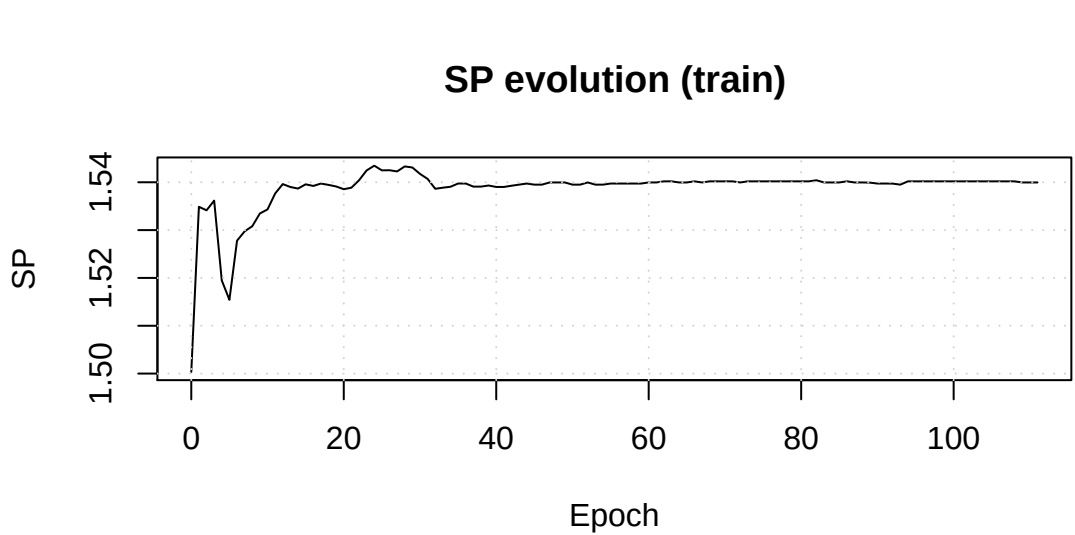
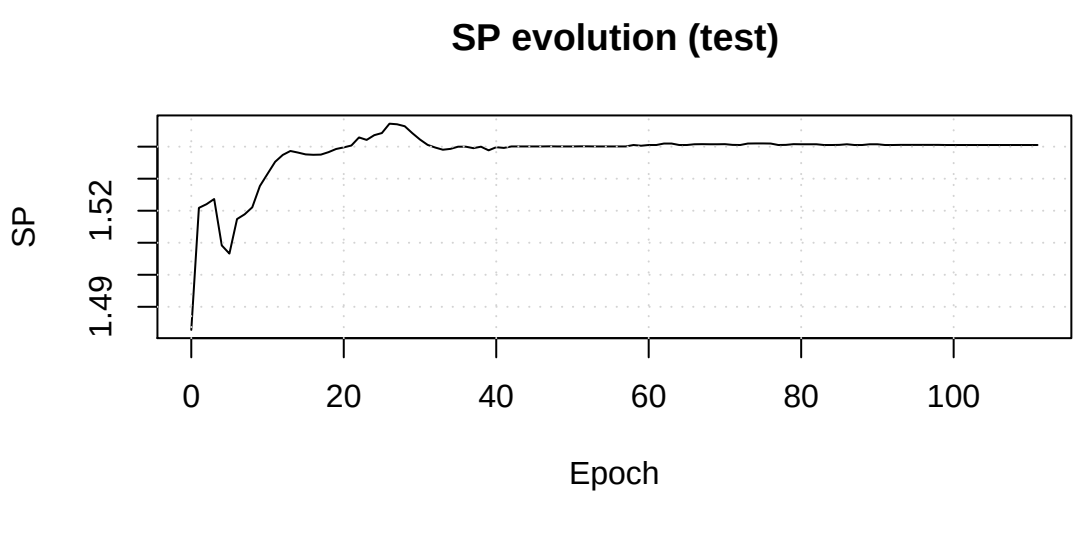
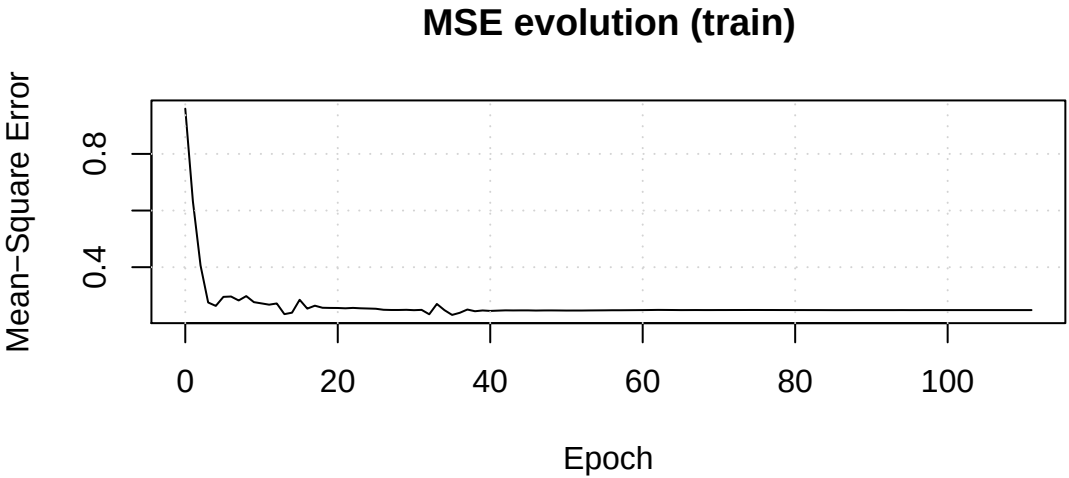
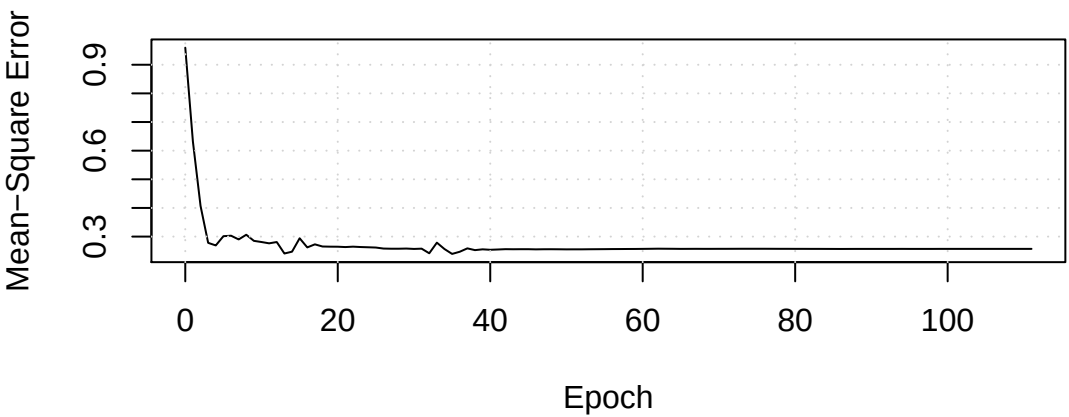
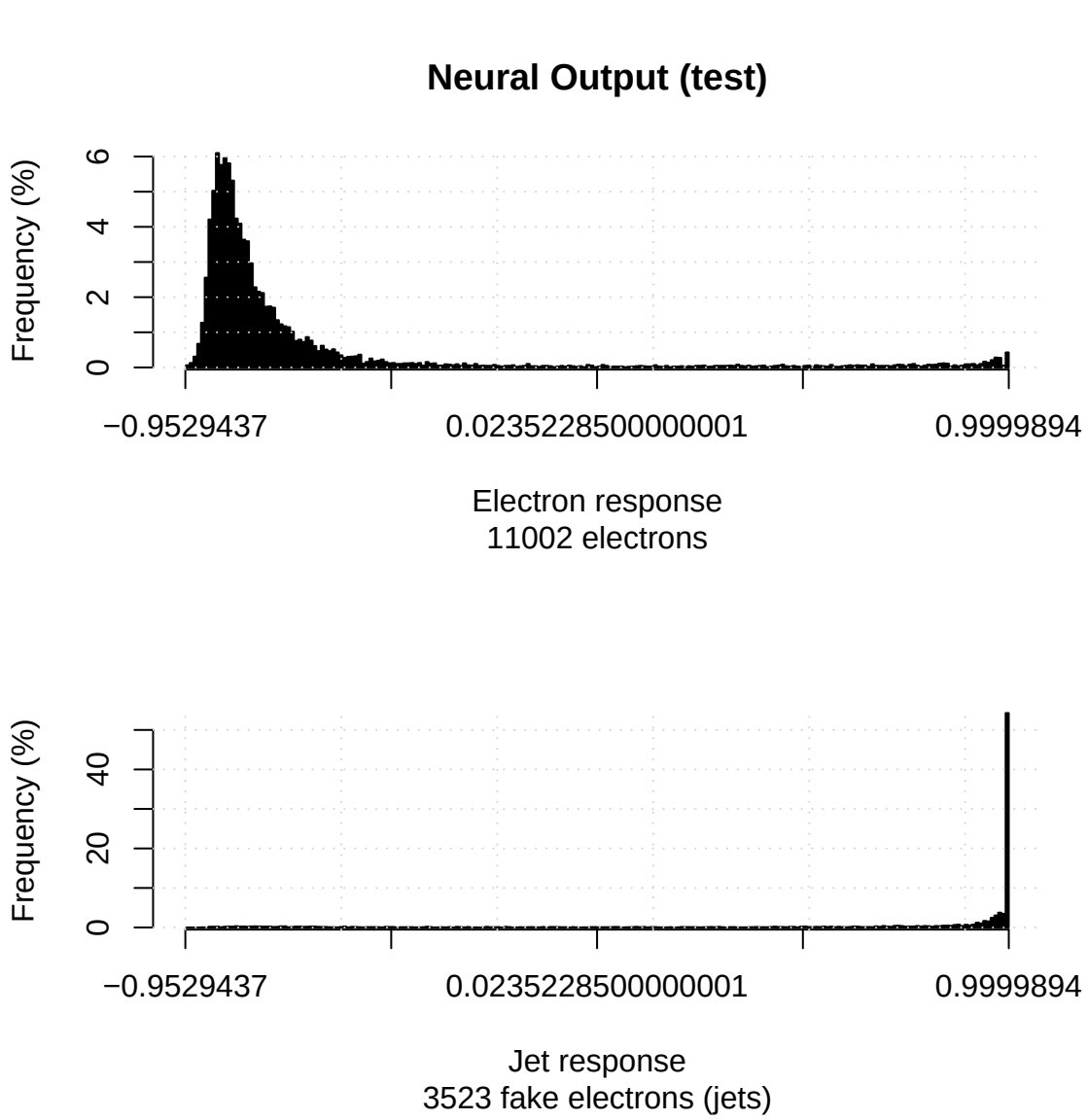
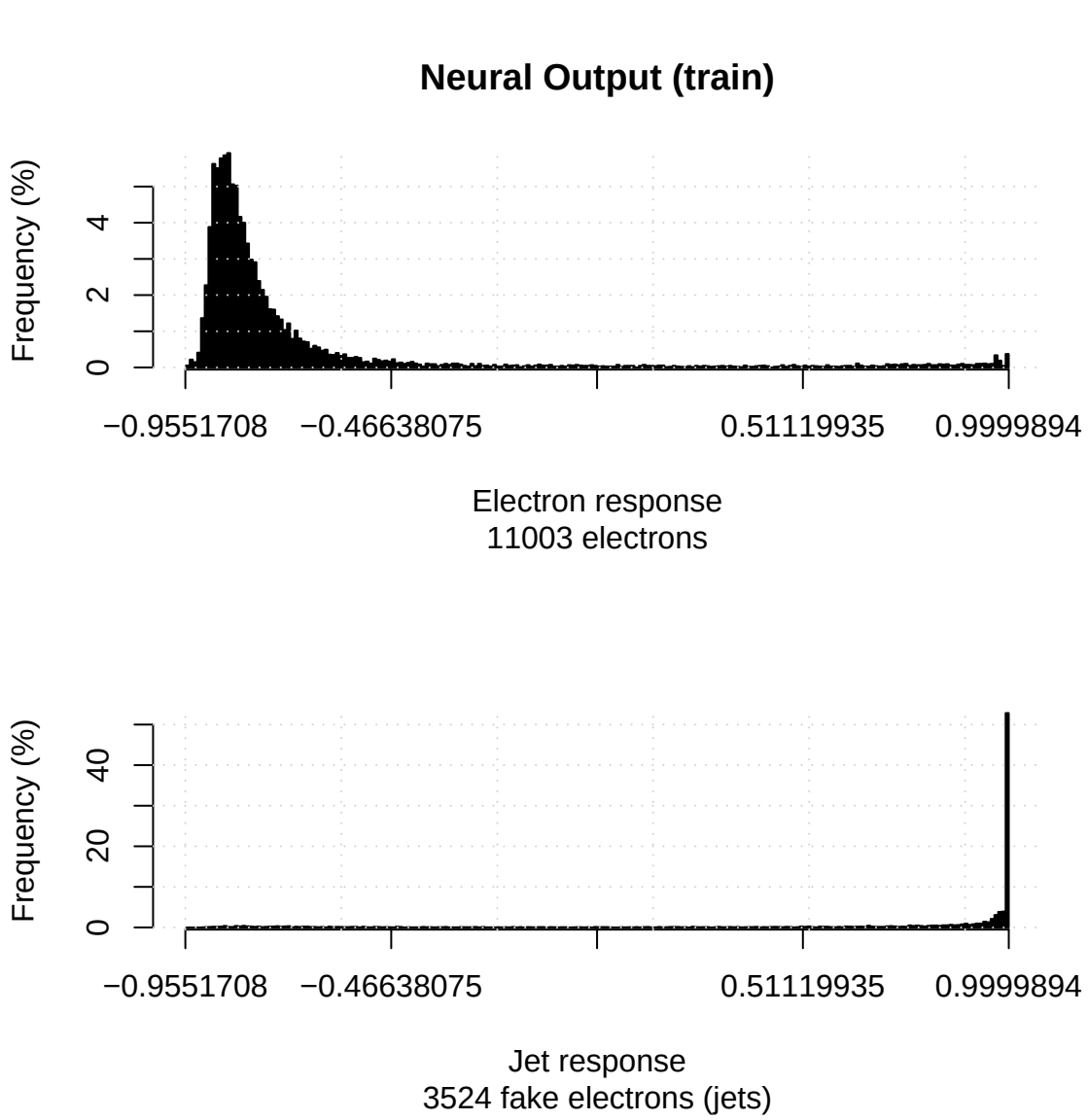

