

Underlying Event Generator Study

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SMIX meeting
11. April 2008

- Particle multiplicities and particle energy flow study

Remainder

- ▶ Pythia 6.4.14 **Minimum bias:** MI off
MI on (tune A, S0)
Top production: MI off
MI on (tune A, S0)
- ▶ **Studied distributions:**
 - ▶ Charged particle multiplicities as function of η
 - ▶ Particle energy flow as function of η
 - ▶ **Cuts:** only particles with $E > 1\text{GeV}$ considered
- ▶ **Differences between UE in Minimum bias and Top processes seen, when triggering on energy deposit in CASTOR region !**

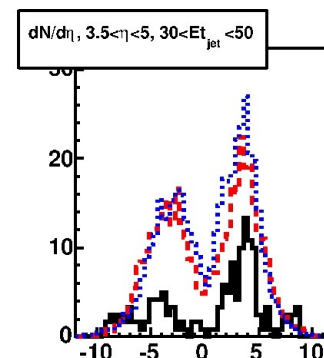
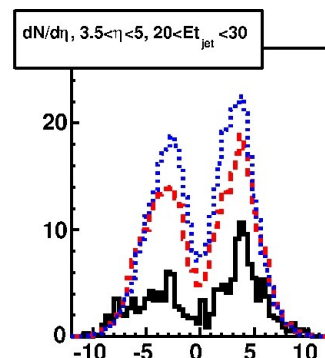
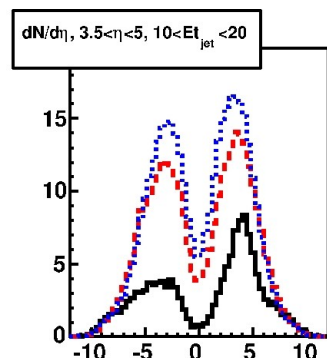
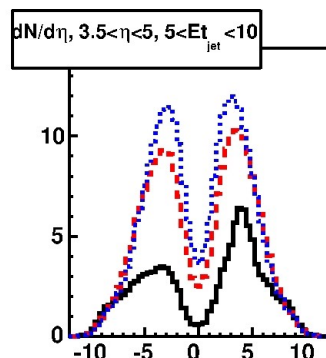
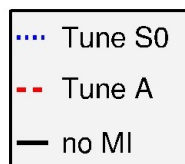
Questions

- ▶ 1.) Does the discrepancy depend on the $M(t\bar{t})$?
 - ▶ No! (already checked)
- ▶ 2.) Is the discrepancy present only when we trigger on energy deposit at very forward η , or does it remain when an energy deposit at more central η is demanded?
 - ▶ a.) Trigger: E_t jet in different η regions
(kt-clus jet algorithm used)
 - ▶ b.) Trigger: E_{sum} in different η regions
- ▶ 3.) Is there any sensitivity to the top decay channel?
 - ▶ a.) $t\bar{t} \rightarrow Wb \ W\bar{b} \rightarrow l\nu_b \ l\nu_{\bar{b}}$ (leptonic)
 - ▶ b.) $t\bar{t} \rightarrow Wb \ W\bar{b} \rightarrow qq\bar{b} \ \bar{q}qb$ (hadronic)

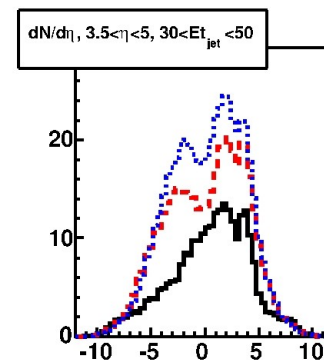
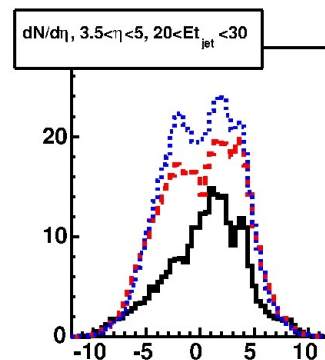
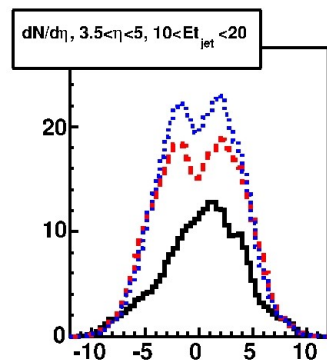
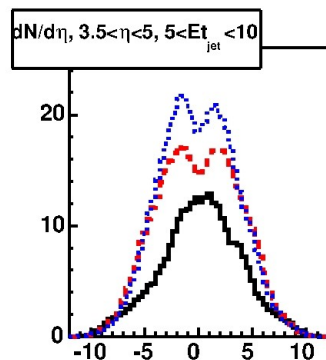
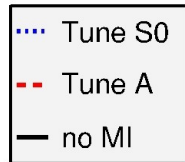
Et(jet) Used as Trigger in Different η Regions

N(part): Et(jet) trigger, $3.5 < \eta < 5$

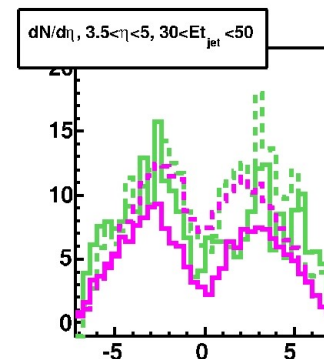
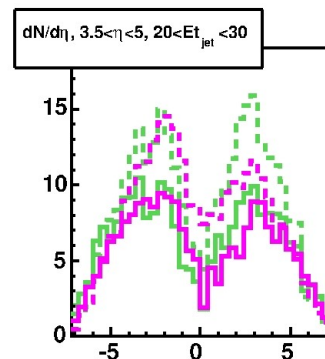
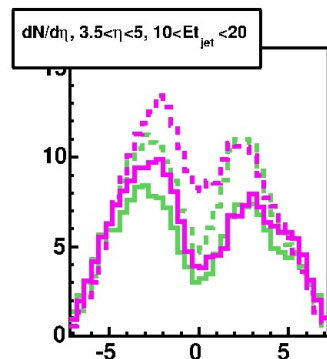
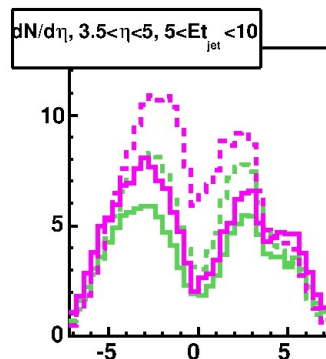
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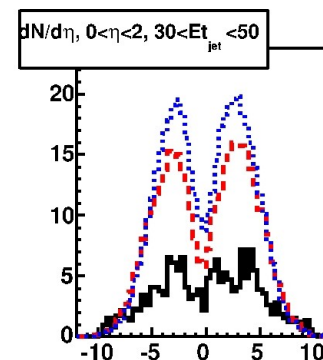
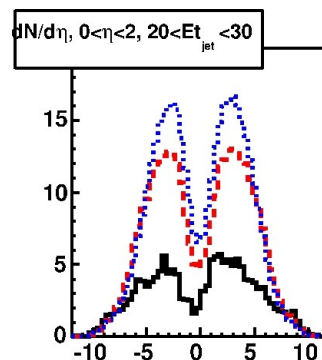
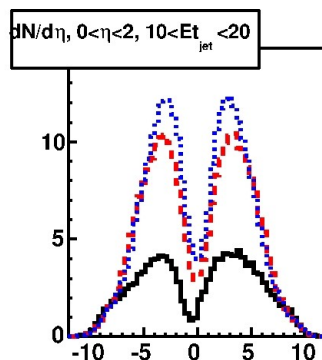
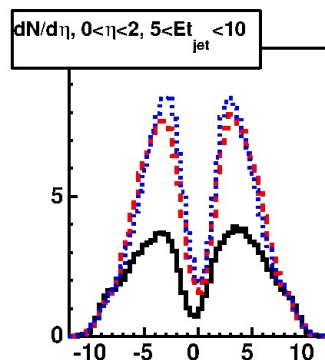
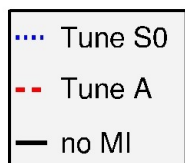


