TrainID 61, epoch 18: ν_τ vs (ν_e+ν_μ)

True Positive Rate

False Positive Rate

0.0
0.2
0.4
0.6
0.8
1.0

$\boldsymbol{\nu_\tau}$ vs (ν_e+ν_μ)
AUC = 0.873

TrainID 61, epoch 18: ν_τ Probability Score

ν_e 0.025–0.030 = 1049
ν_μ 0.025–0.030 = 1
ν_τ 0.025–0.030 = 18
$Z_{\text{Asimov},\,\nu_\tau}$ = 0.55

ν_e (N=6403)
frac>0.90 = **0.005**
frac>0.80 = **0.015**

ν_μ (N=6403)
frac>0.90 = **0.028**
frac>0.80 = **0.064**

ν_τ (N=6403)
frac>0.90 = **0.432**
frac>0.80 = **0.515**

Frequency

0
200
400
600
800
1000

0.0
0.2
0.4
0.6
0.8
1.0

ν_τ Probability Score

TrainID 61, epoch 18: log₁₀(Energy [GeV])–Prob ν_τ of true ν_τ

ν_τ Probability Score \ log₁₀(Energy [GeV])	5.0–5.5	5.5–6.0	6.0–6.5	6.5–7.0	7.0–7.5	7.5–8.0
0.8–1.0	0.29 (343)	0.29 (262)	0.32 (203)	0.37 (175)	0.46 (188)	0.53 (221)
0.6–0.8	0.08 (95)	0.09 (81)	0.10 (64)	0.07 (34)	0.11 (45)	0.09 (37)
0.4–0.6	0.07 (82)	0.06 (58)	0.07 (45)	0.06 (28)	0.05 (21)	0.06 (27)
0.2–0.4	0.07 (80)	0.07 (62)	0.05 (29)	0.07 (33)	0.06 (23)	0.03 (13)
0.0–0.2	0.08 (100)	0.08 (71)	0.07 (45)	0.06 (31)	0.07 (27)	0.04 (17)

ν_τ Probability Score \ log₁₀(Energy [GeV])	5.0–5.5	5.5–6.0	6.0–6.5	6.5–7.0	7.0–7.5	7.5–8.0
0.8–1.0	0.52 (211)	0.57 (220)	0.55 (231)	0.61 (234)	0.60 (234)	
0.6–0.8	0.08 (33)	0.08 (32)	0.07 (29)	0.08 (29)	0.06 (25)	
0.4–0.6	0.04 (18)	0.07 (29)	0.06 (25)	0.04 (14)	0.03 (13)	
0.2–0.4	0.04 (15)	0.04 (15)	0.03 (13)	0.05 (20)	0.04 (17)	
0.0–0.2	0.05 (21)	0.03 (11)	0.04 (18)	0.03 (11)	0.05 (18)	

ν_τ Probability Score \ log₁₀(Energy [GeV])	5.0–5.5	5.5–6.0	6.0–6.5	6.5–7.0	7.0–7.5	7.5–8.0
0.8–1.0	0.08 (95)	0.07 (67)	0.08 (48)	0.09 (42)	0.06 (25)	0.02 (10)
0.6–0.8	0.10 (117)	0.09 (78)	0.09 (55)	0.08 (40)	0.03 (12)	0.05 (21)
0.4–0.6	0.09 (111)	0.10 (90)	0.09 (54)	0.08 (39)	0.07 (27)	0.04 (16)
0.2–0.4	0.08 (99)	0.09 (84)	0.09 (56)	0.06 (31)	0.06 (23)	0.06 (26)
0.0–0.2	0.05 (61)	0.06 (54)	0.06 (35)	0.05 (24)	0.05 (20)	0.07 (29)

ν_τ Probability Score \ log₁₀(Energy [GeV])	5.0–5.5	5.5–6.0	6.0–6.5	6.5–7.0	7.0–7.5	7.5–8.0
0.8–1.0	0.53 (221)	0.52 (211)	0.57 (220)	0.55 (231)	0.61 (234)	0.60 (234)
0.6–0.8	0.09 (37)	0.08 (33)	0.08 (32)	0.07 (29)	0.08 (29)	0.06 (25)
0.4–0.6	0.06 (27)	0.04 (18)	0.07 (29)	0.06 (25)	0.04 (14)	0.03 (13)
0.2–0.4	0.03 (13)	0.04 (15)	0.04 (15)	0.03 (13)	0.05 (20)	0.04 (17)
0.0–0.2	0.04 (17)	0.05 (21)	0.03 (11)	0.04 (18)	0.03 (11)	0.05 (18)

