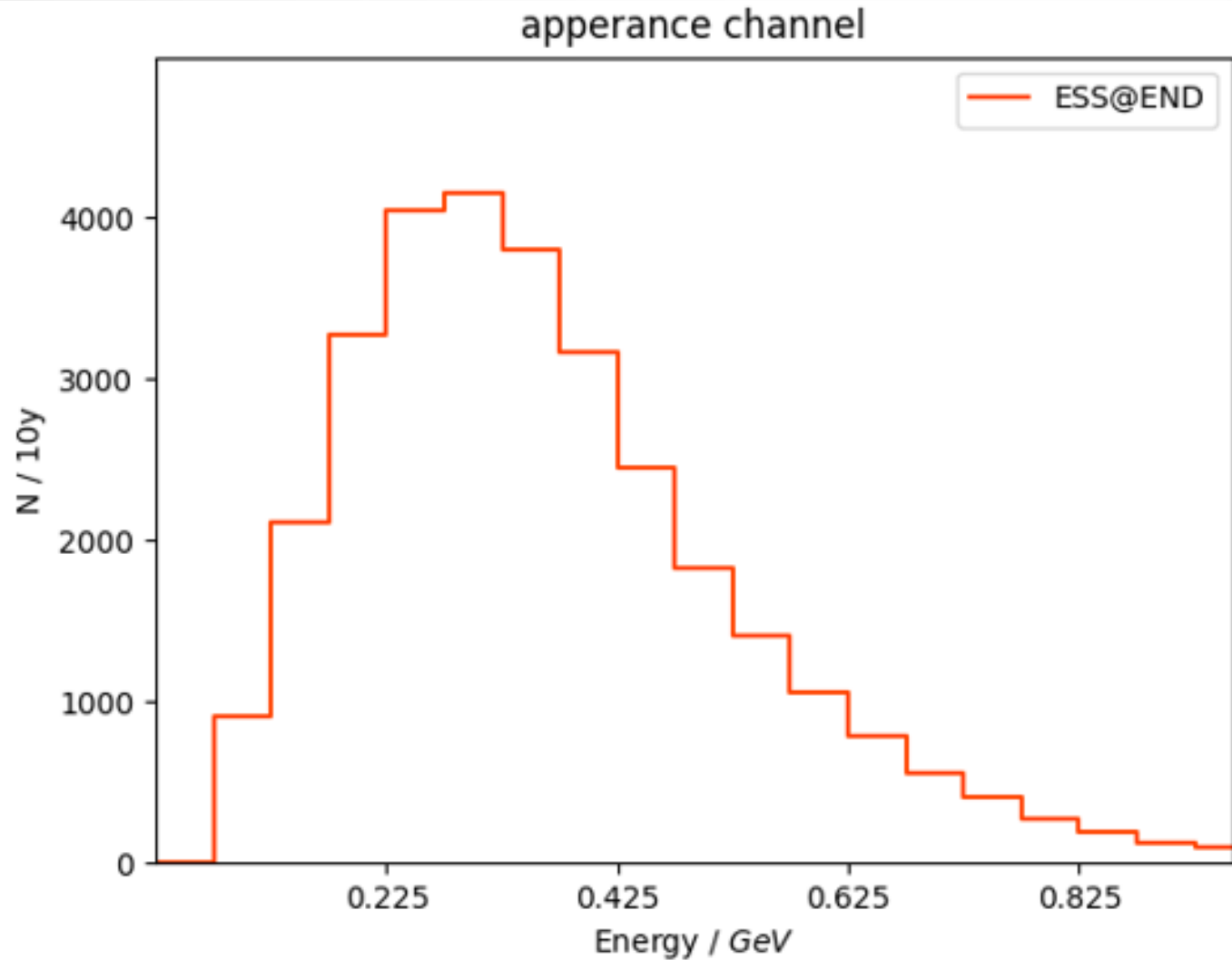




$$\sin^2 2\theta_{\mu e} = \sin^2 2\theta_{14} \sin^2 \theta_{24}$$

- L (LEMMOND) = 50 m
- L (END) = 250 m
- Migration matrices/efficiencies as FD
- Exposure 10 y
- Mass : 500 t (LEMMOND)
750 t (END)
- MicroBooNE bound: ([2210.10216 \(arxiv.org\)](https://arxiv.org/abs/2210.10216))