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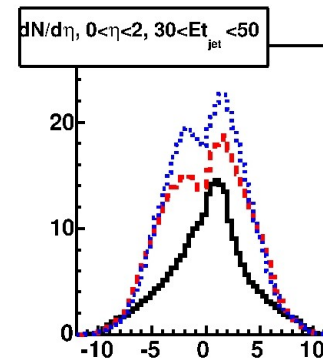
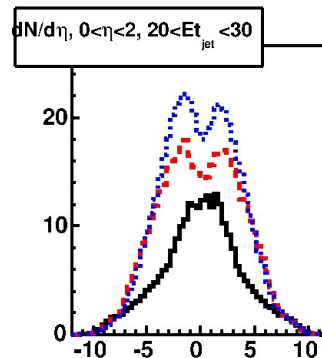
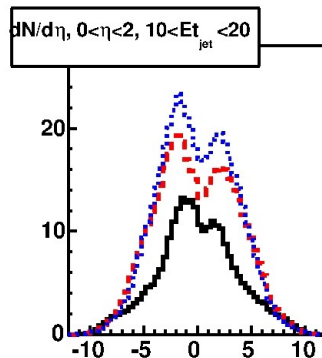
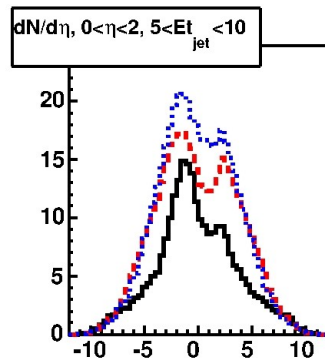
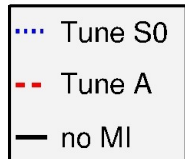


N(part): Et(jet) trigger, $0 < \eta < 2$

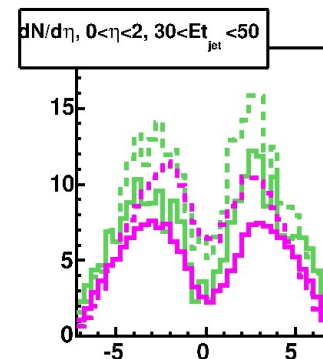
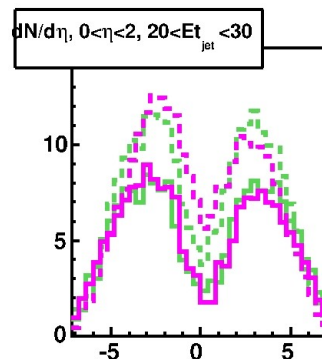
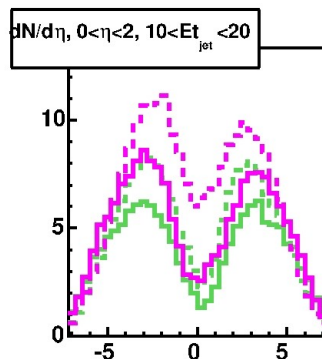
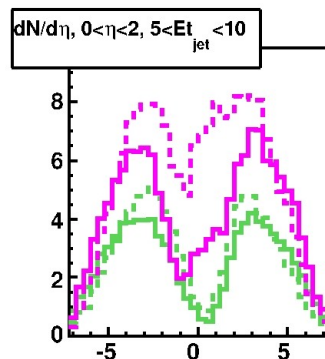
Min Bias:



top:

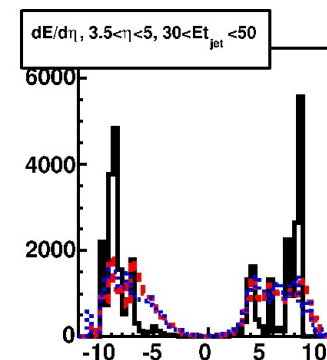
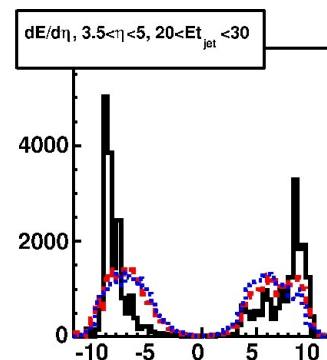
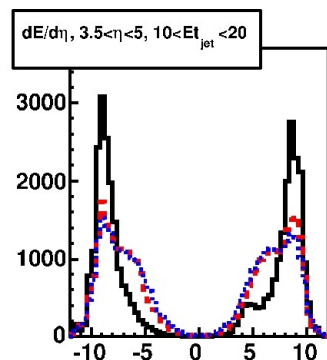
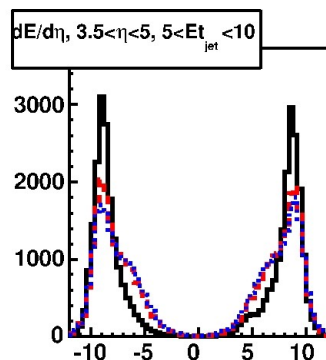
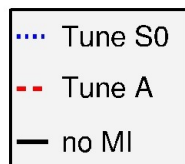


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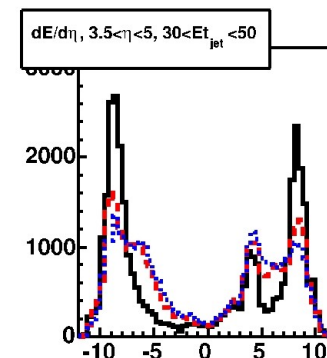
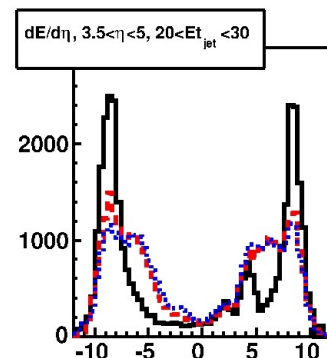
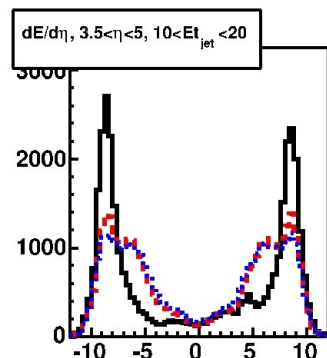
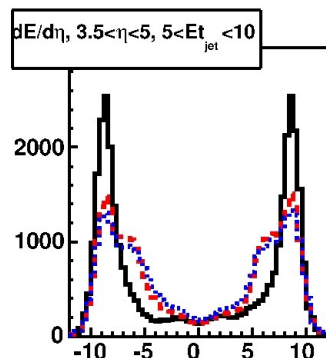
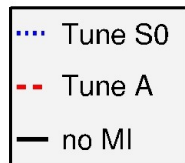