ν_τ Probability Score \ log₁₀(Energy [GeV])	5.0–5.5	5.5–6.0	6.0–6.5	6.5–7.0	7.0–7.5	7.5–8.0
0.8–1.0	0.06 (25)	0.03 (12)	0.05 (21)	0.06 (23)	0.03 (11)	0.05 (19)
0.6–0.8	0.09 (54)	0.08 (39)	0.07 (27)	0.04 (16)	0.04 (16)	0.05 (21)
0.4–0.6	0.09 (56)	0.06 (31)	0.06 (23)	0.06 (26)	0.06 (26)	0.03 (13)
0.2–0.4	0.06 (35)	0.05 (24)	0.05 (20)	0.07 (29)	0.06 (26)	0.05 (20)
0.0–0.2	0.06 (31)	0.05 (23)	0.05 (20)	0.04 (17)	0.05 (21)	0.03 (11)

ν_τ Probability Score \ log₁₀(Energy [GeV])	5.0–5.5	5.5–6.0	6.0–6.5	6.5–7.0	7.0–7.5	7.5–8.0
0.8–1.0	0.07 (29)	0.08 (29)	0.06 (25)	0.03 (9)	0.02 (9)	
0.6–0.8	0.05 (19)	0.03 (11)	0.04 (15)	0.04 (15)	0.03 (10)	
0.4–0.6	0.05 (19)	0.03 (11)	0.04 (15)	0.04 (16)	0.04 (15)	
0.2–0.4	0.07 (29)	0.06 (21)	0.05 (21)	0.04 (18)	0.04 (17)	
0.0–0.2	0.05 (20)	0.05 (19)	0.07 (27)	0.06 (26)	0.05 (20)	

ν_τ Probability Score \ log₁₀(Energy [GeV])	5.0–5.5	5.5–6.0	6.0–6.5	6.5–7.0	7.0–7.5	7.5–8.0
0.8–1.0	0.55 (231)	0.61 (234)	0.60 (234)			
0.6–0.8	0.07 (29)	0.08 (29)	0.06 (25)			
0.4–0.6	0.06 (25)	0.04 (14)	0.03 (13)			
0.2–0.4	0.03 (13)	0.05 (20)	0.04 (17)			
0.0–0.2	0.04 (18)	0.03 (11)	0.05 (18)			

ν_τ Probability Score \ log₁₀(Energy [GeV])	5.0–5.5	5.5–6.0	6.0–6.5	6.5–7.0	7.0–7.5	7.5–8.0
0.8–1.0	0.04 (15)	0.03 (13)	0.04 (17)	0.03 (13)	0.03 (10)	
0.6–0.8	0.05 (19)	0.03 (11)	0.05 (19)	0.02 (9)	0.02 (9)	
0.4–0.6	0.05 (19)	0.03 (11)	0.04 (15)			
0.2–0.4	0.07 (29)	0.06 (21)	0.05 (21)			
0.0–0.2	0.05 (20)	0.05 (19)	0.07 (27)			

Frequency normalised within energy bin

TrainID 61, epoch 18: Zenith–Prob ν_τ of true ν_τ

ν_τ Probability Score \ Zenith [degree]	0–20	20–40	40–60	60–80	80–100	100–120	120–140	140–160	160–180
0.8–1.0	0.48 (346)	0.45 (717)	0.43 (843)	0.42 (624)	0.40 (174)	0.28 (39)	0.22 (13)	0.29 (5)	0.67 (2)
0.6–0.8	0.06 (45)	0.08 (124)	0.09 (185)	0.08 (113)	0.09 (40)	0.10 (14)	0.20 (12)		
0.4–0.6	0.05 (38)	0.05 (85)	0.06 (119)	0.07 (98)	0.05 (22)	0.06 (8)	0.03 (2)	0.18 (3)	
0.2–0.4	0.04 (29)	0.05 (78)	0.05 (106)	0.06 (84)	0.06 (26)	0.04 (6)	0.03 (2)		
0.0–0.2	0.06 (40)	0.06 (91)	0.05 (101)	0.06 (97)	0.06 (27)	0.09 (13)	0.07 (4)	0.18 (3)	0.33 (1)
0.8–1.0	0.04 (29)	0.05 (80)	0.06 (119)	0.06 (91)	0.08 (34)	0.04 (6)	0.13 (8)		
0.6–0.8	0.06 (40)	0.06 (96)	0.06 (126)	0.07 (100)	0.06 (25)	0.12 (16)	0.08 (5)		
0.4–0.6	0.06 (45)	0.07 (105)	0.06 (119)	0.07 (111)	0.07 (31)	0.11 (15)	0.10 (6)	0.18 (3)	
0.2–0.4	0.08 (59)	0.07 (105)	0.06 (123)	0.07 (109)	0.09 (40)	0.08 (11)	0.10 (6)	0.12 (2)	
0.0–0.2	0.07 (48)	0.06 (97)	0.05 (107)	0.05 (74)	0.05 (21)	0.07 (9)	0.03 (2)	0.06 (1)	

