$B \to K^* \mu\mu$ selection

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Reminder

On last $K^*\mu\mu$ meeting we agreed on:

- Use 10 Folds.
- Use DLL instead of ProbNN.
- Use isolation inside MVA.
- Use DLL for μ.

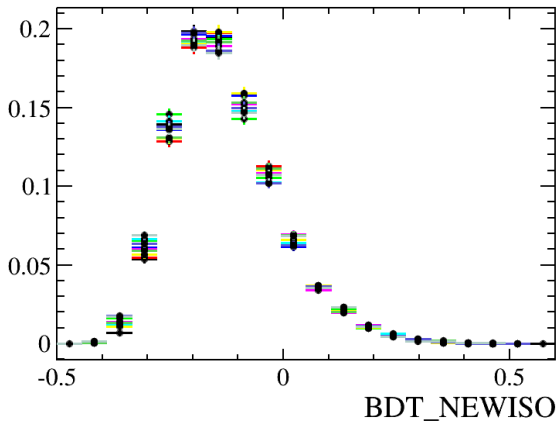
Remaining issues:

- Data agreement
- Use new isolation or the old one
- From me: TMVA vs MatrixNet

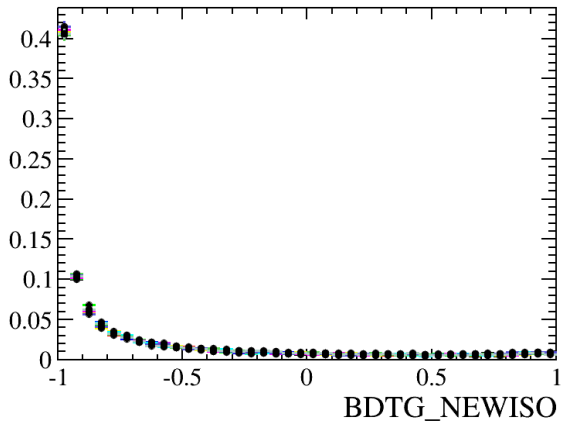
1. Comparison of the performance of each sub-sample from the chopping technique
2. TMVA vs MN performance
3. Conclusion

Fold comparison Background

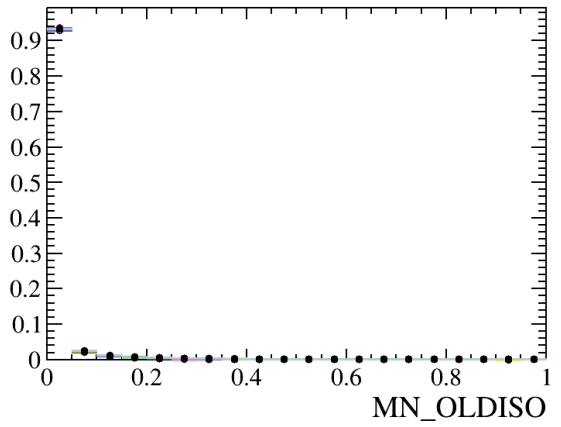
BDT



BDTG



MatrixNet

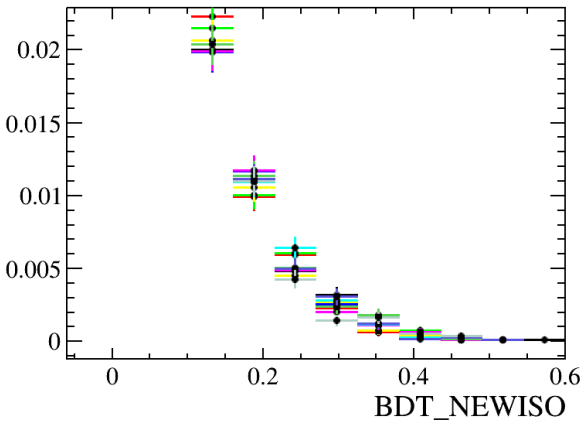


Conclusion

Everything is very consistent.

