

# $B \rightarrow D^{*+} \tau \nu$ Signal Selection

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# Btag

█ Cocktail sample with 12, 700, 000 events

█  $B_{\text{tag}} \rightarrow D \pi, D \rightarrow K \pi$

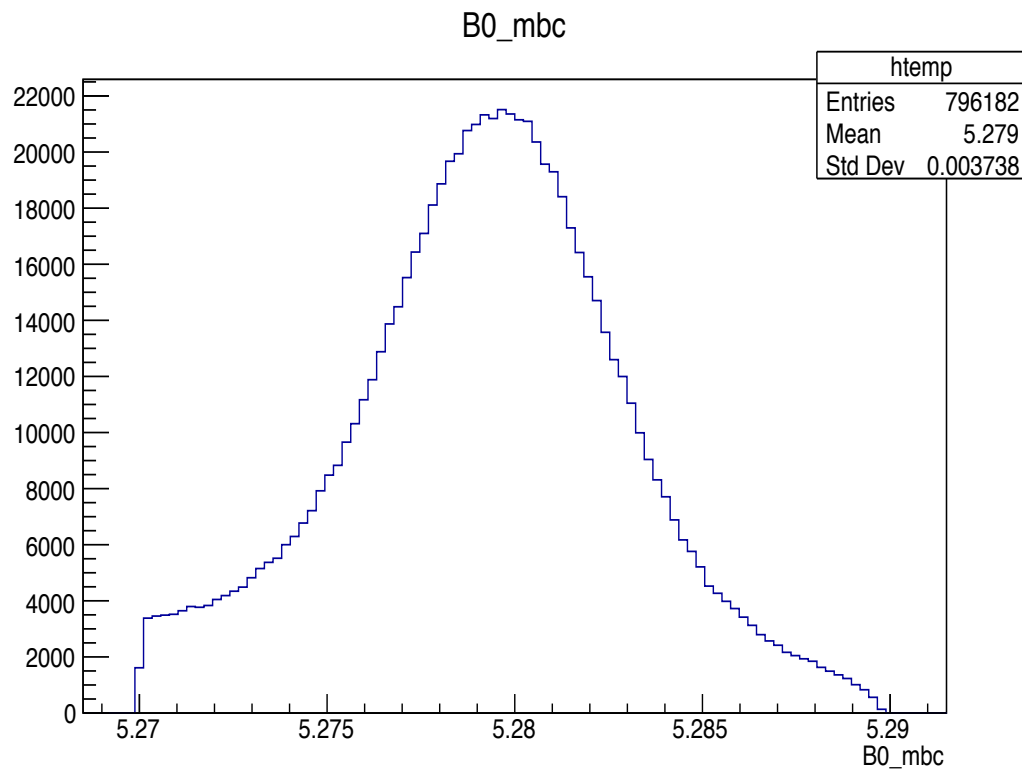
█  $B_{\text{sig}} \rightarrow D^{(*)} \tau \nu$

█  $M_{bc} > 5.27 \text{ GeV}/c^2$

█  $\Delta E < 0.100 \text{ GeV}$

█ Signal Probability  $> 0.100$

█  $R2 < 0.7$  ( $\leftarrow$  loose)

