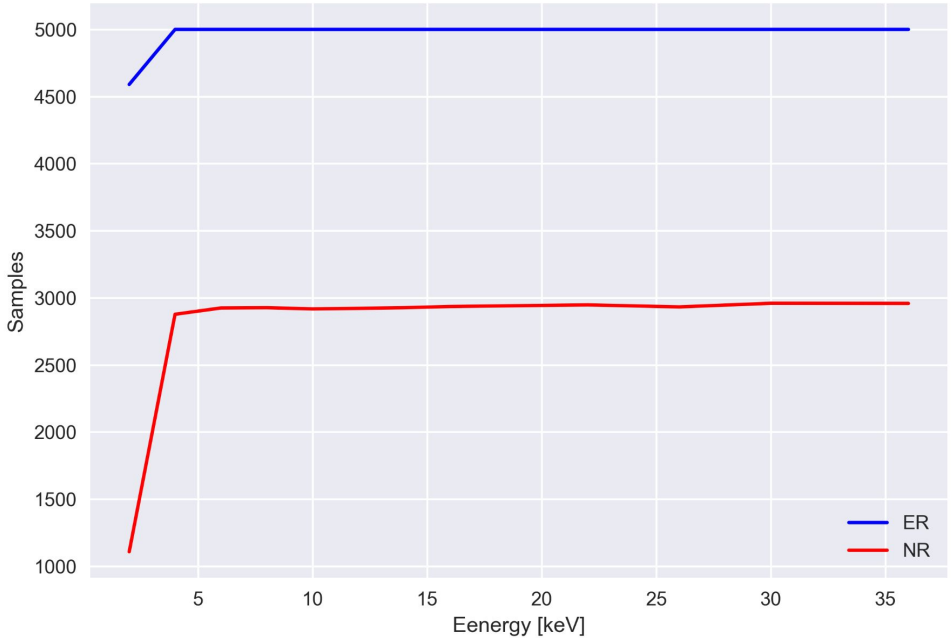
ER/NR discrimination (Autumn21)

A. Prajapati

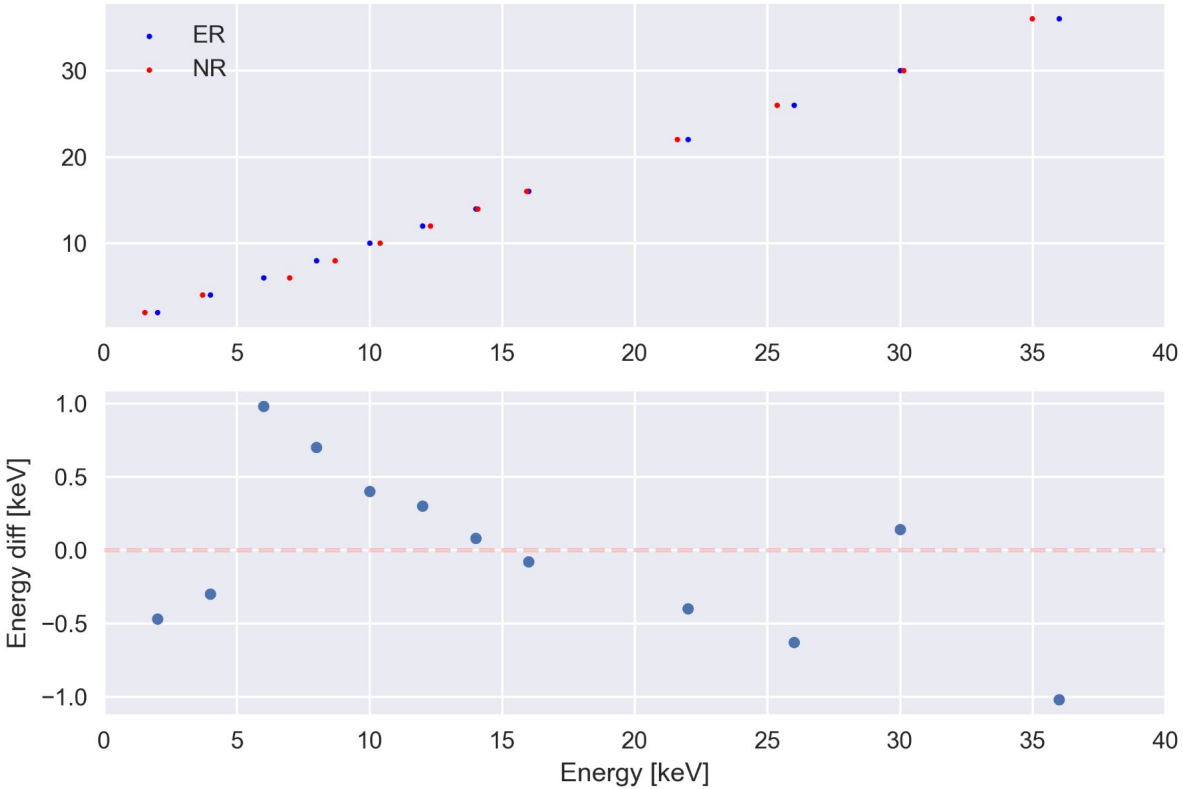
05/05/2022

No. of samples for training



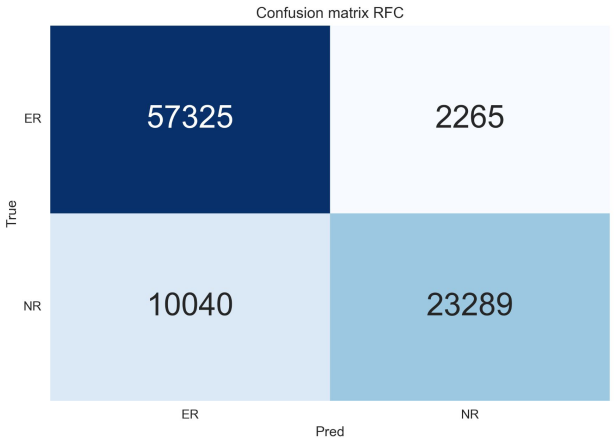
- 5000 events for each energy (except for 2 keV) for ER
- ~3000 events for each energy (except for 3 keV ~1.5keV) for NR.

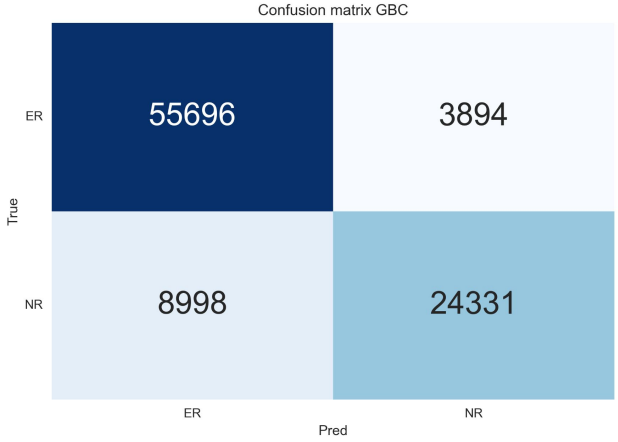
Energies for training

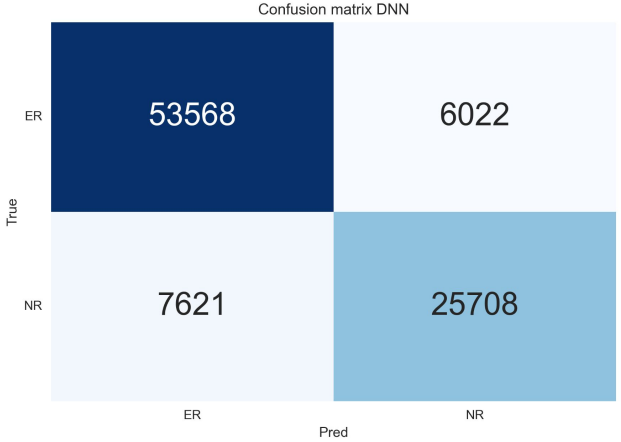


- ER and NR energies that are clubbed together.

