Kinematical Fit & MVA Training

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Kinematical Fit

This method is based on the *TKinFitter package* . More details are available in **CMS AN 2005/025**.

- 4 constrainsts are used: $mW_{lep}, mW_{had}, mTop_{lep}, mTop_{had}$.
- The parameterization is : $\vec{p} = (E_T cos\phi, E_T sin\phi, E_T sinh\eta), E = E_T cosh\eta$
- We up to 7 jets are used to construct the χ^2.
- Only such combination of 4 fitted jets with fit. muon and MET is used which has minimal χ^2 and has been converged.

Events preselection

The selection of semimuonic ttbar events among overwhelming background is done using the following steps.

- SisCone algorithm with $\Delta R = 0.5$ is used to construct jets.
- JES Corrections L2L3 are used
- The lepton impact parameter d0 is calculated with respect to the offline Beamspot
- $Reliso = (E_{calo}(Iso) + P_T(tracker, Iso))/P_T(\mu)$

Table: The Selection derived from TOP-09-003

Step	Description
Step1	$\geq$ 4 jets with $Pt > 30GeV$ (corrected), $\eta < 2.4$
Step2	One GM muon with : $Pt > 30GeV$, $\eta < 2.1$, $N(hits) >= 11$, $d0 < 200\mu$, $\chi^2/ndf < 10$, $Reliso < 0.05$
Step3	veto on the number of muons. The Number == 1.
Step4	veto on electrons (no electrons which are GsfElectron, $\eta < 2.5$, $Pt > 30GeV$, $Reliso < 0.05$)
Step5	Reconstructed MET. No cuts on MET are applied

Kinematical variables of KinFit

- pT_{hadtop}
- η_{hadtop}
- pT_{leptop}
- η_{leptop}
- pT_{hadB}
- η_{hadB}
- pT_{lepB}
- η_{lepB}
- $\Delta\phi(hadB, hadtop)$
- $\Delta\theta(hadQ, hadQBar)$
- $\Delta\phi(hadB, hadW)$
- $\Delta\phi(lepB, lepW)$
- pT_{3jet}/pT_{4jet}
- $\Delta M(leptop, lepW)$
- $\Delta R(leptop, lepW)$
- $\Delta M(hadtop, hadW)$
- $\Delta R(hadtop, hadW)$

Kinematical variables from CMS NOTE 2006/013.

- Perform non-linear least-square kinemtical fit.
- The fit produces combinations of two fitted jets corresponding to b-quarks, fitted muon and neutrino.
- Choose the combination with minimal χ^2.
- Construct W_{lep}, W_{had}, t_{lep}, t_{had} candidates from fitted objects.
- Use kinematical variables to train mva.

Sample used for study

- PYTHIA6 from SUMMER09@7TeV samples.
- https://twiki.cern.ch/twiki/bin/view/CMS/ProductionSummer2009at7TeV
- ttbar events: /TTbar/Summer09-MC_31X_V3_7TeV-v5/GEN-SIM-RECO/
- W+jets events: /Wmunu/Summer09-MC_31X_V3_7TeV-v1/GEN-SIM-RECO
- QCD events: /InclusiveMu15_Pt30/Summer09-MC_31X_V3_7TeV-v1/GEN-SIM-RECO
- Wbb :/Wbb0Jets-alpgen/Summer09-MC_31X_V3_7TeV-v2/GEN-SIM-REC
- Zbb: /Zbb0Jets-alpgen/Summer09-MC_31X_V3_7TeV-v1/GEN-SIM-RECO

Preselecton. Cut Flow Table

Table for TTbarPresel
Xsection in pb 94.3

Evnt tot	Evnt jets rej	Evnt muon rej	Evnt ele rej	Evnt rej MET	GenEvt rej	Accept to train
209630	191503	9278	8963	8963	8963	0

Table for WjetsPresel
Xsection in pb 7899

Evnt tot	Evnt jets rej	Evnt muon rej	Evnt ele rej	Evnt rej MET	GenEvt rej	Accept to train
2022023	790086	283	283	283	283	0

Table for WbbPresel
Xsection in pb 5.0724

Evnt tot	Evnt jets rej	Evnt muon rej	Evnt ele rej	Evnt rej MET	GenEvt rej	Accept to train
377004	306843	22	21	21	21	0