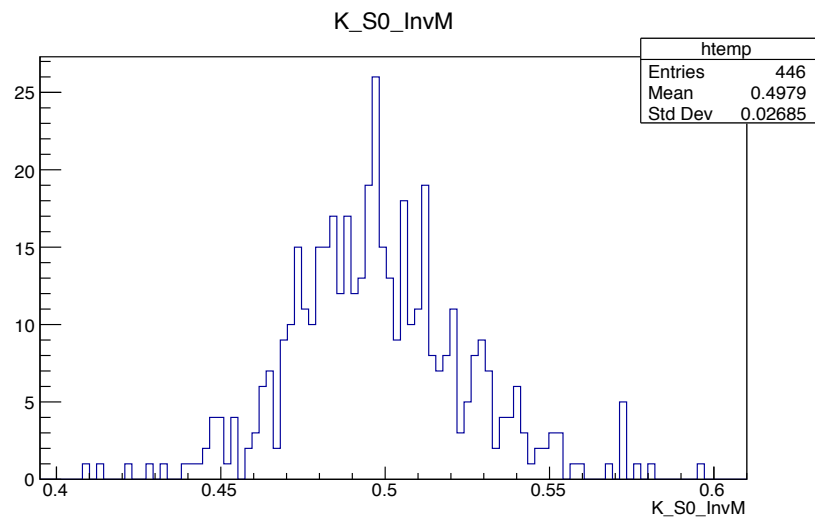
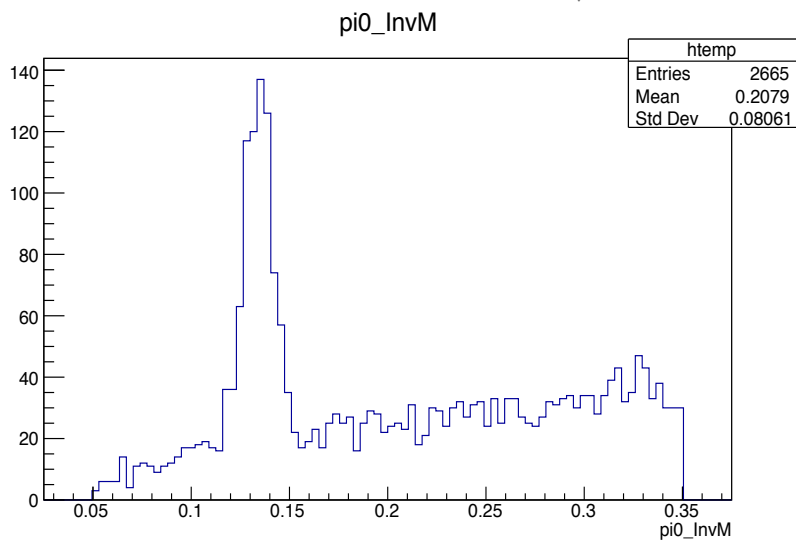


5.4 % of events surviving  
70% truth-matched with  
