Updates on activities.

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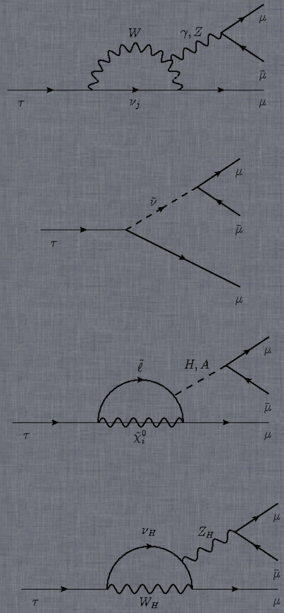
[1] University of Zurich , [2] Institute of Nuclear Physics, Krakow,

30th July 2013



Inflaton analysis

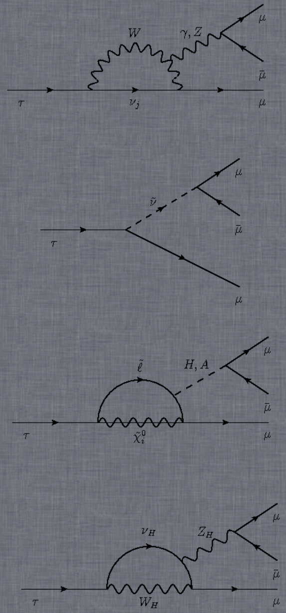
- MC samples
- Normalization Channel

MC studies

η fits

TMVA

Plans for next week



MC Samples

To Study the behaviour of signal I am producing MC samples with different Inflaton life time:

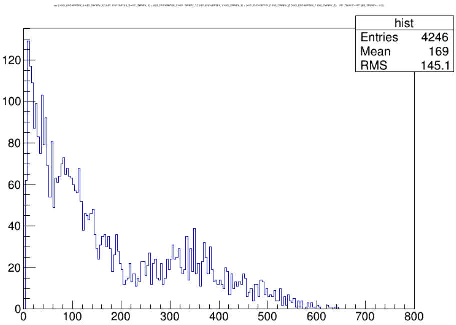
1. $1 \times 10^{-10} s$
2. $2.5 \times 10^{-10} s$
3. $5 \times 10^{-10} s$
4. $7.5 \times 10^{-10} s$
5. $10 \times 10^{-10} s$

All done. ☺

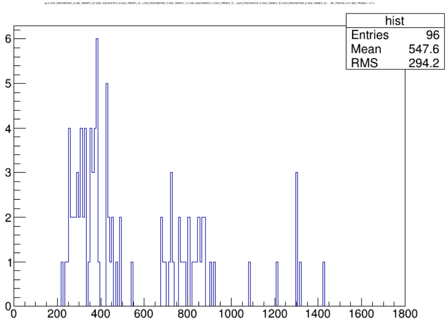
Flight distance

Life Time: $10^{-10} sec$

Long Tracks



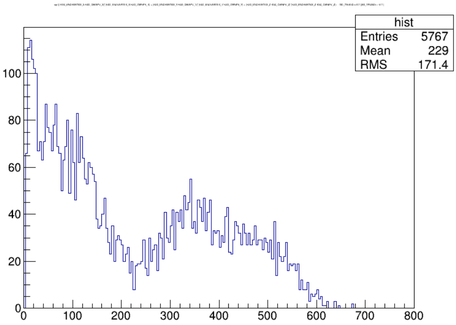
DownStream



Flight distance

Life Time: $2.5 \times 10^{-10} sec$

Long Tracks



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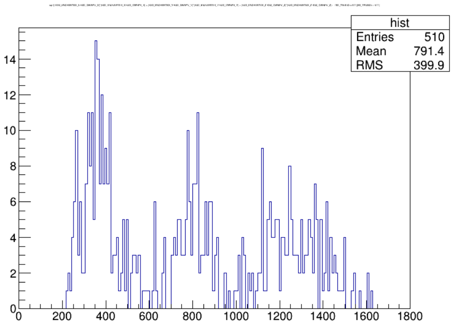
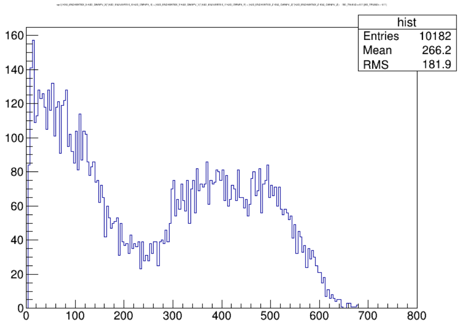


