Delphes Studies on Angles of Acceptance

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Processes

1. I reassessed the distribution of the polar angle θ of products of vector boson fusion events
2. The data obtained by forcing Higgs production in a certain way is significantly skewed, with jets being much more forward than previous simulations

Results

I specified four different vector boson fusion processes from $\mu^+\mu^-$ collision to be run, two of which producing one Higgs and two producing two Higgs. All Higgs were forced to decay to $b\bar{b}$. Jets produced were much more forward than what was recorded previously, and a peak at $\theta \sim 0.17, \eta \sim 2.4$ was observed in $\mu^+\mu^- \to \mu^+\mu^-$ events. An error occured which caused Madgraph to skip generating $\mu^+\mu^- \to \mu^+\mu^- H$ events at $\sqrt{s} = 30$TeV, and caused it to generate less than $50,000$ events for the $\mu^+\mu^- \to \nu_\mu \bar{\nu_\mu} HH$ process at $\sqrt{s} = 30$TeV, both of which are being fixed. Particles data was collected using the cards for the CMS instead of the CCC, so tweaks still have to be made to resolve the behavior of muons at $|\eta| > 2.5$.

Processes

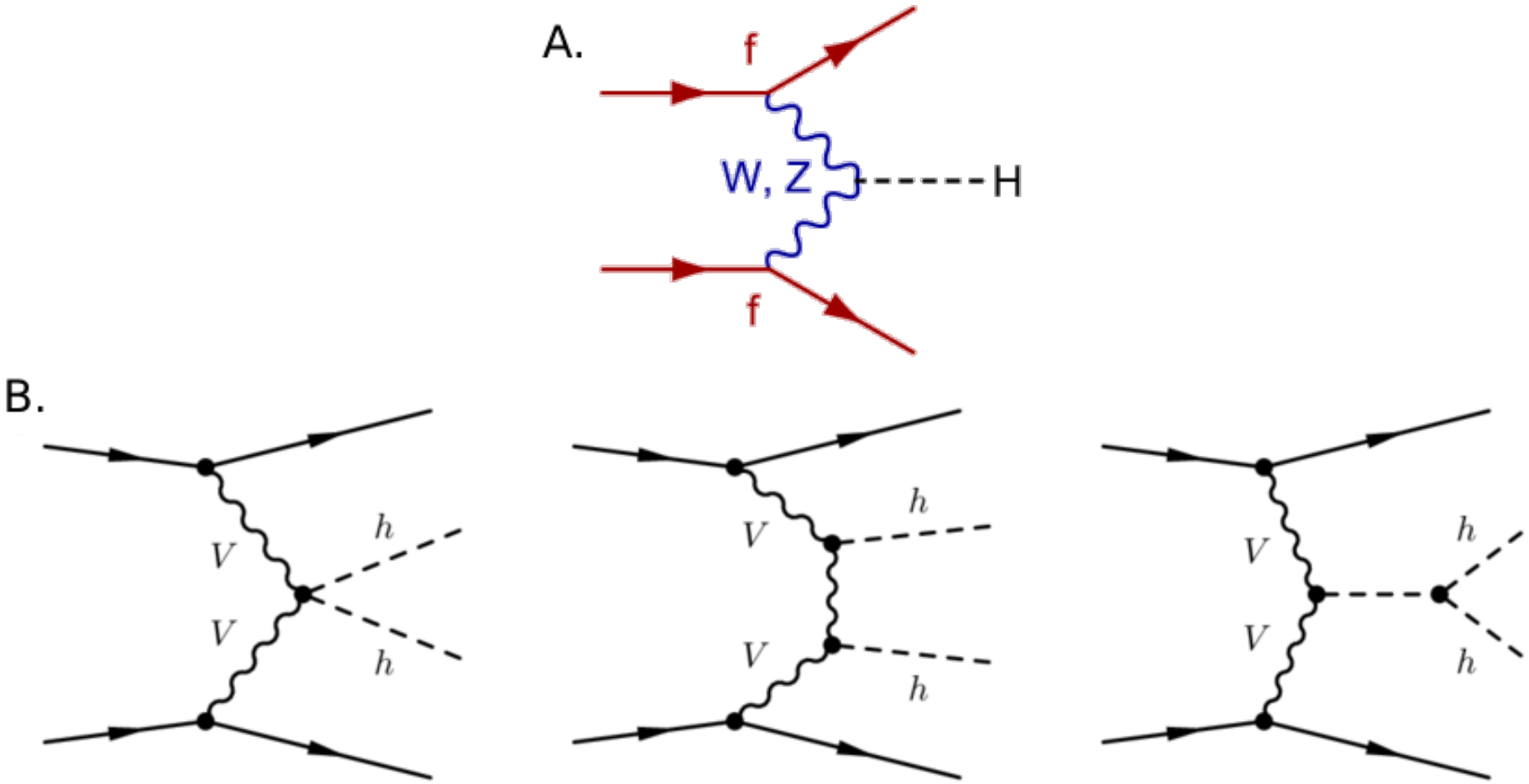

Figure: A. Single-Higgs production from vector boson fusion, B. Leading order diagrams for di-Higgs production from vector boson fusion