E(part): Et(jet) trigger, $3.5 < \eta < 5$

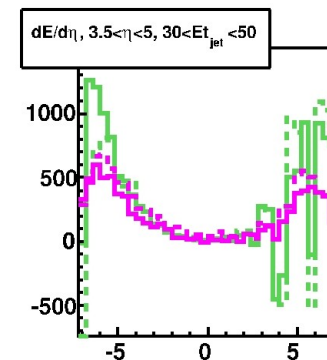
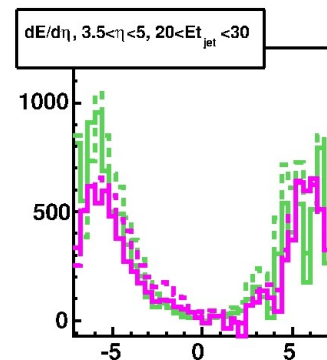
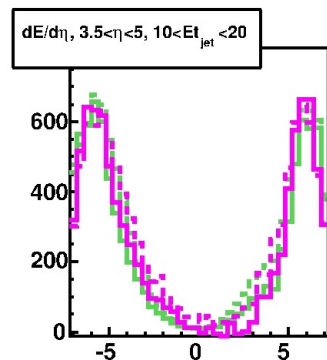
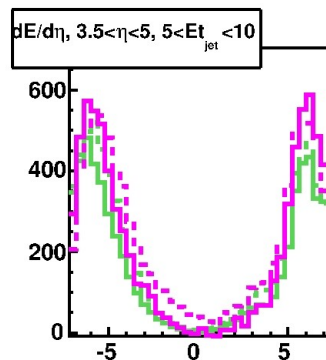
Min Bias:



top:

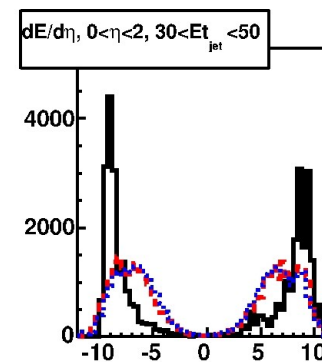
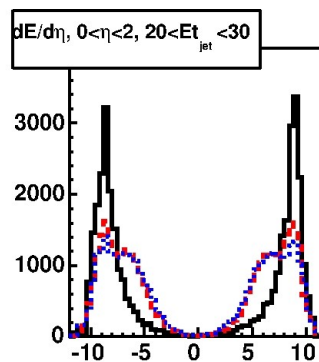
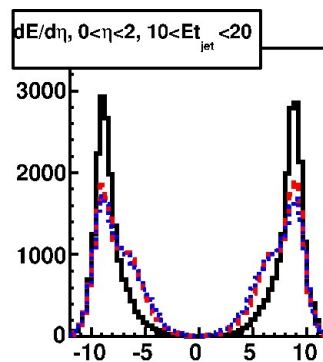
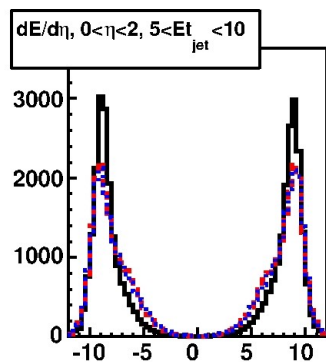
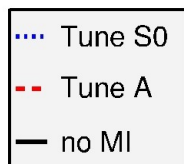


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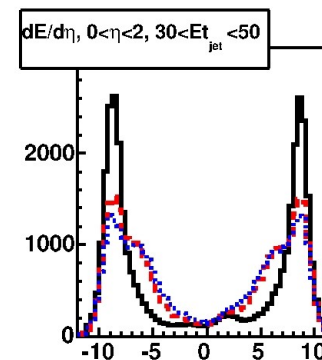
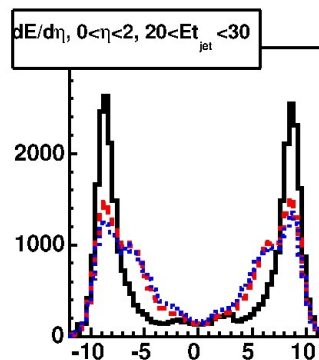
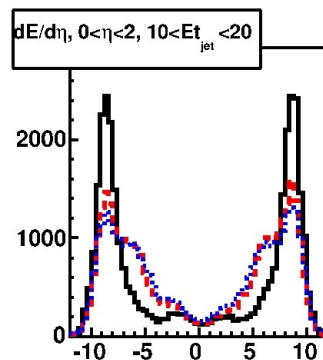
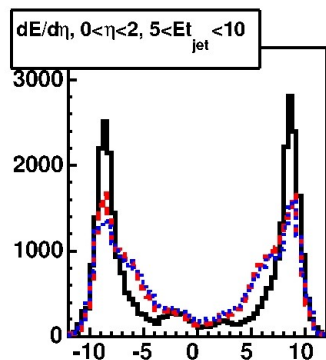
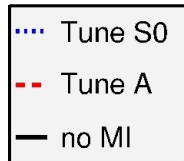


E(part): Et(jet) trigger, $0 < \eta < 2$

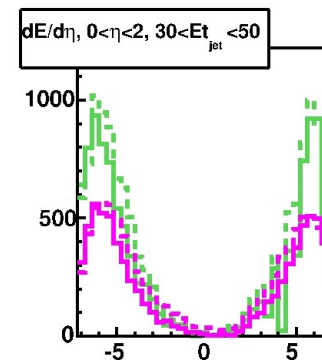
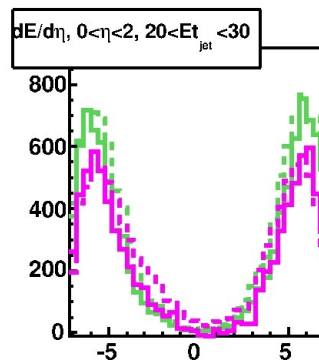
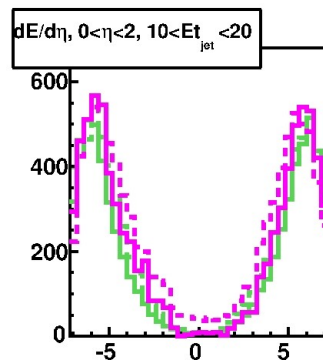
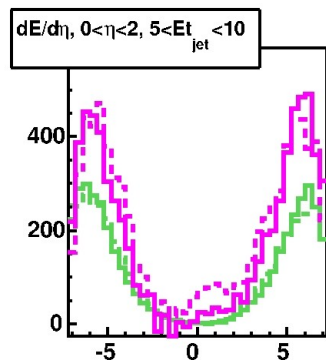
Min Bias:



top:



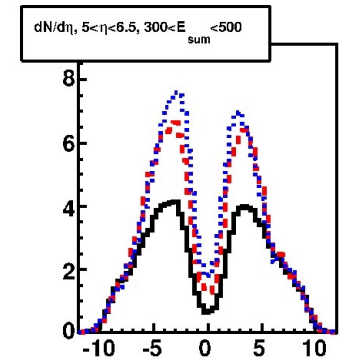
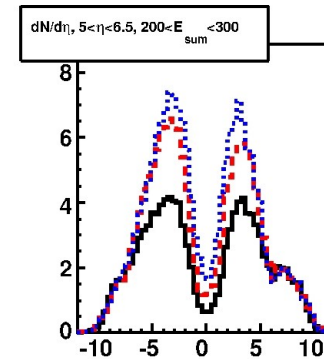
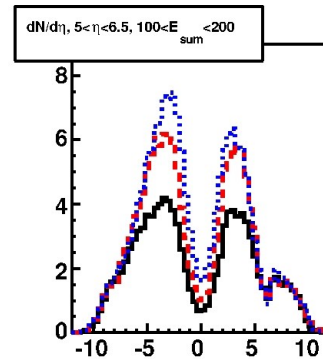
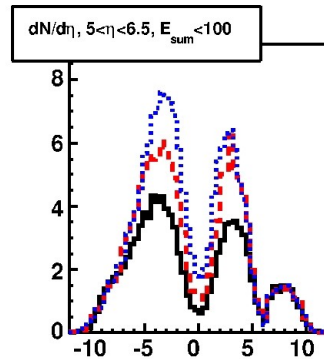
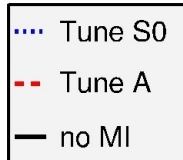
MI - noMI:



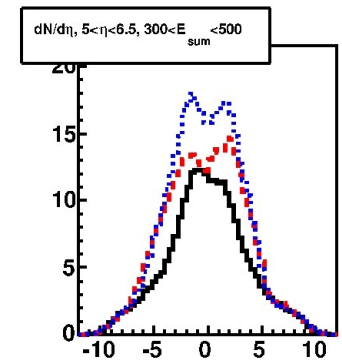
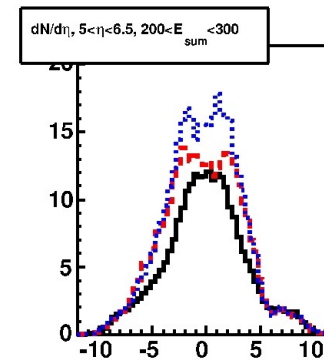
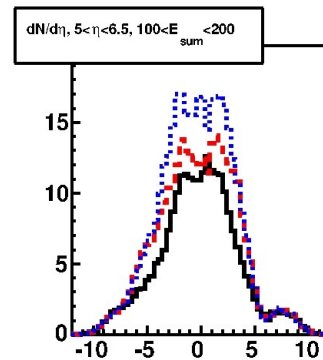
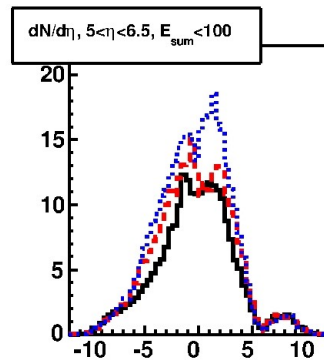
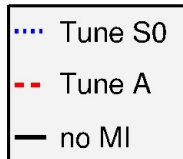
ΣE_{part} in given η Region Used as Trigger

N(part): ΣE_{part} trigger, $5 < \eta < 6.5$

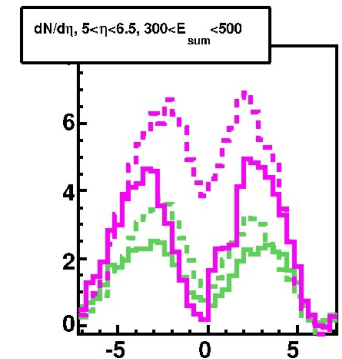
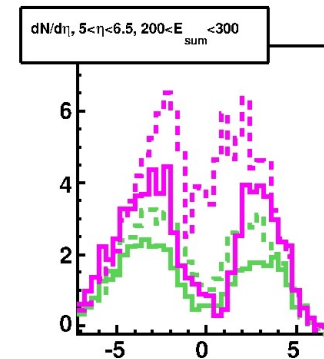
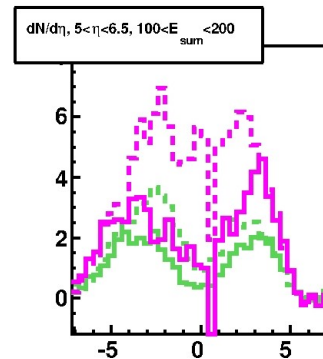
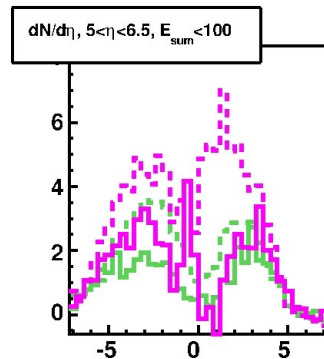
Min Bias:



top:

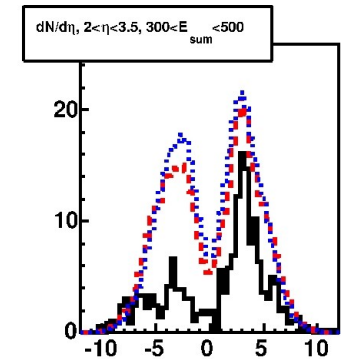
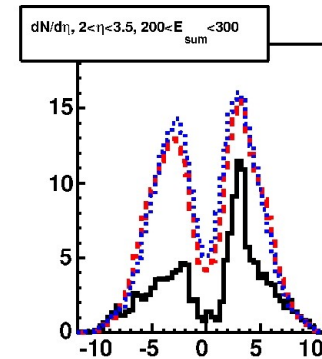
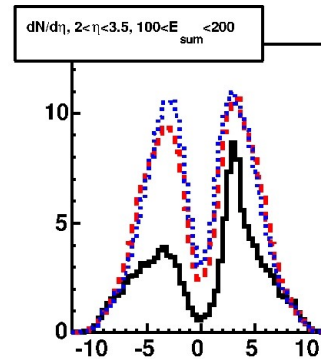
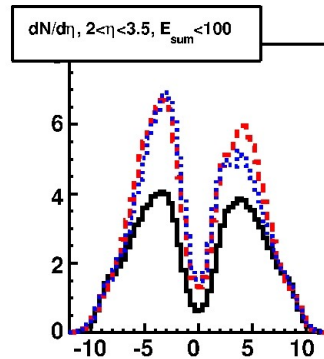
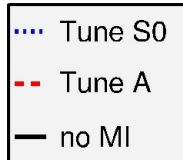


