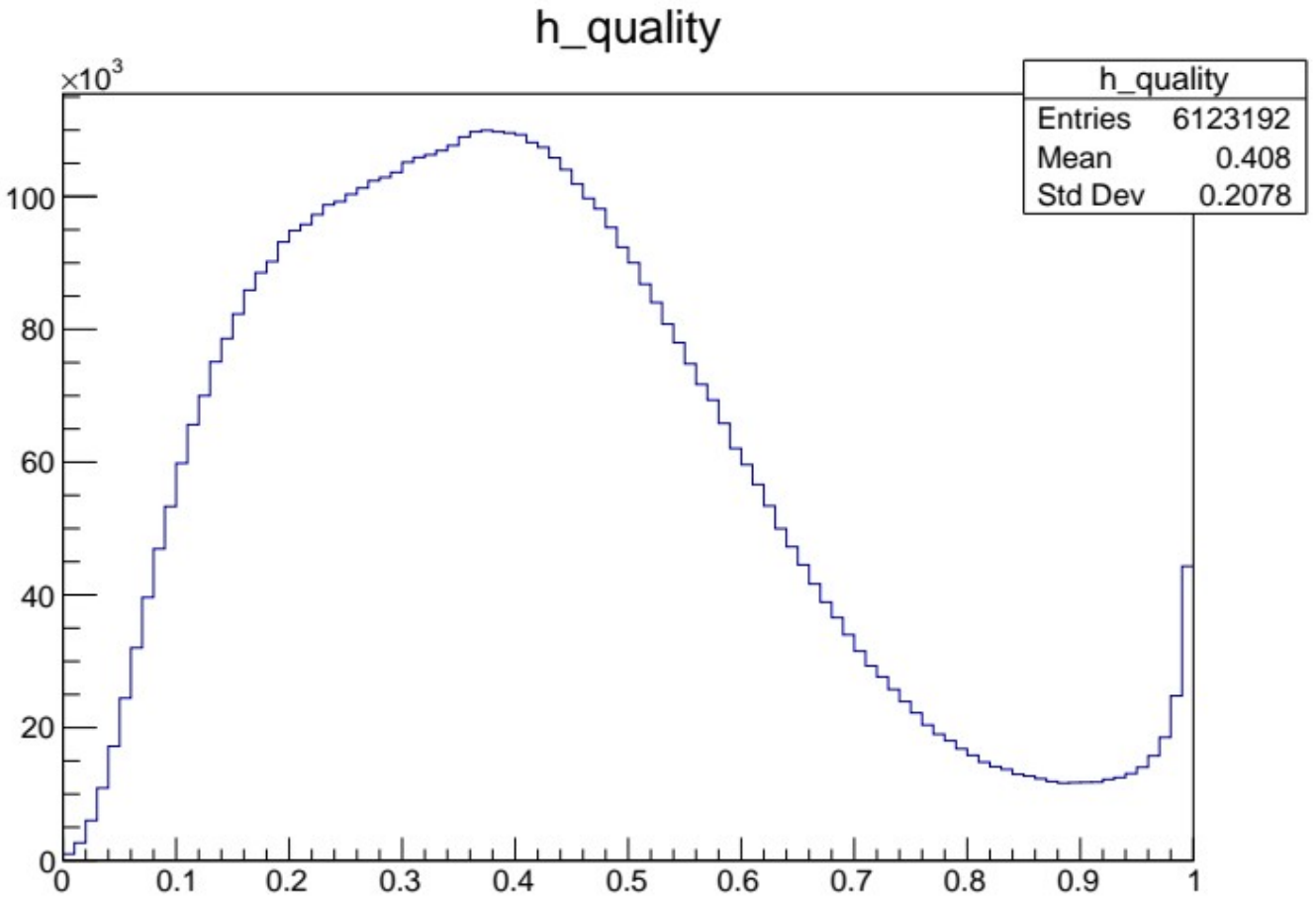
# Improving KM3NeT’s event classification with Deep Learning

Final results and conclusions

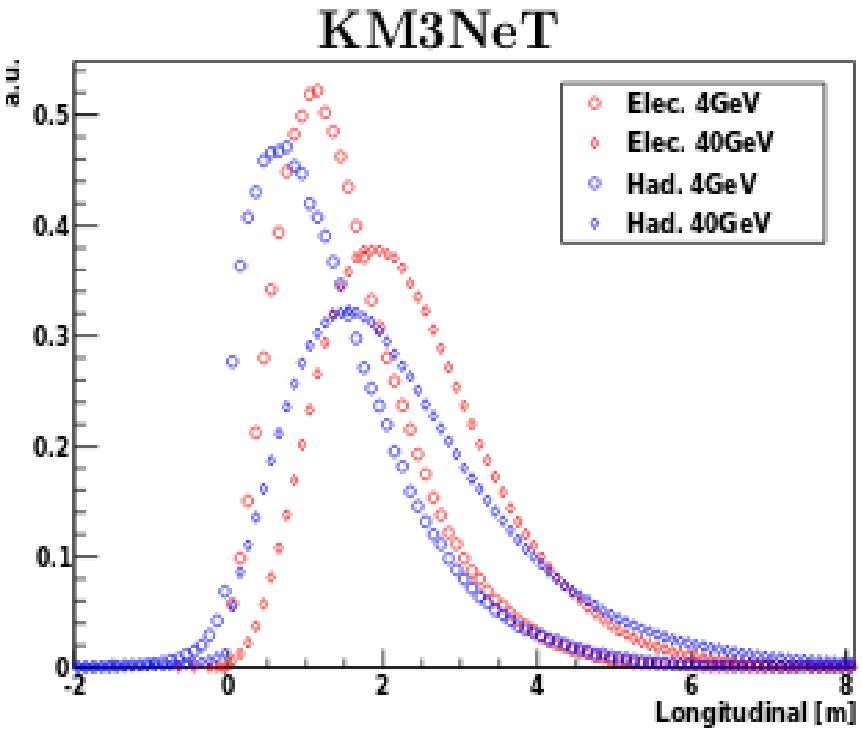
**Premise: We can do better IN T-S classification and we can do better THAN T-S classification.**

