

## Caratteristiche analisi

- DNN: train e test su eventi di segnale con un'unica massa
- Collezione jet: TCC
- Analisi: merged
- Canale: ggF
- Segnale: Radion (125395 eventi)
- Training fraction: 0.8

## Casi studiati

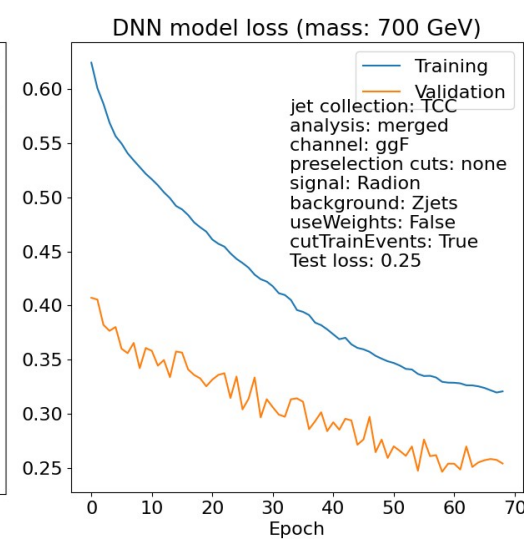
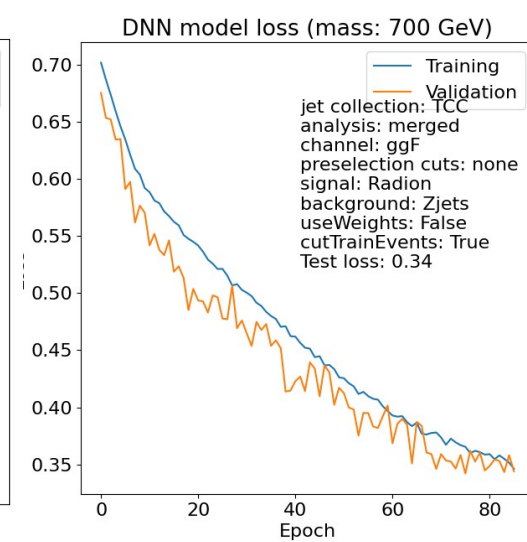
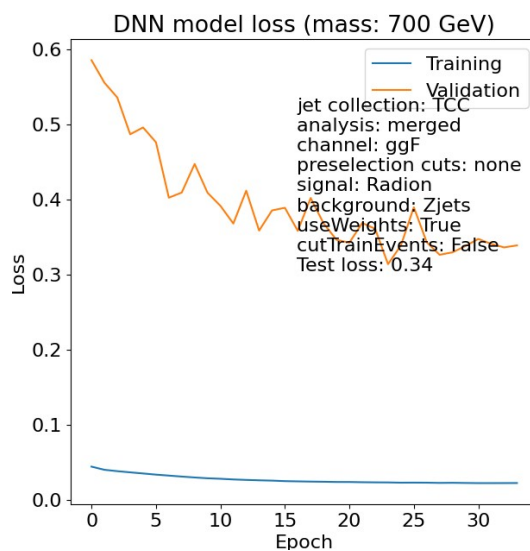
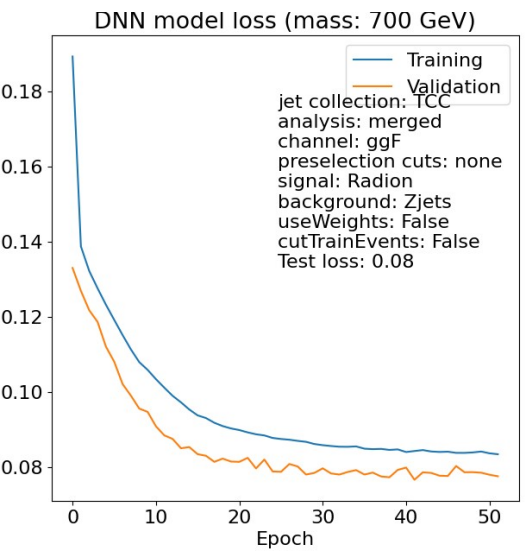
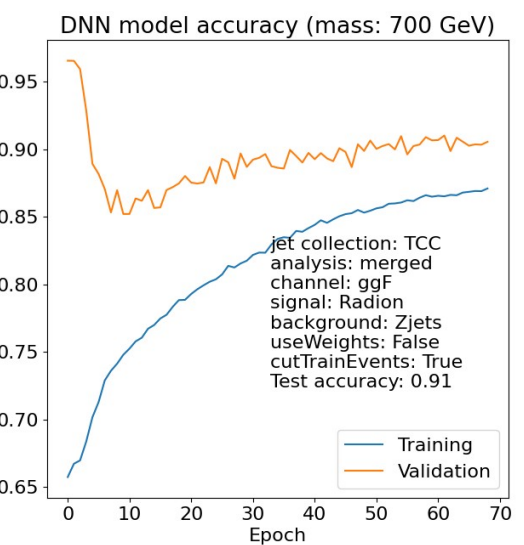
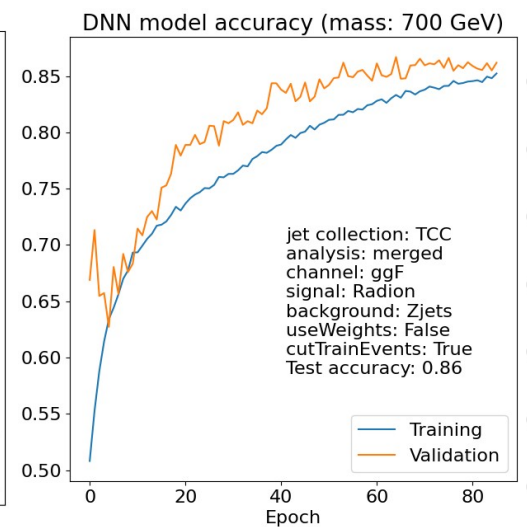
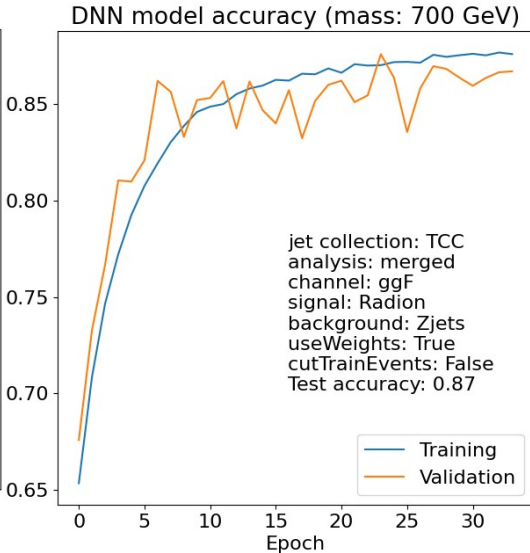
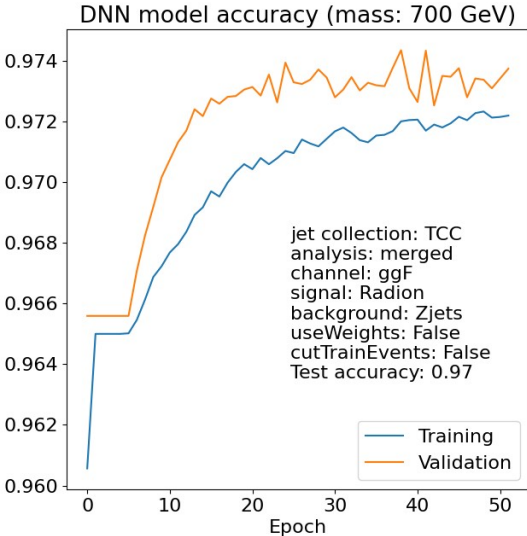
Addestramento della rete confrontato in 4 diversi casi:

- 1) sull'intero campione di train
- 2) sull'intero campione di train ma con pesi per compensare il diverso numero di eventi di segnale e di background
- 3) su un sottoinsieme del campione di train con uguale numero di eventi di segnale e di background
- 4) su un sottoinsieme del campione di train con  $N \cdot \text{sig} = \text{bkg}$  (N fissato a priori)

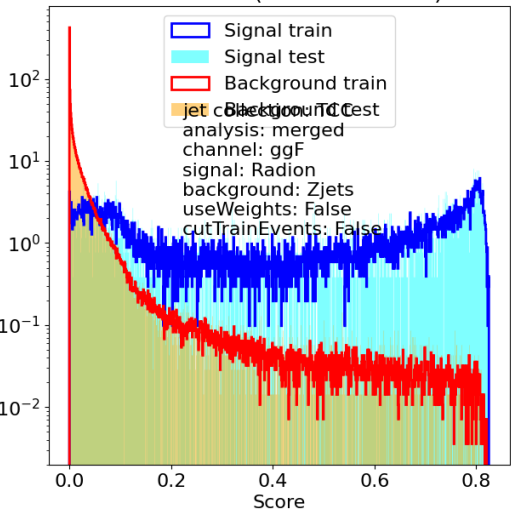
Ogni caso è stato studiato per 3 valori di massa del segnale (700 GeV, 3000 GeV, 6000 GeV) e due diversi background (Zjets o Diboson)

# Massa 700 GeV, Zjets

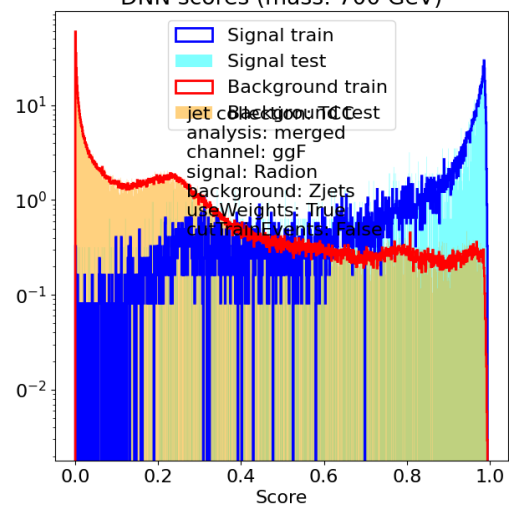
	Intero campione	Intero campione+pesi	sig=bkg	2sig=bkg
Segnale train	9924 (3.6% bkg)	9924	9924	9924
Bkg train	273622	273622	9924	19848
Segnale test	3169	3169	3169	3169
Bkg test	86032	86032	86032	86032
Loss su train	0.0818	0.0224	0.3415	0.3169
Accuracy su train	0.9726	0.8753	0.8557	0.8749
Loss su validazione	0.0775	0.3389	0.3439	0.2540
Accuracy su validazione	0.9737	0.8670	0.8618	0.9056
Loss su test	0.0779	0.3370	0.3412	0.2529
Accuracy su test	0.9735	0.8672	0.8633	0.9063
Area ROC	0.95	0.95	0.94	0.945
Reiezione bkg @ 0.90 WP	7.4	7.4	6.3	6.0
Reiezione bkg @ 0.99 WP	1.9	2.0	2.0	1.8



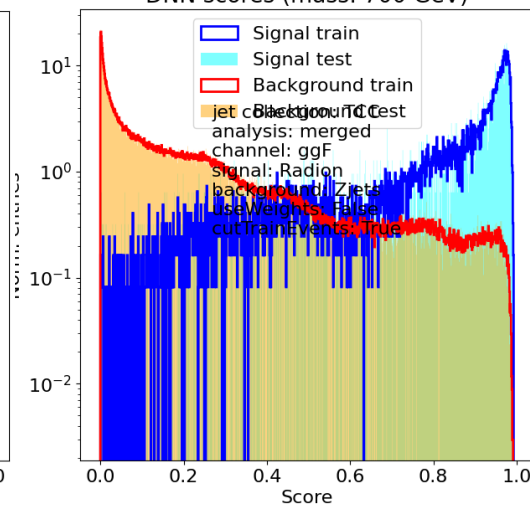
DNN scores (mass: 700 GeV)



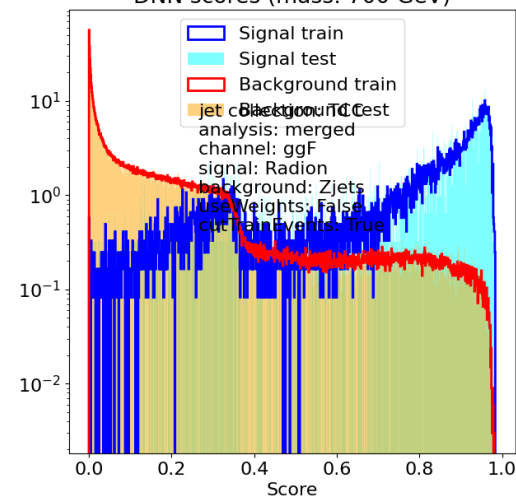
DNN scores (mass: 700 GeV)



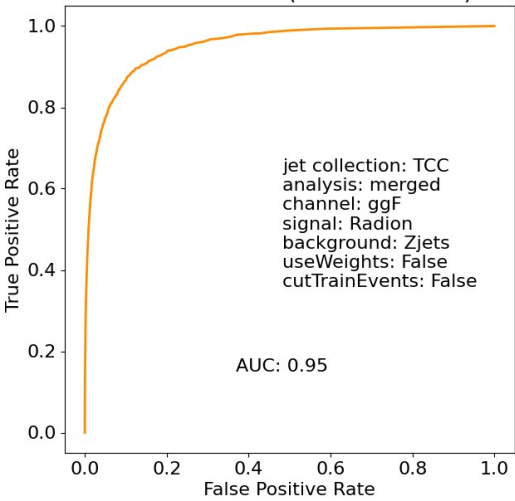
DNN scores (mass: 700 GeV)



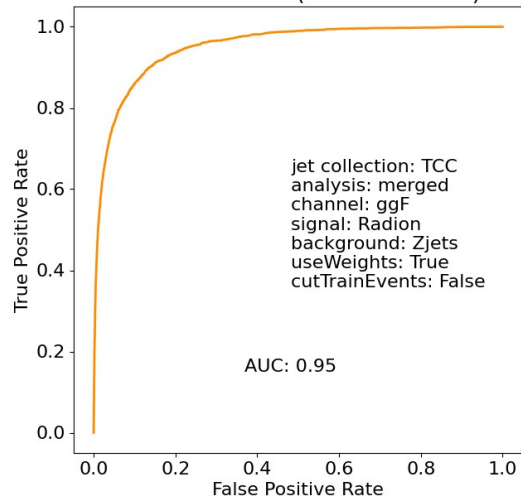
DNN scores (mass: 700 GeV)



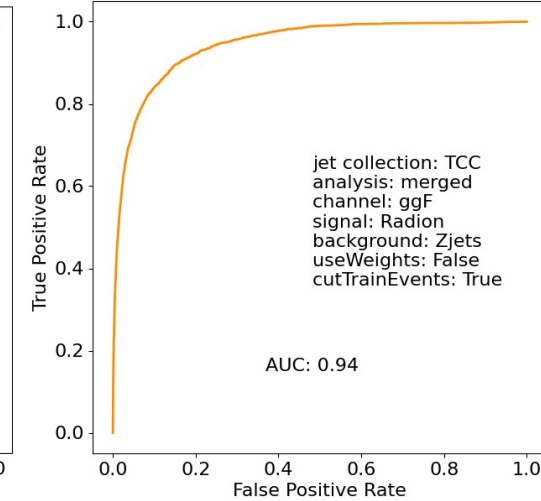
DNN ROC curve (mass: 700 GeV)



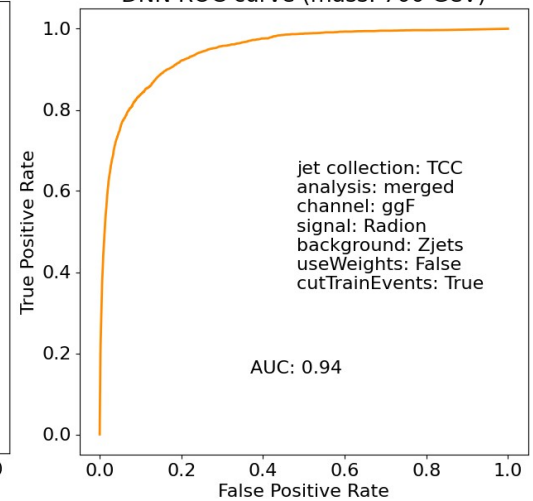
DNN ROC curve (mass: 700 GeV)