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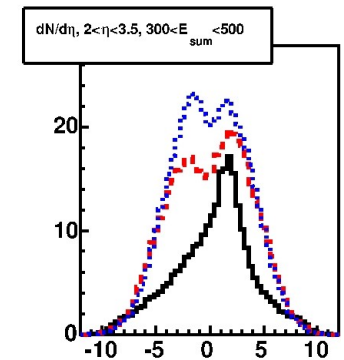
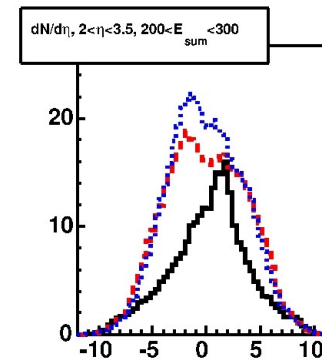
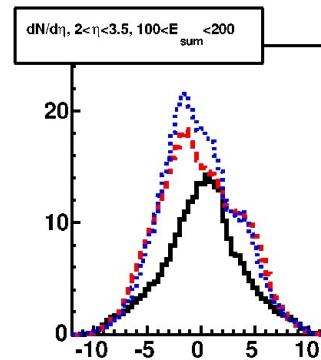
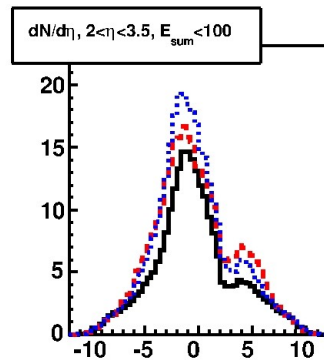
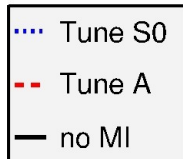


$N(\text{part}): \Sigma E_{\text{part}} \text{ trigger}, 2 < \eta < 3.5$

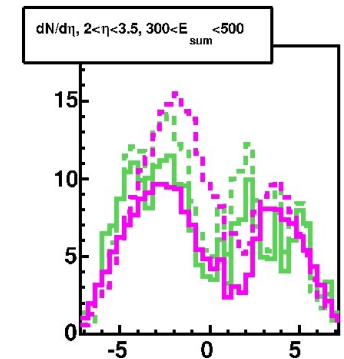
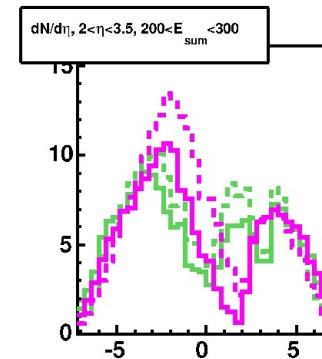
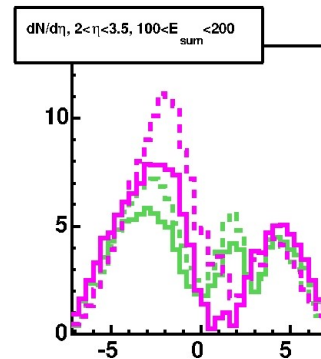
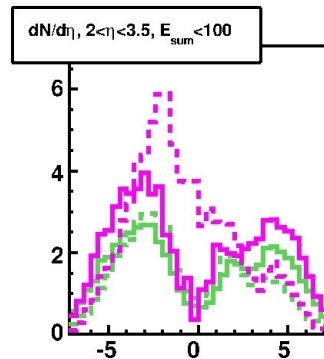
Min Bias:



top:

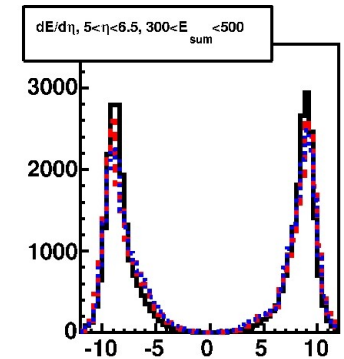
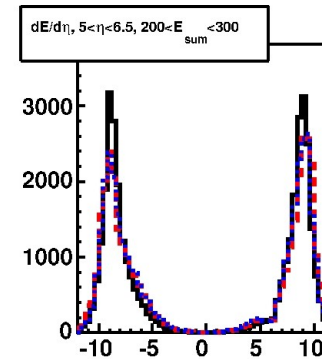
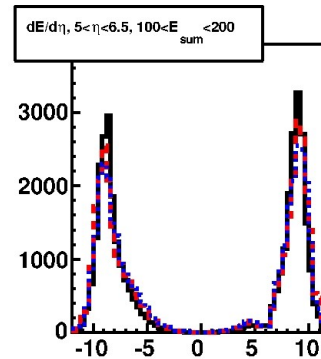
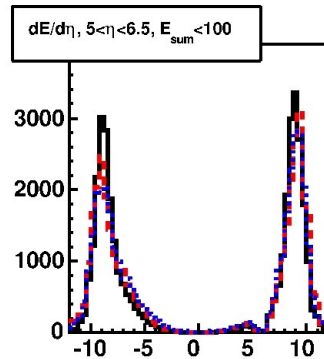
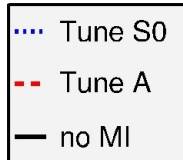


MI - noMI:

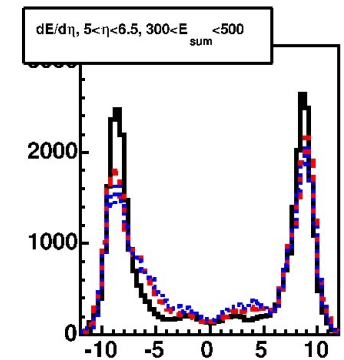
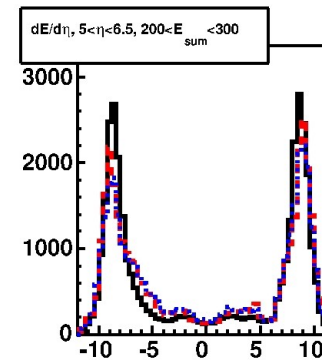
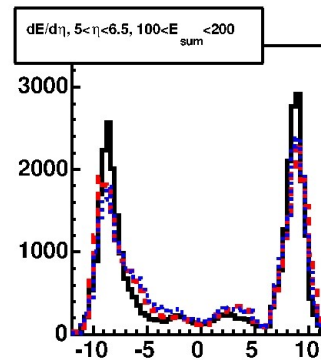
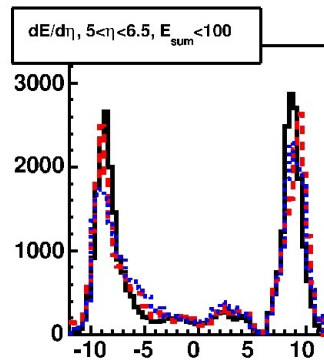
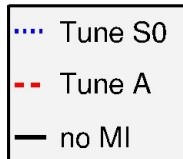


E(part): ΣE_{part} trigger, $5 < \eta < 6.5$

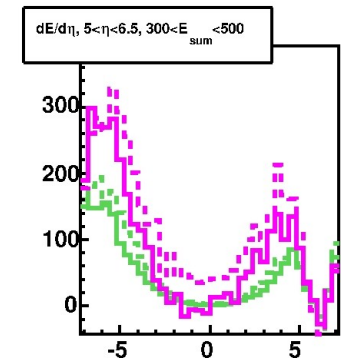
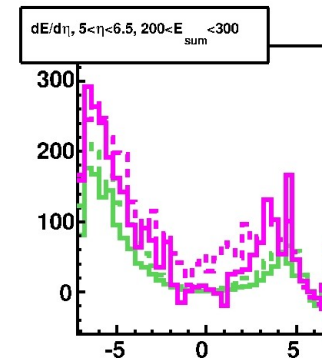
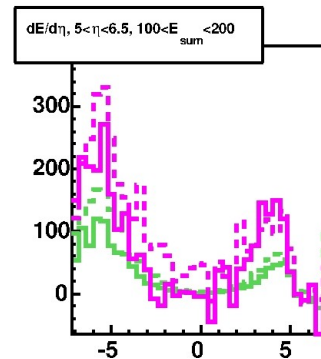
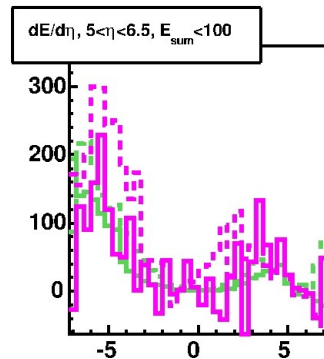
Min Bias:



top:

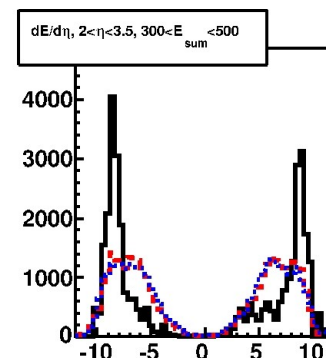
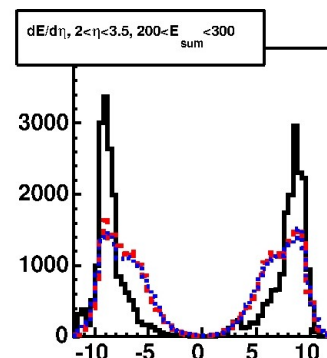
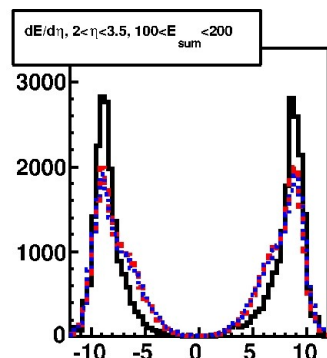
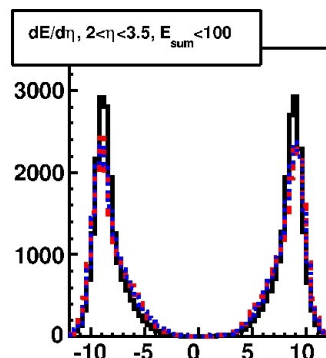
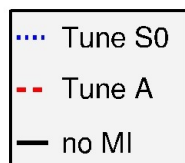


MI - noMI:

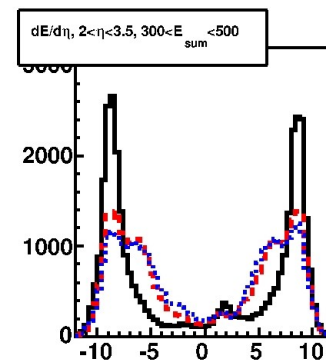
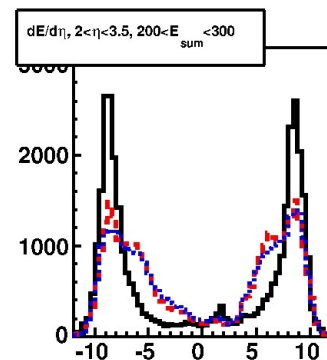
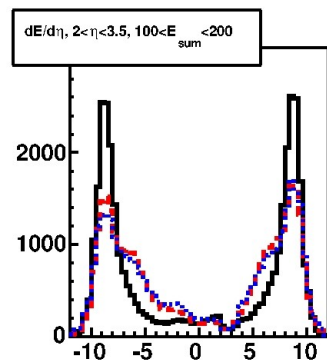
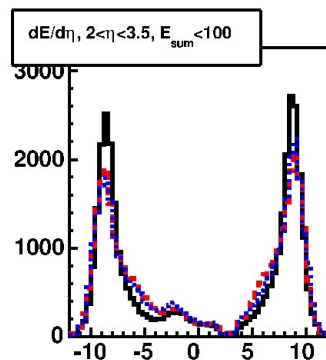
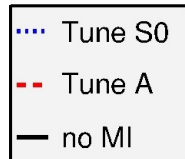


E(part): ΣE_{part} trigger, $2 < \eta < 3.5$

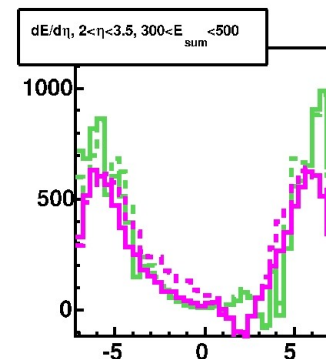
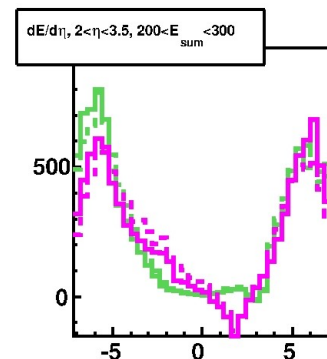
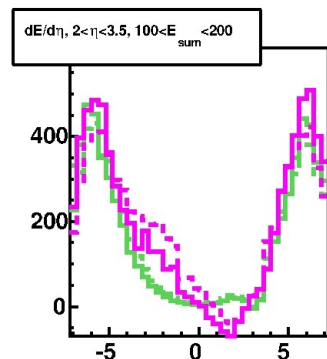
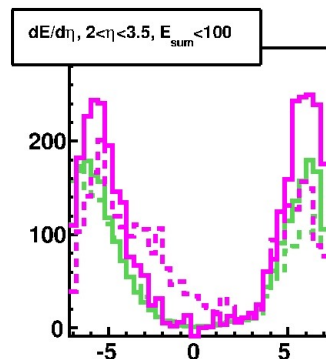
Min Bias:



top:



MI - noMI:

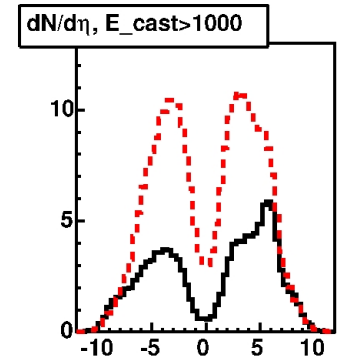
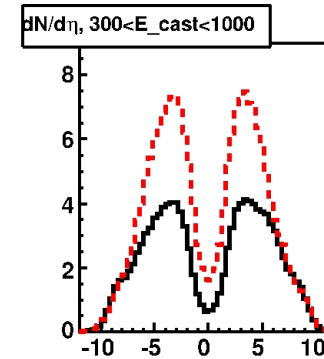
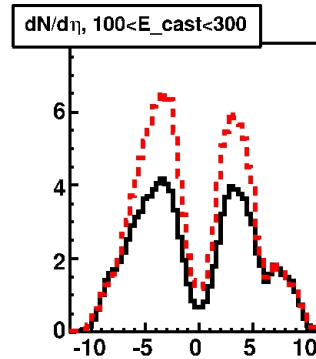
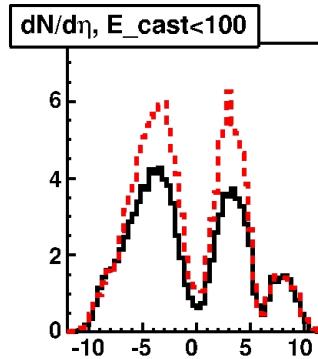