CM

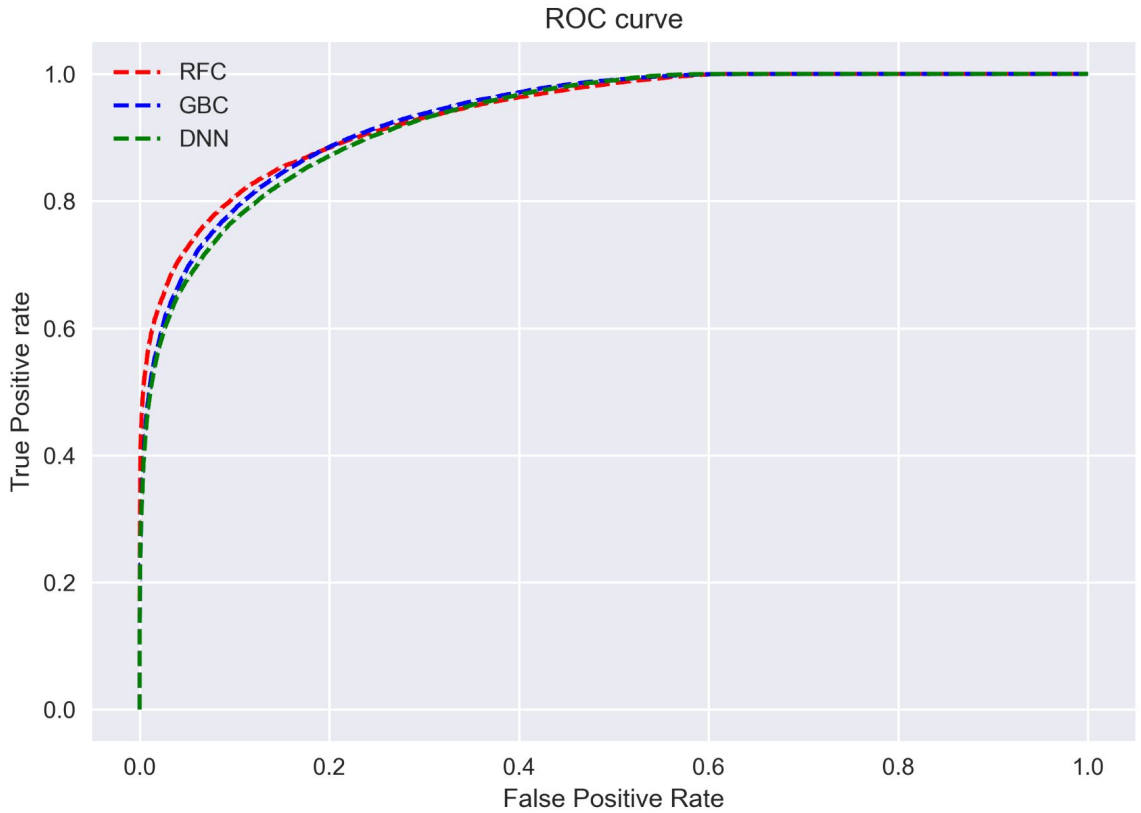






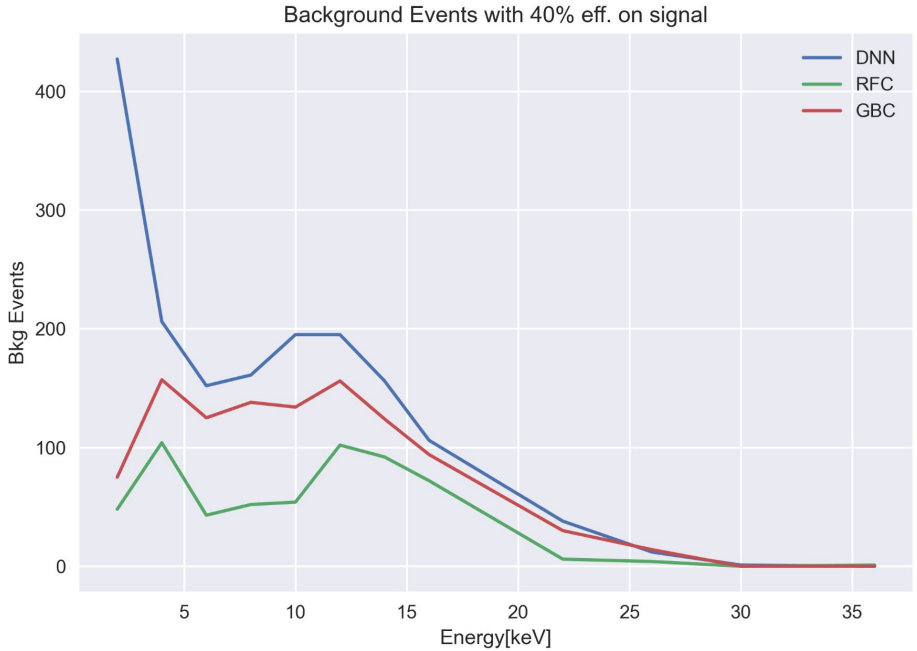
Less number of ER are classified as nuclear recoil in Random Forest Classifier compared to other two models.

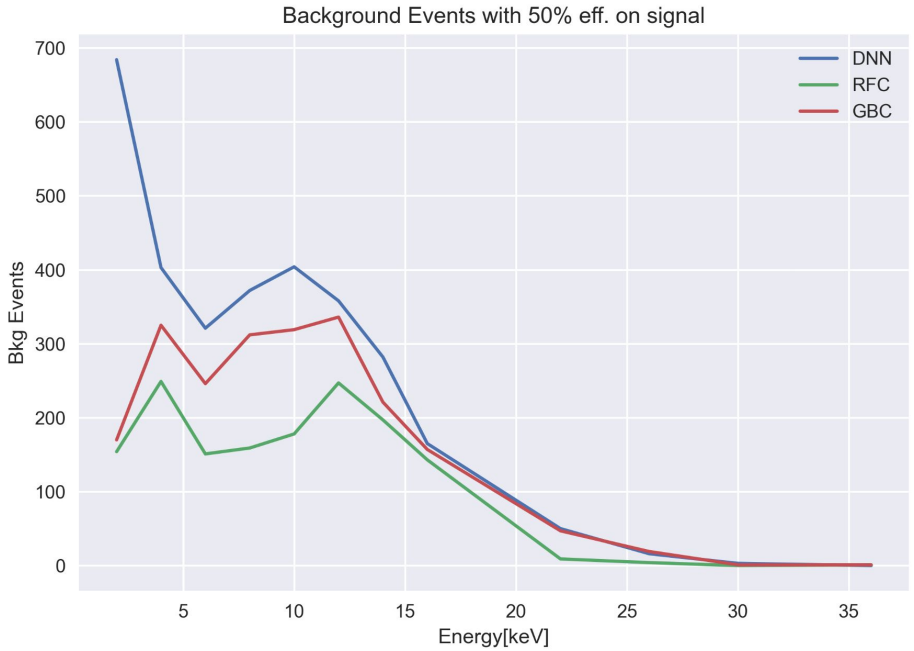
ROC



Performance of all 3 network is very similar. However, RFC is slightly better than other 2 models.

