My BDT worked. Until I looked at data.

My ML failure story

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University of Oslo
HAMLET-PHYSICS 2026, Copenhagen

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- Rare signal, plenty of background
  - 500.000 proton-proton collisions per second
  - ~0.7% produce a beauty quark pair
  - A few tens of % of these hadronize to a $B^{\pm}$ meson
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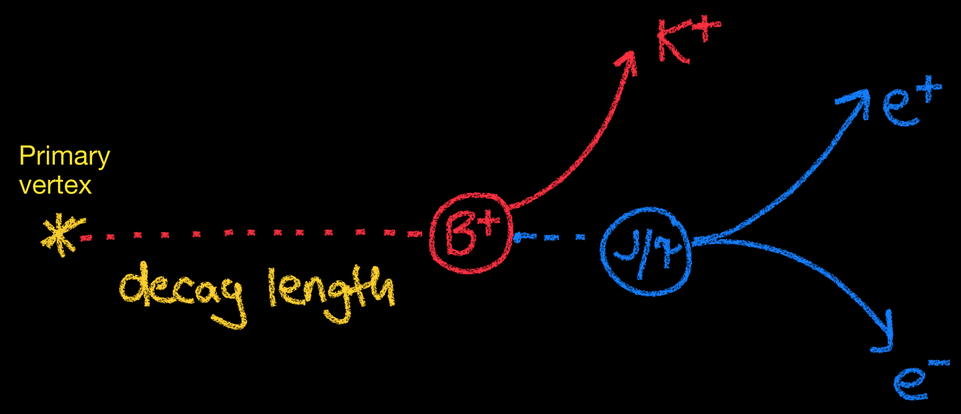

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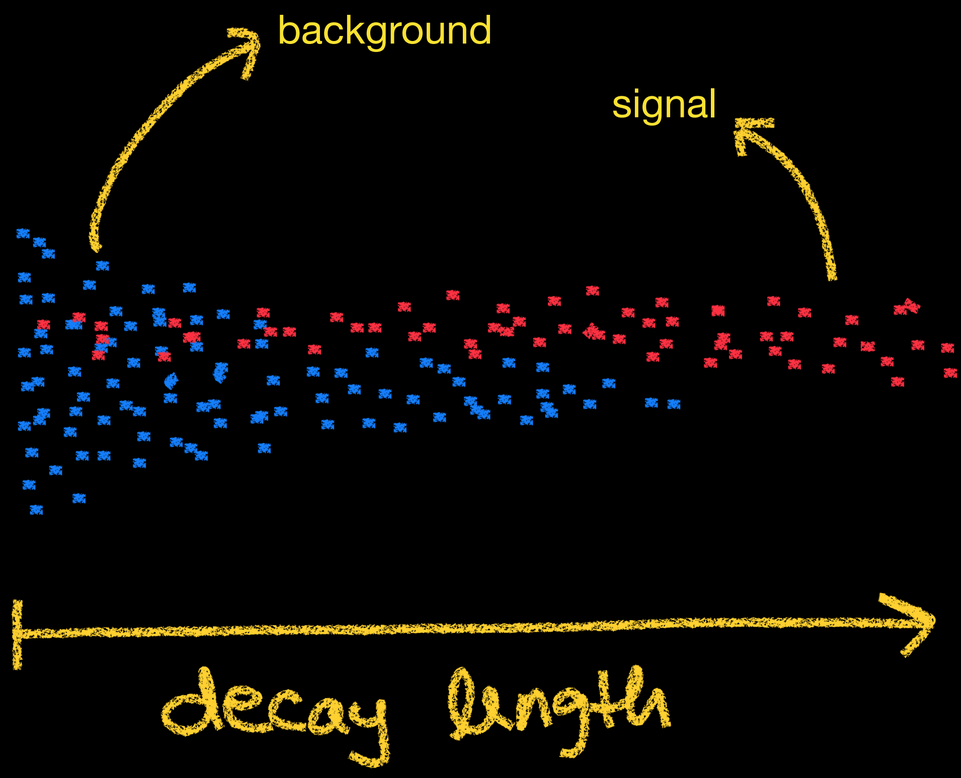

