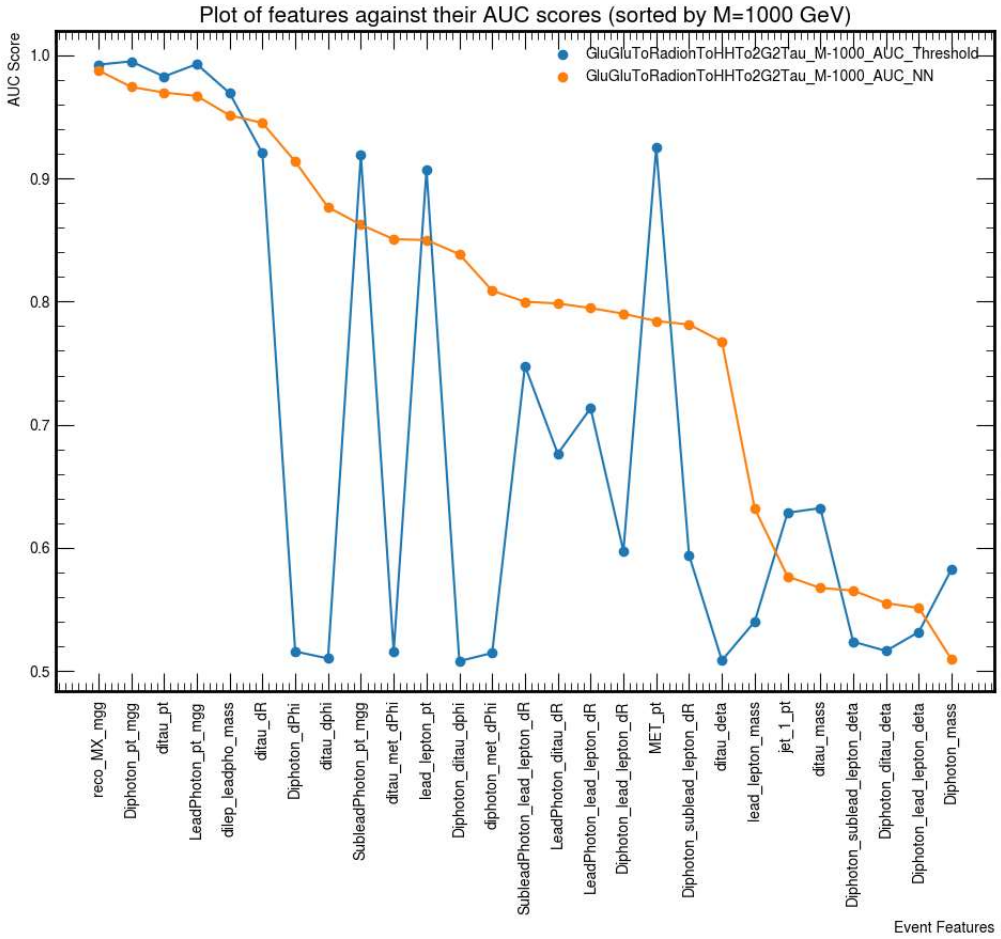
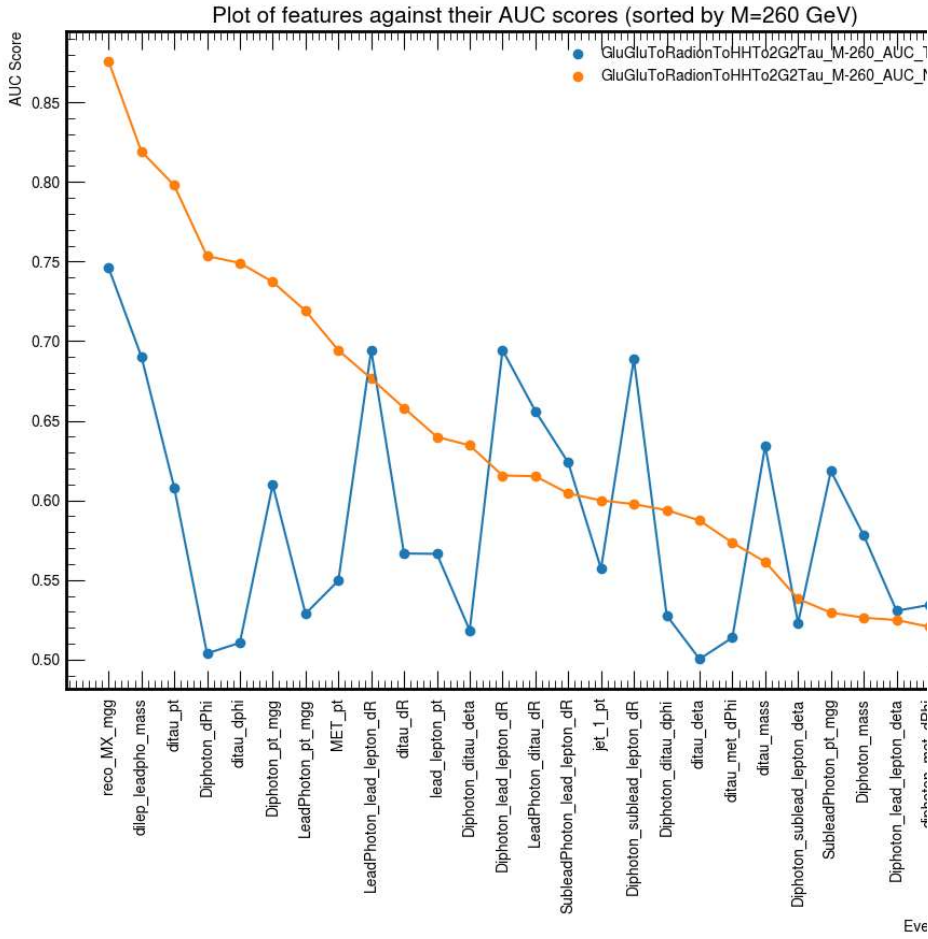
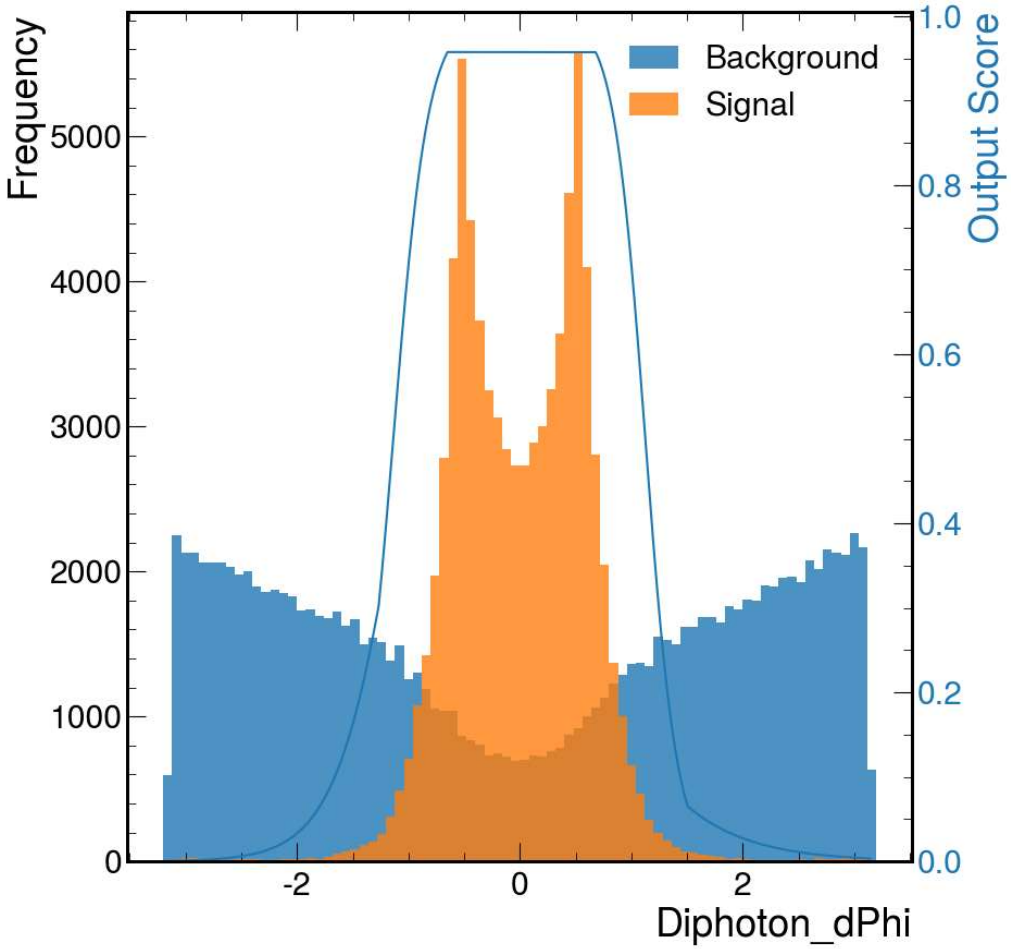
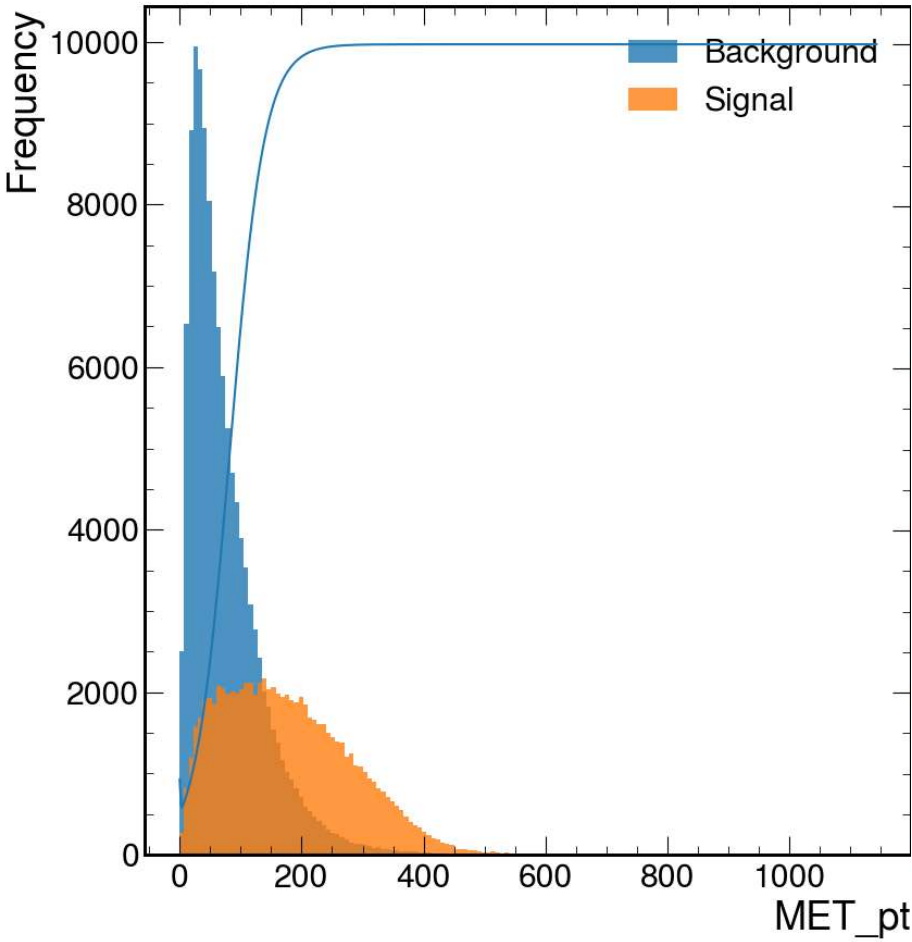
Project Aim