PDG ID

# B<sub>sig</sub>

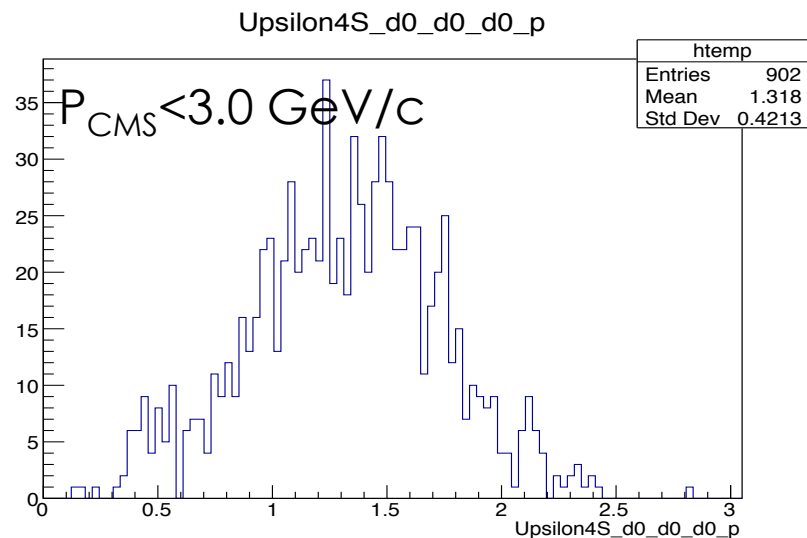
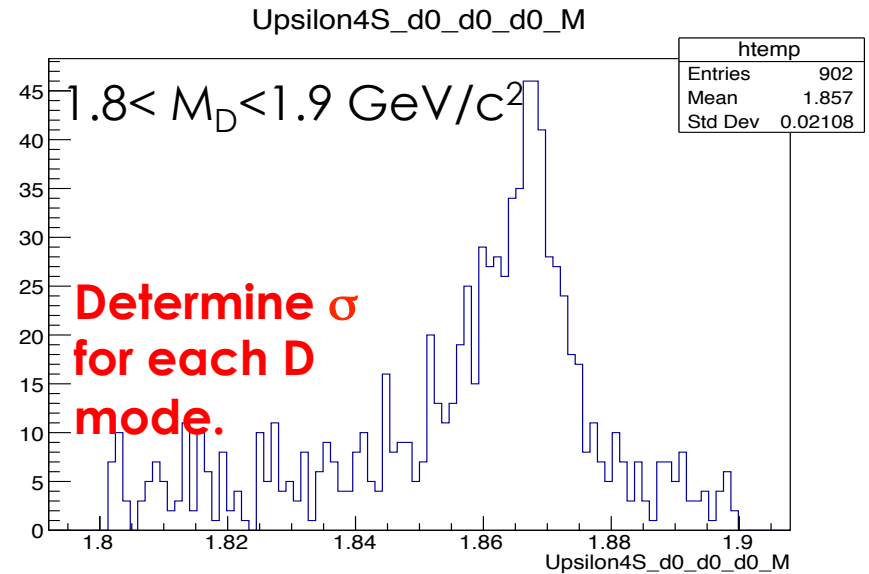
## Tracks:

- ▣  $\pi^+$  : pionID>0.258 and dr < 0.5 and -2 < dz < 2 and pt > 0.1
- ▣  $K^+$  : kaonID>0.685 and dr < 0.5 and -2 < dz < 2 and pt > 0.1 and 0.3<useCMSFrame(p)<2.8
- ▣  $\mu^+$  : muonID>0.438 and dr < 0.5 and -2 < dz < 2 and pt > 0.1 and 0.3<useCMSFrame(p)<1.8
- ▣  $e^+$ :elecID>0.597 and dr < 0.5 and -2 < dz < 2 and pt > 0.1 and 0.3<useCMSFrame(p)<1.8
- ▣  $K_S^0$ :  $\pi^+\pi^-$  combinations with vertex fit and 0.45<M<0.55 GeV/c<sup>2</sup> (Standard List)
- ▣  $\pi^0$  : combine gamma:tight list E<sub>γ</sub>>50 MeV and 0.124<M<0.14 GeV/c<sup>2</sup>



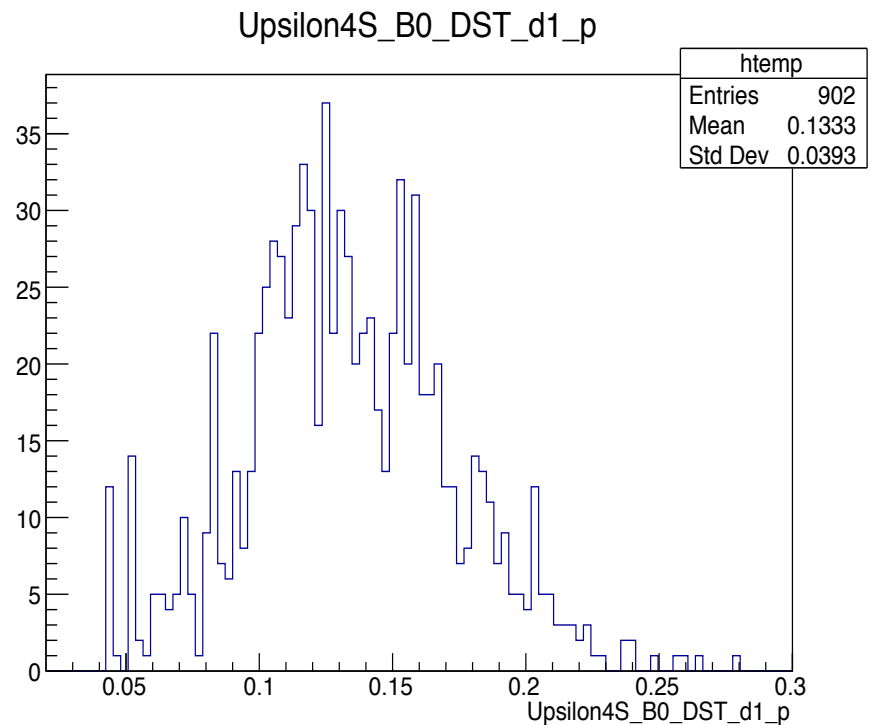
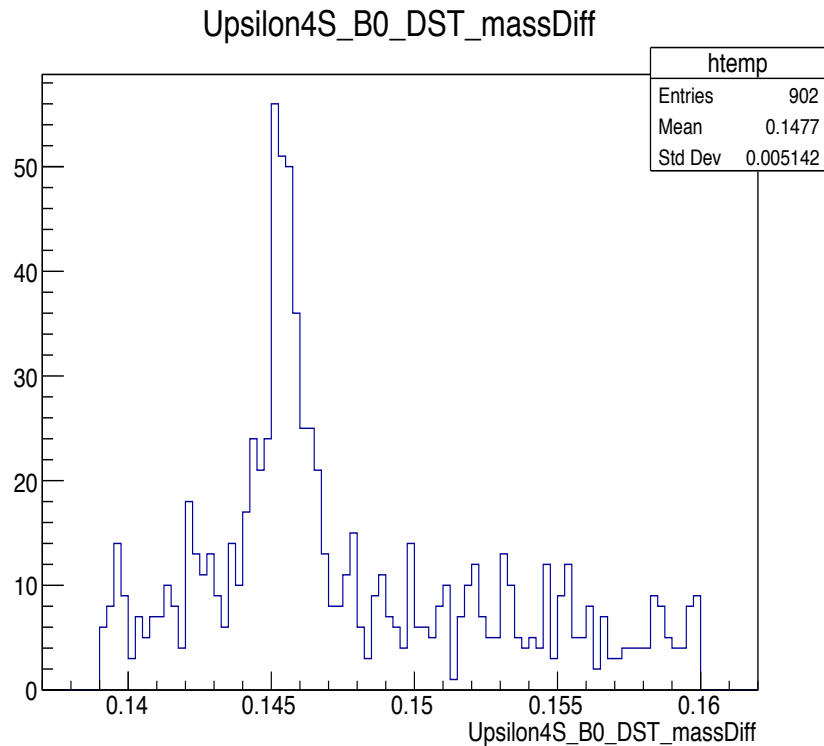
# D reconstruction