Flight distance

Life Time: $5 \times 10^{-10} sec$

Long Tracks



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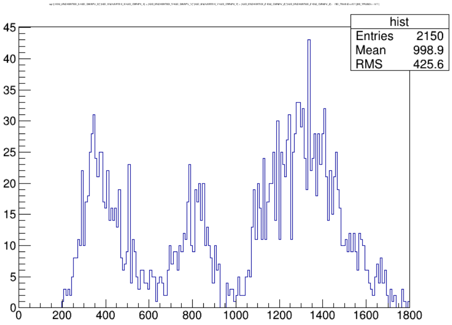
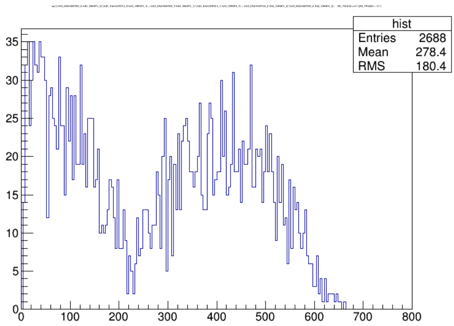


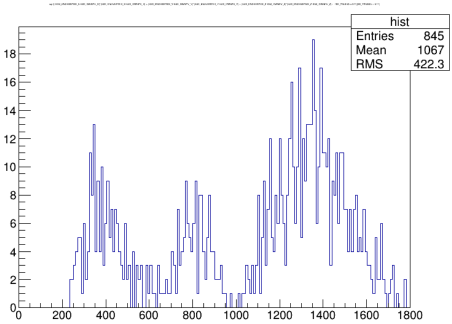
Flight distance

Life Time: $7.5 \times 10^{-10} sec$

Long Tracks



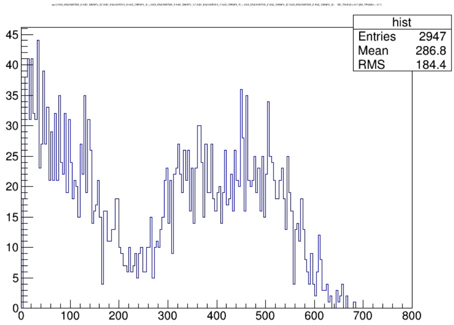
DownStream



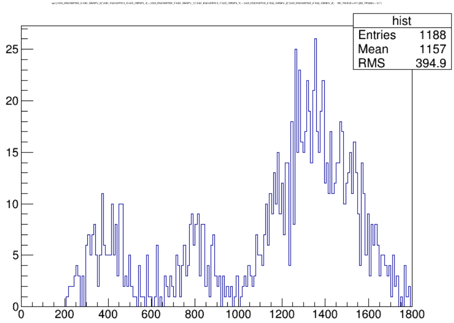
Flight distance

Life Time: $10 \times 10^{-10} sec$

Long Tracks



DownStream

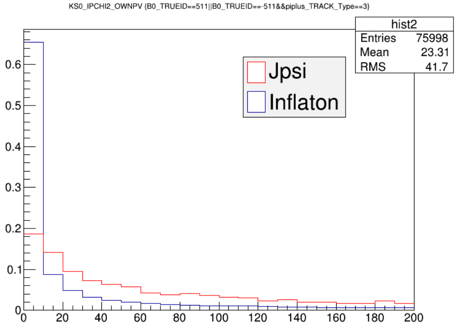


Normalization channel

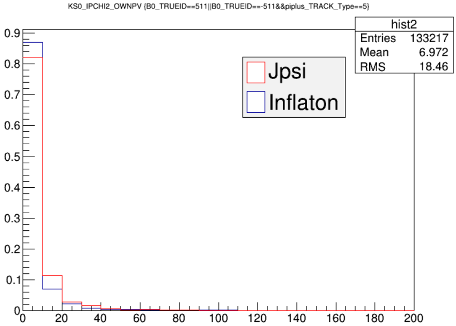
For the first idea we wanted to use $B^0 \to J/\psi K_s$. I had to compare how K_s imitates our signal inflaton on MC.:

IPCHI2

Long Tracks



DownStream



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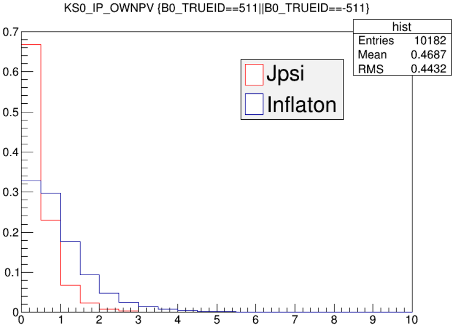
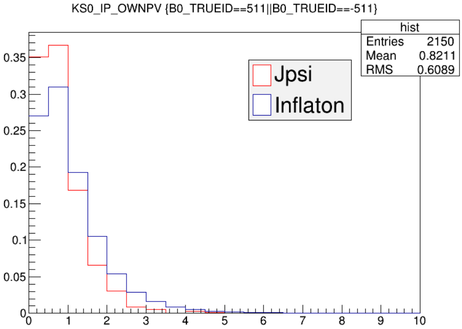
Long Tracks



DownStream



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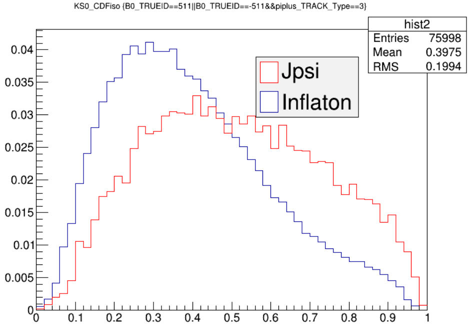
Normalization channel

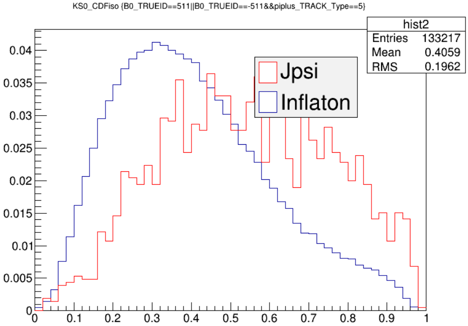
For the first idea we wanted to use $B^0 \to J/\psi K_s$. I had to compare how K_s imitates our signal inflaton on MC.:

Cone isolation

Long Tracks



DownStream



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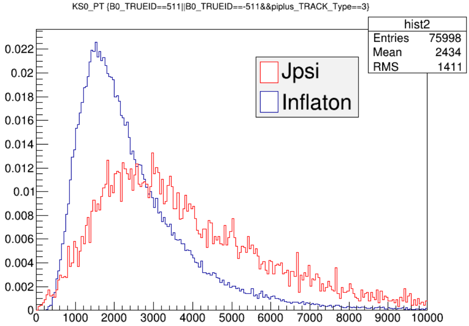
Normalization channel

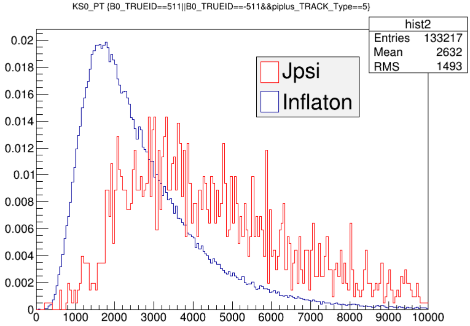
For the first idea we wanted to use $B^0 \to J/\psi K_s$. I had to compare how K_s imitates our signal inflaton on MC.:

Pt

Long Tracks



DownStream



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Normalization channel

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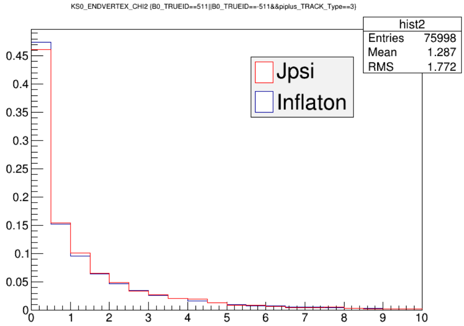
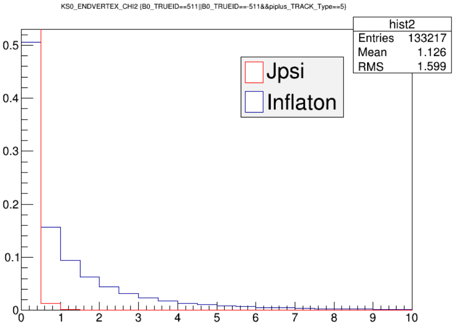
Vtx Chi2

Long Tracks



DownStream



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Summary on inflaton

1. Bid difference between control channel and signal ☹
2. Different control channel? Some Λ channel?
3. Reweigh MC?

MC Signal

Reminder:

- In 2011 we simulated a mixture of $\tau \to 3\mu$.
- We found out that the cross section is wrong in MC.
- We reweighed all this distributions to match the correct cross section.
- But what with DPC? This can't be reweighed!
- Let's check how ϵ_{DPC} depends on signal channel.

Cross check procedure

Let's run Pythia6 with 8 TeV CM energy. With old decfile(aka the wrong mixture of $c\bar{c}$ and $b\bar{b}$. We get:

- $\epsilon_{DPC} = 17.9\%$
- For $7 TeV\%$ we had:17.7%
- This part looks reasonable. We would expected a small gain.

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Cross check procedure

We then simulate two samples for each of 5 sources of τ.

- 1st Sample with Geometry+Daughter[1] Cuts. $\epsilon_{DPC+DAU}$
- 2nd Sample with Daughter Cut. ϵ_{DAU}

[1] Daugher cuts forces τ to come from a specific mother. Ex. B.

MC Signal

τ source	$\epsilon_{DPC+DAU}[\%]$	$\epsilon_{DAU}[\%]$	$\epsilon_{DPC}[\%]$
$D \to \tau$	12.12 ± 0.07	32.71 ± 0.13	18.5 ± 0.1
$B \to D \to \tau$	1.36 ± 0.01	3.99 ± 0.03	17.0 ± 0.1
$D_s \to \tau$	11.79 ± 0.07	31.53 ± 0.13	18.6 ± 0.1
$B \to D_s \to \tau$	1.75 ± 0.01	5.04 ± 0.03	17.4 ± 0.1
$B \to \tau$	5.16 ± 0.05	14.85 ± 0.13	17.4 ± 0.2

Let's take wrong weights from MC and calculate the ϵ_{DPC}:
$\epsilon_{DPC,WRONG} = 17.86$, with agriment with simulating the wrong mixture from beginning!

MC Signal

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Let's take wrong weights from MC and calculate the ϵ_{DPC}:
$\epsilon_{DPC,WRONG} = 17.86\%$, with agriment with simulating the wrong mixture from beginning!
If we take the correct weights we obtain:
$\epsilon_{DPC,CORRECT} = 18.60\%$. We underestimated our efficiency!

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MC Signal

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How ever the overall effect will be smaller cuz the same thing will happen for the normalization channel.

Control channel

I observed similar effect for the normalization channel $D_s \to \phi(\mu\mu)\pi$:

	$\epsilon_{DPC}[\%]$
$B \to D_s \to \phi\pi$	16.91%
$cc \to D_s \to \phi\pi$	18.52%

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Pythia Wars

I have found an other disturbing thing. Lets compare pythia 6 with pythia8:

	$\epsilon_{DPC}[\%]$
Pythia 6	17.9
Pythia 8	19.1

This looks worse than it is. Jon checked and this happens not only to $\tau \to 3\mu$. Turn out this is common. $B_s \to \mu\mu$ aslo has the same problem. However thanks to normalization this the ratio of efficiencies changes by 0.1%.
We are safe anyway.