SP evolution (train)
SP
1.50
1.52
1.54
0
20
40
60
80
100
Epoch

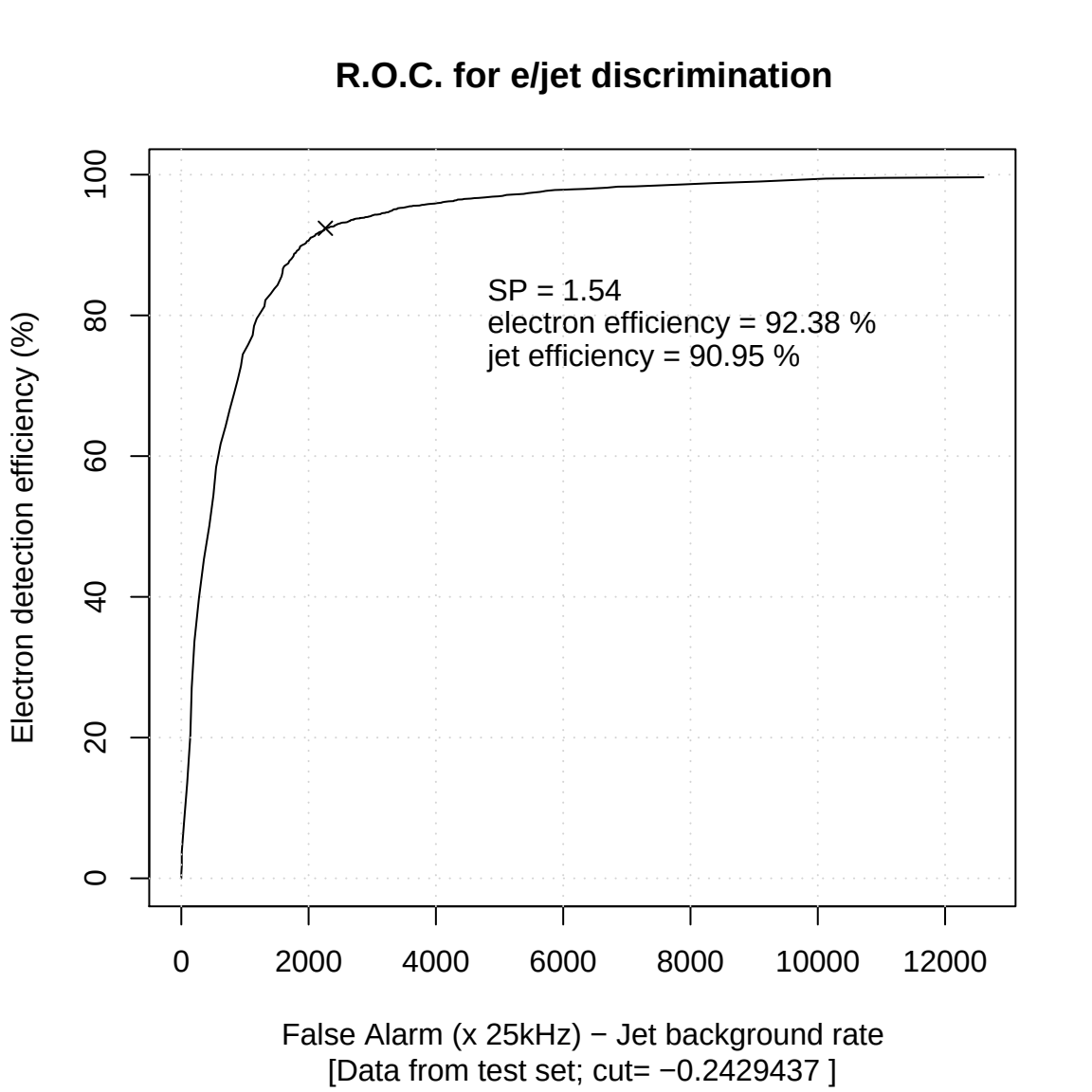

SP evolution (test)
SP
1.49
1.52
0
20
40
60
80
100
Epoch

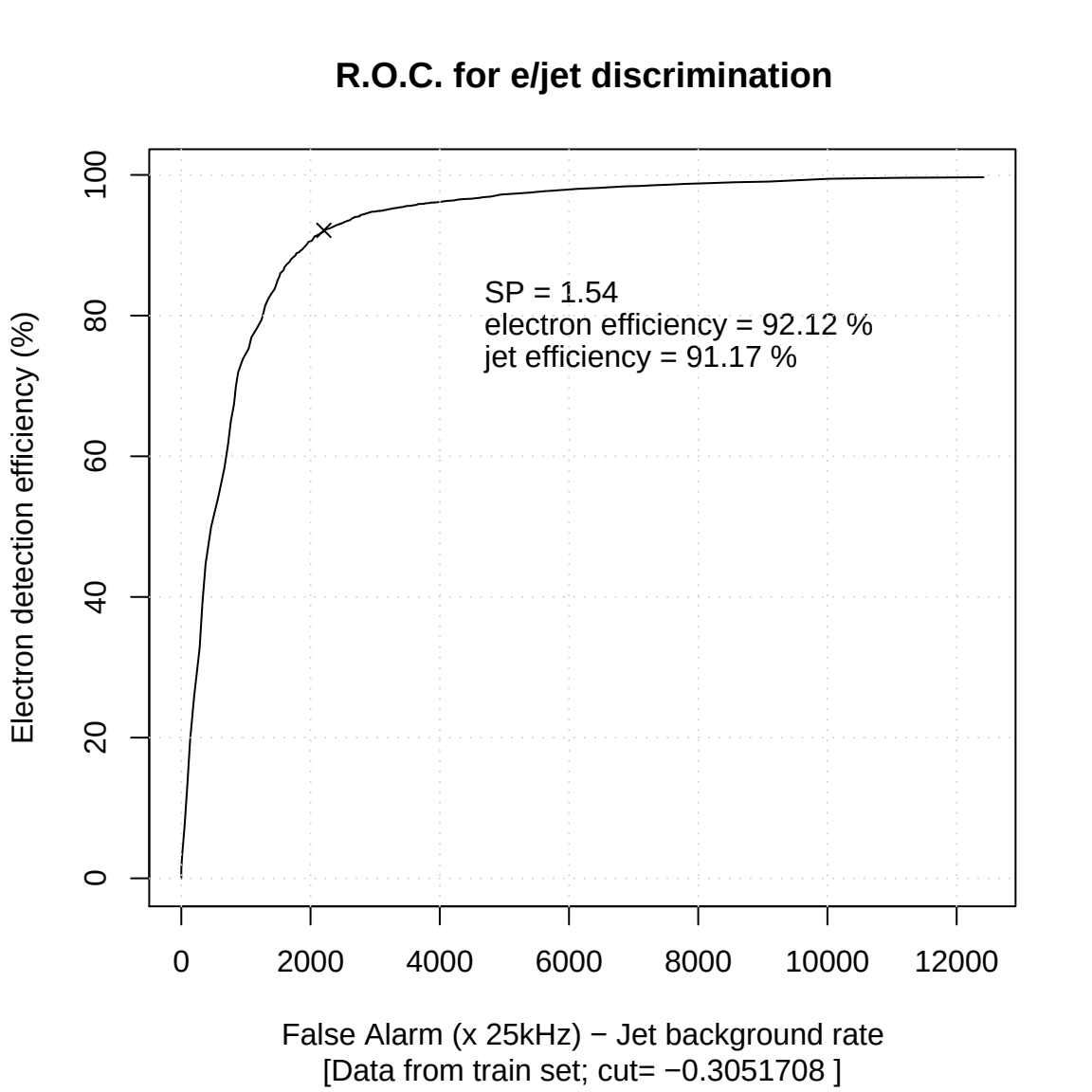

MSE evolution (train)
Mean−Square Error
0.4
0.8
0
20
40
60
80
100
Epoch

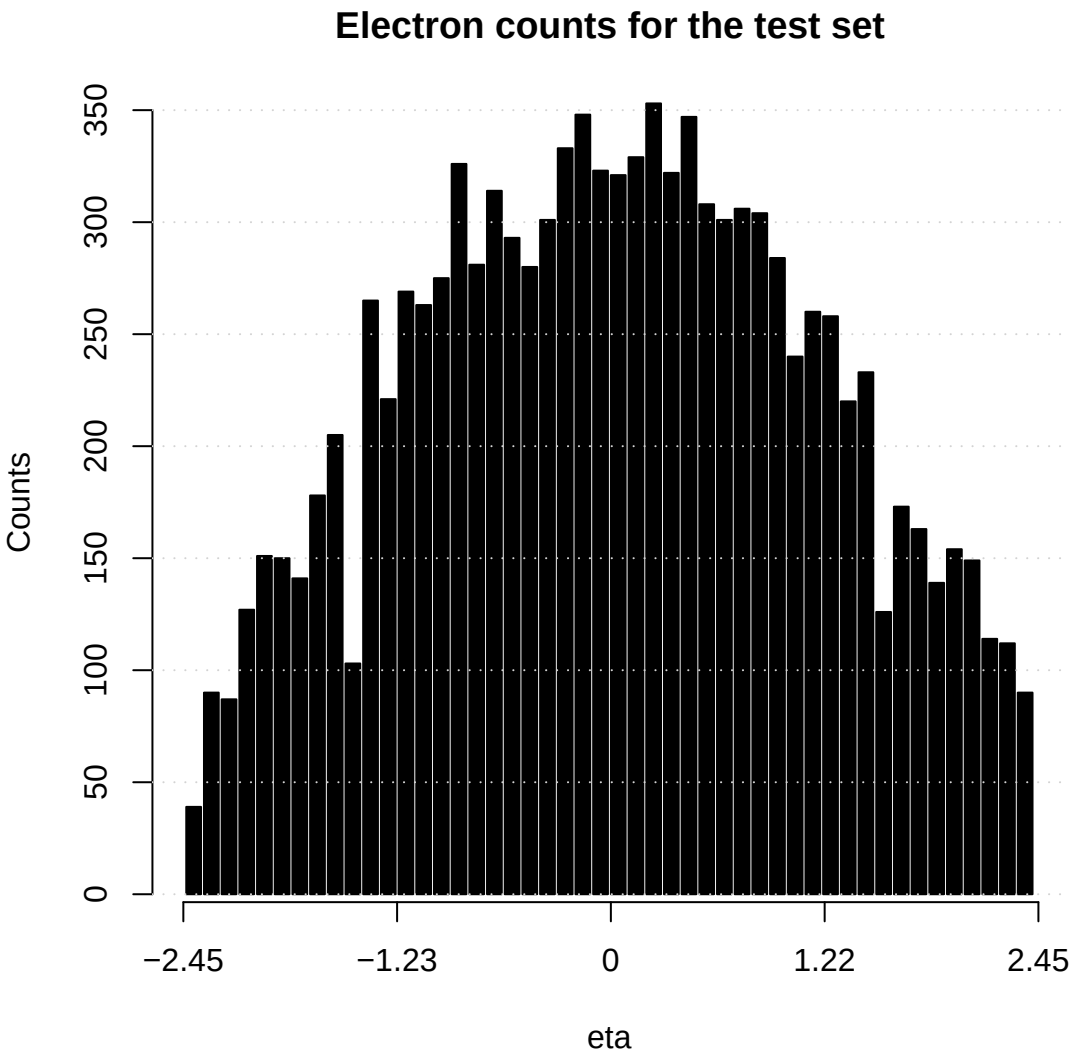

MSE evolution (test)
Mean−Square Error
0.3
0.6
0.9
0
20
40
60
80
100
Epoch

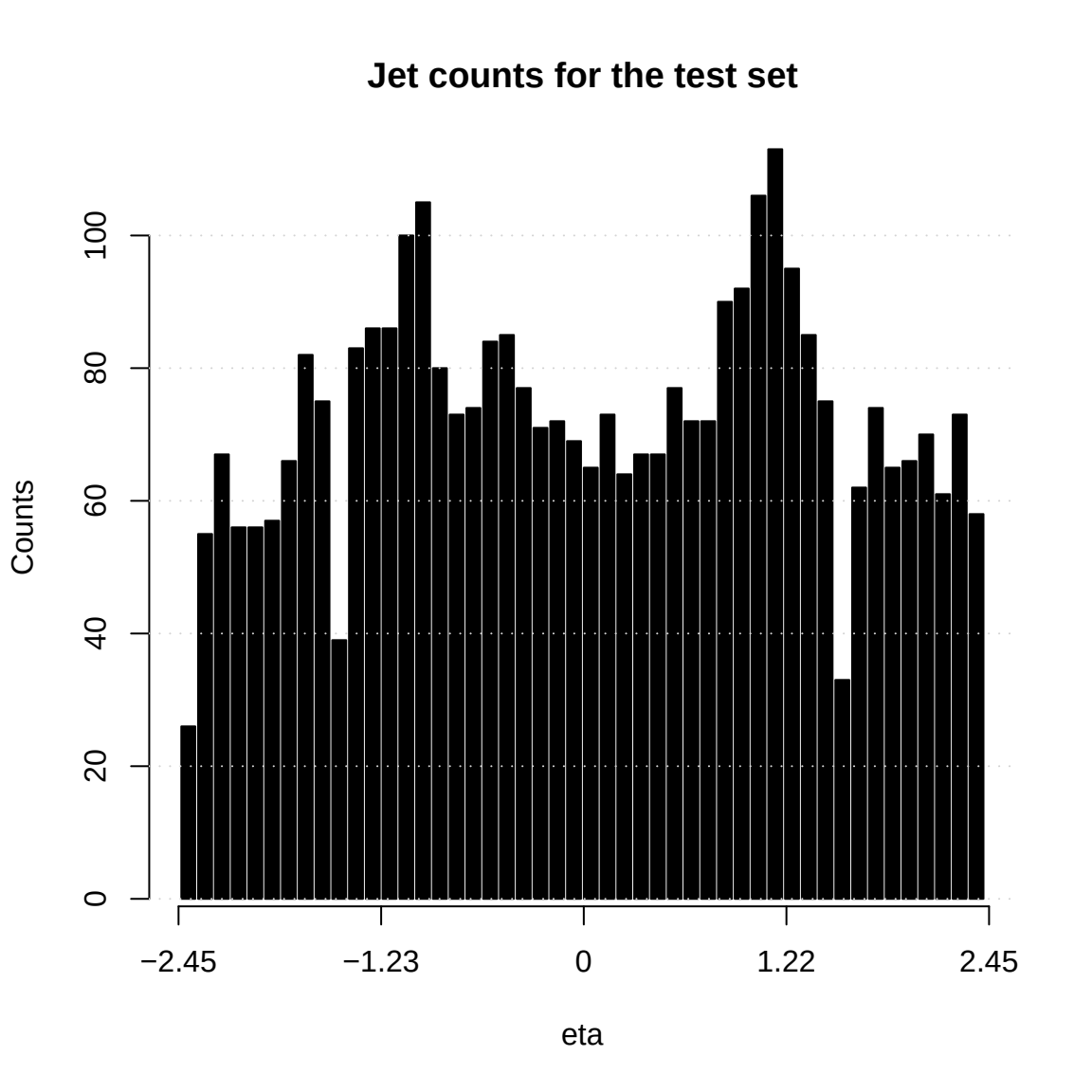

Neural Output (test)
Frequency (%)
0
2
4
6
−0.9529437
0.0235228500000001
0.9999894
Electron response
11002 electrons
Frequency (%)
0
20
40
−0.9529437
0.0235228500000001
0.9999894
Jet response
3523 fake electrons (jets)

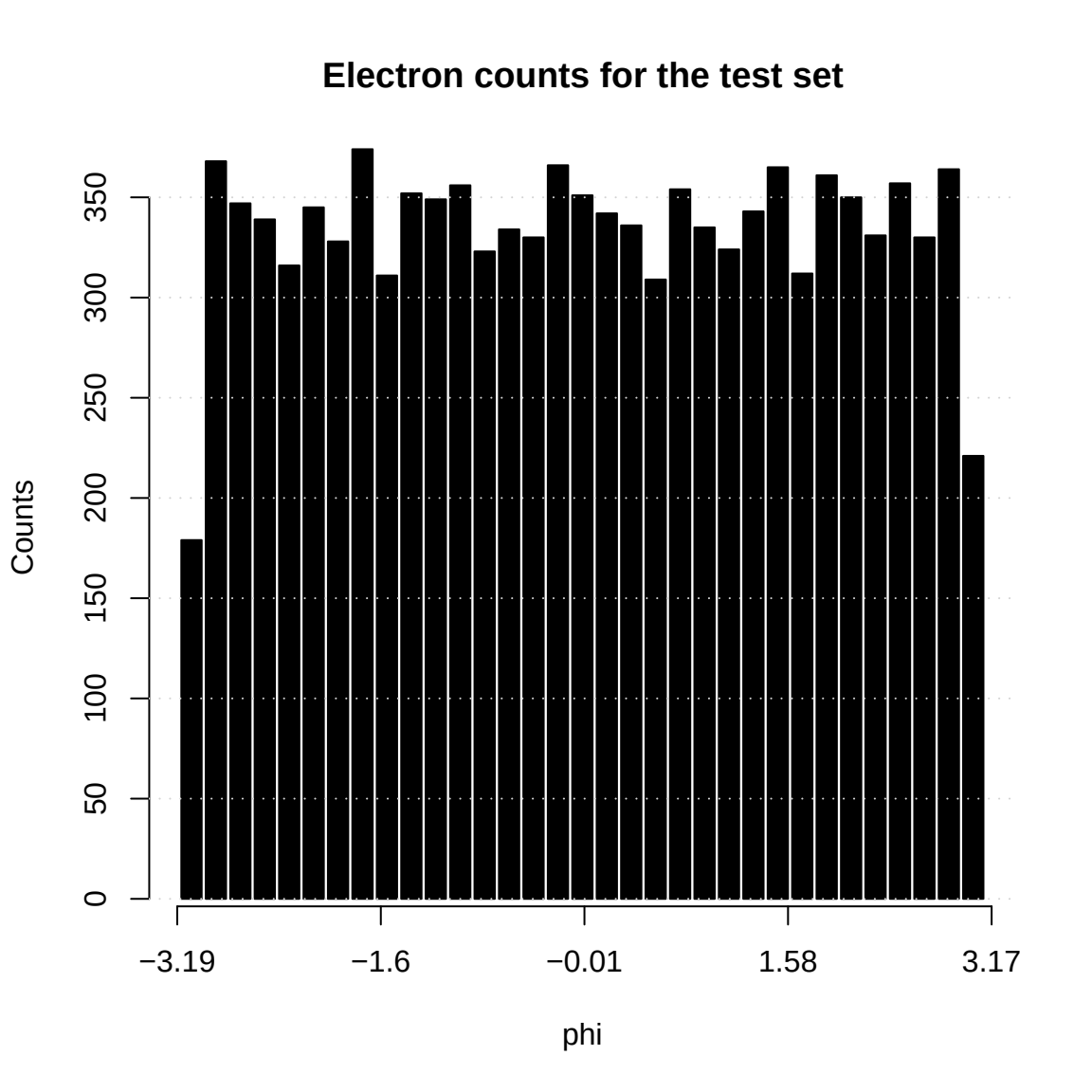

Neural Output (train)
Frequency (%)
0
2
4
−0.9551708
−0.46638075
0.51119935
0.9999894
Electron response
11003 electrons
Frequency (%)
0
20
40
−0.9551708
−0.46638075
0.51119935
0.9999894
Jet response
3524 fake electrons (jets)

