# ttbar threshold studies

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# Objectives and Plans

## Cross-section extraction at ttbar threshold scan

➢ Analysis of MC samples produced at threshold √s:

- Find realistic selections to separate signal from background
- Implement *b*-tagging technique, possibly calibrating it in situ
  - *b*-tag counting method → extract simultaneously ttbar cross-section and *b*-tag efficiency from number of events with 1/2 *b*-jets [https://arxiv.org/pdf/2308.09529.pdf]
- In general aim for minimal selections that are stable over different √s for the threshold scan

➢ Uncertainties estimation

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## Cross-section extraction at ttbar threshold scan

➢ Analysis of MC samples produced at threshold √s

➢ Uncertainties estimation:

- *theoretical uncertainties* (most of them already available) → it can be interesting to see how big is the impact on the final measurement if some of these uncertainties are reduced in the future
- *statistical uncertainty* → related to various colliders
- *experimental uncertainties* → machine related unc (e.g. energy spread), acceptance and reconstruction unc., and so on
  - study various scenarios to find what is more important to improve for a better final precision
  - study correlation of systematics across various √s to check effects on final fit results
  - assume beam energy known perfectly for cross-section extraction and then convolute results with various beam energy spread scenarios

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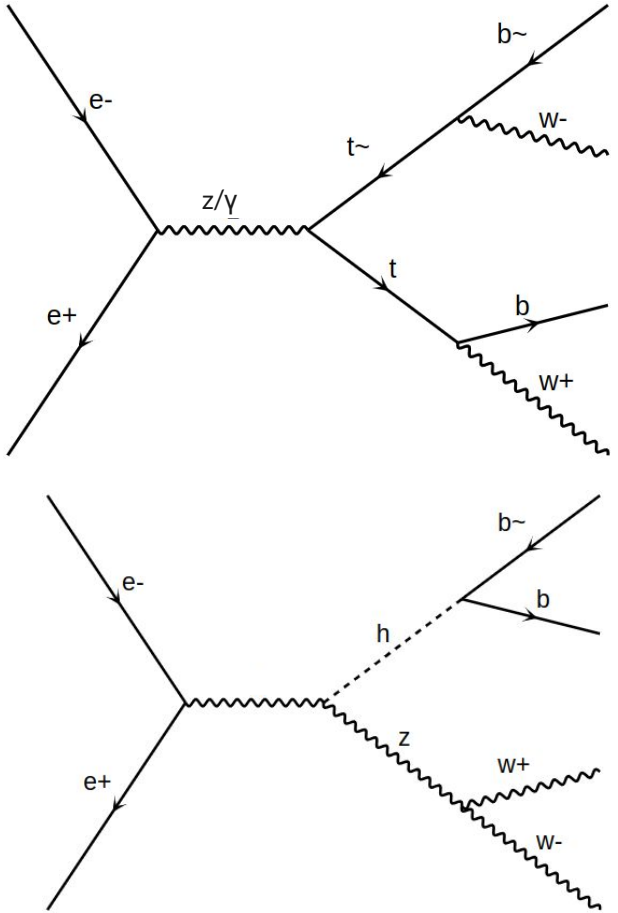
## Cross-section extraction at ttbar threshold scan

Samples to use:

- Full simulation samples not yet available at desired √s → will be produced soon
  - plan to analyse FCC ttbar sample with method explained in previous slide
  - need to separate ttbar and single top processes (signal) from ZH (background)
  - can use other papers to take into consideration reduction of other background processes (need to check efficiency is stable over threshold scan)

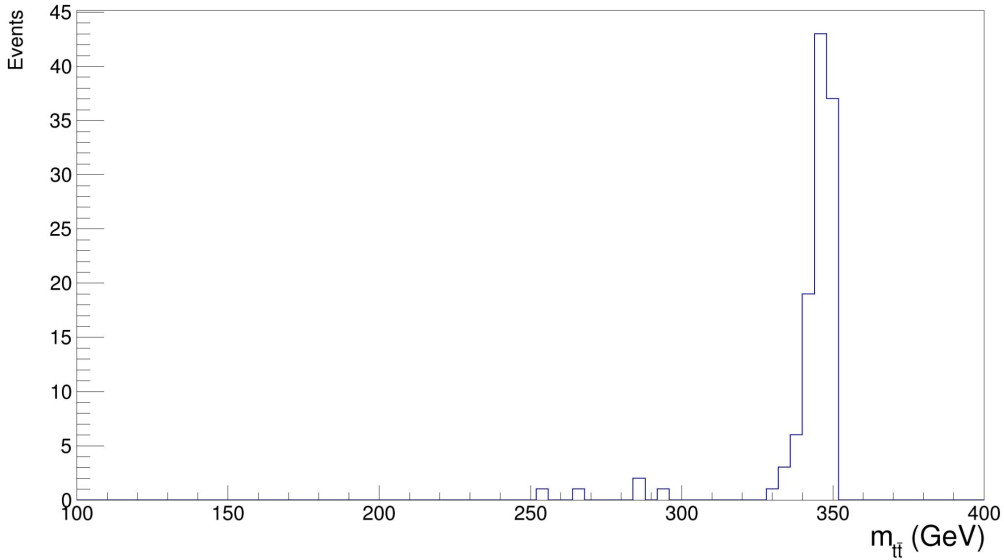
- Currently available particle level sample e+ e- → μ+ μ- ν ν b b at √s = 350 GeV
  - main process e+ e- → t t → W b W b, also single top and ZH
  - used for initial study of the kinematic of various processes



# Whizard sample: $e^+e^- \rightarrow WbWb$

ttbar invariant mass distribution:

- we want to select ttbar process decaying to WbWb → μ+μ-νν̄bb̄
  - selecting a final state with 2 muons and 2 b → efficiency 1.1%
  - invariant mass distribution for ttbar show expected peak, asymmetric toward lower energy values



# Backup