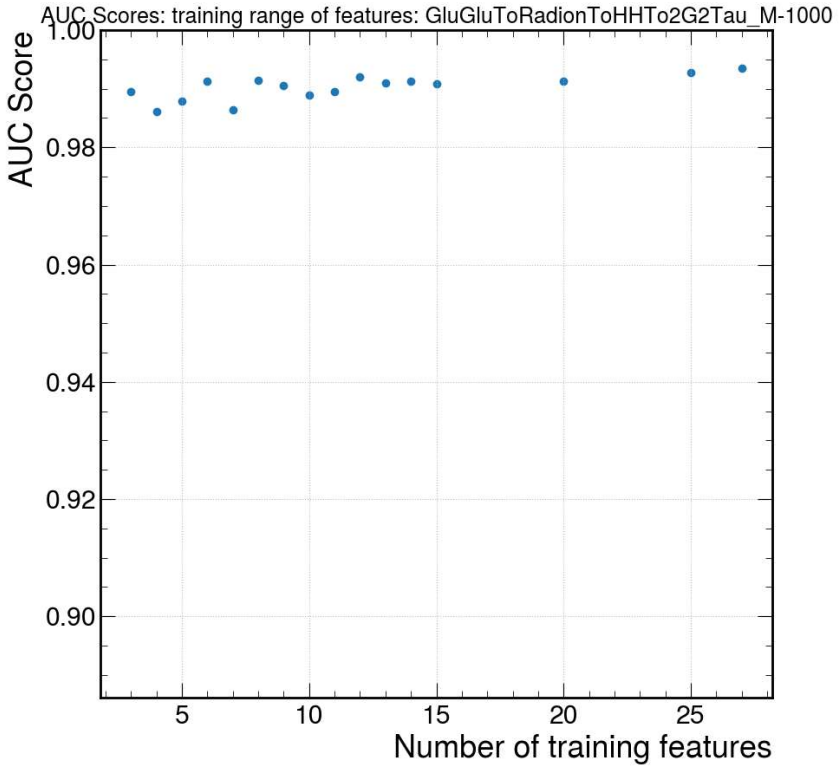
Employing parametric neural networks to enhance the exploration o new physics beyond the Standard Model, this project focuses on analyzing Higgs boson decay products, specifically photons and tau leptons, to identify novel resonances.

