

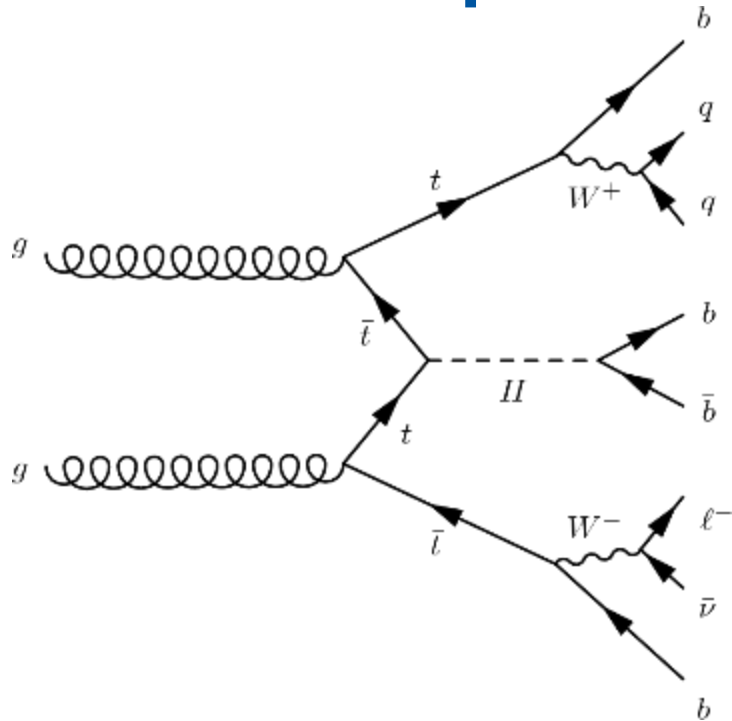
# Neural Network Regression to Approximate Matrix Element Method Likelihoods

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# The $t\bar{t}H$ process

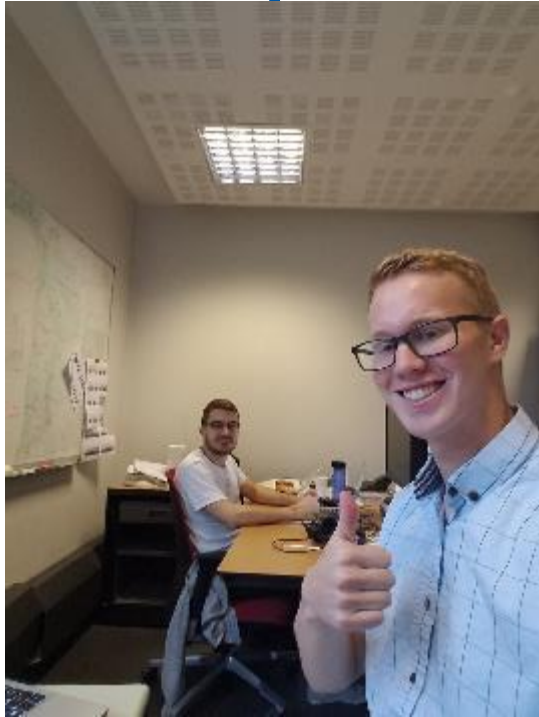


- Directly measure the Higgs-top Yukawa coupling
- Separate the signal from the background with multivariate analysis

# Matrix Element Method (MEM)

- Powerful method for exploiting theoretical and experimental data for analysis
- ttH process: 8 final state particles for 22 free parameters
- Slow and computationally expensive