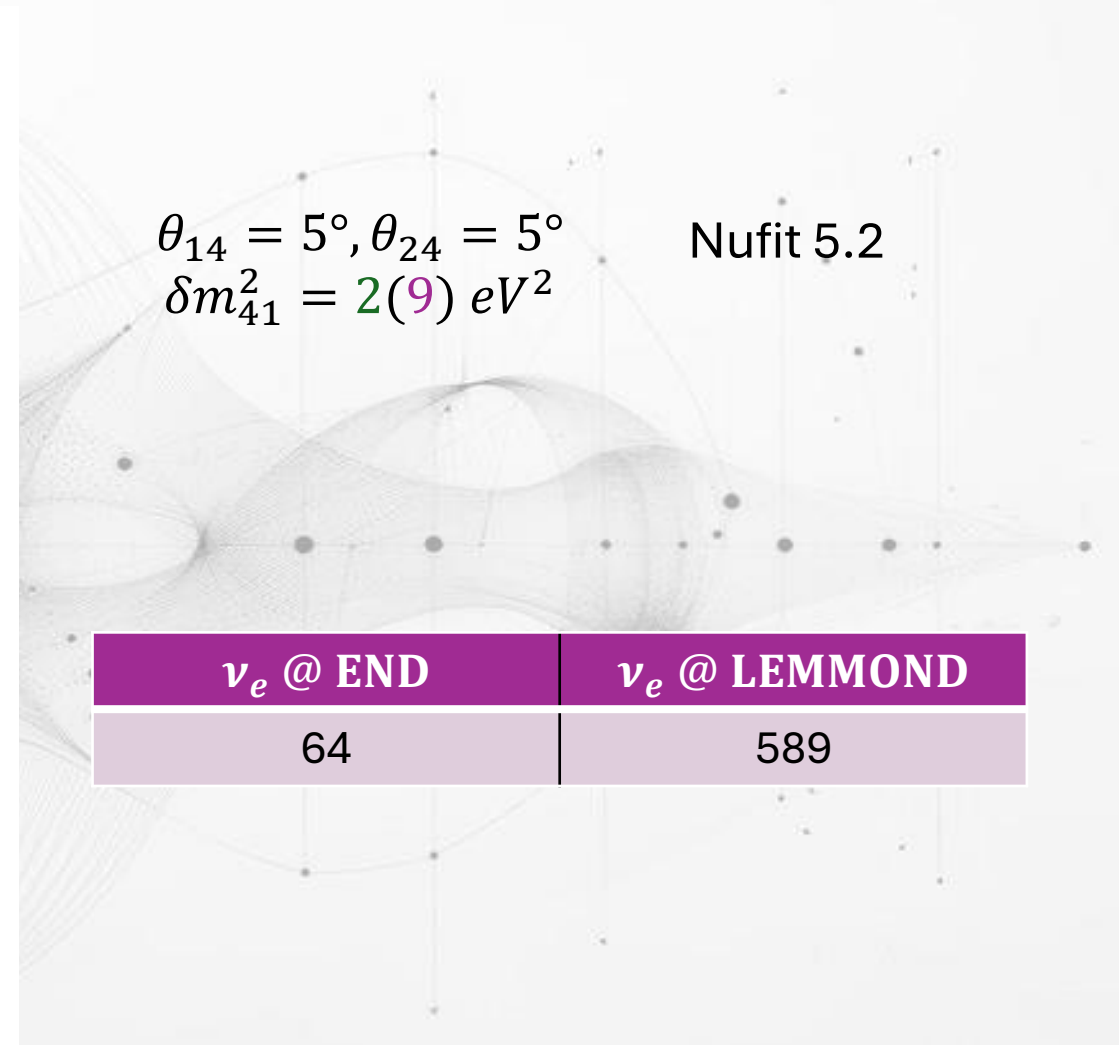
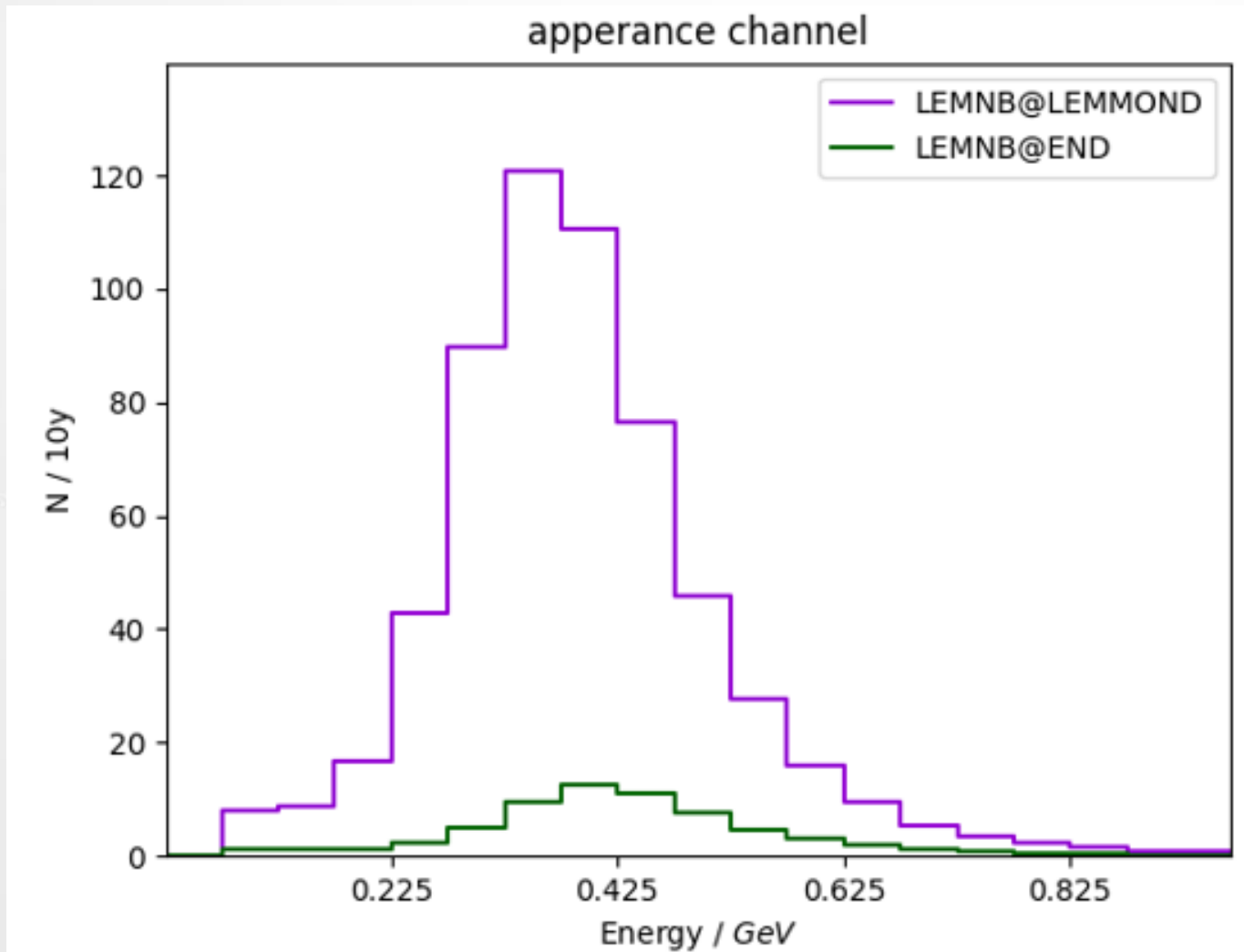


$$\theta_{14} = 5^\circ, \theta_{24} = 5^\circ$$
$$\delta m_{41}^2 = 1 \text{ eV}^2$$

