



It Takes Two to Tango: Search for Di-Higgs Production at the LHC



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BACKGROUND

- The Standard Model is the physicist's Periodic table, it gives the building blocks for all the matter in our universe
- The last piece of the Model, the Higgs boson, gives all the other particles mass
- Studying the production of pairs of Higgs' gives us insight on open questions in physics:
 - Does the Higgs give itself mass?
 - Is the Higgs Composite (made of other particles)?
 - Are there other Higgs particles?

Standard Model of Elementary Particles

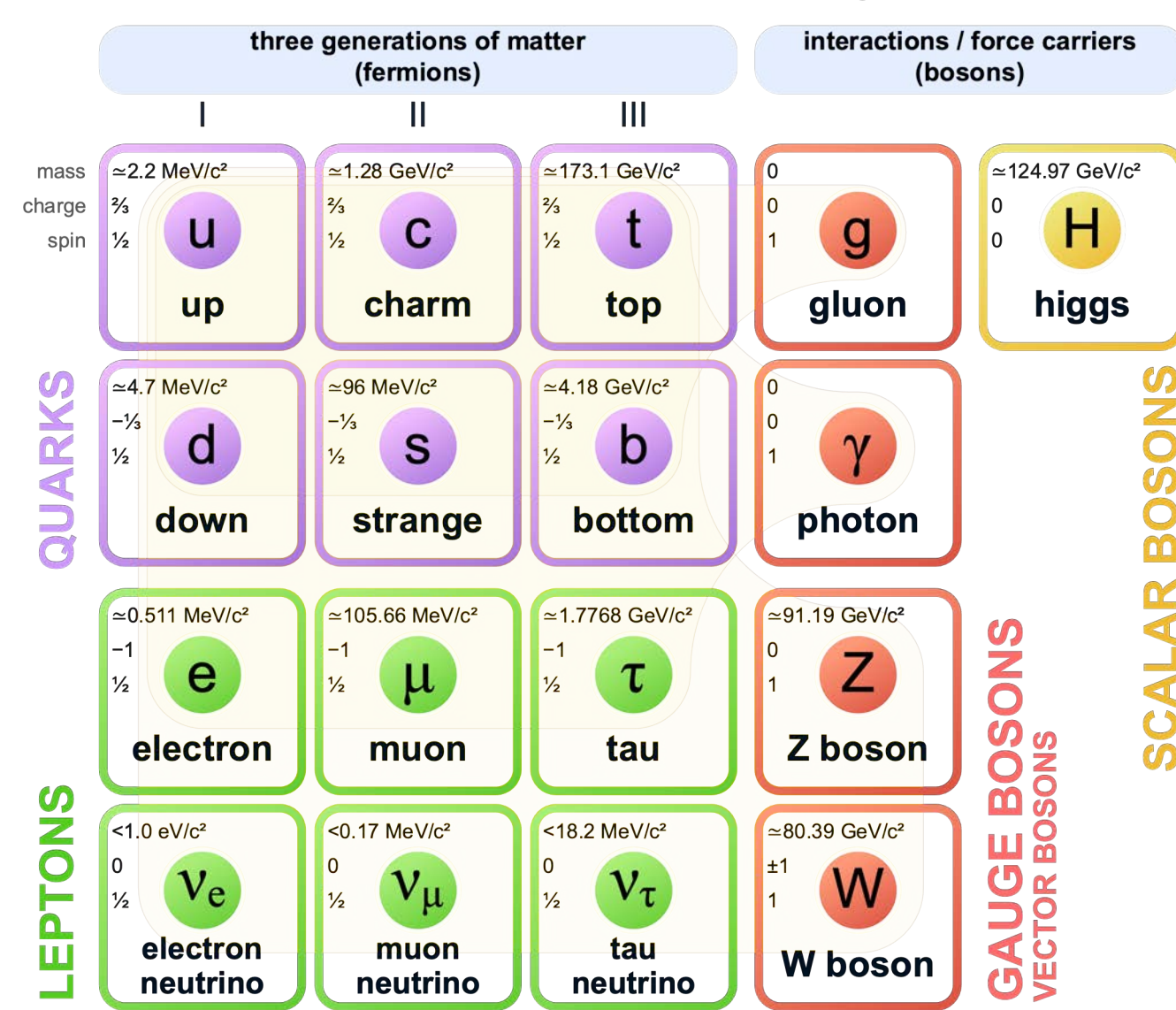


Figure 1: The Standard Model of Particles

PURPOSE

- Develop a new search strategy for the Di-Higgs production process
- Test the search strategy on simulated proton-proton collision events
- Improve the experimental sensitivity for the Di-Higgs signal in the region close to the standard model