Counts normalised within zenith bin

TrainID 61, epoch 18: ν_α vs (ν_β+ν_γ)

True Positive Rate

False Positive Rate

0.0
0.2
0.4
0.6
0.8
1.0

ν_e (AUC = 0.965)
ν_μ (AUC = 0.946)
ν_τ (AUC = 0.873)

TrainID 61, epoch 18: ν_μ vs (ν_e+ν_τ)

True Positive Rate

False Positive Rate

0.0
0.2
0.4
0.6
0.8
1.0

$\boldsymbol{\nu_\mu}$ vs (ν_e+ν_τ)
AUC = 0.946

TrainID 61, epoch 18: ν_μ Probability Score

ν_e 0.015–0.025 = 4023
ν_μ 0.015–0.025 = 27
ν_τ 0.015–0.025 = 1134
$Z_{\text{Asimov},\,\nu_\mu}$ = 0.38

ν_e (N=6403)
frac>0.90 = **0.000**
frac>0.80 = **0.000**

ν_μ (N=6403)
frac>0.90 = **0.354**
frac>0.80 = **0.540**

ν_τ (N=6403)
frac>0.90 = **0.012**
frac>0.80 = **0.042**

Frequency

0
200
400
600
800
1000

0.0
0.2
0.4
0.6
0.8
1.0

ν_μ Probability Score

TrainID 61, epoch 18: log₁₀(Energy [GeV])–Prob ν_μ of true ν_μ

ν_μ Probability Score \ log₁₀(Energy [GeV])	5.0–5.5	5.5–6.0	6.0–6.5	6.5–7.0	7.0–7.5	7.5–8.0
0.8–1.0	0.22 (255)	0.23 (204)	0.26 (172)	0.32 (150)	0.34 (144)	0.37 (148)
0.6–0.8	0.17 (202)	0.18 (162)	0.19 (125)	0.22 (105)	0.20 (85)	0.19 (74)
0.4–0.6	0.13 (147)	0.13 (117)	0.15 (99)	0.10 (46)	0.15 (63)	0.12 (46)
0.2–0.4	0.08 (94)	0.08 (75)	0.07 (48)	0.07 (32)	0.05 (23)	0.07 (29)
0.0–0.2	0.07 (83)	0.05 (43)	0.06 (40)	0.03 (16)	0.04 (18)	0.05 (18)

ν_μ Probability Score \ log₁₀(Energy [GeV])	5.0–5.5	5.5–6.0	6.0–6.5	6.5–7.0	7.0–7.5	7.5–8.0
0.8–1.0	0.40 (158)	0.43 (174)	0.49 (187)	0.55 (214)	0.58 (226)	
0.6–0.8	0.19 (75)	0.21 (86)	0.18 (68)	0.15 (58)	0.18 (69)	
0.4–0.6	0.13 (50)	0.12 (51)	0.10 (37)	0.09 (34)	0.06 (25)	
0.2–0.4	0.05 (21)	0.06 (24)	0.04 (17)	0.04 (15)	0.04 (16)	
0.0–0.2	0.03 (12)	0.05 (19)	0.03 (12)	0.03 (11)	0.02 (8)	