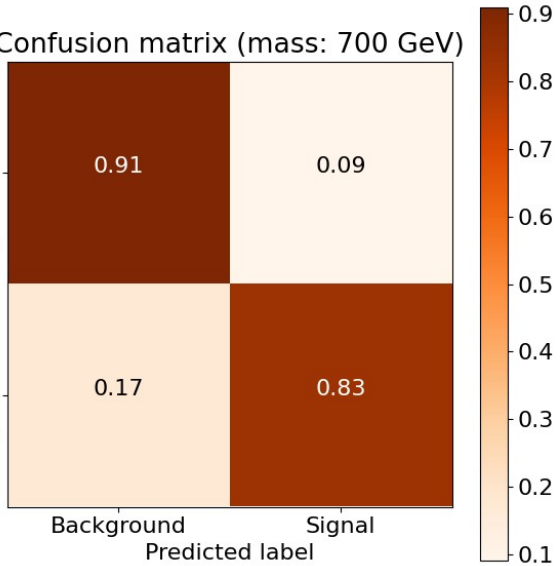
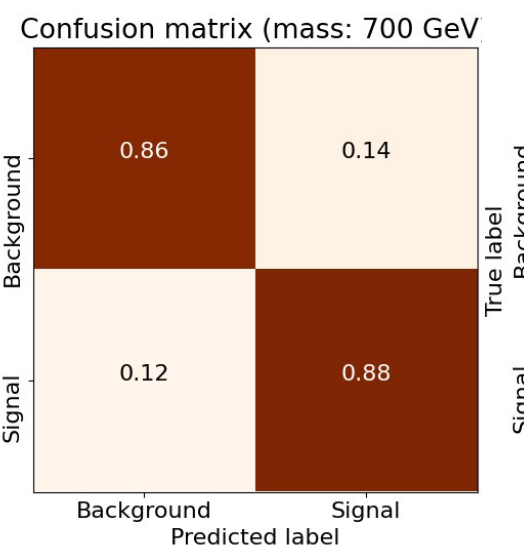
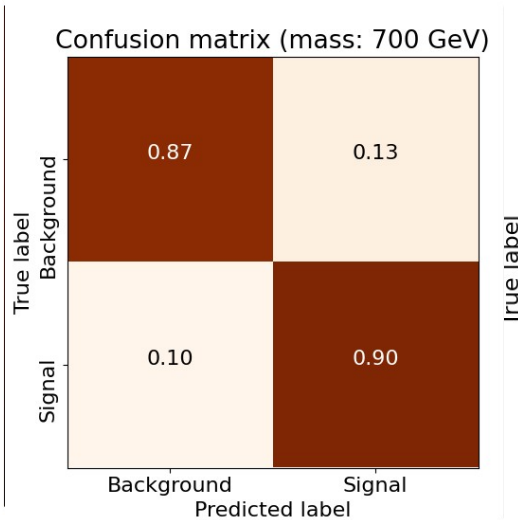
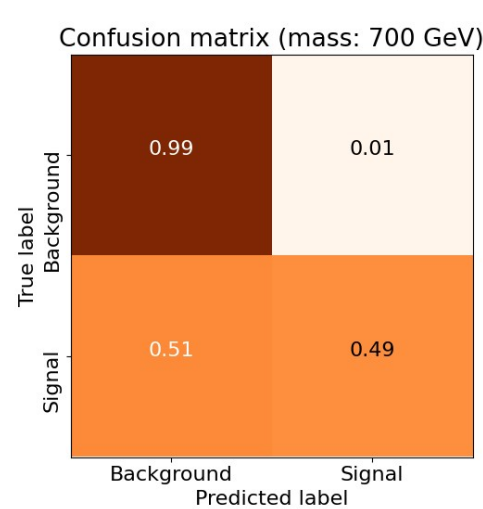
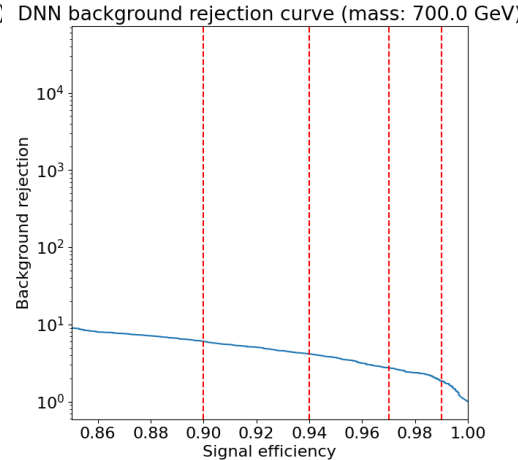
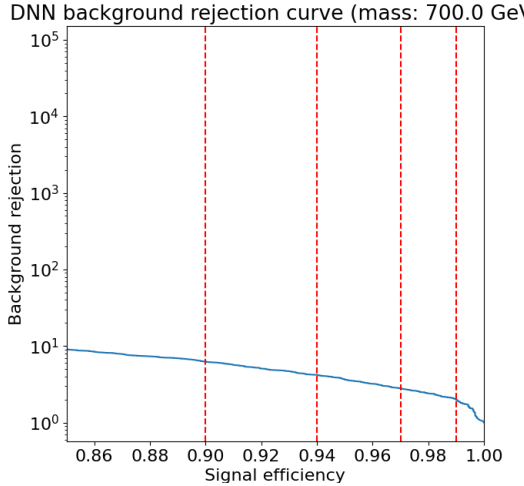
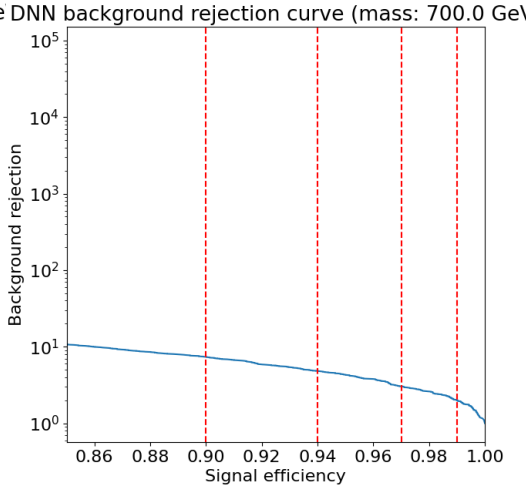
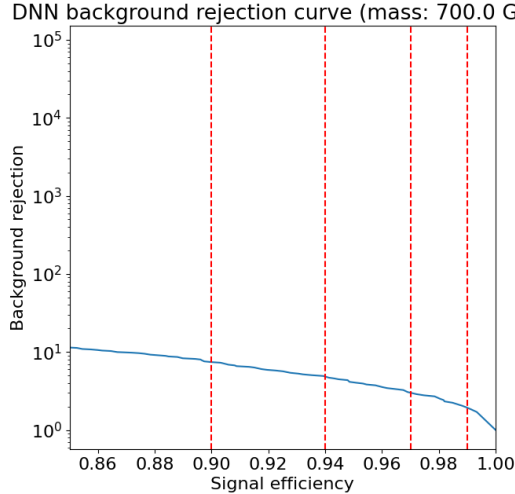


DNN ROC curve (mass: 700 GeV)



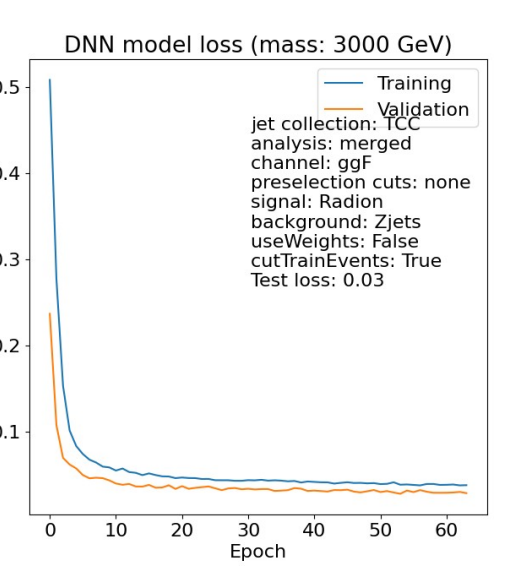
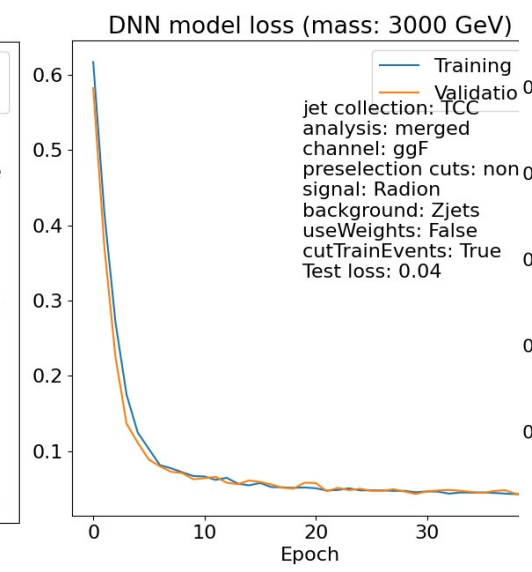
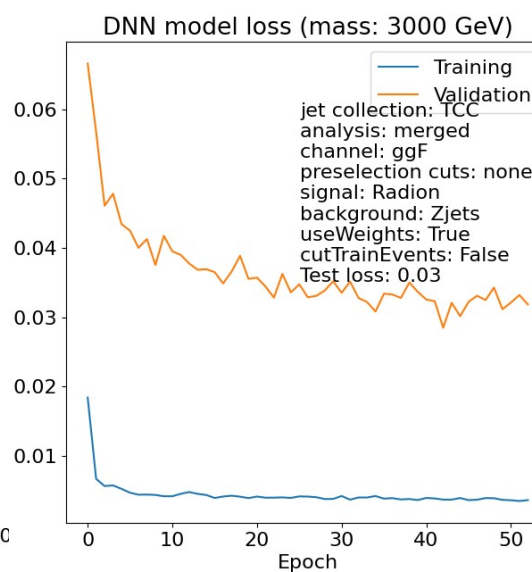
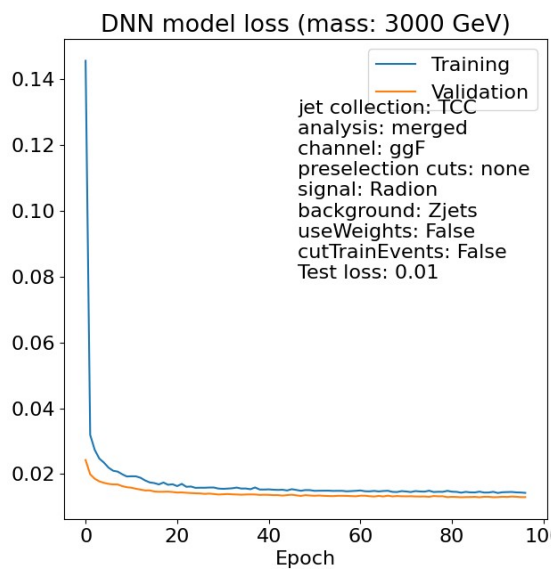
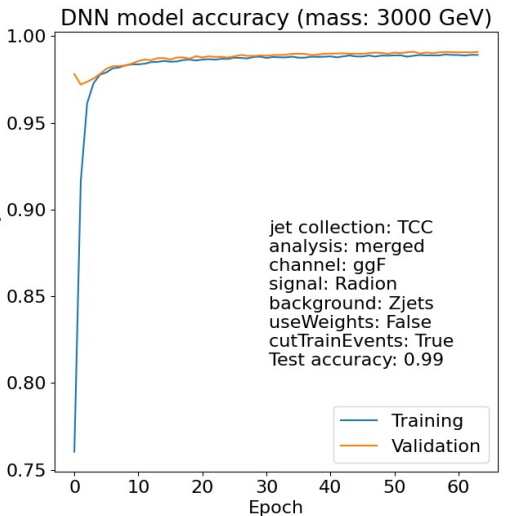
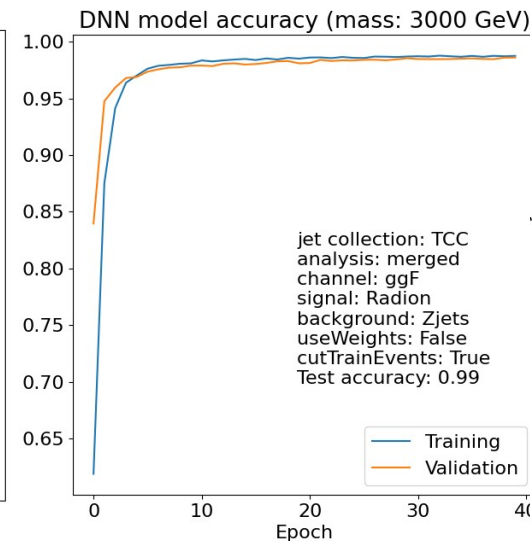
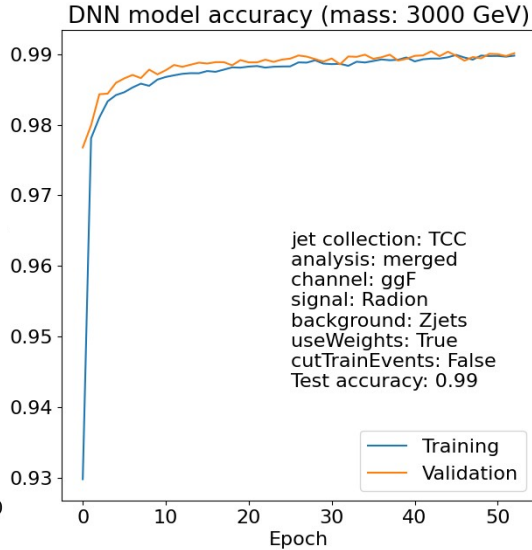
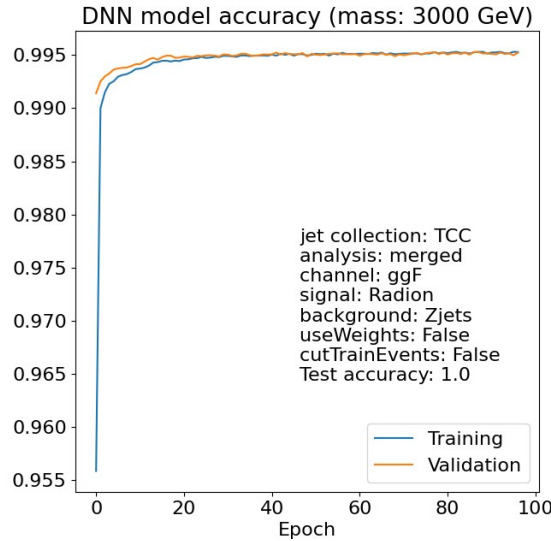
DNN ROC curve (mass: 700 GeV)