Top Decay Channel Study

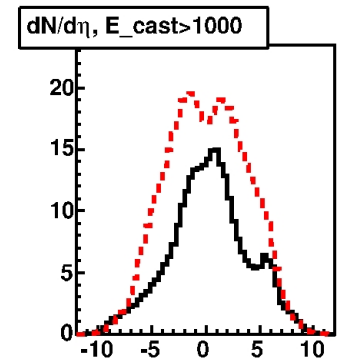
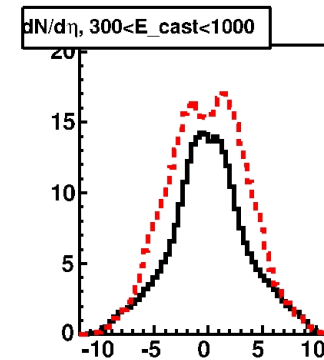
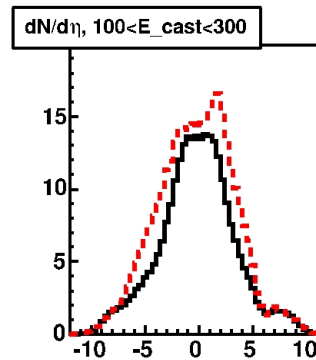
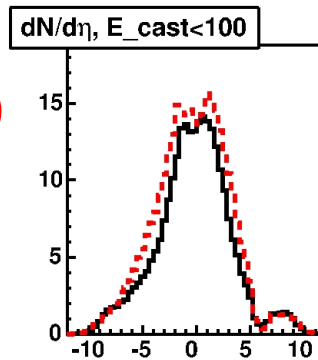
(energy deposit in CASTOR used as trigger)

Particle Multiplicities

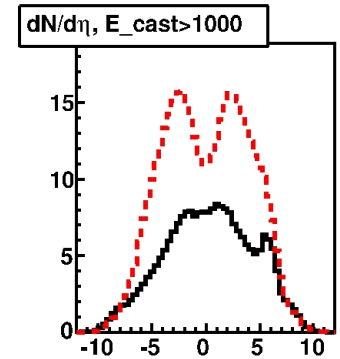
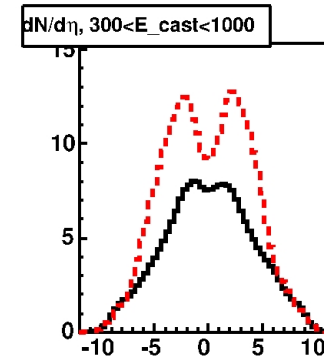
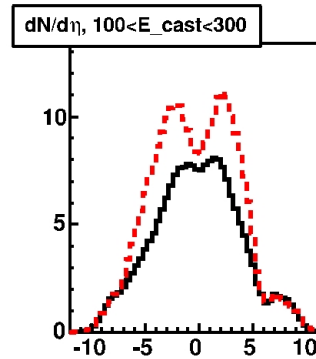
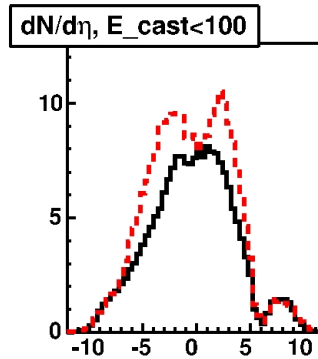
Min Bias:



top: (hadronic)



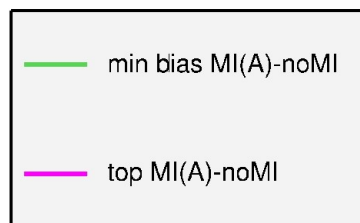
top: (leptonic)



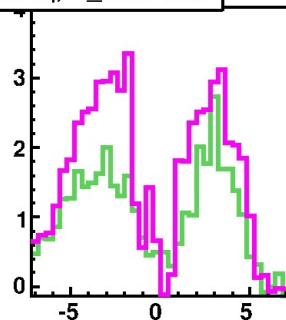
Particle Multiplicities

(hadronic)

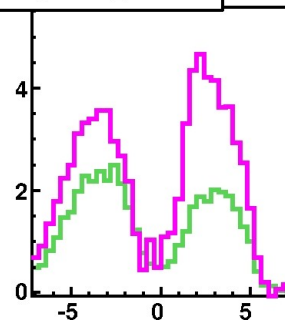
MI - noMI:



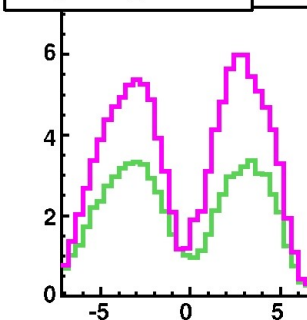
$dN/d\eta$, $E_{\text{cast}} < 100$



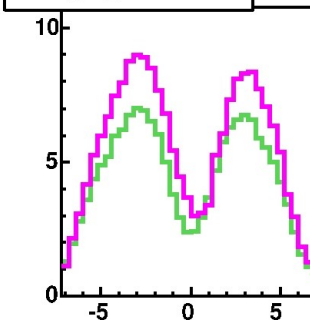
$dN/d\eta$, $100 < E_{\text{cast}} < 300$



$dN/d\eta$, $300 < E_{\text{cast}} < 1000$

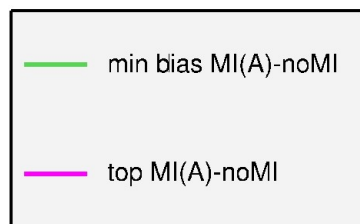


$dN/d\eta$, $E_{\text{cast}} > 1000$

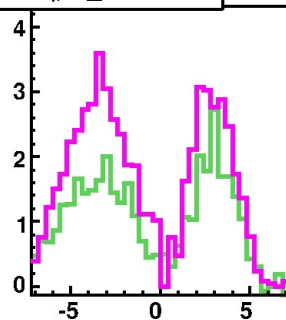


(leptonic)

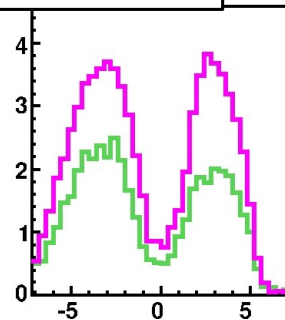
MI - noMI:



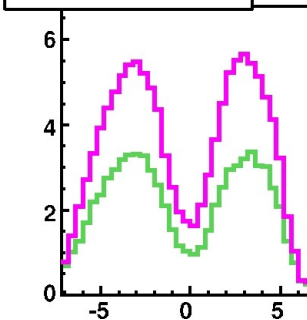
$dN/d\eta$, $E_{\text{cast}} < 100$



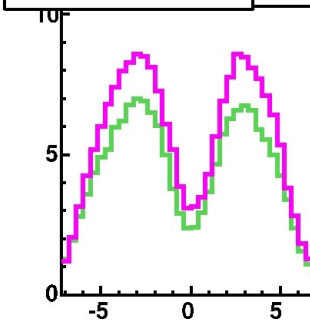
$dN/d\eta$, $100 < E_{\text{cast}} < 300$