ν_μ Probability Score \ log₁₀(Energy [GeV])	5.0–5.5	5.5–6.0	6.0–6.5	6.5–7.0	7.0–7.5	7.5–8.0
0.8–1.0	0.06 (65)	0.05 (46)	0.05 (31)	0.04 (18)	0.03 (13)	0.02 (8)
0.6–0.8	0.04 (52)	0.06 (55)	0.03 (22)	0.03 (16)	0.04 (17)	0.04 (15)
0.4–0.6	0.07 (80)	0.06 (52)	0.06 (40)	0.06 (30)	0.04 (17)	0.04 (14)
0.2–0.4	0.09 (100)	0.07 (66)	0.06 (42)	0.05 (25)	0.05 (20)	0.05 (19)
0.0–0.2	0.08 (97)	0.08 (70)	0.07 (48)	0.07 (31)	0.05 (21)	0.06 (25)

ν_μ Probability Score \ log₁₀(Energy [GeV])	5.0–5.5	5.5–6.0	6.0–6.5	6.5–7.0	7.0–7.5	7.5–8.0
0.8–1.0	0.02 (9)	0.02 (9)	0.04 (16)	0.03 (13)	0.01 (5)	
0.6–0.8	0.03 (13)	0.02 (8)	0.02 (6)	0.02 (7)	0.03 (12)	
0.4–0.6	0.02 (9)	0.02 (9)	0.03 (12)	0.02 (7)	0.02 (6)	
0.2–0.4	0.05 (21)	0.04 (16)	0.03 (12)	0.04 (14)	0.03 (13)	
0.0–0.2	0.08 (32)	0.03 (13)	0.04 (15)	0.04 (16)	0.03 (11)	

Frequency normalised within energy bin

TrainID 61, epoch 18: Zenith–Prob ν_μ of true ν_μ

ν_μ Probability Score \ Zenith [degree]	0–20	20–40	40–60	60–80	80–100	100–120	120–140	140–160	160–180
0.8–1.0	0.42 (311)	0.41 (681)	0.35 (653)	0.31 (469)	0.27 (118)	0.18 (24)	0.22 (10)	0.10 (2)	
0.6–0.8	0.19 (141)	0.18 (306)	0.19 (351)	0.19 (289)	0.14 (62)	0.20 (26)	0.17 (8)	0.25 (5)	0.33 (1)
0.4–0.6	0.10 (71)	0.12 (196)	0.11 (206)	0.13 (190)	0.12 (50)	0.13 (17)	0.15 (7)	0.15 (3)	
0.2–0.4	0.05 (34)	0.05 (89)	0.06 (117)	0.07 (112)	0.10 (45)	0.08 (11)	0.11 (5)	0.05 (1)	
0.0–0.2	0.04 (26)	0.04 (72)	0.05 (92)	0.05 (70)	0.05 (21)	0.04 (5)	0.02 (1)	0.15 (3)	
0.8–1.0	0.03 (25)	0.03 (52)	0.04 (76)	0.03 (51)	0.05 (22)	0.08 (10)	0.09 (4)		
0.6–0.8	0.03 (23)	0.03 (58)	0.03 (53)	0.05 (68)	0.04 (18)	0.04 (5)	0.04 (2)	0.05 (1)	0.33 (1)
0.4–0.6	0.04 (27)	0.04 (62)	0.04 (76)	0.05 (74)	0.08 (34)	0.04 (5)	0.04 (2)	0.15 (3)	
0.2–0.4	0.05 (36)	0.04 (69)	0.06 (108)	0.06 (90)	0.07 (32)	0.11 (14)	0.07 (3)	0.05 (1)	0.33 (1)
0.0–0.2	0.05 (39)	0.06 (96)	0.06 (116)	0.06 (97)	0.07 (28)	0.11 (15)	0.09 (4)	0.05 (1)	

Counts normalised within zenith bin

TrainID 61, epoch 18: ν_e vs (ν_μ+ν_τ)

True Positive Rate

False Positive Rate

0.0
0.2
0.4
0.6
0.8
1.0

$\boldsymbol{\nu_e}$ vs (ν_μ+ν_τ)
AUC = 0.965

TrainID 61, epoch 18: ν_e Probability Score

ν_e 0.000–0.005 = 14
ν_μ 0.000–0.005 = 5734
ν_τ 0.000–0.005 = 4006
$Z_{\text{Asimov},\,\nu_e}$ = 0.14