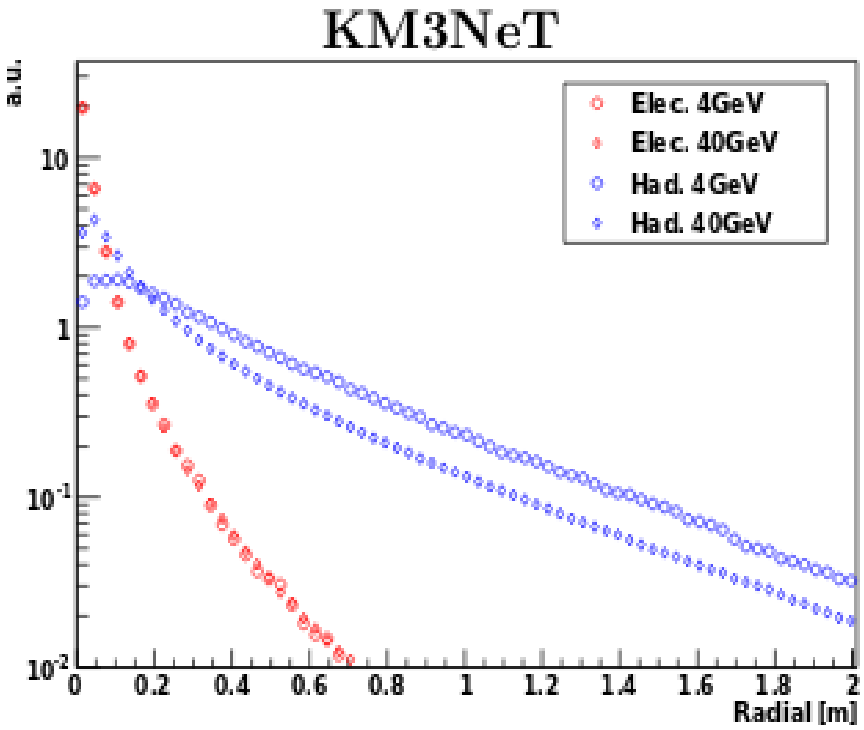
# Track – Shower current id




Source: Lodewijk Nauta (KM3NeT)

# But ORCA has some more resolution



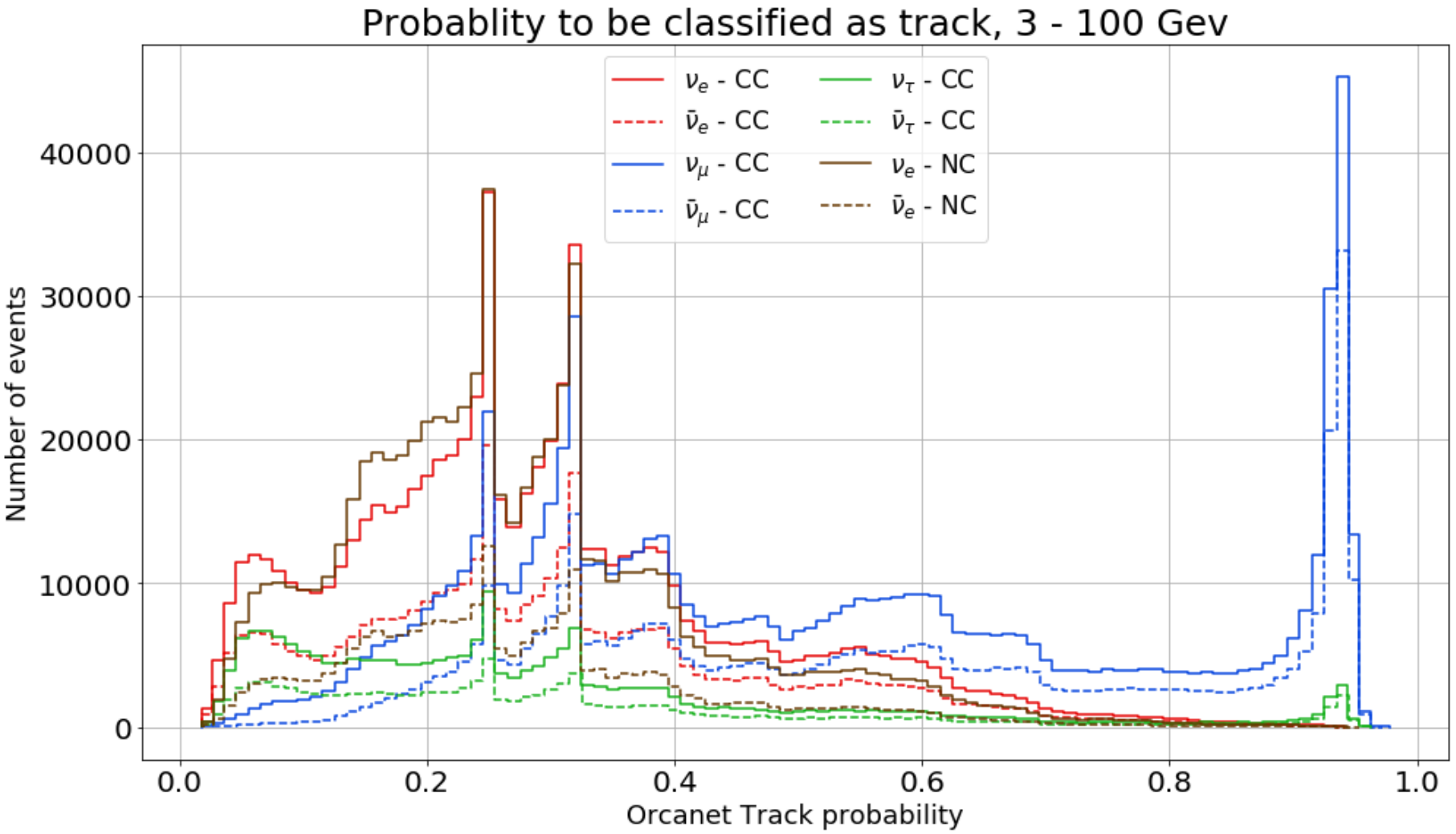

ORCA’s Light emission profiles,
from Letter of Intent (2016)