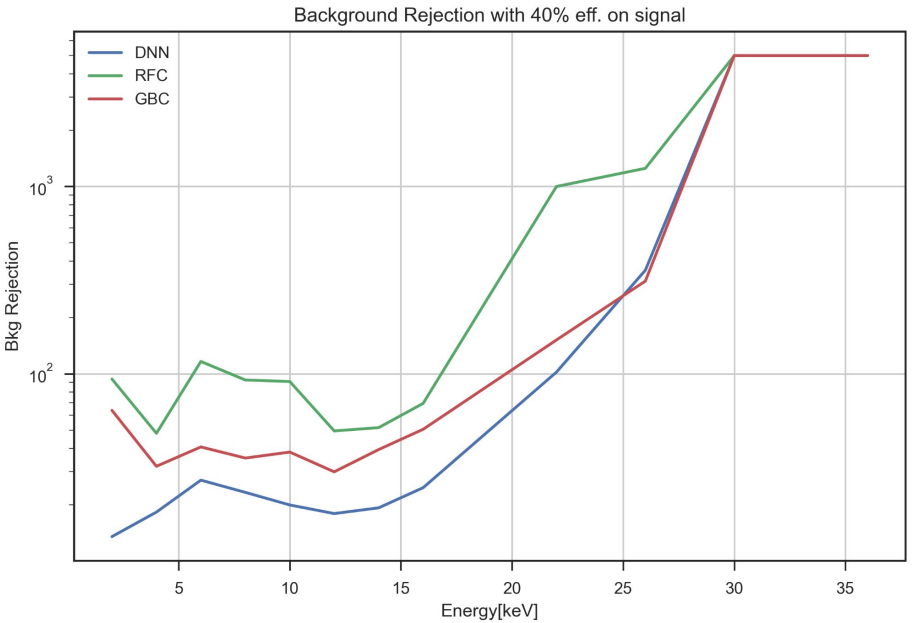
Background

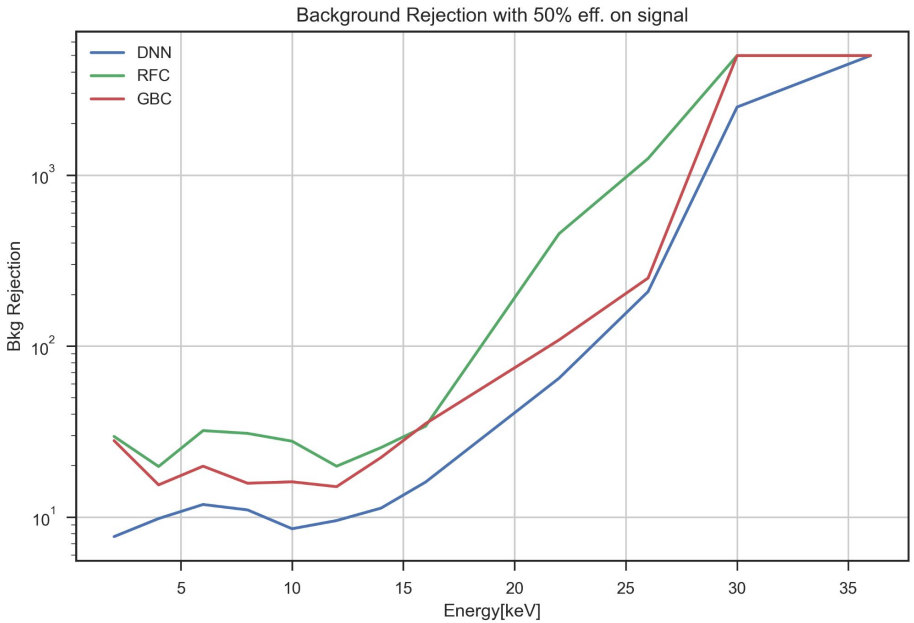




No. of ER events classified as NR in each energy bin.

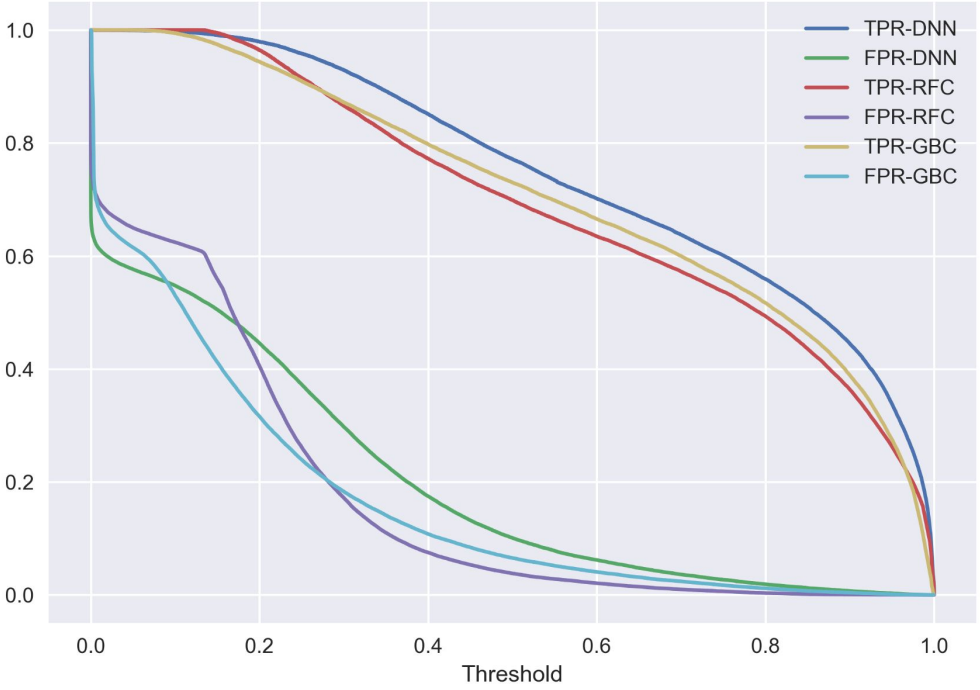
Rejection





Rejection = Total No. of ER/ No. of ER left.