Results

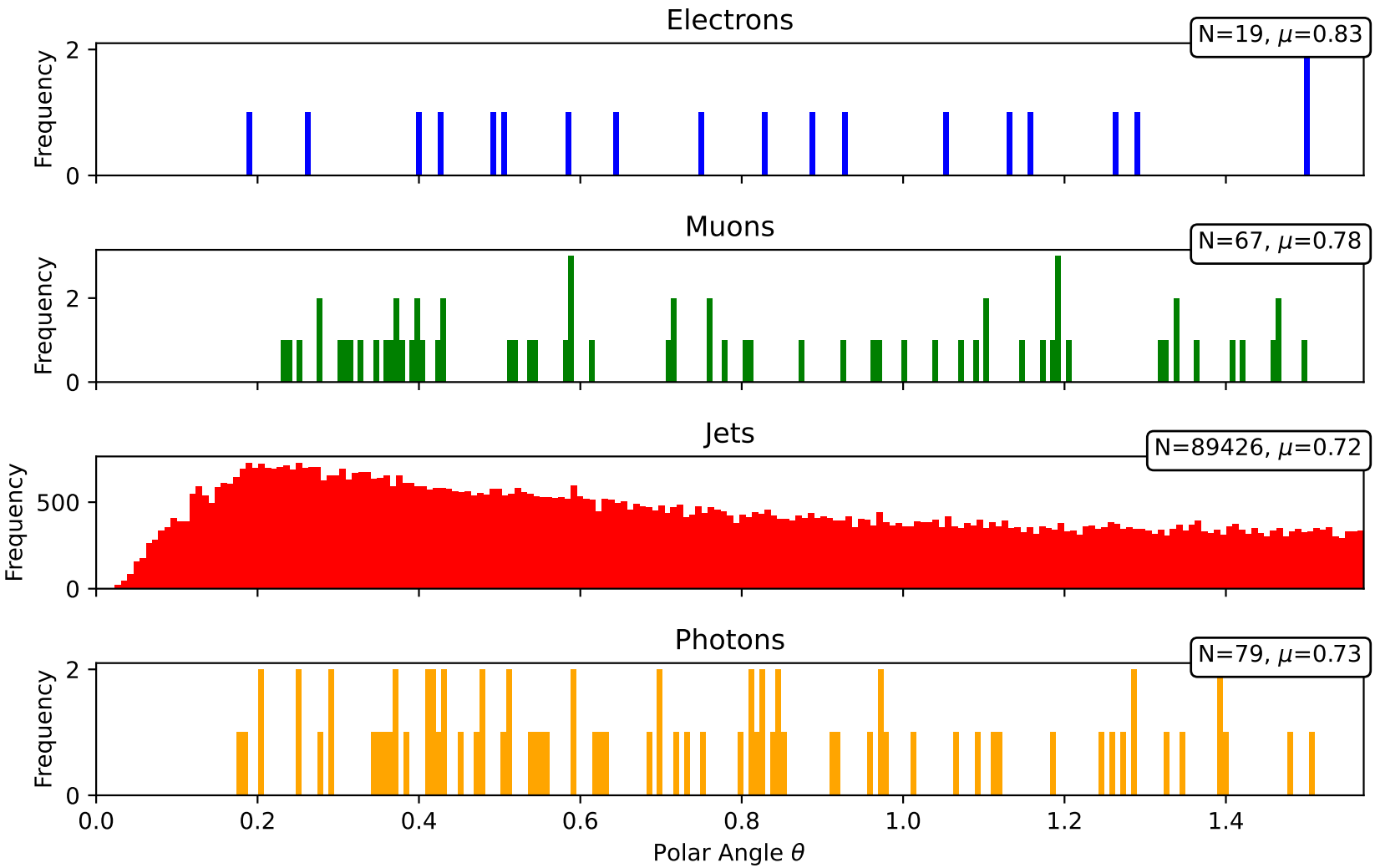

Figure: Process: $\mu^+\mu^- \to \nu_\mu \bar{\nu_\mu} H$ at $\sqrt{s} = 3\text{TeV}, N_{\text{events}} = 50,000$