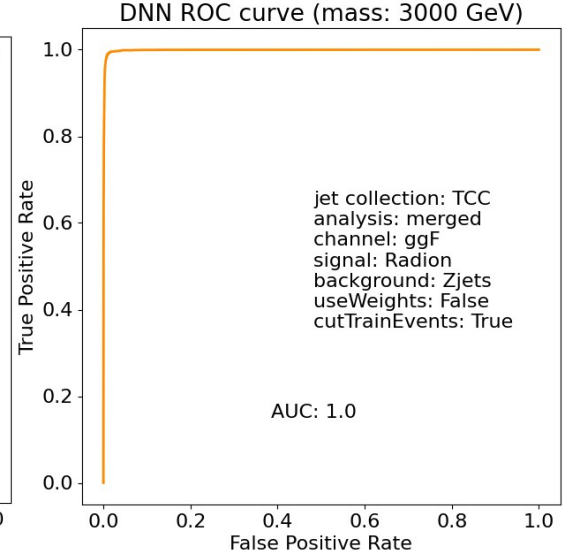
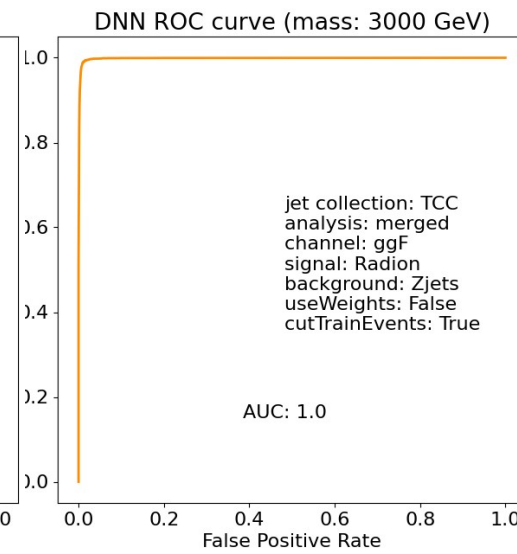
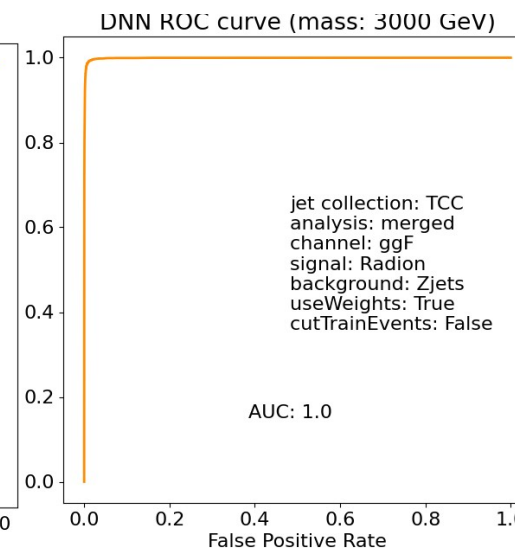
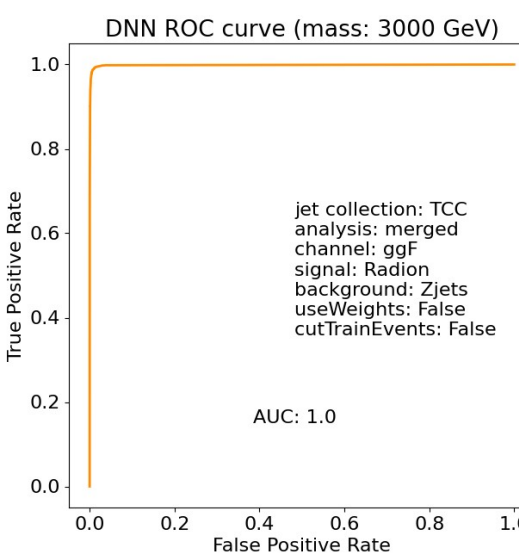
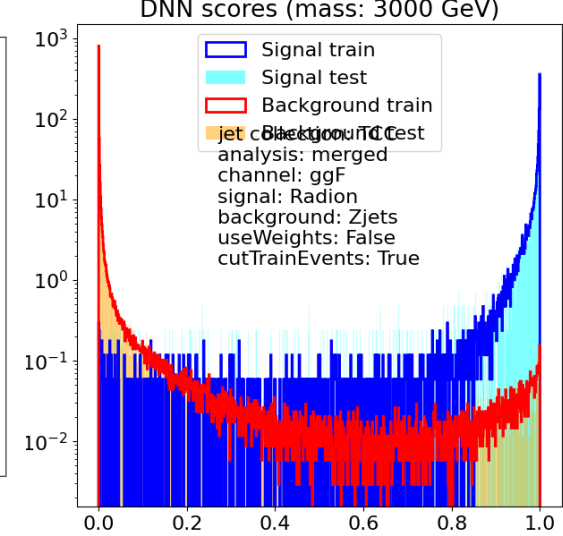
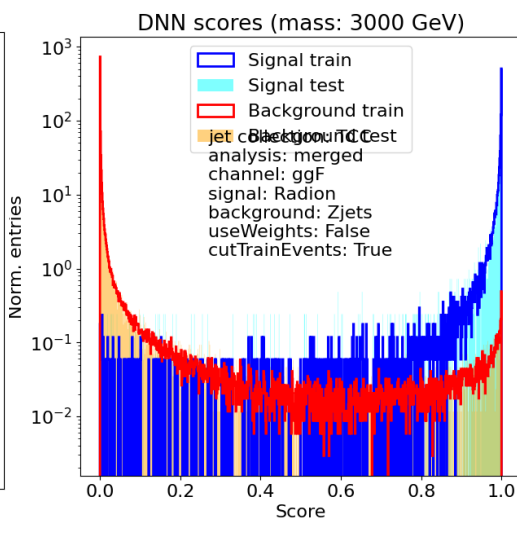
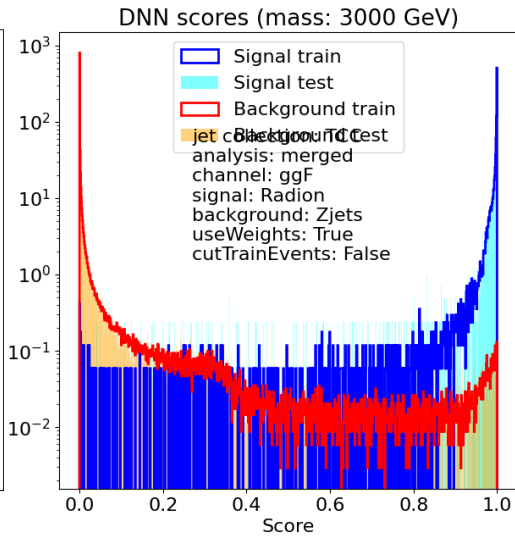
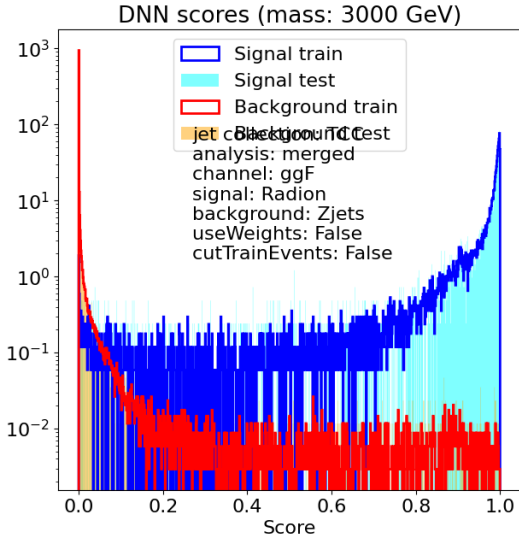


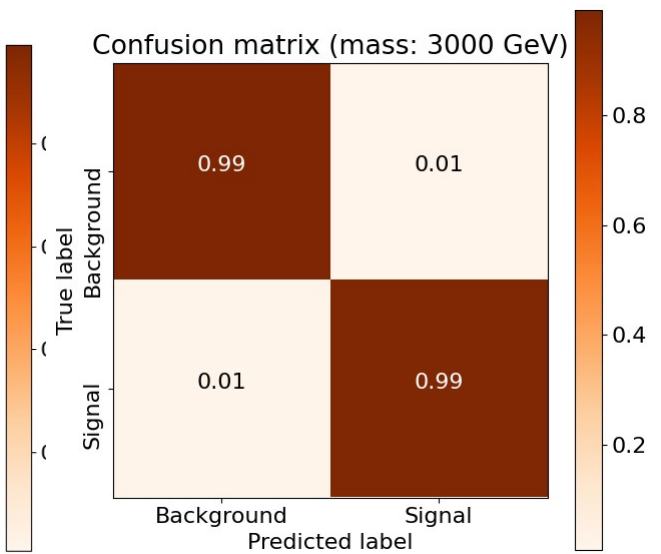
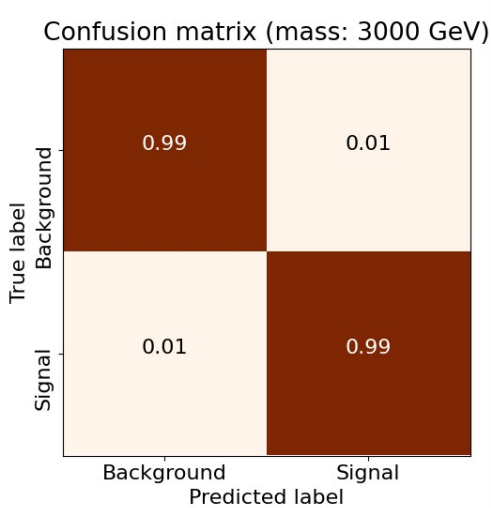
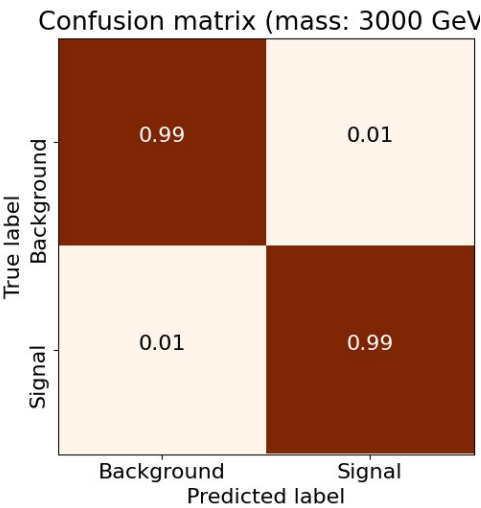
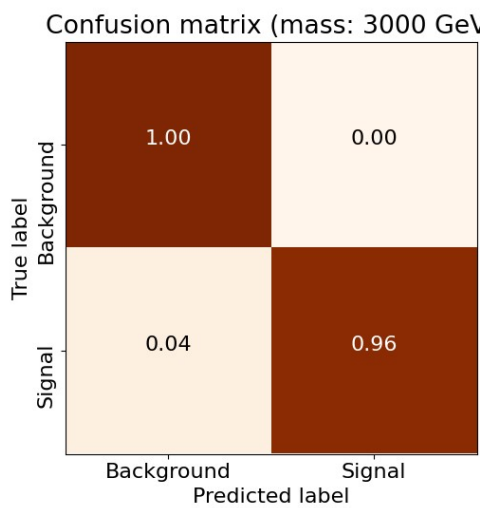
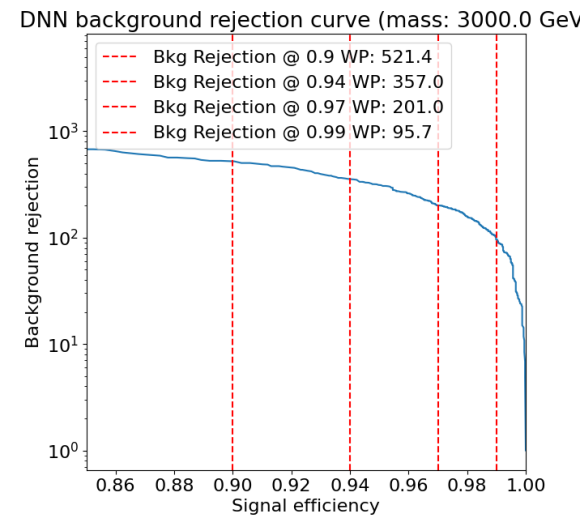
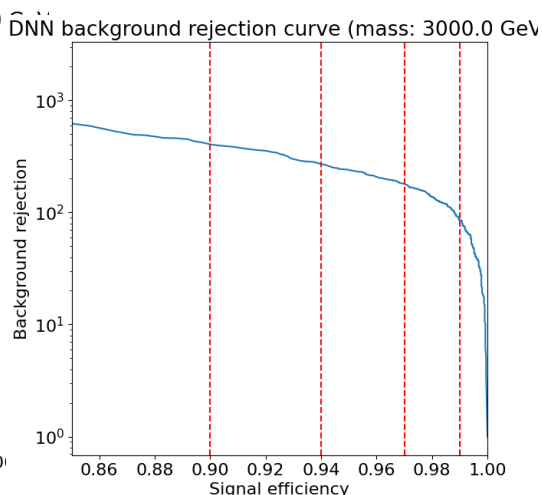
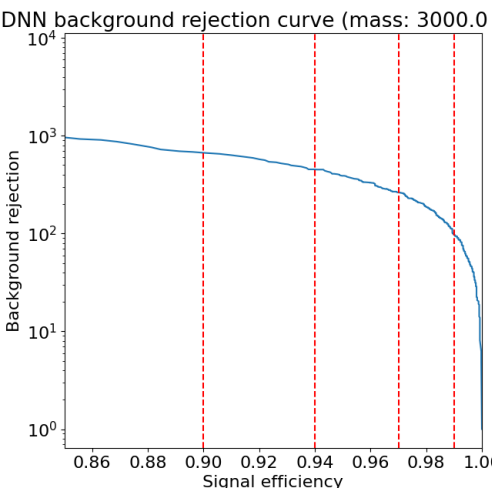
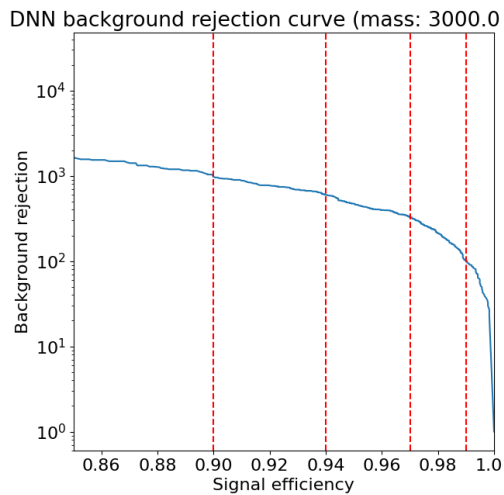
# Massa 3000 GeV, Zjets

	Intero campione	Intero campione + pesi	sig=bkg	2sig=bkg
Segnale train	13581 (5% bkg)	13581	13581	13581
Bkg train	273615	273615	13581	27162
Segnale test	4143	4143	4143	4143
Bkg test	86032	86032	86032	86032
Loss su train	0.0142	0.0036	0.0433	0.0366
Accuracy su train	0.9954	0.9898	0.9873	0.9896
Loss su validazione	0.013	0.0319	0.0435	0.0285
Accuracy su validazione	0.995	0.9901	0.9860	0.9909
Loss su test	0.0124	0.0303	0.0412	0.0272
Accuracy su test	0.996	0.9907	0.9869	0.9913
Area ROC	0.998	0.999	0.999	0.999
Reiezione bkg @ 0.90 WP	1024.2	666.9	402	521.4
Reiezione bkg @ 0.99 WP	101.8	97.4	86	95.7



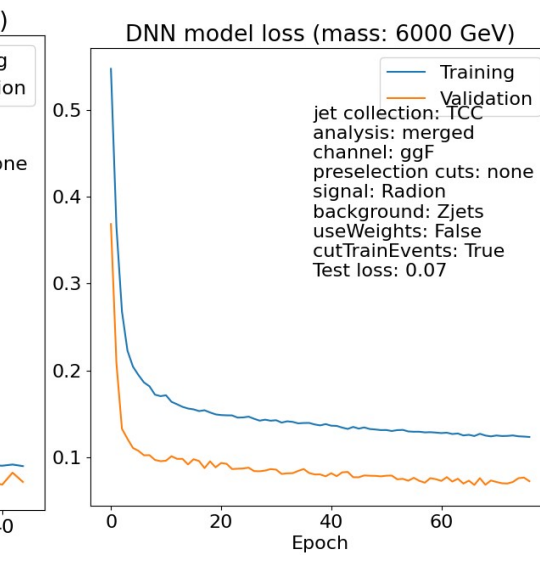
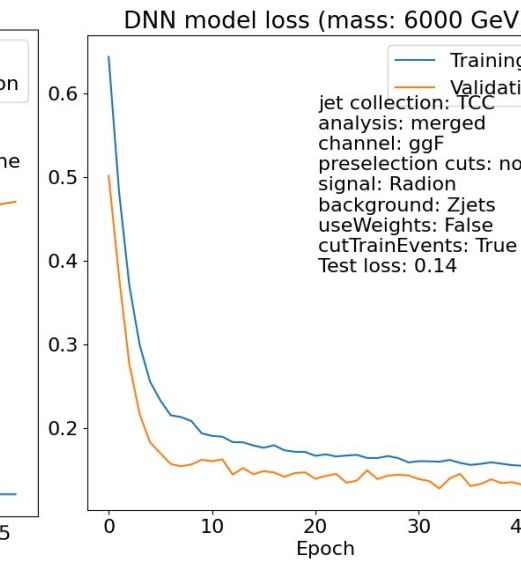
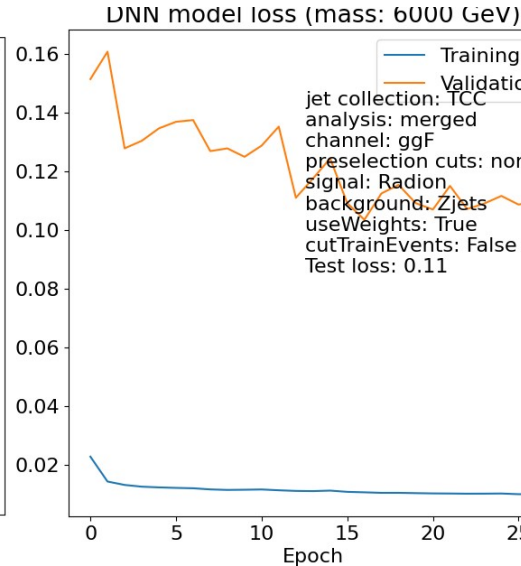
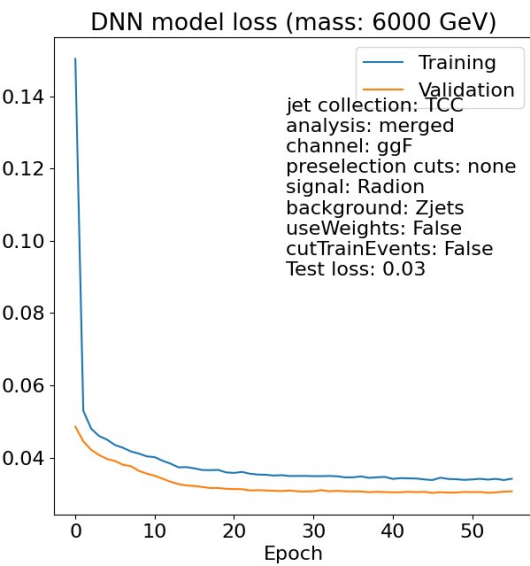
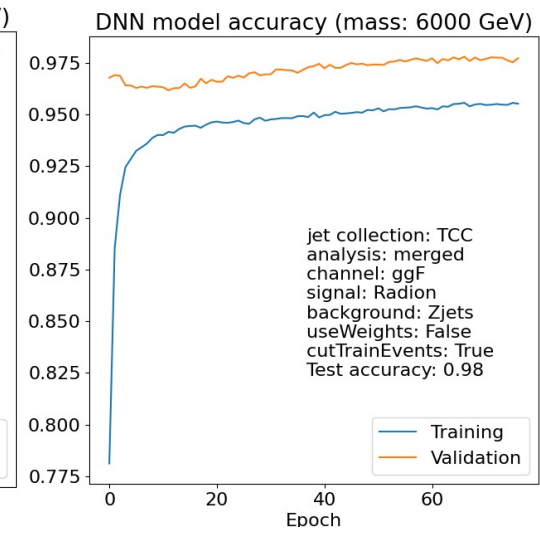
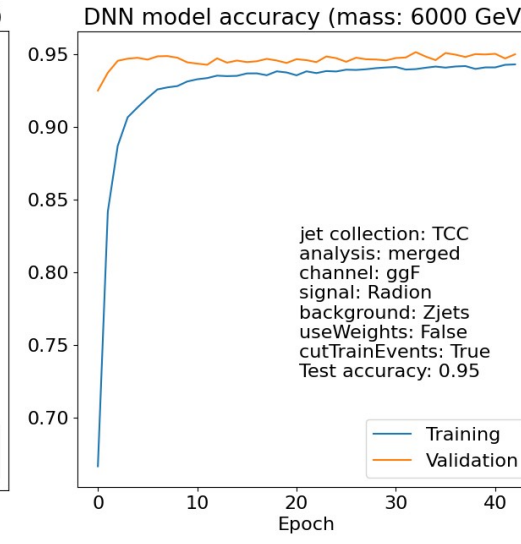
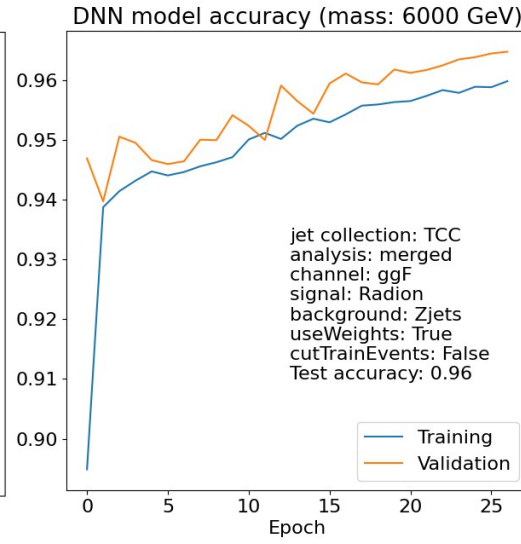
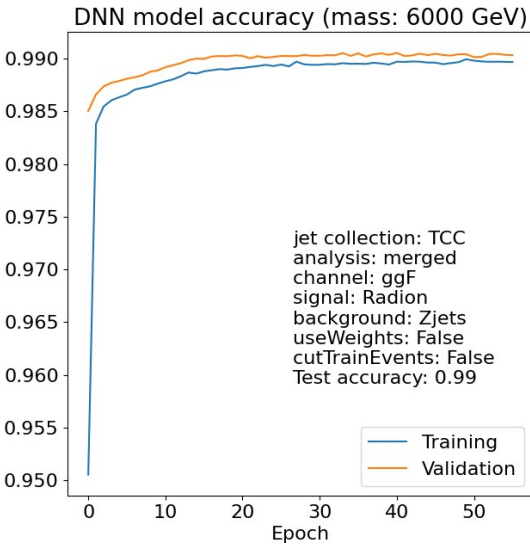