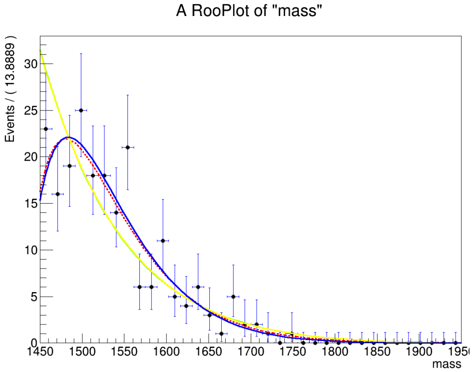
η fits

- Till yesterday we took η for fitting directly from MC.
- But how much eta is there?
- We might have combinatorial background with partially reconstructed η.
- Lots of thanks to Paul for speedy implementation of this idea!
- To increase the sensitivity I took left mass range larger! Make the fit more stable.

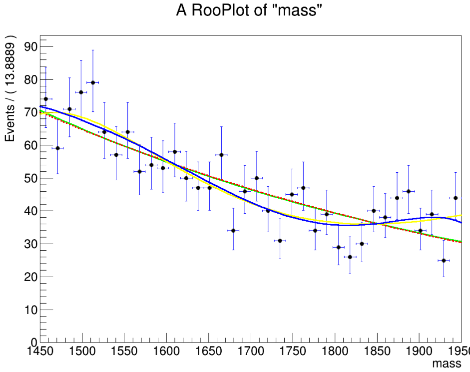
η fits

Extreme case: Trash bins

Only η



η with combinatorics.



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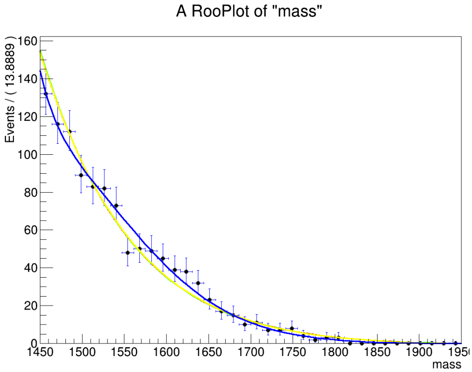
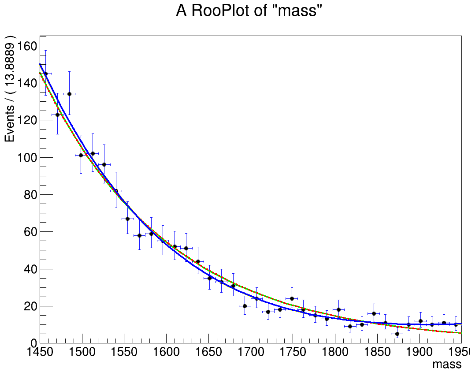
η fits

Not only the trash bin is affected: pid $0.725 - 0.86$
geo: $-0.48 - 0.05$

Only η



η with combinatorics.



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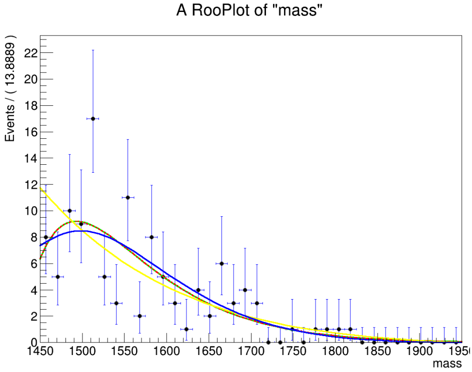
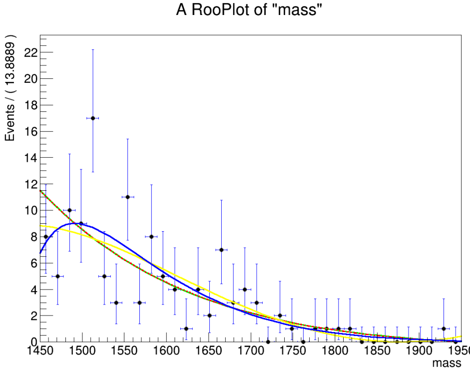
η fits

As old Chinese wisdom says: "One event can make a difference"
Not only the trash bin is affected: pid $0.6 - 0.65$
geo: $0.65 - 0.74$

Only η



η with combinatorics.



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Conclusions on η

- 23% of events in the ntuple are background.
- Much better shape of η.
- PDF similar in each bin!
- Much smaller linkage of η to mass window!
- PDFs are ready for fitting with 2012 data!