Results

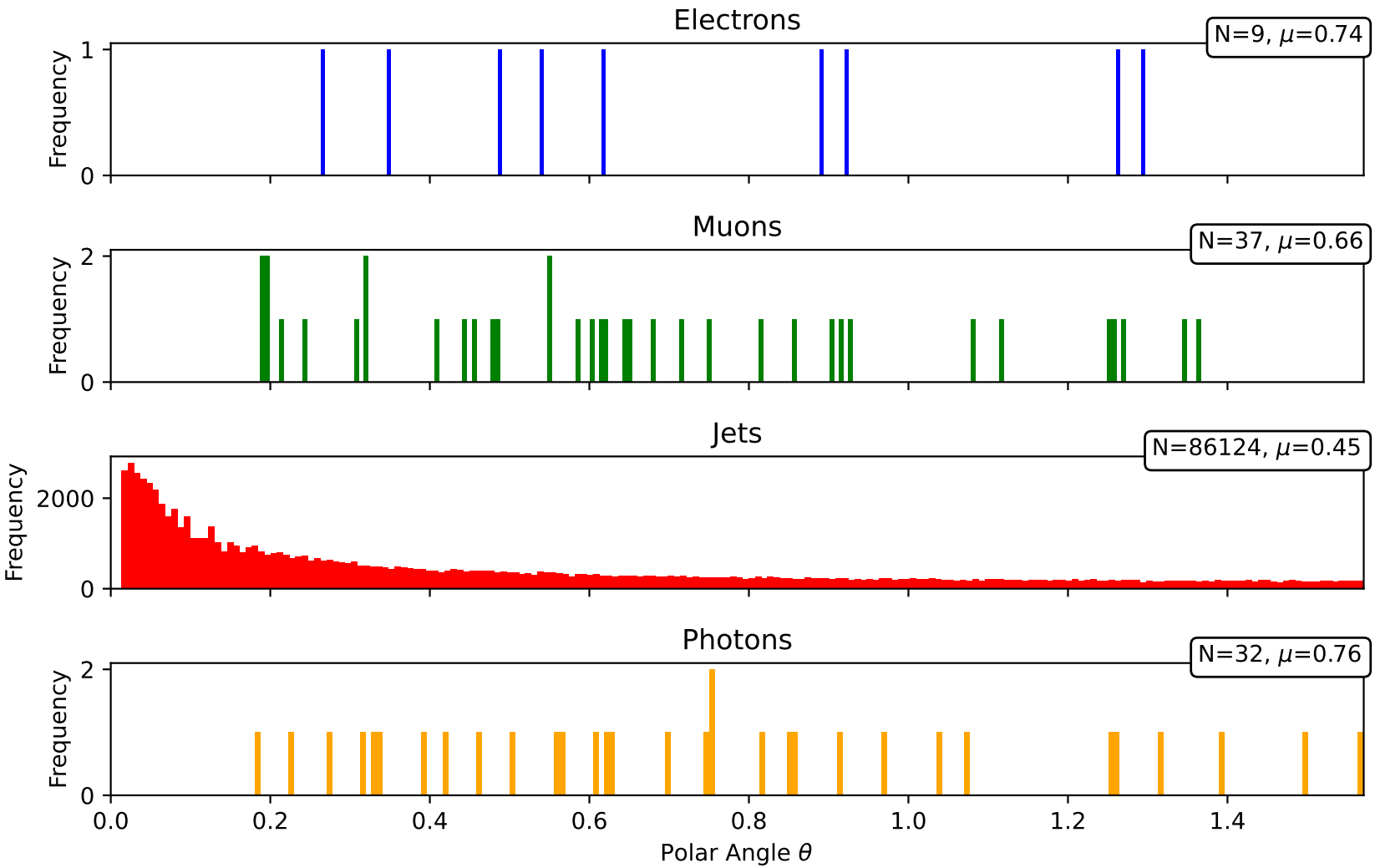

Figure: Process: $\mu^+\mu^- \to \nu_\mu \bar{\nu_\mu} H$ at $\sqrt{s} = 30\text{TeV}, N_{\text{events}} = 50,000$

