FCNF and L/BNV in Λ_c decays

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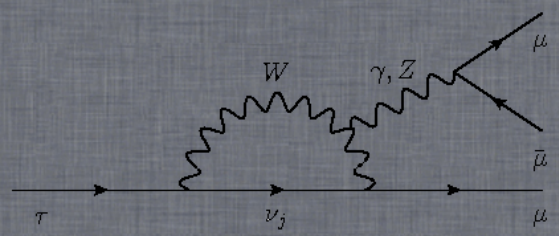
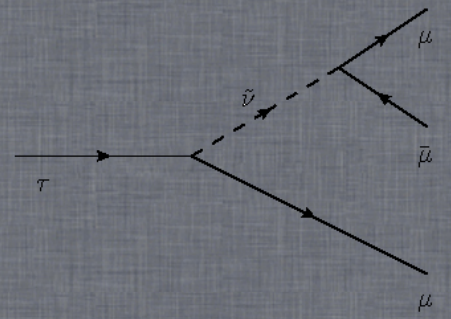
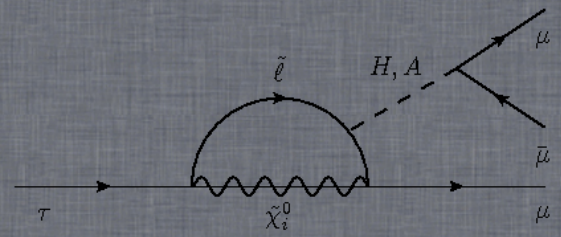
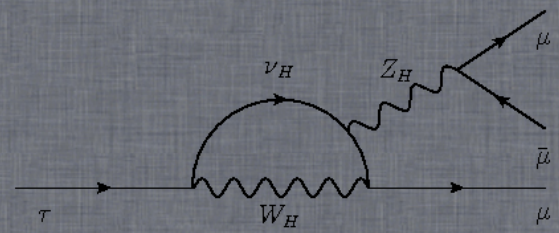