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



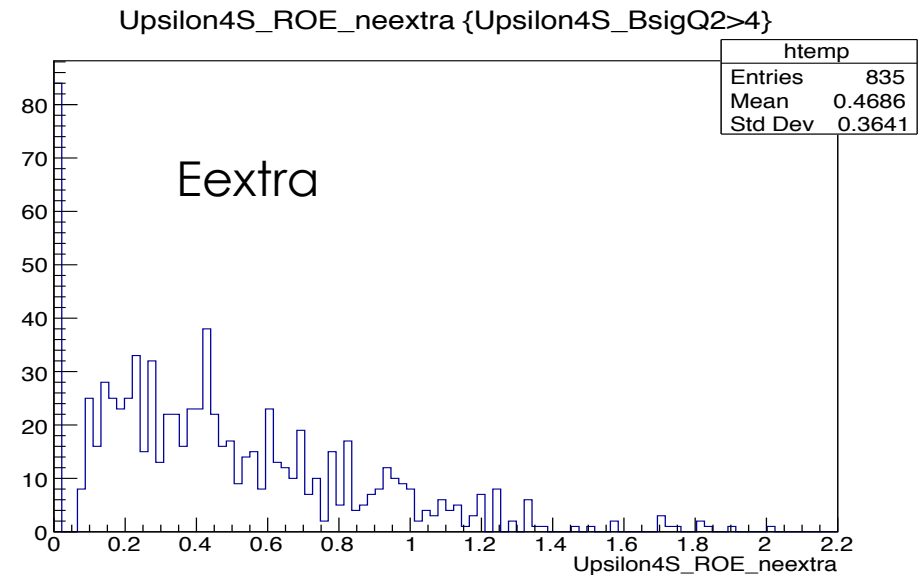
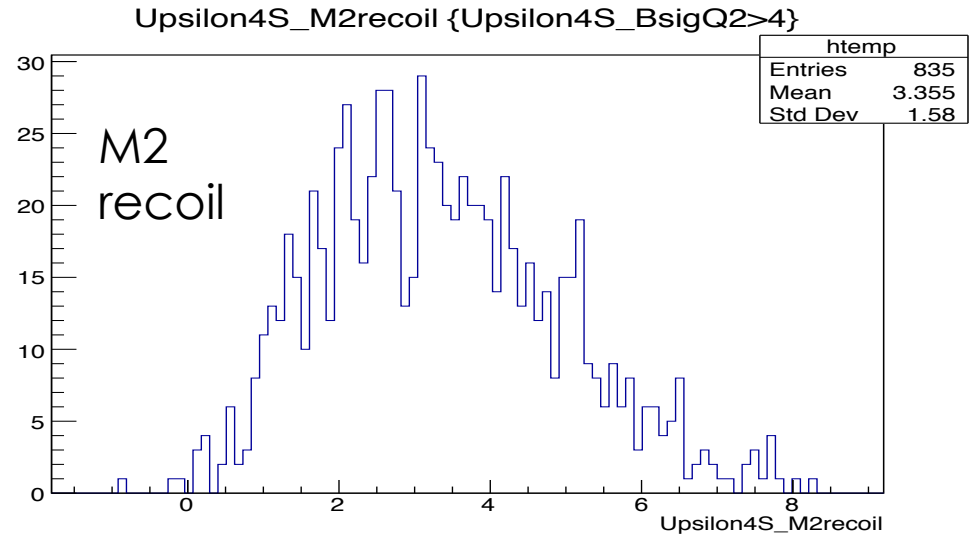
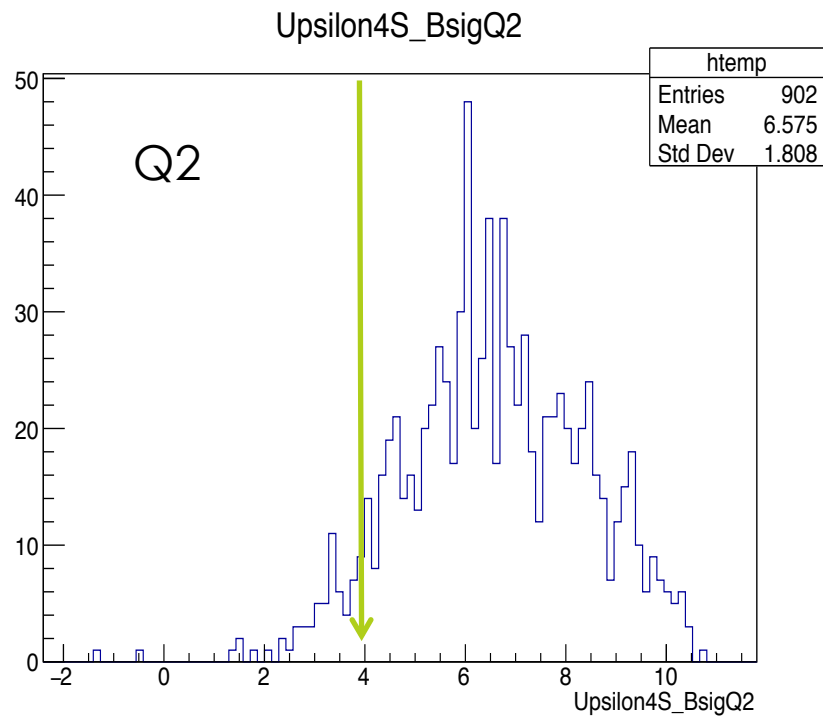
# D\* reconstruction:

- 60 <  $\pi^{+/\ 0}$  p < 250 MeV
- 139 <  $M_{D^*} - M_D < 160$  MeV/c<sup>2</sup>