Table for ZbbPresel2
Xsection in pb 1.8046

Evnt tot	Evnt jets rej	Evnt muon rej	Evnt ele rej	Evnt rej MET	GenEvt rej	Accept to train
36618	30506	6	6	6	6	0

Table for QCDPresel
Xsection in pb 6.116e+07

Evnt tot	Evnt jets rej	Evnt muon rej	Evnt ele rej	Evnt rej MET	GenEvt rej	Accept to train
6411818	6409883	3	3	3	3	0

END)

MVA Training. Cut Flow Table

Table for TTbarTrainMVA10
Xsection in pb 94.3

Evnt tot	Evnt jets rej	Evnt muon rej	Evnt ele rej	Evnt rej MET	GenEvt rej	Accept to train
4696	4696	4696	4696	4696	4696	4414

Table for WjetsTrainMVA10
Xsection in pb 7899

Evnt tot	Evnt jets rej	Evnt muon rej	Evnt ele rej	Evnt rej MET	GenEvt rej	Accept to train
283	283	283	283	283	283	265

Table for WbbTrainMVA10
Xsection in pb 5.1528

Evnt tot	Evnt jets rej	Evnt muon rej	Evnt ele rej	Evnt rej MET	GenEvt rej	Accept to train
21	21	21	21	21	21	21

Table for ZbbTrainMVA10
Xsection in pb 1.8046

Evnt tot	Evnt jets rej	Evnt muon rej	Evnt ele rej	Evnt rej MET	GenEvt rej	Accept to train
6	6	6	6	6	6	6

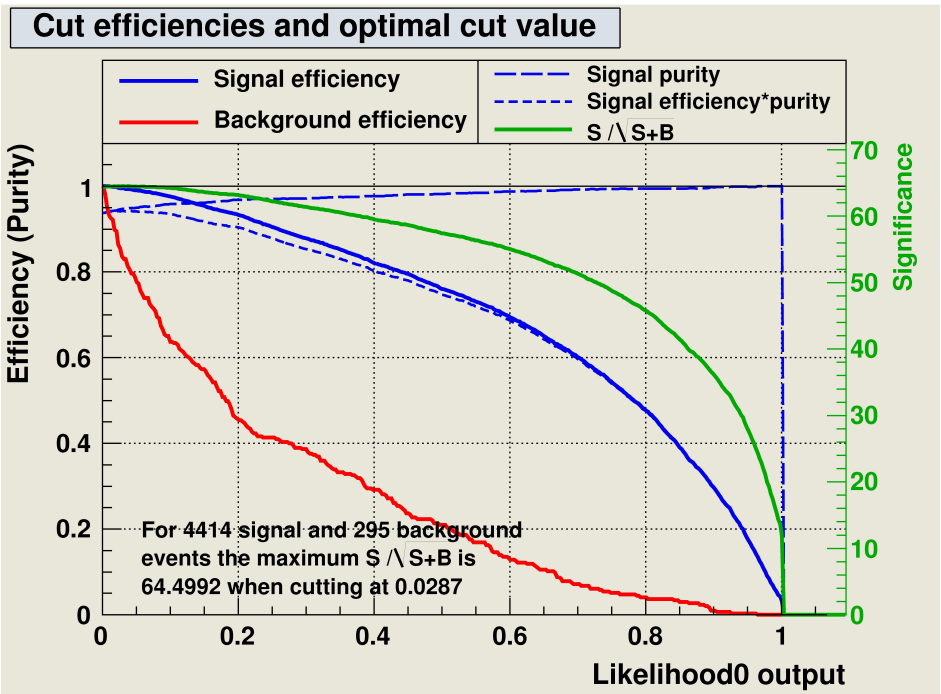
Table for QCDTrainMVA10
Xsection in pb 6.116e+07

Evnt tot	Evnt jets rej	Evnt muon rej	Evnt ele rej	Evnt rej MET	GenEvt rej	Accept to train
3	3	3	3	3	3	3