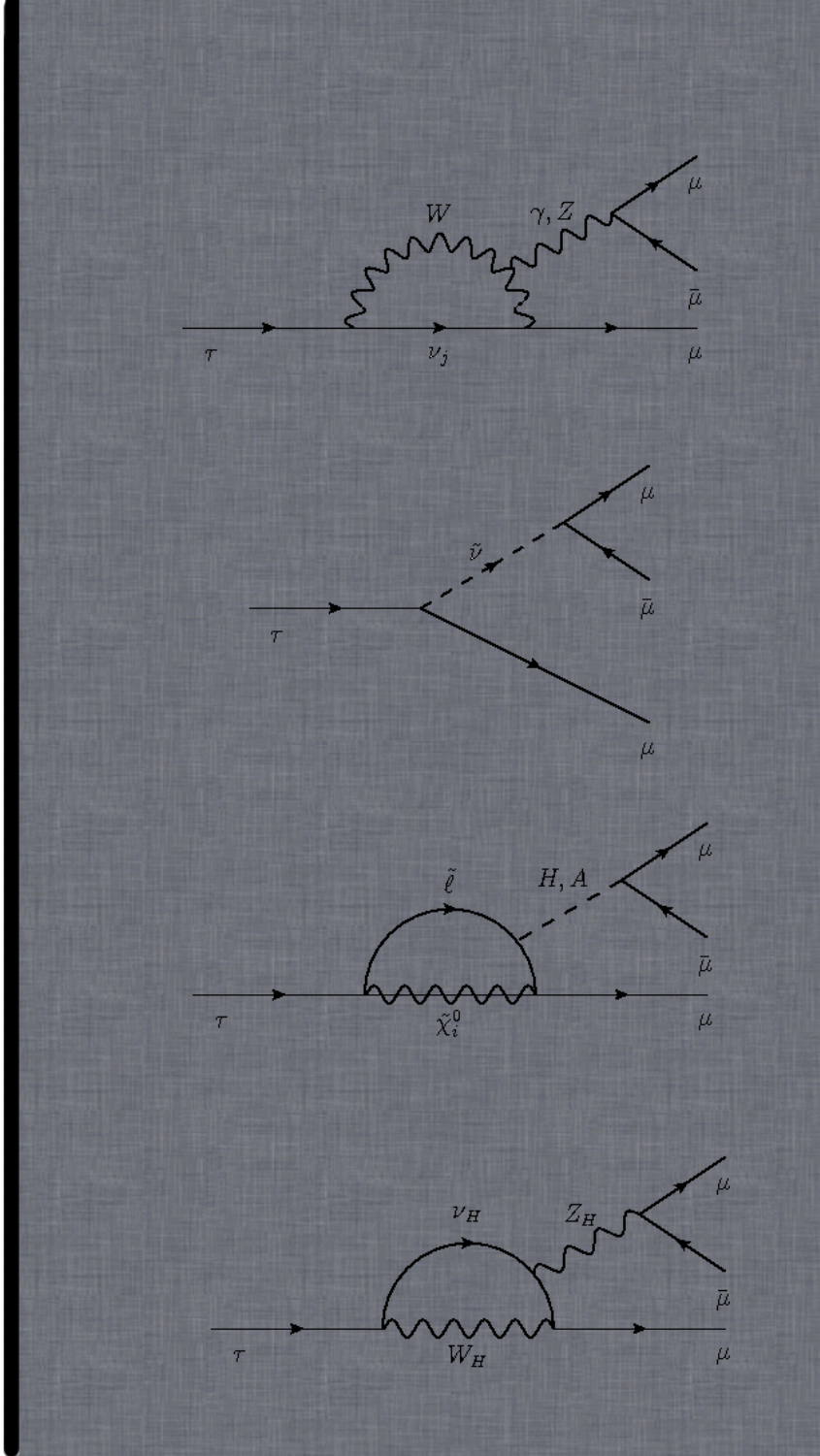
Motivation

Strategy

Normalization channel

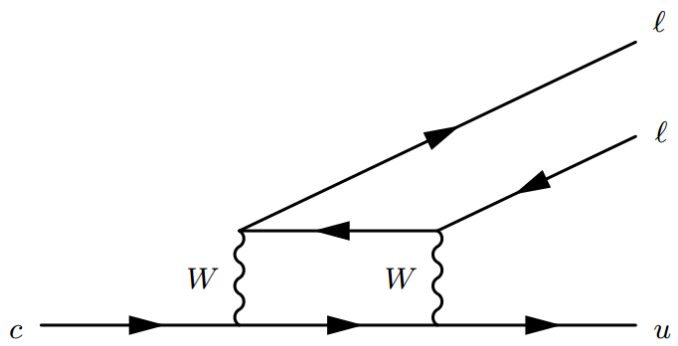
MVA

Summary



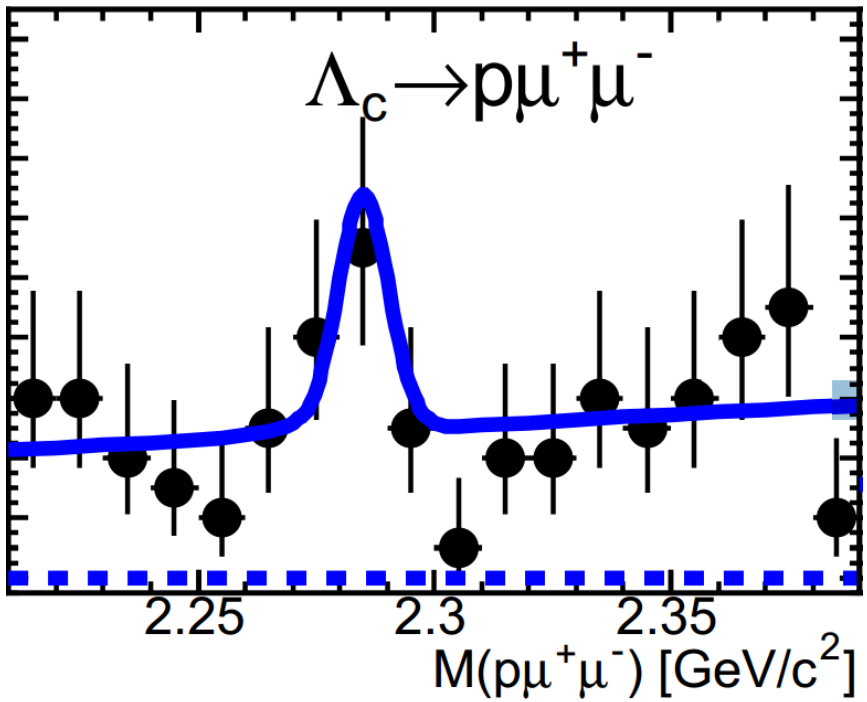
Why to search for $\Lambda_c \to \mathrm{p}\mu^+\mu^-$?

- Decay of $\Lambda_c^+ \to \mathrm{p}\mu^+\mu^-$ is a FCNC.
- Extremely suppressed in SM due to GIM mechanism.
- We will use the experience from $\tau \to \mathrm{p}\mu\mu$.



$\mathcal{B}(\Lambda_c^+ \to p\mu^-\mu^+) < 4.4 \times 10^{-5}$
90% CL arXiv:1107.4465

We should easily beat Babar.



Yield: $11.1 \pm 5.0 \pm 2.5$