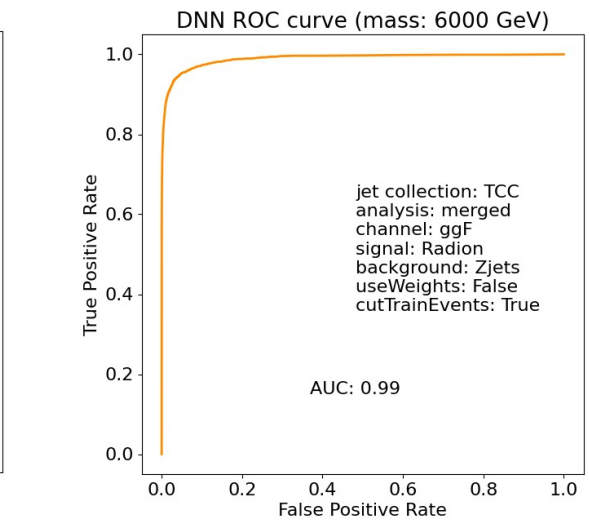
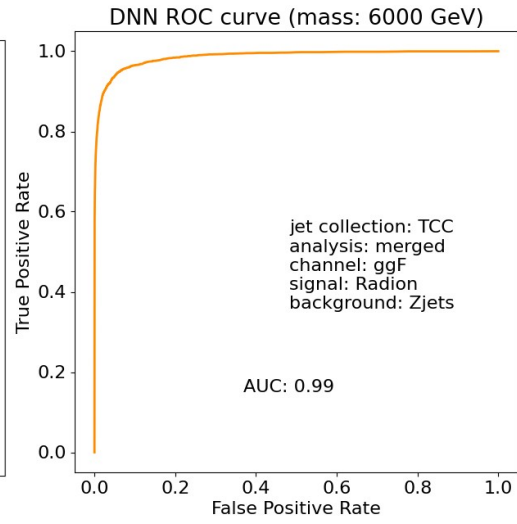
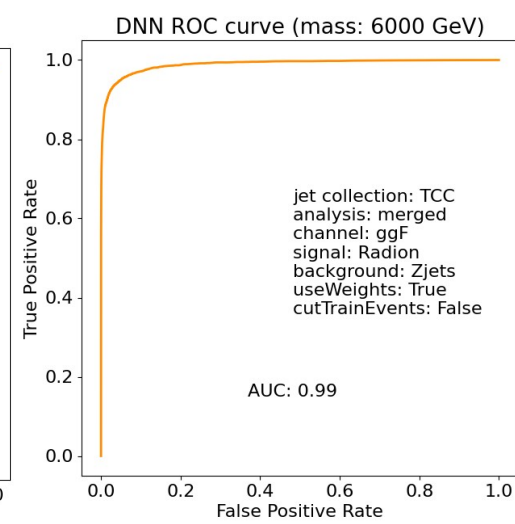
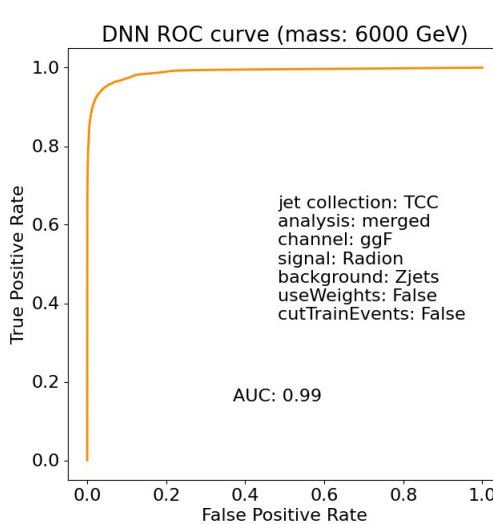
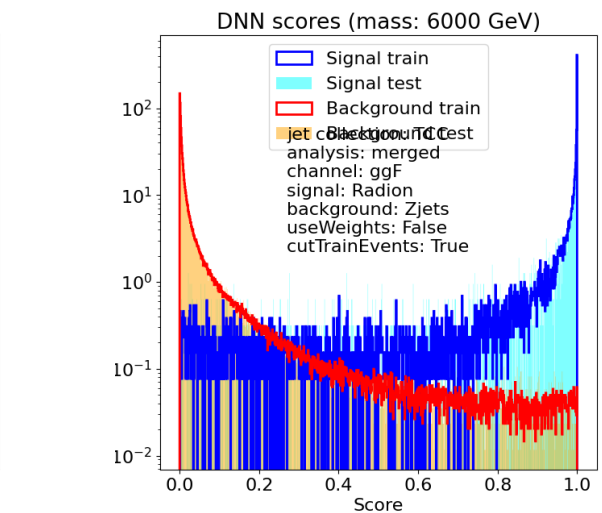
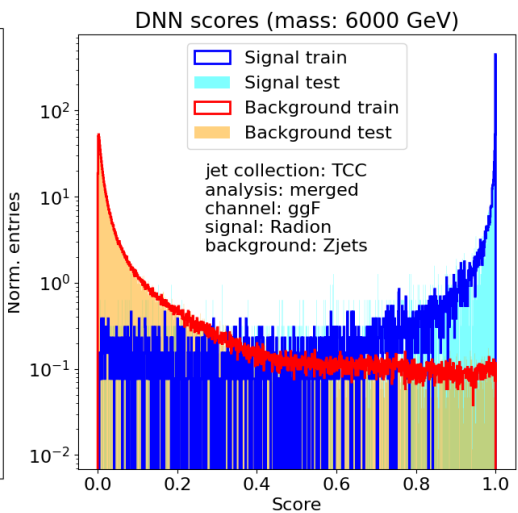
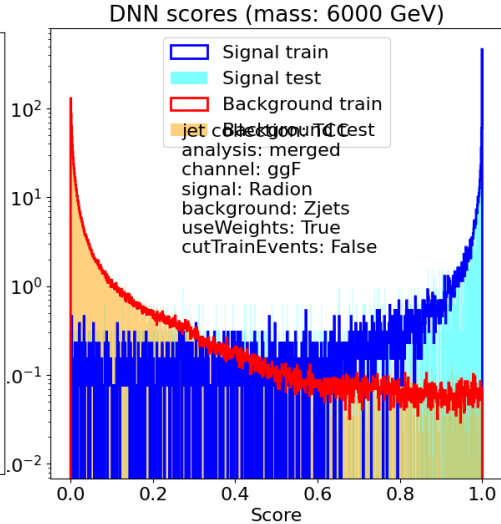
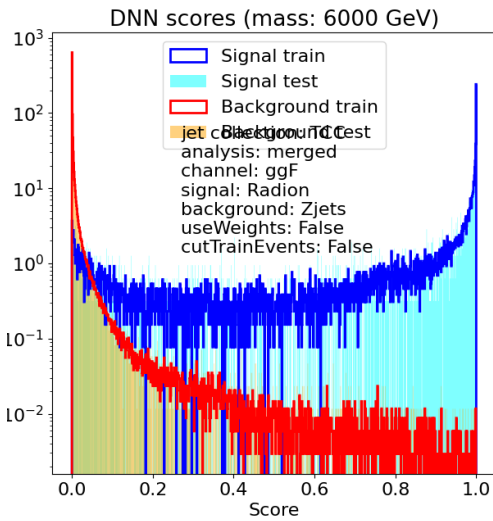




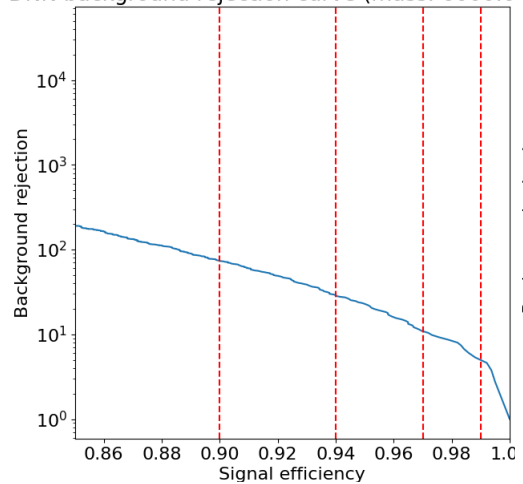
# Massa 6000 GeV, Zjets

	Intero campione	Intero campione+pesi	sig=bkg	2Sig=bkg
Segnale train	10473 (3.8% bkg)	10437	10437	10437
Bkg train	273614	273614	10437	20874
Segnale test	3169	3169	3169	3169
Bkg test	86032	86032	86032	86032
Loss su train	0.0339	0.0098	0.1567	0.1216
Accuracy su train	0.9898	0.9603	0.9420	0.9564
Loss su validazione	0.0307	0.1097	0.1353	0.0728
Accuracy su validazione	0.9901	0.9647	0.9499	0.9773
Loss su test	0.0311	0.1109	0.137	0.0748
Accuracy su test	0.9903	0.9633	0.949	0.9763
Area ROC	0.987	0.99	0.986	0.99
Reiezione bkg @ 0.90 WP	73.1	65.9	41.4	66
Reiezione bkg @ 0.99 WP	5.4	4.5	3.9	4.5

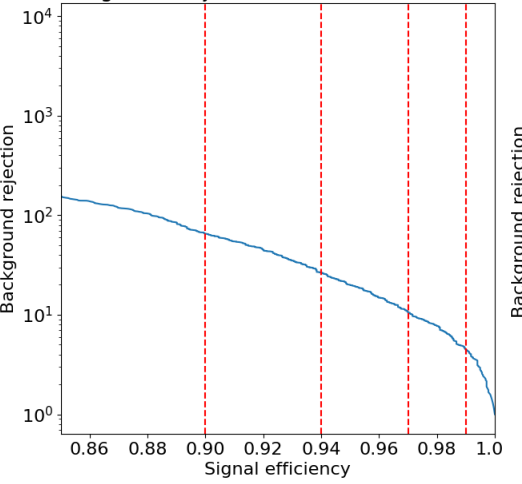




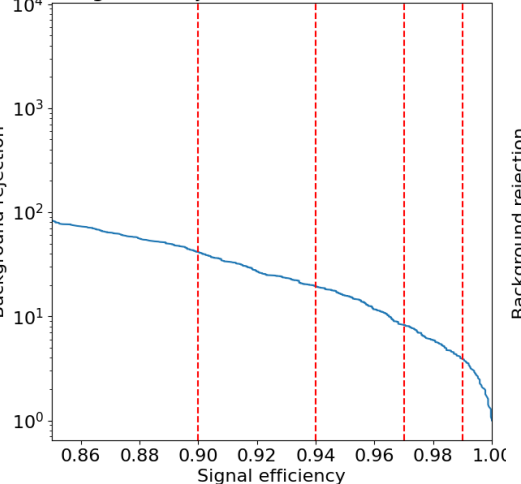
DNN background rejection curve (mass: 6000.0 GeV)



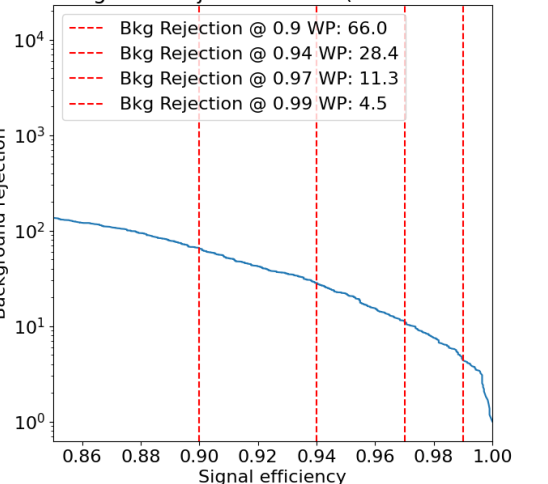
DNN background rejection curve (mass: 6000.0 GeV)



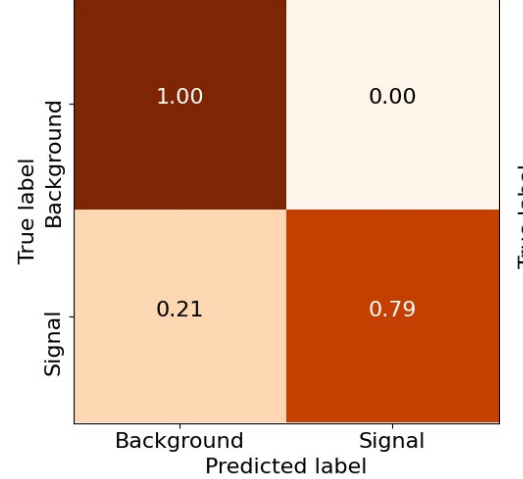
DNN background rejection curve (mass: 6000.0 GeV)



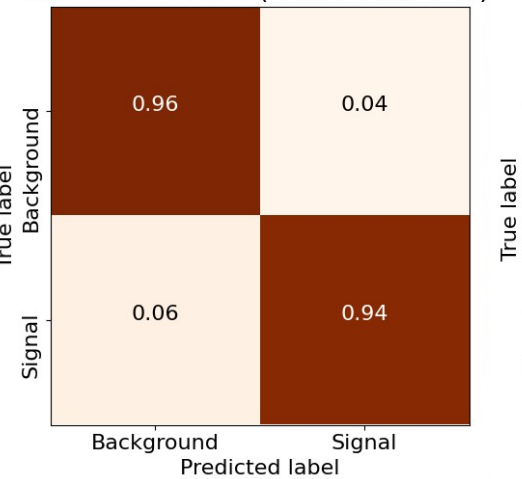
DNN background rejection curve (mass: 6000.0 GeV)



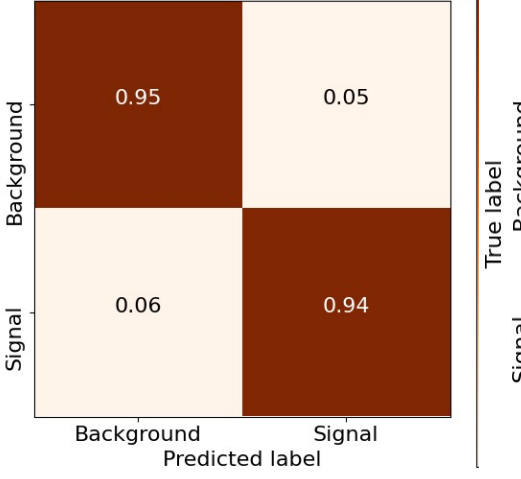
Confusion matrix (mass: 6000 GeV)



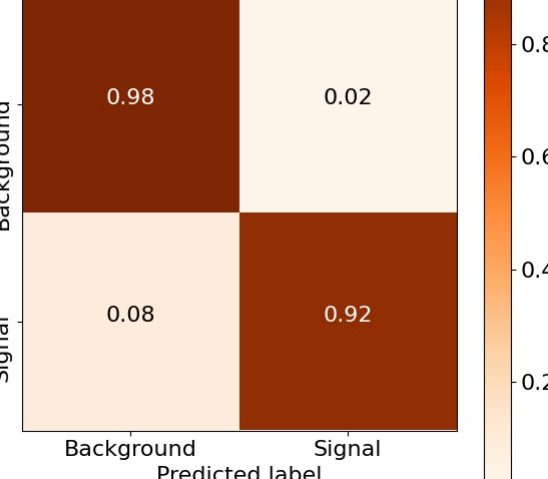
Confusion matrix (mass: 6000 GeV)