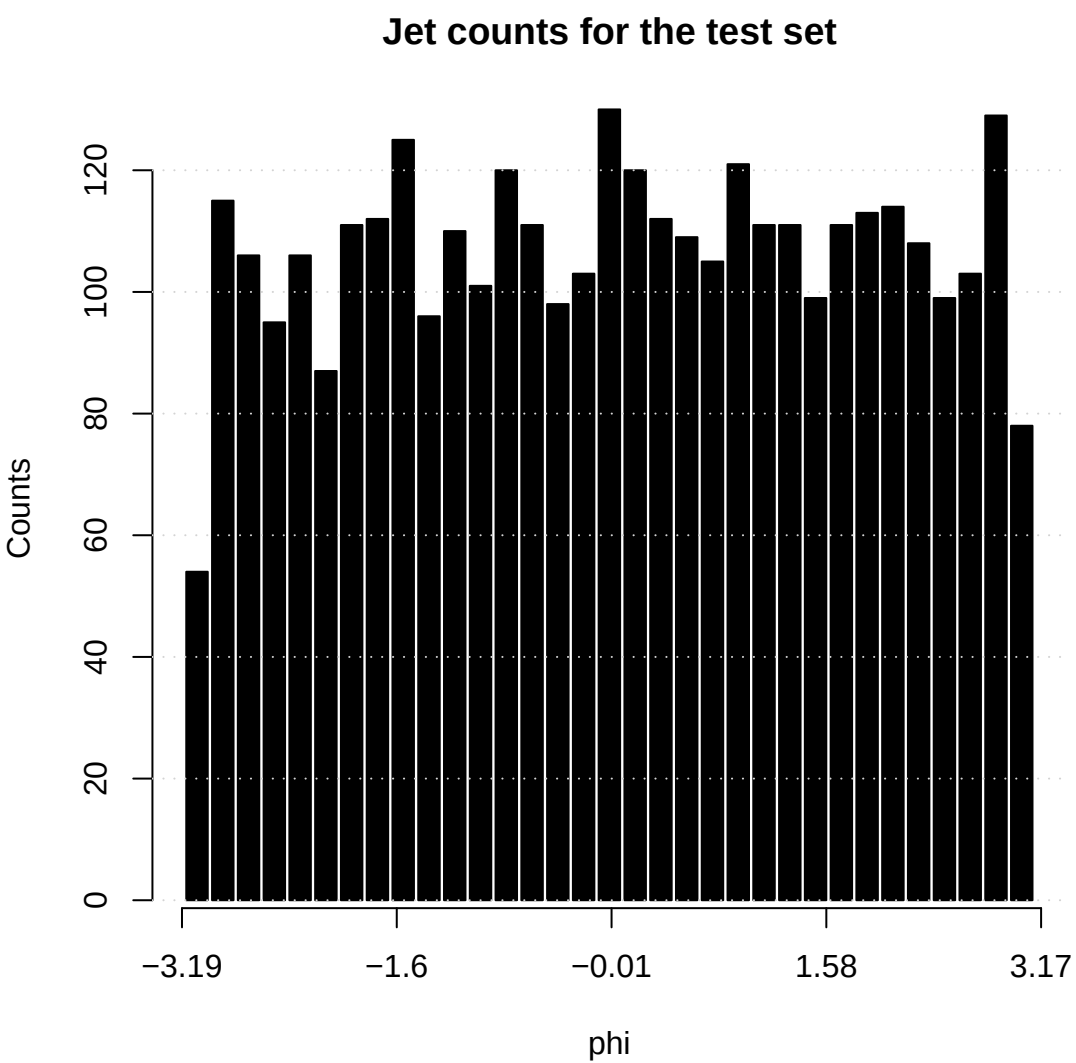

R.O.C. for e/jet discrimination
Electron detection efficiency (%)
0
20
40
60
80
100
0
2000
4000
6000
8000
10000
12000
SP = 1.54
electron efficiency = 92.38 %
jet efficiency = 90.95 %
False Alarm (x 25kHz) − Jet background rate
[Data from test set; cut= −0.2429437]

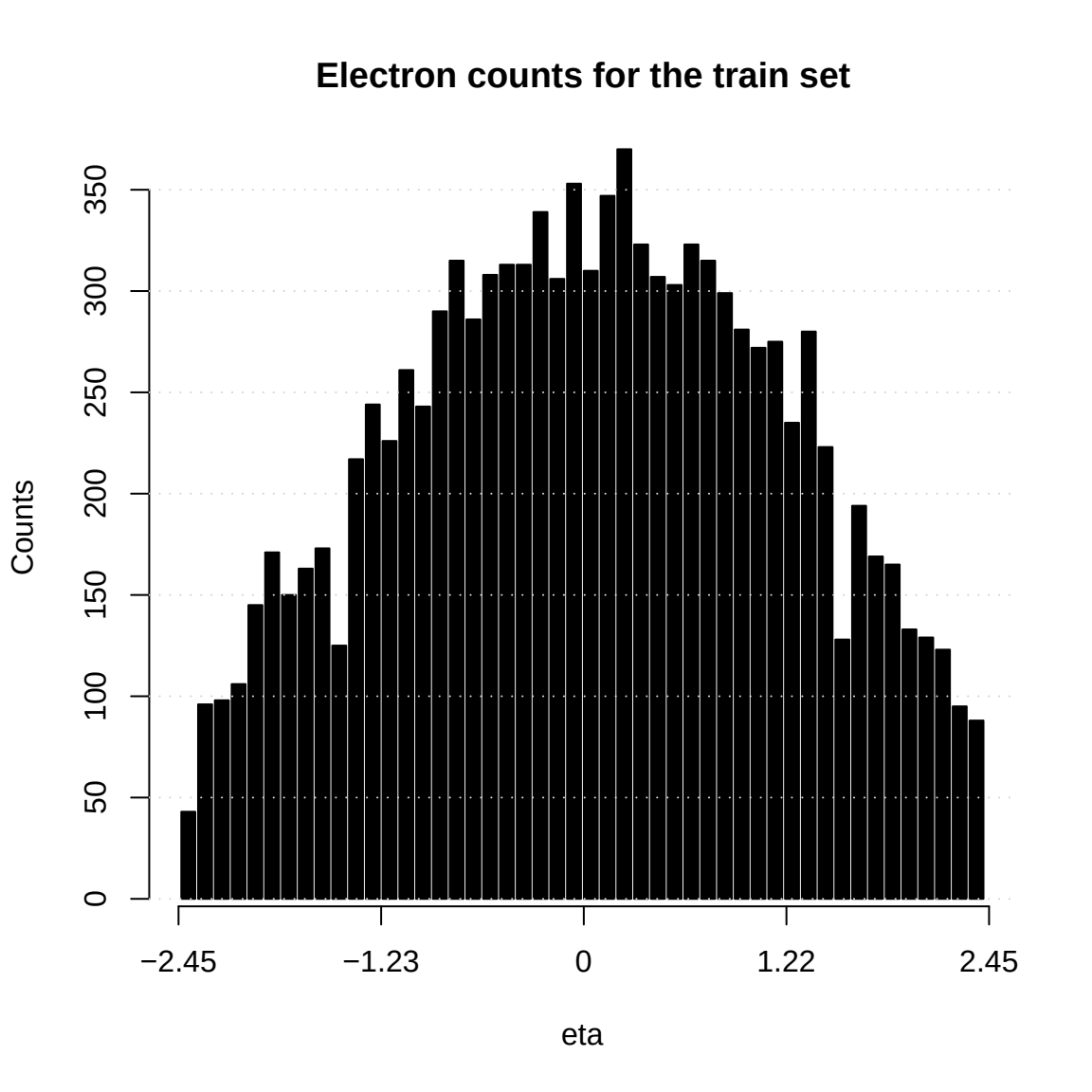

R.O.C. for e/jet discrimination
SP = 1.54
electron efficiency = 92.12 %
jet efficiency = 91.17 %
Electron detection efficiency (%)
0
20
40
60
80
100
0
2000
4000
6000
8000
10000
12000
False Alarm (x 25kHz) − Jet background rate
[Data from train set; cut= −0.3051708]

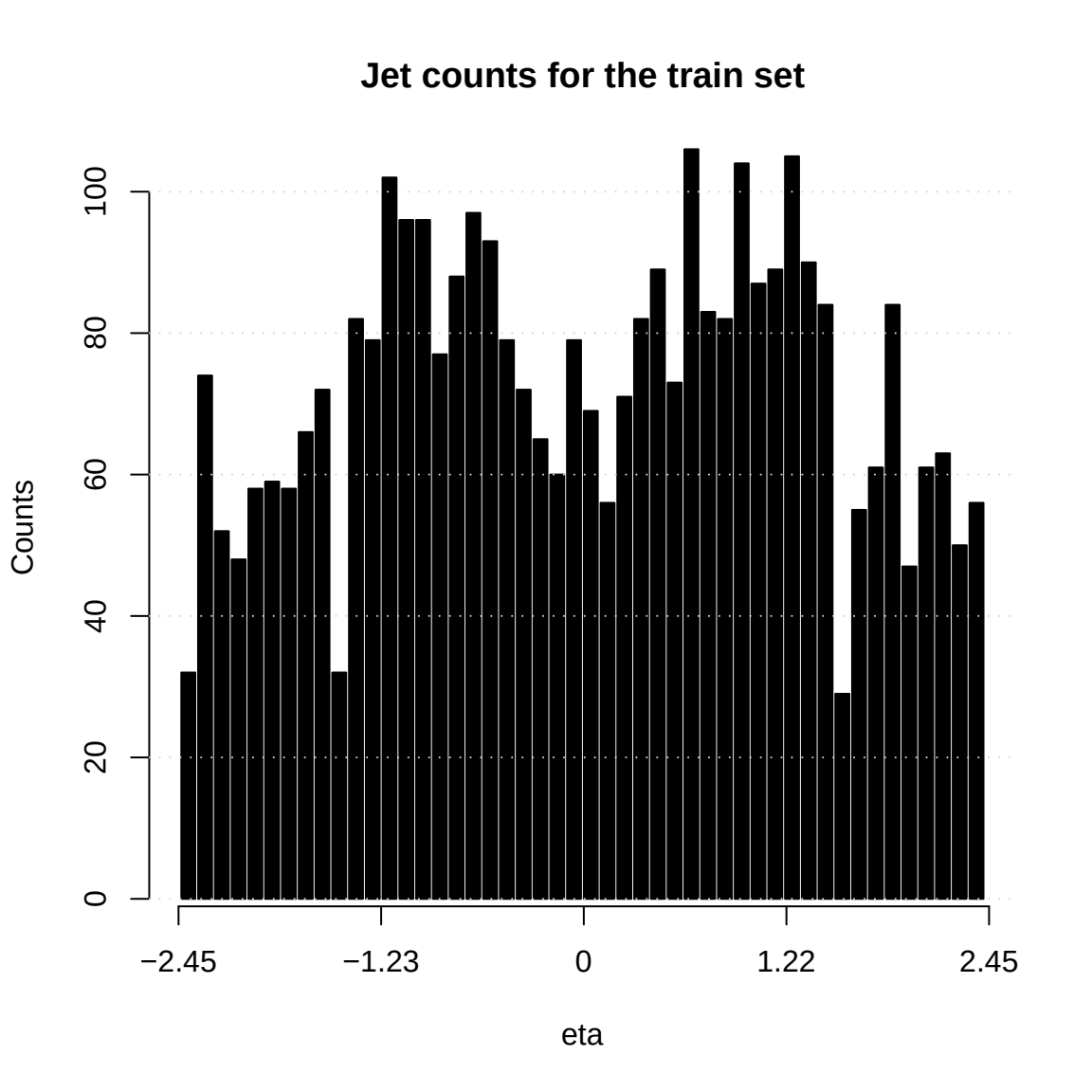

Electron counts for the test set
Counts
0
50
100
150
200
250
300
350
−2.45
−1.23
0
1.22
2.45
eta