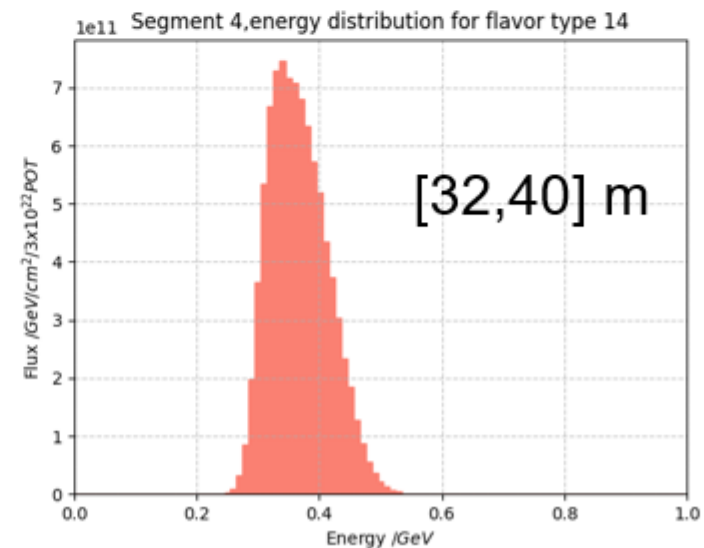
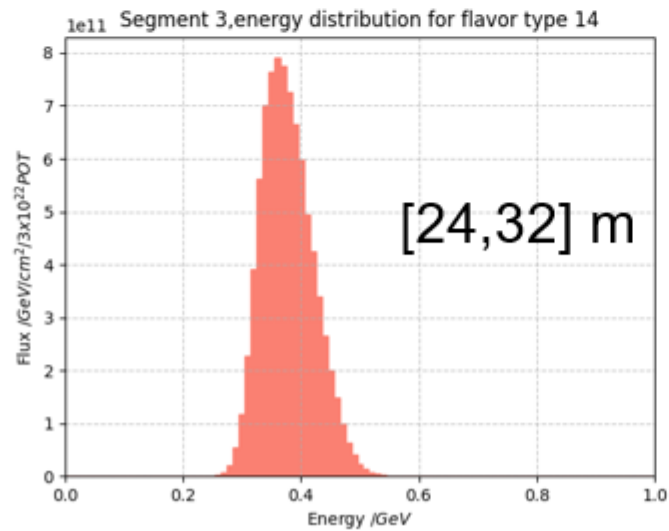
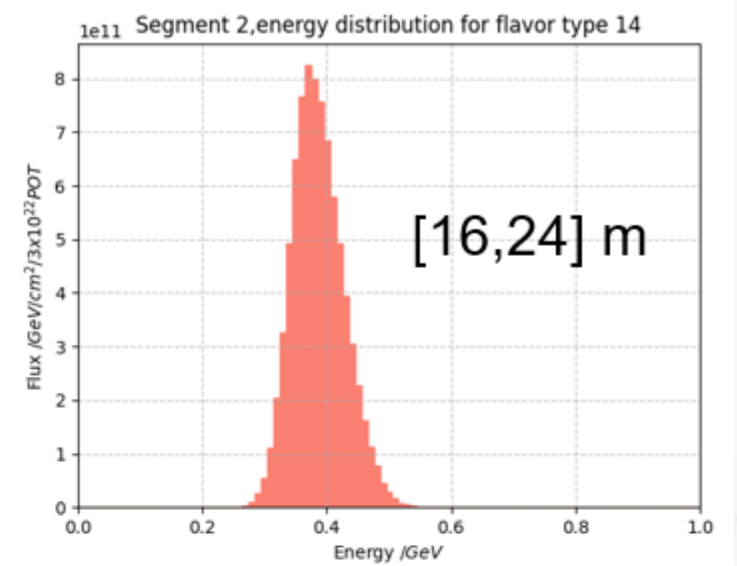
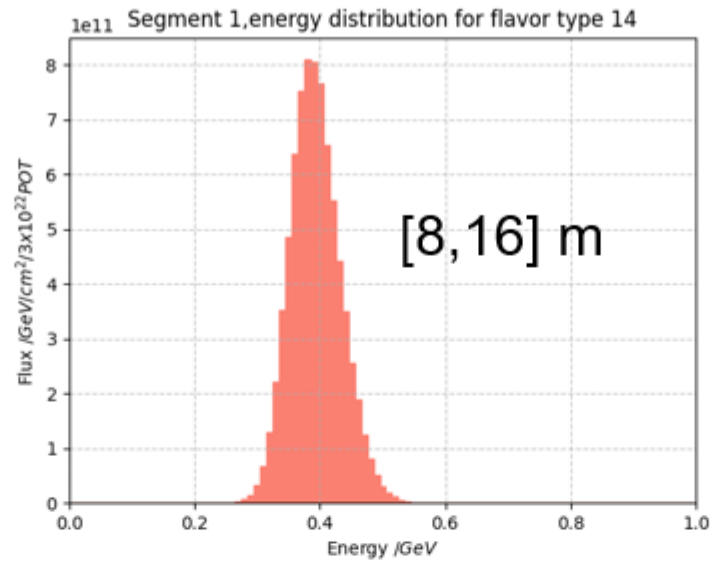
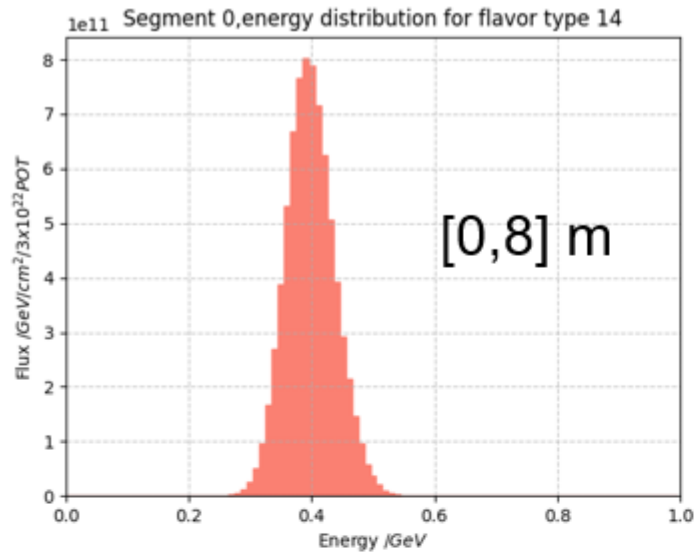
Nufit 5.2