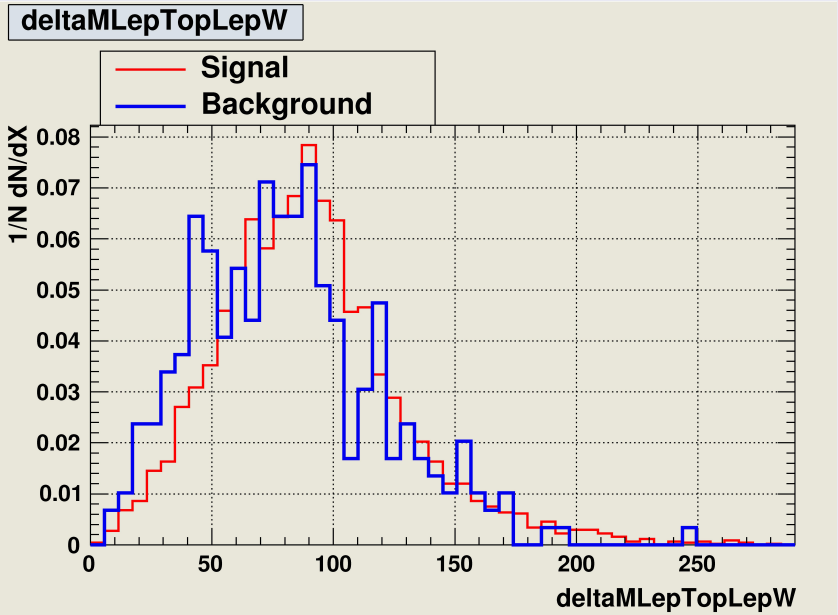
put put (END)