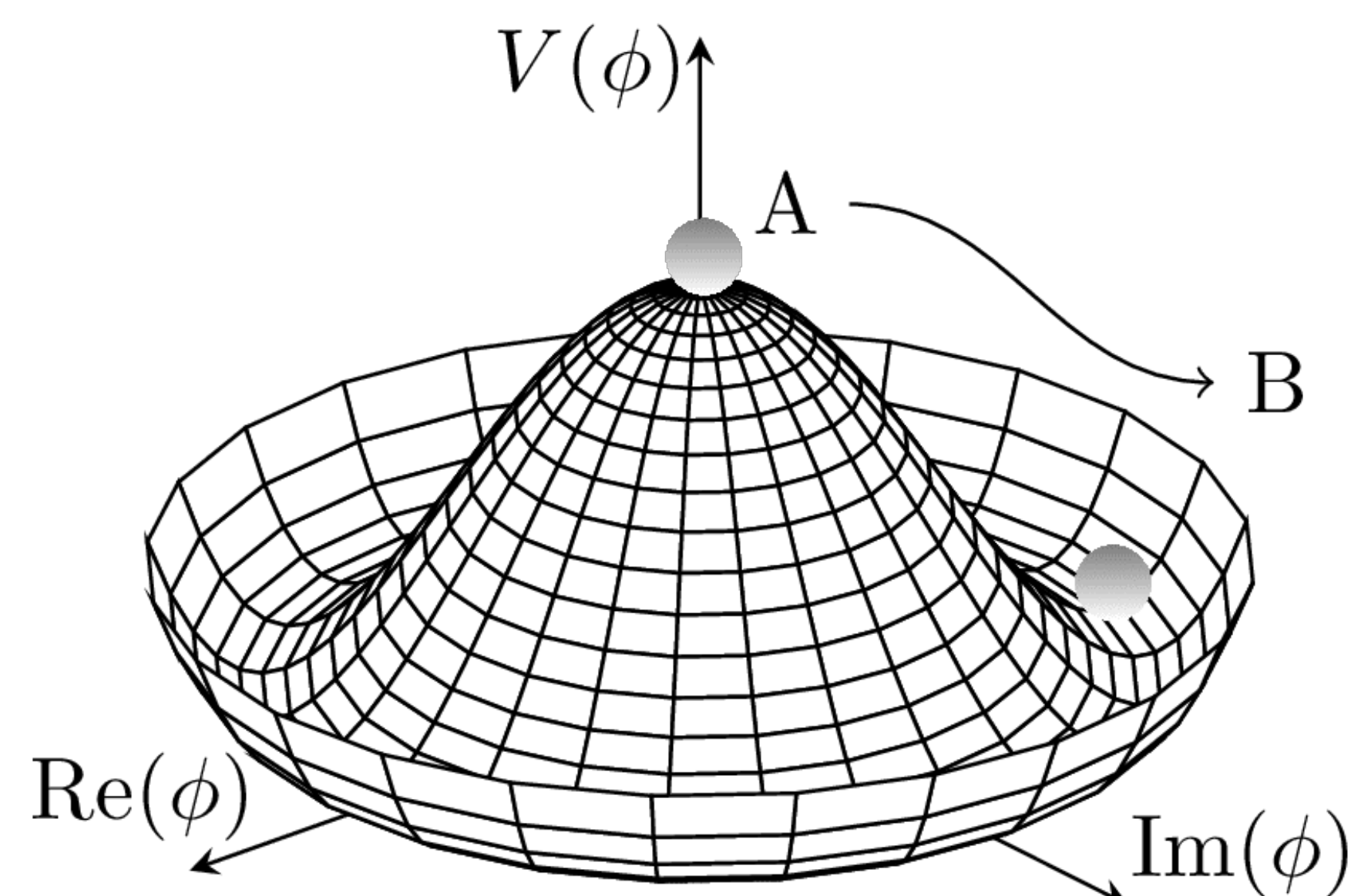
