$B^0 \to K^* \mu^- \mu^+$ selection update

Marcin Chrząszcz
Małgorzata Pikies

University of Zurich[UZH]

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# Selection requirements

- Used good old Stripping line: `B2XMuMu_Line` (S21).
- In additional to stripping cuts $DLL_K > 1$ applied.
- Trigger used:

L0DiMuonDecision, L0MuonDecision
Hlt1TrackMuonDecision, Hlt1TrackAllL0Decision
Hlt2Topo(2,3)BodyBBDTDecision, Hlt2TopoMu(2,3)BodyBBDTDecision, Hlt2DiMuonDecision

- All lines in TOS.
- Selection follows previous $B \rightarrow K\mu\mu$ analysis.

MVA training

- Used the standard k-Folding technique with 10 folds.
- As always randomized the folds etc.
- As signal proxy used the *Splot* $B^+ \to K^+ J/\psi$.
- *Mass modelled with double CB and single exponent.*

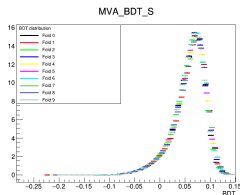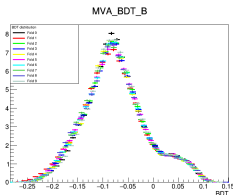A RooPlot of "B_plus_M"
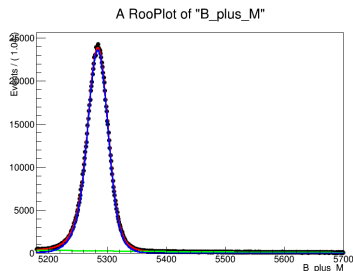
- The fitted parameters in agreement with previous analysis.

BDT

- Used the standard k-Folding technique with 10 folds.
- Variables used in the training:

```
     K_Kst_IPCHI2_OWNPV
  B_plus_ENDVERTEX_CHI2
   e_minus_IPCHI2_OWNPV
    e_plus_IPCHI2_OWNPV
  J_psi_1S_IPCHI2_OWNPV
          B_plus_PT
   B_plus_IPCHI2_OWNPV
      B_plus_FD_OWNPV
      B_plus_DiraAngle
           B_plus_P
           K_Kst_P
```

- Used the standard k-Folding technique with 10 folds.
- Variables used in the training:

- Standard BDT training no optimisation:
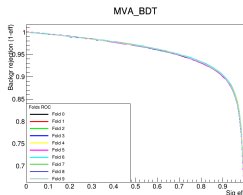
- All folds are in very good agreement!

BDT

- Used the standard k-Folding technique with 10 folds.
- Variables used in the training:
- Standard BDT training optimisation (optimized on area under the ROC curve):
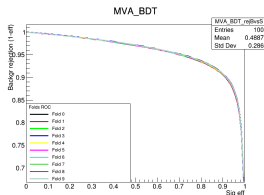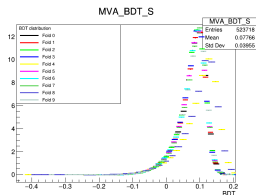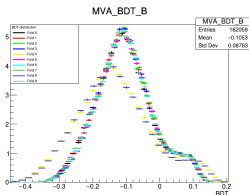
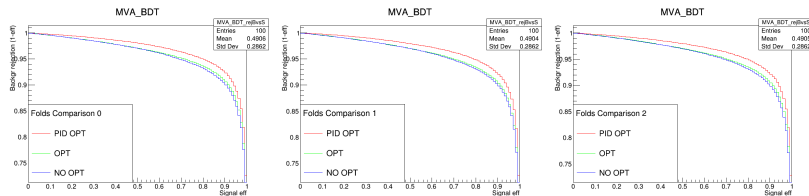- 2 folds are different, but this is only the artefact of the BDT.

- Used the standard k-Folding technique with 10 folds.
- Variables used in the training:
- Standard BDT training optimisation (optimized on area under the ROC curve):
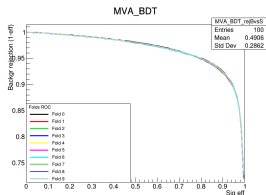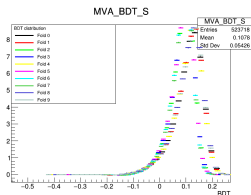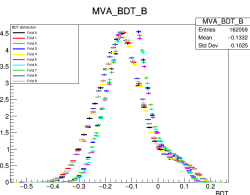
- Again the artefact of the optimisation.

Performance comparison

- Now let's compare the gain on optimizing the parameters of the BDT.

- Clearly the PID and optimisation helps in the MVA!

To do

- Fix the artefacts in of the DBT training for the optimised observables.
- Days before Xmas Danny added the utility to EOS to generate events, so I plan to produce toy MC that can be used for studies and later on for systematics.
- Start looking at the acceptance correction:
  - Cross check that all variables are modeled well in MC(should be as they have been ok for $B \to K^* \mu\mu$).
  - From Kaggle contests there was an idea to use a BDT driven method to unfold the distributions.
  - Will also cross check the normal moments method of unfolding.

Backup