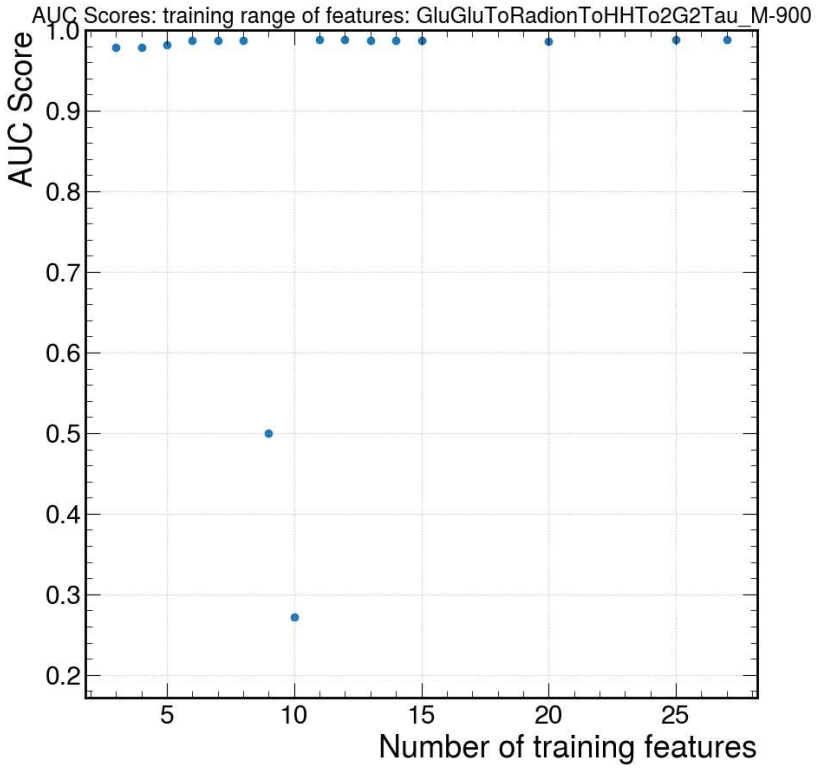

Plot of features against their AUC scores (sorted by M=1000 GeV)
AUC Score
1.0
0.9
0.8
0.7
0.6
0.5
GluGluToRadionToHHTo2G2Tau_M-1000_AUC_Threshold
GluGluToRadionToHHTo2G2Tau_M-1000_AUC_NN
reco_MX_mgg
Diphoton_pt_mgg
ditau_pt
LeadPhoton_pt_mgg
dilep_leadpho_mass
ditau_dR
Diphoton_dPhi
ditau_dphi
SubleadPhoton_pt_mgg
ditau_met_dPhi
lead_lepton_pt
Diphoton_ditau_dphi
diphoton_met_dPhi
SubleadPhoton_lead_lepton_dR
LeadPhoton_ditau_dR
LeadPhoton_lead_lepton_dR
Diphoton_lead_lepton_dR
MET_pt
Diphoton_sublead_lepton_dR
ditau_deta
lead_lepton_mass
jet_1_pt
ditau_mass
Diphoton_sublead_lepton_deta
Diphoton_ditau_deta
Diphoton_lead_lepton_deta
Diphoton_mass
Event Features

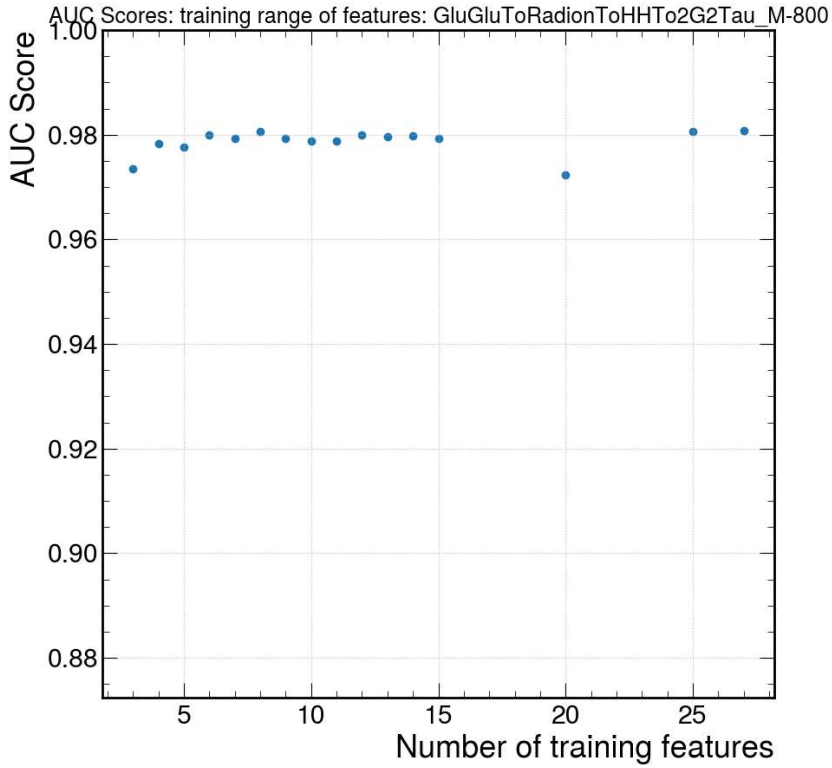

Plot of features against their AUC scores (sorted by M=260 GeV)
AUC Score
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
GluGluToRadionToHHTo2G2Tau_M-260_AUC_T
GluGluToRadionToHHTo2G2Tau_M-260_AUC_N
reco_MX_mgg
dilep_leadpho_mass
ditau_pt
Diphoton_dPhi
ditau_dphi
Diphoton_pt_mgg
LeadPhoton_pt_mgg
MET_pt
LeadPhoton_lead_lepton_dR
ditau_dR
lead_lepton_pt
Diphoton_ditau_deta
Diphoton_lead_lepton_dR
LeadPhoton_ditau_dR
SubleadPhoton_lead_lepton_dR
jet_1_pt
Diphoton_sublead_lepton_dR
Diphoton_ditau_dphi
ditau_deta
ditau_met_dPhi
ditau_mass
Diphoton_sublead_lepton_deta
SubleadPhoton_pt_mgg
Diphoton_mass
Diphoton_lead_lepton_deta
Eve

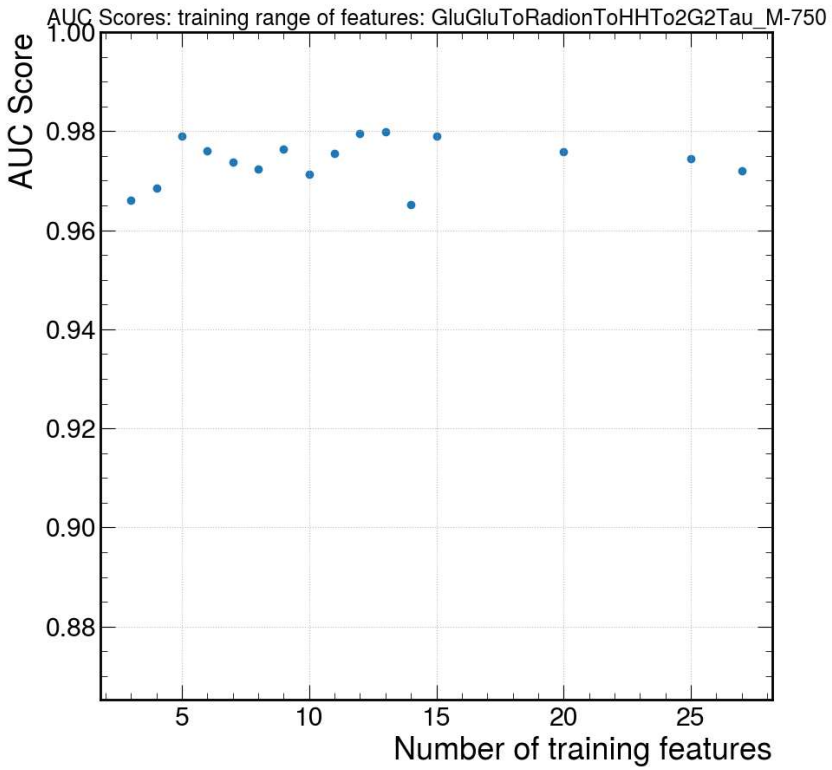

Frequency
Output Score
Background
Signal
Diphoton_dPhi
0
1000
2000
3000
4000
5000
0.0
0.2
0.4
0.6
0.8
1.0
-2
0
2

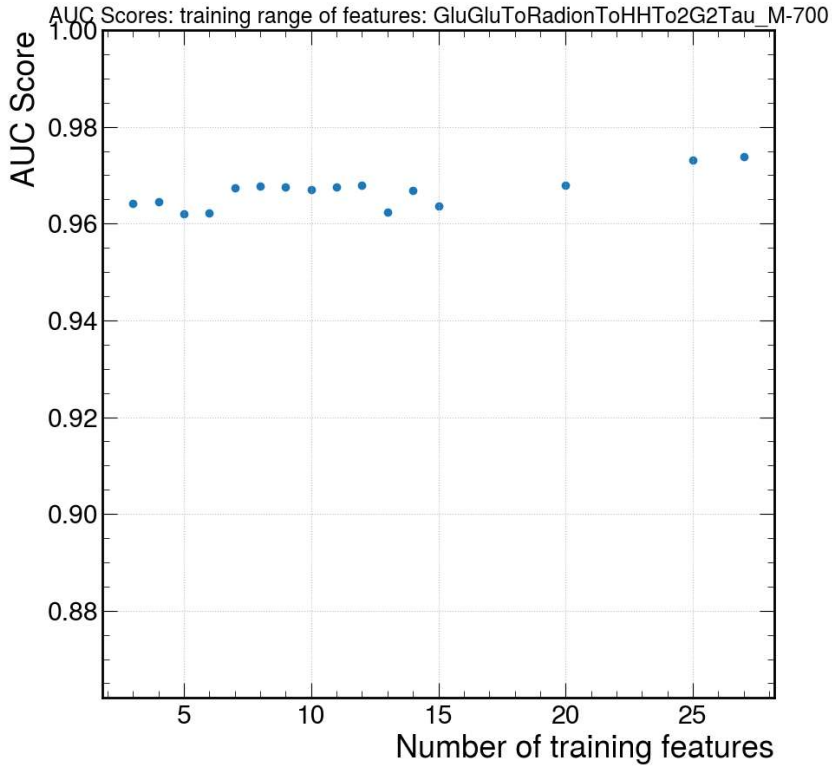

Frequency
Background
Signal
MET_pt
0
2000
4000
6000
8000
10000
0
200
400
600
800
1000