ν_e (N=6403)
frac>0.90 = **0.544**
frac>0.80 = **0.717**

ν_μ (N=6403)
frac>0.90 = **0.004**
frac>0.80 = **0.013**

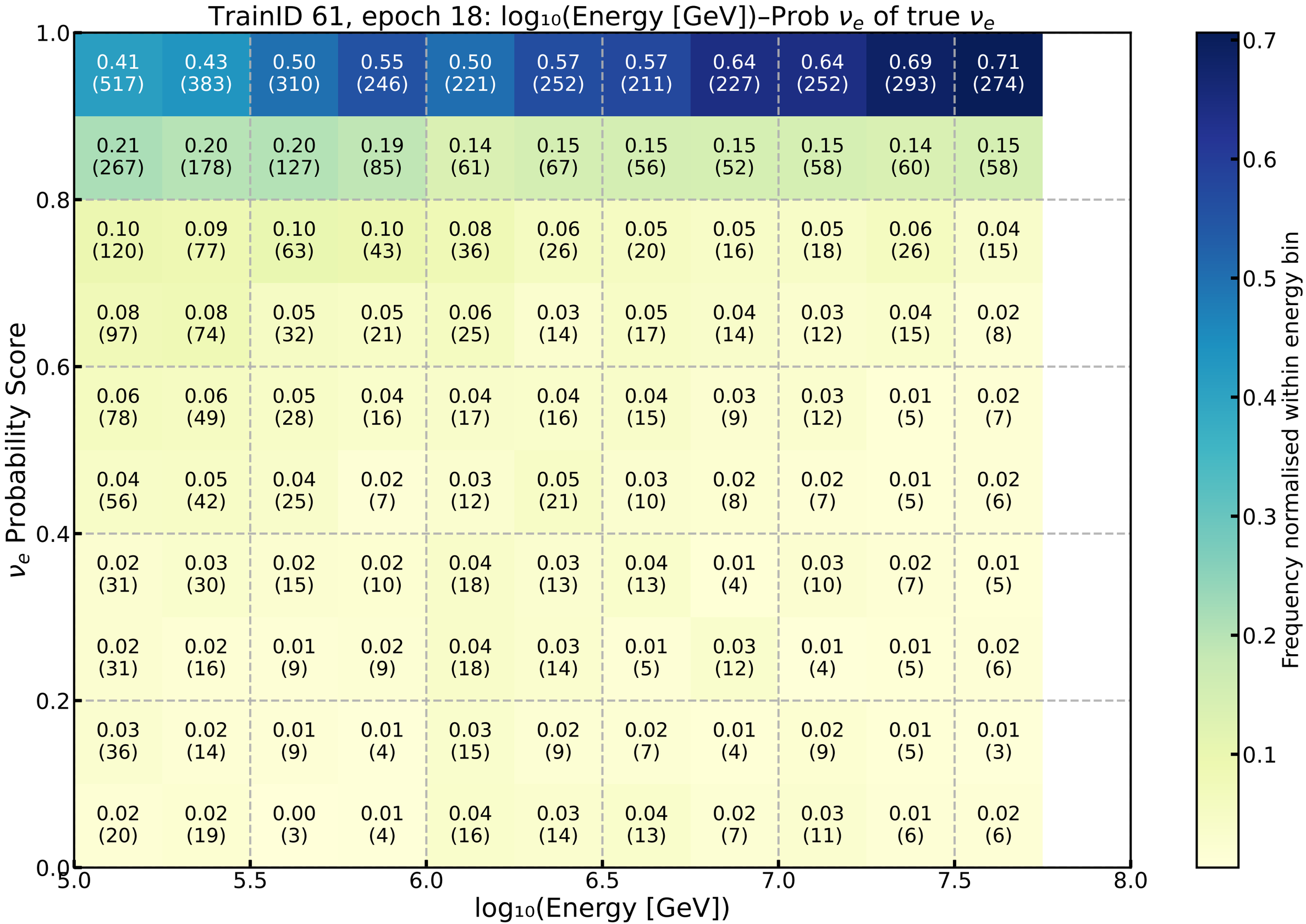
ν_τ (N=6403)
frac>0.90 = **0.033**
frac>0.80 = **0.072**