**Let’s try something else.**

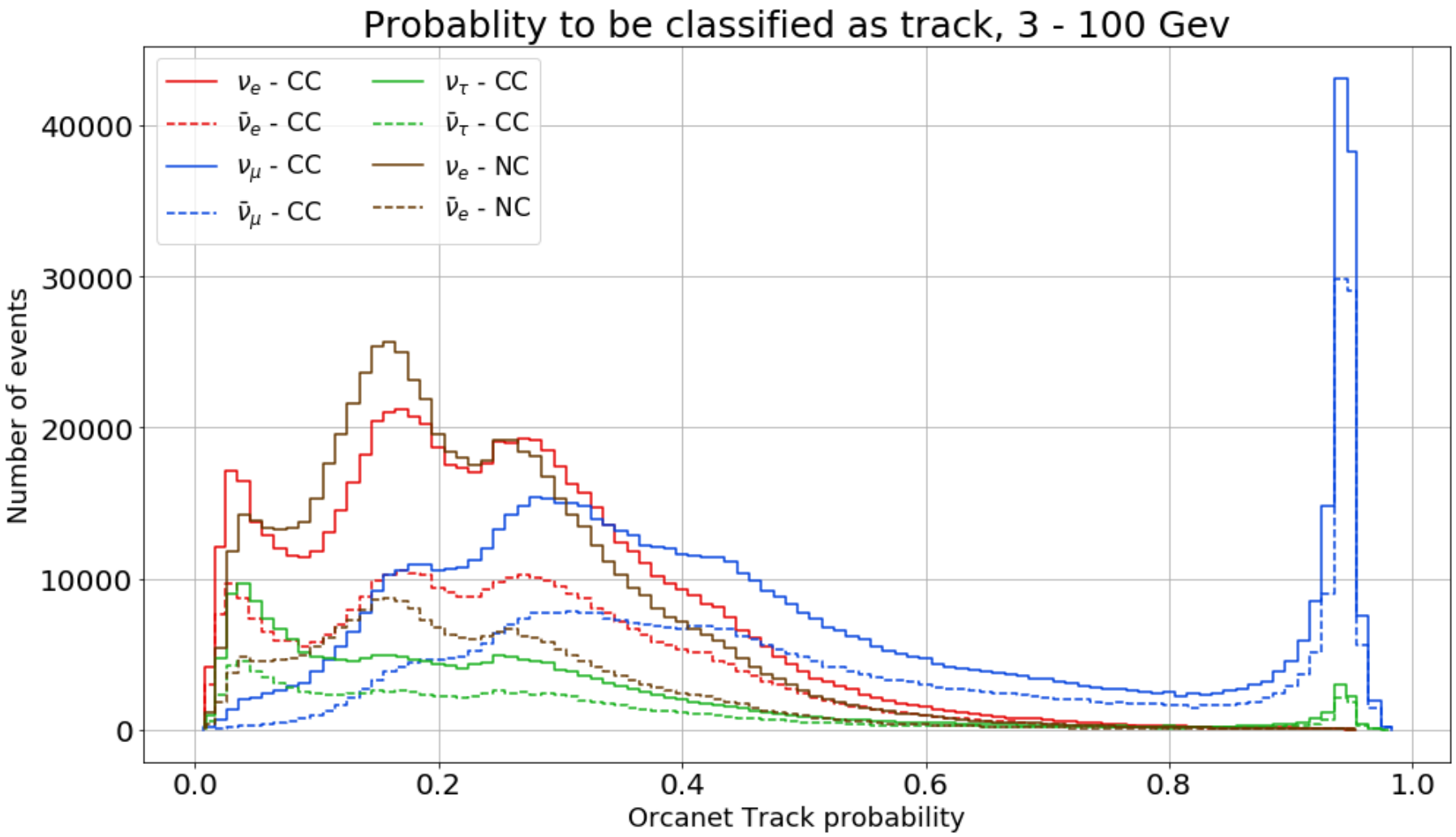
**3 cat: mu-CC, e-CC, else.**

**4 cat: e-CC, mu-CC, tau-CC, NC**

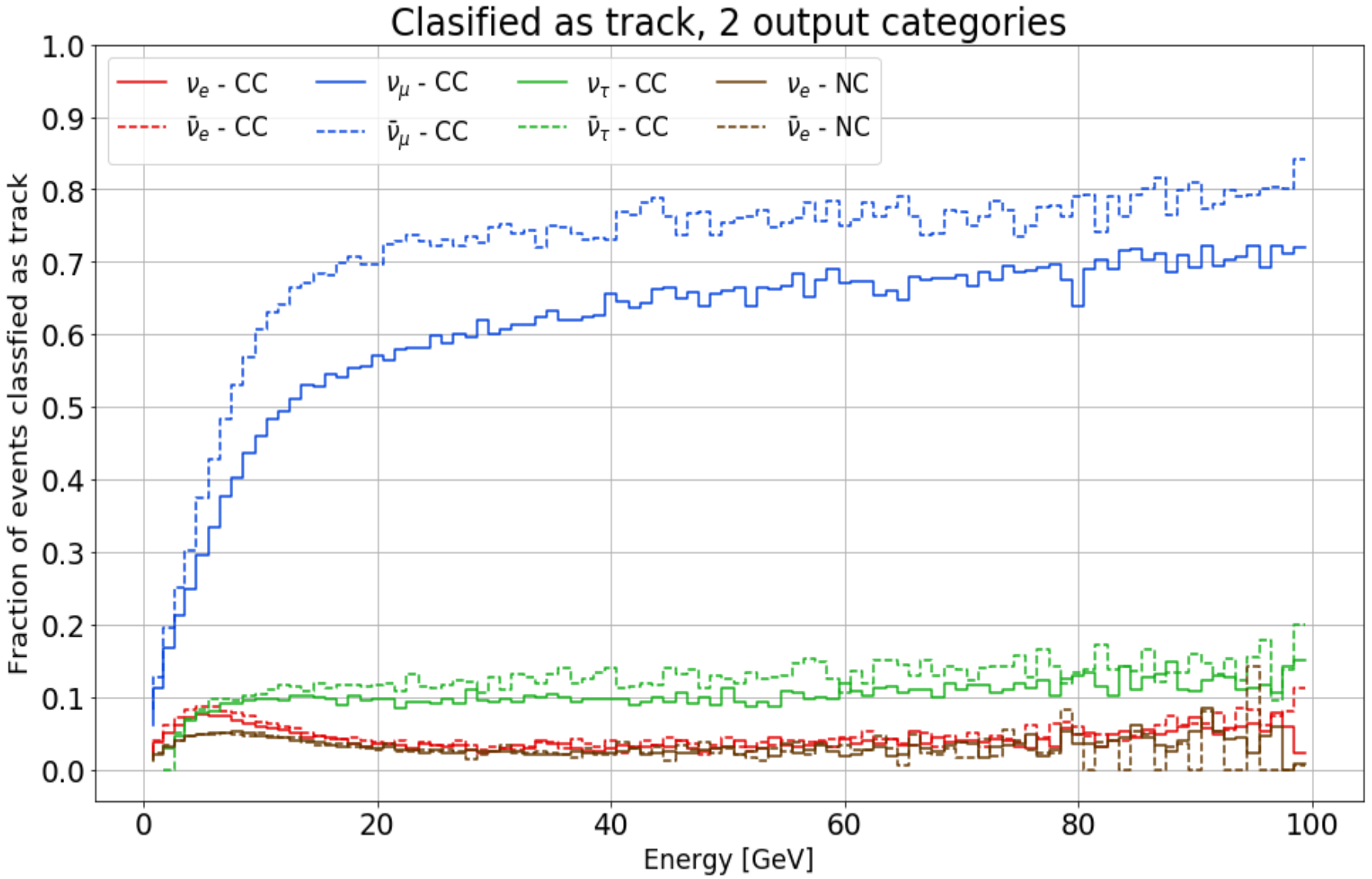
# Prediction output, 2 categories



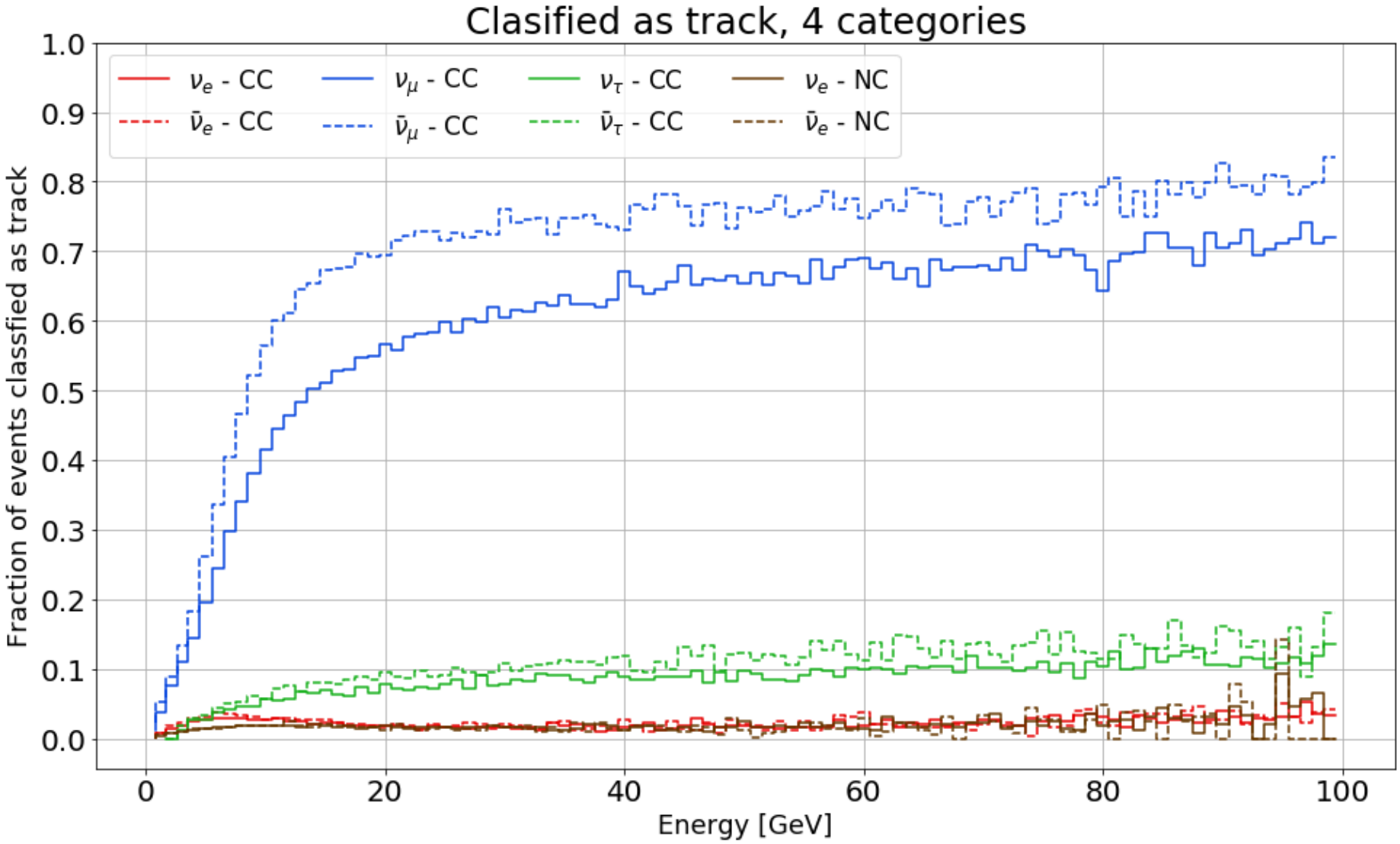