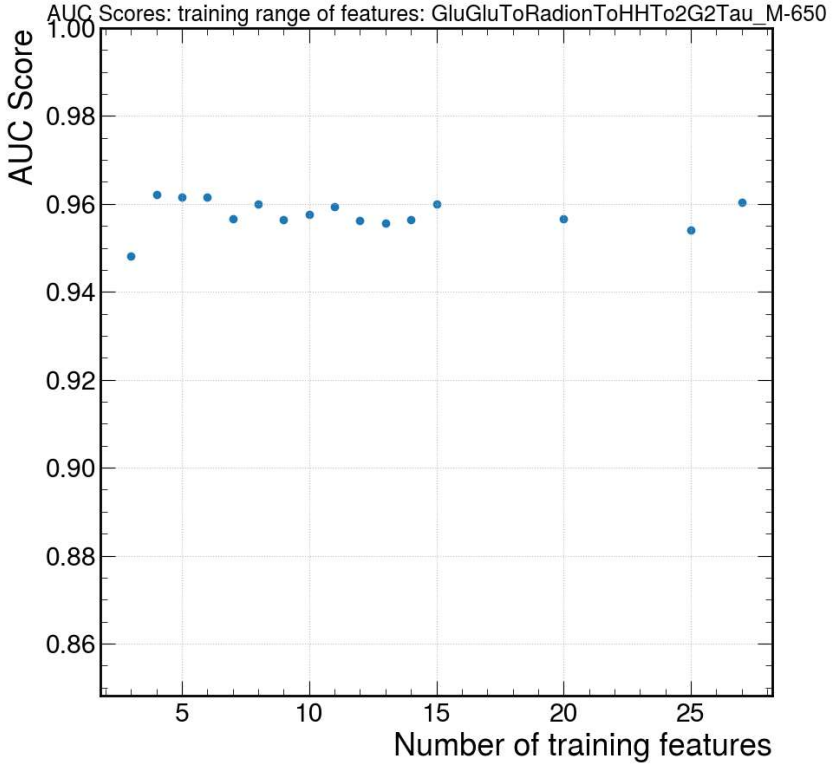

AUC Scores: training range of features: GluGluToRadionToHHTo2G2Tau_M-1000
AUC Score
1.00
0.98
0.96
0.94
0.92
0.90
5
10
15
20
25
Number of training features

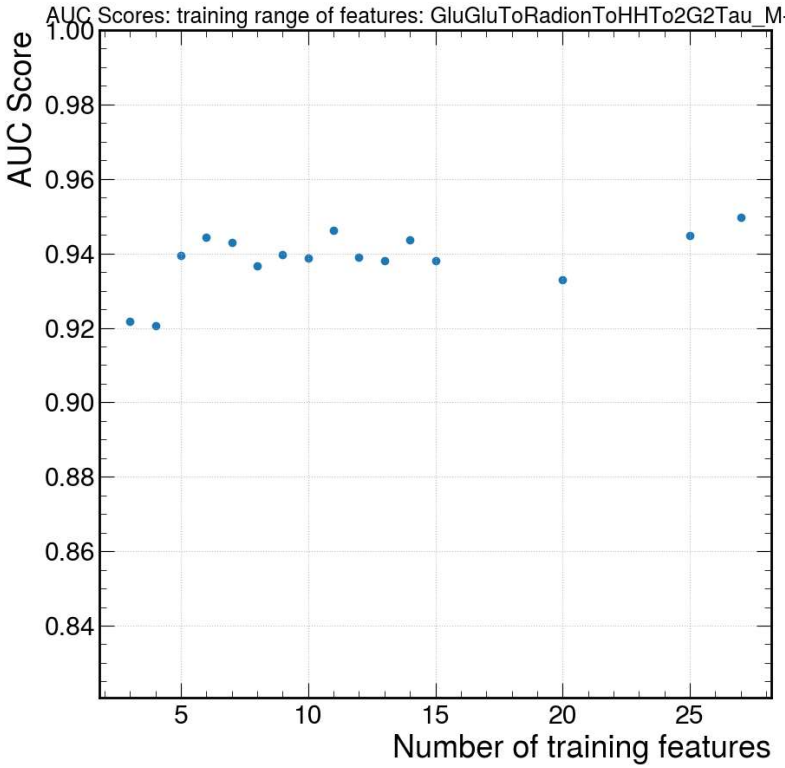

AUC Scores: training range of features: GluGluToRadionToHHTo2G2Tau_M-900
AUC Score
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
5
10
15
20
25
Number of training features

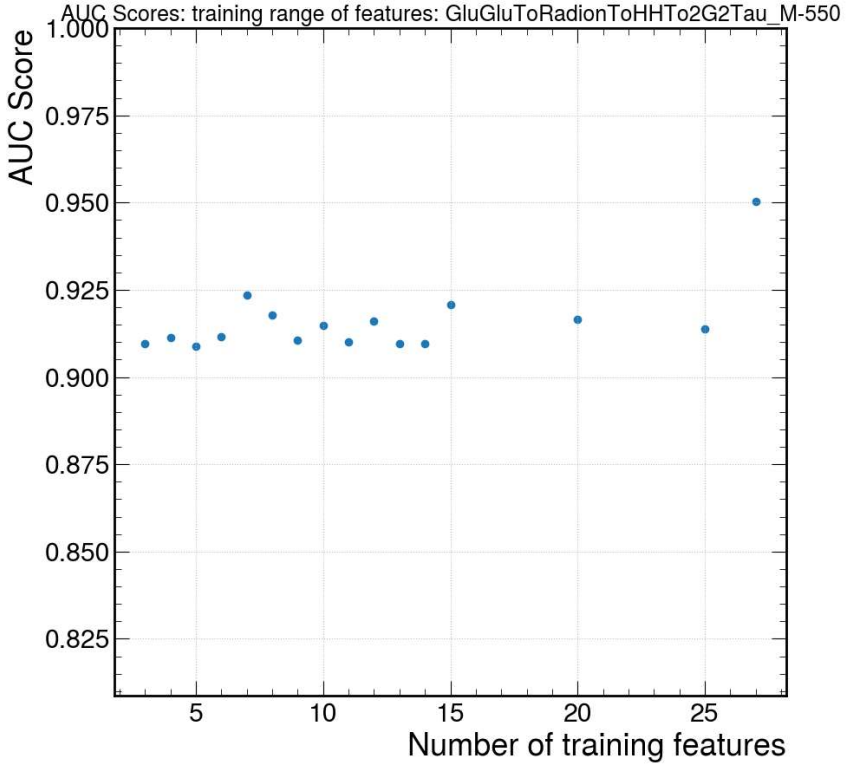

AUC Scores: training range of features: GluGluToRadionToHHTo2G2Tau_M-800
AUC Score
1.00
0.98
0.96
0.94
0.92
0.90
0.88
5
10
15
20
25
Number of training features