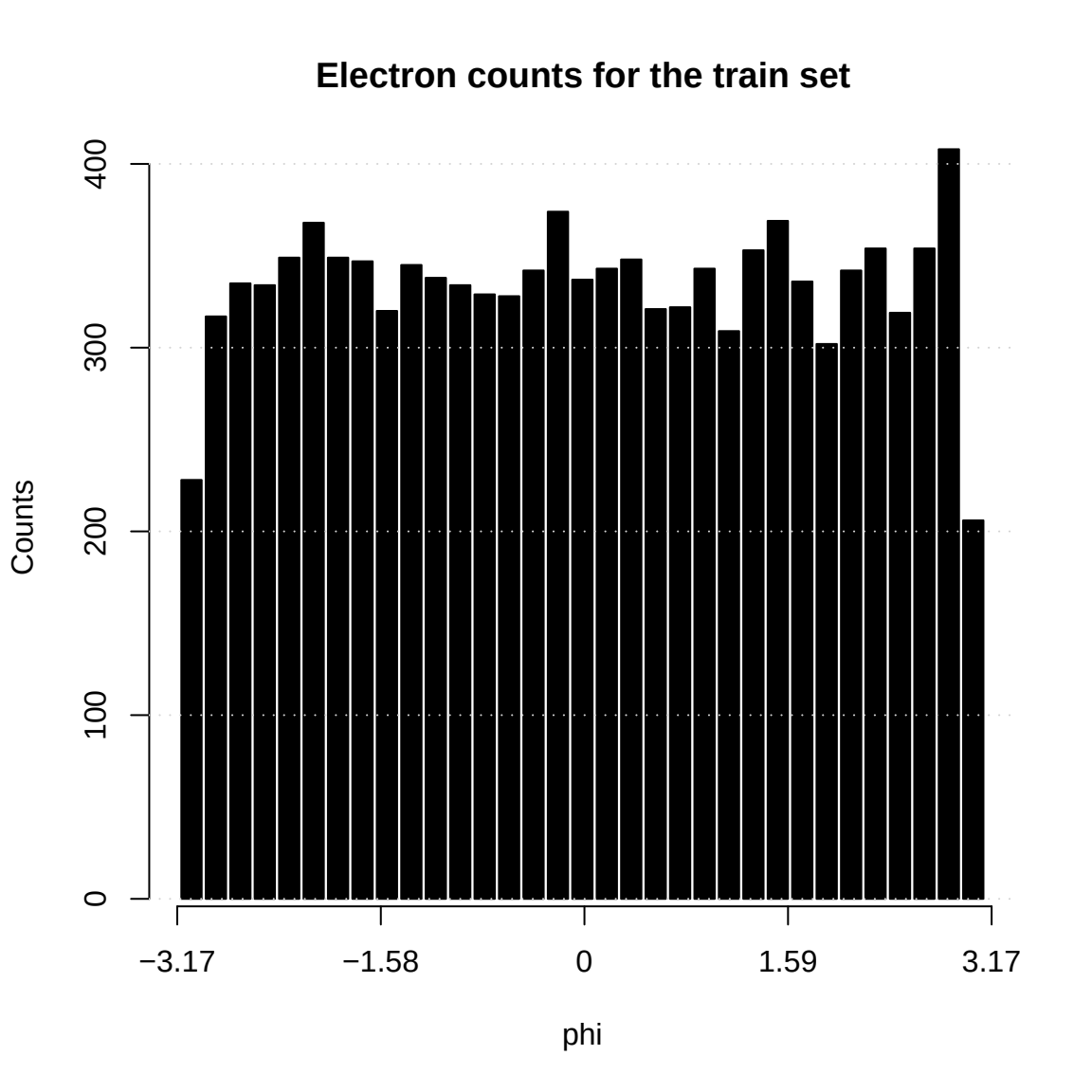

Jet counts for the test set
Counts
0
20
40
60
80
100
−2.45
−1.23
0
1.22
2.45
eta

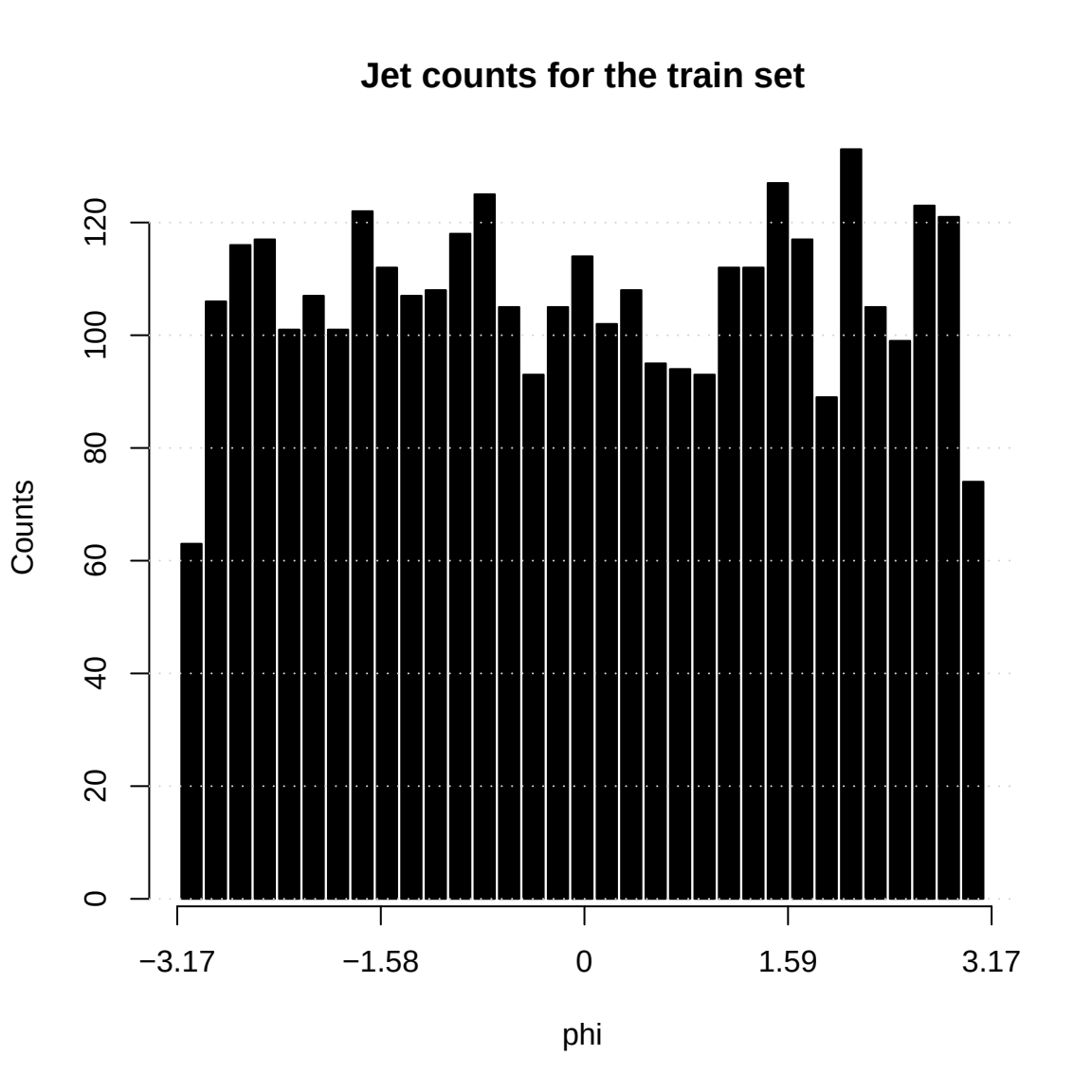

Electron counts for the test set
Counts
0
50
100
150
200
250
300
350
−3.19
−1.6
−0.01
1.58
3.17
phi


Jet counts for the test set
Counts
0
20
40
60
80
100
120
−3.19
−1.6
−0.01
1.58
3.17
phi

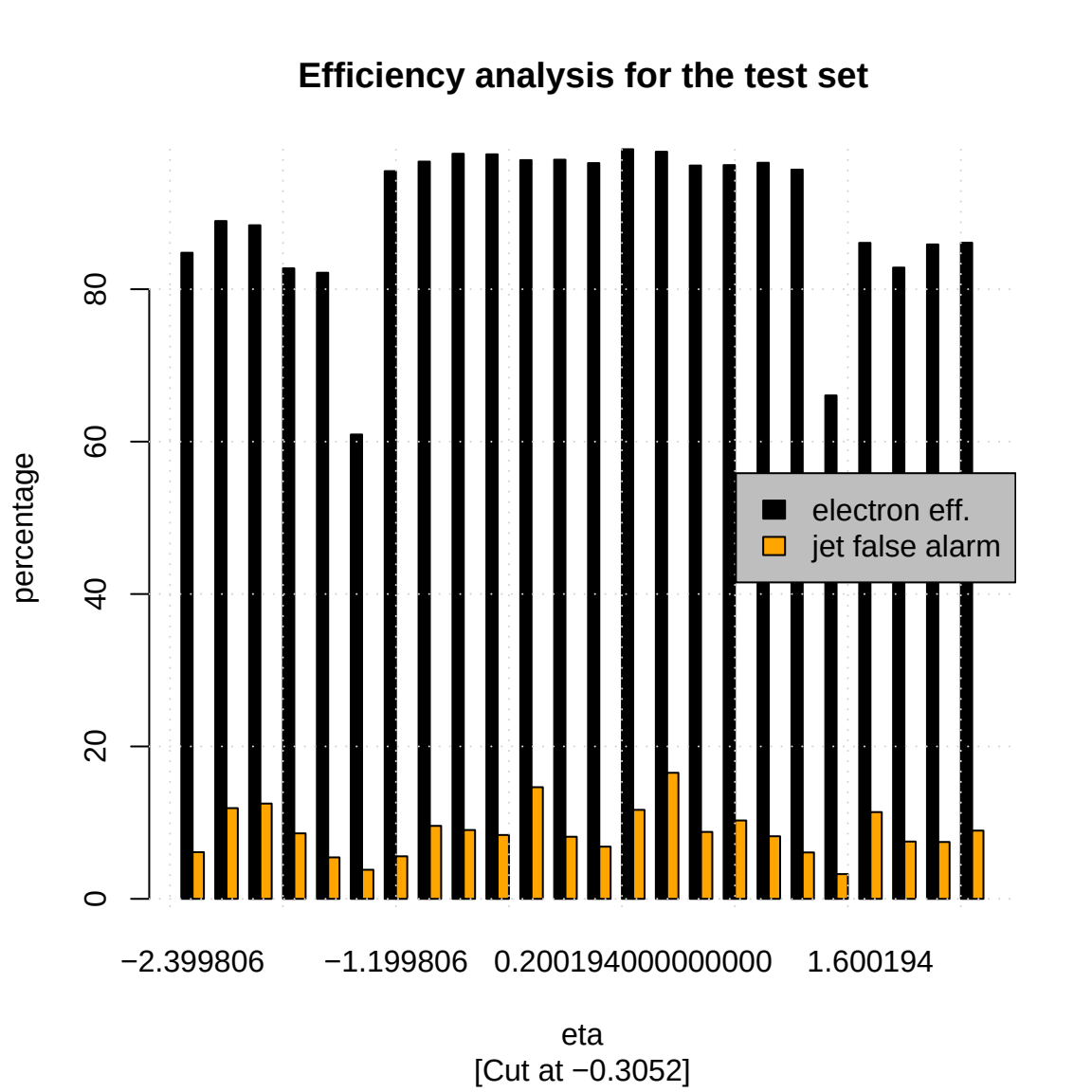

Electron counts for the train set
Counts
0
50
100
150
200
250
300
350
−2.45
−1.23
0
1.22
2.45
eta


Jet counts for the train set
Counts
0
20
40
60
80
100
−2.45
−1.23
0
1.22
2.45
eta

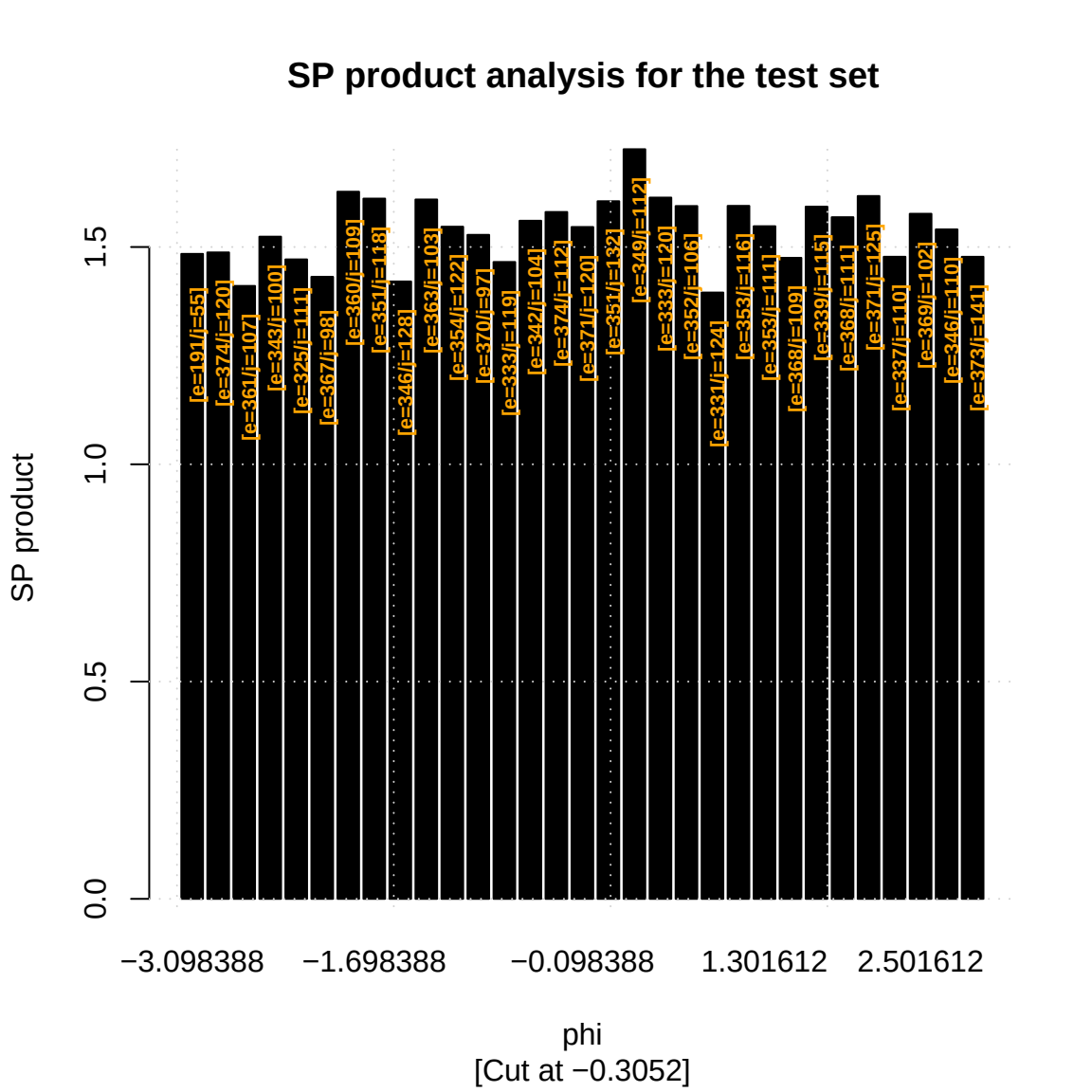

Electron counts for the train set
Counts
0
100
200
300
400
−3.17
−1.58
0
1.59
3.17
phi

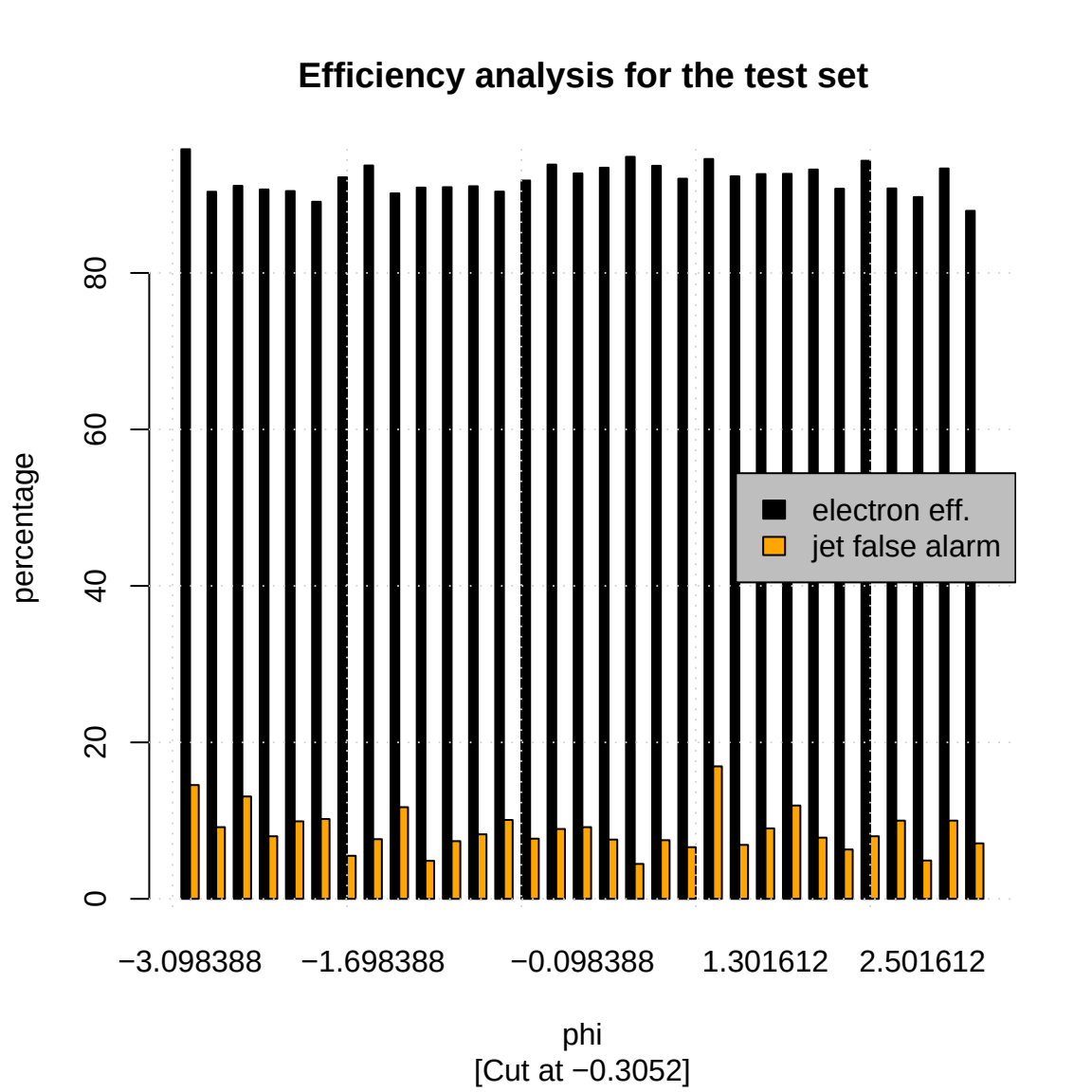

Jet counts for the train set
Counts
0
20
40
60
80
100
120
−3.17
−1.58
0
1.59
3.17
phi