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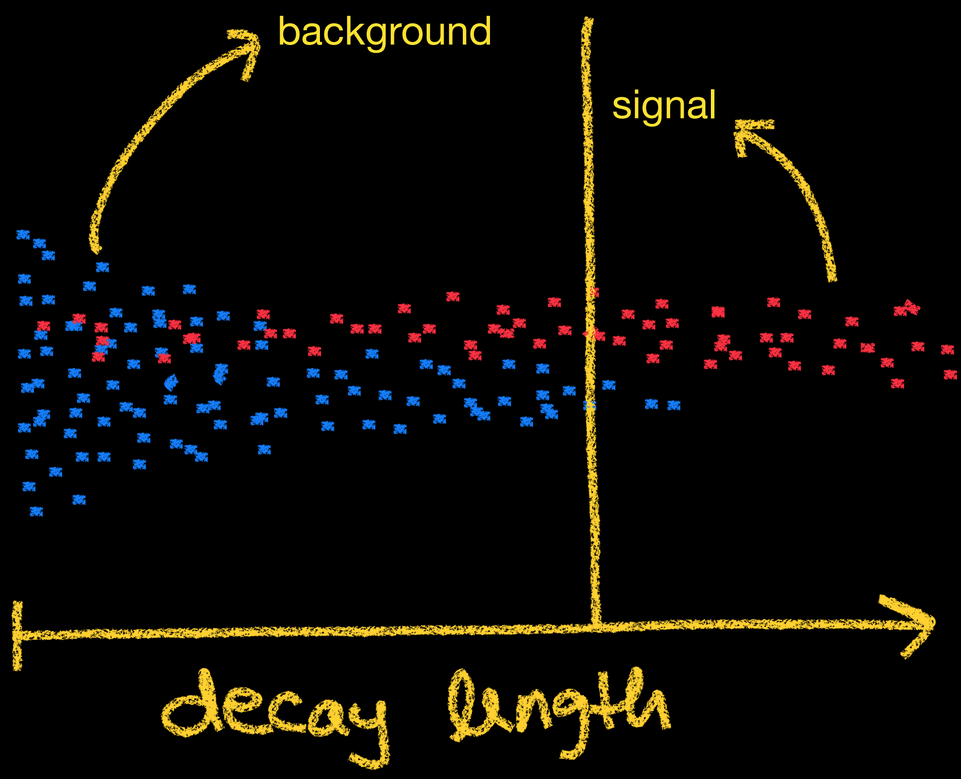

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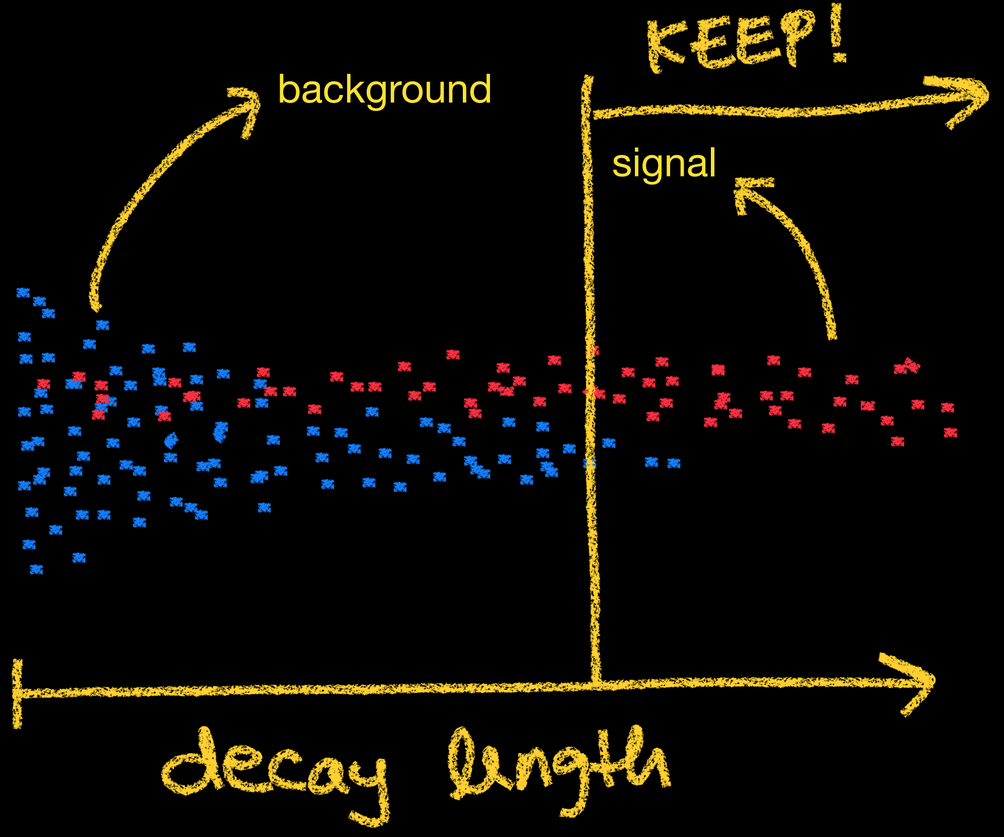