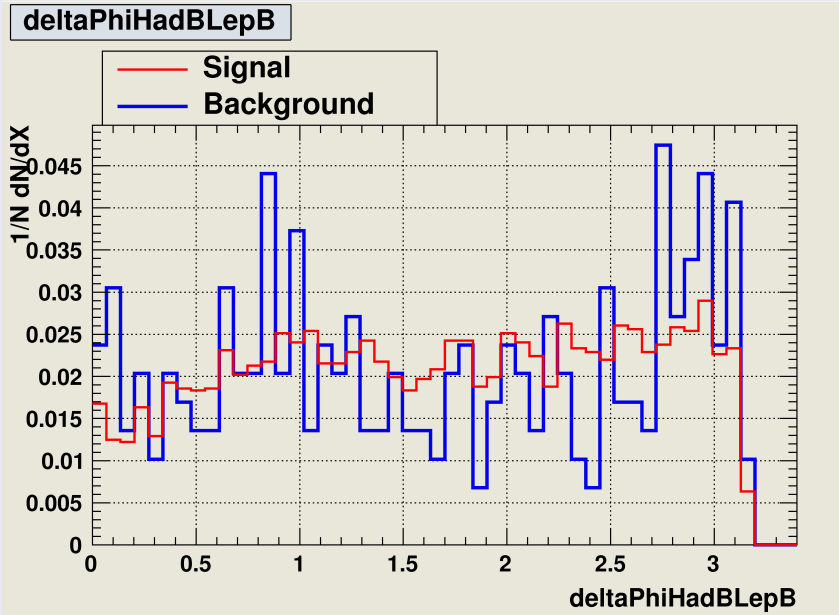
MVA Efficiencies

Figure: MVA Cut. = 0.7378 @ $20pb^{-1}$

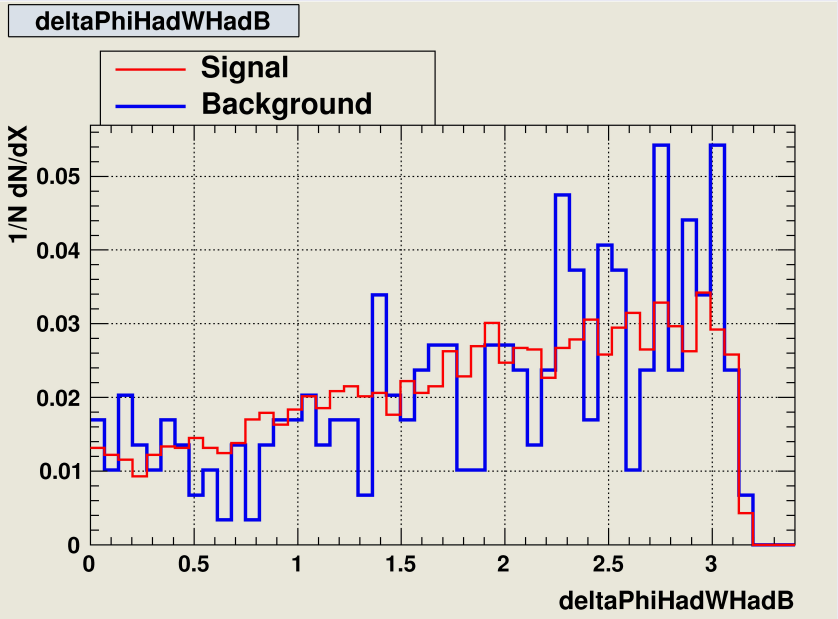


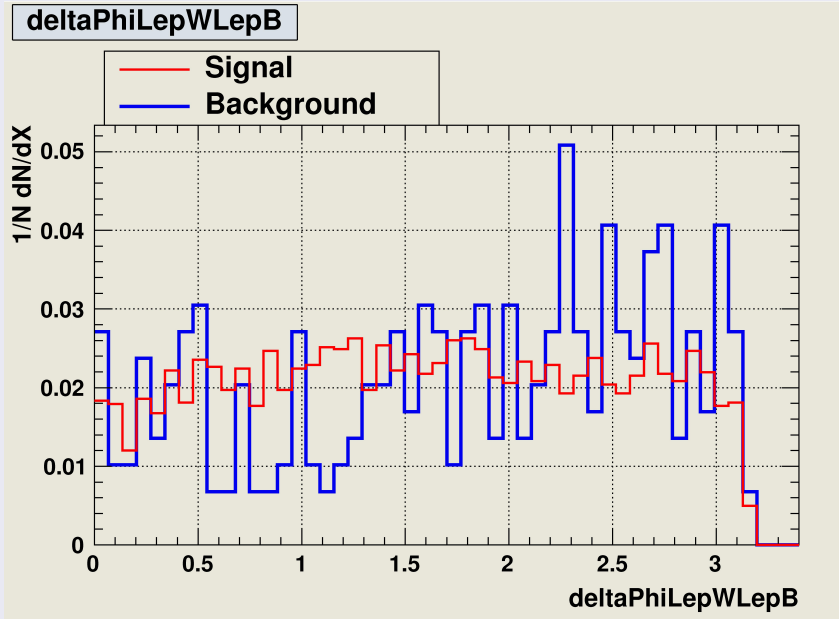
Normalized distributions of the variables.





Normalized distributions of variables.





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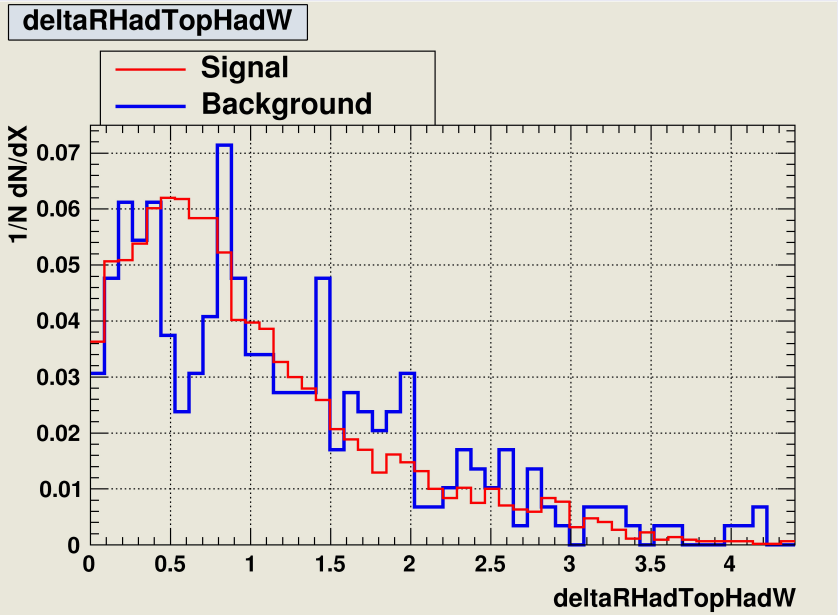