Results

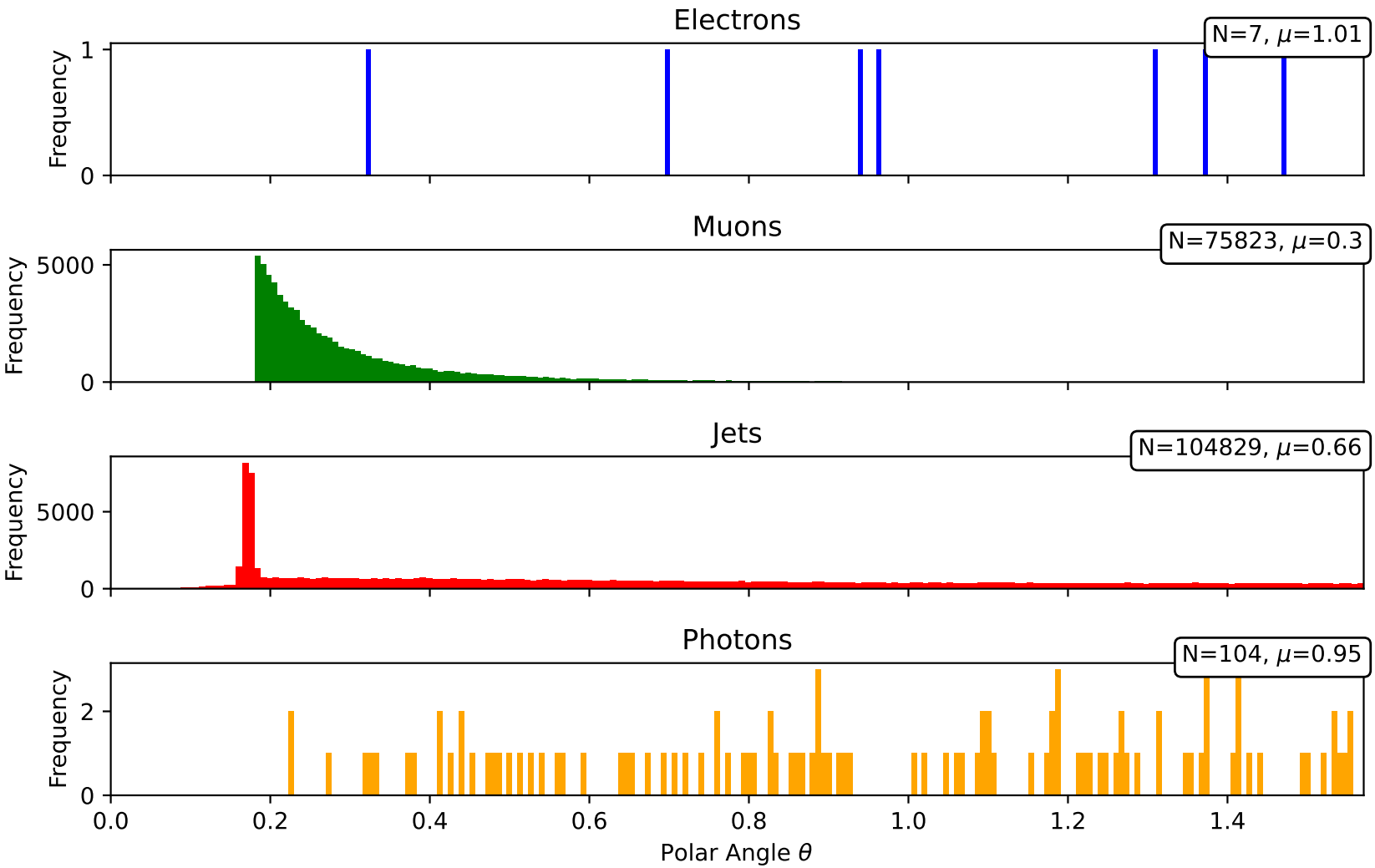

Figure: Process: $\mu^+\mu^- \to \mu^+\mu^- H$ at $\sqrt{s} = 3\text{TeV}, N_{\text{events}} = 50,000$