# Prediction output, 4 categories



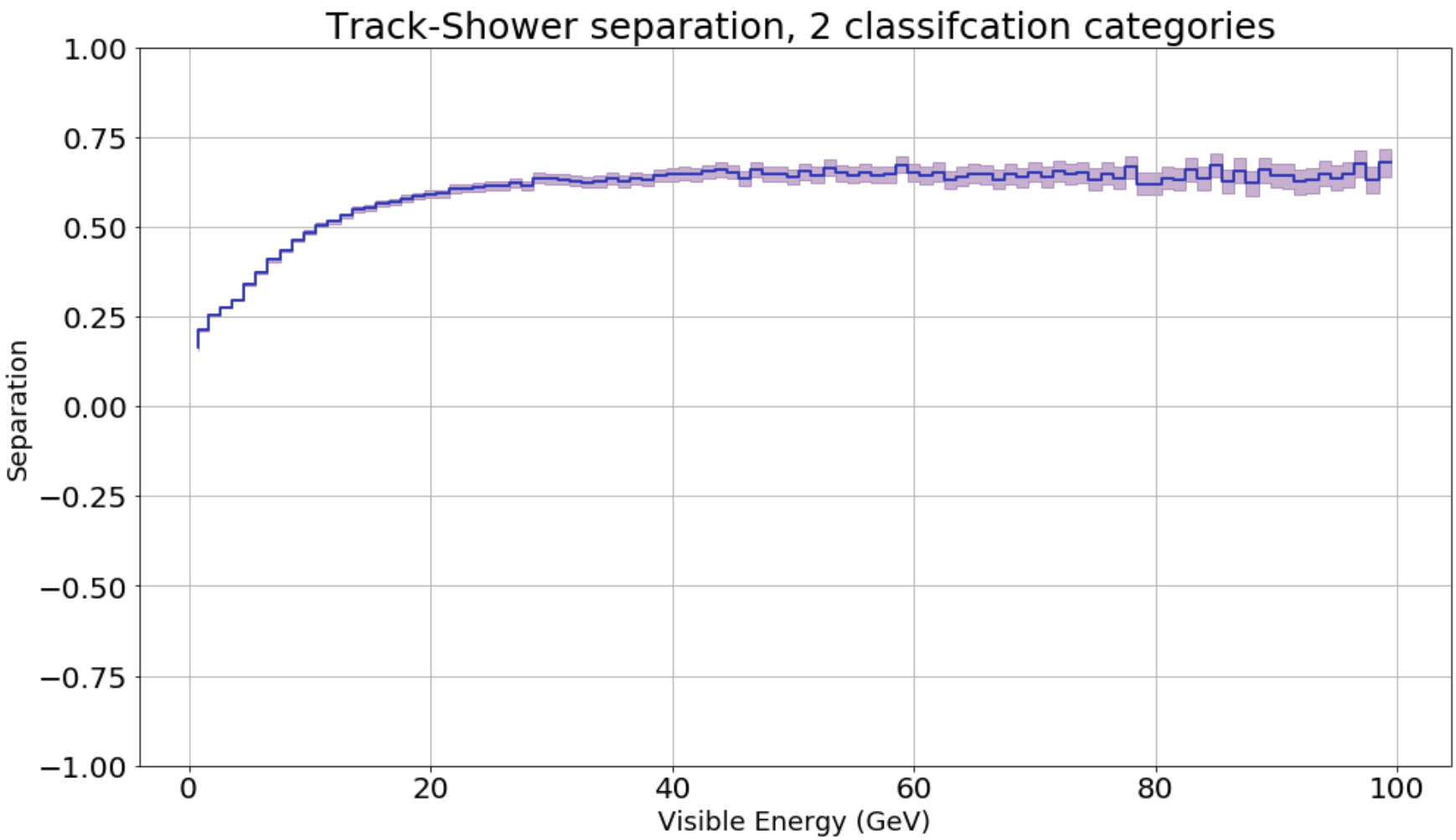
# Energy distribution, 2 categories



# Energy distribution, 4 categories

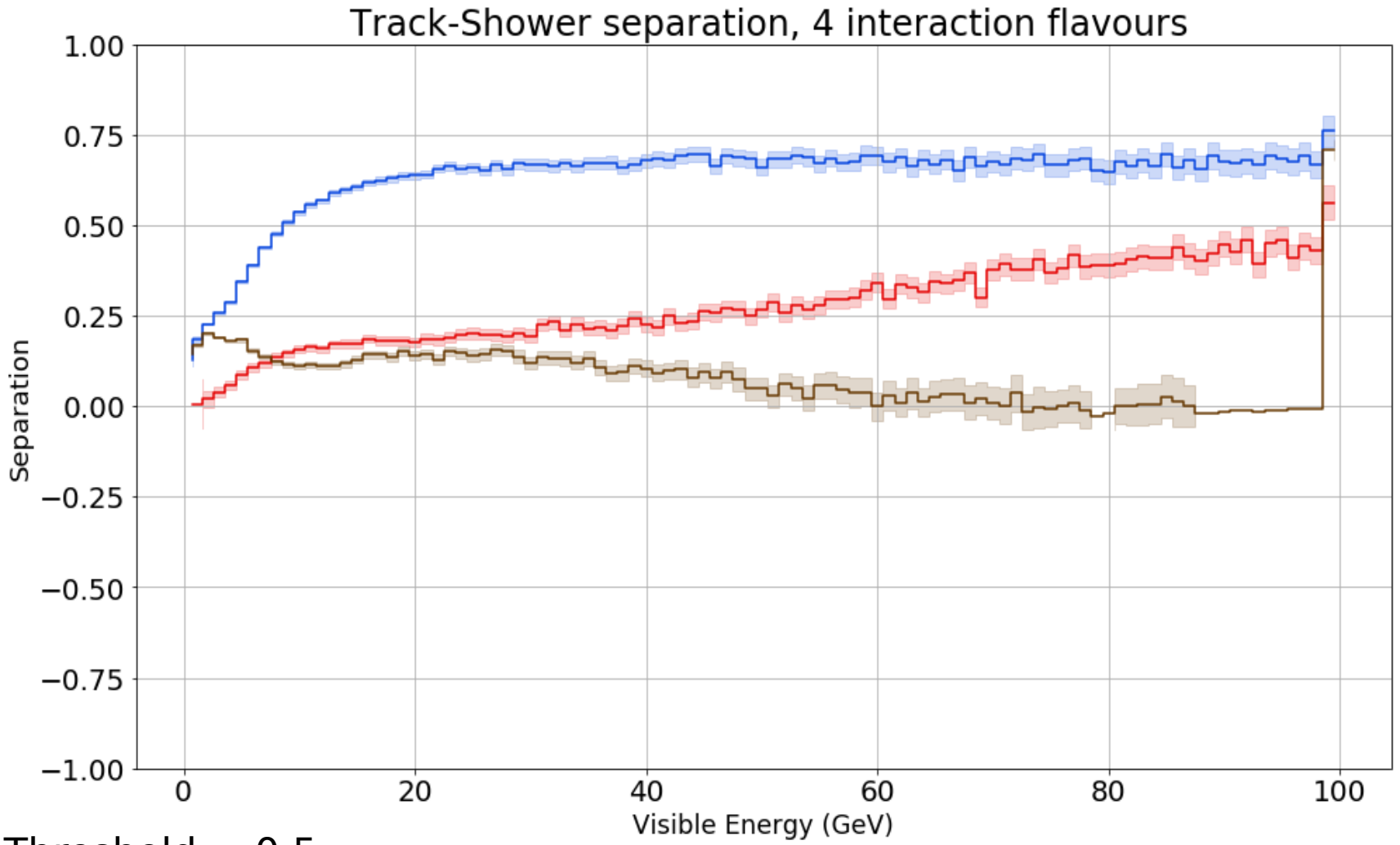