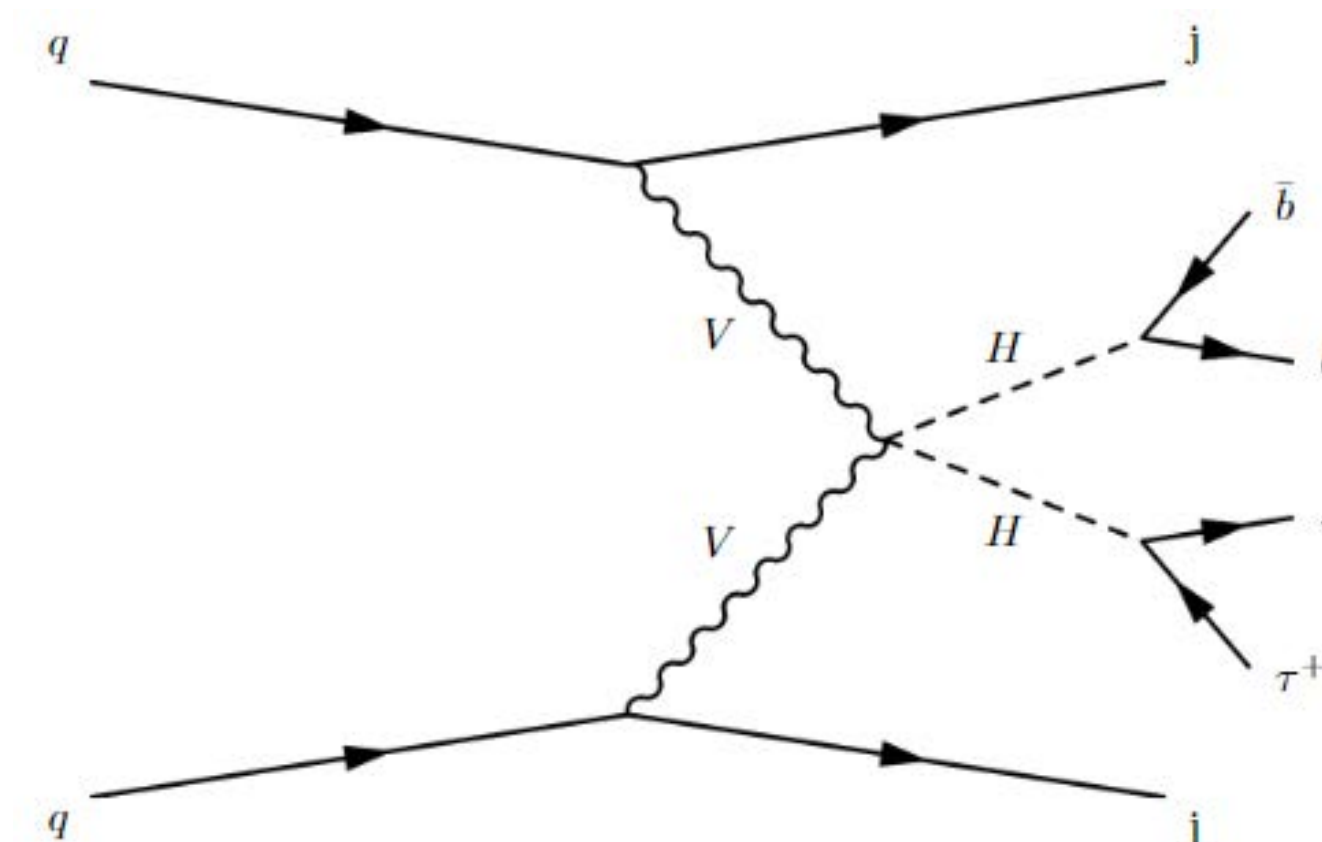