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Strategy

Follow the strategy of τ analysis:

- Take prompt Λ_c, separate approach to SL.
- Loose cut preselection.
- Train MVA on MC prompt signal and recalibrate on data.
- Calibrate on date.
- Normalize to $\Lambda_c^+ \to \mathrm{p}K^-\pi^+$, $\Lambda_c^+ \to \mathrm{p}\pi^-\pi^+$ or $\Lambda_c \to \mathrm{p}\phi(\mu\mu)$.
- Optimise the binning in MVA.
- CLs method for limit.

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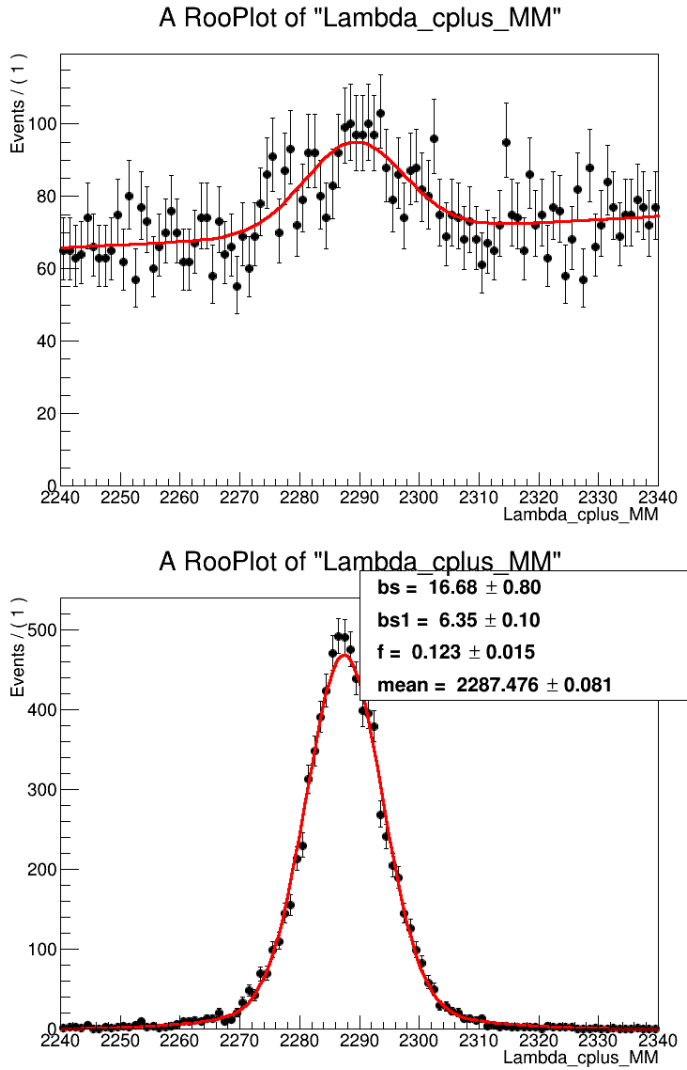
Normalization channel