ν_e

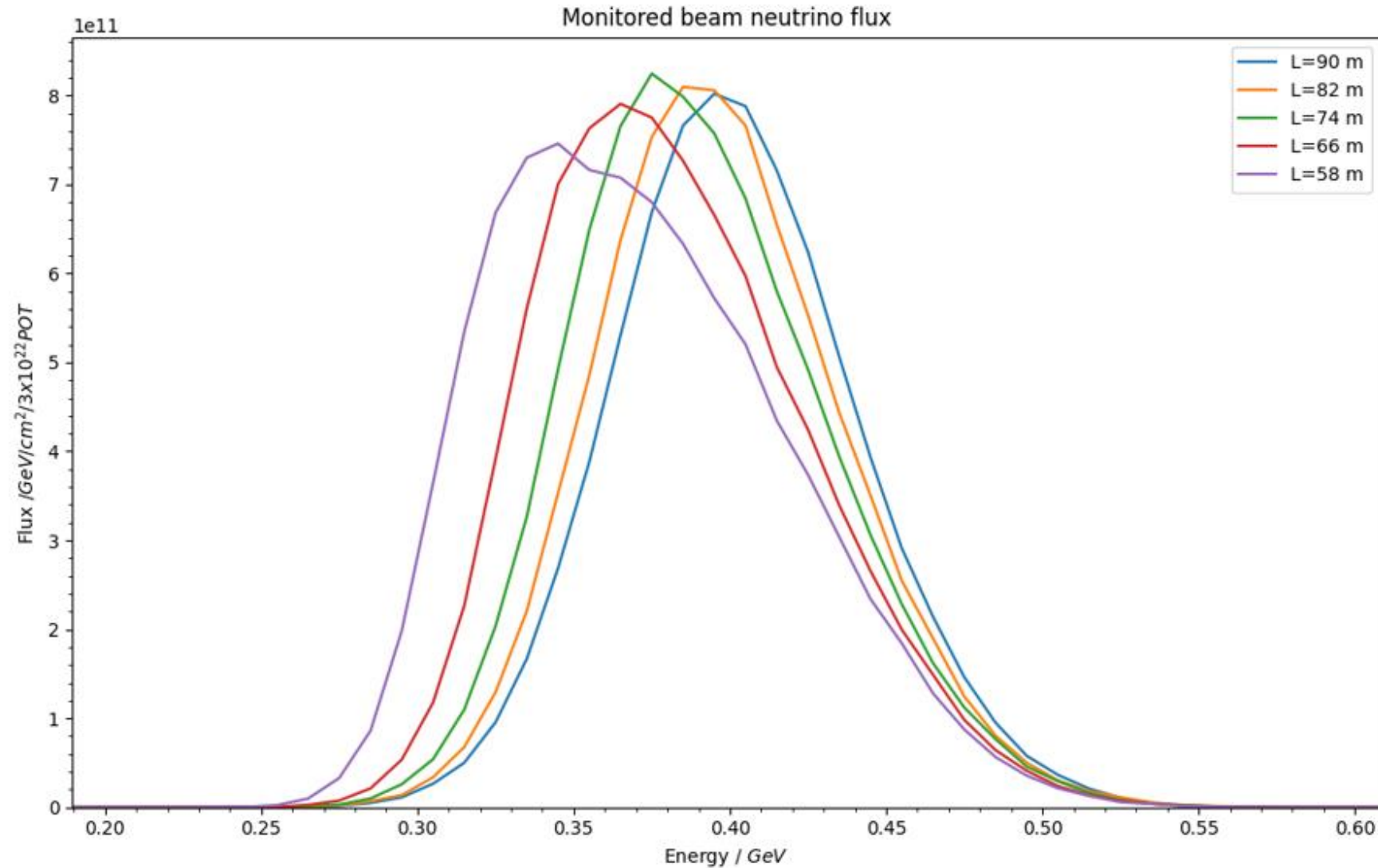
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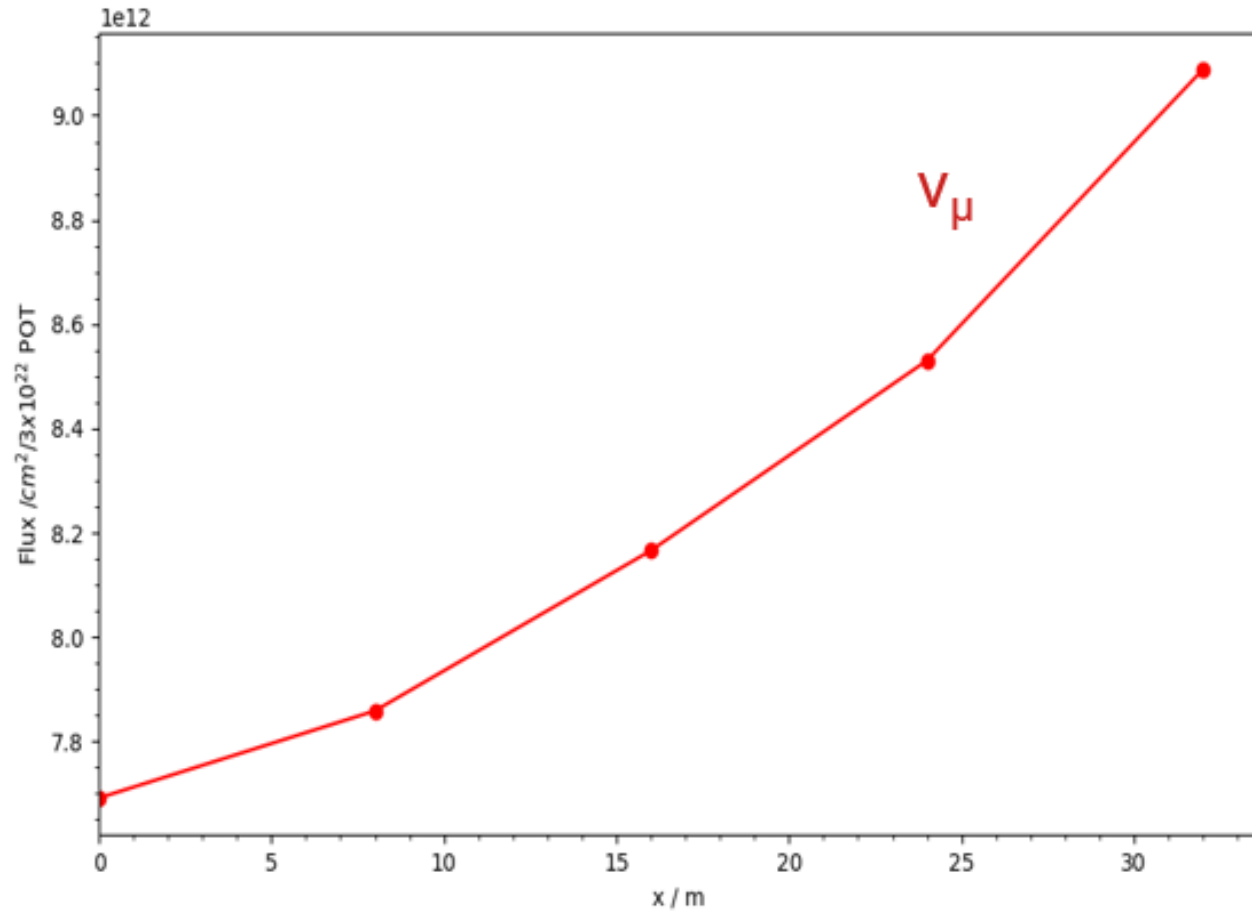
LEMNB - segmented production tunnel