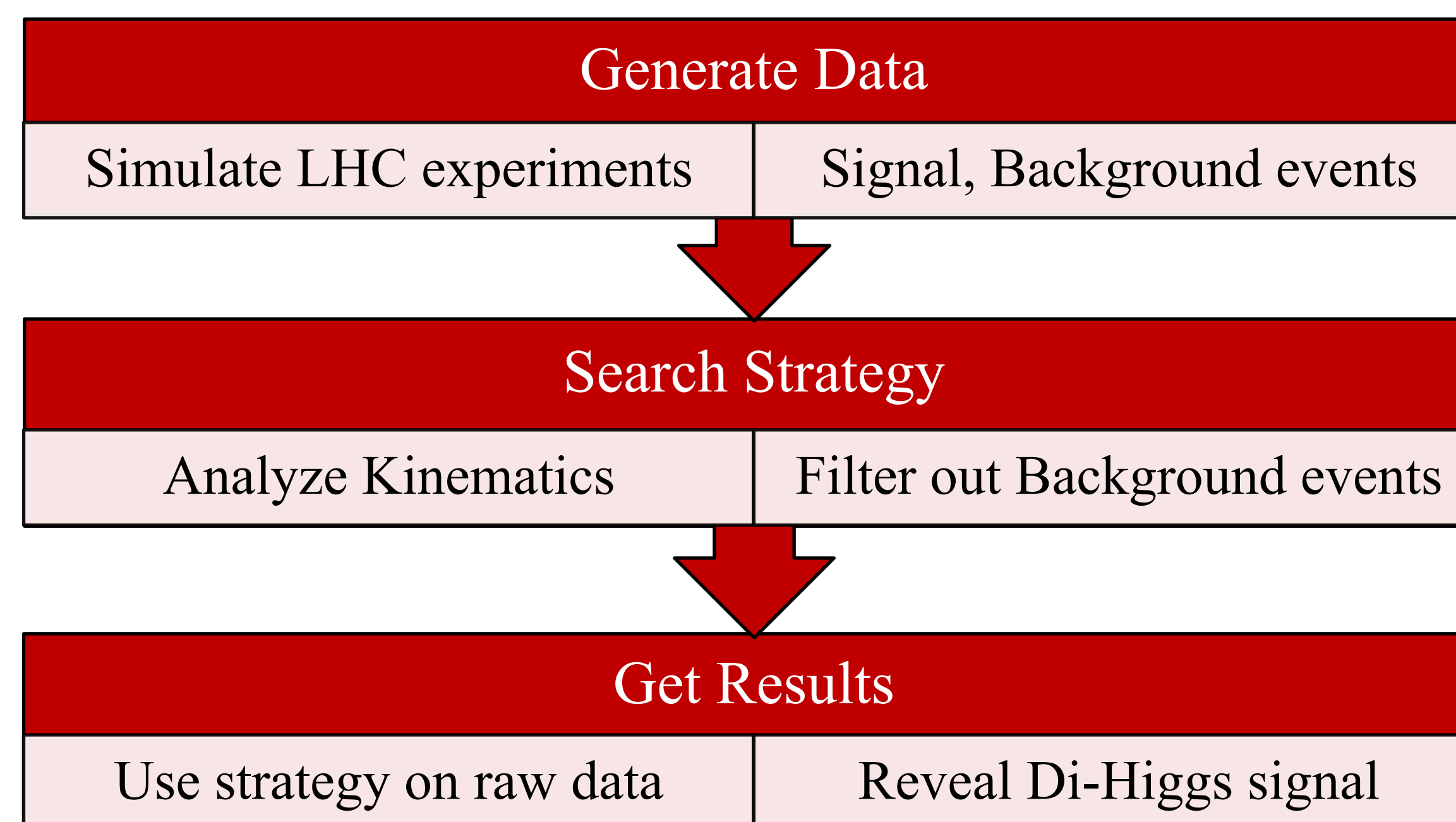