Fold comparison Background ZOOM

BDT



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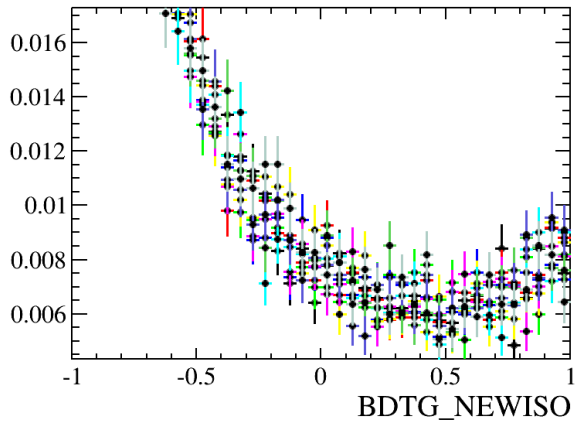
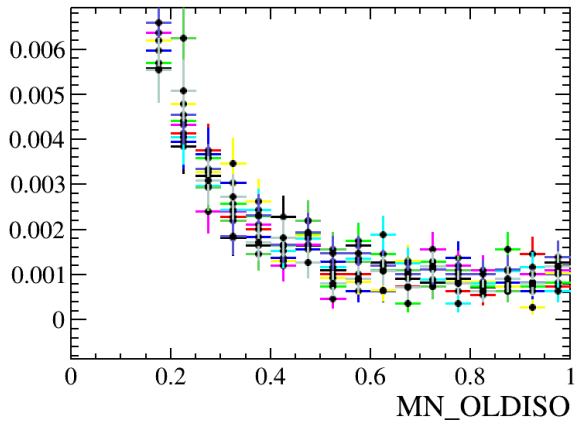


MatrixNet

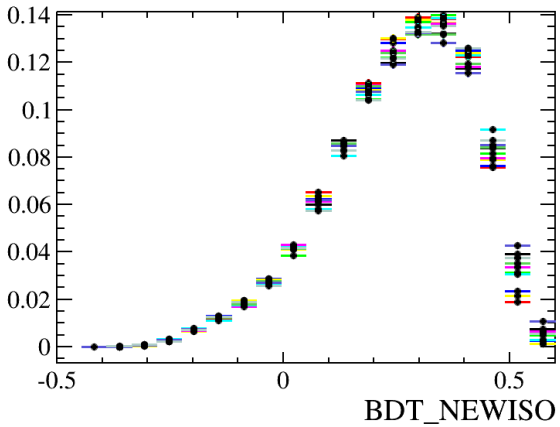


Conclusion

We only see statistical fluctuations within 2σ. What would one expect with 10 folds.

Fold comparison Sploted $K^*\mu\mu$

BDT



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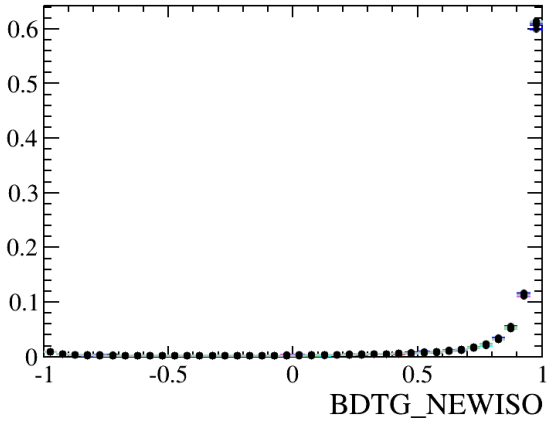
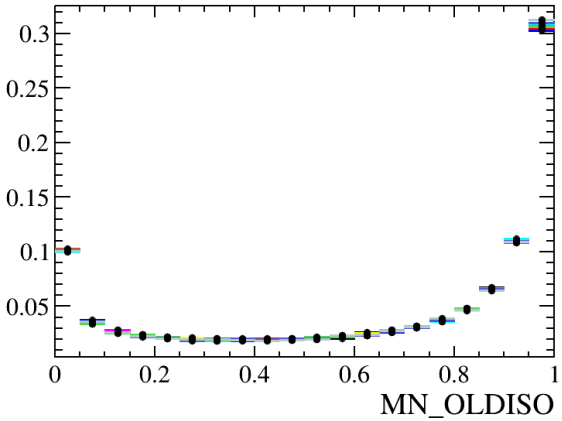