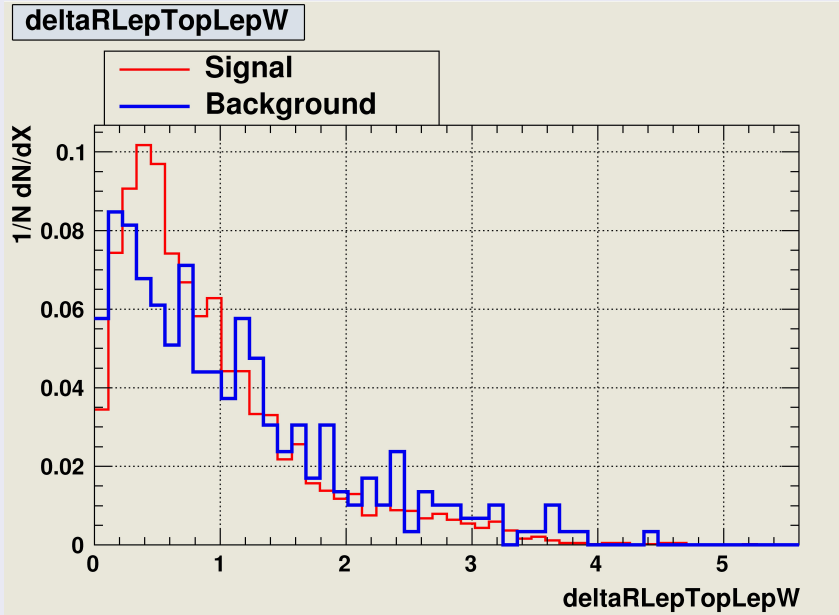

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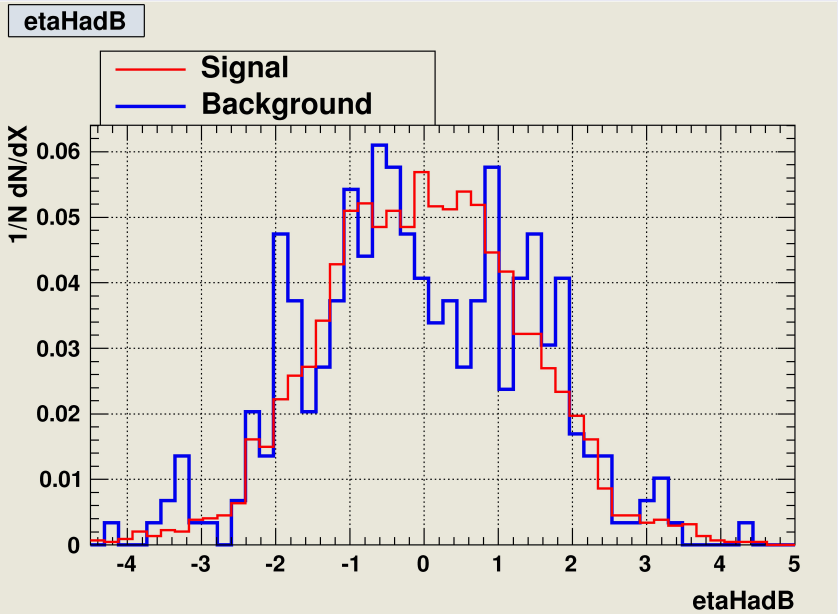