# Correlation, 2 categories



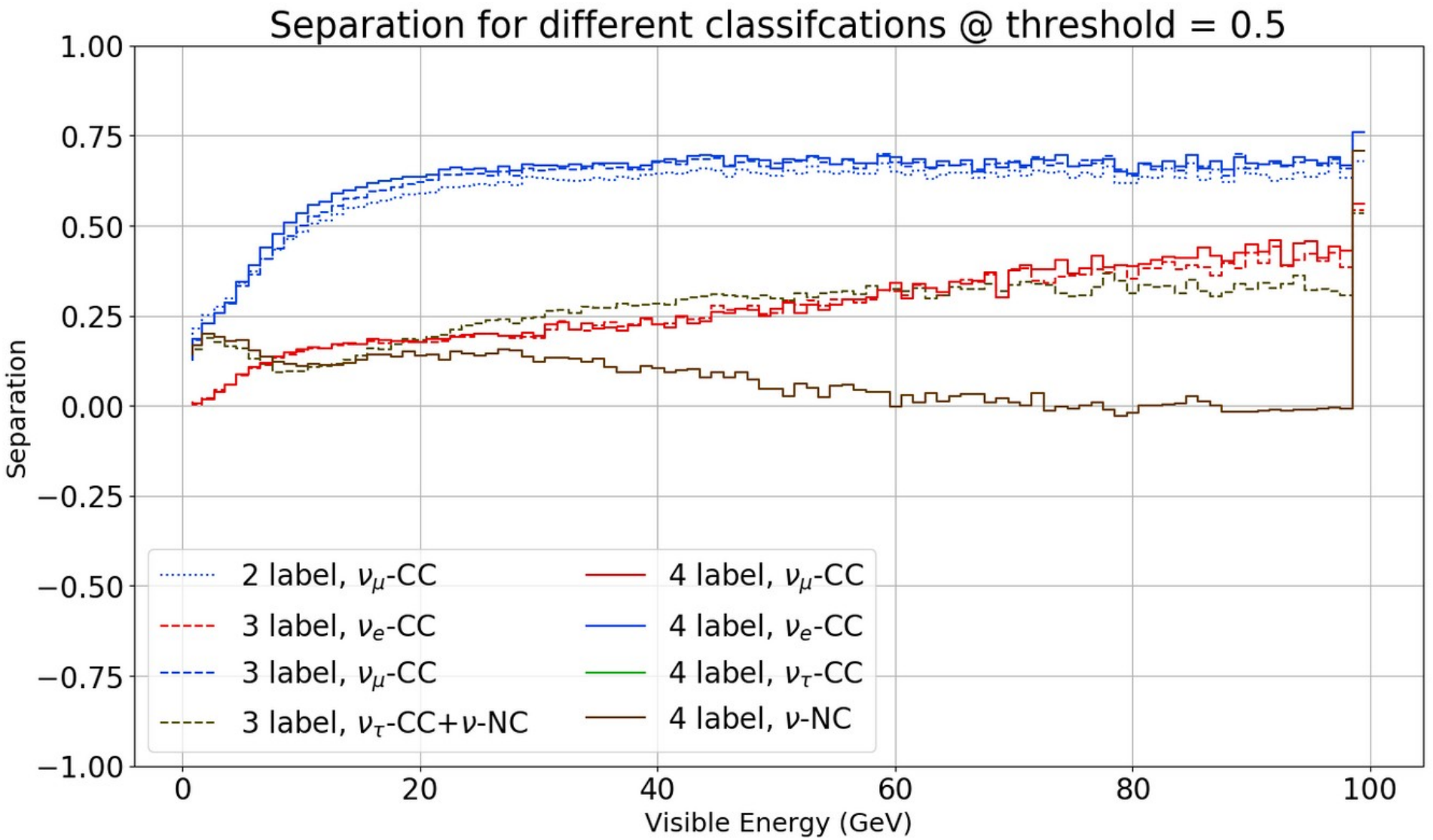

Threshold = 0.5

# Correlation, 4 categories

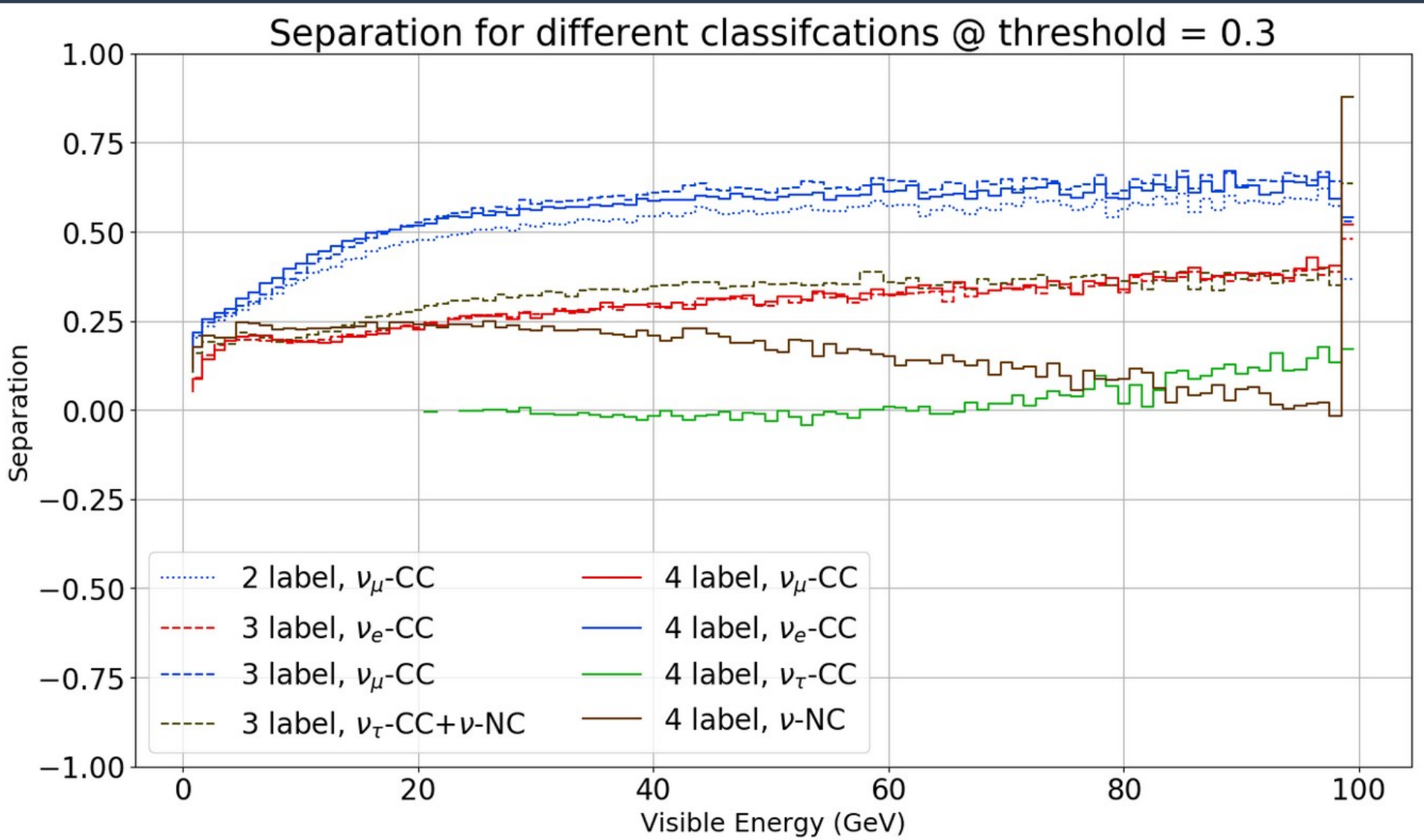



Threshold = 0.5

# Category comparison

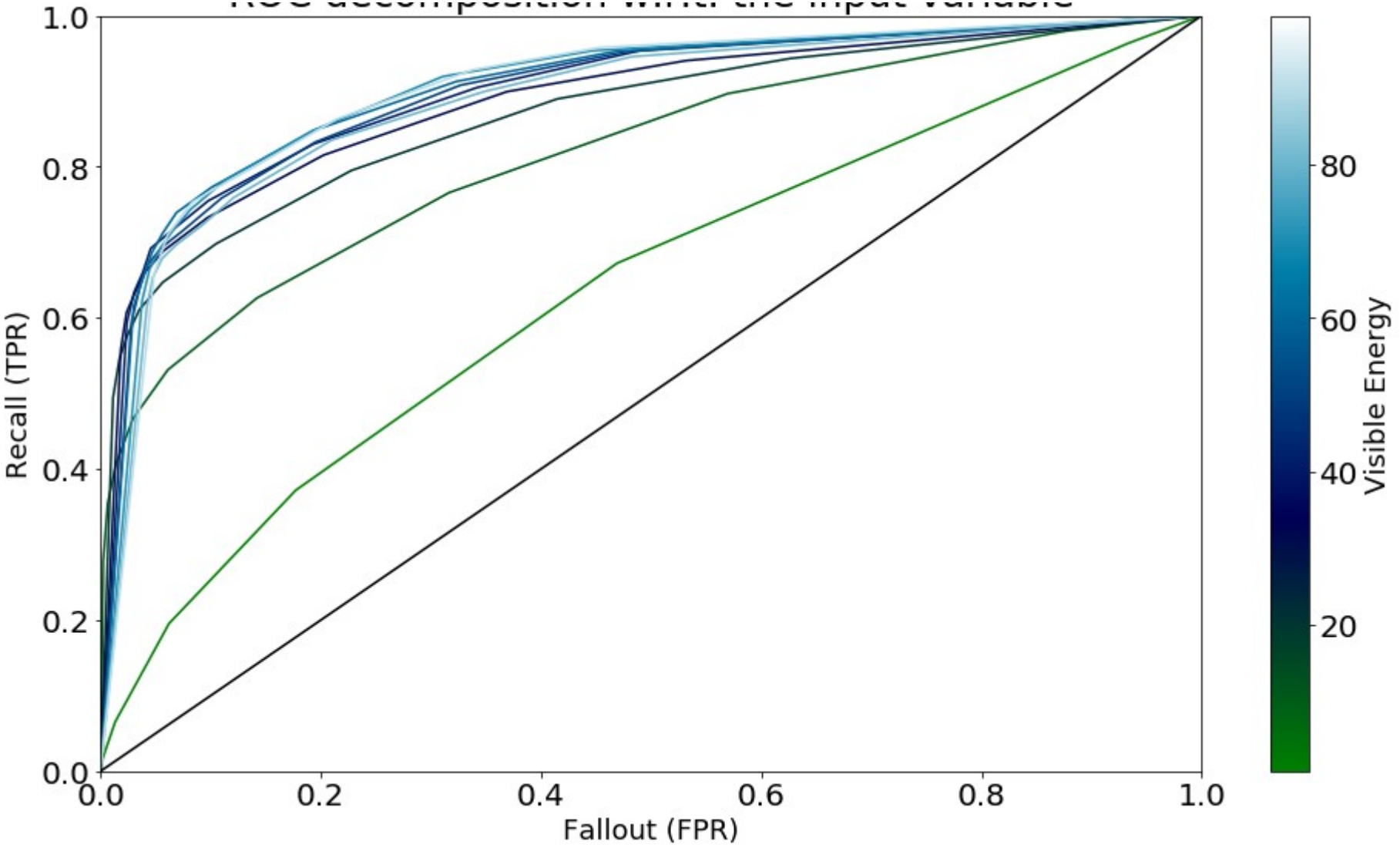