MatrixNet

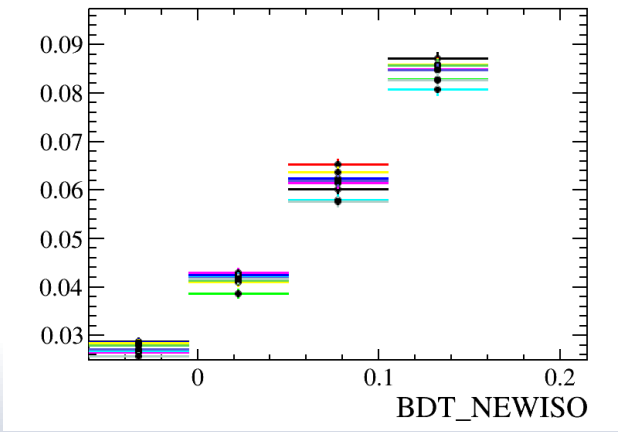


Conclusion

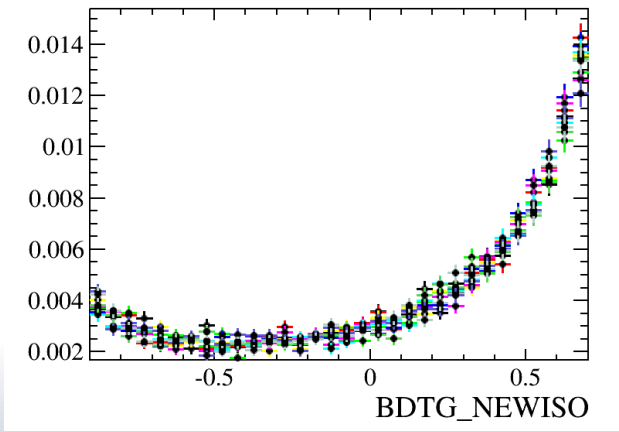
Again everything very consistent.