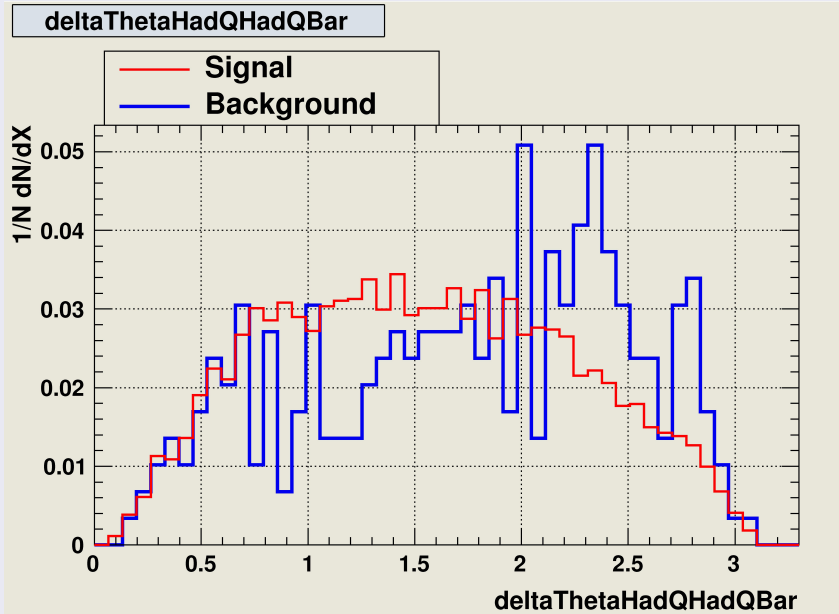

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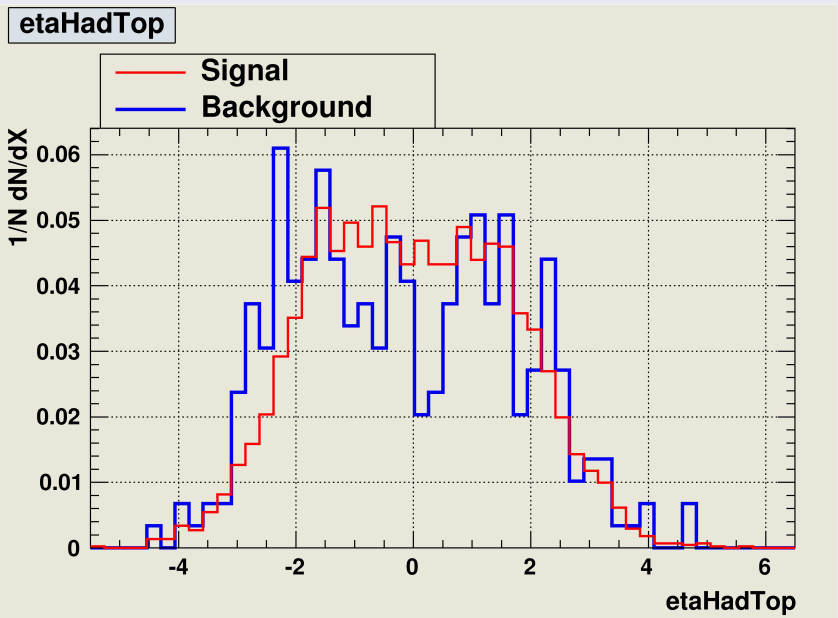

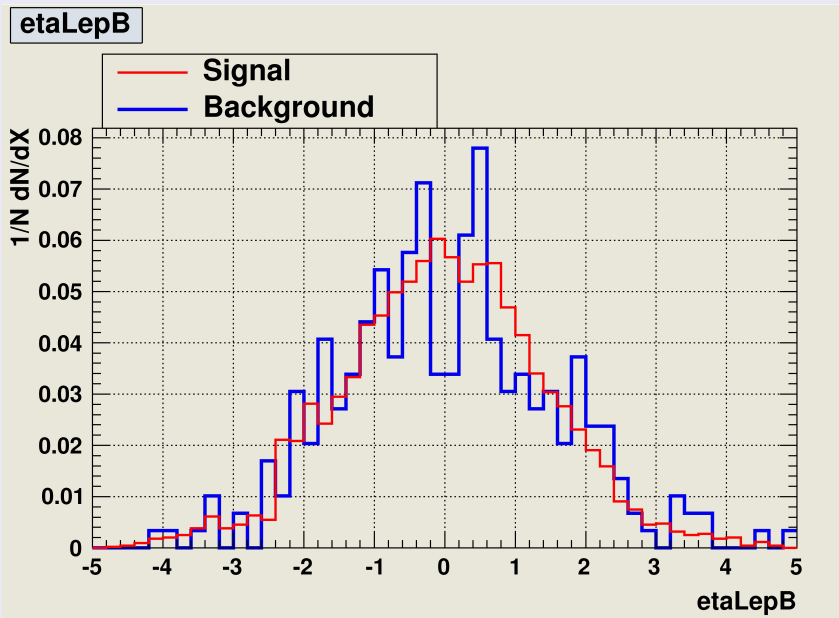

Normalized distributions of variables.