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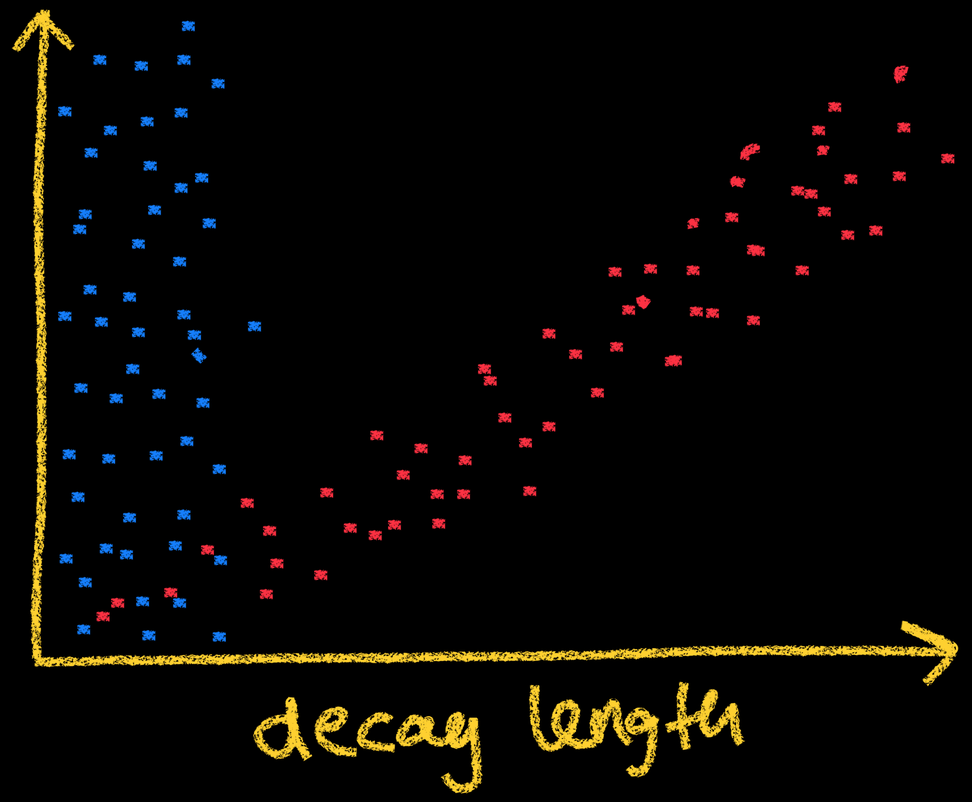

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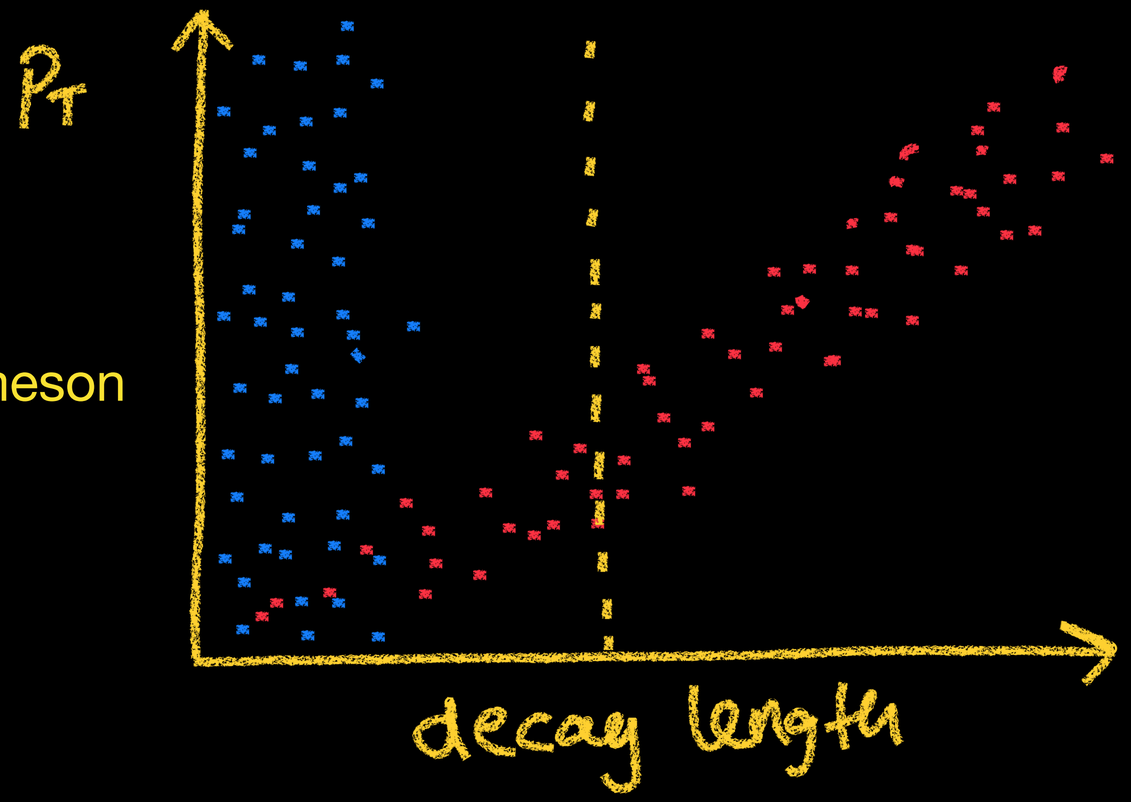