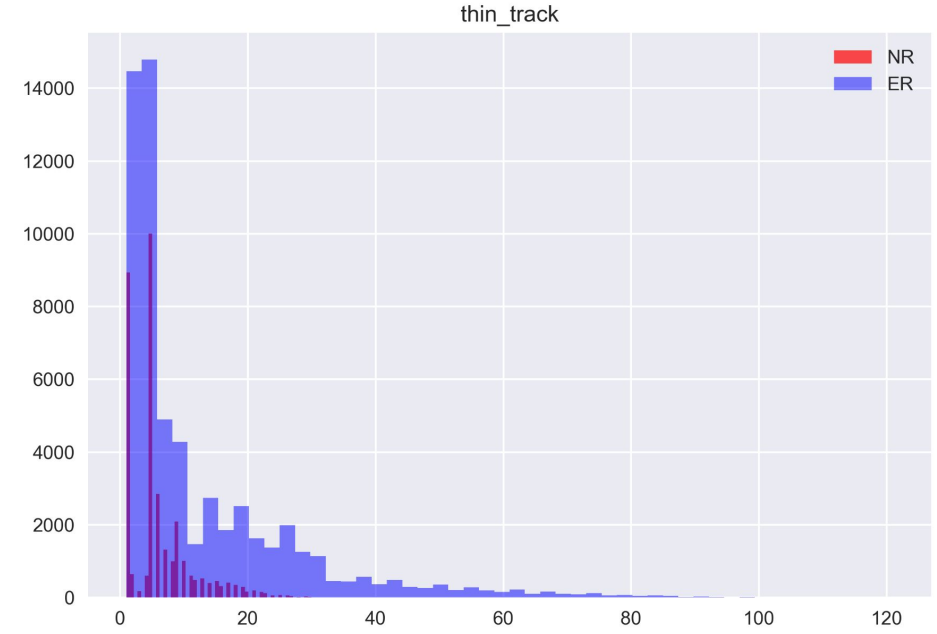
TPR and FPR

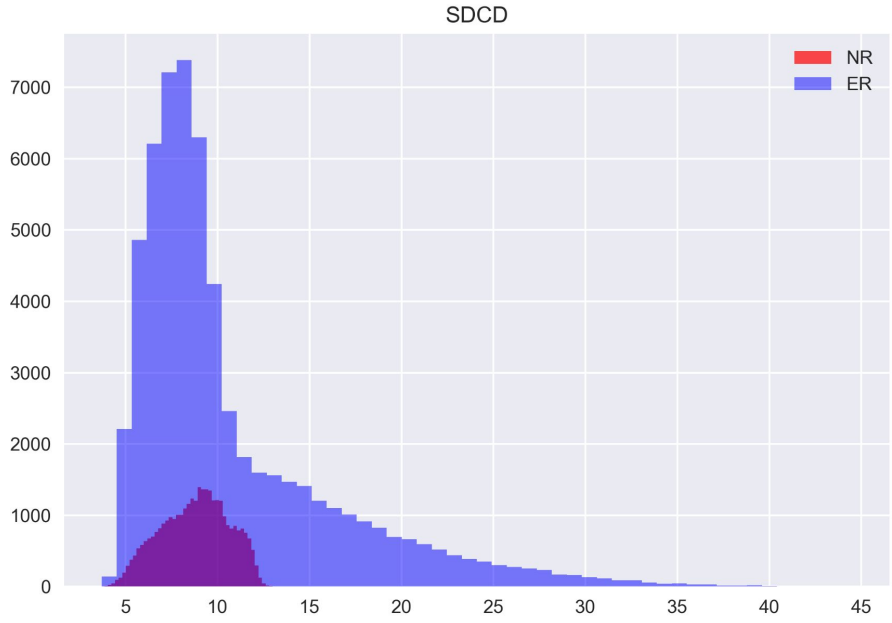


Models	Signal eff.	Bkg. eff.[%]
RFC	40	0.1
	50	0.72
GBC	40	4.6
	50	6.7
DNN	40	0.05
	50	0.15
Cut on Delta	40	0.8
	50	3.5

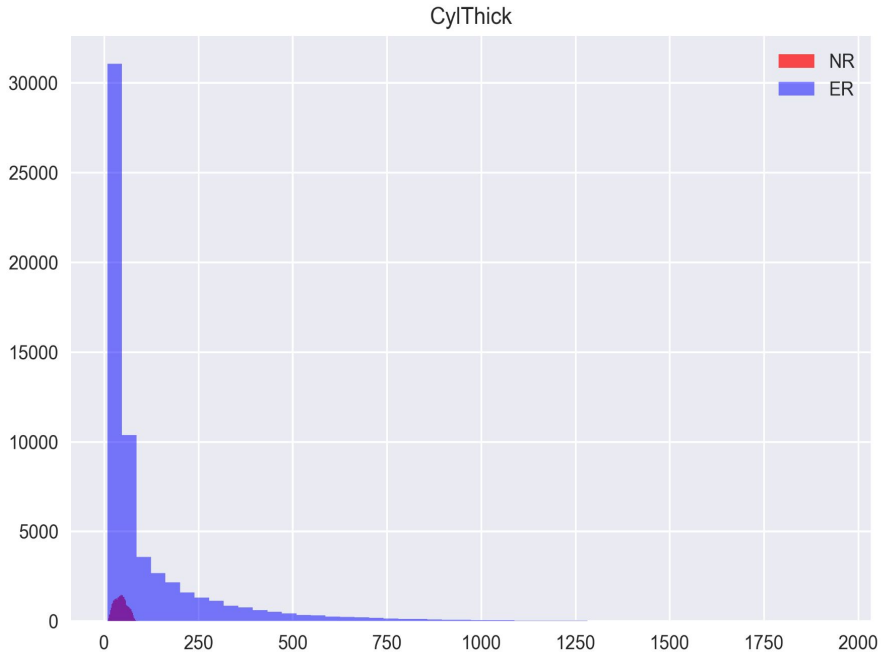
Distribution of discriminating variables in energy range of [0-36] keV