Introduction

Kaggle (leading machine learning competition platform).

kaggle

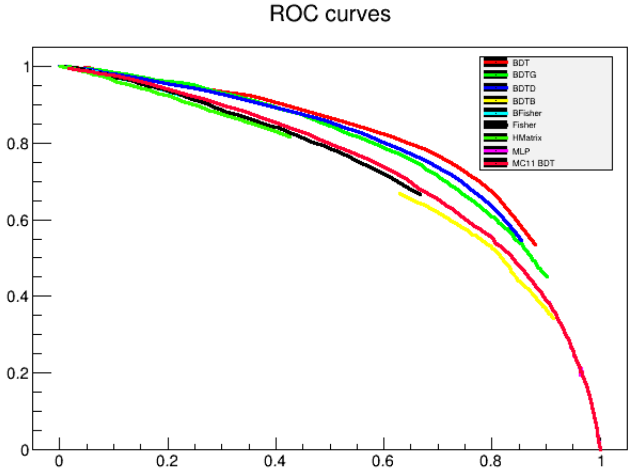
If you notice how people win this competition; you'll notice that sometimes people combine two or more algorithm into ensemble and get better results.
This is called blending.
Isn't $\tau \to 3\mu$ perfect environment to play?

First attempts

- Let's take our background produced so far.
- Already a comparable sample to 2011! Generator cuts are doing their job.
- Let's train each signal on separate source of τ.

$B \to \tau$

We really suck in selecting this channel.



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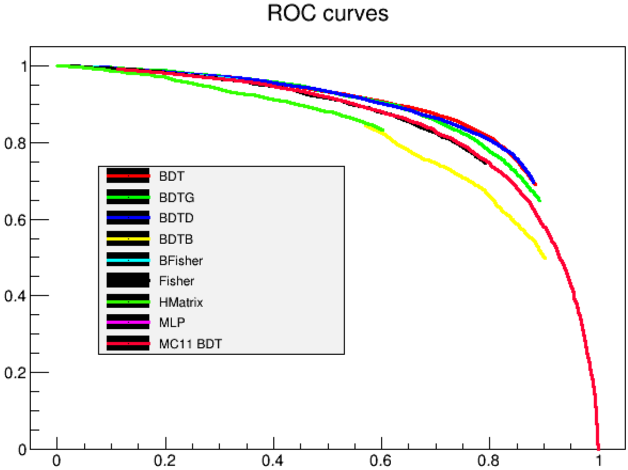
$B \to D_s \to \tau$

On the biggest contributing channel we are quite optimal.



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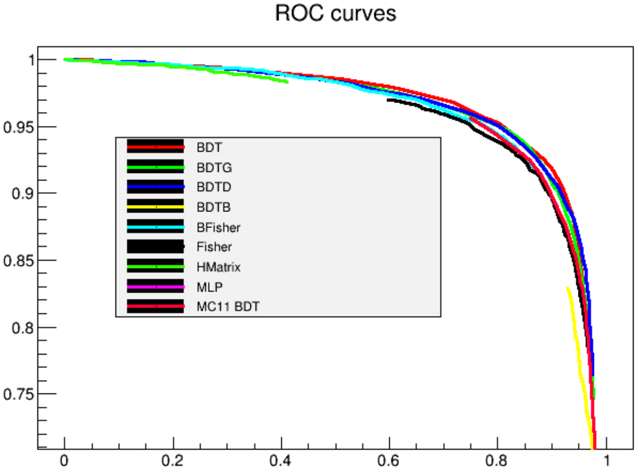
$D_s \to \tau$

On the biggest contributing channel we are quite optimal.



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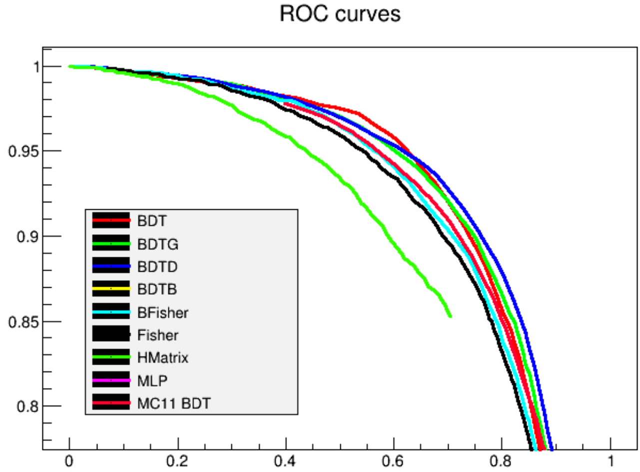
$B \to D^+ \to \tau$

On the biggest contributing channel we are quite optimal.