Results

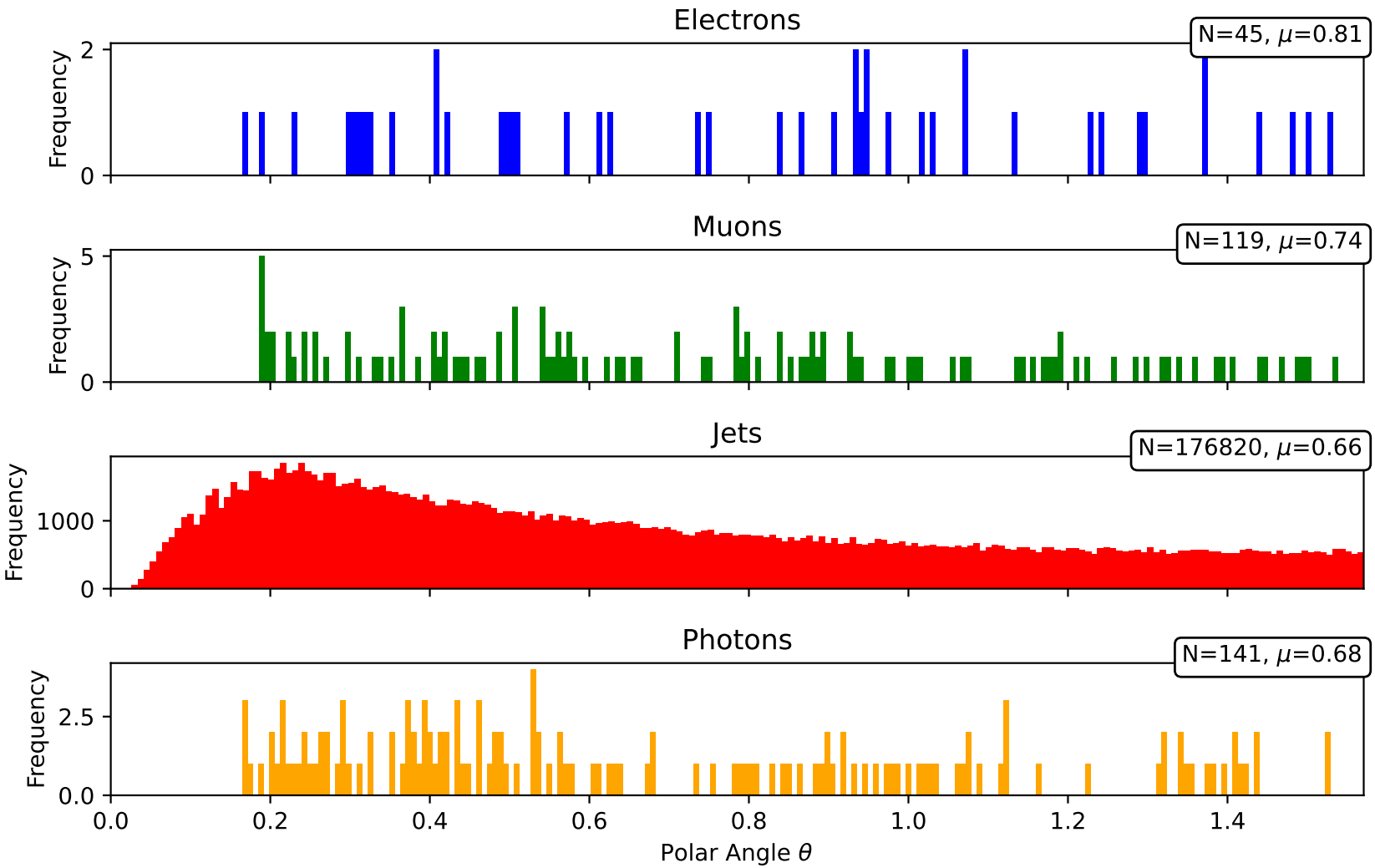

Figure: Process: $\mu^+\mu^- \to \nu_\mu \bar{\nu_\mu} HH$ at $\sqrt{s} = 3\text{TeV}, N_{\text{events}} = 50,000$