- We have 3 candidates for normalization channel.
  1. $\Lambda_c \to \mathrm{p}\phi(\mu\mu)$, $BR = (2.4 \pm 0.8) \times 10^{-7}$
  2. $\Lambda_c^+ \to \mathrm{p}K^-\pi^+$, $BR = (5.0 \pm 1.3) \times 10^{-2}$
  3. $\Lambda_c^+ \to \mathrm{p}\pi^-\pi^+$, $BR = (3.5 \pm 2.0) \times 10^{-3}$

  From above list $\Lambda_c \to \mathrm{p}\phi(\mu\mu)$ is a perfect candidate for normalization. However Br is a bit low.

First look in data I

- With some PID and vertex cuts we can see our $\Lambda_c \to \mathrm{p}\phi(\mu\mu)$
- Back of the envelope calculations predict we should have 400 of those events in $3fb^{-1}$
- A bit small for normalization.



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Possible background

Resonance	$\mathcal{B}(\Lambda_c \to pX)$	$\mathcal{B}(X \to \mu\mu)$
η	UNKNOWN	$(5.8 \pm 0.6) \times 10^{-6}$
ρ^0	UNKNOWN	$(4.55 \pm 0.28) \times 10^{-5}$
ω	UNKNOWN	$(9.1 \pm 3.0) \times 10^{-5}$
$f(980)$	$(2.8 \pm 1.9) \times 10^{-3}$	UNKNOWN
ϕ	$(8.2 \pm 2.7) \times 10^{-4}$	$(2.89 \pm 0.19) \times 10^{-4}$
Resonance	$\mathcal{B}(\Lambda_c \to pX)$	$\mathcal{B}(X \to \mu\mu\gamma)$
η	UNKNOWN	$(3.1 \pm 0.4) \times 10^{-4}$

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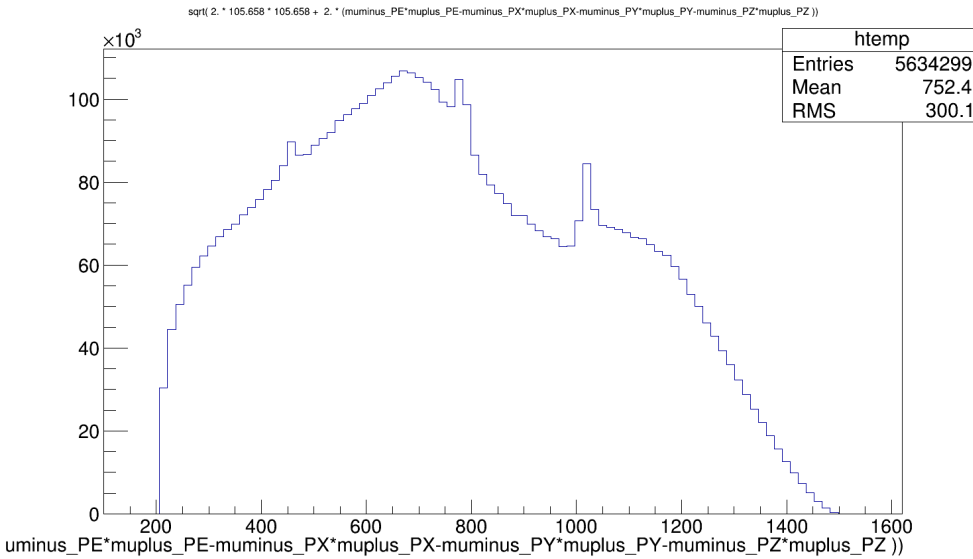
First look in data II

- We also have looked at dimuon spectrum.
- Clearly ϕ, η, ω visible.
- We also see in data $\Lambda_c \to \omega(\mu\mu)\mathrm{p}$.