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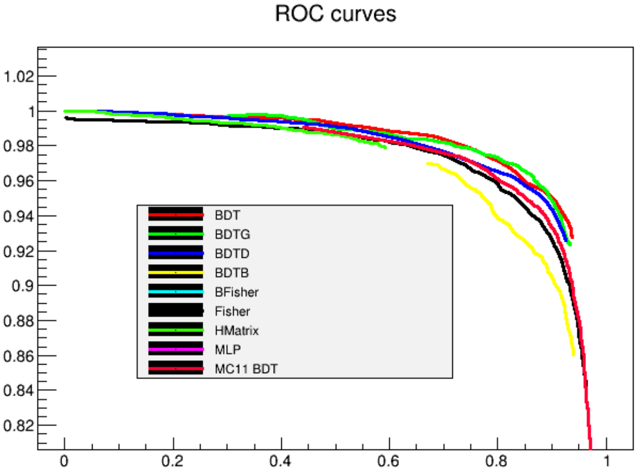
$D^+ \to \tau$

On the biggest contributing channel we are quite optimal.



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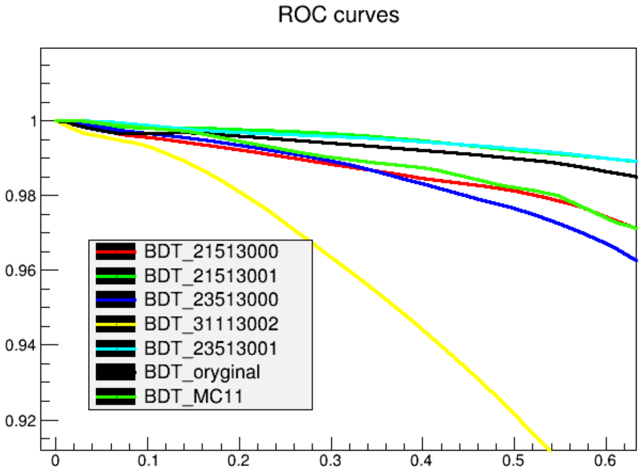
Comparison on mix sample

On the biggest contributing channel we are quite optimal.



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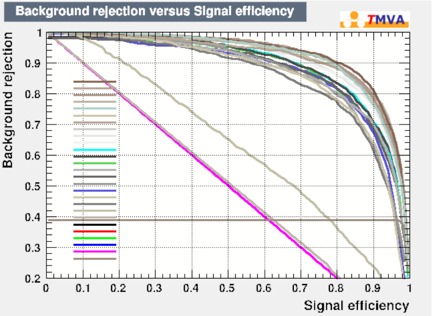
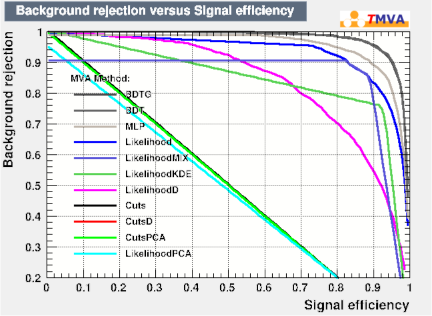
Blending, very very preliminary

OLD method



Assembled



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Conclusions on TMVA

- Each of the signal components is enormously larger than MVA trained on mix.
- Method looks very promising if we can find a nice blending method(work for next week).
- Mayby discusion on TMVA/MatrixNet/Neurobayes is next to leading order effect compared to this method?
- How to evaluator which MVA is better?

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To do

- Finish producing cc bck
- Continue blending.
- Finish calculating new 2D binning optimisation(last night it was still calculating).
- Start Normalizing the η
- Produce Normalization channel MC.
- Play with MatrixNet.

Things done

- Implemented FastJet for into our BEC.
- Have all Λ_c ntuples and zoontuples.
- Λ_b: looking into normalization channel.