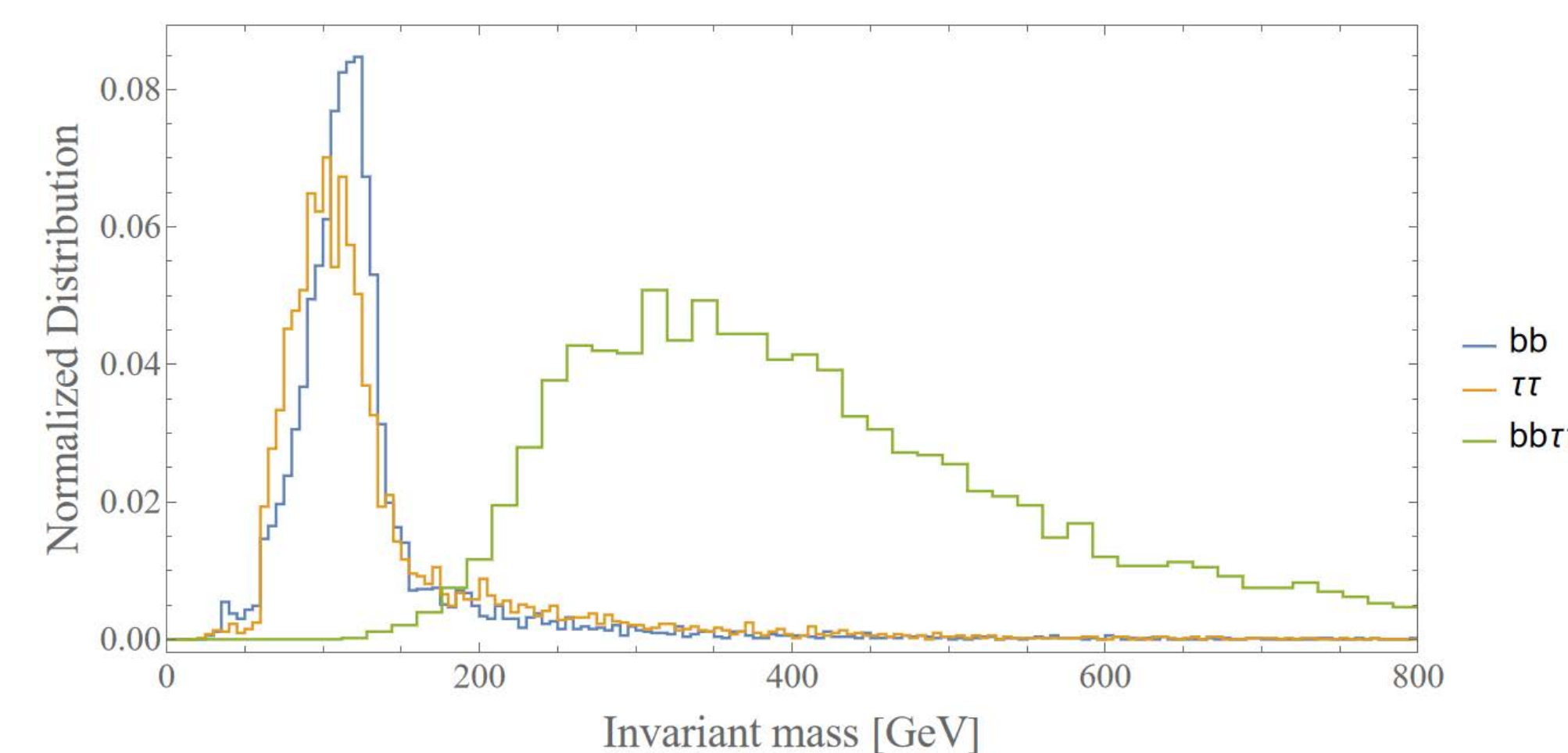
Figure 2: Graph of the Higgs Potential

MATERIALS AND METHODS



RESULTS

Cut	Signal	$t\bar{t}$	Multijet	$bb + jets$
VBF Topology	14.07%	1.76%	0.004%	0.12%
Signal Topology	0.29%	0.005%	0.003%	0.005%
Veto Jets	0.28%	0.0044%	0.003%	0.0005%