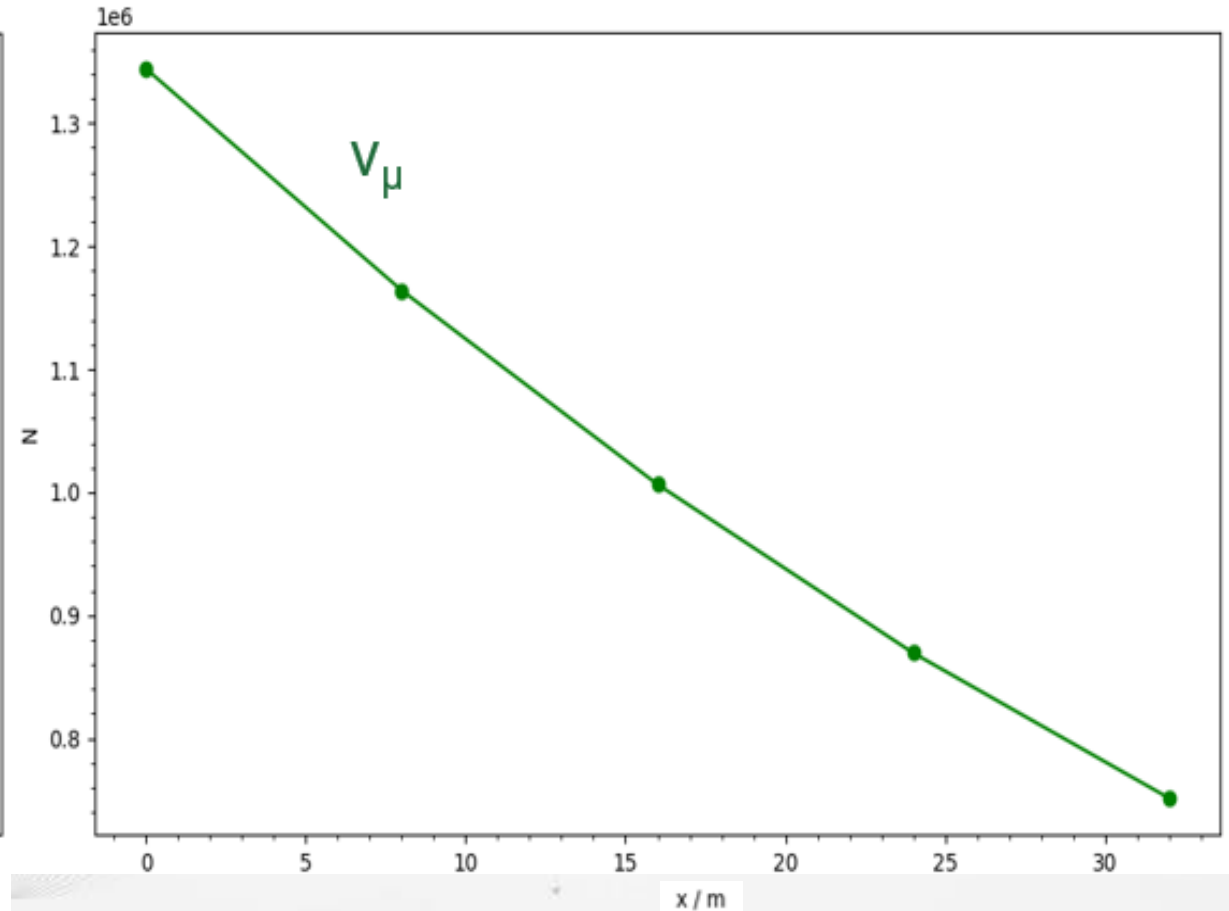
LEMNB - segmented production tunnel - FLUX