Fold comparison Sploted K*$\mu\mu$ ZOOM

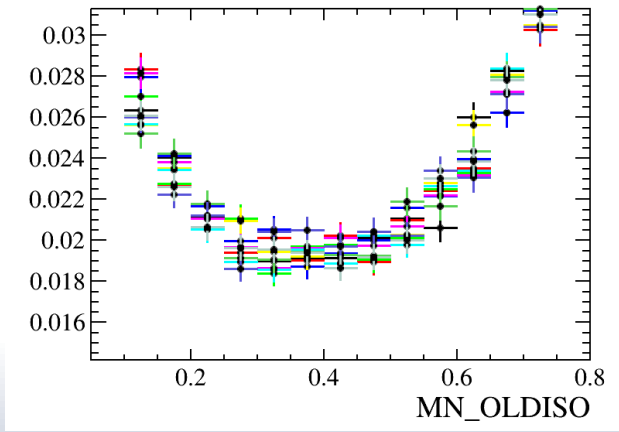
BDT



BDTG



MatrixNet

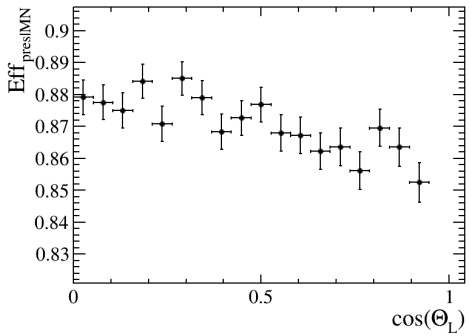


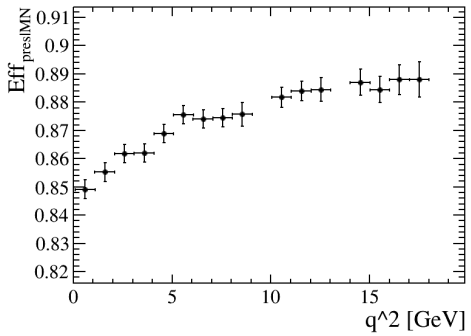
Conclusion

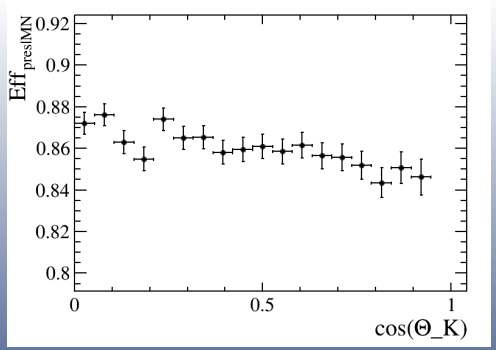
Again everything very consistent with statistical fluctuations.

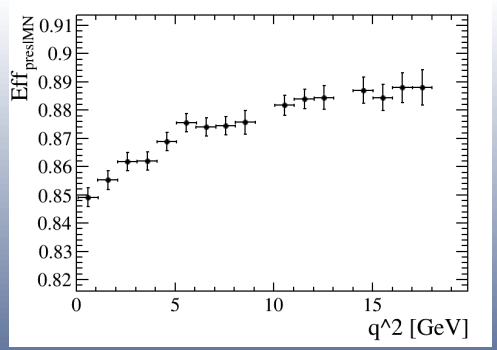
Acceptance

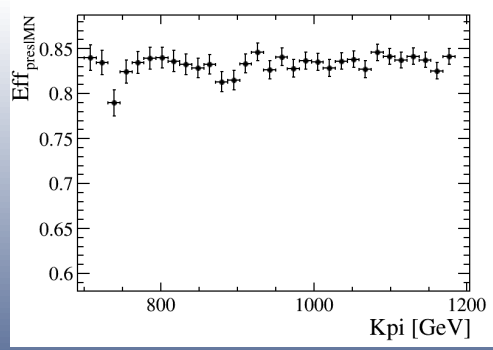
All the classifiers show the same behavior: only the BDT is shown here (others in the backup)











Chopping stability I

I have tested each formula on MC following the procedure:

- Add 10 formulas to MC ntuples.
- For each formula make a cut.
- Calculate the efficiency.

Chopping stability I, BDTG

Fold	Eff.[%]	Err.[%]
0	86.86	0.09
1	87.04	0.09
2	87.02	0.09
3	86.88	0.09
4	86.94	0.09
5	87.02	0.09
6	87.10	0.09
7	86.99	0.09
8	87.14	0.09
9	87.12	0.09

Conclusion

Everything consistent with statistical fluctuations!

Chopping stability II, MatrixNet

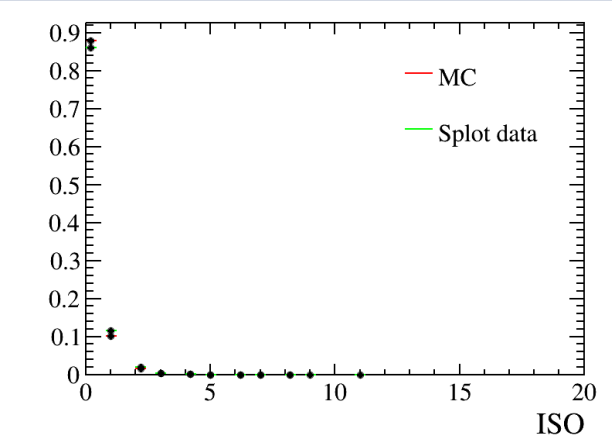
Fold	Eff.[%]	Err.[%]
0	89.56	0.08
1	89.59	0.08
2	89.59	0.08
3	89.60	0.08
4	89.56	0.08
5	89.56	0.08
6	89.60	0.08
7	89.63	0.08
8	89.65	0.08
9	89.55	0.08