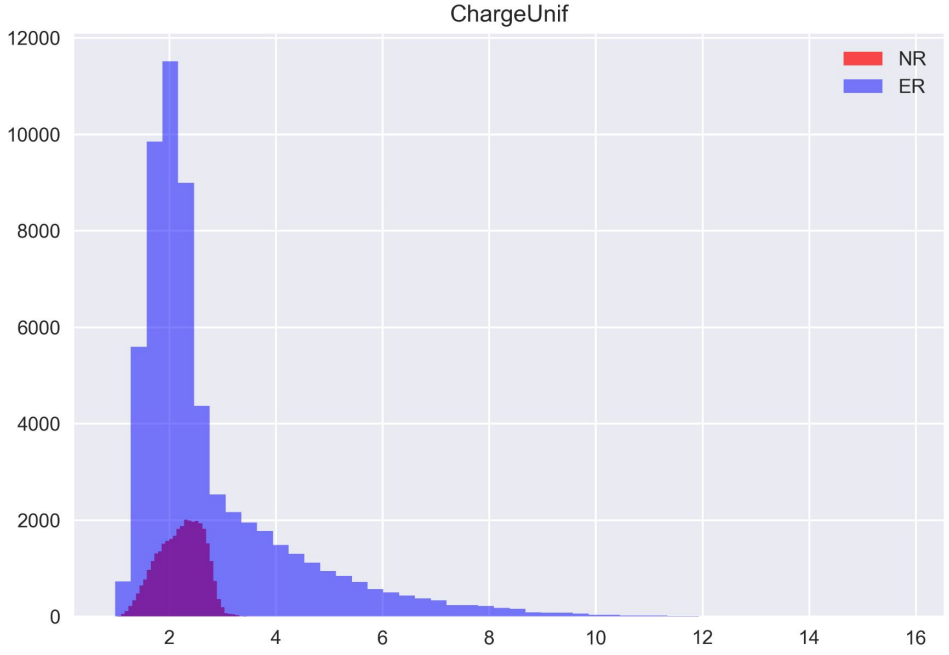
Thinning and SDCD



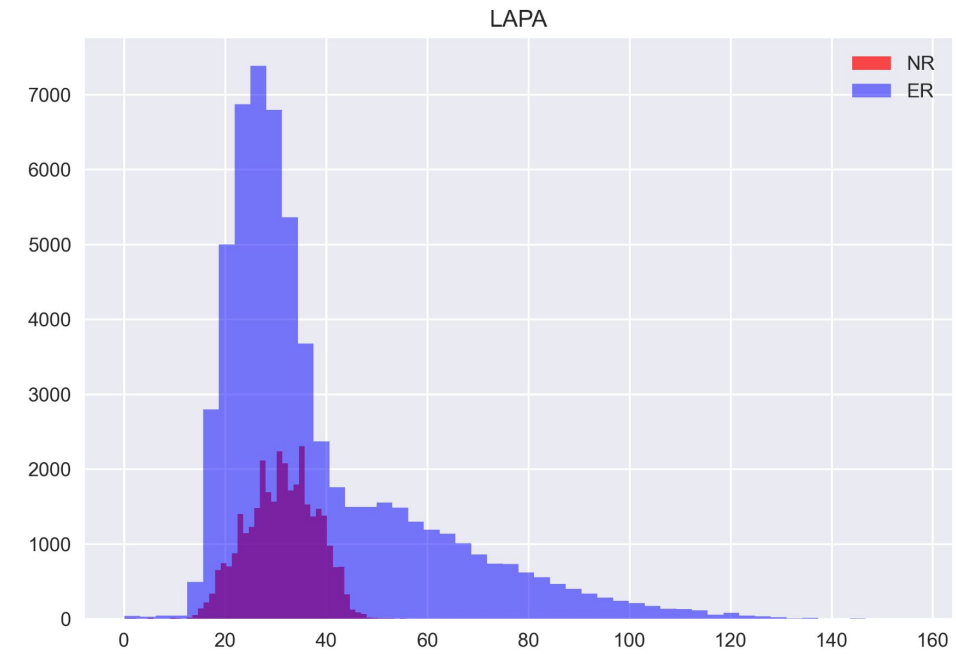


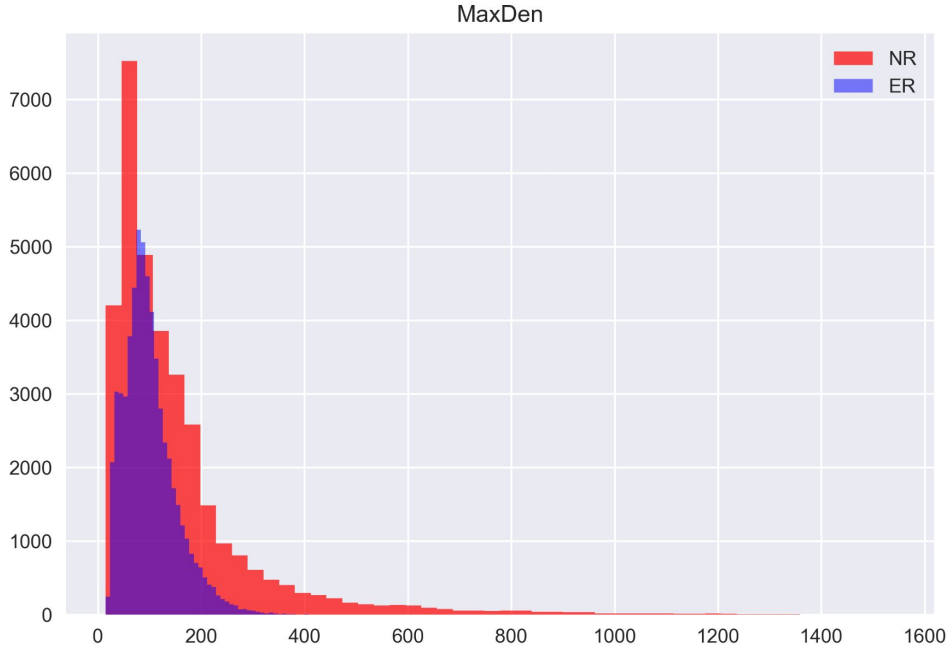
CylThick and ChargeUnif



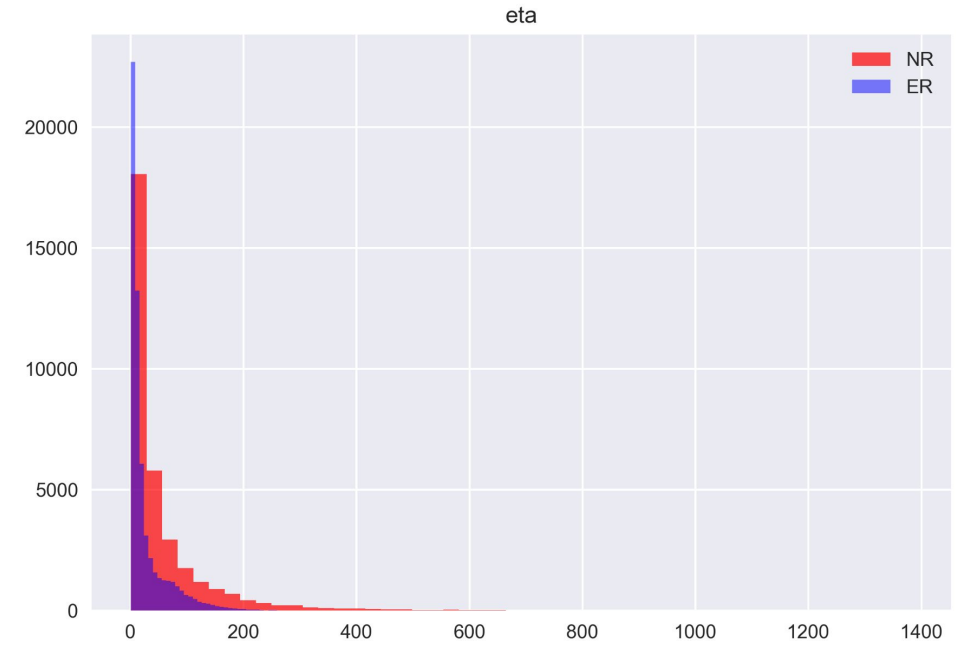


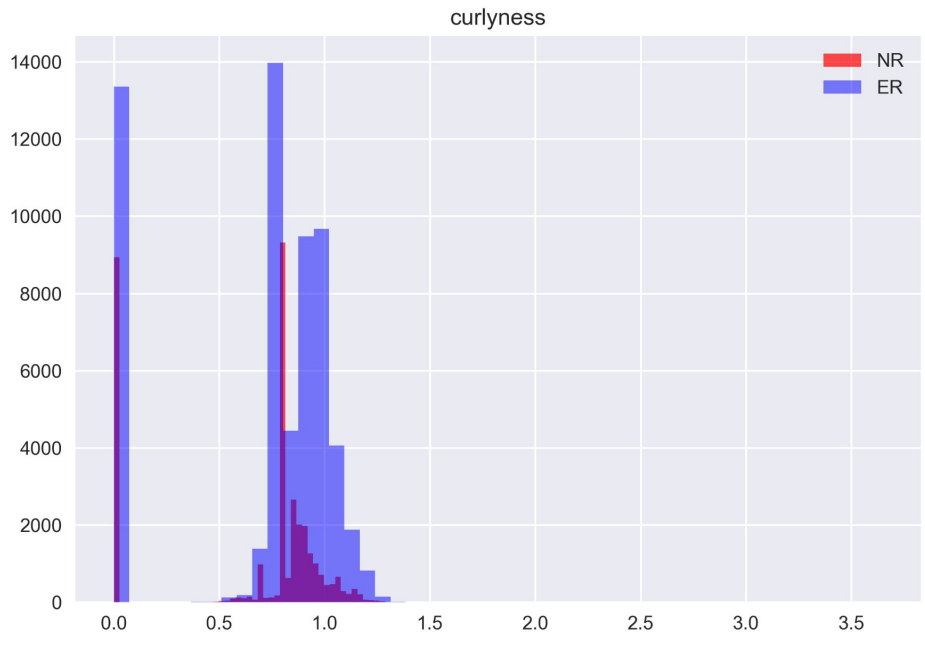
LAPA and MaxDen