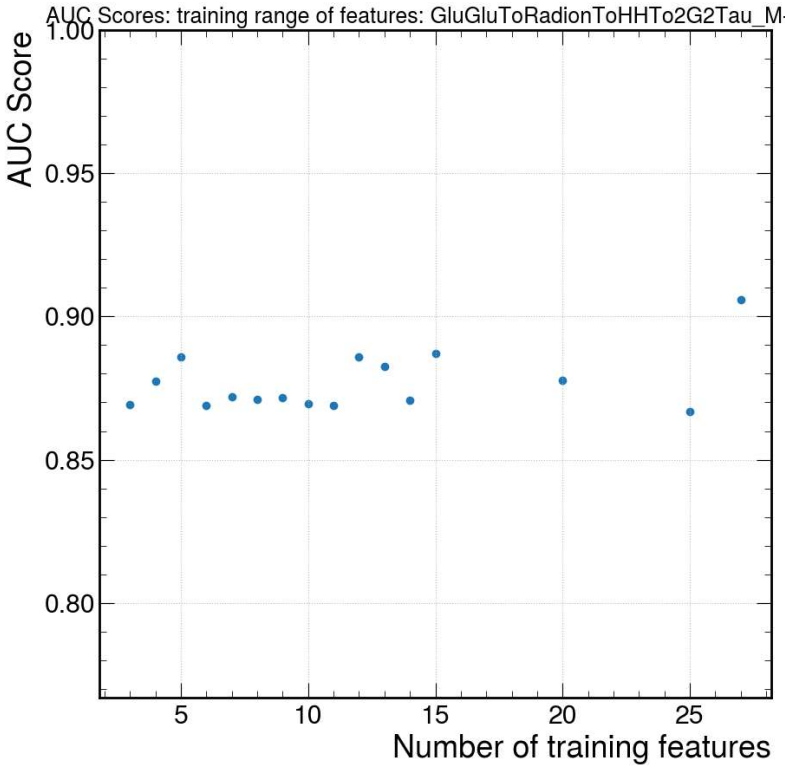

AUC Scores: training range of features: GluGluToRadionToHHTo2G2Tau_M-750
AUC Score
1.00
0.98
0.96
0.94
0.92
0.90
0.88
5
10
15
20
25
Number of training features

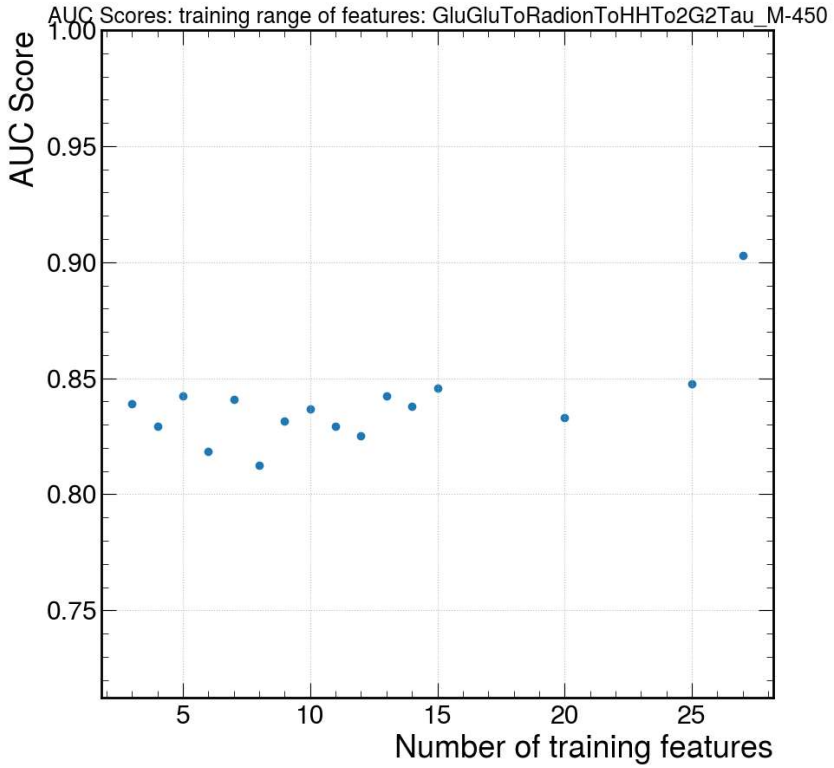

AUC Scores: training range of features: GluGluToRadionToHHTo2G2Tau_M-700
AUC Score
1.00
0.98
0.96
0.94
0.92
0.90
0.88
5
10
15
20
25
Number of training features

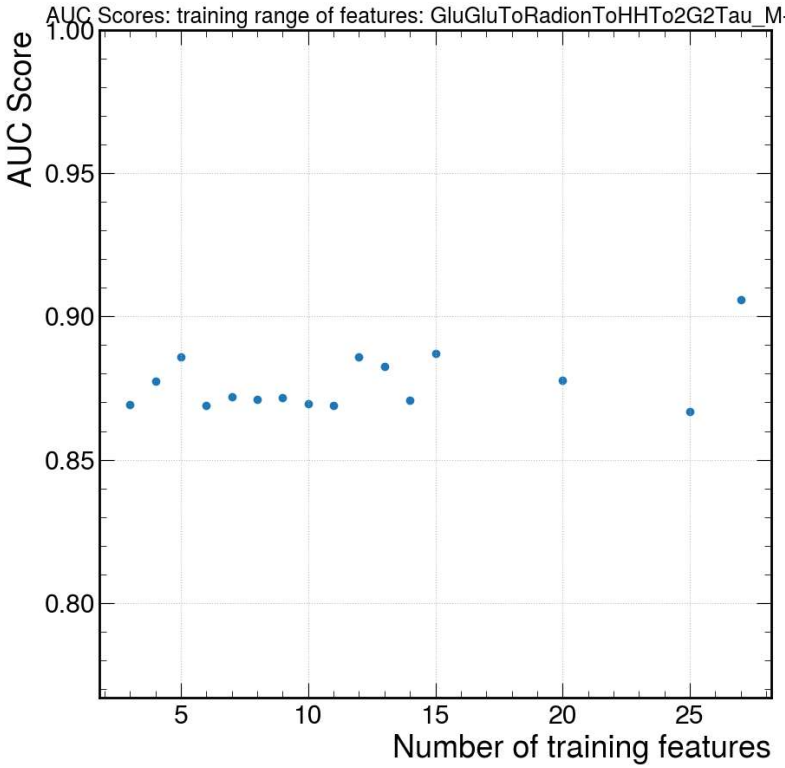

AUC Scores: training range of features: GluGluToRadionToHHTo2G2Tau_M-650
AUC Score
1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86
5
10
15
20
25
Number of training features

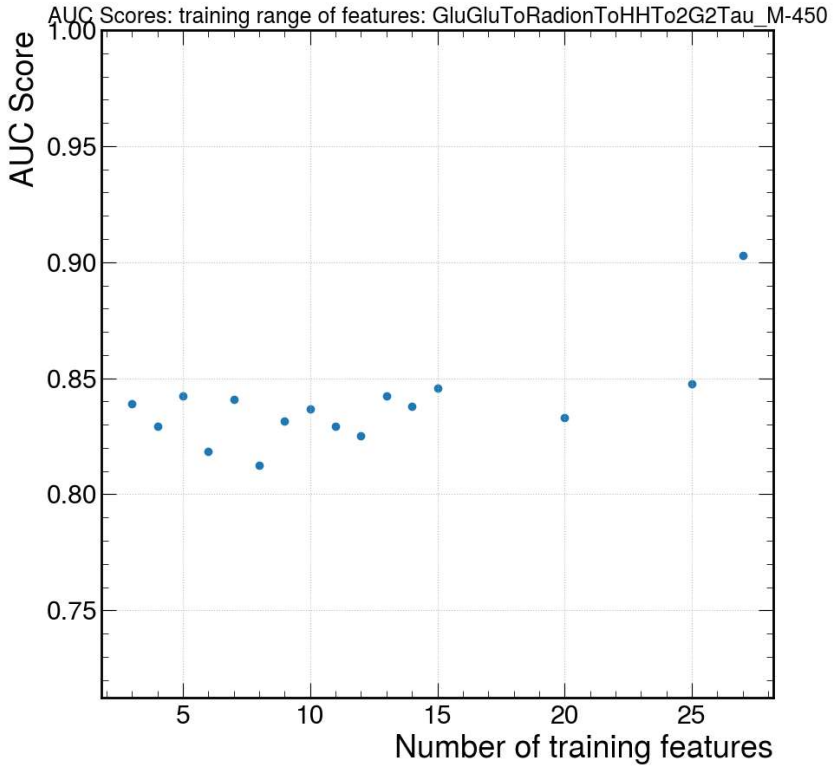

AUC Scores: training range of features: GluGluToRadionToHHTo2G2Tau_M-600
AUC Score
1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86
0.84
5
10
15
20
25
Number of training features