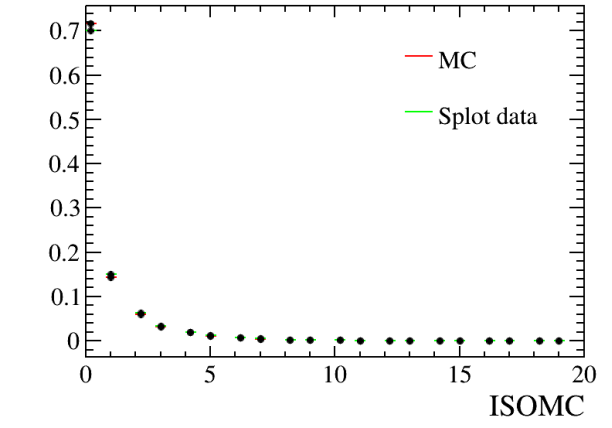
Conclusion

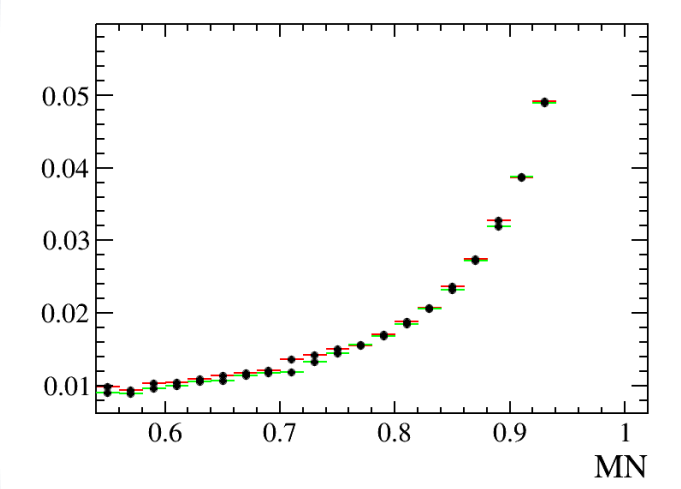
Everything consistent with statistical fluctuations!

MC Data comparison

We performed MC/Data comparison using weights provided by Sam.







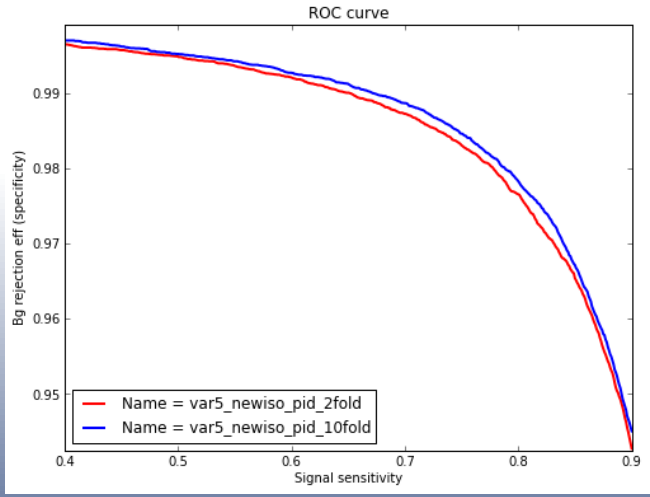
Conclusion

New Isolation in slightly better agreement.
MatrixNet in similar agreement as BDT.

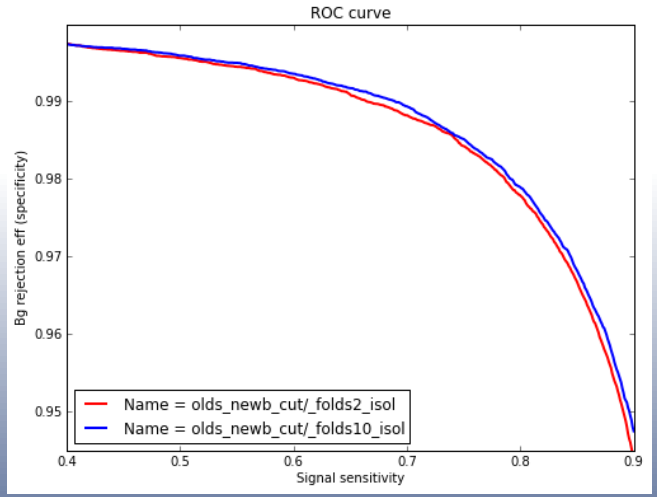
Effect of new K-pi mass window on the chopping I

Due to enlarged K-pi mass window the gain of chopping is reduced (but remember, the chopping helps also in keeping the results more homogeneous)

SMALL K* mass.