LEMNB - segmented production tunnel - FLUX

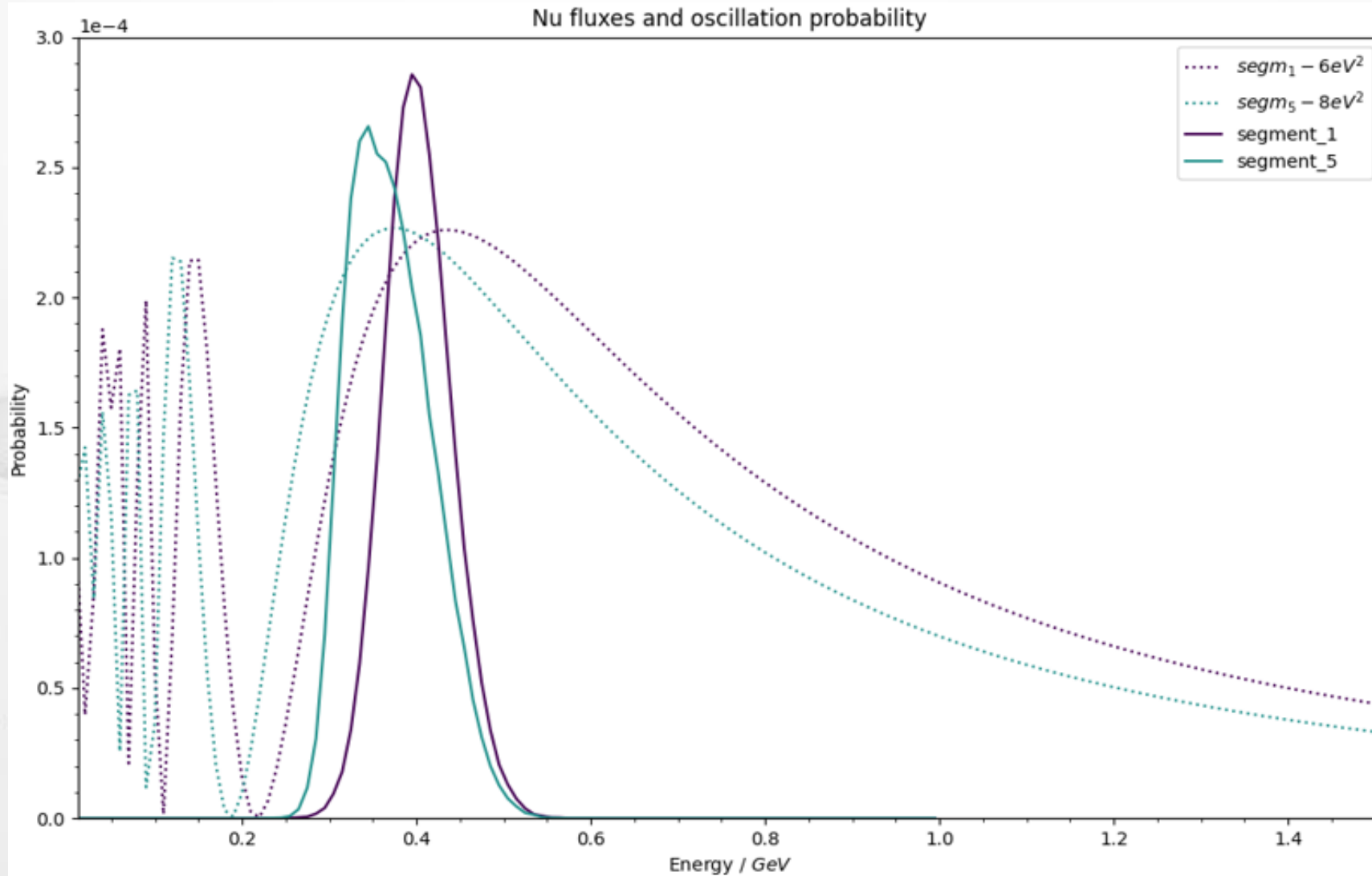


With detector

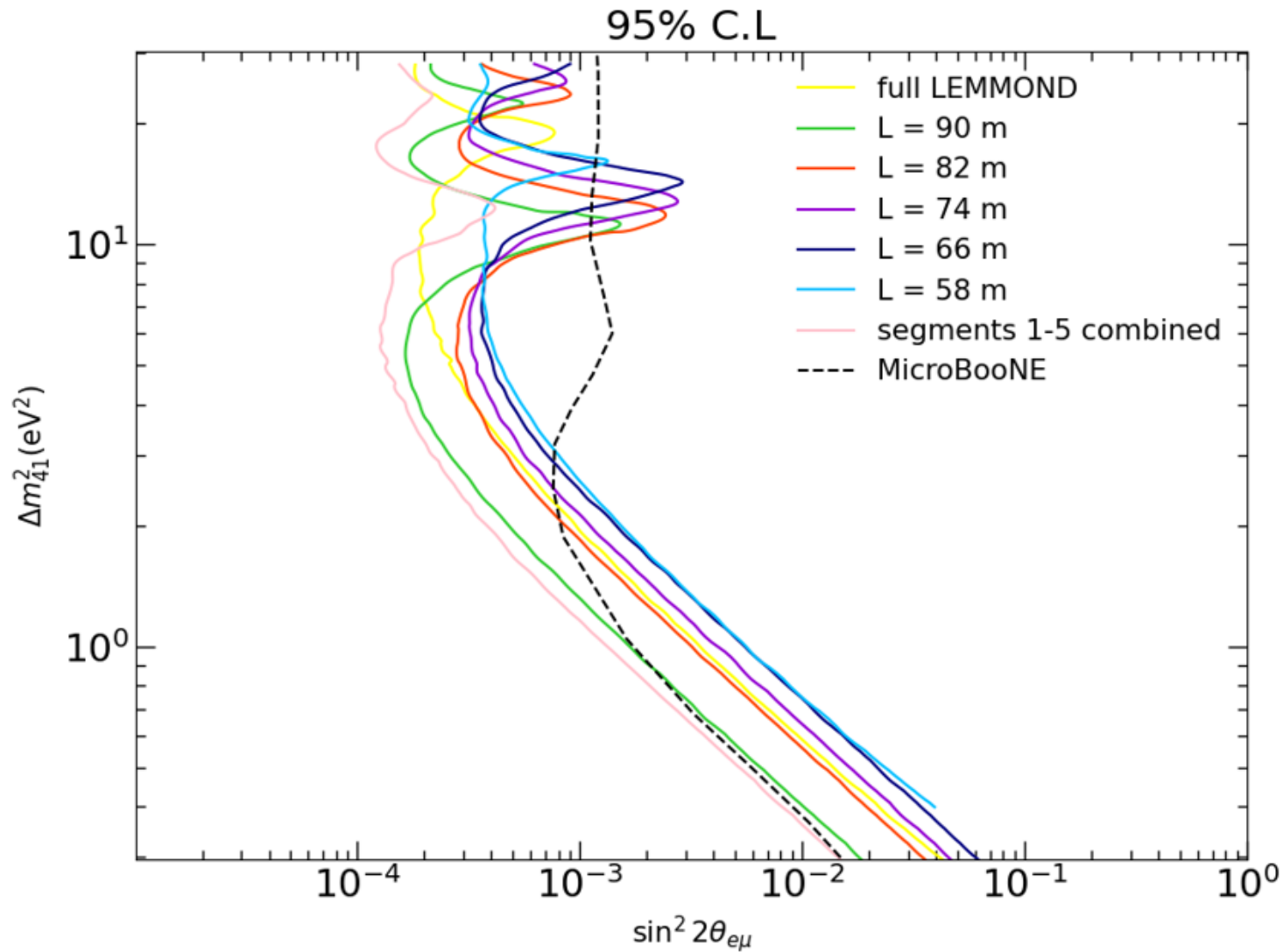


Without detector

LEMNB - segmented production tunnel - PROBABILITY



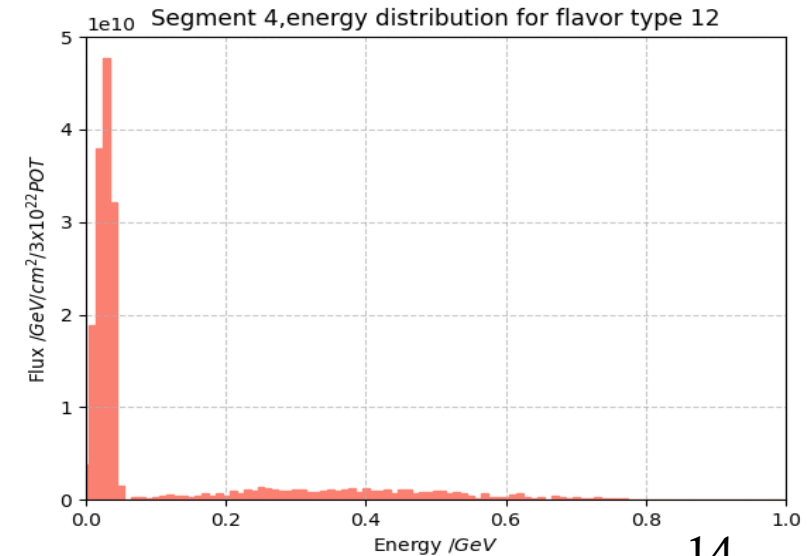