Frequency

0
200
400
600
800
1000

0.0
0.2
0.4
0.6
0.8
1.0

ν_e Probability Score


TrainID 61, epoch 18: log10(Energy [GeV])–Prob ν_e of true ν_e
ν_e Probability Score
log10(Energy [GeV])
Frequency normalised within energy bin
0.41 (517) 0.43 (383) 0.50 (310) 0.55 (246) 0.50 (221) 0.57 (252) 0.57 (211) 0.64 (227) 0.64 (252) 0.69 (293) 0.71 (274)
0.21 (267) 0.20 (178) 0.20 (127) 0.19 (85) 0.14 (61) 0.15 (67) 0.15 (56) 0.15 (52) 0.15 (58) 0.14 (60) 0.15 (58)
0.10 (120) 0.09 (77) 0.10 (63) 0.10 (43) 0.08 (36) 0.06 (26) 0.05 (20) 0.05 (16) 0.05 (18) 0.06 (26) 0.04 (15)
0.08 (97) 0.08 (74) 0.05 (32) 0.05 (21) 0.06 (25) 0.03 (14) 0.05 (17) 0.04 (14) 0.03 (12) 0.04 (15) 0.02 (8)
0.06 (78) 0.06 (49) 0.05 (28) 0.04 (16) 0.04 (17) 0.04 (16) 0.04 (15) 0.03 (9) 0.03 (12) 0.01 (5) 0.02 (7)
0.04 (56) 0.05 (42) 0.04 (25) 0.02 (7) 0.03 (12) 0.05 (21) 0.03 (10) 0.02 (8) 0.02 (7) 0.01 (5) 0.02 (6)
0.02 (31) 0.03 (30) 0.02 (15) 0.02 (10) 0.04 (18) 0.03 (13) 0.04 (13) 0.01 (4) 0.03 (10) 0.02 (7) 0.01 (5)
0.02 (31) 0.02 (16) 0.01 (9) 0.02 (9) 0.04 (18) 0.03 (14) 0.01 (5) 0.03 (12) 0.01 (4) 0.01 (5) 0.02 (6)
0.03 (36) 0.02 (14) 0.01 (9) 0.01 (4) 0.03 (15) 0.02 (9) 0.02 (7) 0.01 (4) 0.02 (9) 0.01 (5) 0.01 (3)
0.02 (20) 0.02 (19) 0.00 (3) 0.01 (4) 0.04 (16) 0.03 (14) 0.04 (13) 0.02 (7) 0.03 (11) 0.01 (6) 0.02 (6)
0.0 0.2 0.4 0.6 0.8 1.0
5.0 5.5 6.0 6.5 7.0 7.5 8.0
0.1 0.2 0.3 0.4 0.5 0.6 0.7

TrainID 61, epoch 18: Zenith–Prob ν_e of true ν_e

ν_e Probability Score \ Zenith [degree]	0–20	20–40	40–60	60–80	80–100	100–120	120–140	140–160	160–180
0.8–1.0	0.60 (269)	0.57 (518)	0.54 (691)	0.55 (854)	0.54 (795)	0.49 (253)	0.43 (74)	0.43 (25)	0.50 (4)
0.6–0.8	0.17 (75)	0.17 (157)	0.17 (220)	0.17 (260)	0.18 (266)	0.16 (84)	0.20 (35)	0.14 (8)	0.25 (2)
0.4–0.6	0.06 (28)	0.07 (64)	0.09 (110)	0.06 (94)	0.07 (105)	0.10 (51)	0.11 (19)	0.09 (5)	0.25 (2)
0.2–0.4	0.05 (22)	0.06 (52)	0.04 (51)	0.06 (87)	0.05 (80)	0.07 (34)	0.06 (10)	0.14 (8)	
0.0–0.2	0.02 (9)	0.03 (29)	0.04 (52)	0.05 (73)	0.04 (55)	0.05 (26)	0.06 (10)	0.07 (4)	
0.8–1.0	0.03 (15)	0.03 (24)	0.03 (38)	0.03 (48)	0.03 (49)	0.04 (19)	0.04 (7)	0.03 (2)	
0.6–0.8	0.02 (9)	0.02 (18)	0.03 (35)	0.03 (40)	0.03 (46)	0.02 (10)	0.01 (2)	0.02 (1)	
0.4–0.6	0.02 (8)	0.02 (14)	0.02 (26)	0.02 (37)	0.02 (28)	0.03 (14)	0.01 (2)	0.05 (3)	
0.2–0.4	0.01 (4)	0.02 (14)	0.02 (28)	0.02 (25)	0.02 (26)	0.03 (13)	0.04 (7)	0.02 (1)	
0.0–0.2	0.02 (8)	0.01 (13)	0.01 (18)	0.02 (29)	0.02 (31)	0.02 (12)	0.05 (8)	0.02 (1)	

Counts normalised within zenith bin