# Category comparison

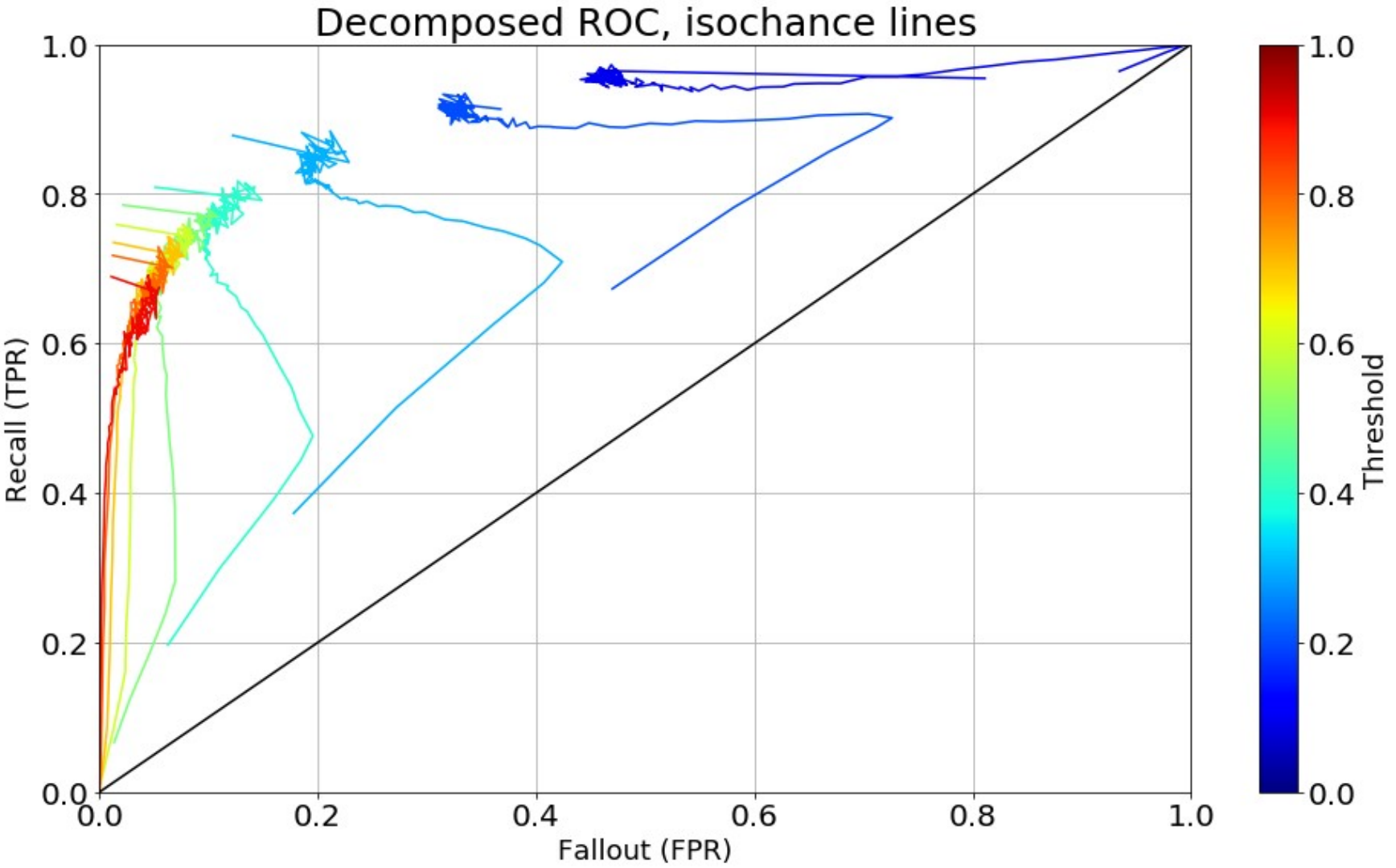


**So what is the best threshold?**

# ROC – Isoenergy curves



# ROC – Isothreshold curves



# Main conclusions:

**Improved separation IN 2 categories.**

Improved separation for tracks, all other factors equal.

**4 category separation is better THAN 2.**

- Lower threshold for same performance.  Less statistics lost in analysis.
- Non-zero separation for neutral current and tau.

**We can find the best threshold for a given dataset.**

- Bayesian determination of the event's probability.

# What next?

- Sensitivity study with MONA.

- Expected improvement of another 10% of improvement can be gained just with higher statistics and data cuts.

# The end ...?