Confusion matrix (mass: 6000 GeV)

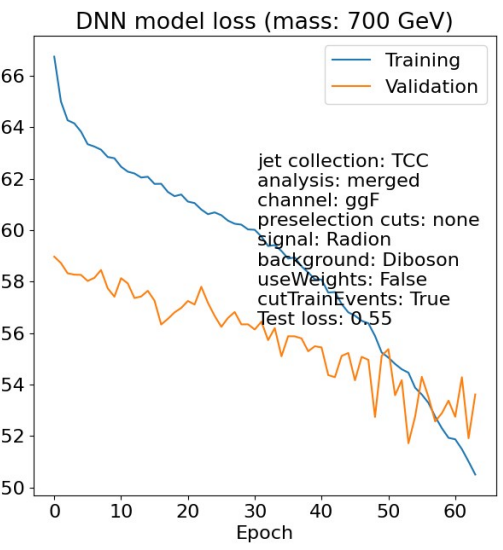
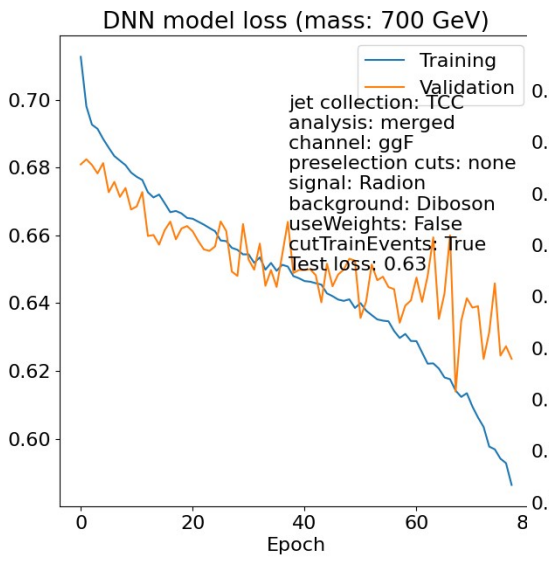
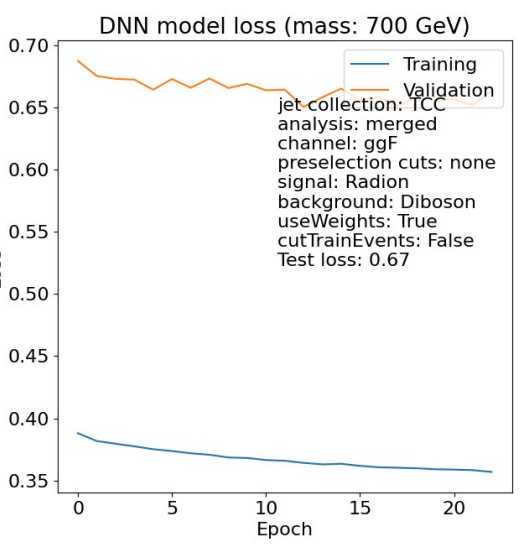
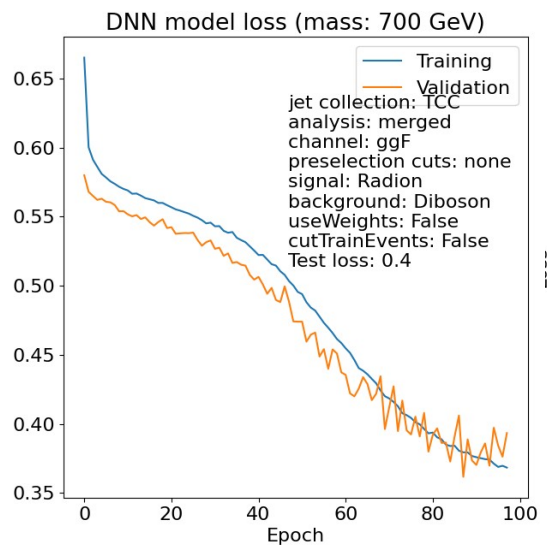
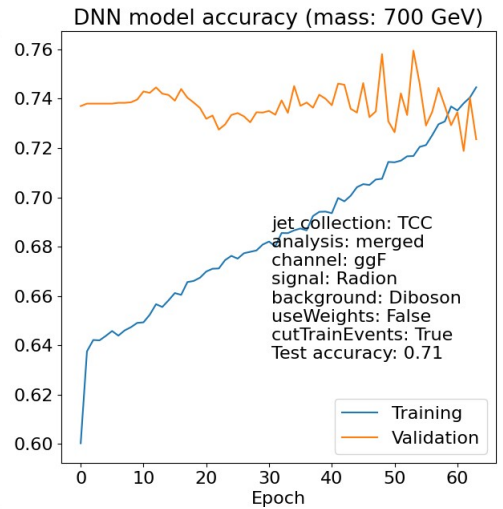
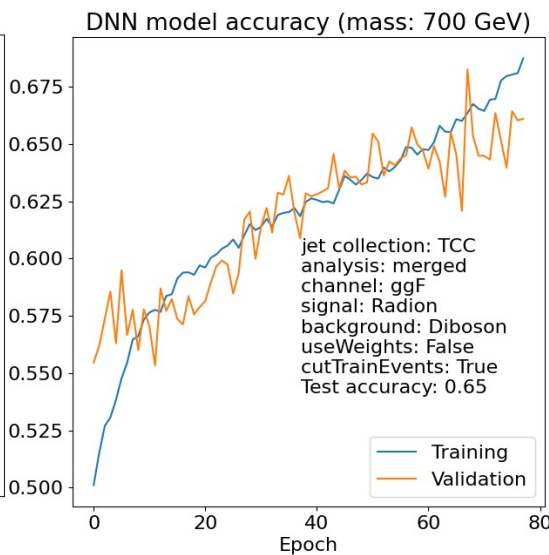
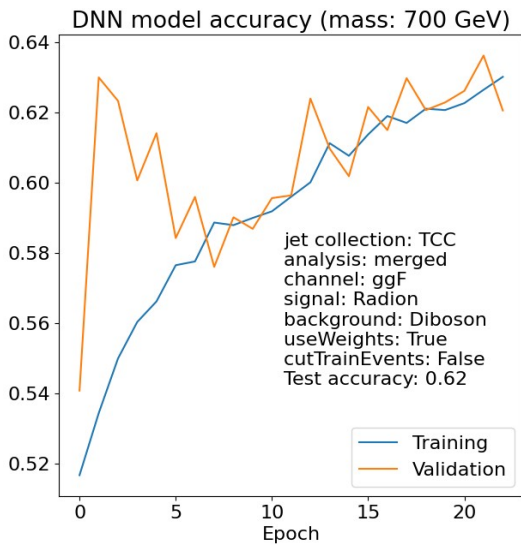
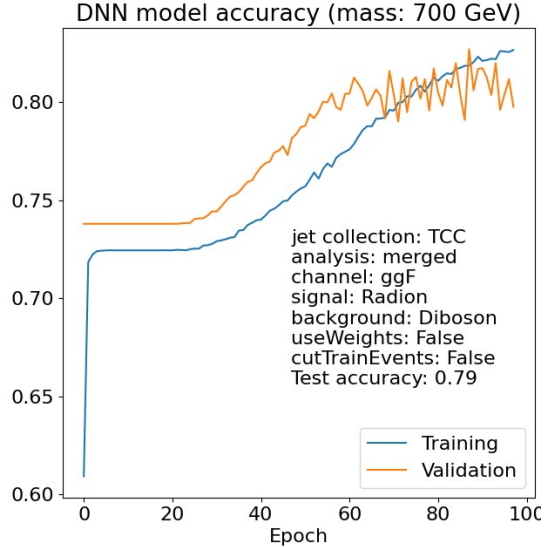


Confusion matrix (mass: 6000 GeV)



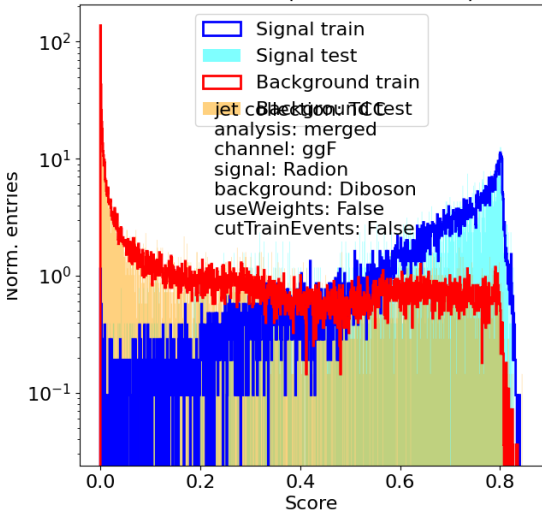
# Massa 700 GeV, Diboson

	Intero campione	Intero campione+pesi	sig=bkg	2sig=bkg
Segnale train	10062 (38% bkg)	10062	10062	10062
Bkg train	26455	26455	10062	18258
Segnale test	3078	3078	3078	3078
Bkg test	8180	8180	8180	8108
Loss su train	0.3677	0.3557	0.5870	0.5064
Accuracy su train	0.8286	0.6304	0.6862	0.7448
Loss su validazione	0.3934	0.6636	0.6236	0.5361
Accuracy su validazione	0.7976	0.6207	0.6611	0.7235
Loss su test	0.4024	0.6680	0.6289	0.5472
Accuracy su test	0.7894	0.6174	0.6530	0.7063
Area ROC	0.881	0.682	0.788	0.819
Reiezione bkg @ 0.90 WP	3.3	1.3	1.8	2.1
Reiezione bkg @ 0.99 WP	1.8	1.0	1.2	1.2

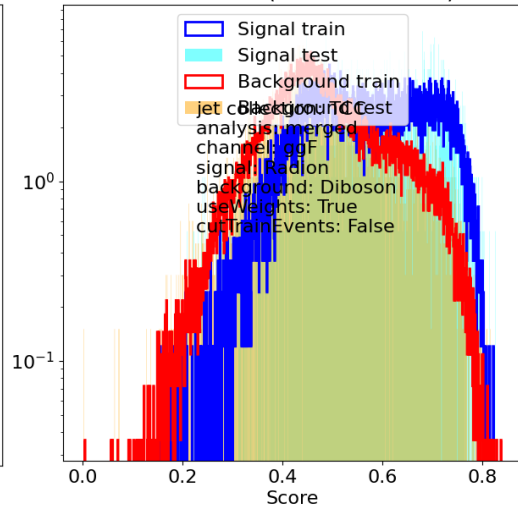




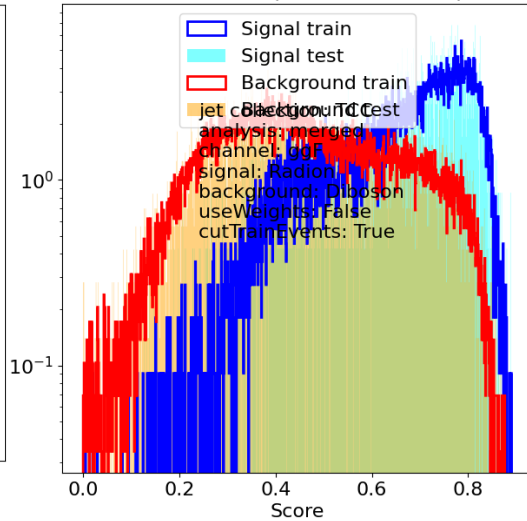
DNN scores (mass: 700 GeV)



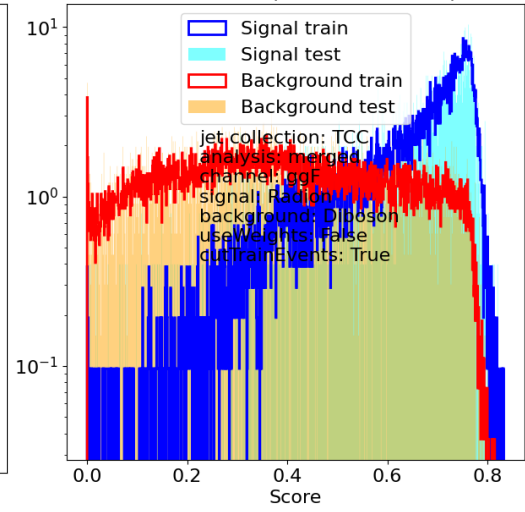
DNN scores (mass: 700 GeV)



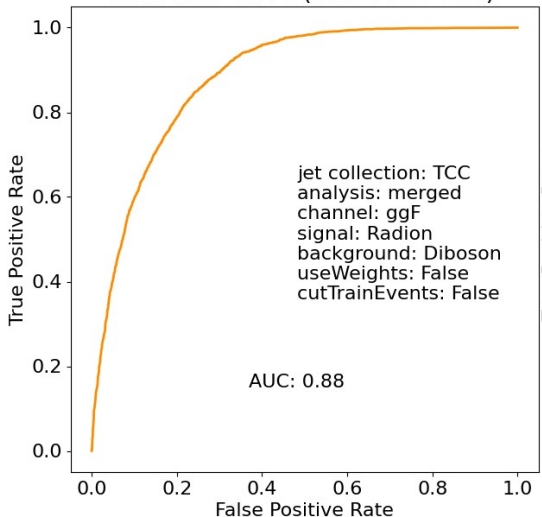
DNN scores (mass: 700 GeV)



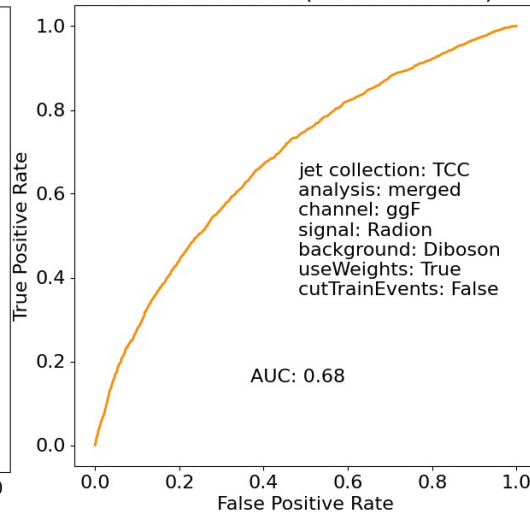
DNN scores (mass: 700 GeV)



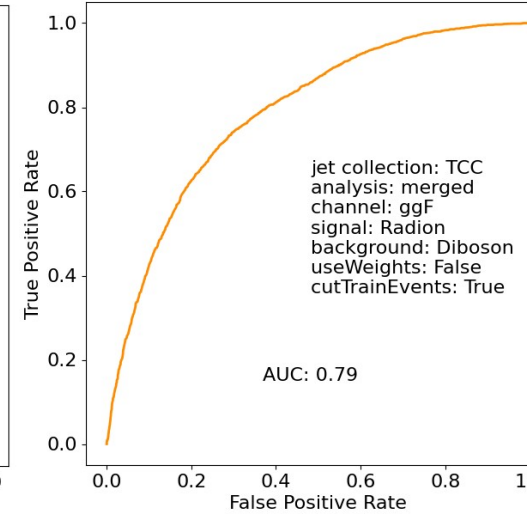
DNN ROC curve (mass: 700 GeV)



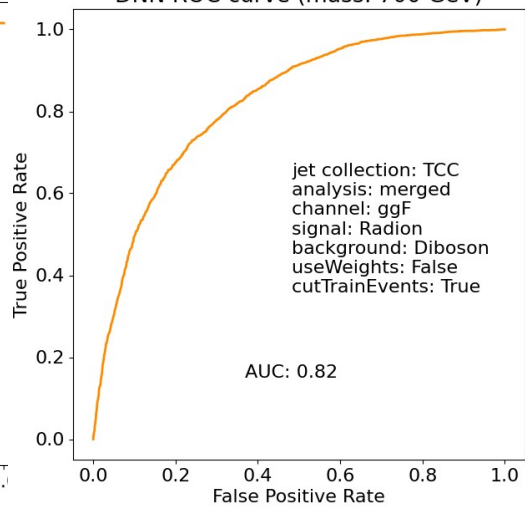
DNN ROC curve (mass: 700 GeV)