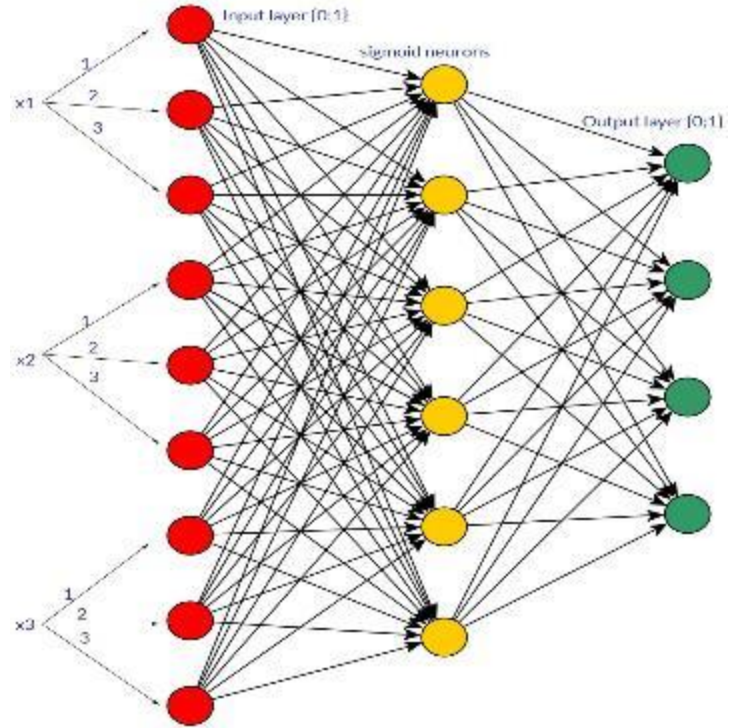
# Accomplishments



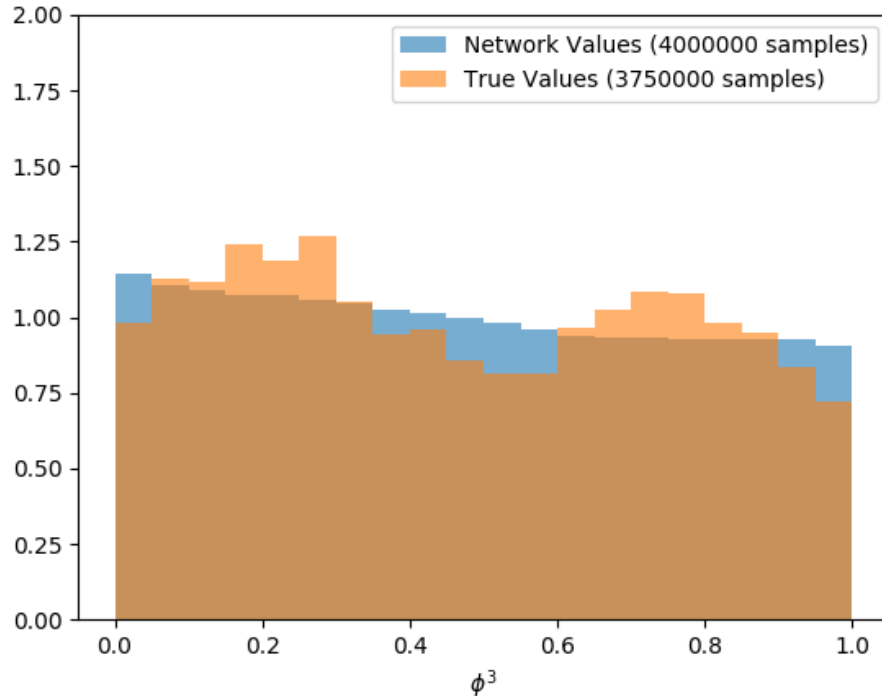
- MEM is working
- Accurately modeled 3 particle final state system with PDFs and MEM
- Accurately modeled 4 particle final state without PDFs and MEM

# Network for 4 Particles

- Actual function is much more complex
- Issues with both mcmc and uniform sampling
- Computation is slower
- Overtraining

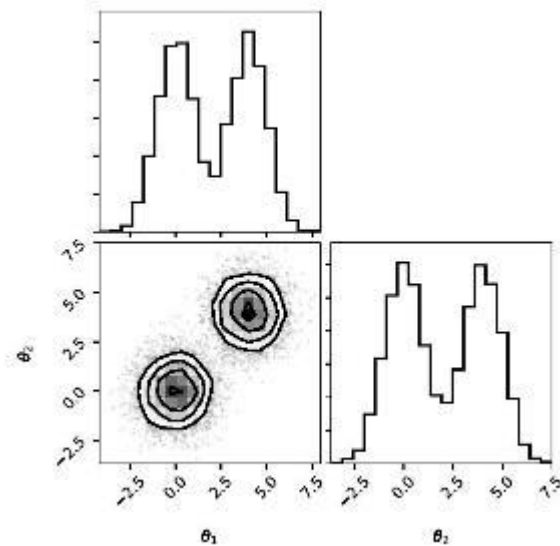
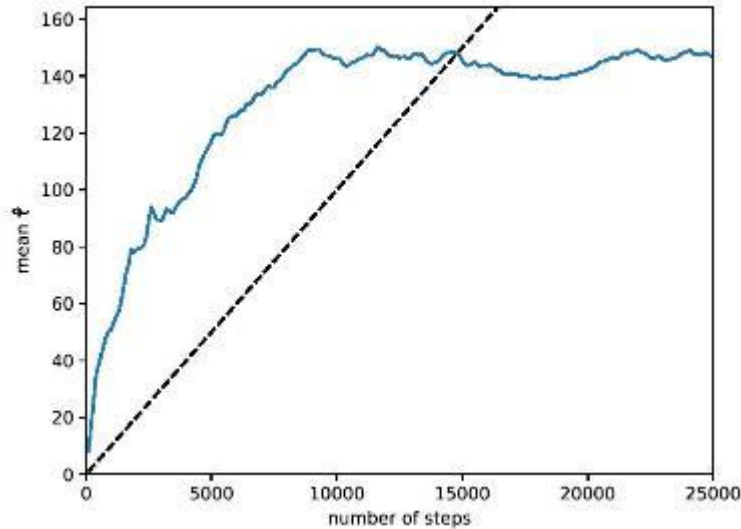


# Evaluating the Model



Parameter	Sum of the Squared Errors
$p_{T_1}$	3.82873
$\eta_1$	4.88136
$\phi_1$	0.405396
$p_{T_2}$	4.30627
$\eta_2$	2.42689
$\phi_2$	0.954483
$p_{T_3}$	3.51935
$\eta_3$	5.34008
$\phi_3$	0.280893
$p_{Z_4}$	6.4159
Overall Test Statistic	3.23594

# Sampling Issues



# What's Next

- Ensure accuracy of sampling and evaluation
- Improve models for 4 particle final state
- Begin modeling for 6 particle final state



