
Semi-tauonic analysis

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Physics Meeting

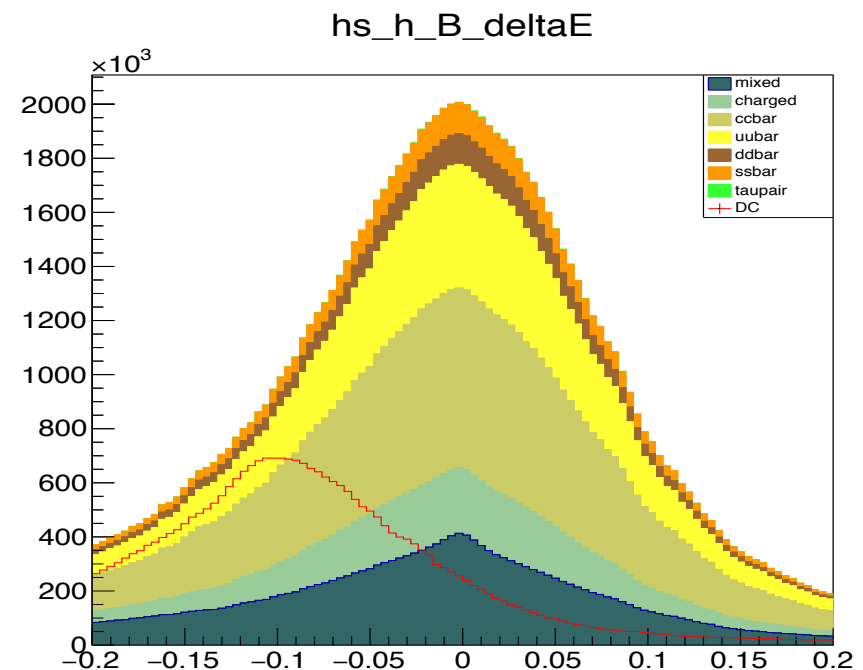
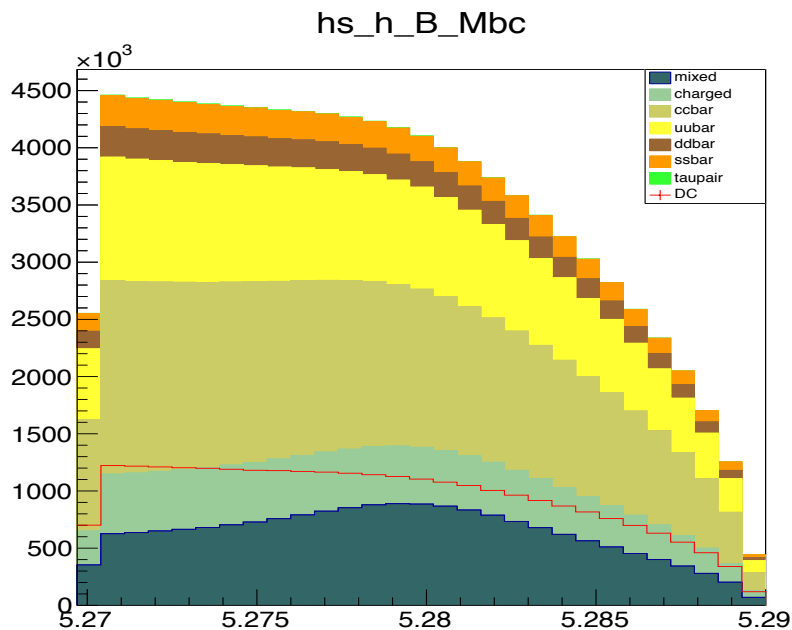
Wednesday, September 5, 18

FEI Data Challenge sample: B0

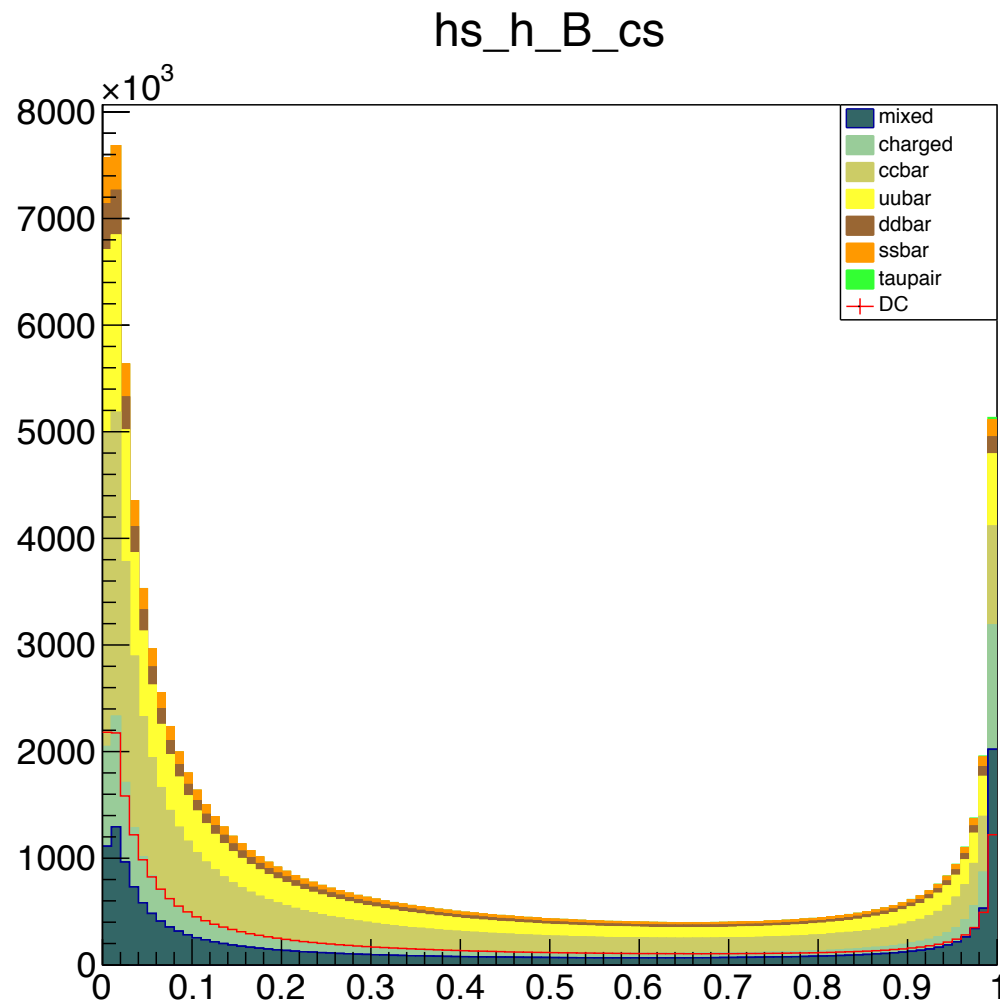
■ B_{tag} cuts:

- $M_{bc} > 5.27 \text{ GeV}/c^2$
- $-0.2 < \Delta E < 0.2 \text{ GeV}$,
- $\text{signalProbability} > 0.001$

- Data challenge (1 ab-1) sample skimmed with **release-02** training.
- MC9 1 ab-1 skimmed with release-01-00-00 training.
- Currently MC9 is being reskimmed with release-02-00-01.



Continuum Suppression



Fast BDT
trained with
Cleo Cones
and KFSW
variables

Cut > 0.6

Signal selection:

□ B_{tag} cuts:

- $M_{bc} > 5.27 \text{ GeV}/c^2$
- $-0.1 < \Delta E < 0.1 \text{ GeV}$,
- $\text{signalProbability} > 0.001$

D cuts:

- **π^+ :good** , track cuts and $p_T > 0.1$
- **K^+ :good** , track cuts and $p_T > 0.1$
- $\pi^0 \rightarrow \gamma\gamma$
 - Gamma tight list
 - $\text{clusterE1E9} > 0.7$
 - $0.124 < \text{InvM} < 0.140 \text{ GeV}/c^2$
- $K_s^0 \rightarrow \pi^+ \pi^-$
 - $0.45 < \text{InvM} < 0.55 \text{ GeV}/c^2$
 - merged list
- **D candidates:**
 - $1.8 < M < 1.9 \text{ GeV}/c^2$
 - $p_{\text{CMS}} < 3.0 \text{ GeV}/$

#	Decay	BF
1	$D^+ \rightarrow K^- \pi^+ \pi^+$	$8.98 \pm 0.28\%$
2	$D^+ \rightarrow K^- \pi^+ \pi^+ \pi^0$	$5.98 \pm 0.23\%$
3	$D^+ \rightarrow K_s^0 \pi^+$	$1.47 \pm 0.08\%$
4	$D^+ \rightarrow K_s^0 \pi^+ \pi^- \pi^+$	$2.97 \pm 0.11\%$
5	$D^+ \rightarrow K_s^0 \pi^+ \pi^0$	$7.05 \pm 0.27\%$
6	$D^+ \rightarrow K_s^0 K^+$	1.05%
7	$D^0 \rightarrow K^- \pi^+$	$3.89 \pm 0.04\%$
8	$D^0 \rightarrow K_s^0 \pi^0$	$1.19 \pm 0.04\%$
9	$D^0 \rightarrow K^- \pi^+ \pi^0$	$14.2 \pm 0.5\%$
10	$D^0 \rightarrow K^- \pi^+ \pi^- \pi^+$	$8.11 \pm 0.15\%$
11	$D^0 \rightarrow K_s^0 \pi^+ \pi^-$	$2.75 \pm 0.18\%$
12	$D^0 \rightarrow K_s^0 \pi^+ \pi^- \pi^0$	$5.1 \pm 0.6\%$

Signal Selection:

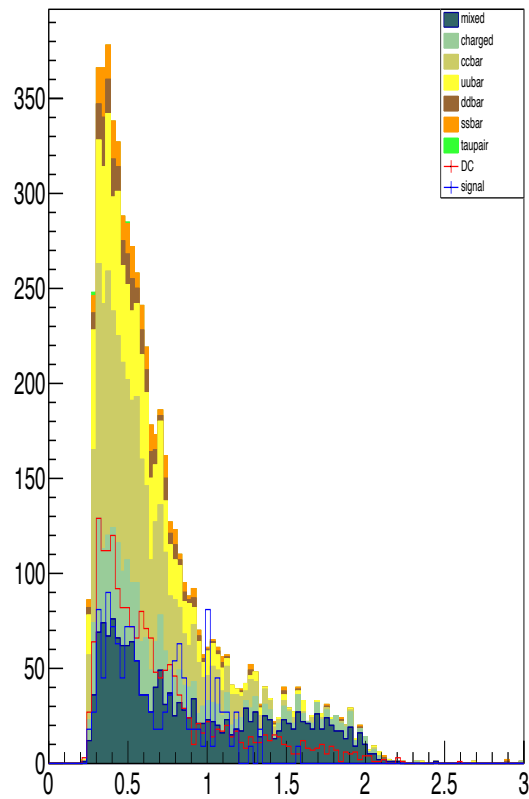
Mode	Decay	BF
1	$D^{*+} \rightarrow D^0 \pi^+$	$67.7 \pm 0.5 \%$
2	$D^{*+} \rightarrow D + \pi^0$	$30.7 \pm 0.5 \%$