Results

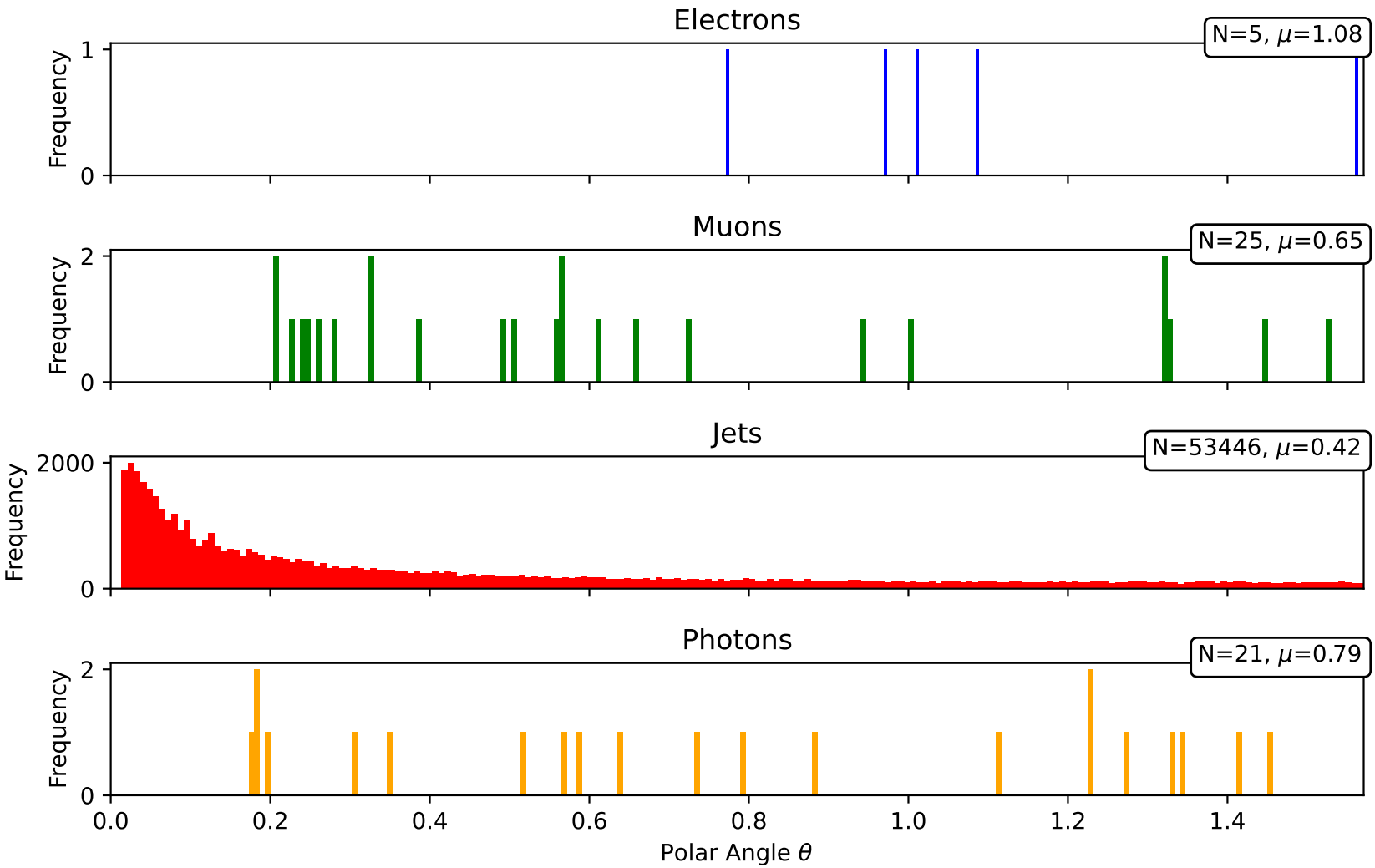

Figure: Process: $\mu^+\mu^- \to \nu_\mu \bar{\nu_\mu} HH$ at $\sqrt{s} = 30\text{TeV}, N_{\text{events}} = 15,629$