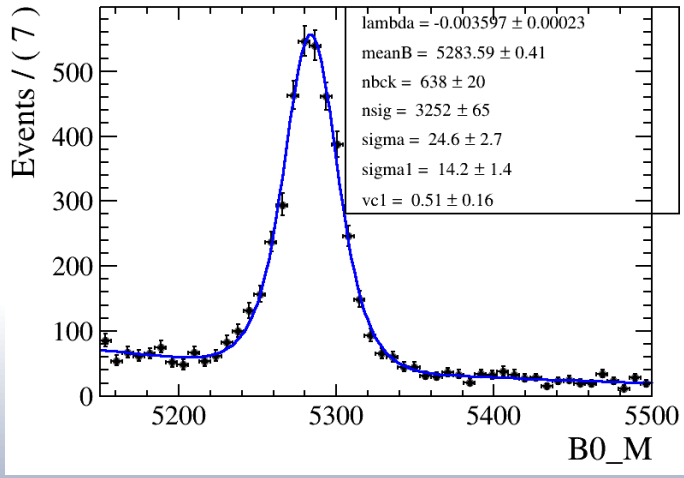
LARGE K* mass.



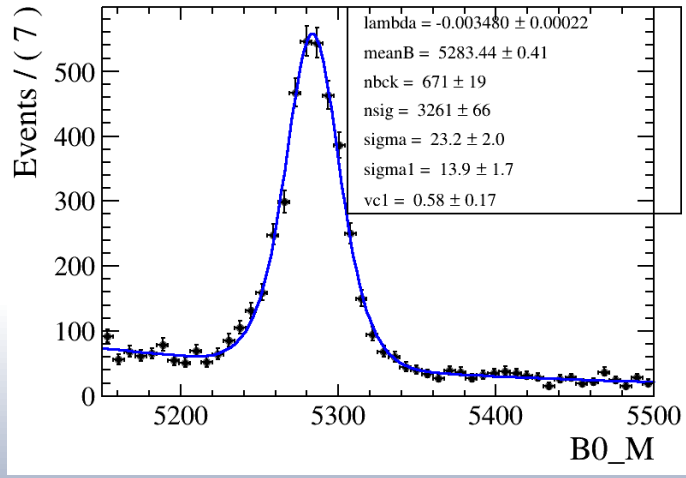
Effect of new K-pi mass window on the chopping II

We disagree with Sam on this issue.
Not easy to drive conclusion on ROC curve. Numerical results from 2 vs 10 Folds training.

10 Folds, Large K^* mass cut.



2 Folds, Large K^* mass cut.



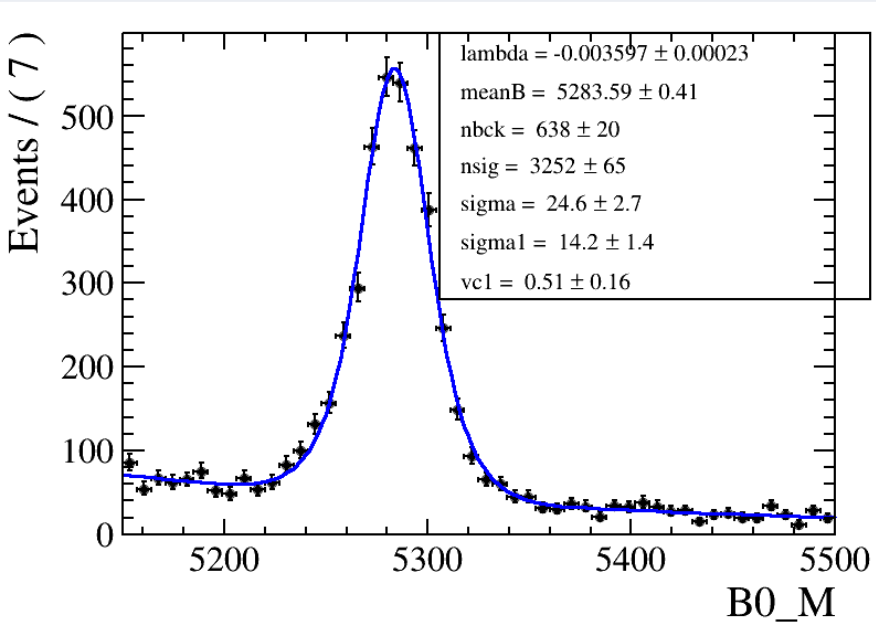
Conclusion

One gaisn 5% background rejection.