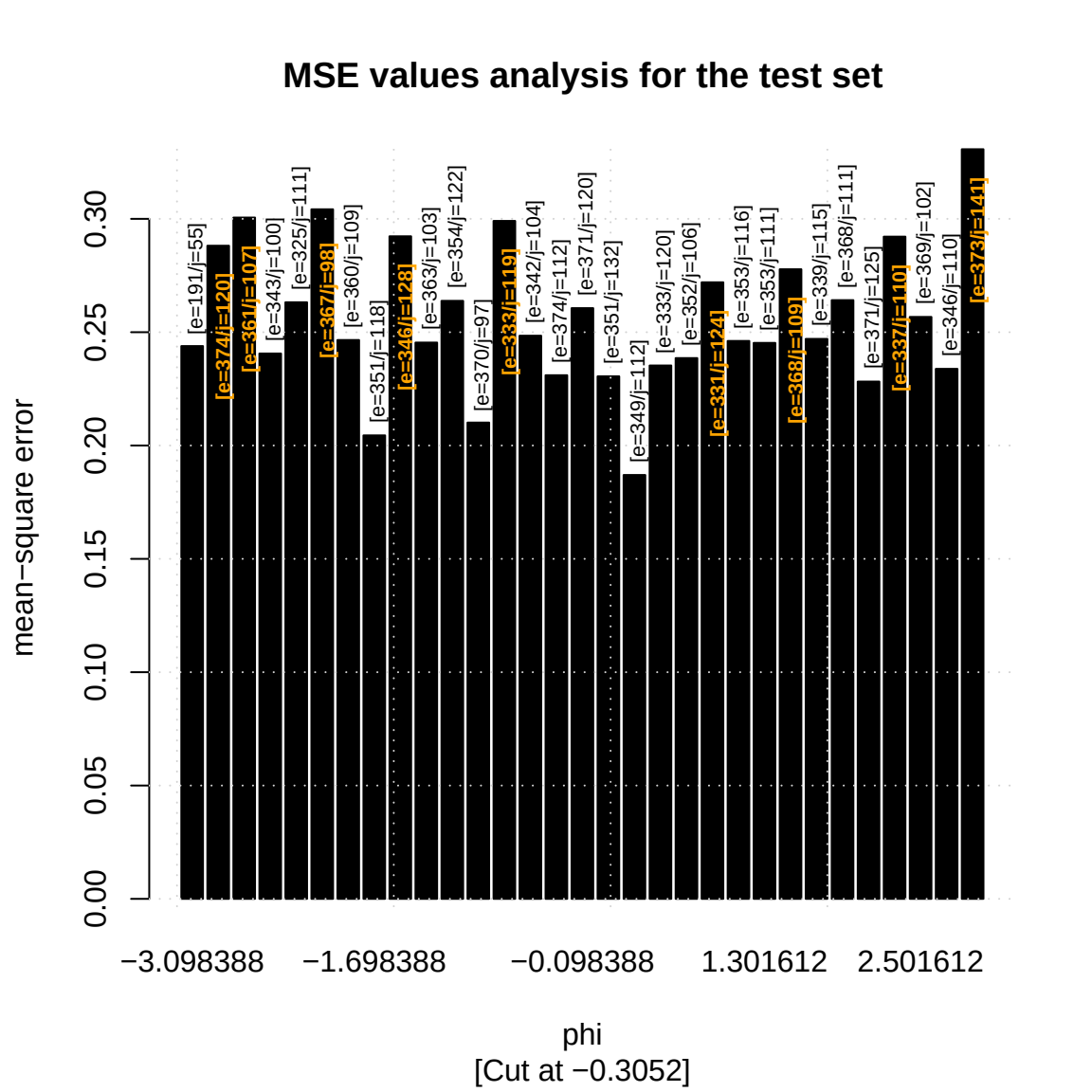
SP product analysis for the test set
SP product
0.0
0.5
1.0
1.5
[e=92/j=49]
[e=199/j=126]
[e=267/j=120]
[e=307/j=128]
[e=370/j=147]
[e=407/j=131]
[e=510/j=179]
[e=583/j=188]
[e=584/j=155]
[e=608/j=167]
[e=588/j=157]
[e=698/j=135]
[e=637/j=146]
[e=673/j=137]
[e=663/j=133]
[e=609/j=148]
[e=592/j=175]
[e=528/j=207]
[e=487/j=197]
[e=383/j=123]
[e=352/j=123]
[e=303/j=133]
[e=269/j=134]
[e=223/j=134]
−2.399806
−1.199806
0.400194
1.400194
eta
[Cut at −0.3052]

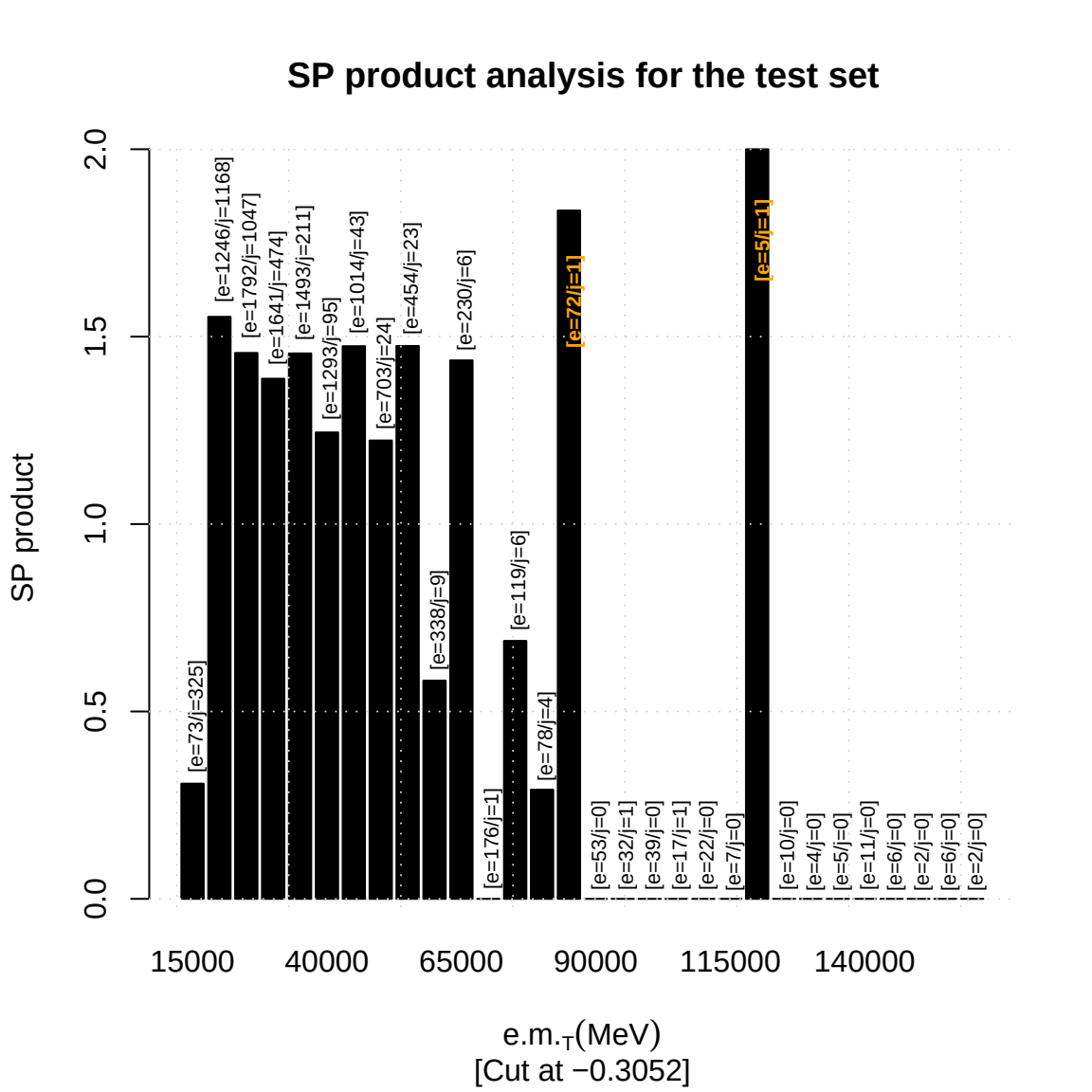

Efficiency analysis for the test set
percentage
0
20
40
60
80
electron eff.
jet false alarm
−2.399806
−1.199806
0.200194000000000
1.600194
eta
[Cut at −0.3052]

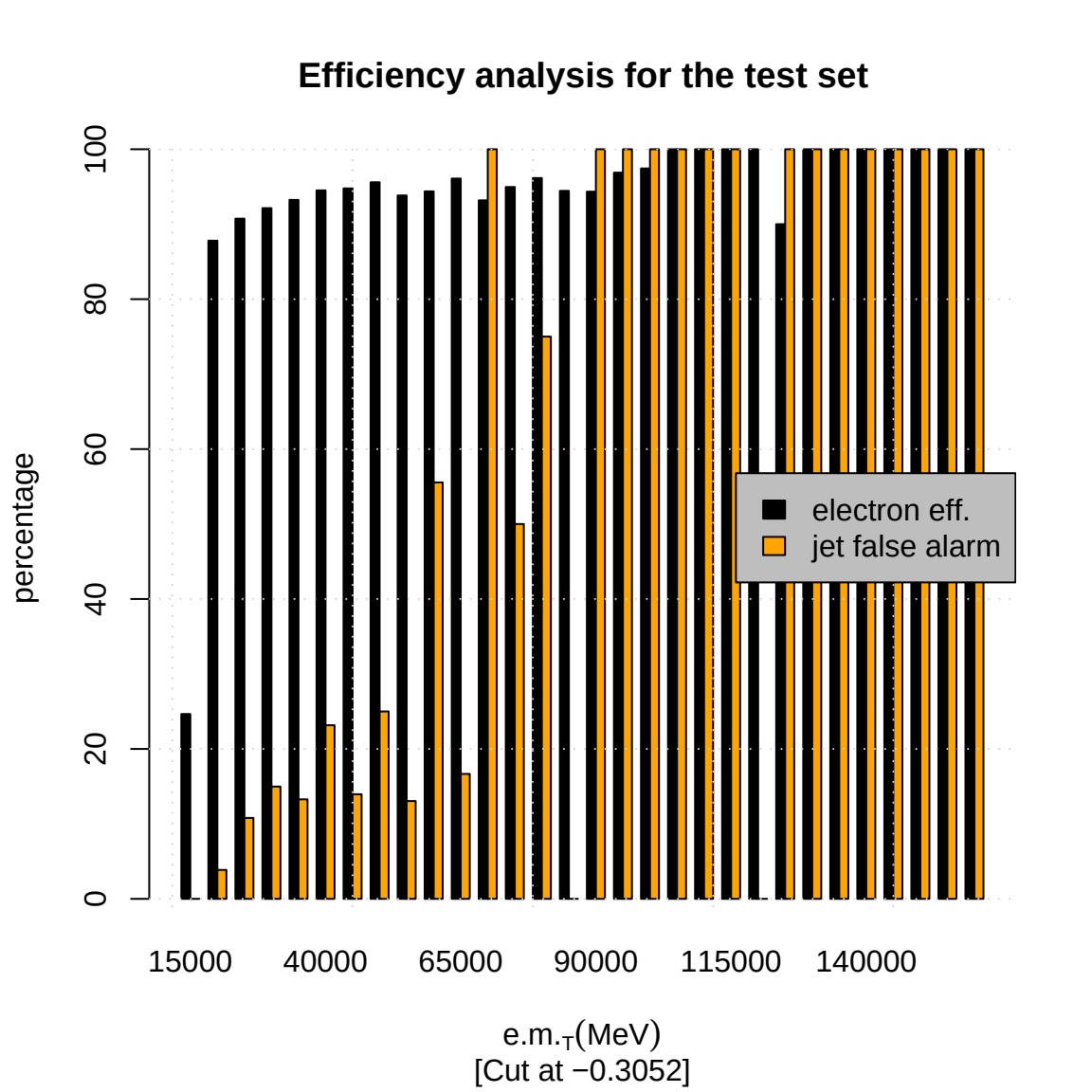
MSE values analysis for the test set
mean−square error
0.0
0.2
0.4
0.6
0.8
[e=92/j=49]
[e=199/j=126]
[e=267/j=120]
[e=307/j=128]
[e=370/j=147]
[e=407/j=131]
[e=510/j=179]
[e=583/j=188]
[e=584/j=155]
[e=608/j=167]
[e=588/j=157]
[e=698/j=135]
[e=637/j=146]
[e=673/j=137]
[e=663/j=133]
[e=609/j=148]
[e=592/j=175]
[e=528/j=207]
[e=487/j=197]
[e=383/j=123]
[e=352/j=123]
[e=303/j=133]
[e=269/j=134]
[e=223/j=134]
−2.399806
−1.199806
0.400194
1.400194
eta
[Cut at −0.3052]


SP product analysis for the test set
SP product
0.0
0.5
1.0
1.5
[e=191/j=55]
[e=374/j=120]
[e=361/j=107]
[e=343/j=100]
[e=325/j=111]
[e=367/j=98]
[e=360/j=109]
[e=351/j=118]
[e=346/j=128]
[e=363/j=103]
[e=354/j=122]
[e=370/j=97]
[e=333/j=119]
[e=342/j=104]
[e=374/j=112]
[e=371/j=120]
[e=351/j=132]
[e=349/j=112]
[e=333/j=120]
[e=352/j=106]
[e=331/j=124]
[e=353/j=116]
[e=353/j=111]
[e=368/j=109]
[e=339/j=115]
[e=368/j=111]
[e=371/j=125]
[e=337/j=110]
[e=369/j=102]
[e=346/j=110]
[e=373/j=141]
−3.098388
−1.698388
−0.098388
1.301612
2.501612
phi
[Cut at −0.3052]