Results

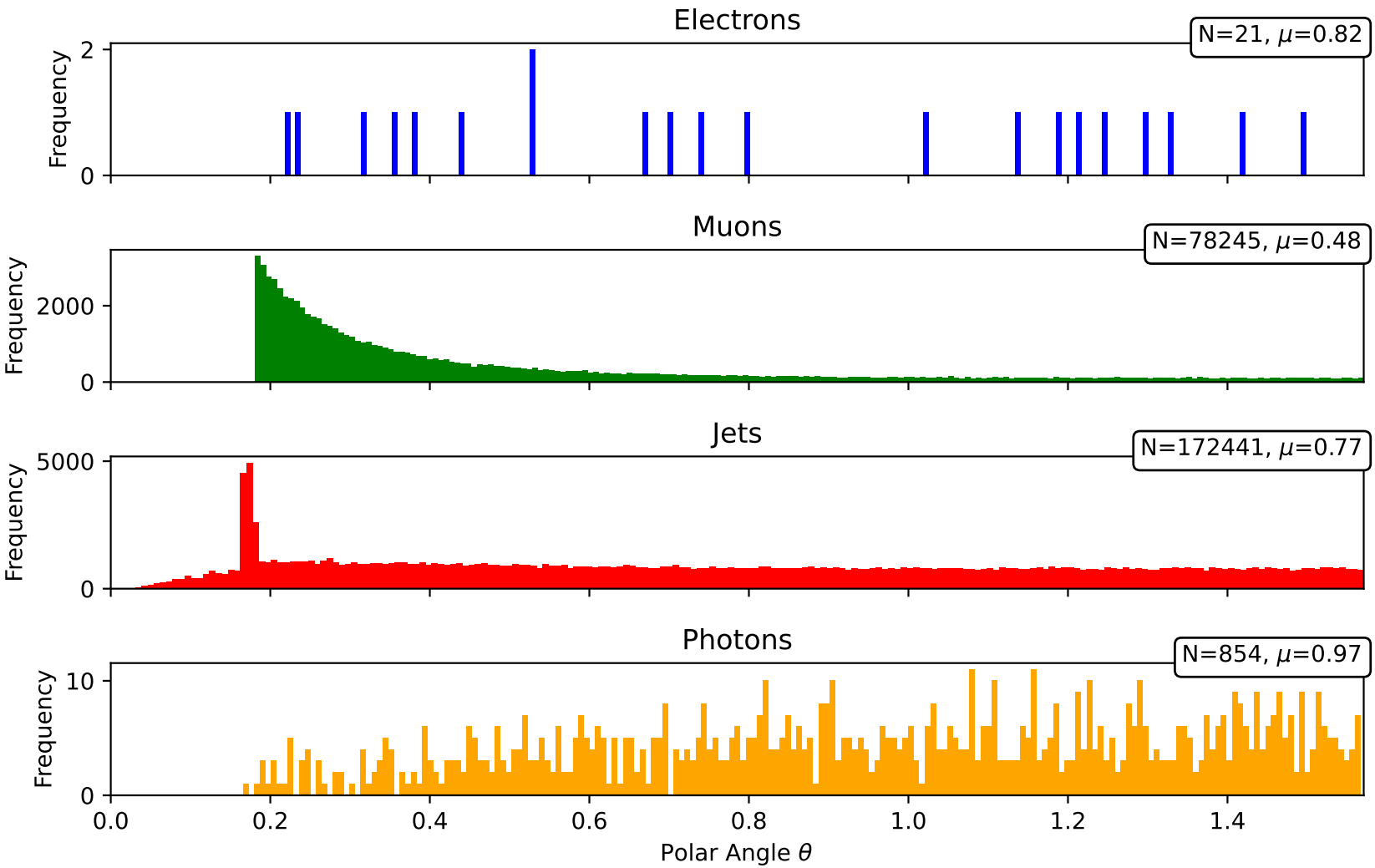

Figure: Process: $\mu^+\mu^- \to \mu^+\mu^- HH$ at $\sqrt{s} = 3\text{TeV}, N_{\text{events}} = 50,000$