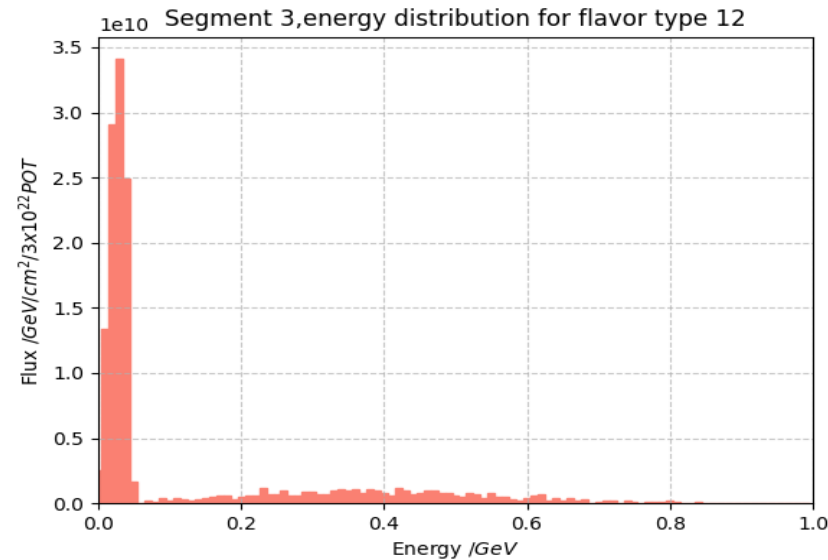
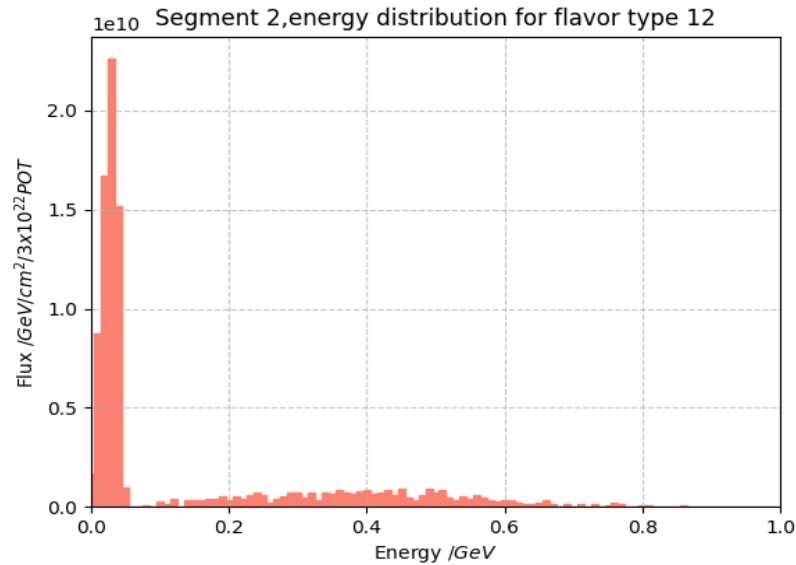
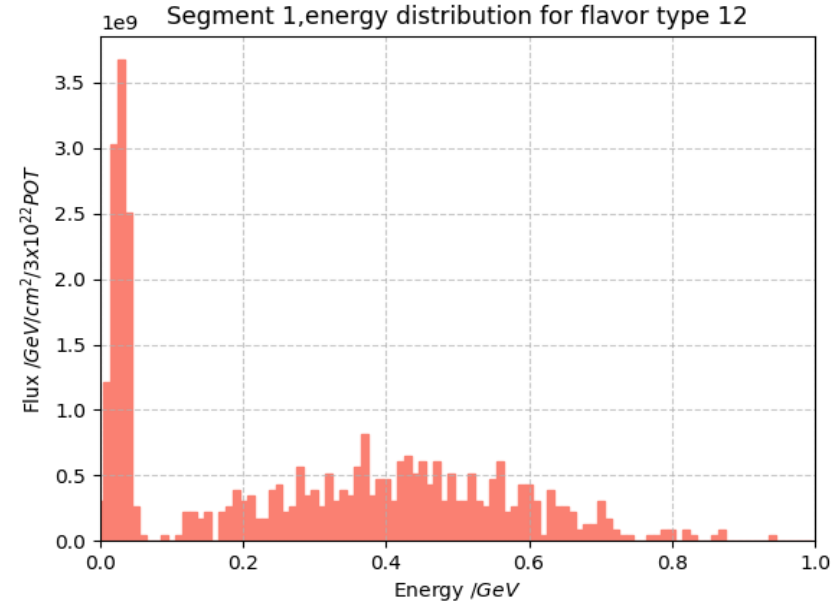
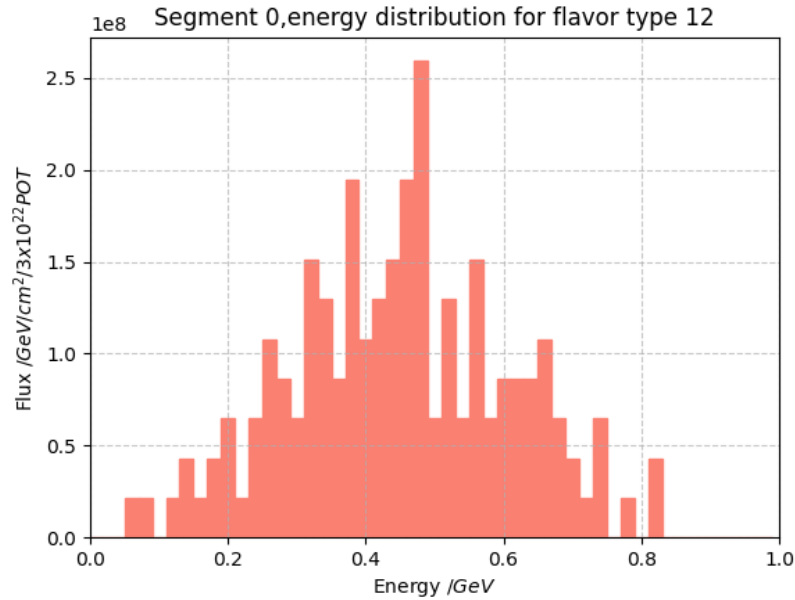
LEMNB - segmented production tunnel - SENSITIVITY