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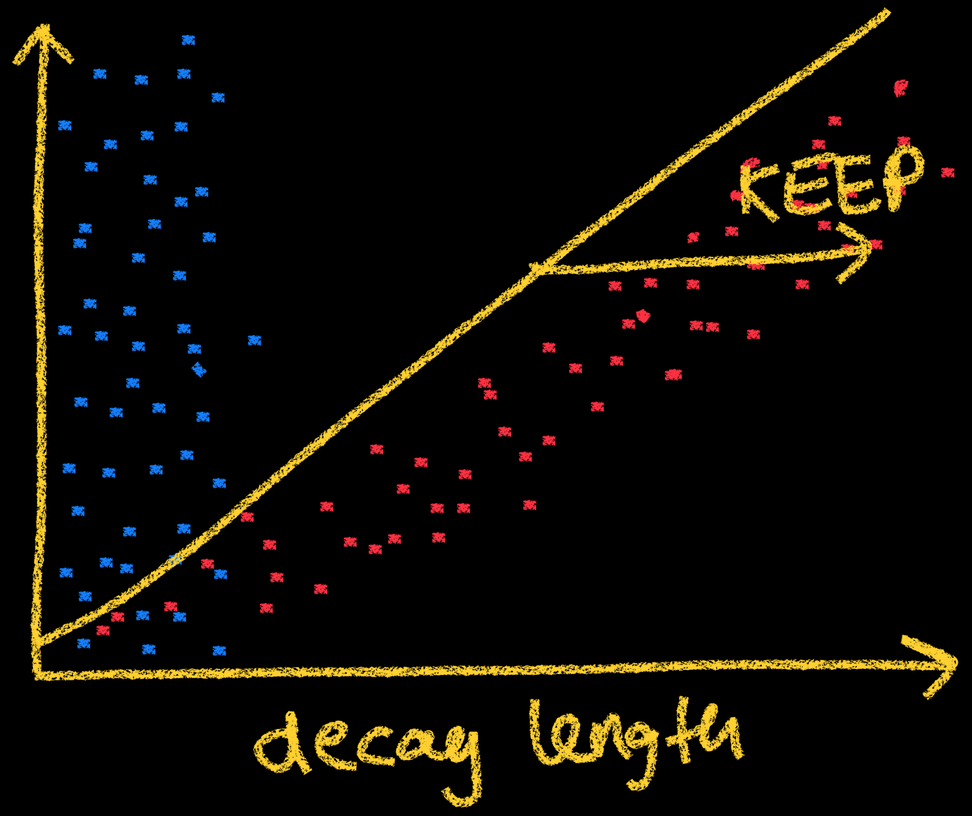
- **Solution: Boosted Decision Tree (BDT)**