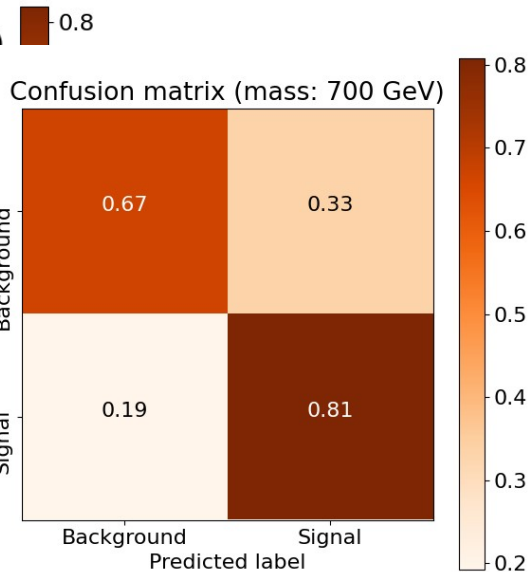
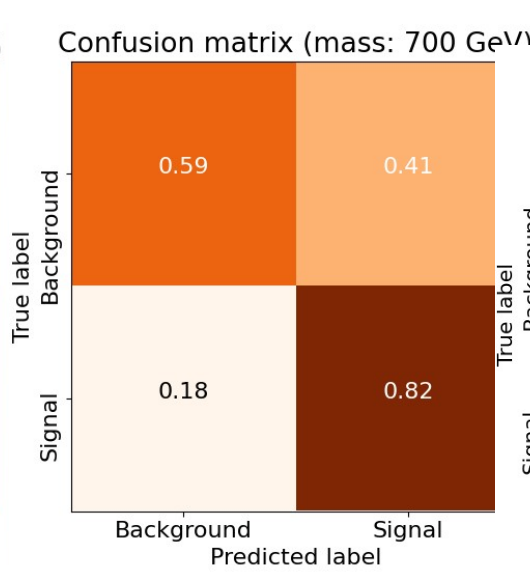
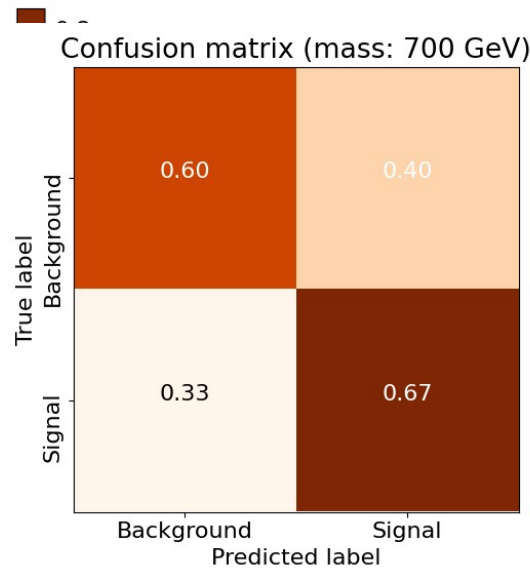
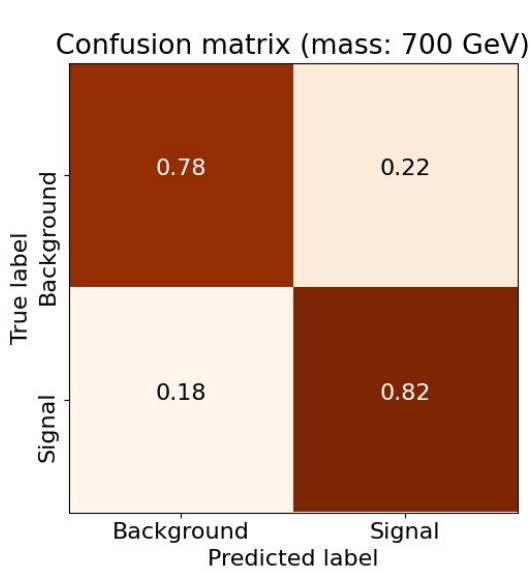
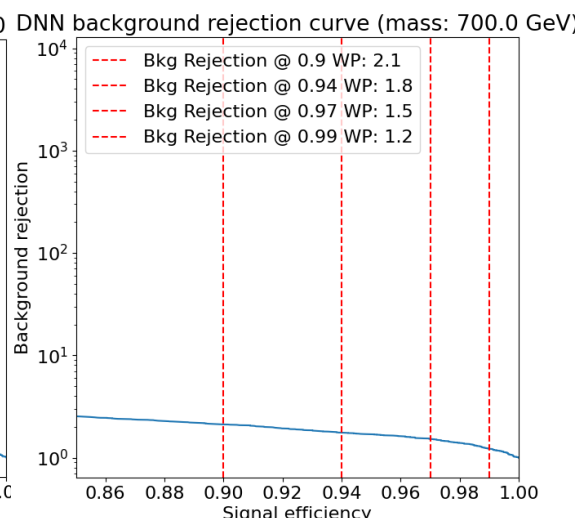
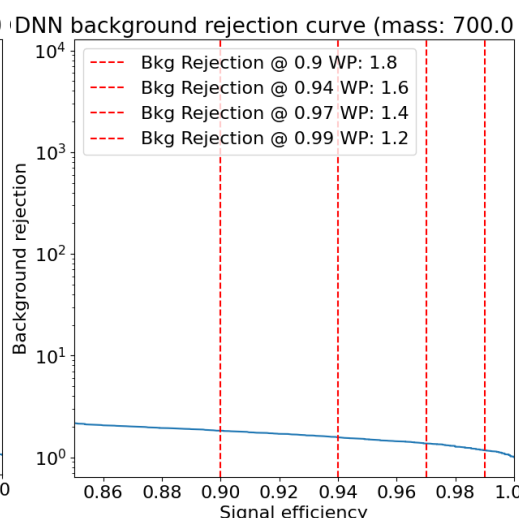
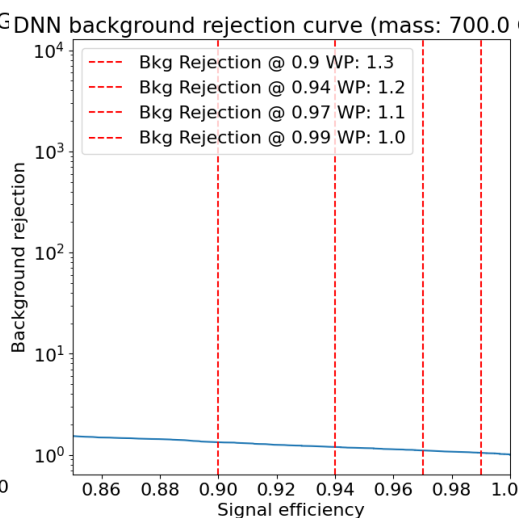
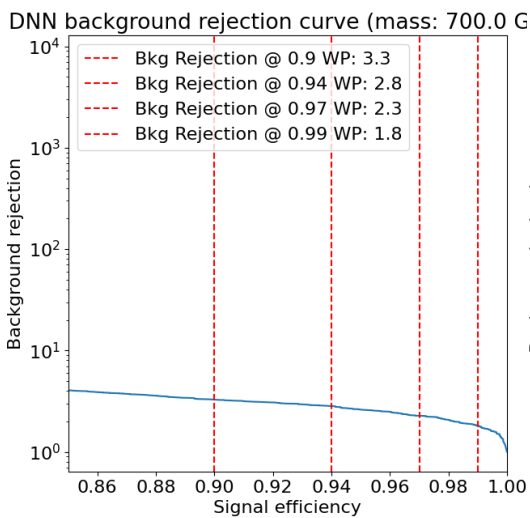


DNN ROC curve (mass: 700 GeV)



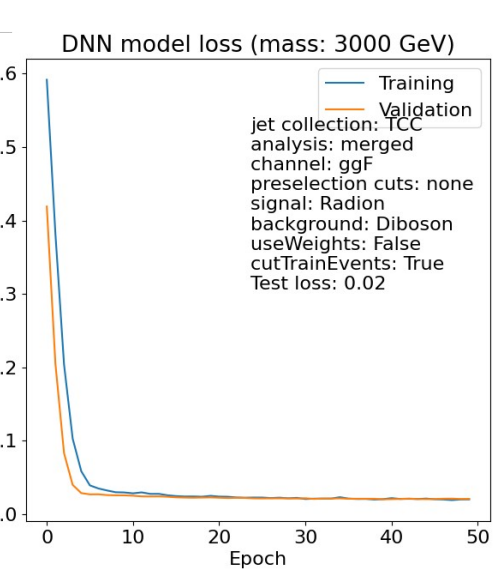
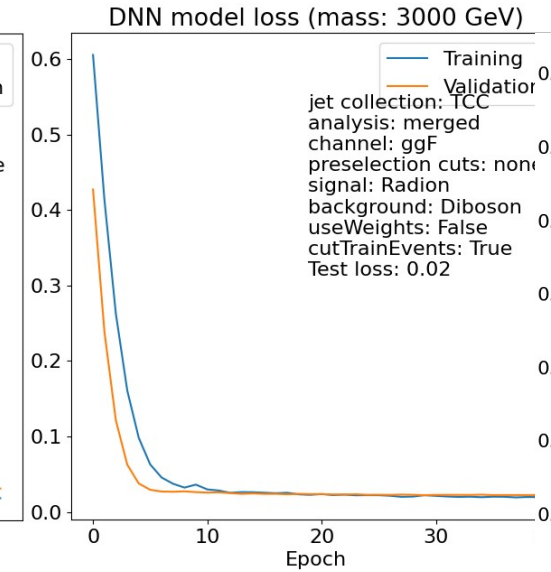
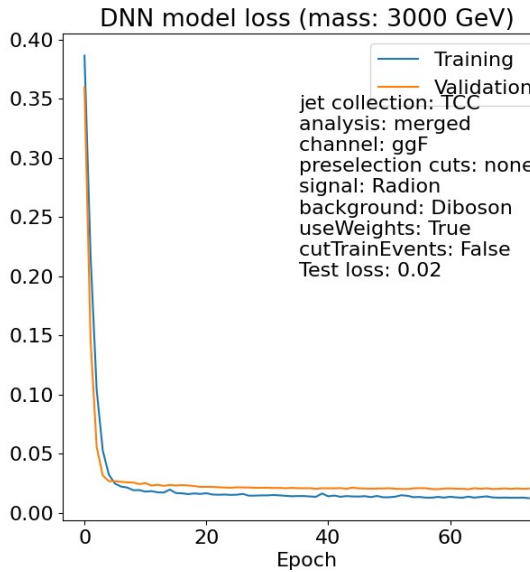
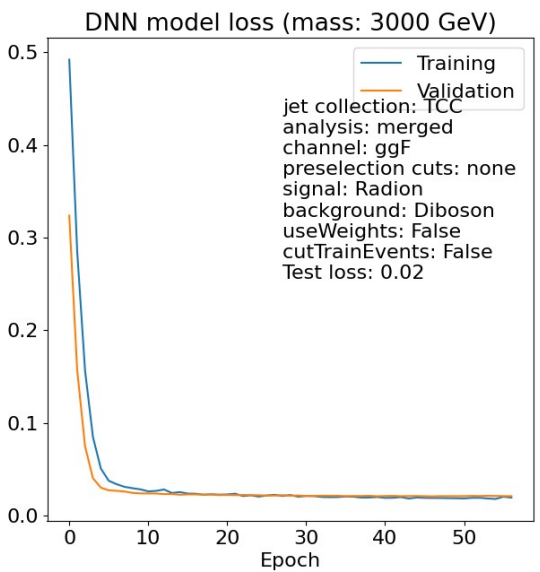
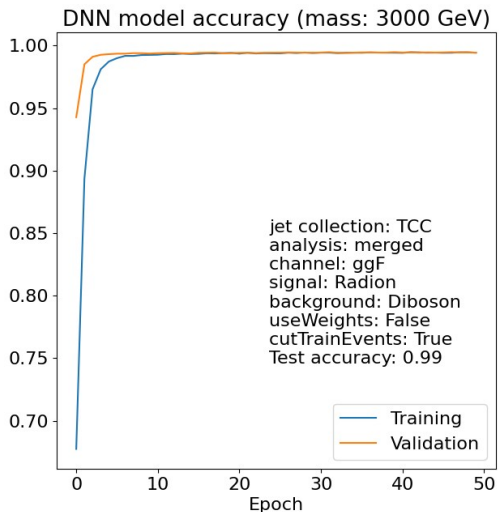
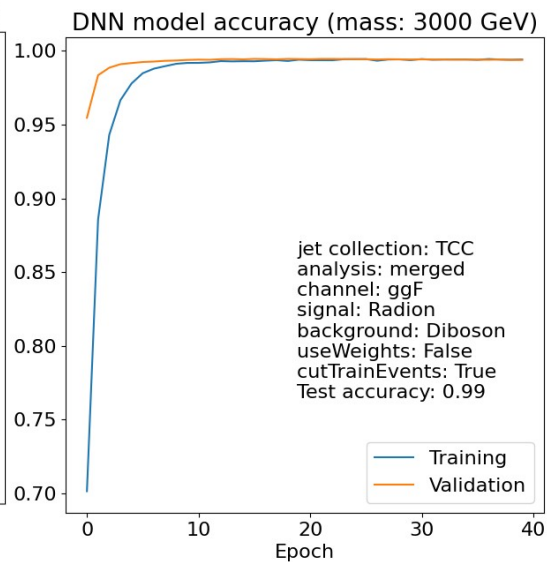
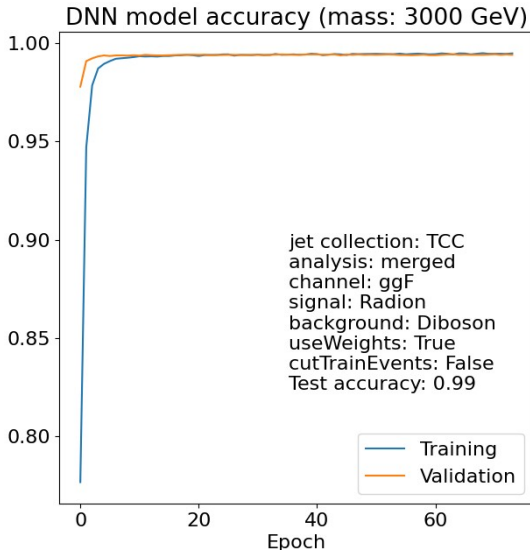
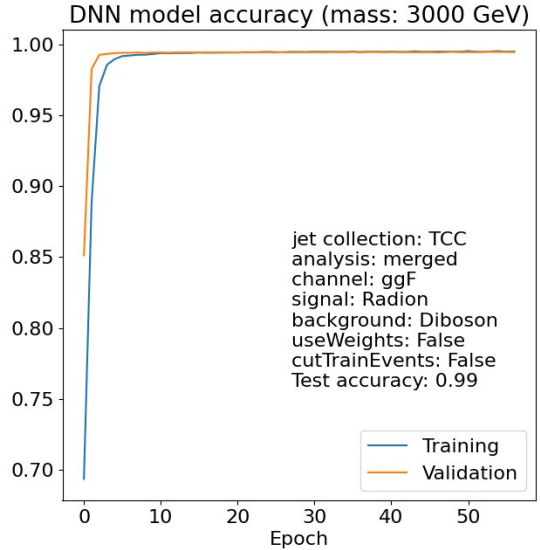
DNN ROC curve (mass: 700 GeV)