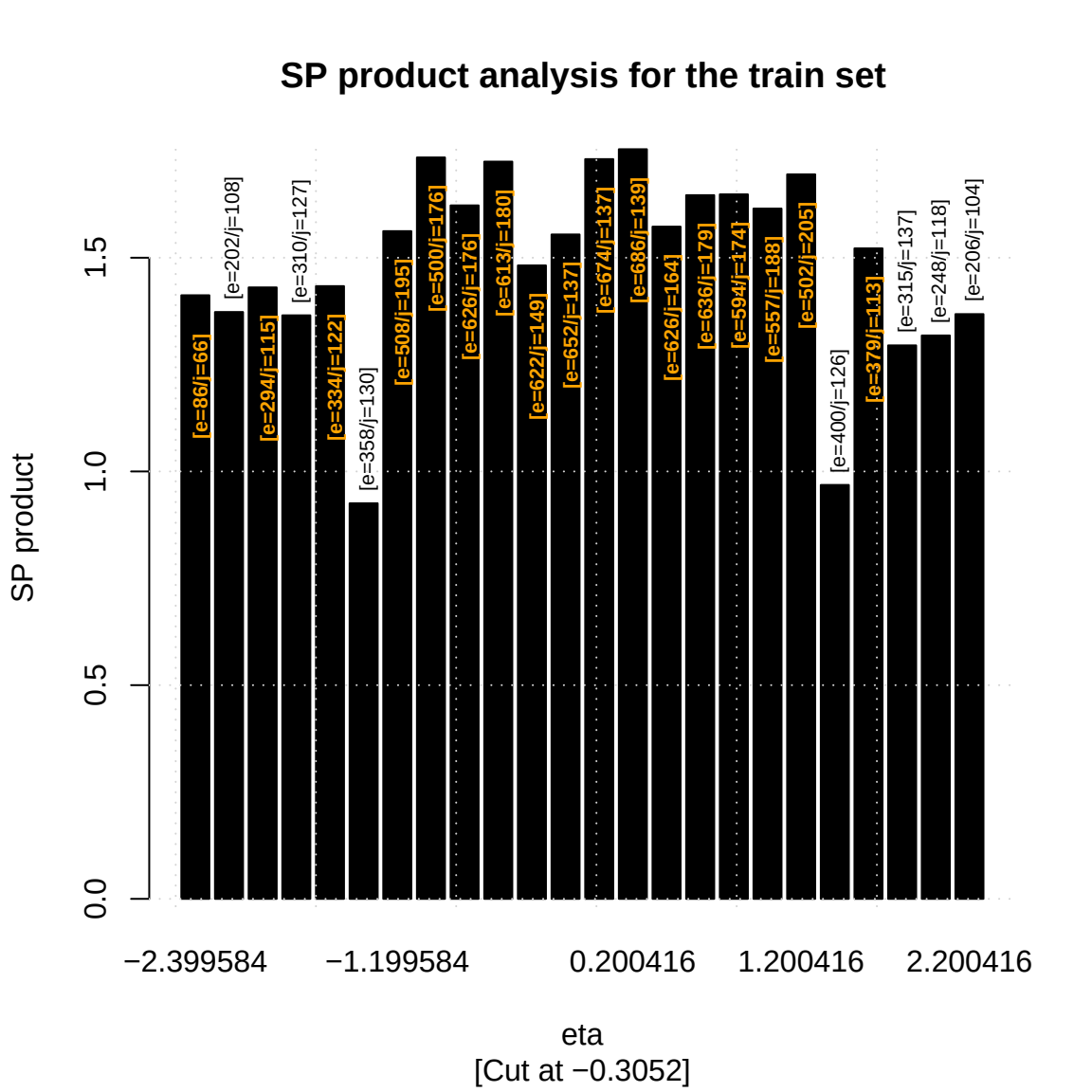

Efficiency analysis for the test set
percentage
0
20
40
60
80
electron eff.
jet false alarm
−3.098388
−1.698388
−0.098388
1.301612
2.501612
phi
[Cut at −0.3052]

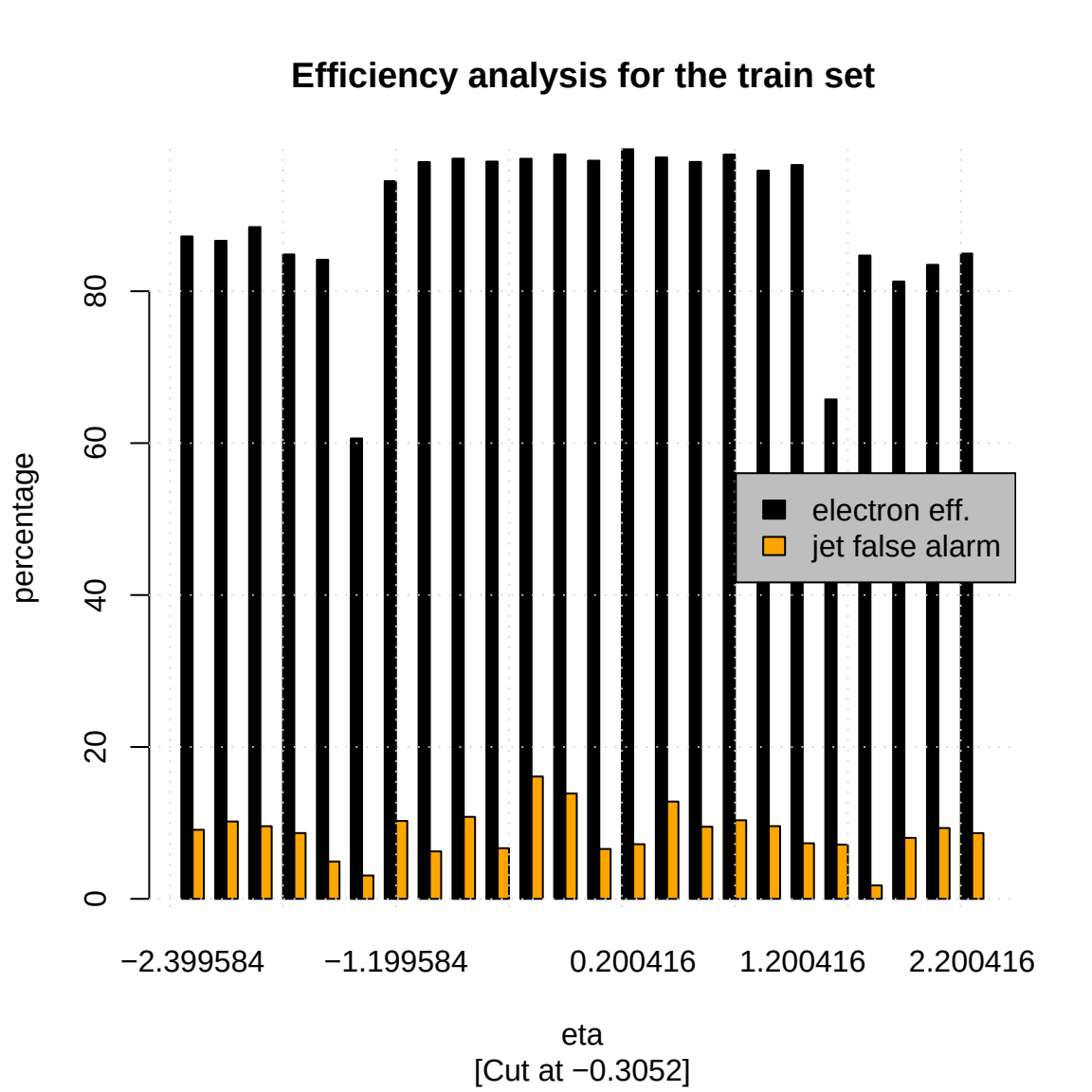

MSE values analysis for the test set
mean−square error
0.00
0.05
0.10
0.15
0.20
0.25
0.30
[e=191/j=55]
[e=374/j=120]
[e=361/j=107]
[e=343/j=100]
[e=325/j=111]
[e=367/j=98]
[e=360/j=109]
[e=351/j=118]
[e=346/j=128]
[e=363/j=103]
[e=354/j=122]
[e=370/j=97]
[e=333/j=119]
[e=342/j=104]
[e=374/j=112]
[e=371/j=120]
[e=351/j=132]
[e=349/j=112]
[e=333/j=120]
[e=352/j=106]
[e=331/j=124]
[e=353/j=116]
[e=353/j=111]
[e=368/j=109]
[e=339/j=115]
[e=368/j=111]
[e=371/j=125]
[e=337/j=110]
[e=369/j=102]
[e=346/j=110]
[e=373/j=141]
−3.098388
−1.698388
−0.098388
1.301612
2.501612
phi
[Cut at −0.3052]

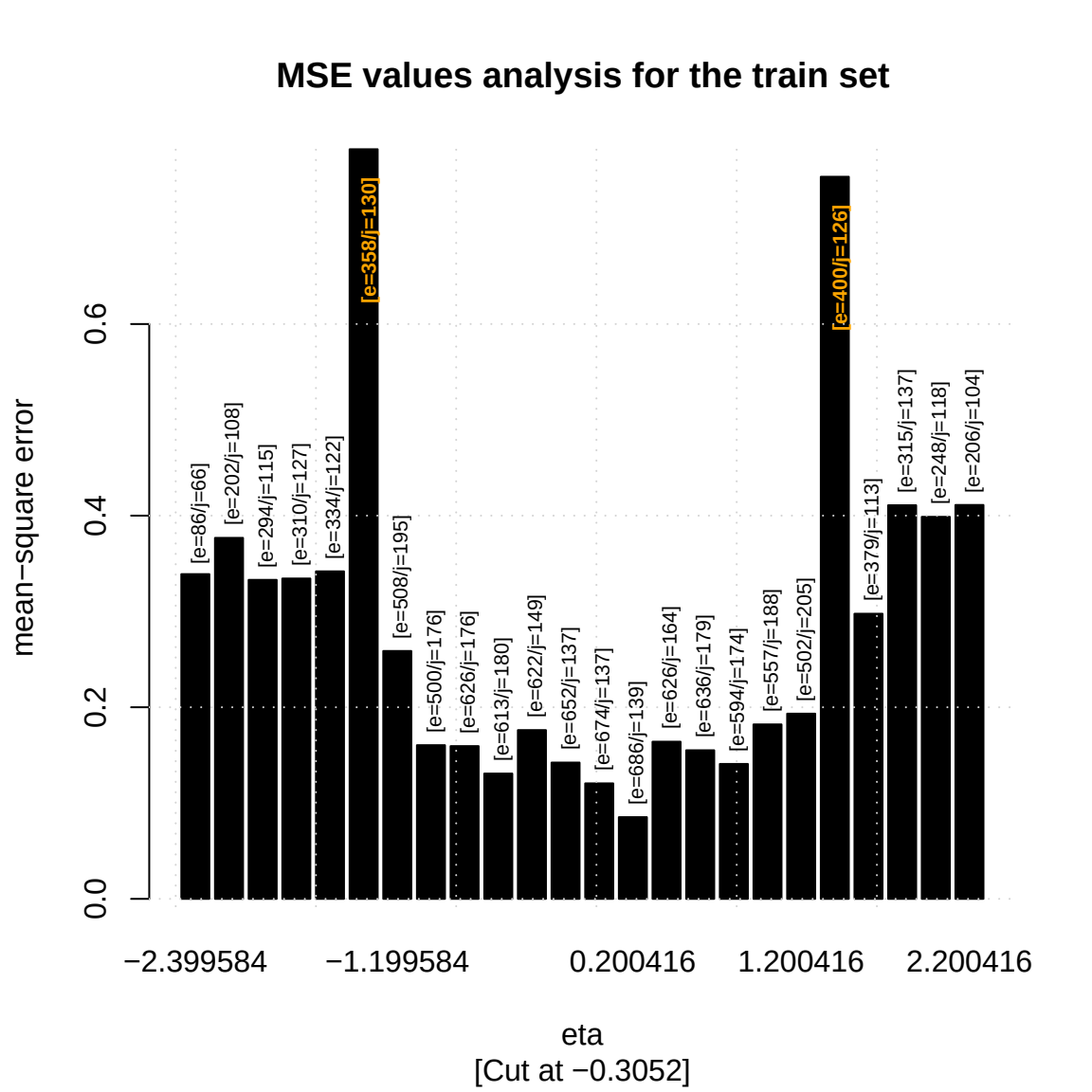

SP product analysis for the test set
SP product
0.0
0.5
1.0
1.5
2.0
[e=73/j=325]
[e=1246/j=1168]
[e=1792/j=1047]
[e=1641/j=474]
[e=1493/j=211]
[e=1293/j=95]
[e=1014/j=43]
[e=703/j=24]
[e=454/j=23]
[e=338/j=9]
[e=230/j=6]
[e=176/j=1]
[e=119/j=6]
[e=78/j=4]
[e=72/j=1]
[e=53/j=0]
[e=32/j=1]
[e=39/j=0]
[e=17/j=1]
[e=22/j=0]
[e=7/j=0]
[e=5/j=1]
[e=10/j=0]
[e=4/j=0]
[e=5/j=0]
[e=11/j=0]
[e=6/j=0]
[e=2/j=0]
[e=6/j=0]
[e=2/j=0]
15000
40000
65000
90000
115000
140000
e.m.$_T$(MeV)
[Cut at −0.3052]

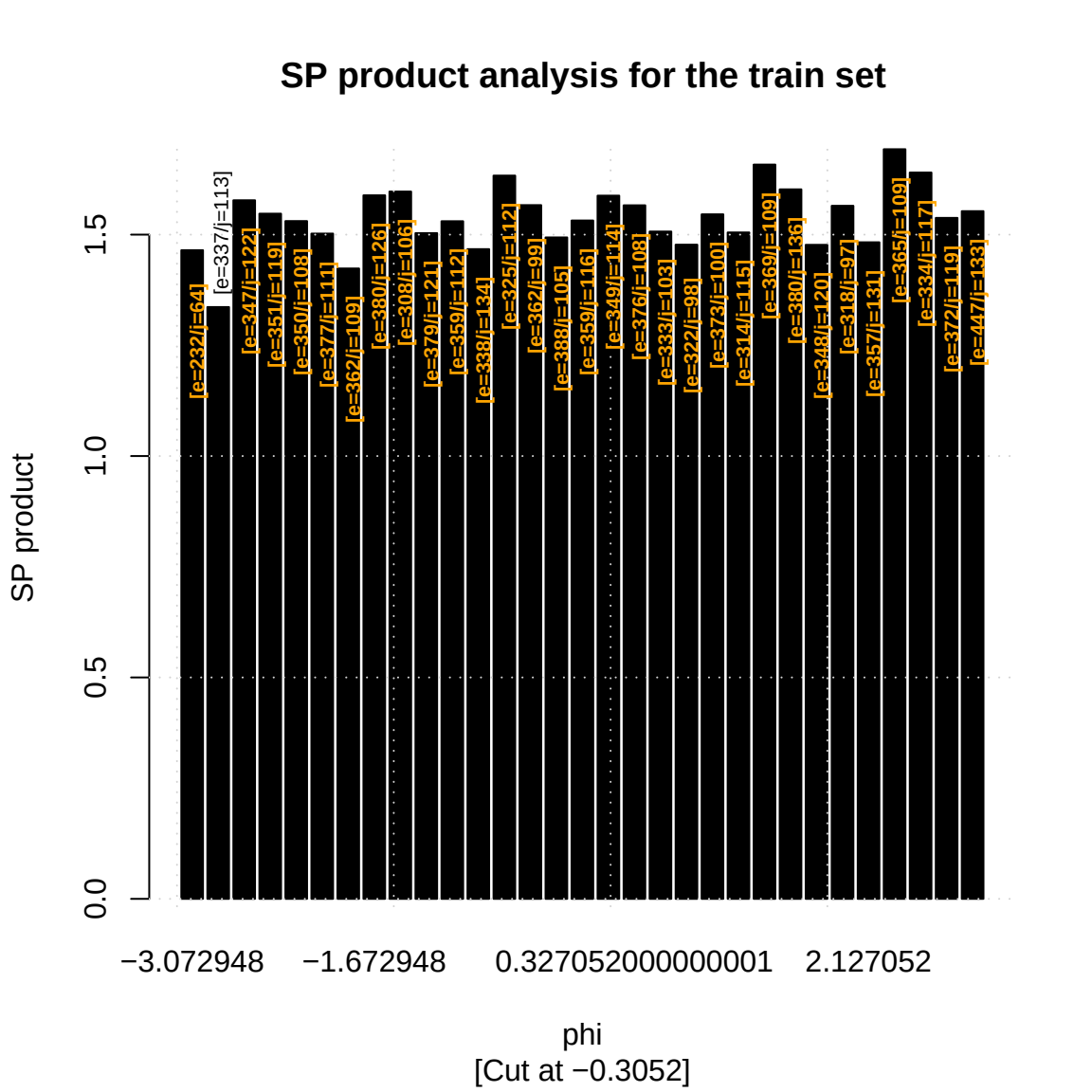

Efficiency analysis for the test set
percentage
0
20
40
60
80
100
15000
40000
65000
90000
115000
140000
electron eff.
jet false alarm
e.m.$_T$(MeV)
[Cut at −0.3052]