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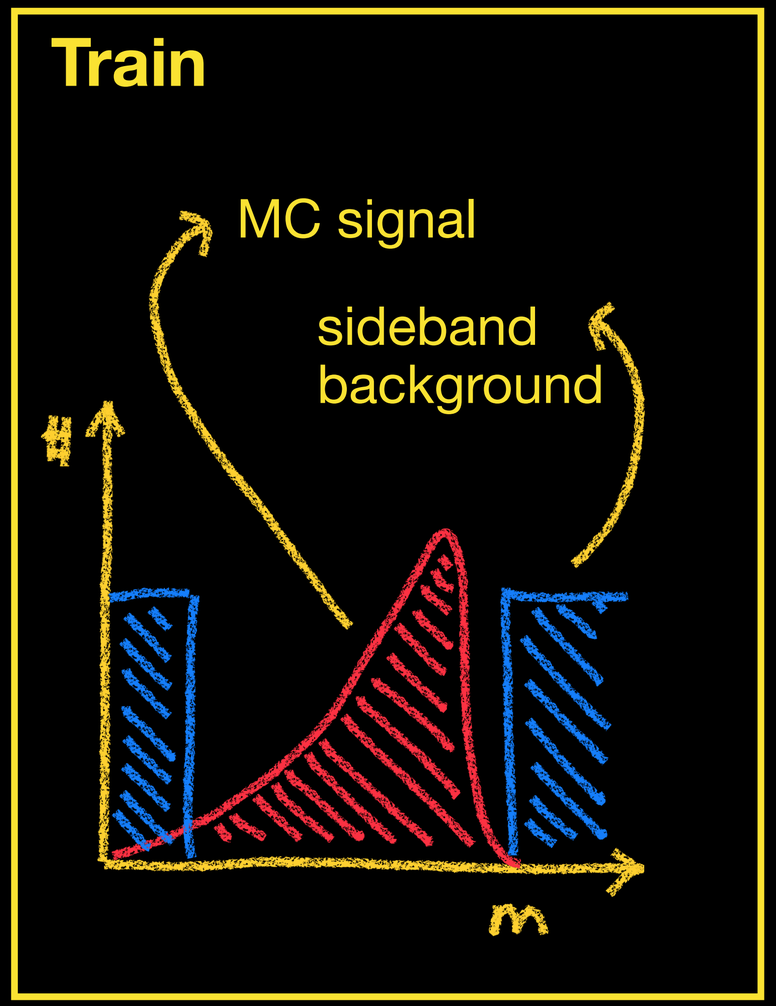

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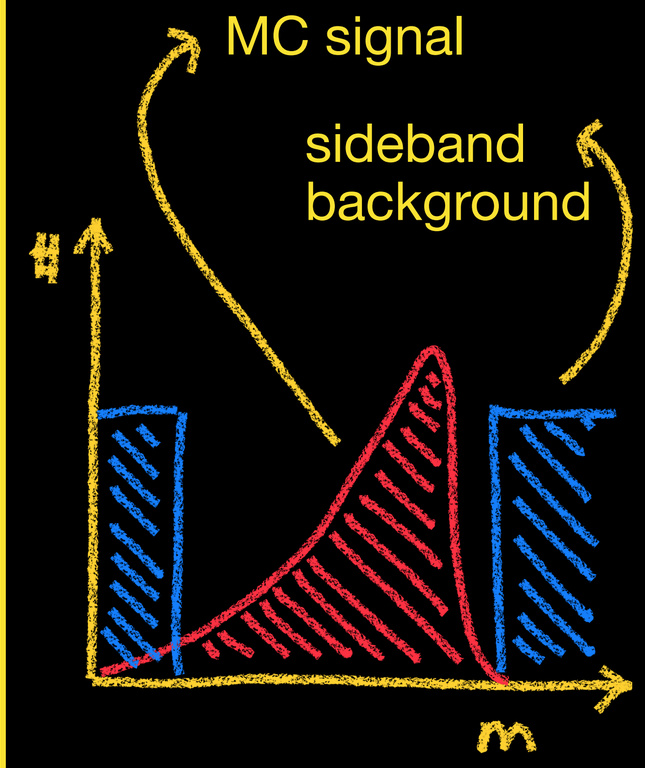
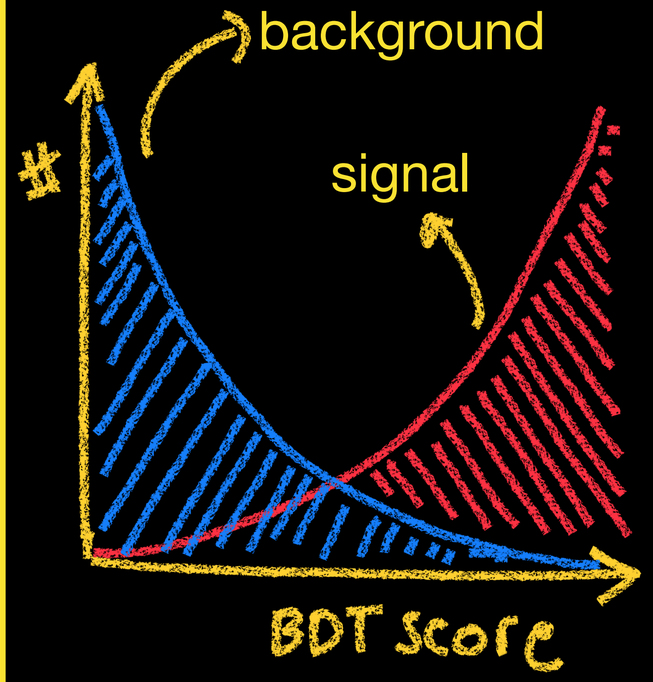
Train