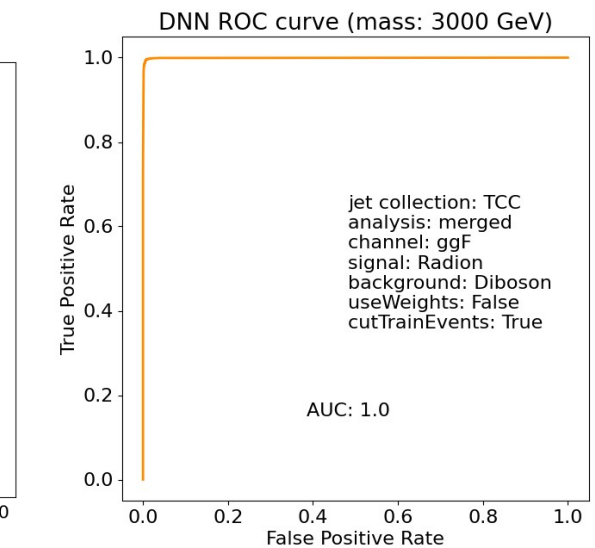
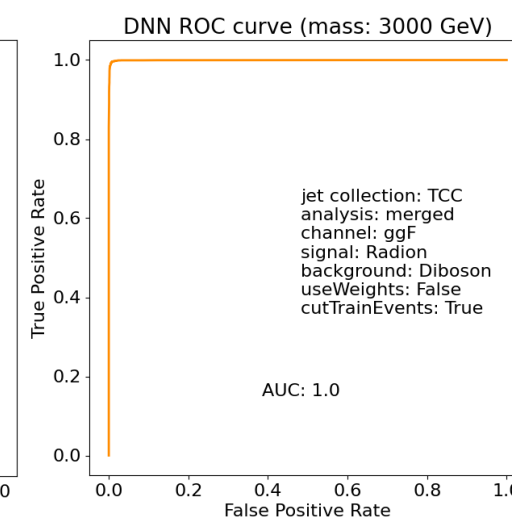
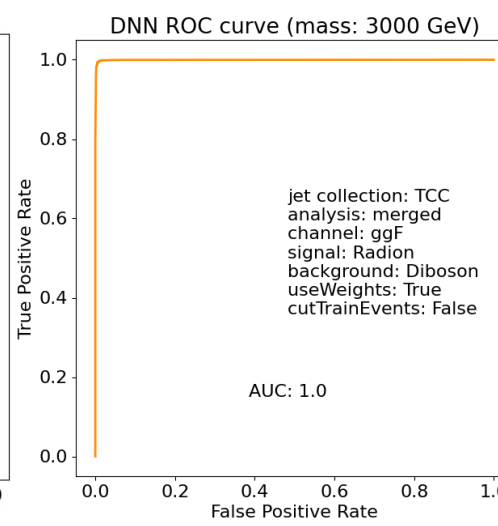
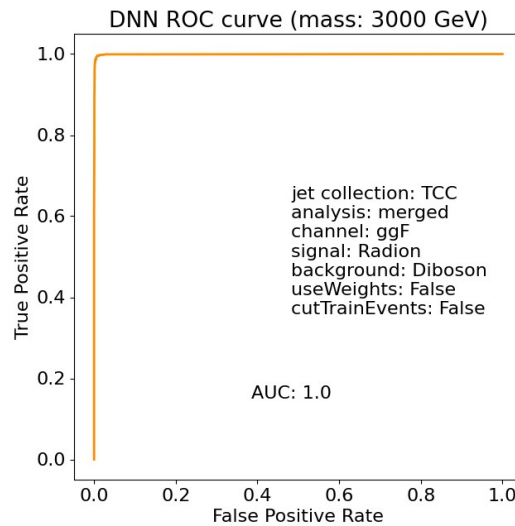
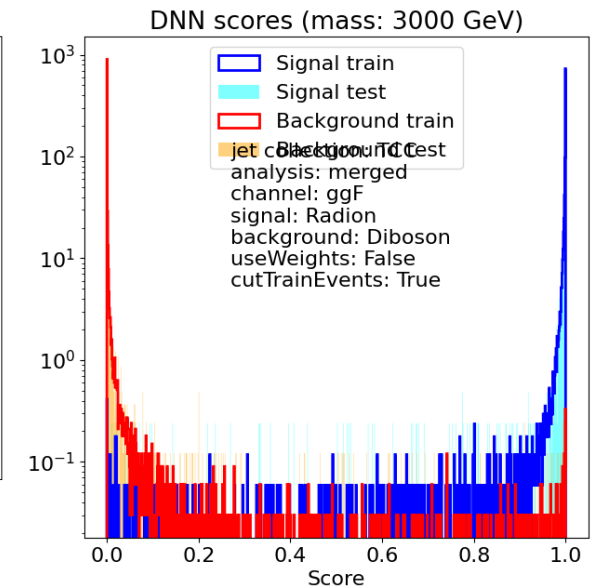
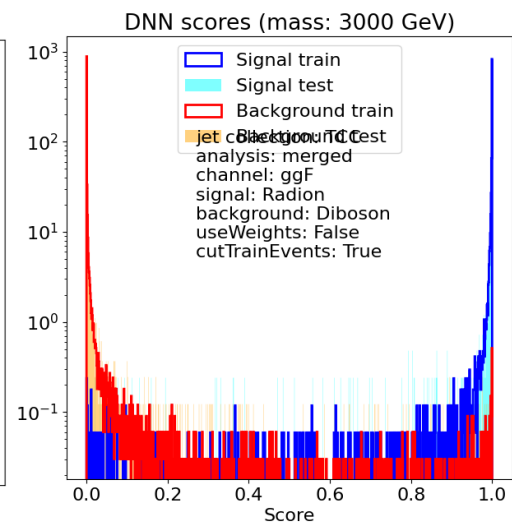
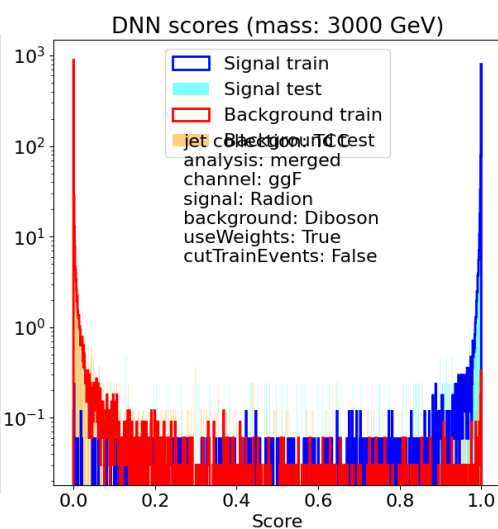
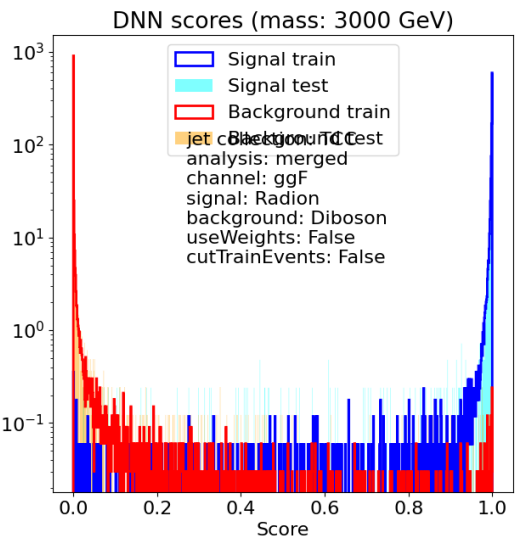




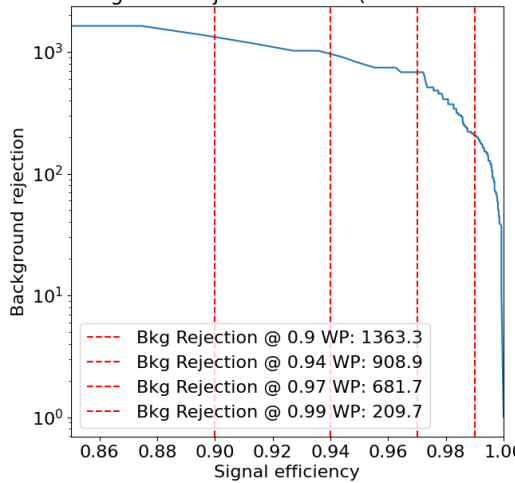
# Massa 3000 GeV, Diboson

	Intero campione	Intero campione+pesi	sig=bkg	1.5sig=bkg
Segnale train	13614 (51% bkg)	13614	13614	13614
Bkg train	26462	26462	13614	20038
Segnale test	4165	4165	4165	4165
Bkg test	8180	8180	8180	8180
Loss su train	0.0189	0.0125	0.0189	0.0212
Accuracy su train	0.9949	0.9949	0.9946	0.9938
Loss su validazione	0.0209	0.0206	0.0226	0.0207
Accuracy su validazione	0.9949	0.9940	0.9939	0.9944
Loss su test	0.0224	0.0238	0.0247	0.0228
Accuracy su test	0.9937	0.9934	0.9936	0.9934
Area ROC	0.998	0.999	0.999	0.999
Reiezione bkg @ 0.90 WP	1363.3	1168.6	1363.3	1363.6
Reiezione bkg @ 0.99 WP	209.7	227.2	204.5	221.1

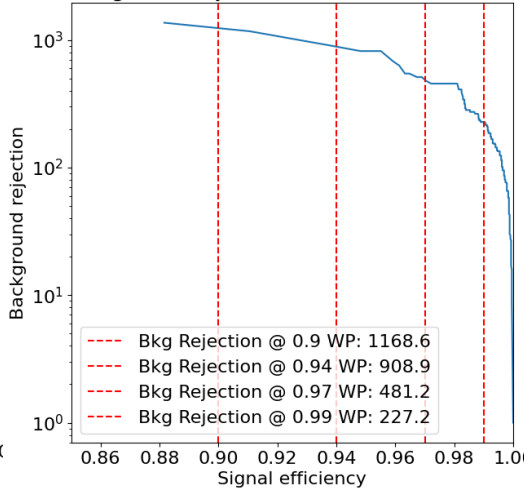




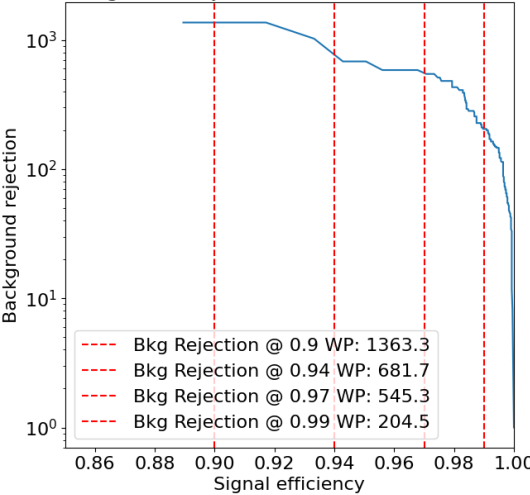
DNN background rejection curve (mass: 3000.0



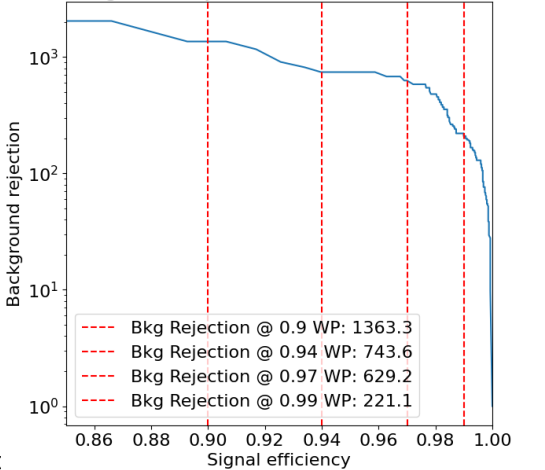
DNN background rejection curve (mass: 3000.0



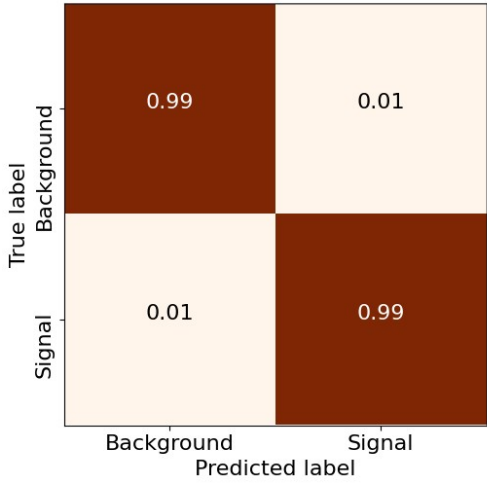
DNN background rejection curve (mass: 3000.0



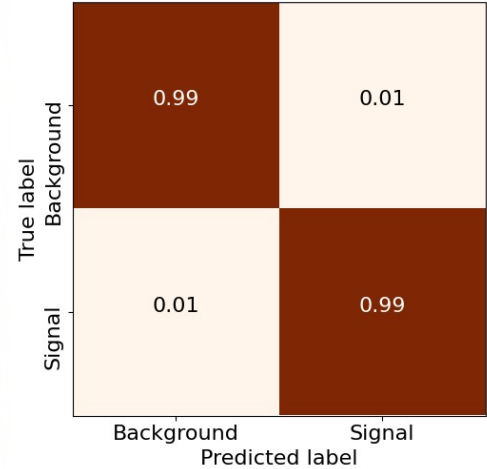
DNN background rejection curve (mass: 3000.0



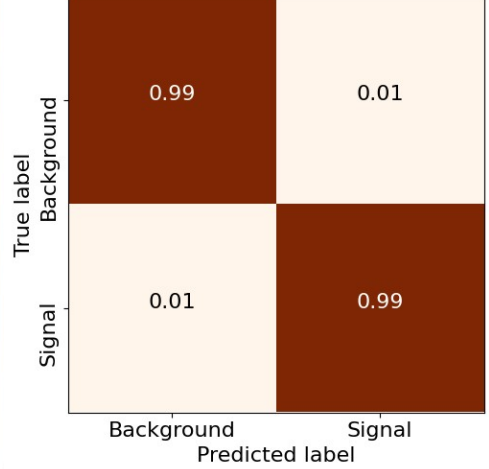
Confusion matrix (mass: 3000 GeV)



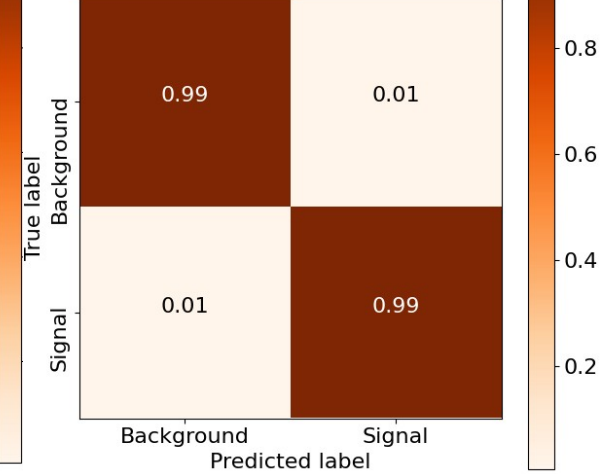
Confusion matrix (mass: 3000 GeV)



Confusion matrix (mass: 3000 GeV)



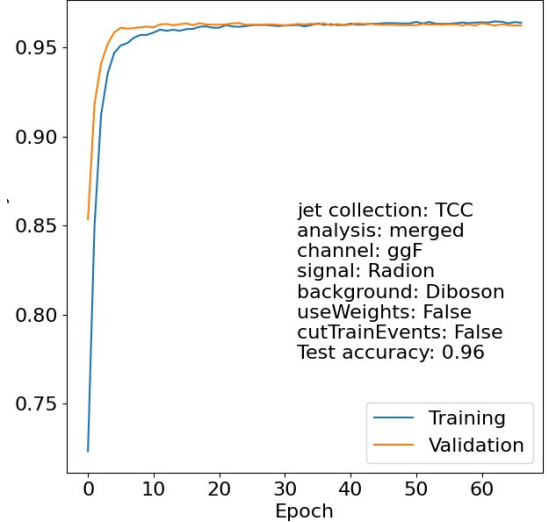
Confusion matrix (mass: 3000 GeV)



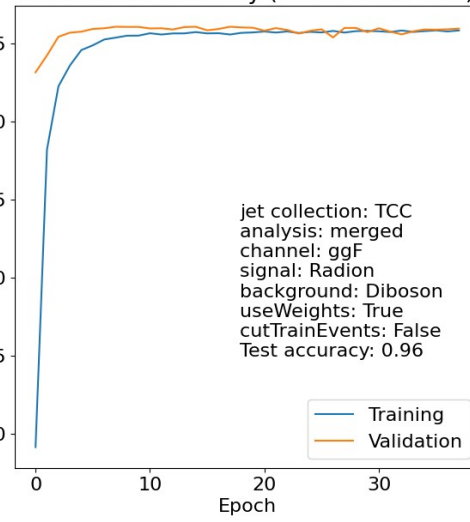
# Massa 6000 GeV, Diboson

	Intero campione	Intero campione+pesi	sig=bkg	1.5sig=bkg
Segnale train	10448	10448	10448	10448
Bkg train	26473	26473	10448	18460
Segnale test	3269	3269	3249	3249
Bkg test	8180	8180	8180	8180
Loss su train	0.0999	0.073	0.1280	0.1114
Accuracy su train	0.9643	0.958	0.9520	0.9581
Loss su validazione	0.1027	0.1113	0.1157	0.1065
Accuracy su validazione	0.9623	0.9593	0.9592	0.9611
Loss su test	0.1015	0.1113	0.1152	0.1068
Accuracy su test	0.9645	0.9598	0.9593	0.9620
Area ROC	0.99	0.99	0.99	0.99
Reiezione bkg @ 0.90 WP	82.6	75.7	72.4	75.7
Reiezione bkg @ 0.99 WP	4.8	3.9	4.8	4.7

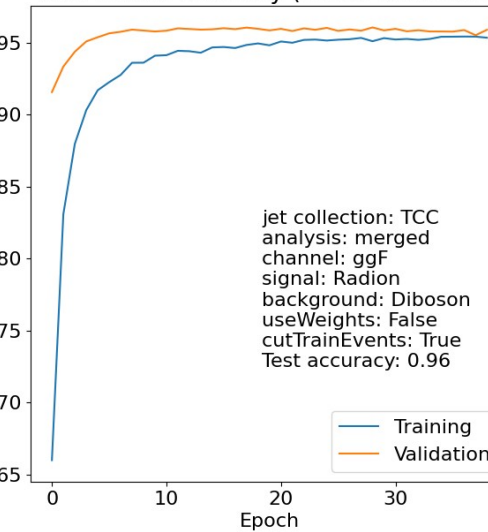
DNN model accuracy (mass: 6000 GeV)



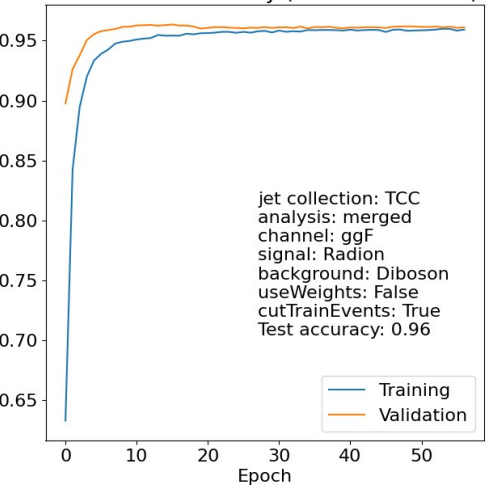
DNN model accuracy (mass: 6000 GeV)



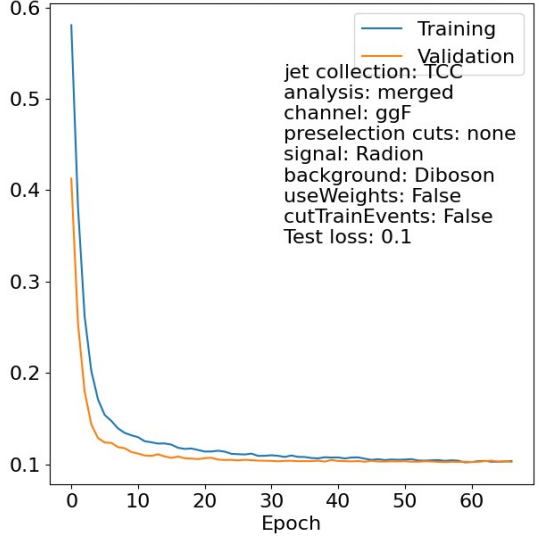
DNN model accuracy (mass: 6000 GeV)