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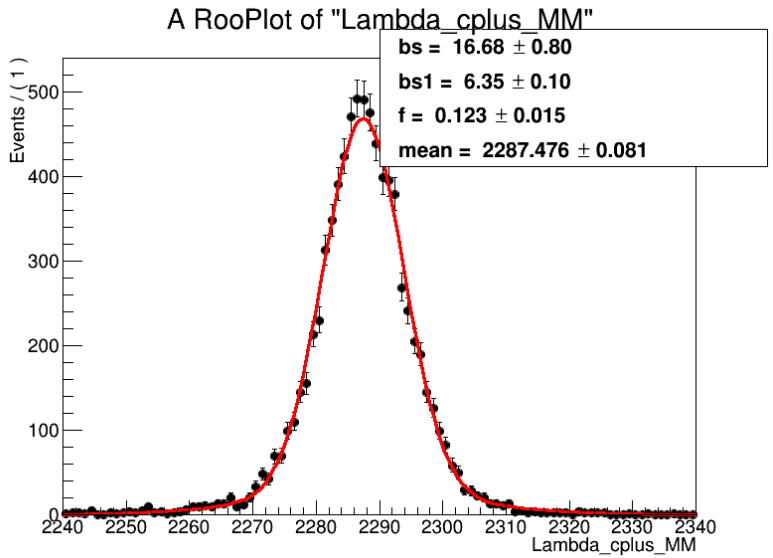
Preliminary selection

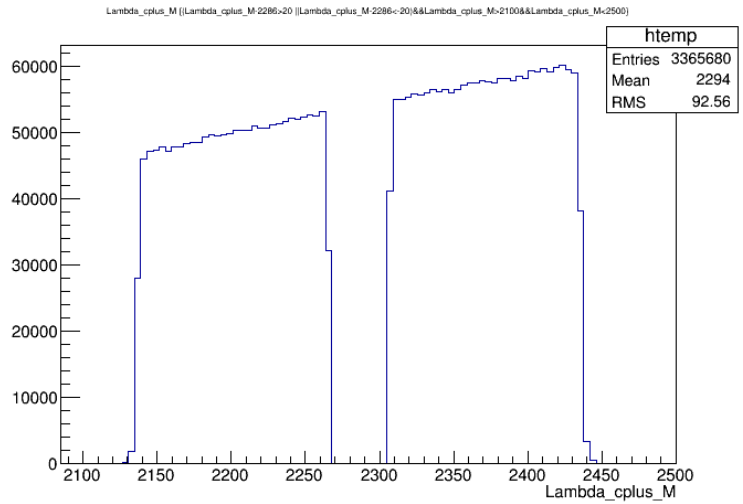
Stripping:

- PID(μ)>-5, PID(p) >10
- IPCHi2>9, PID($\mu - K$)>0, GHOST<0.3, PID(p)>10, Pt>300
- $\Delta m < 150 MeV$
- $c\tau > 100 \mu m$
- $IPChi2 < 225$

Additional:

- Blind region $|m(p\mu\mu) - 2286.46| < 20 MeV$.
- ϕ, ω veto.