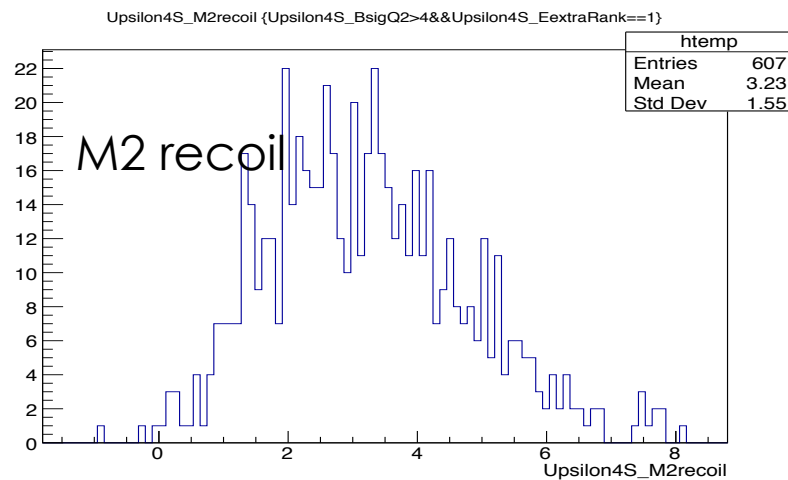
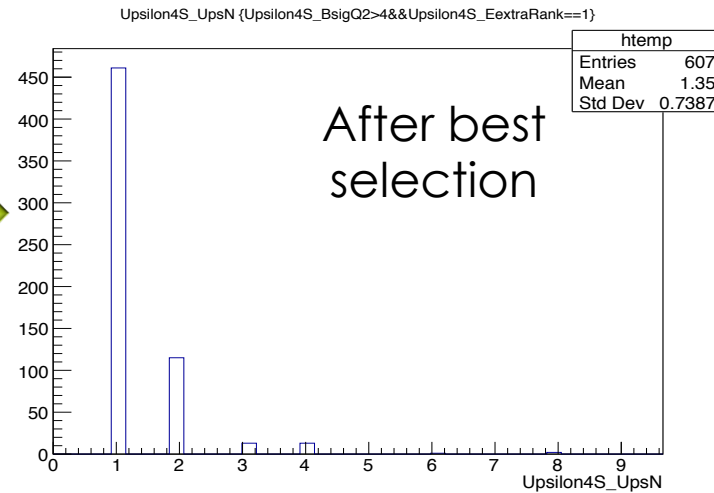
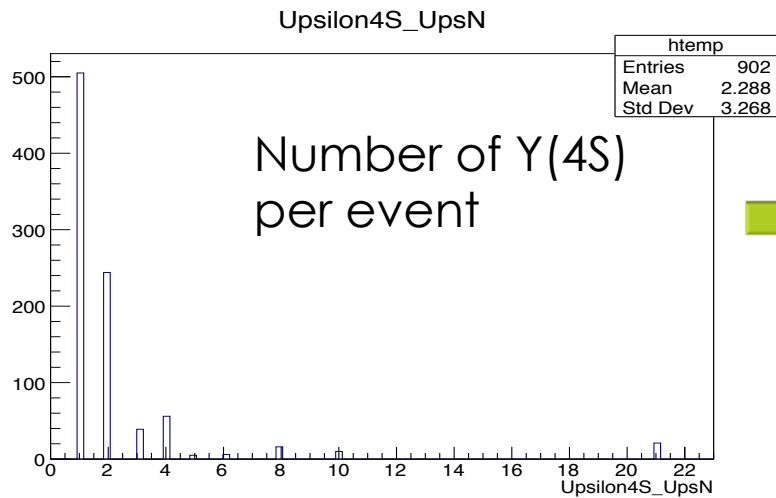
# $B_{\text{tag}} + D^*|$