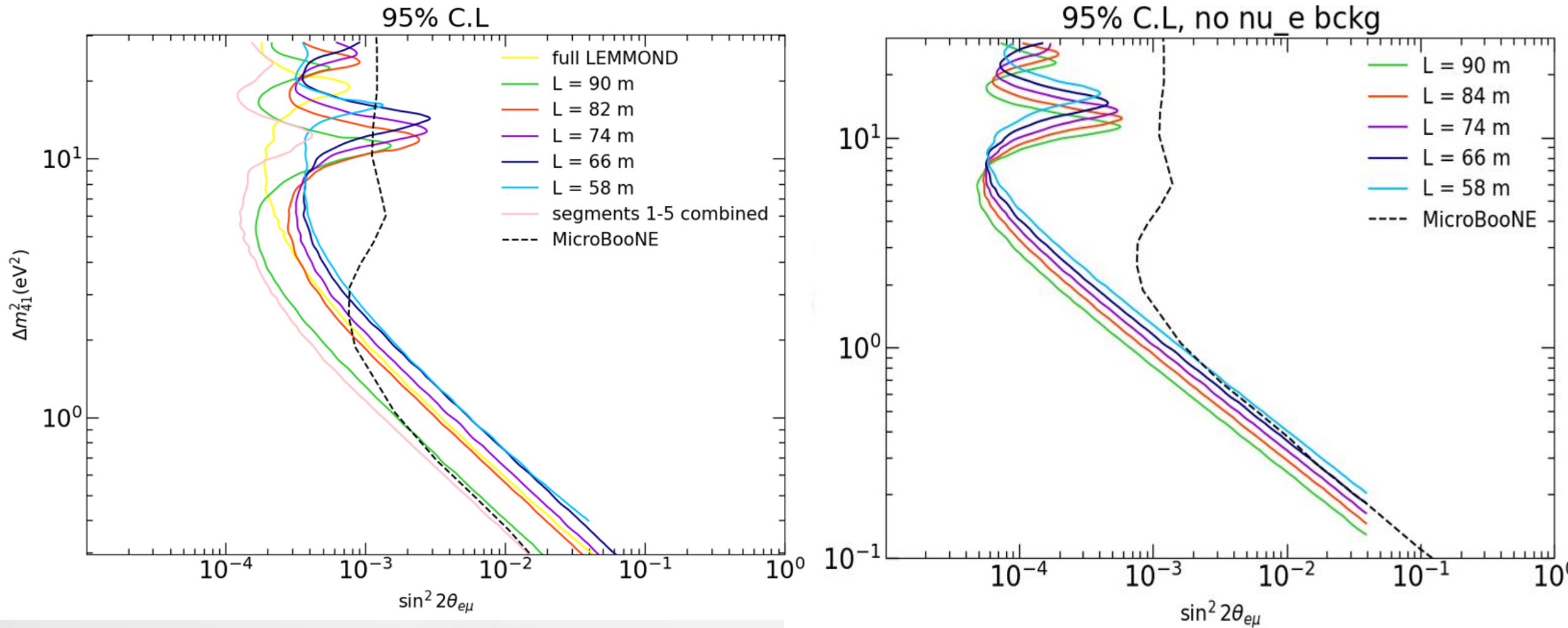
$$\sin^2 2\theta_{\mu e} = \sin^2 2\theta_{14} \sin^2 \theta_{24}$$

- Migration matrices/efficiencies as FD
- Exposure 10 y
- Mass : 500 t

LEMNB - segmented production tunnel - ν_e BCKG



LEMNB - segmented production tunnel - SENSITIVITY



- Include antineutrino flux
- Investigate muon neutrinos production points along the tunnel (detector role)
- Understand sensitivity of the segmented flux (combining multiple experiments in GLoBES)
- Understand sensitivity in δm_{41}^2 vs. $\theta_{14} / \theta_{24}$ plane
- Analysis with the LEnuSTORM flux



Thank you!