Results

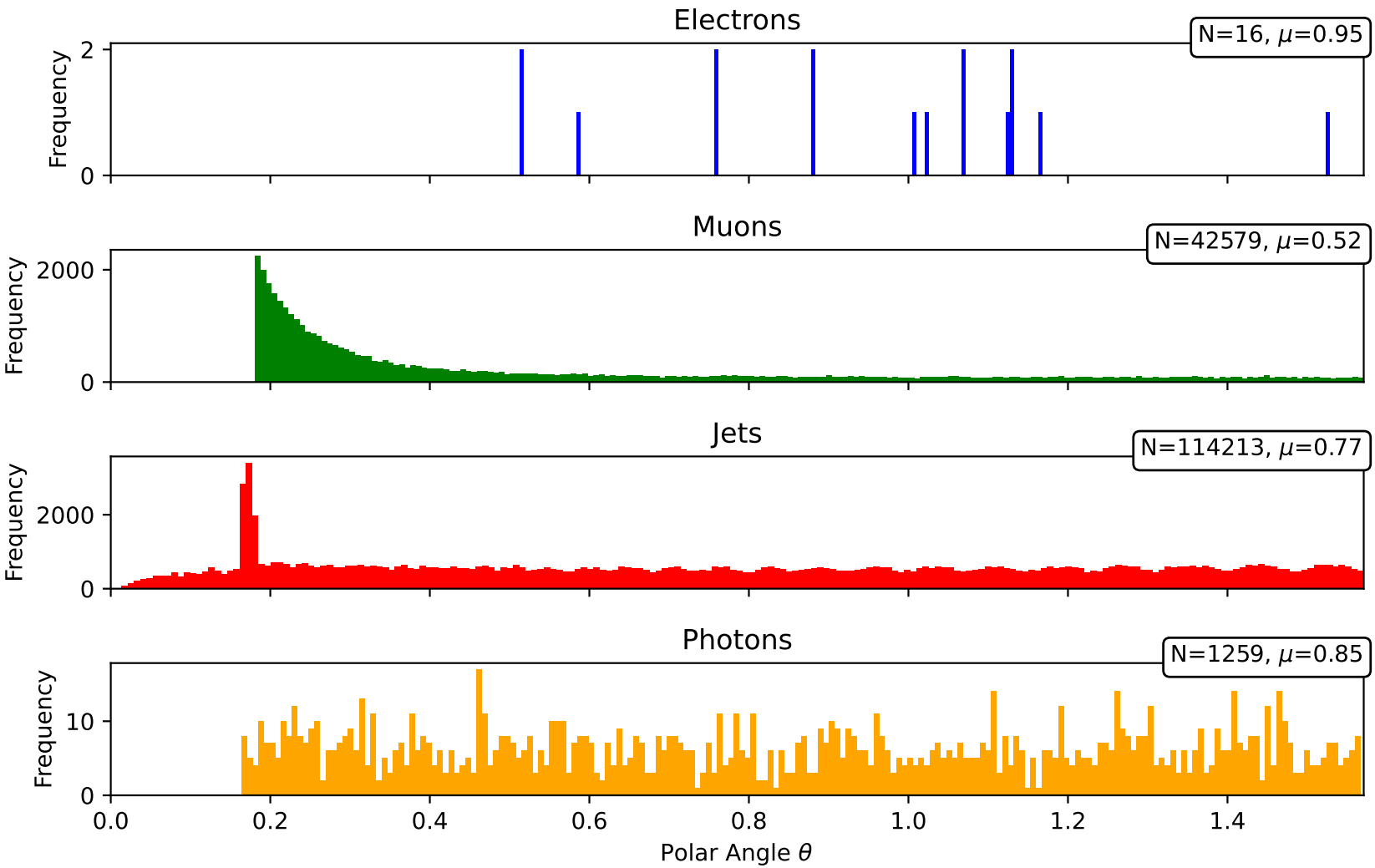

Figure: Process: $\mu^+\mu^- \to \mu^+\mu^- HH$ at $\sqrt{s} = 30\text{TeV}, N_{\text{events}} = 50,000$

Next Steps

This week, I will work on generating additional events for the 30TeV $\mu^+\mu^- \to \mu^+\mu^- HH$ process, as well as generating processes for the $\mu^+\mu^- \to \nu_\mu \bar{\nu_\mu} H$ process at 30TeV. I will also fix the cutoff on the muon acceptance angle to resolve the behavior of muons close to the beam line in $\mu^+\mu^- \to \mu^+\mu^-$ collisions, as outgoing muons have $|\eta| > 2.5$ around half the time in $\sqrt{s} = 30$TeV collisions and 75% of the time in $\sqrt{s} = 3$TeV collisions.