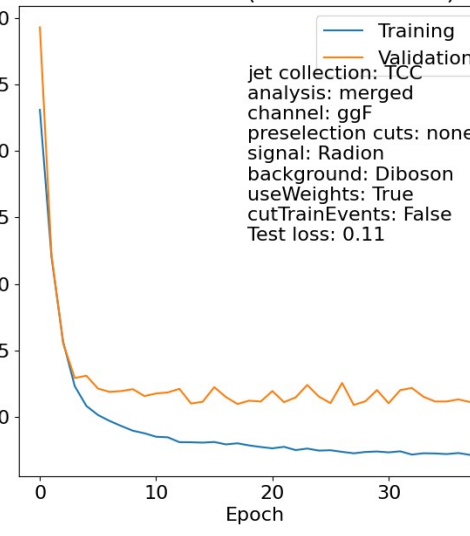
DNN model accuracy (mass: 6000 GeV)



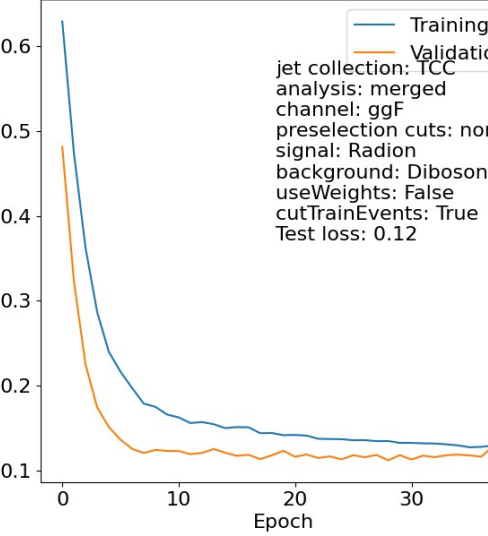
DNN model loss (mass: 6000 GeV)



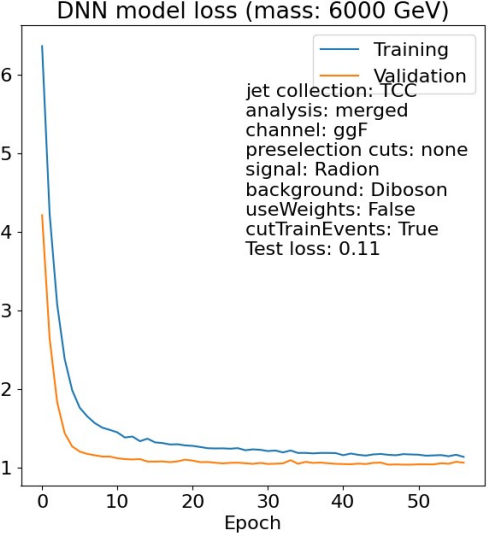
DNN model loss (mass: 6000 GeV)



DNN model loss (mass: 6000 GeV)

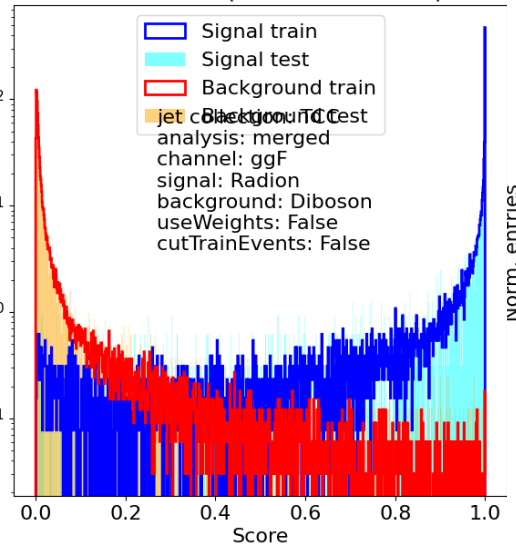


DNN model loss (mass: 6000 GeV)

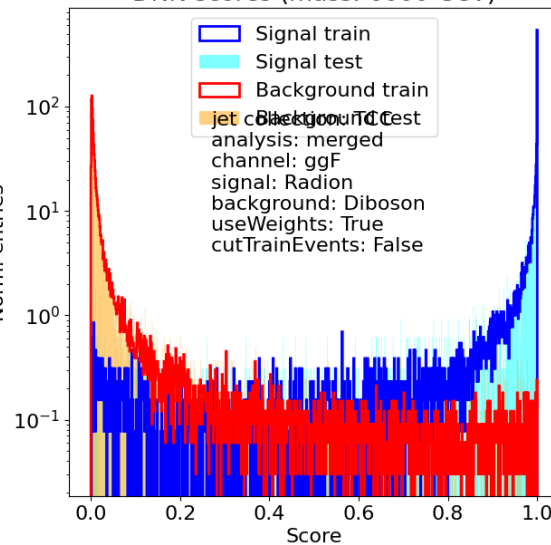




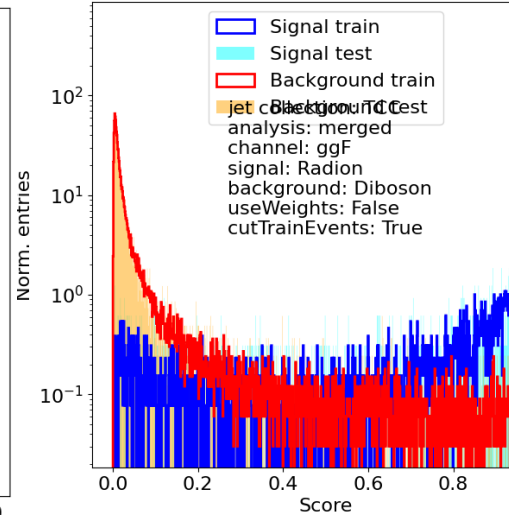
DNN scores (mass: 6000 GeV)



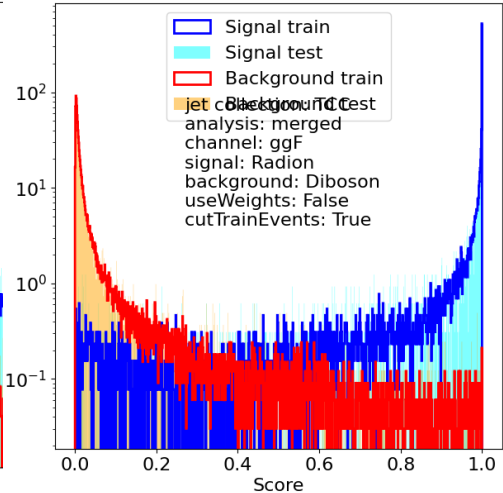
DNN scores (mass: 6000 GeV)



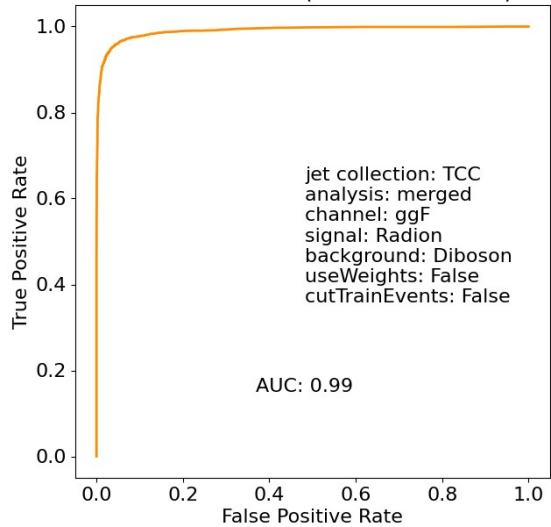
DNN scores (mass: 6000 GeV)



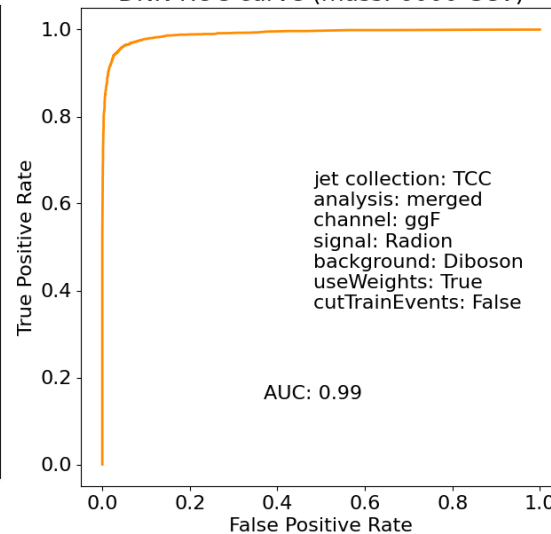
DNN scores (mass: 6000 GeV)



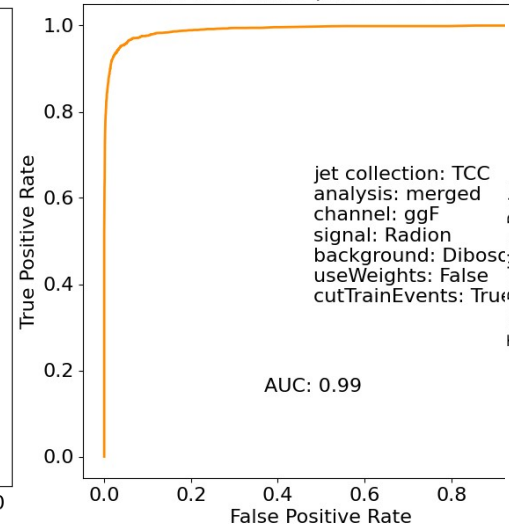
DNN ROC curve (mass: 6000 GeV)



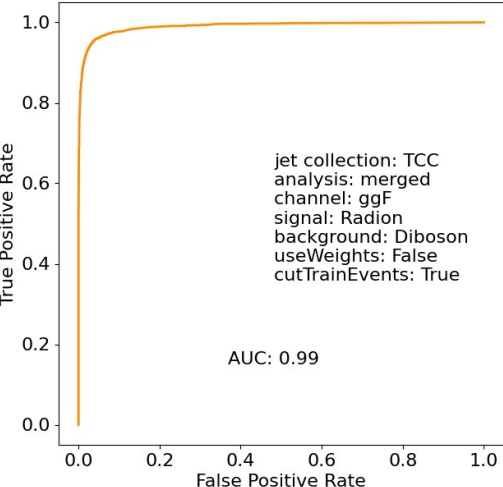
DNN ROC curve (mass: 6000 GeV)



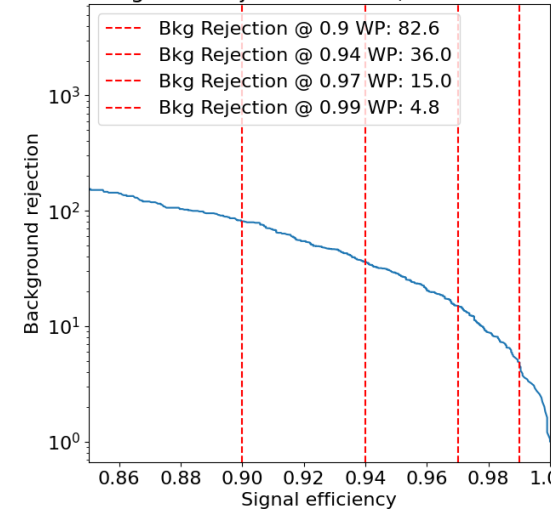
DNN ROC curve (mass: 6000 GeV)



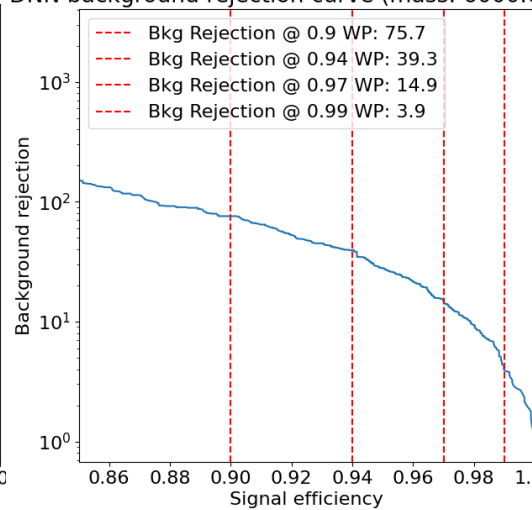
DNN ROC curve (mass: 6000 GeV)



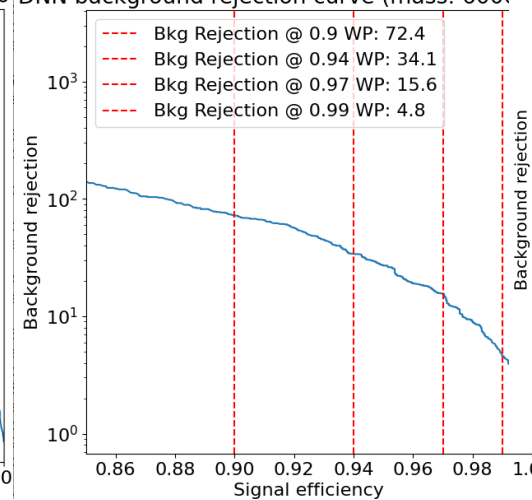
DNN background rejection curve (mass: 6000.0 GeV)



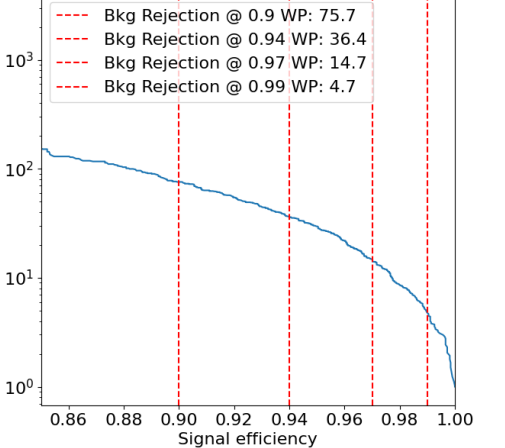
DNN background rejection curve (mass: 6000.0 GeV)



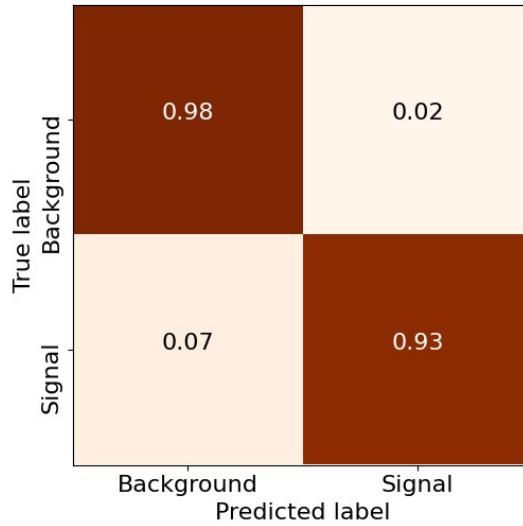
DNN background rejection curve (mass: 6000.0 GeV)



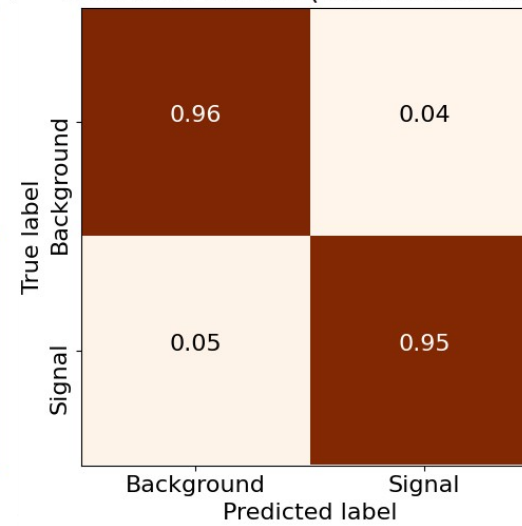
DNN background rejection curve (mass: 6000.0 GeV)



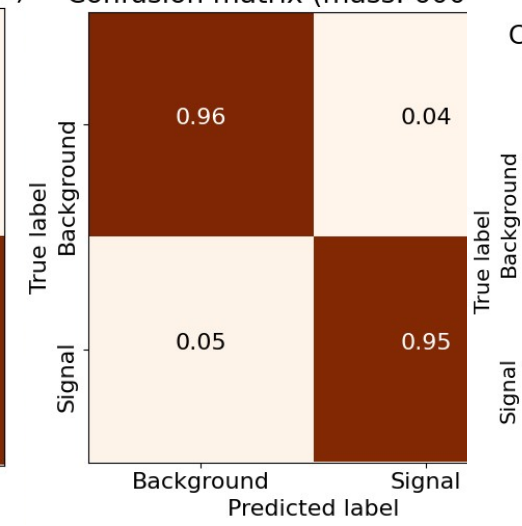
Confusion matrix (mass: 6000 GeV)



Confusion matrix (mass: 6000 GeV)



Confusion matrix (mass: 6000 GeV)



Confusion matrix (mass: 6000 GeV)