Promise

AUC = 0.99, large expected significance gain



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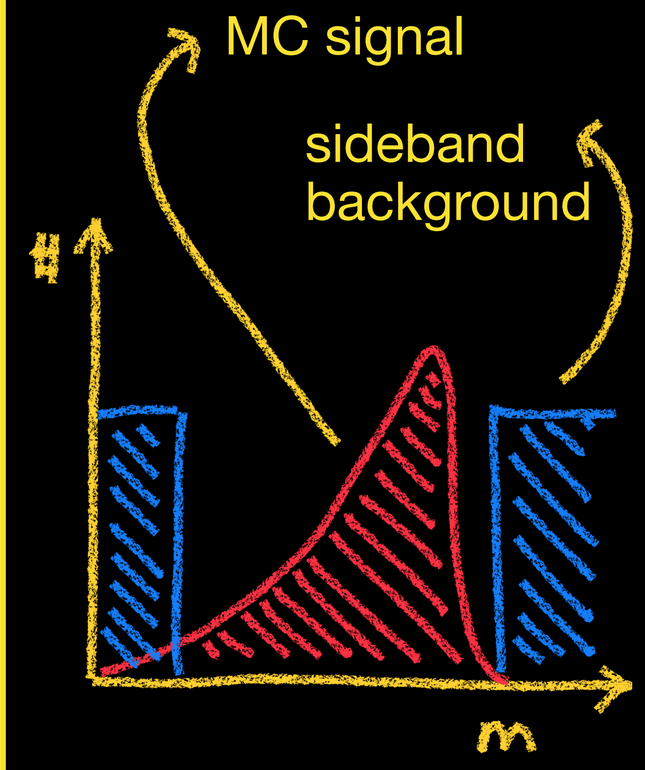

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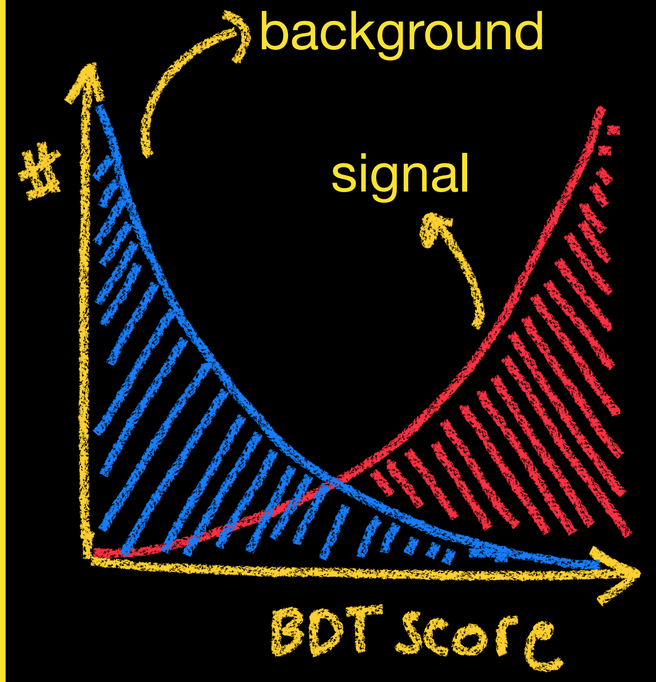
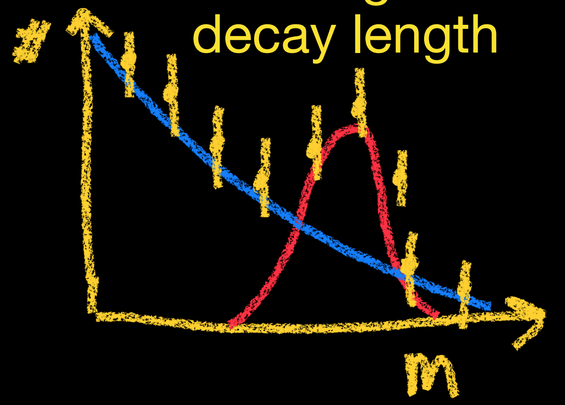