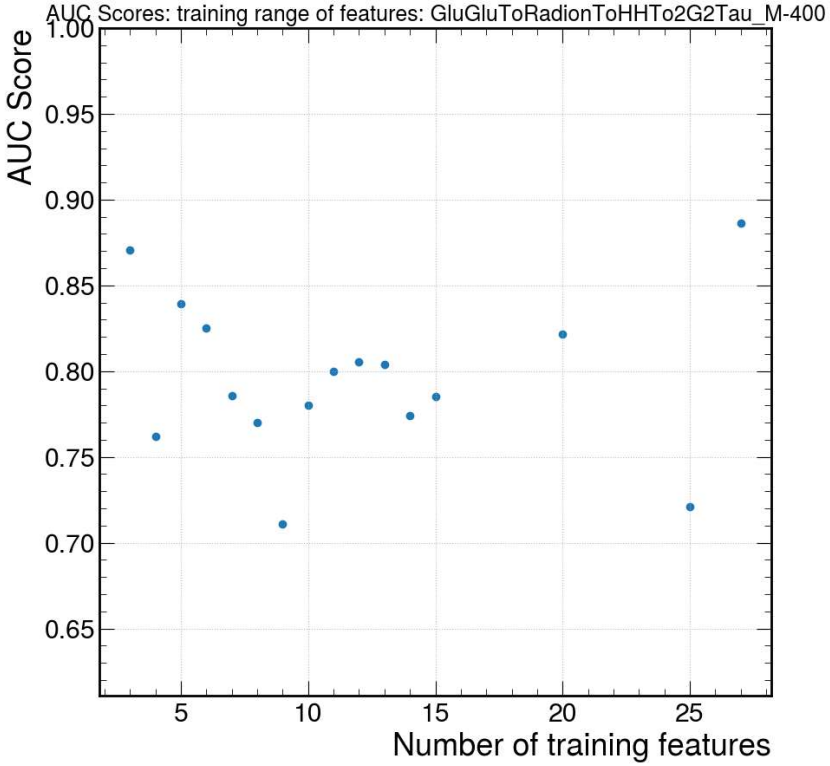

AUC Scores: training range of features: GluGluToRadionToHHTo2G2Tau_M-550
AUC Score
1.000
0.975
0.950
0.925
0.900
0.875
0.850
0.825
5
10
15
20
25
Number of training features

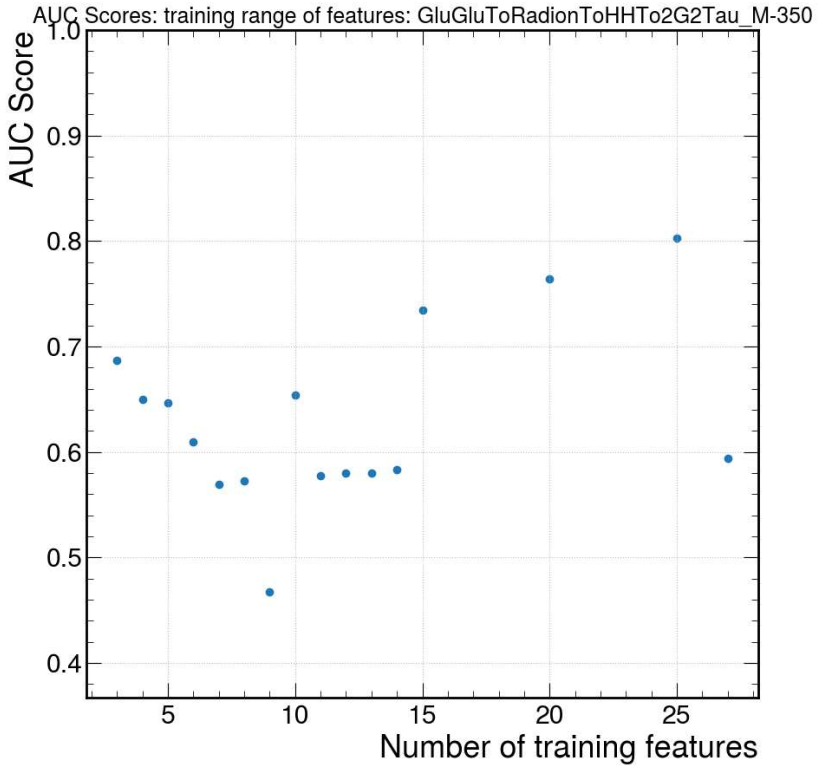

AUC Scores: training range of features: GluGluToRadionToHHTo2G2Tau_M-500
AUC Score
1.00
0.95
0.90
0.85
0.80
5
10
15
20
25
Number of training features

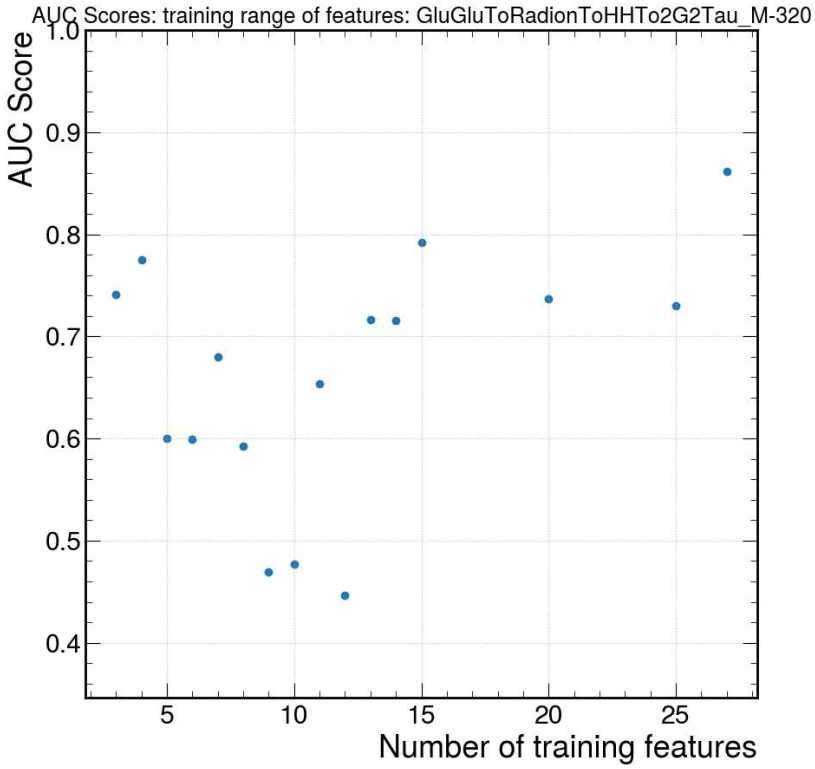

AUC Scores: training range of features: GluGluToRadionToHHTo2G2Tau_M-450
AUC Score
1.00
0.95
0.90
0.85
0.80
0.75
5
10
15
20
25
Number of training features