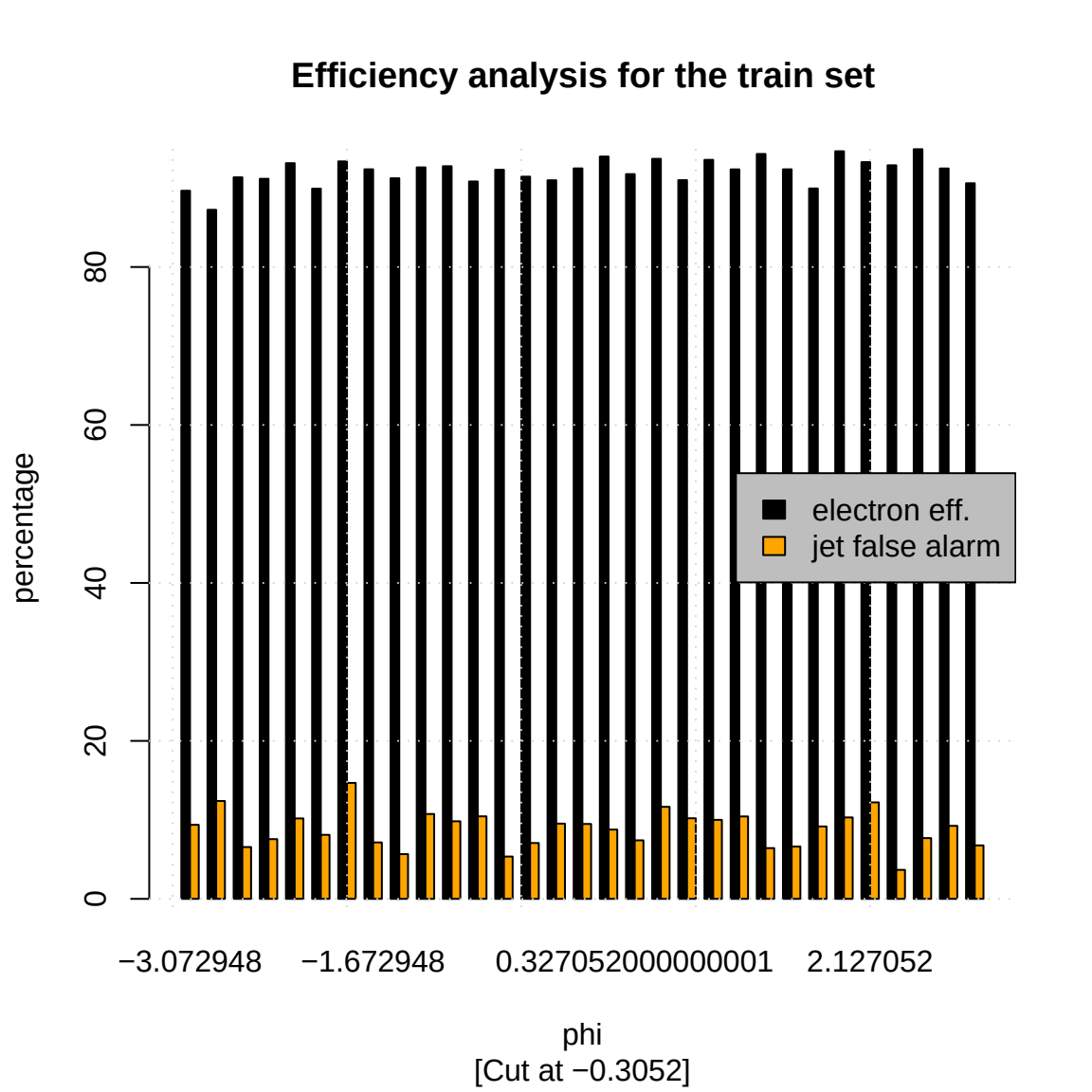
MSE values analysis for the test set
mean−square error
0.0
0.1
0.2
0.3
0.4
[e=73/j=325]
[e=1246/j=1168]
[e=1792/j=1047]
[e=1641/j=474]
[e=1493/j=211]
[e=1293/j=95]
[e=1014/j=43]
[e=703/j=24]
[e=454/j=23]
[e=338/j=9]
[e=230/j=6]
[e=176/j=1]
[e=119/j=6]
[e=78/j=4]
[e=72/j=1]
[e=53/j=0]
[e=32/j=1]
[e=39/j=0]
[e=17/j=1]
[e=22/j=0]
[e=7/j=0]
[e=5/j=1]
[e=10/j=0]
[e=4/j=0]
[e=5/j=0]
[e=11/j=0]
[e=6/j=0]
[e=2/j=0]
[e=6/j=0]
[e=2/j=0]
15000
40000
65000
90000
115000
140000
e.m.$_T$(MeV)
[Cut at −0.3052]

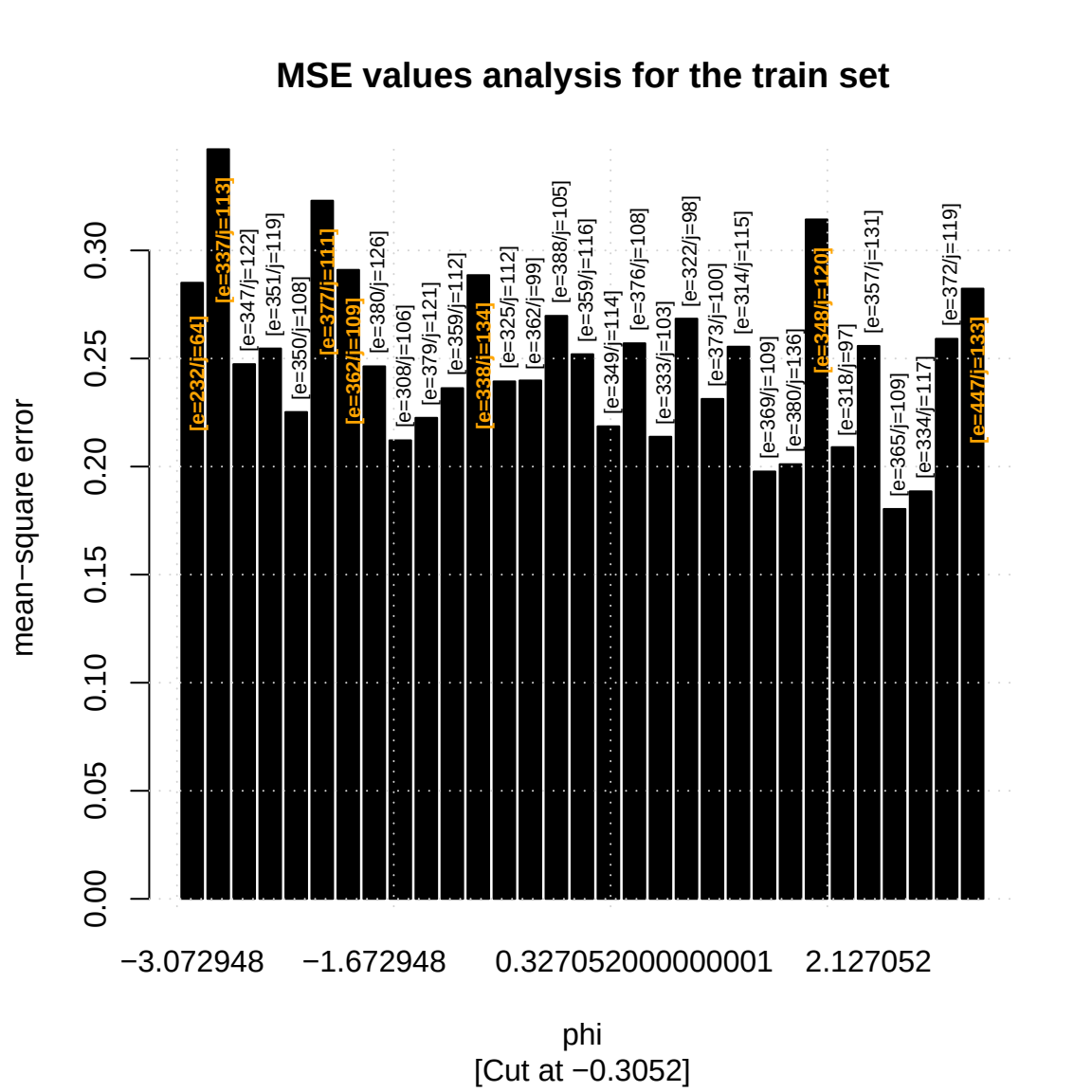

SP product analysis for the train set
SP product
0.0
0.5
1.0
1.5
[e=86/j=66]
[e=202/j=108]
[e=294/j=115]
[e=310/j=127]
[e=334/j=122]
[e=358/j=130]
[e=508/j=195]
[e=500/j=176]
[e=626/j=176]
[e=613/j=180]
[e=622/j=149]
[e=652/j=137]
[e=674/j=137]
[e=686/j=139]
[e=626/j=164]
[e=636/j=179]
[e=594/j=174]
[e=557/j=188]
[e=502/j=205]
[e=400/j=126]
[e=379/j=113]
[e=315/j=137]
[e=248/j=118]
[e=206/j=104]
−2.399584
−1.199584
0.200416
1.200416
2.200416
eta
[Cut at −0.3052]

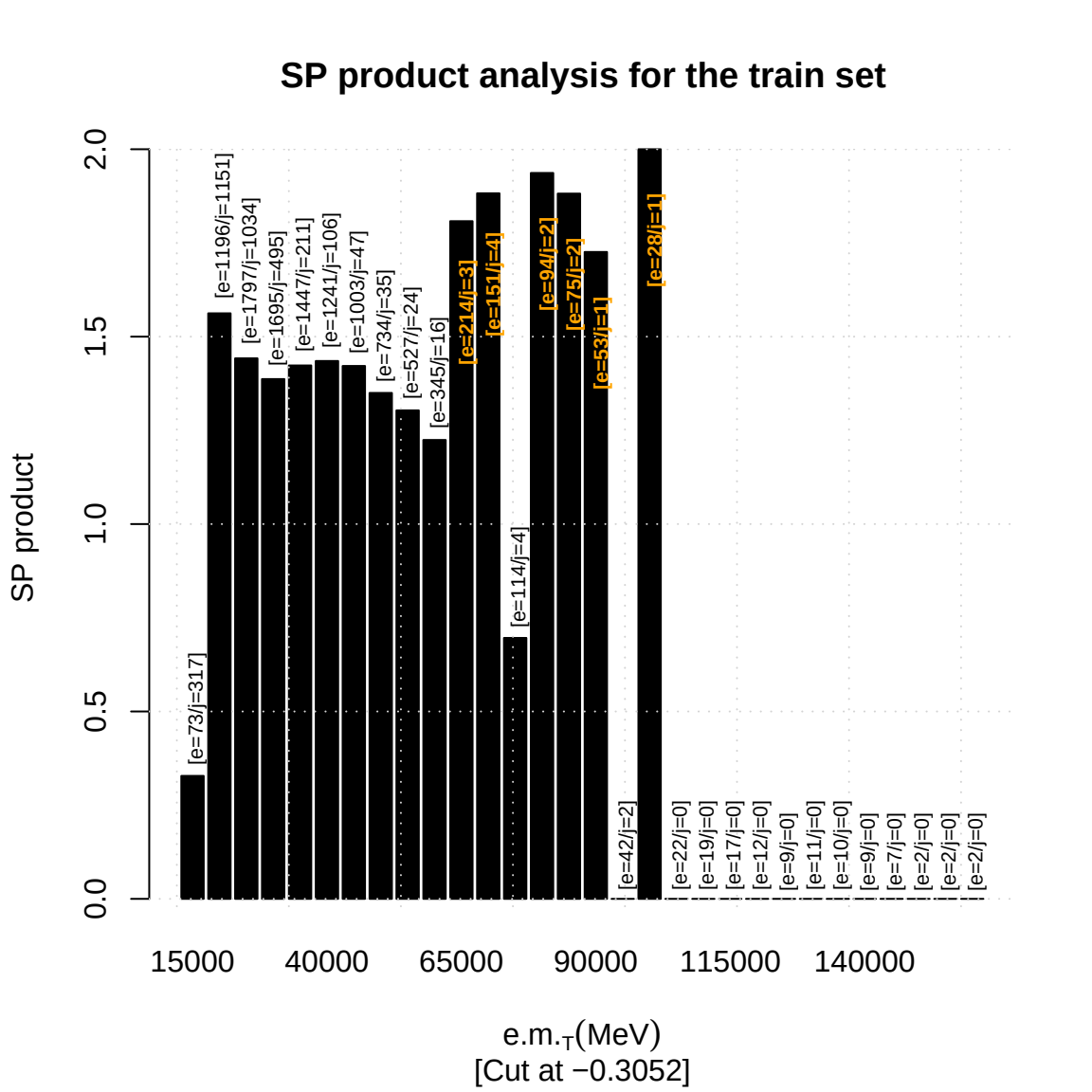

Efficiency analysis for the train set
percentage
0
20
40
60
80
electron eff.
jet false alarm
−2.399584
−1.199584
0.200416
1.200416
2.200416
eta
[Cut at −0.3052]

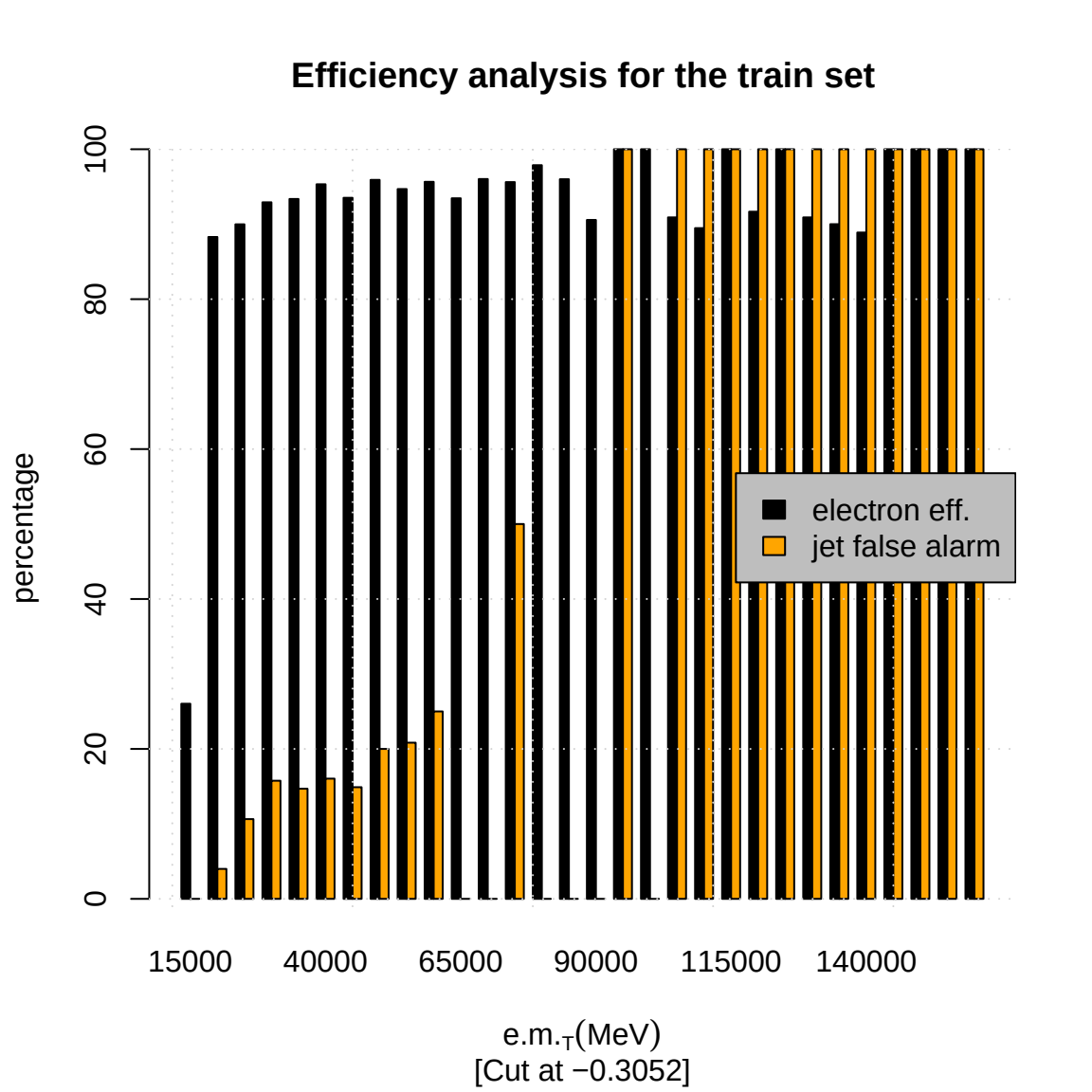

MSE values analysis for the train set
mean−square error
0.0
0.2
0.4
0.6
[e=86/j=66]
[e=202/j=108]
[e=294/j=115]
[e=310/j=127]
[e=334/j=122]
[e=358/j=130]
[e=508/j=195]
[e=500/j=176]
[e=626/j=176]
[e=613/j=180]
[e=622/j=149]
[e=652/j=137]
[e=674/j=137]
[e=686/j=139]
[e=626/j=164]
[e=636/j=179]
[e=594/j=174]
[e=557/j=188]
[e=502/j=205]
[e=400/j=126]
[e=379/j=113]
[e=315/j=137]
[e=248/j=118]
[e=206/j=104]
−2.399584
−1.199584
0.200416
1.200416
2.200416
eta
[Cut at −0.3052]