$$60 < p_{\pi} < 250 \text{ MeV}$$
$$0.139 < M_{D^*} - M_D < 0.160 \text{ GeV}$$

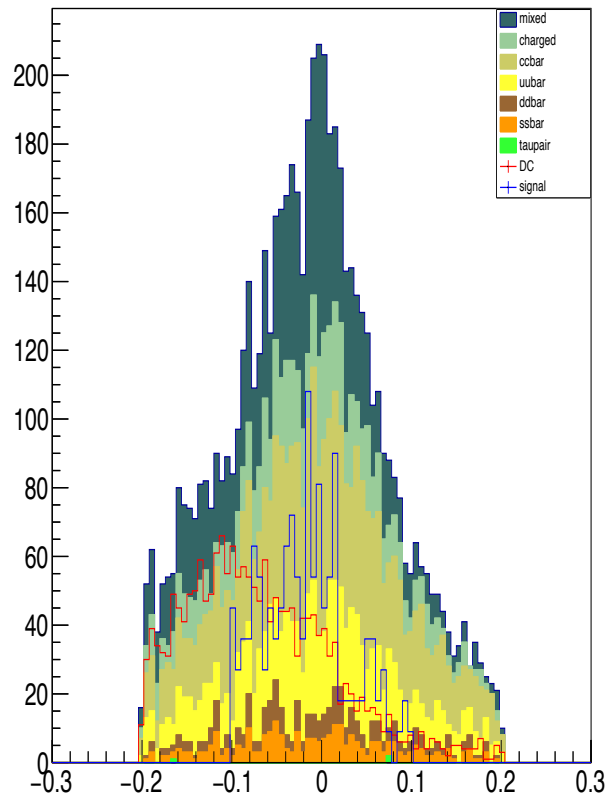
- ROE tracks: $p_T > 50 \text{ MeV}$ and $-2 < d_r < 2$ and $-4.0 < d_z < 4.0$
- ROE clusters:
 - $[\text{clusterReg} == 1 \text{ and } \text{clusterR} > 0.06 \text{ and } \text{abs}(\text{clusterTiming}) < 18]$
 - $[\text{clusterReg} == 2 \text{ and } \text{clusterE} < 0.06 \text{ and } \text{abs}(\text{clusterTiming}) < 20]$ or
 - $[\text{clusterReg} == 3 \text{ and } \text{clusterE} < 0.056 \text{ and } \text{abs}(\text{clusterTiming}) < 44]$
 - ROE charge == 0 ,
 - # of ROE tracks == 0,
 - Choose candidate with lowest E_{extra} and highest B_{tag} signal probability.
 - $P_{\text{miss}} > 200 \text{ MeV}$
 - $Q^2 > 4 \text{ GeV}$

$B^0 \rightarrow D^+ \tau \nu$:

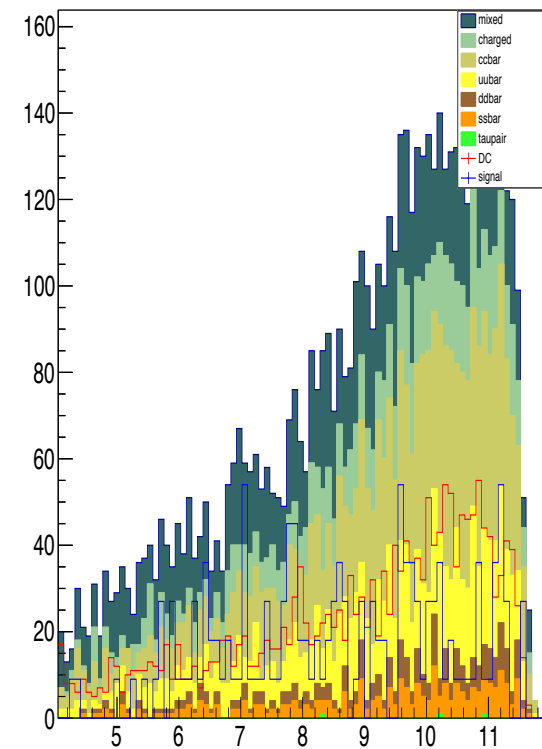
hs_h_Bsig_plepton



hs_h_Btag_deltaE

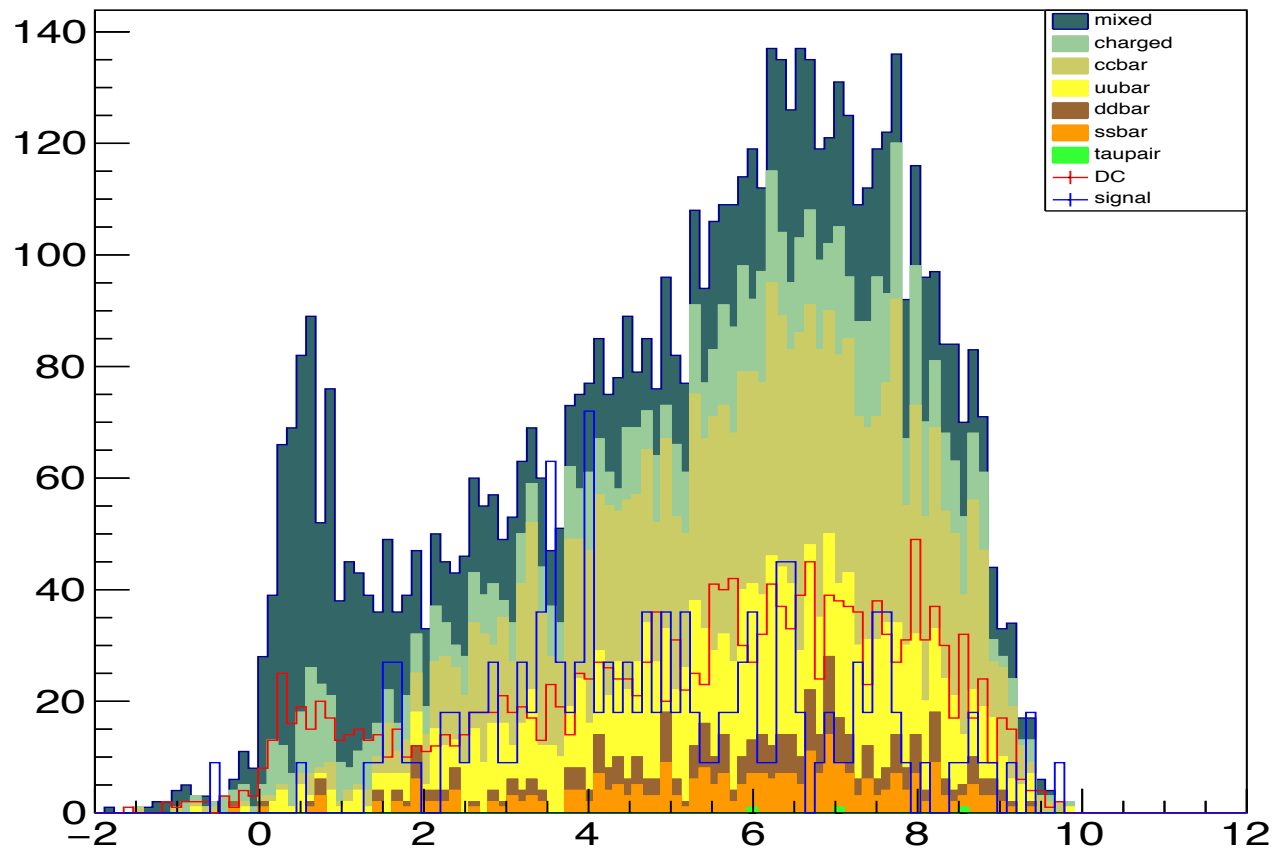


hs_h_BsigQ2



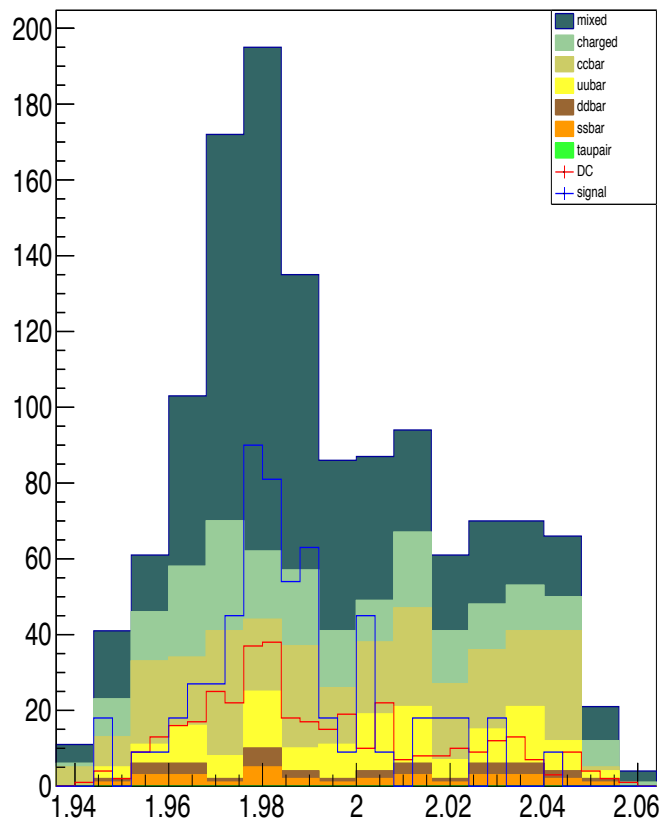
$B^0 \rightarrow D^+ \tau \nu$:

hs_h_Bsig_M2recoil

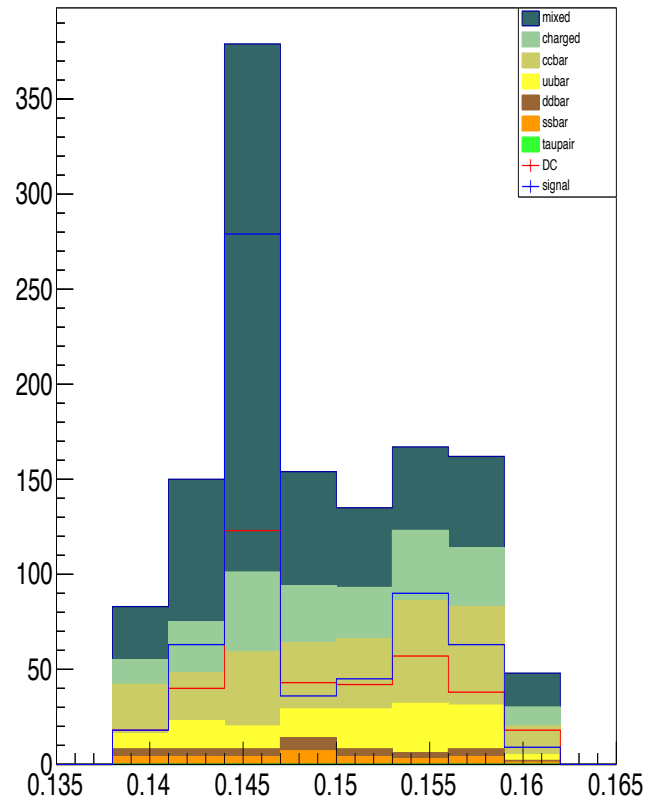


$$B^0 \rightarrow D^{*+} + \tau \nu:$$

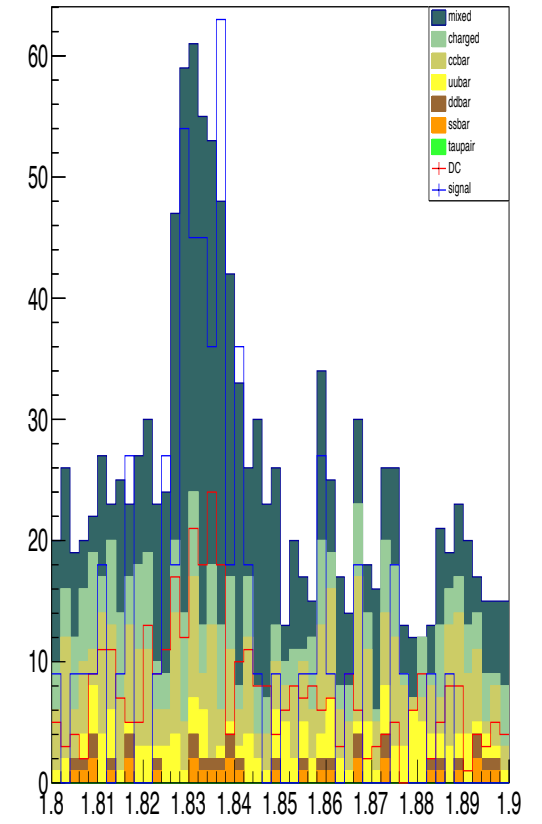
hs_h_Bsig_DstarMass



hs_h_Bsig_DstMassDiff

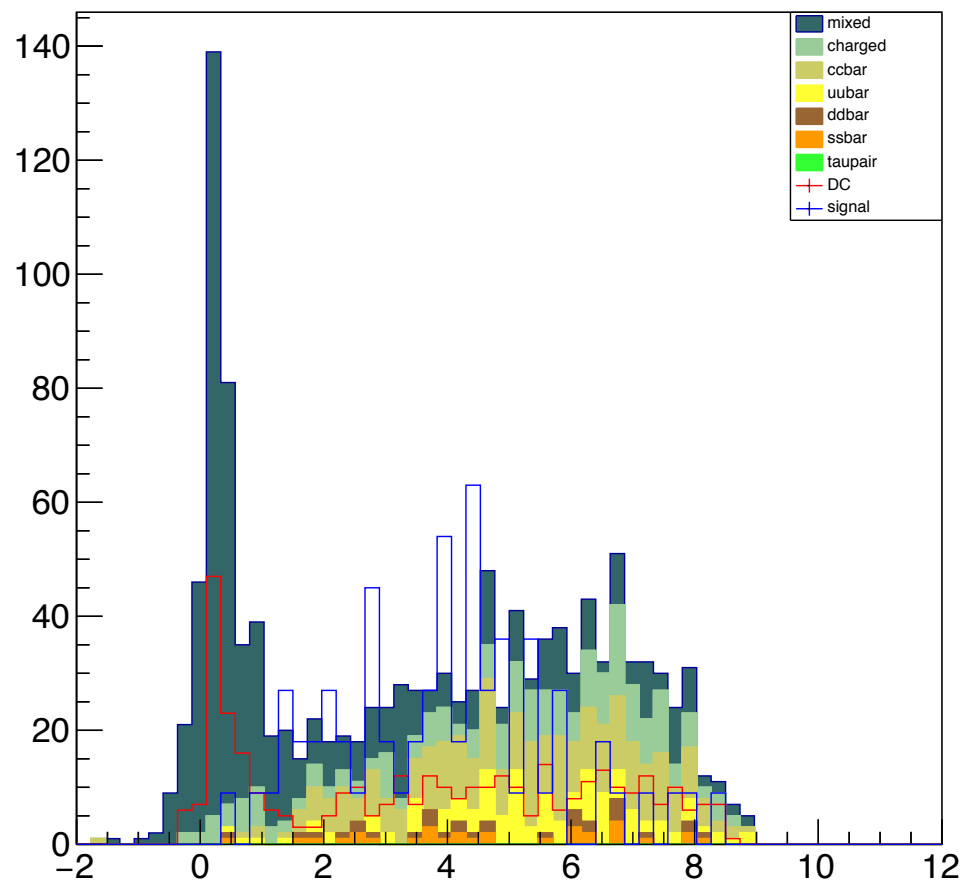


hs_h_Bsig_Dmass