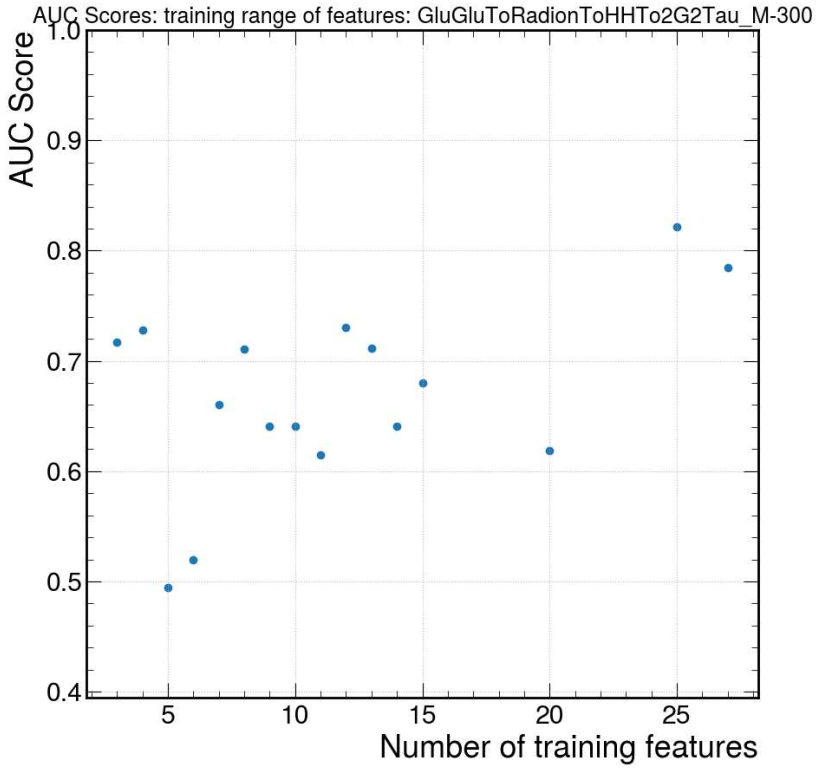

AUC Scores: training range of features: GluGluToRadionToHHTo2G2Tau_M-500
AUC Score
1.00
0.95
0.90
0.85
0.80
5
10
15
20
25
Number of training features

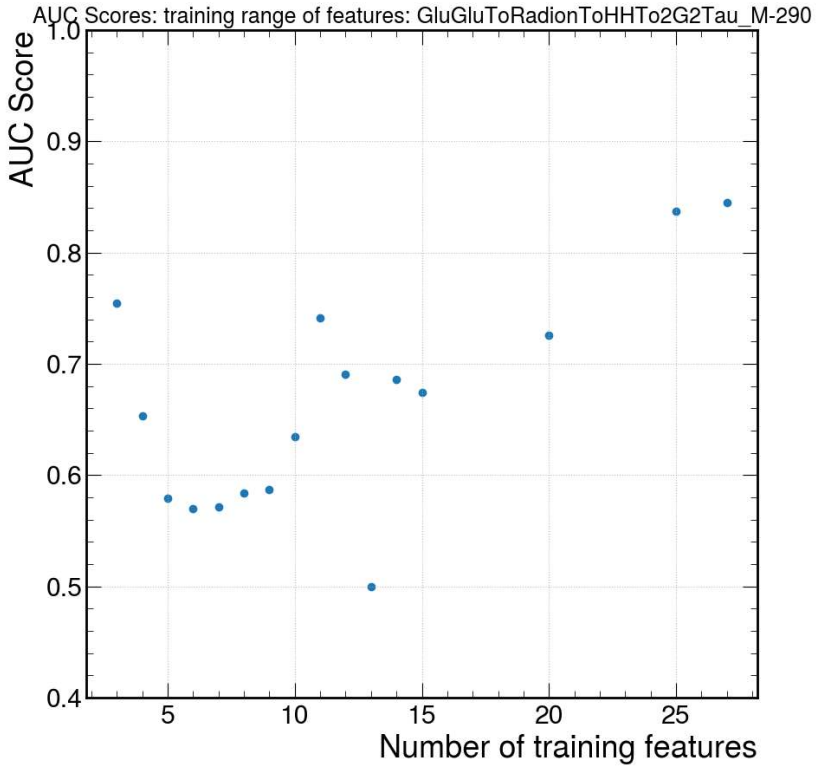

AUC Scores: training range of features: GluGluToRadionToHHTo2G2Tau_M-450
AUC Score
1.00
0.95
0.90
0.85
0.80
0.75
5
10
15
20
25
Number of training features

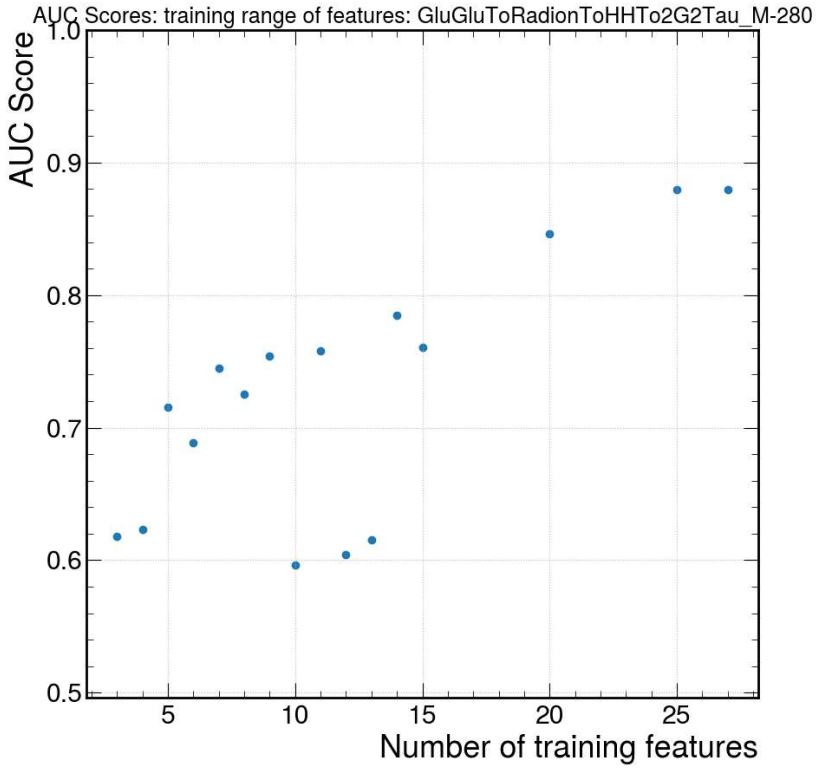

AUC Scores: training range of features: GluGluToRadionToHHTo2G2Tau_M-400
AUC Score
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
5
10
15
20
25
Number of training features

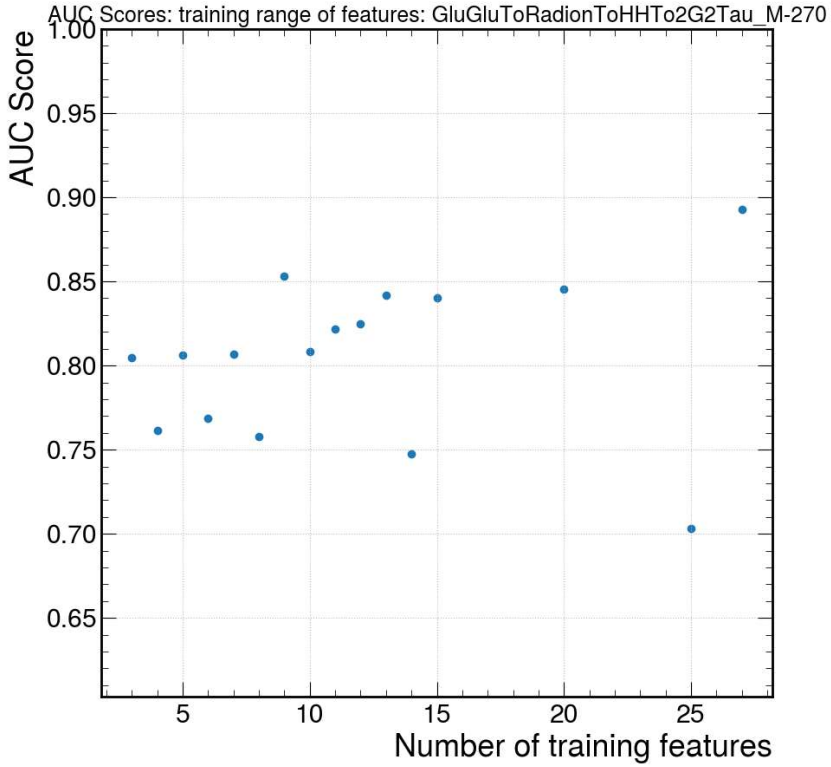

AUC Scores: training range of features: GluGluToRadionToHHTo2G2Tau_M-350
AUC Score
1.0
0.9
0.8
0.7
0.6
0.5
0.4
5
10
15
20
25
Number of training features