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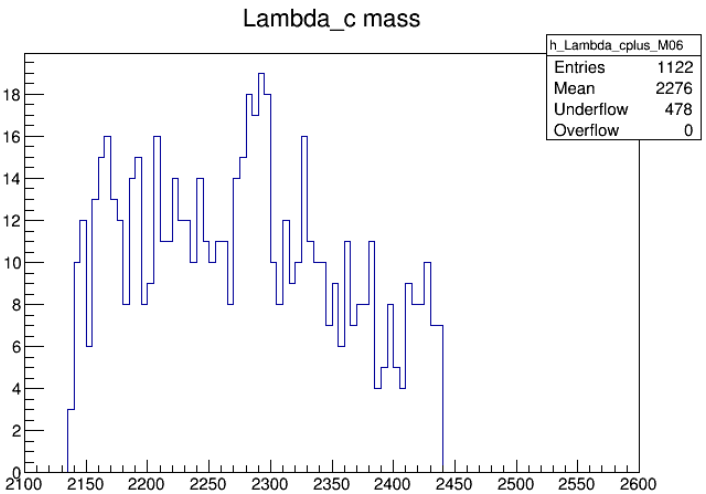
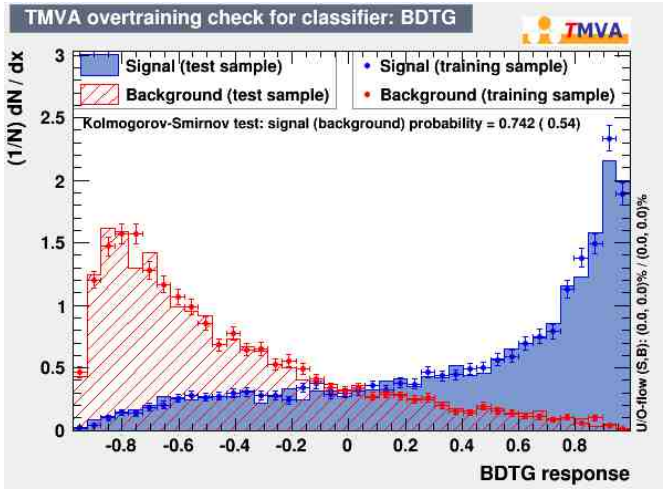
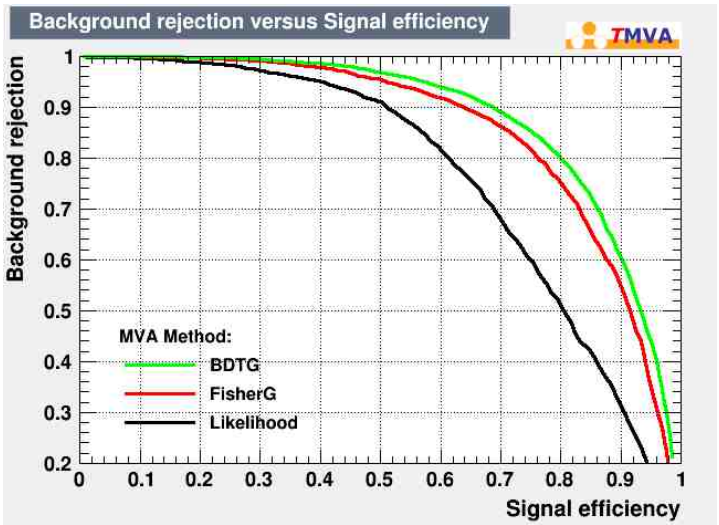
Preliminary TMVA

- Variables adopted form $\tau \to 3\mu$(see Marta's talk).
- In the future we will use Blending for the classifiers.
- Already thanks to this BDTG we can pick up $\Lambda_c \to \omega(\mu\mu)\mathrm{p}$.







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Summary

- Looks like we will have limits $\mathcal{O}(10^{-7})$ - $\mathcal{O}(10^{-8})$
- We already see a new $\Lambda_c \to \omega \mathrm{p}$ decay!
- Normalization channel is still open, but we are converging towards $\Lambda_c^+ \to \mathrm{p}\pi^-\pi^+$
- We have one tight cut on the stripping (flight distance), we are considering several solutions.

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