TRIUMF

Projection studies of Higgs boson pair (HH) production to $b\bar{b}b\bar{b}$ final state at the HL-LHC using the ATLAS detector

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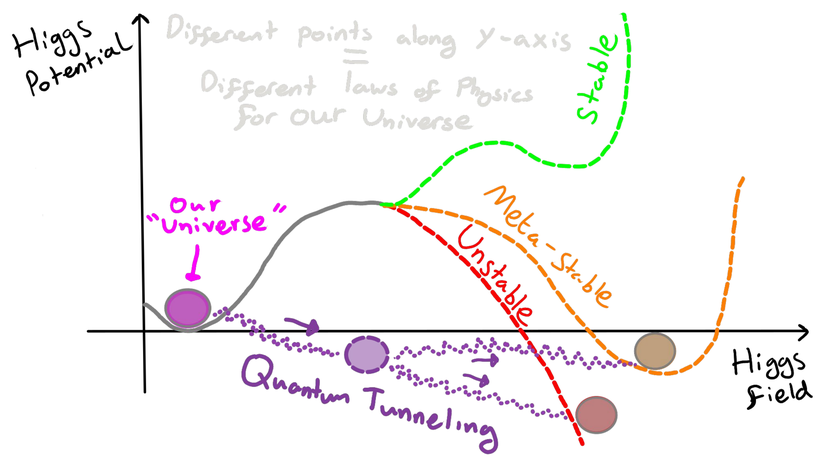
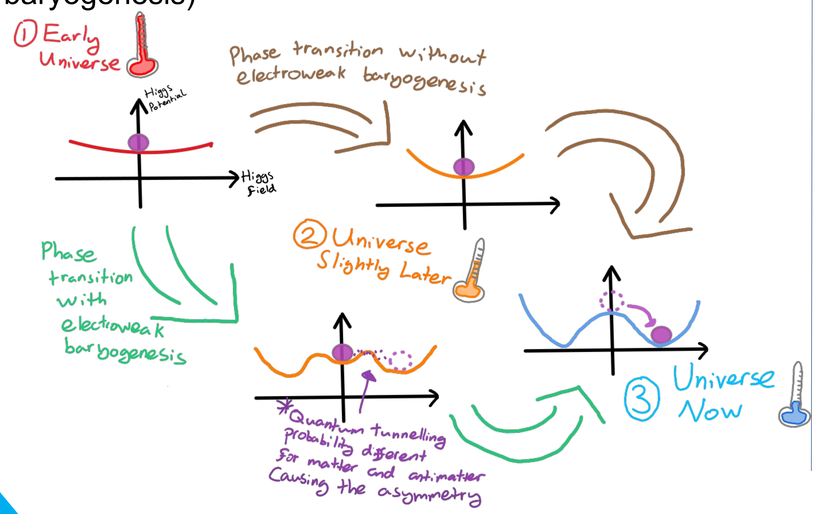
1) Why care about HH?

- Single Higgs (H) production probed, no new physics
- Pair production of Higgs (HH) more rare, not observed yet
- Higgs potential not measured either -- has profound consequences, and can be measured with HH -- potential stable?



- How Higgs potential transitioned to its shape today could answer matter-antimatter asymmetry problem (electroweak baryogenesis)



2) Why care about the HL-LHC?

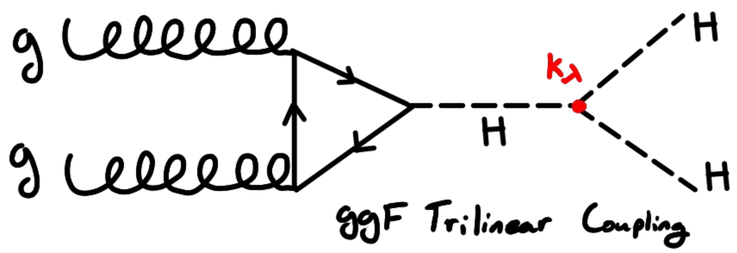
- Higher rate & energy of collisions means more HH events
- So perfect place to study properties of HH production!
- Important to see our potential sensitivity at HL-LHC

3) How do we project to the HL-LHC?

- Use Run 2 data
- Then add scale factors to take into account the change in conditions from Run 2 to the HL-LHC

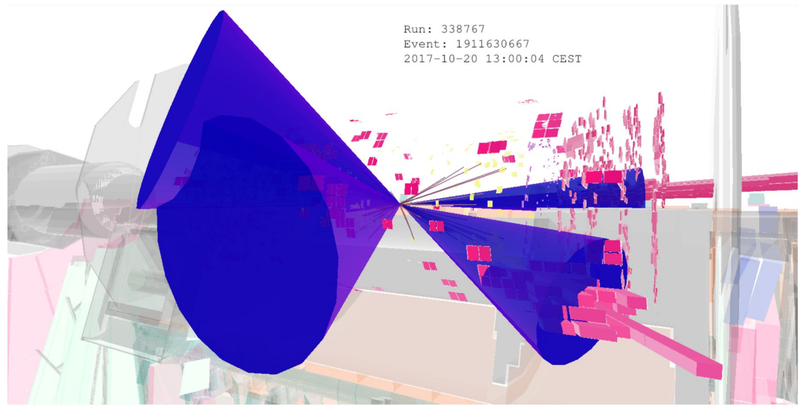
4) How do we produce HH?

- HH production via Higgs trilinear coupling most important
- Process parametrized by κ_λ ,where κ_λ=1 within the SM
- κ_λ directly influences shape of Higgs potential

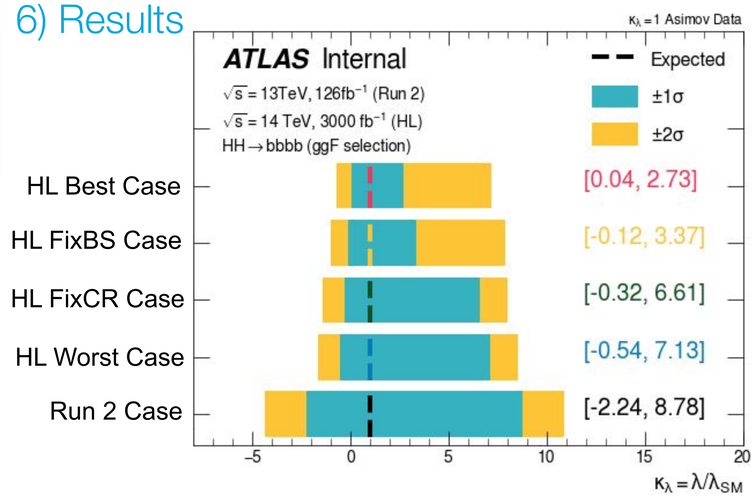


5) How do we detect HH?

- Search for 4 b-jets (HH->4b) using the ATLAS detector
- Large branching fraction of decay, but large QCD backgrounds, estimated with neural network



6) Results



7) Conclusion

- Higgs pair production HH not discovered yet
- Physics of HH has profound consequences
- HL-LHC perfect place to explore HH physics
- ATLAS HH->4b combined with other channels will not only observe HH, but learn about the Higgs potential with significant precision

Discovery, accelerated