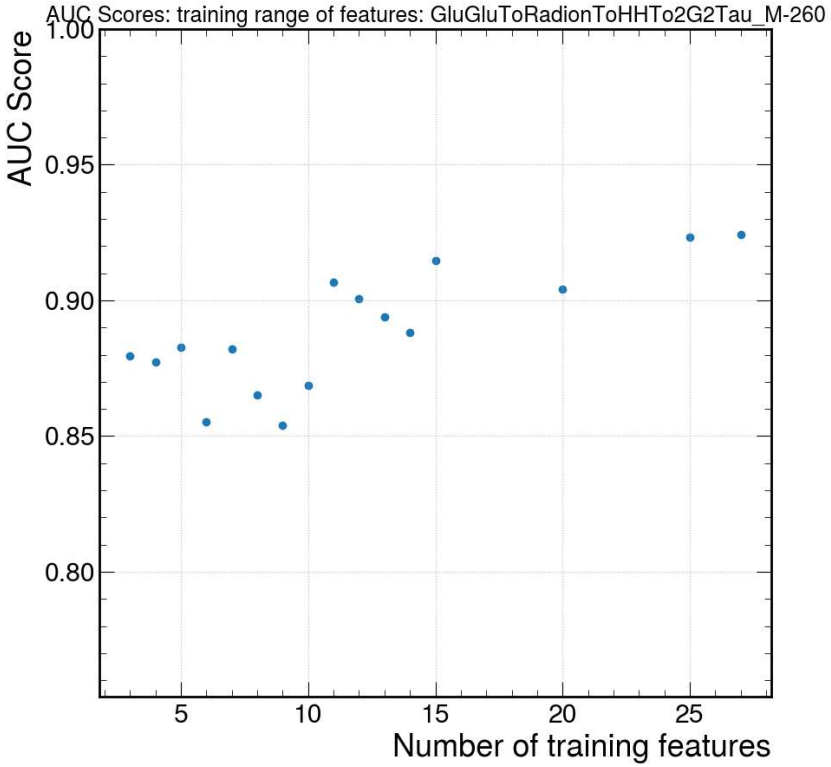

AUC Scores: training range of features: GluGluToRadionToHHTo2G2Tau_M-320
AUC Score
1.0
0.9
0.8
0.7
0.6
0.5
0.4
5
10
15
20
25
Number of training features

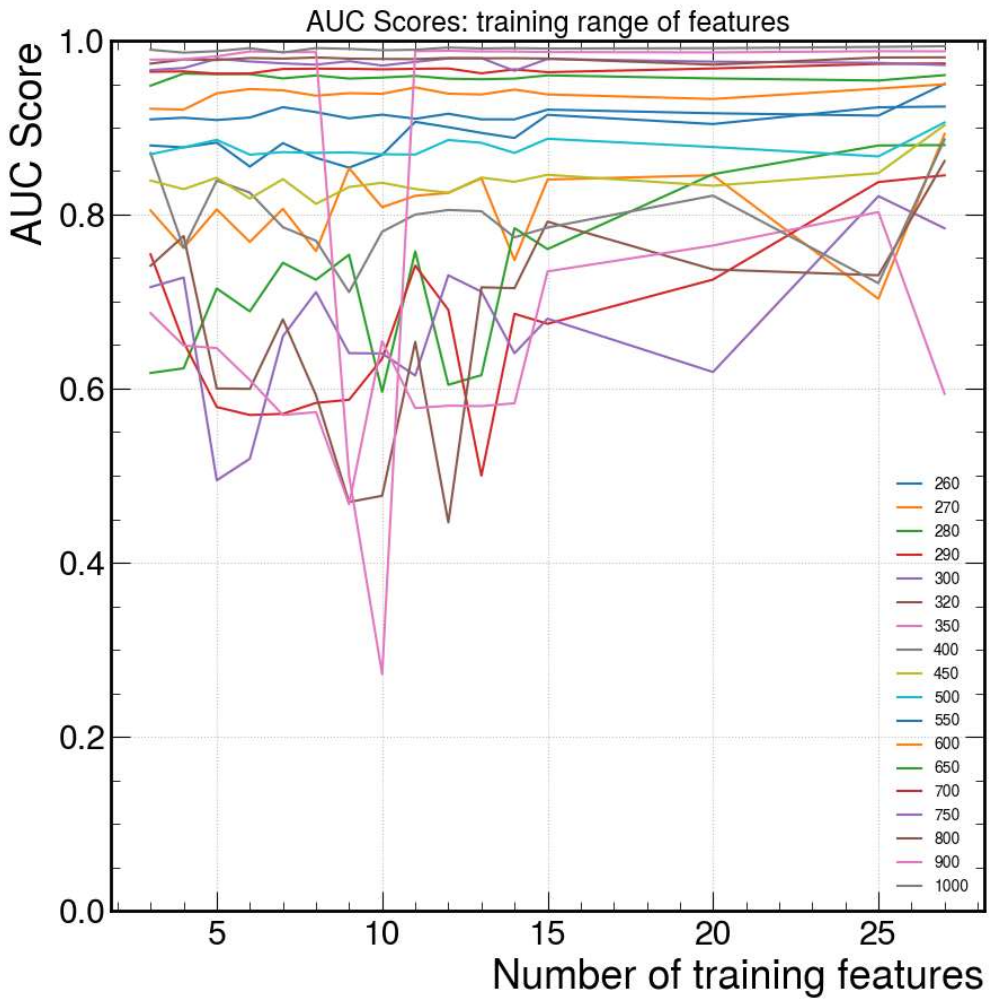

AUC Scores: training range of features: GluGluToRadionToHHTo2G2Tau_M-300
AUC Score
1.0
0.9
0.8
0.7
0.6
0.5
0.4
5
10
15
20
25
Number of training features


AUC Scores: training range of features: GluGluToRadionToHHTo2G2Tau_M-290
AUC Score
1.0
0.9
0.8
0.7
0.6
0.5
0.4
5
10
15
20
25
Number of training features


AUC Scores: training range of features: GluGluToRadionToHHTo2G2Tau_M-280
AUC Score
1.0
0.9
0.8
0.7
0.6
0.5
5
10
15
20
25
Number of training features


AUC Scores: training range of features: GluGluToRadionToHHTo2G2Tau_M-270
AUC Score
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
5
10
15
20
25
Number of training features


AUC Scores: training range of features: GluGluToRadionToHHTo2G2Tau_M-260
AUC Score
1.00
0.95
0.90
0.85
0.80
5
10
15
20
25
Number of training features


AUC Scores: training range of features
AUC Score
1.0
0.8
0.6
0.4
0.2
0.0
5
10
15
20
25
Number of training features
260
270
280
290
300
320
350
400
450
500
550
600
650
700
750
800
900
1000

Next Steps

- Find the optimal features which provide the highest AUC score acr all mass hypothesis
- Find the most optimal architecture on each mass hypothesis
- Produce code that outputs an AUC score for each event feature hierarchy across a range of architectures at each mass hypothesis
- Find the highest AUC scores from each mass and determine the architecture and feature hierarchy