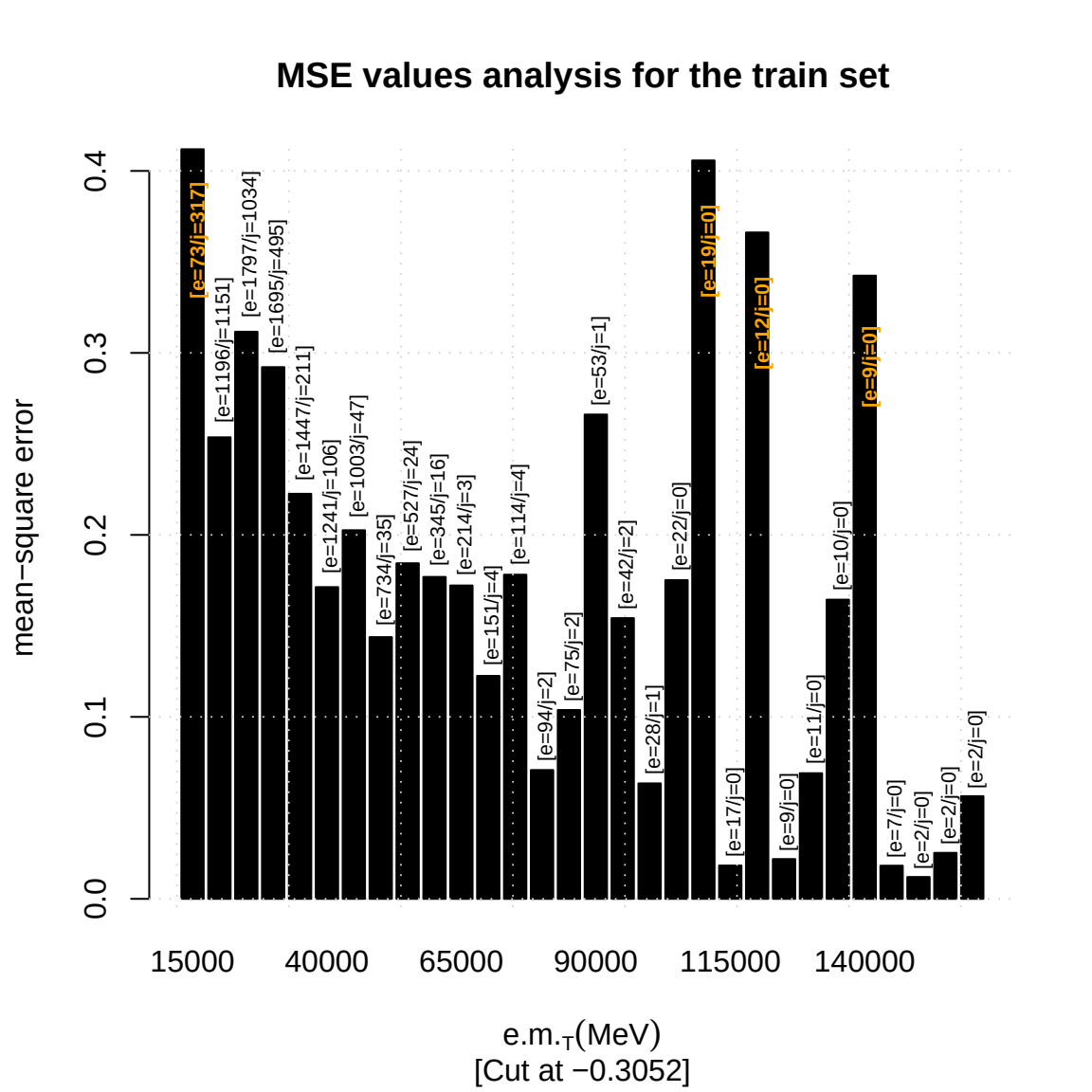

SP product analysis for the train set
SP product
0.0
0.5
1.0
1.5
[e=232/j=64]
[e=337/j=113]
[e=347/j=122]
[e=351/j=119]
[e=350/j=108]
[e=377/j=111]
[e=362/j=109]
[e=380/j=126]
[e=308/j=106]
[e=379/j=121]
[e=359/j=112]
[e=338/j=134]
[e=325/j=112]
[e=362/j=99]
[e=388/j=105]
[e=359/j=116]
[e=349/j=114]
[e=376/j=108]
[e=333/j=103]
[e=322/j=98]
[e=373/j=100]
[e=314/j=115]
[e=369/j=109]
[e=380/j=136]
[e=348/j=120]
[e=318/j=97]
[e=357/j=131]
[e=365/j=109]
[e=334/j=117]
[e=372/j=119]
[e=447/j=133]
−3.072948
−1.672948
0.327052000000001
2.127052
phi
[Cut at −0.3052]

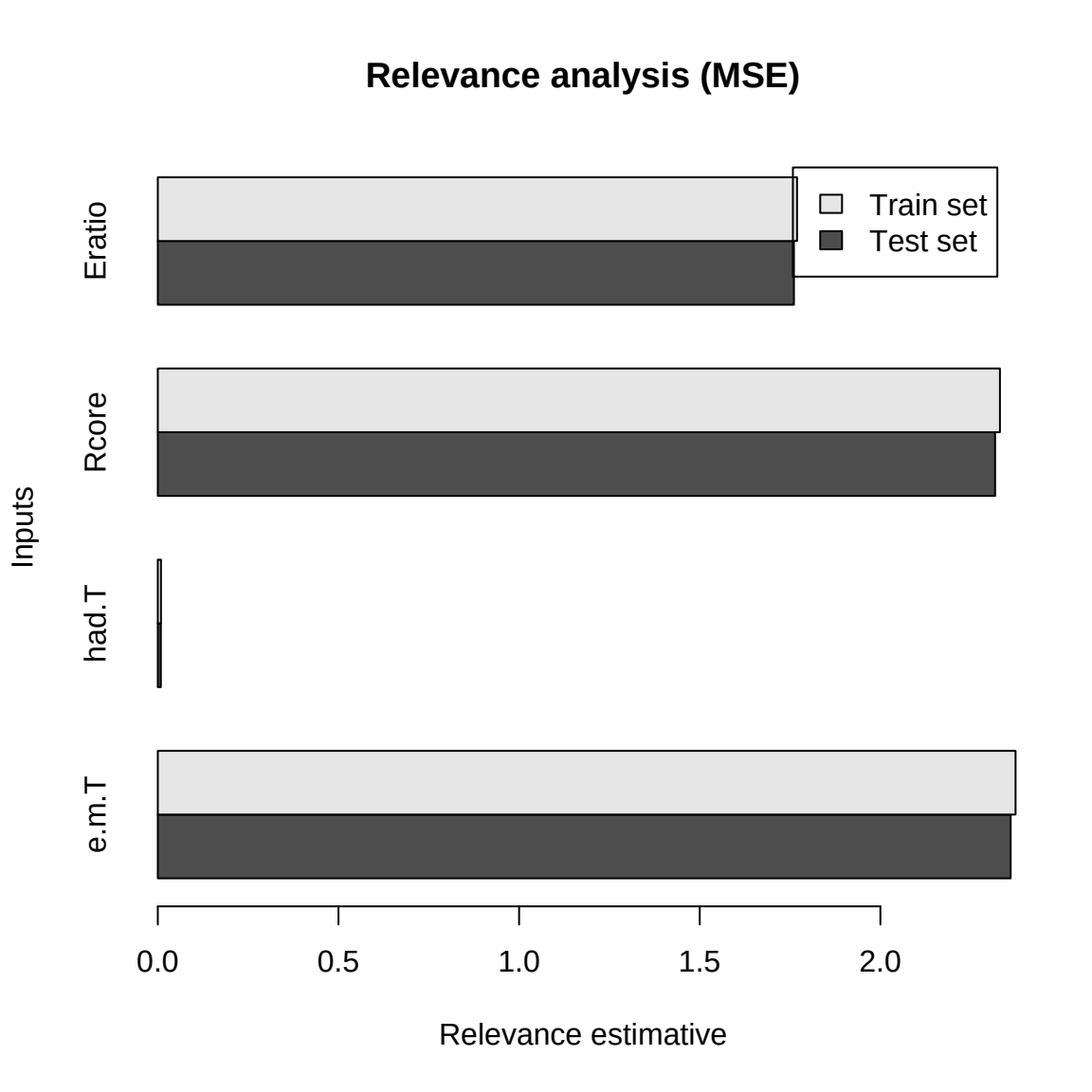

Efficiency analysis for the train set
percentage
0
20
40
60
80
electron eff.
jet false alarm
−3.072948
−1.672948
0.327052000000001
2.127052
phi
[Cut at −0.3052]

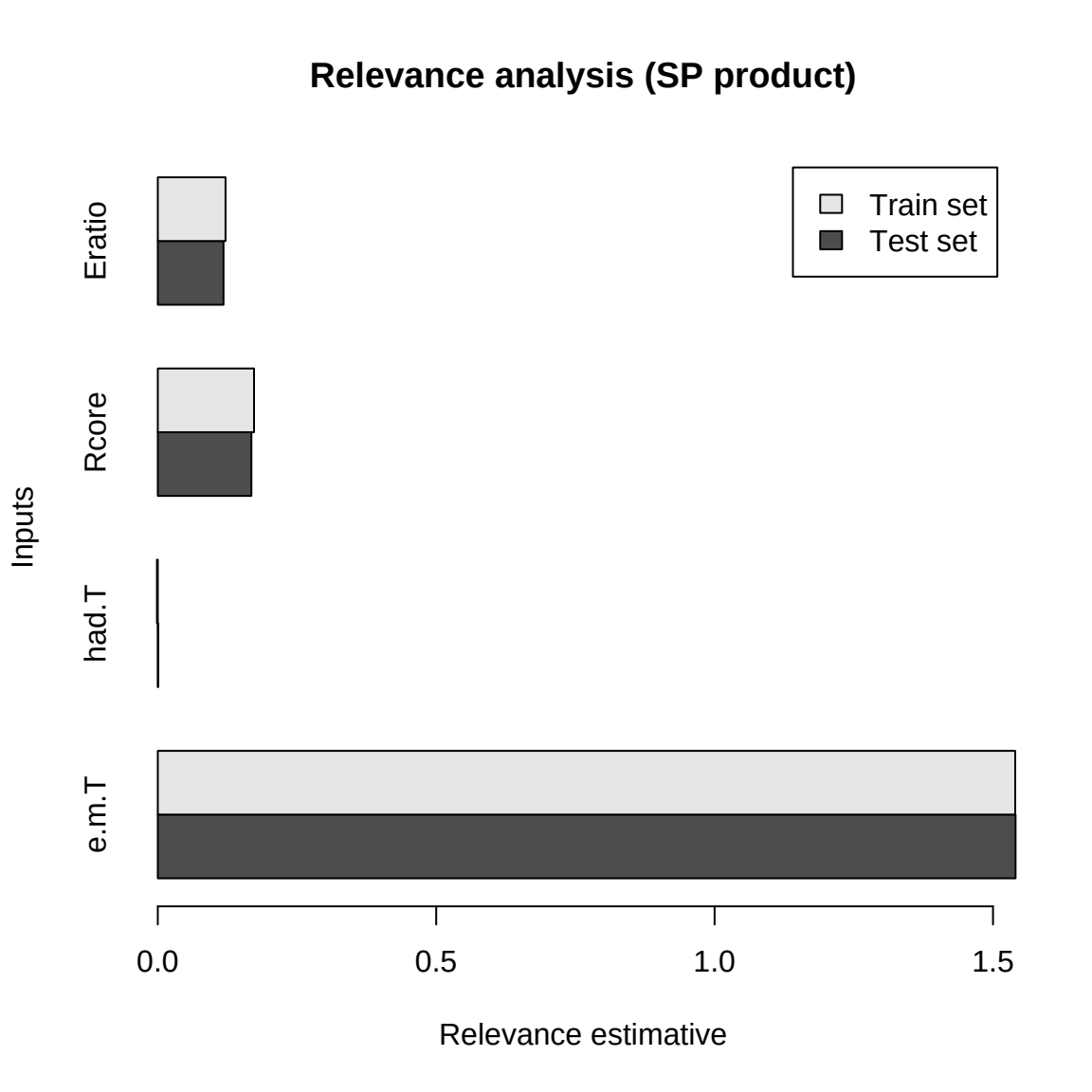

MSE values analysis for the train set
mean−square error
0.00
0.05
0.10
0.15
0.20
0.25
0.30
[e=232/j=64]
[e=337/j=113]
[e=347/j=122]
[e=351/j=119]
[e=350/j=108]
[e=377/j=111]
[e=362/j=109]
[e=380/j=126]
[e=308/j=106]
[e=379/j=121]
[e=359/j=112]
[e=338/j=134]
[e=325/j=112]
[e=362/j=99]
[e=388/j=105]
[e=359/j=116]
[e=349/j=114]
[e=376/j=108]
[e=333/j=103]
[e=322/j=98]
[e=373/j=100]
[e=314/j=115]
[e=369/j=109]
[e=380/j=136]
[e=348/j=120]
[e=318/j=97]
[e=357/j=131]
[e=365/j=109]
[e=334/j=117]
[e=372/j=119]
[e=447/j=133]
−3.072948
−1.672948
0.327052000000001
2.127052
phi
[Cut at −0.3052]


SP product analysis for the train set
SP product
0.0
0.5
1.0
1.5
2.0
[e=73/j=317]
[e=1196/j=1151]
[e=1797/j=1034]
[e=1695/j=495]
[e=1447/j=211]
[e=1241/j=106]
[e=1003/j=47]
[e=734/j=35]
[e=527/j=24]
[e=345/j=16]
[e=214/j=3]
[e=151/j=4]
[e=114/j=4]
[e=94/j=2]
[e=75/j=2]
[e=53/j=1]
[e=42/j=2]
[e=28/j=1]
[e=22/j=0]
[e=19/j=0]
[e=17/j=0]
[e=12/j=0]
[e=9/j=0]
[e=11/j=0]
[e=10/j=0]
[e=9/j=0]
[e=7/j=0]
[e=2/j=0]
[e=2/j=0]
[e=2/j=0]
15000
40000
65000
90000
115000
140000
e.m.$_T$(MeV)
[Cut at −0.3052]


Efficiency analysis for the train set
percentage
0
20
40
60
80
100
15000
40000
65000
90000
115000
140000
electron eff.
jet false alarm
e.m.$_T$(MeV)
[Cut at −0.3052]


MSE values analysis for the train set
mean−square error
0.0
0.1
0.2
0.3
0.4
[e=73/j=317]
[e=1196/j=1151]
[e=1797/j=1034]
[e=1695/j=495]
[e=1447/j=211]
[e=1241/j=106]
[e=1003/j=47]
[e=734/j=35]
[e=527/j=24]
[e=345/j=16]
[e=214/j=3]
[e=151/j=4]
[e=114/j=4]
[e=94/j=2]
[e=75/j=2]
[e=53/j=1]
[e=42/j=2]
[e=28/j=1]
[e=22/j=0]
[e=19/j=0]
[e=17/j=0]
[e=12/j=0]
[e=9/j=0]
[e=11/j=0]
[e=10/j=0]
[e=9/j=0]
[e=7/j=0]
[e=2/j=0]
[e=2/j=0]
[e=2/j=0]
15000
40000
65000
90000
115000
140000
e.m.$_T$(MeV)
[Cut at −0.3052]


Relevance analysis (MSE)
Train set
Test set
Eratio
Rcore
had.T
e.m.T
Inputs
0.0
0.5
1.0
1.5
2.0
Relevance estimative


Relevance analysis (SP product)
Train set
Test set
Eratio
Rcore
had.T
e.m.T
Inputs
0.0
0.5
1.0
1.5
Relevance estimative