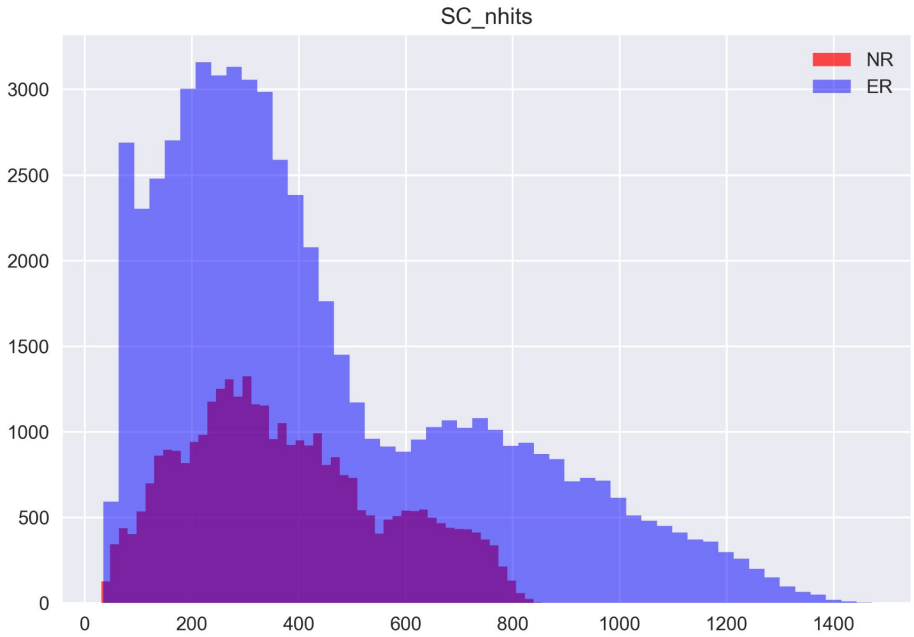


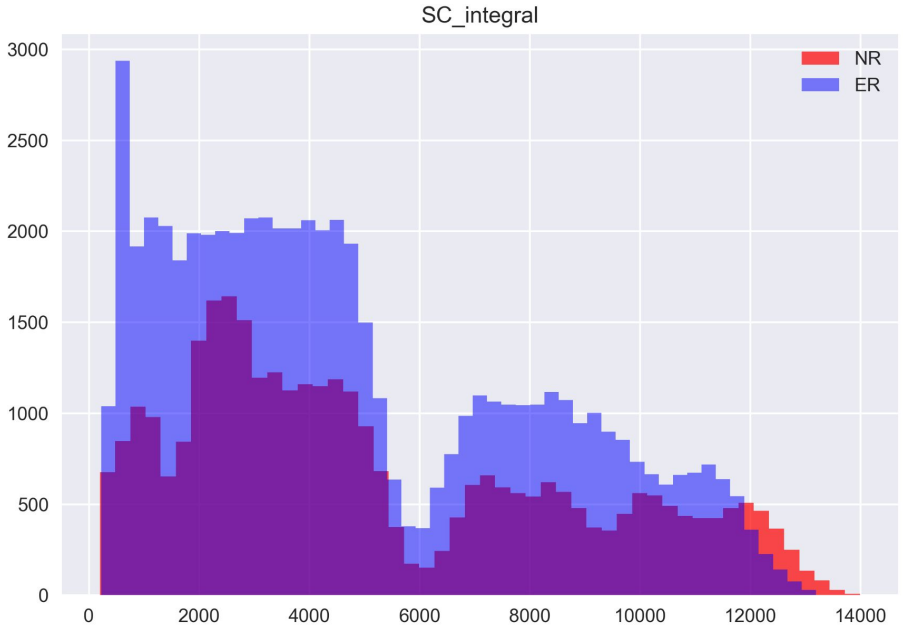
eta and curlyness



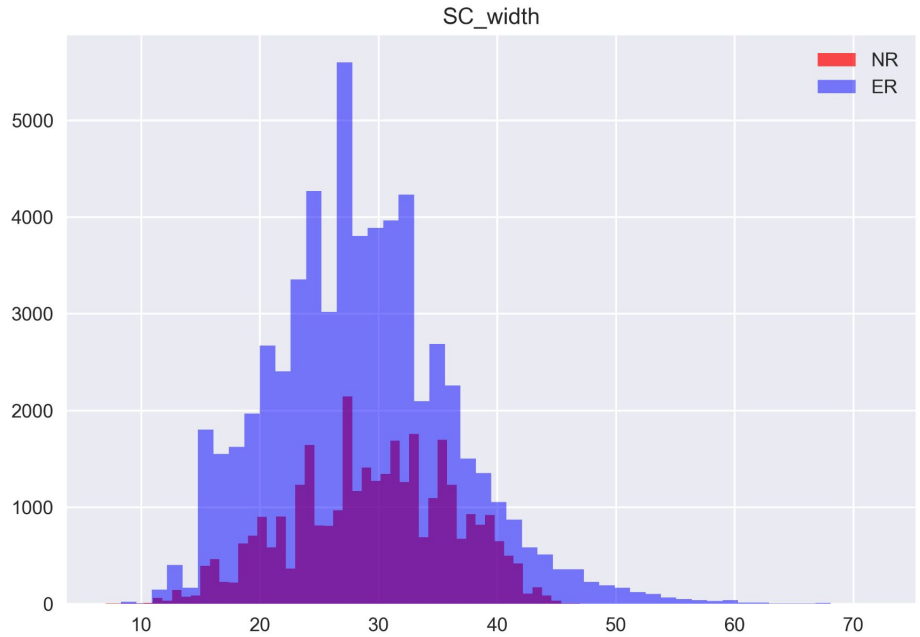


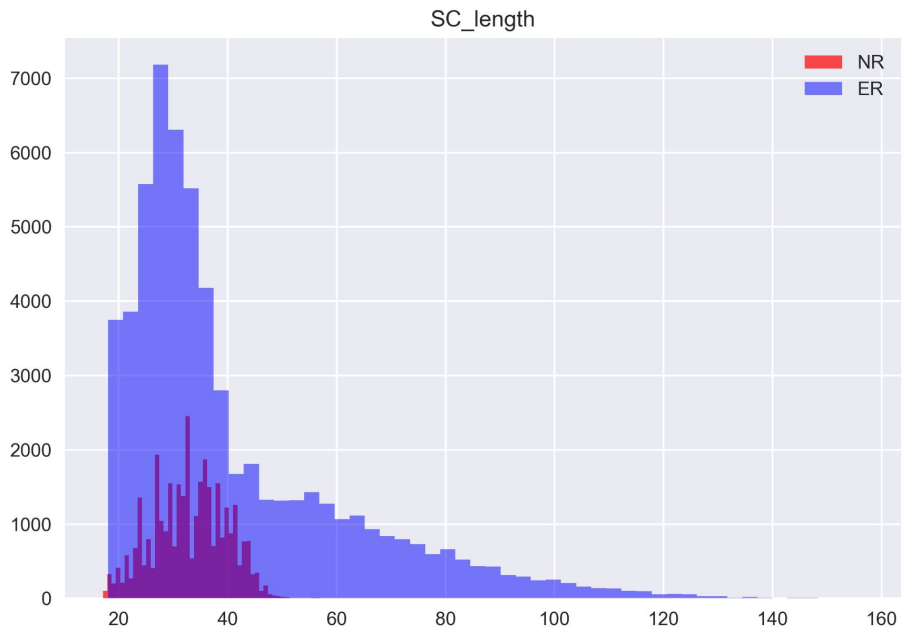
nhits and integral



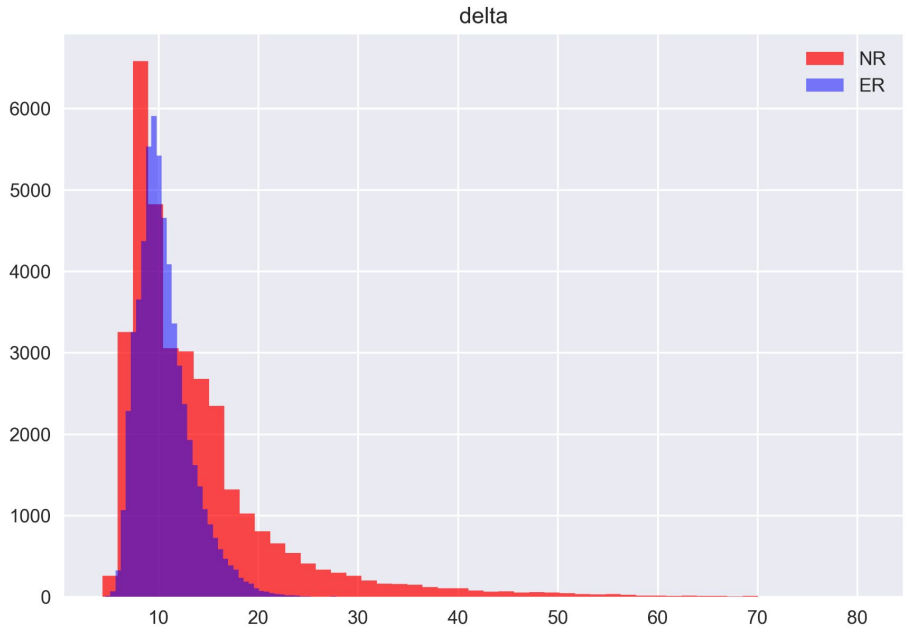


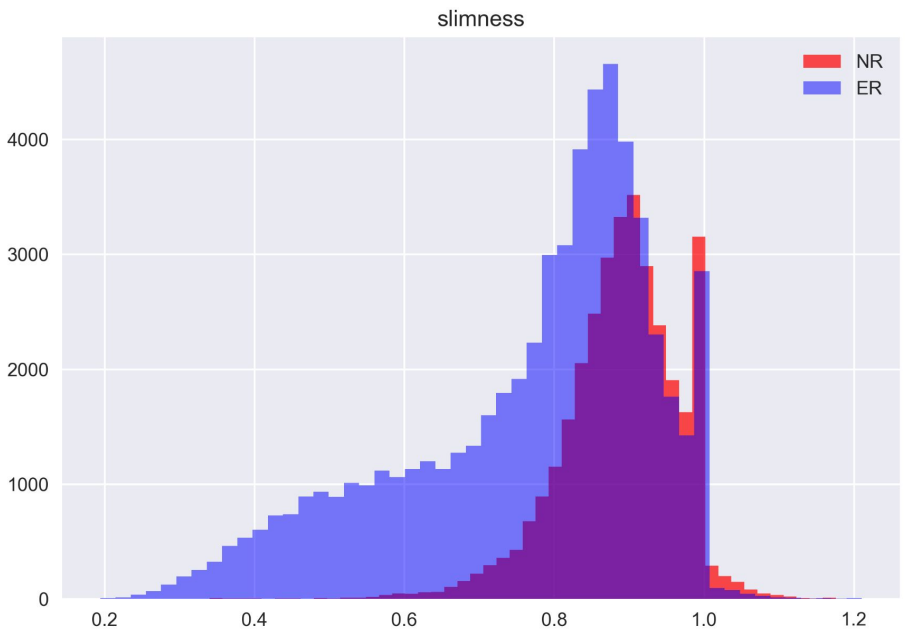