Reality

Rectangular cuts on decay length



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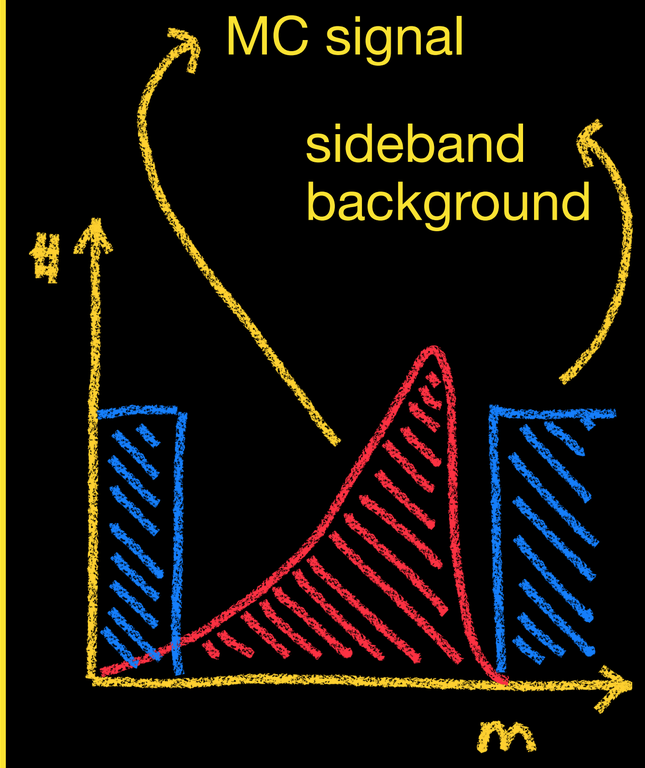

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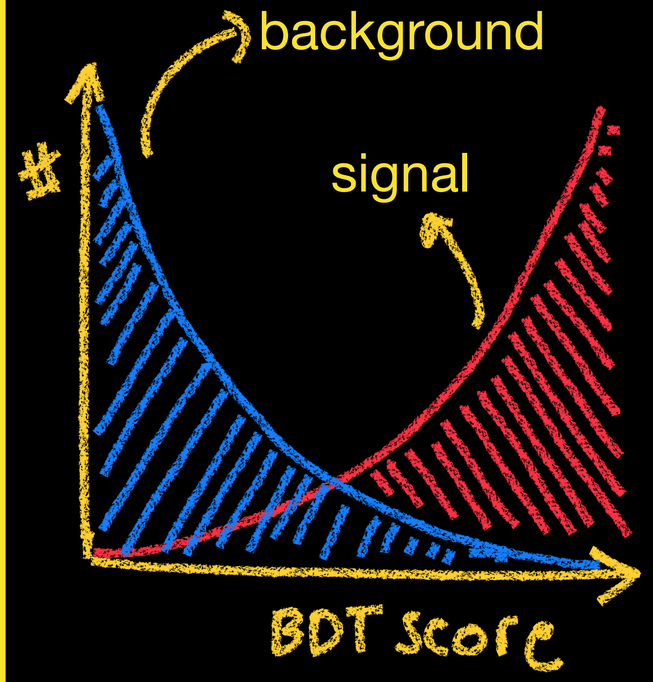

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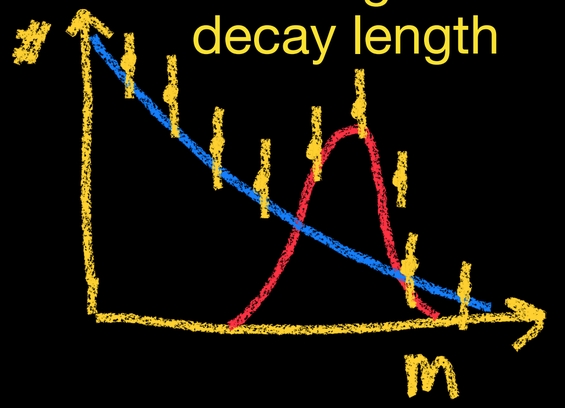