- ROE tracks == 0
- ROE charge == 0
- $Q^2 > 4.0 \text{ GeV}^2/c^4$



# Best Y(4S) candidate selection

- Choose Y(4S) with the lowest  $E_{\text{extra}}$

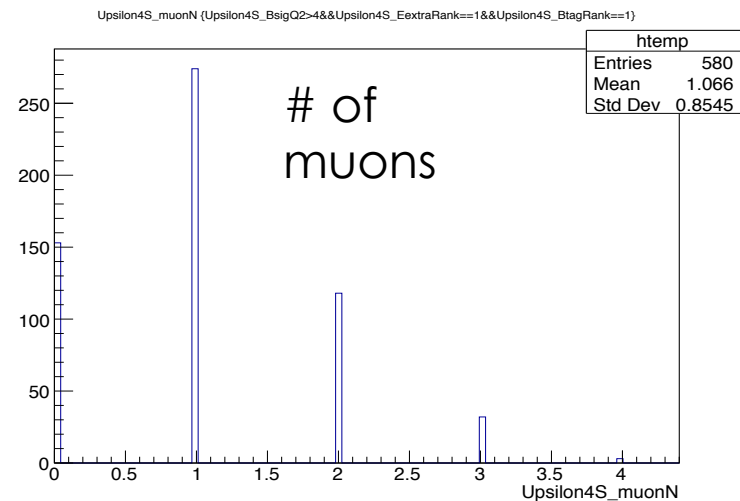
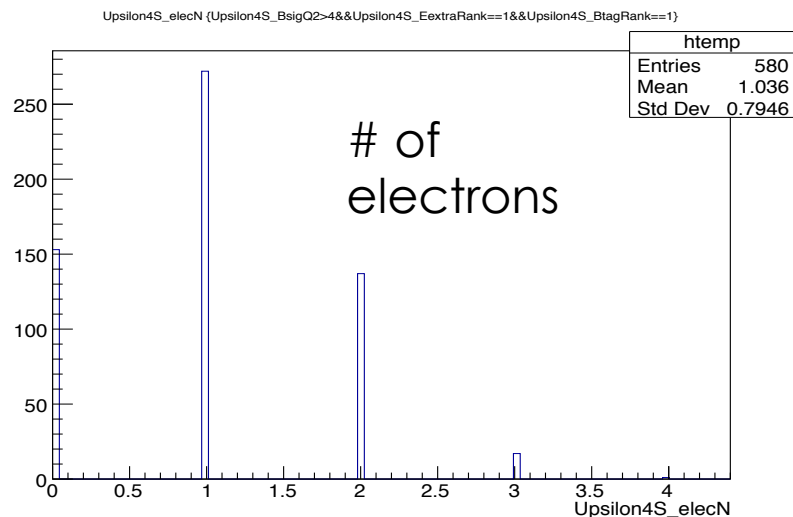


Number of events after full selection: 594

Efficiency=0.0046%

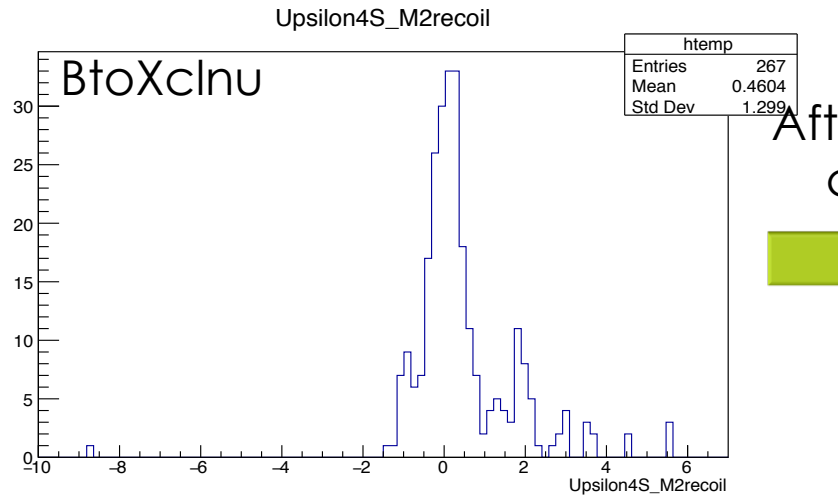
# Multiple candidates

- 2  $B_{\text{sig}}$  candidates per event:
  - Some events have two leptons with `electronID==1` AND `muonID==1`.
  - Strange...
  - Cut `nElectron+nMuon==1` results in significant efficiency loss .
  - Need to optimize PID lists, and use `else if` statements.
    - If a particle is tagged as an electron, it is not a muon..
  - After doing so, we can require only one lepton per event.





# Backgrounds:



After q2  
cut