width and length



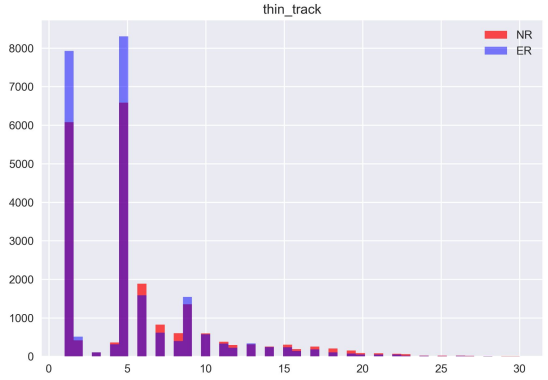


delta and slimness





Distribution in energy range of [0-15] keV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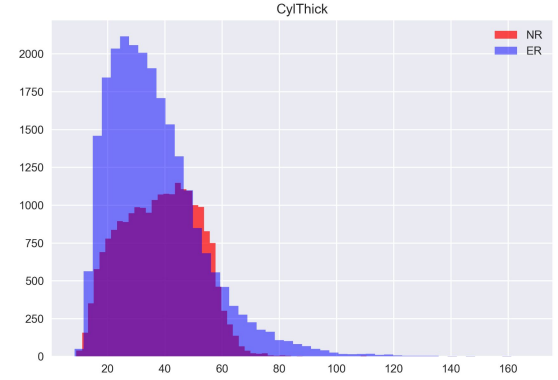
5000
6000
7000
8000
0
5
10
15
20
25
30