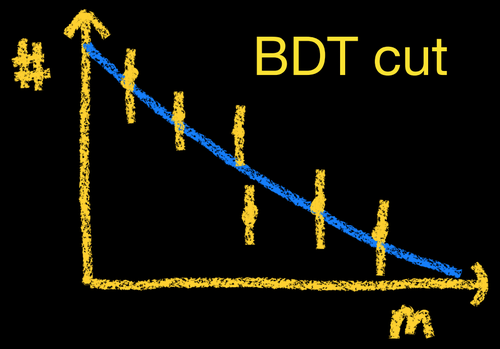

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Signal/background
definition

Is MC signal
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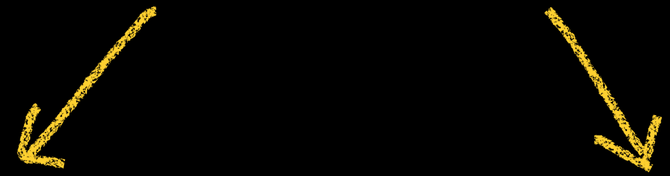

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Signal/background
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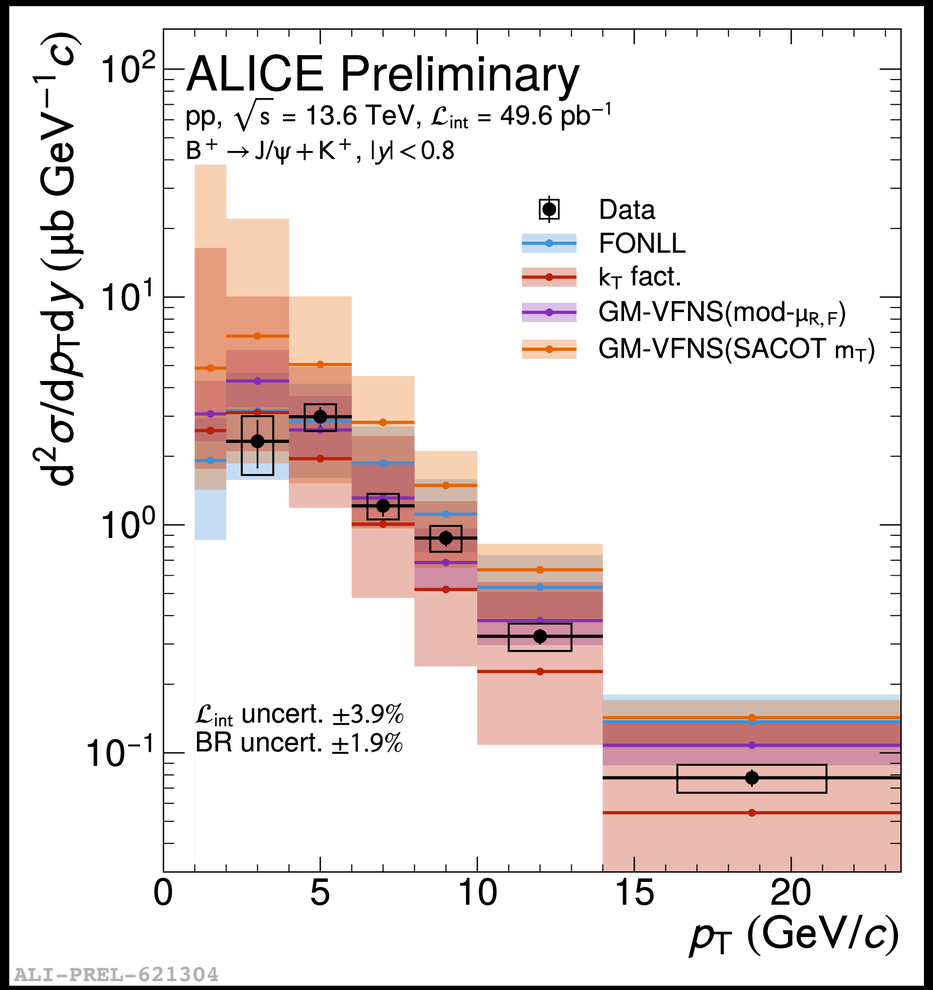
Rectangular cuts
work

PhD to finish

Was I right to stop?
What would you have tried next?

Backup



$$\sigma_{pp}^{H} = \sum_{a,b=g,q,\bar{q}} f_{a/A}(x_1,\mu_F^2) \otimes f_{b/B}(x_2,\mu_F^2) \otimes \hat{\sigma}_{ab\to Q\bar{Q}}(x_1,x_2,\mu_F^2,\mu_R^2) \otimes D_{Q\to H_Q}(z,\mu_F^2)$$