Signal Kinematics

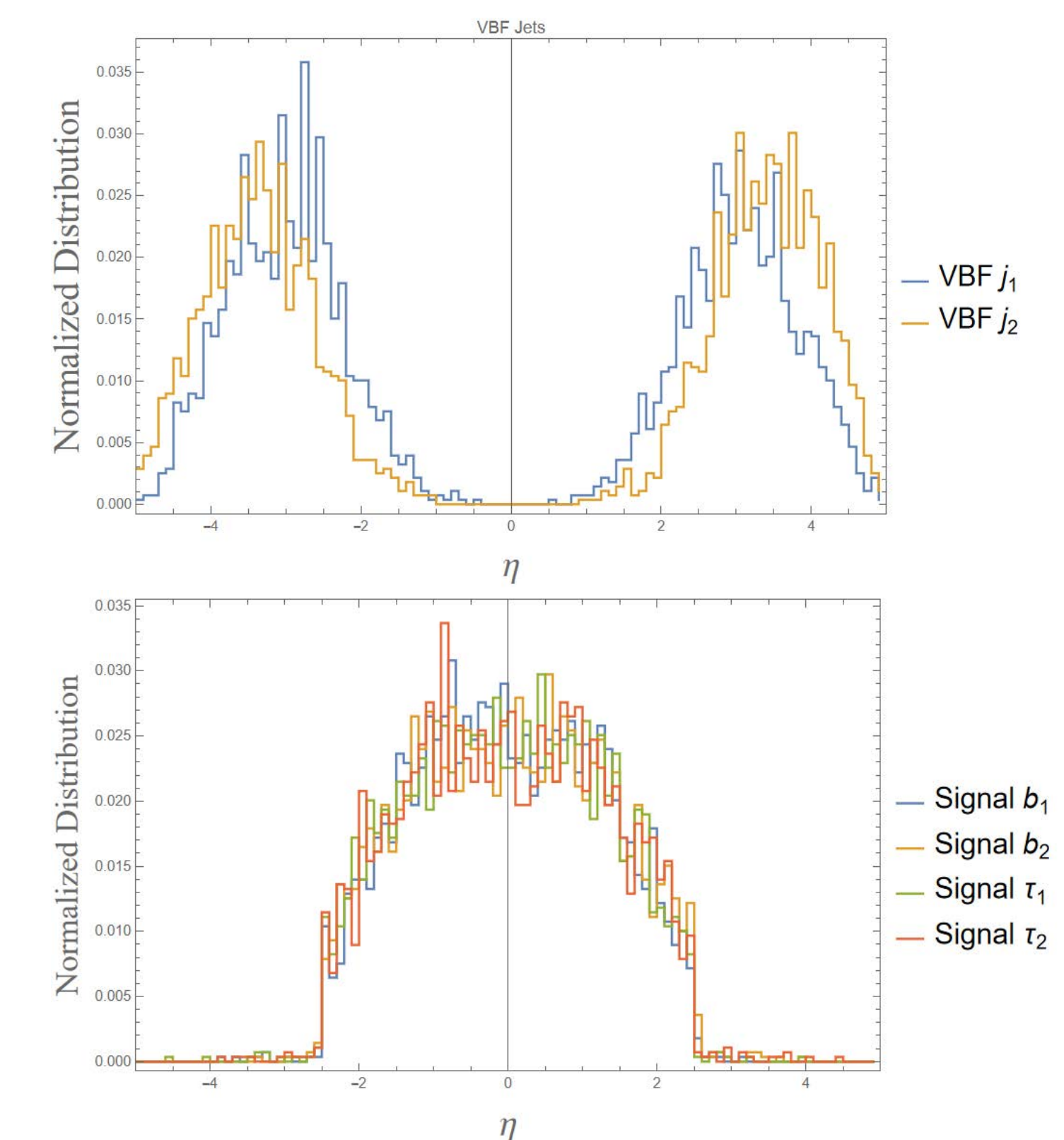


Figure 3: Pseudorapidity of Di-Higgs jets

CONCLUSIONS

Currently, we are getting good background suppression, but our selection cuts are also suppressing our signal too much

Future work:

- Reevaluate our selection cuts to amplify our signal
- Study how our cut efficiencies change with κ_{2V}
- Compare our search strategy with the current $HH \rightarrow b\bar{b}b\bar{b}$ searches
- Give our strategy to experimentalists to use for actual LHC experiments

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