CylThick
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ER
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750
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1500
1750
2000
20
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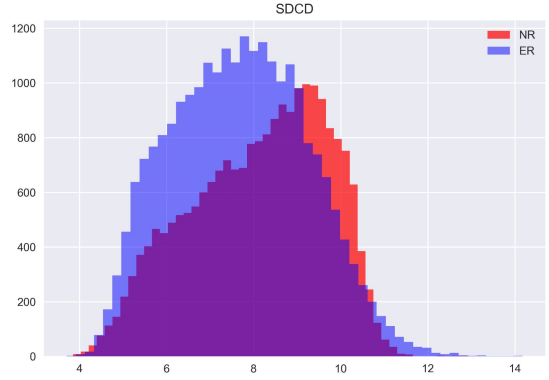
100
120
140
160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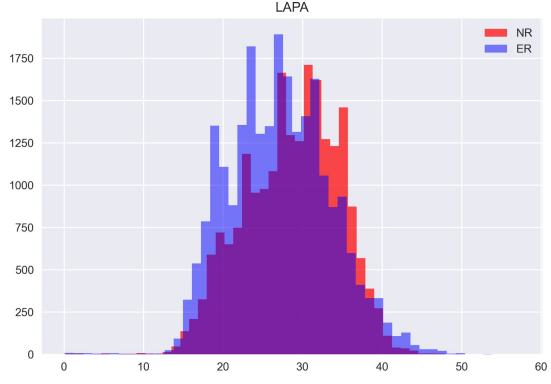
6
8
10
12
14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NR
ER
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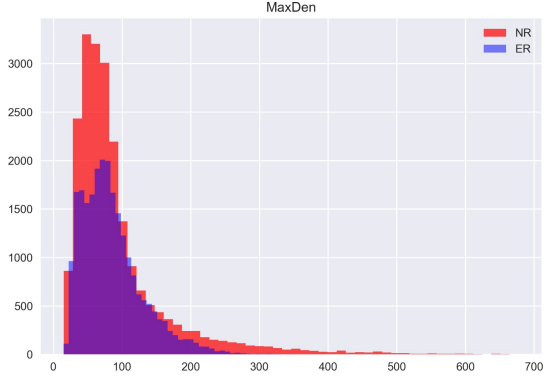
0
10
20
30
40
50
60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ER
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0
100
200
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400
500
600
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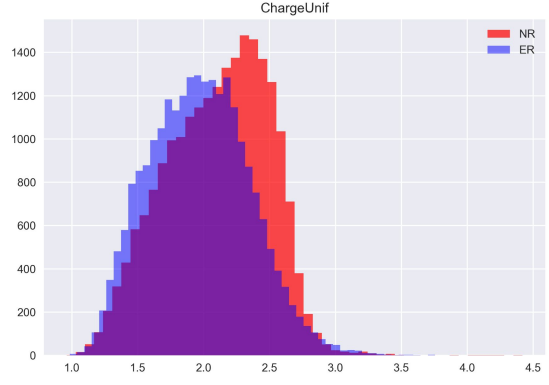
ChargeUnif
NR
ER
0
200
400
600
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1000
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1.0
1.5
2.0
2.5
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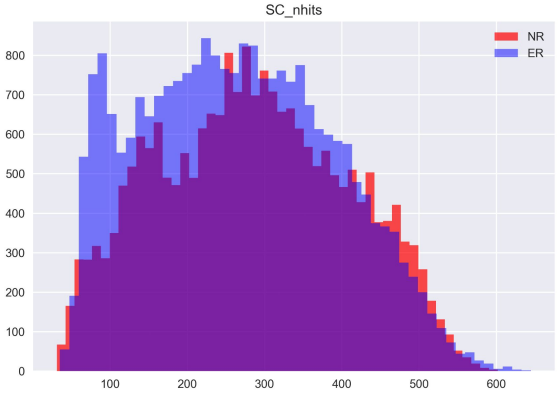
4.5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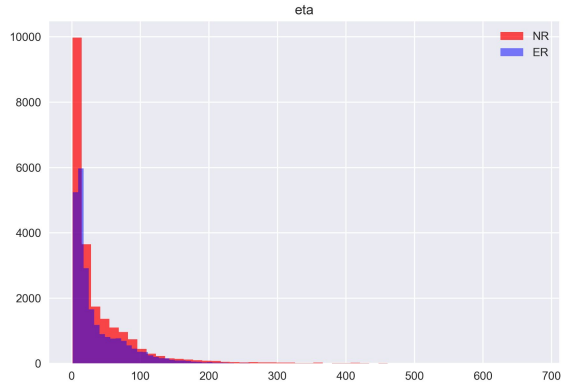
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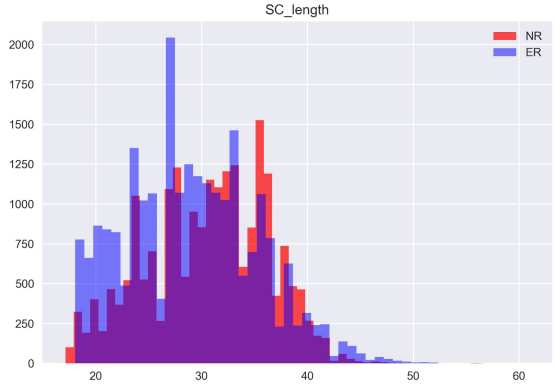
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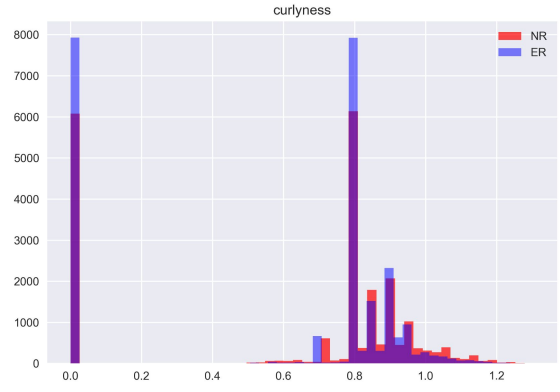
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ER
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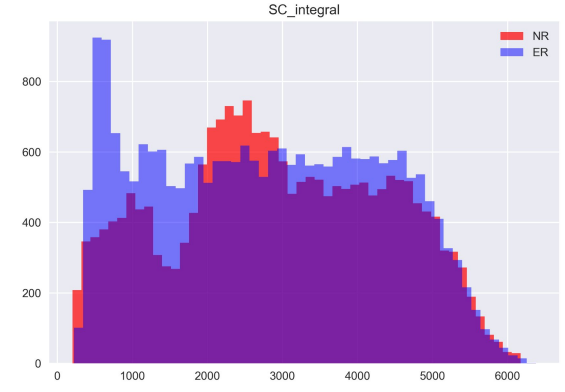
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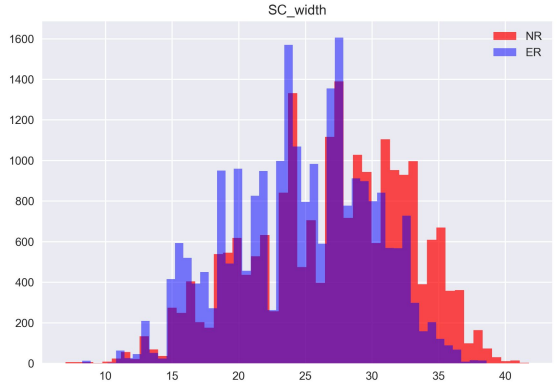
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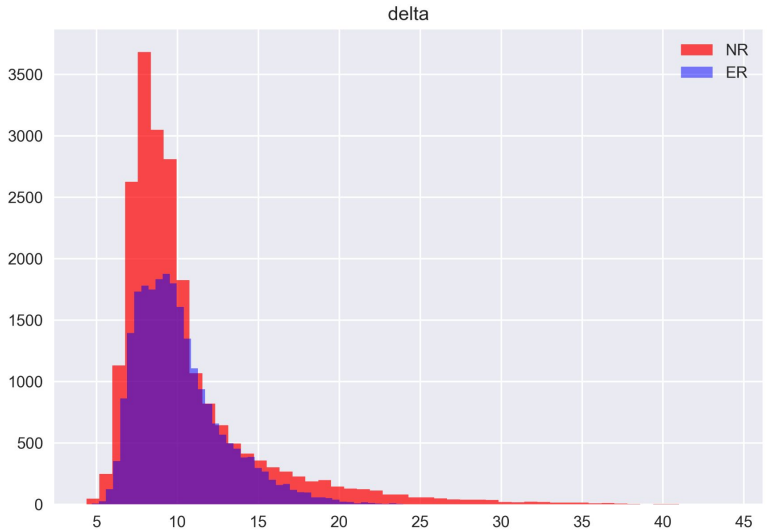
1600
10
15
20
25
30
35
40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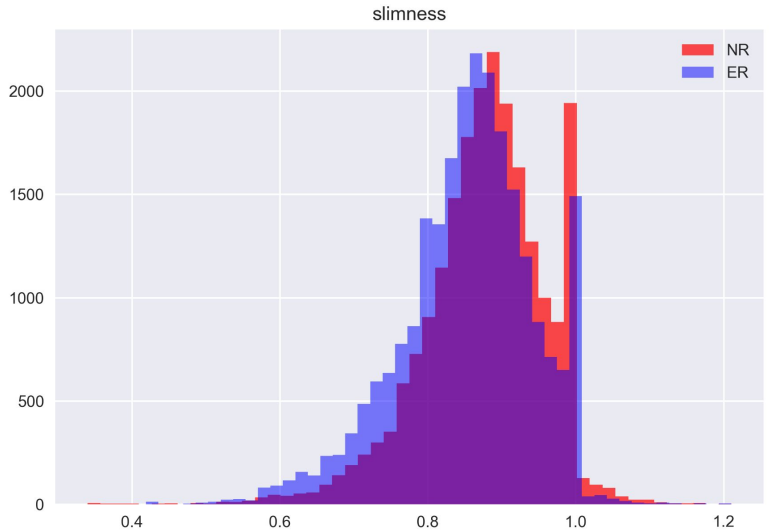
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0.6
0.8
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1.2