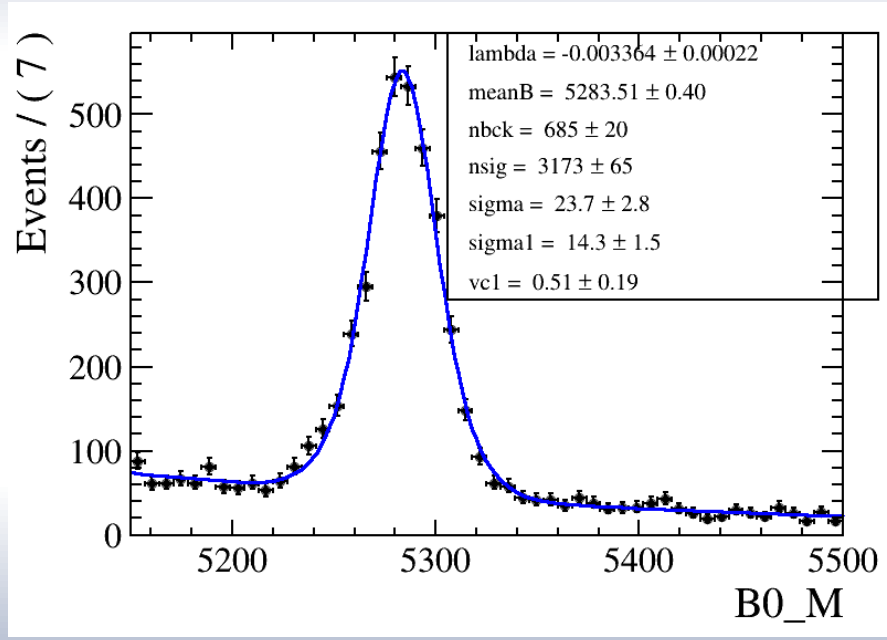
TMVA vs MN

Both classifiers show the same level of correlation in angles. Let's see their performance.

MatrixNet



BDTG



Conclusion

Matrix Net we gain 2.4% in signal and 6.9% of bck rejection.

MatrixNet numbers

q^2	MatrixNet		BDTG	
$[GeV^2]$	Signal	Bck	Signal	Bck
$0.1, 2$	484 ± 24	54 ± 7	465 ± 24	58 ± 7
$2, 4.3$	291 ± 21	84 ± 8	270 ± 20	98 ± 7
$4.3, 8.68$	823 ± 34	221 ± 11	807 ± 34	235 ± 11
$10.09, 12.86$	660 ± 28	138 ± 7	658 ± 28	142 ± 8
$14.18, 16$	481 ± 24	58 ± 5	467 ± 24	66 ± 6
$16, 19$	532 ± 25	60 ± 7	529 ± 25	61 ± 7
$0.1, 19$	3252 ± 65	638 ± 20	3173 ± 65	685 ± 20

Conclusion

1. Agreement in the MVA distribution for different sub-samples from the chopping: chopping helps in keeping results more homogeneous!
2. Effectively we can use one classifier; simplification of the analysis.
3. Slightly better performance of chopping in case of Larger K^* mass window.
4. New isolation is slightly better then the $B_s^0 \to \mu\mu$.
5. MatrixNet performed slightly better then BDT.

From last time (in agreement with present Sam's studies)

- ProbbNN performs better than DLL (from our studies 15% less background)
- NewIso slightly better than $B_s^0 \to \mu\mu$ (but with better Data/MC agreement).

BACKUP

Acceptance MatrixNet

MatrixNet