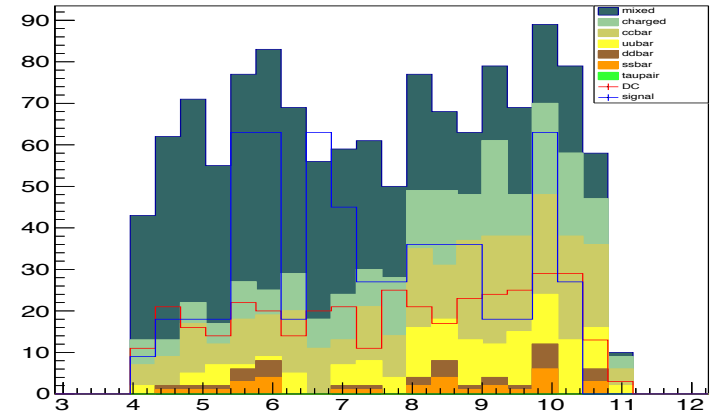


$$B^0 \rightarrow D^{*+} + \tau \nu:$$

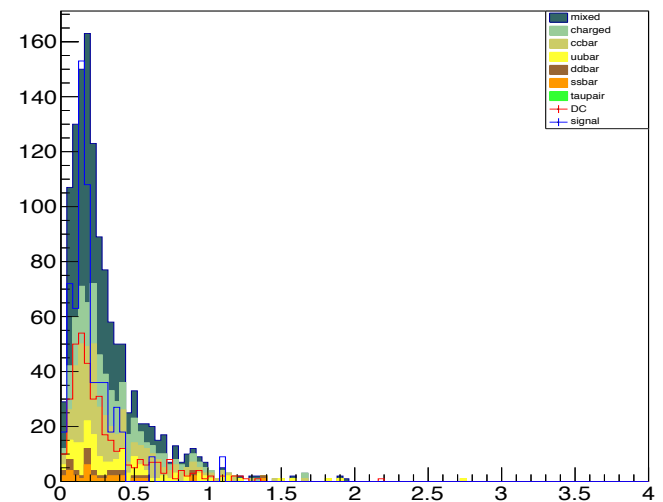
hs_h_Bsig_M2recoil



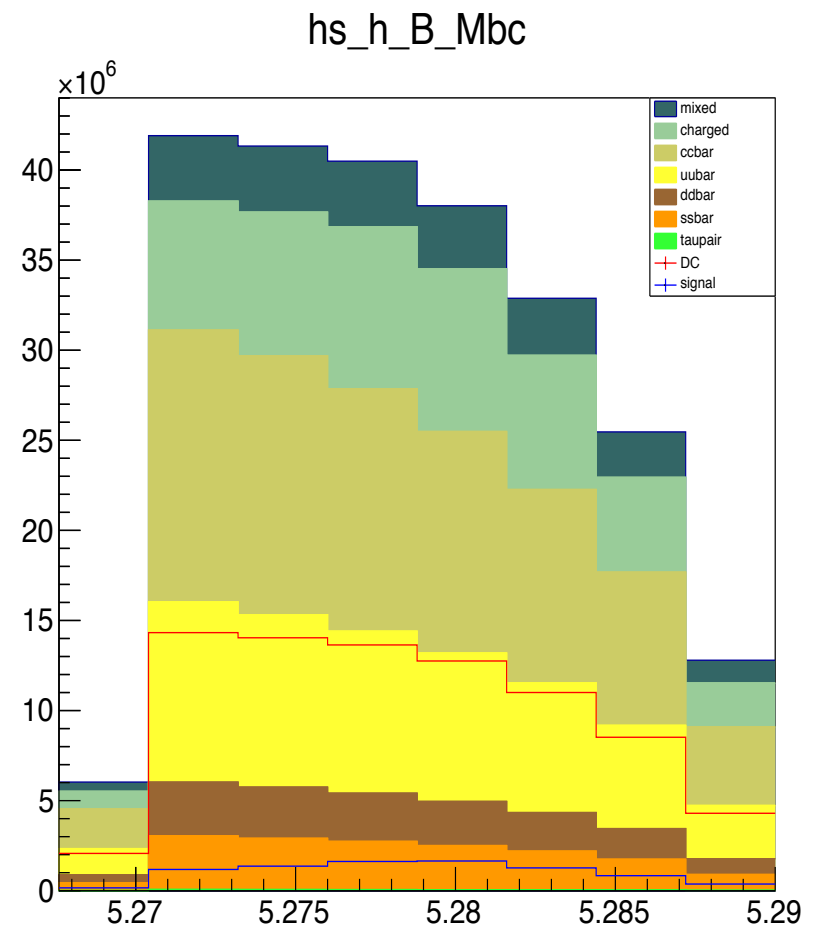
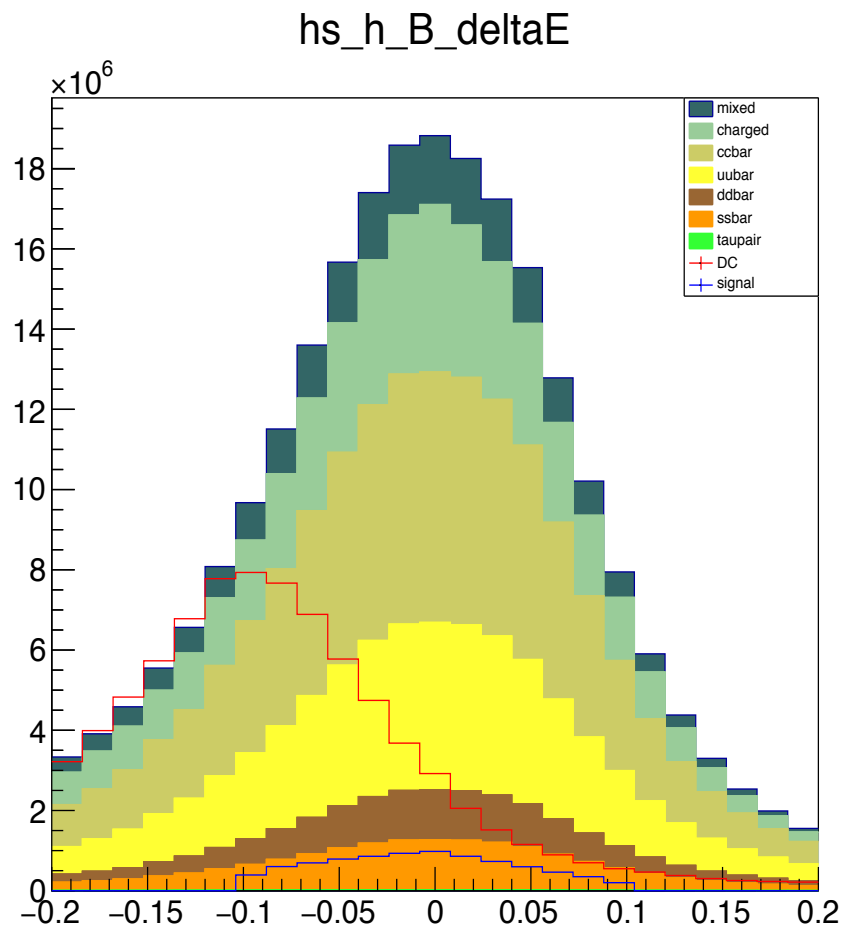
hs_h_BsigQ2



hs_h_Bsig_Eextra

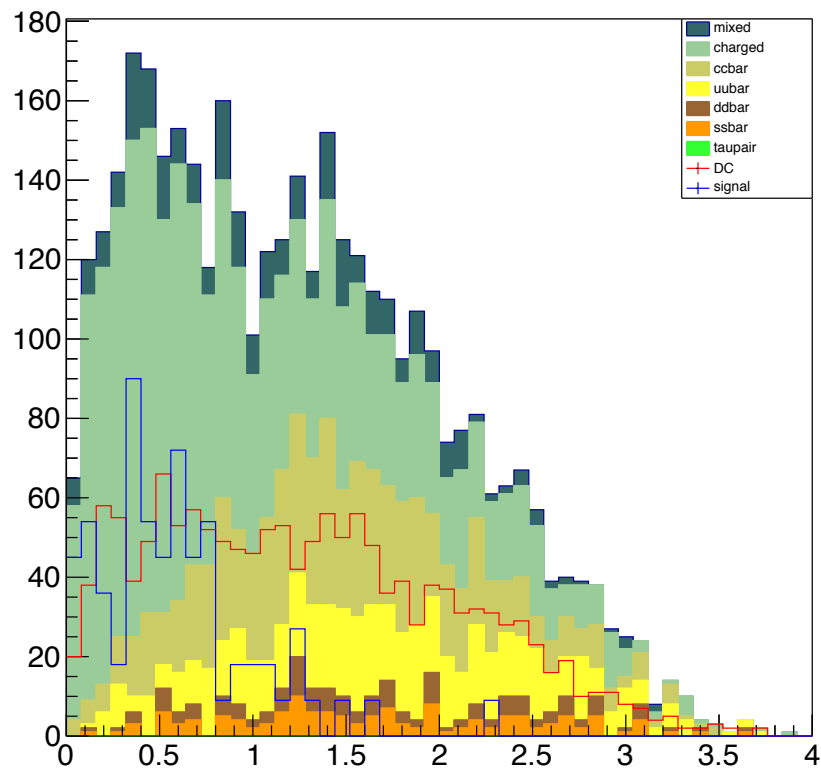


B⁺:

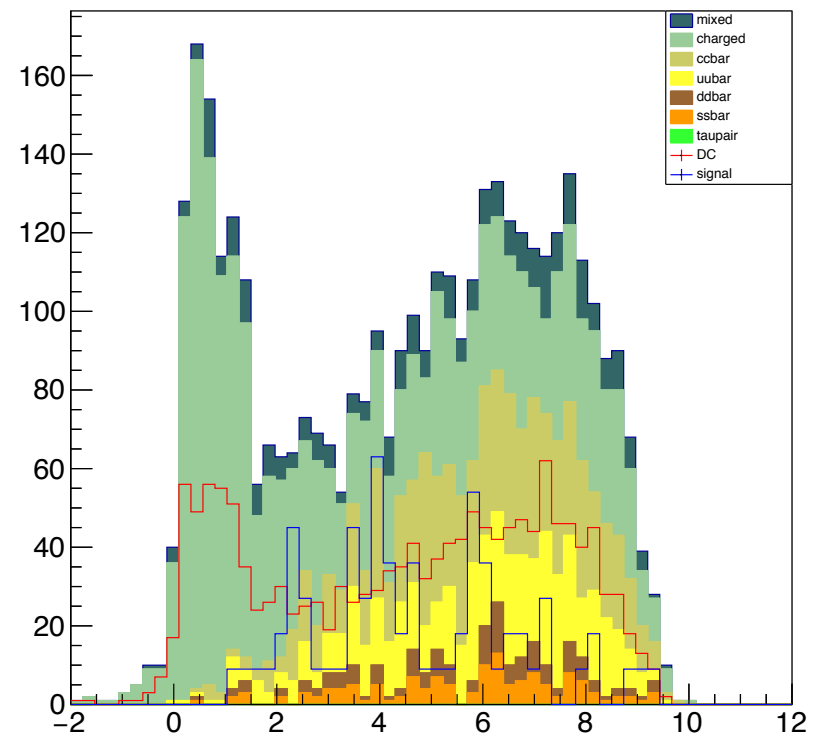


$B^+ \rightarrow D^0 \tau \nu$:

hs_h_Bsig_Eextra



hs_h_Bsig_M2recoil



Partial Reconstruction analysis

Full prod 5 run:

Track cuts: $-2 < dz < 2.0$, $dr < 0.5$ $p_{\text{CMS}} > 1.2$

Electrons: $E/p > 0.8$

Muons: $\text{muon ID} > 0.2$

$60 < \text{pion Momentum} < 200 \text{ MeV}$

$B \rightarrow D^* l \nu$, with partial reconstruction of the D^* .

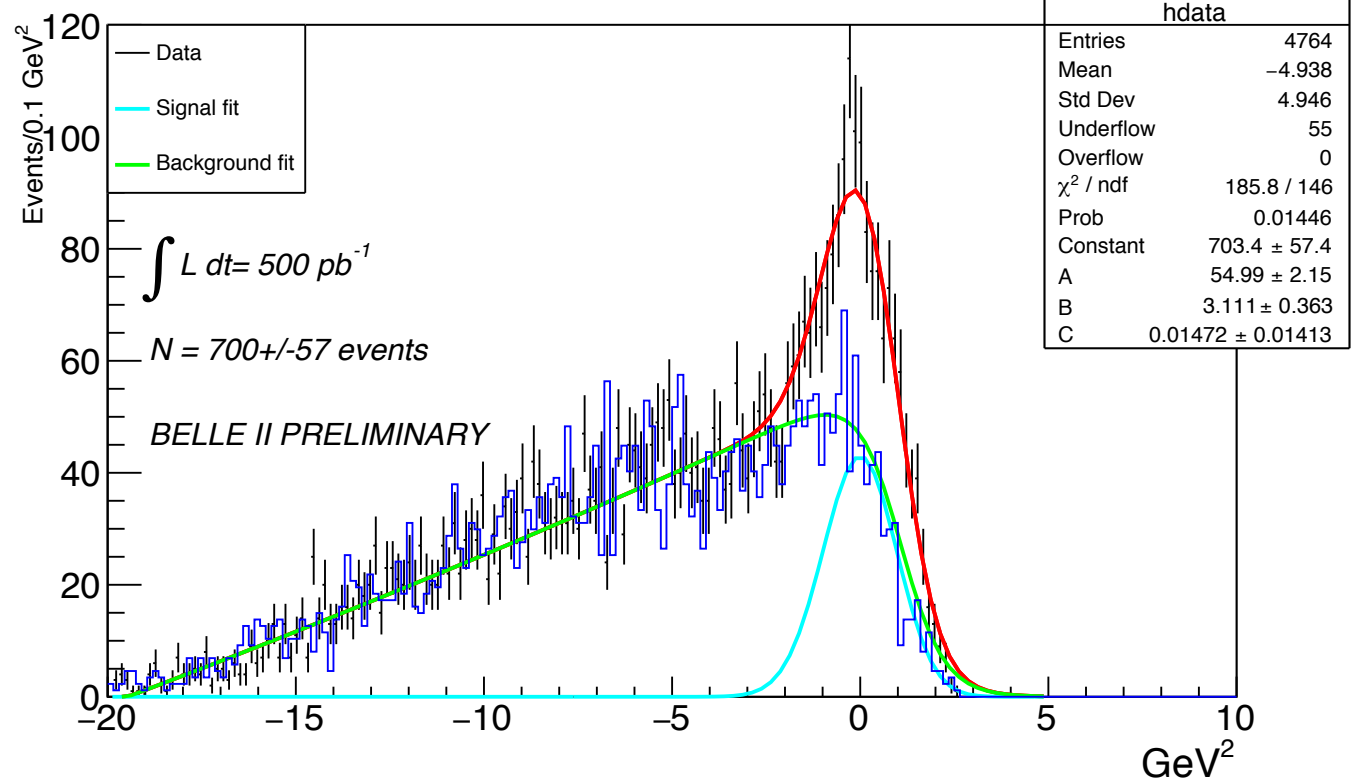
$B0_{\text{sig}} \rightarrow e^- \pi^+$

$B0_{\text{sig}} \rightarrow \mu^- \pi^+$

D^* momentum estimated as a linear function of pion momentum

Background shape estimated with WS data.

Mv2



Conclusion

- Discrepancy between data challenge (release-02 FEI) and MC9 (release-01 FEI).
 - MC9 skims with FEI release-02 are ongoing.
 - Better understanding of deltaE
- Background suppression required or better understanding of backgrounds to uncover new physics signal if any in Data Challenge.
- Partial reconstruction analysis is being worked on.
 - Background suppression is also required.