$dN/d\eta$, $300 < E_{\text{cast}} < 1000$

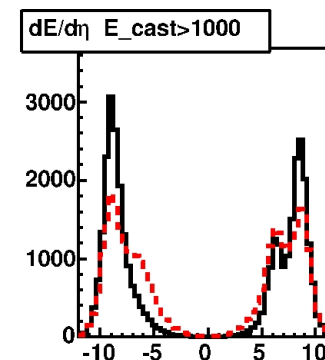
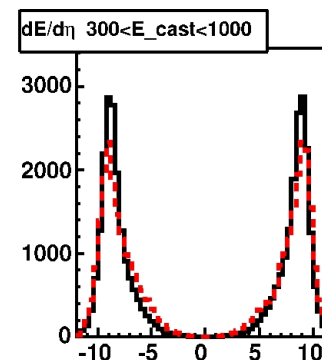
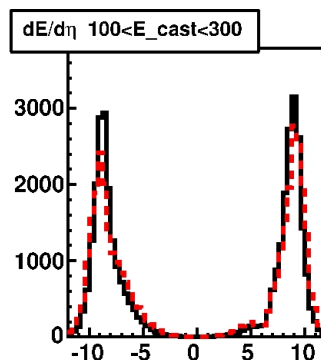
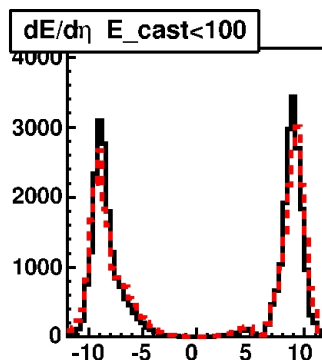


$dN/d\eta$, $E_{\text{cast}} > 1000$

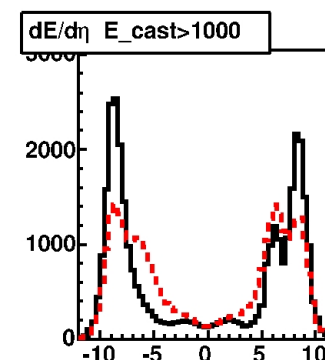
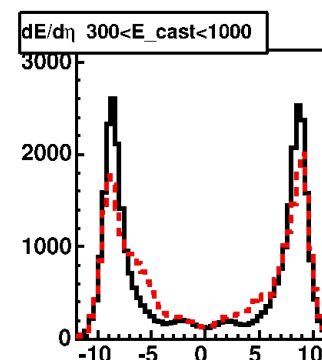
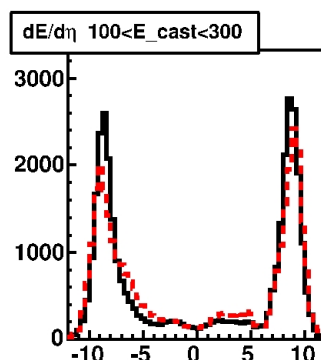
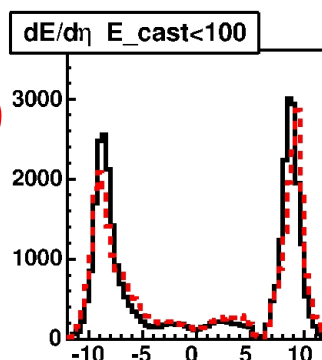


Particle Energy Flow

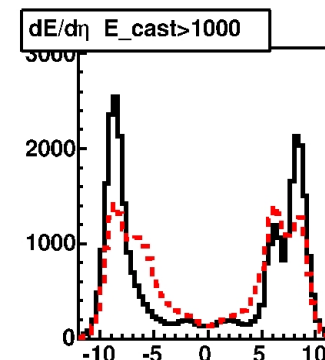
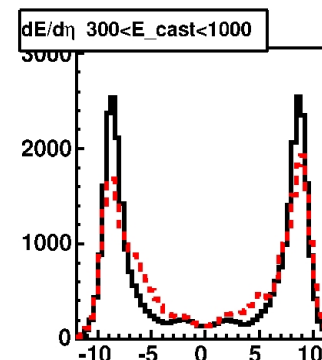
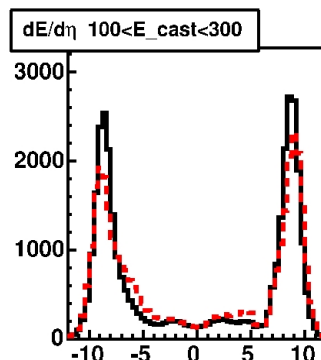
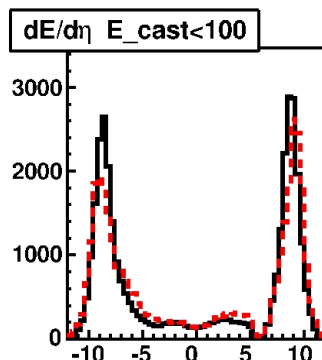
Min Bias:



top: (hadronic)



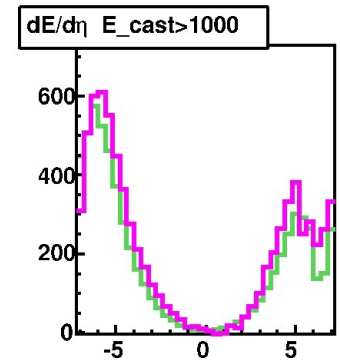
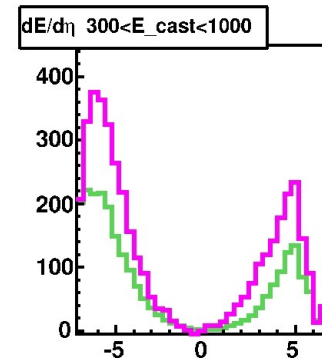
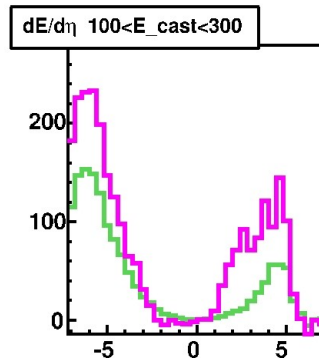
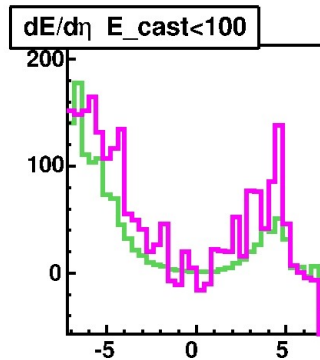
top: (leptonic)



Particle Energy Flow

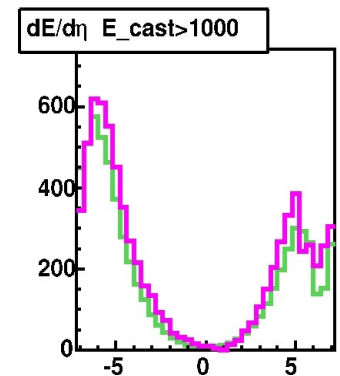
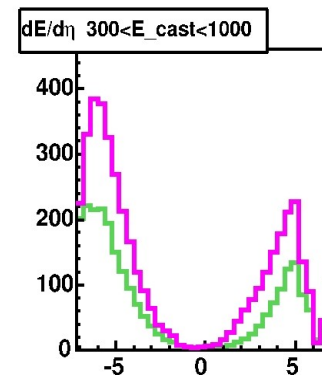
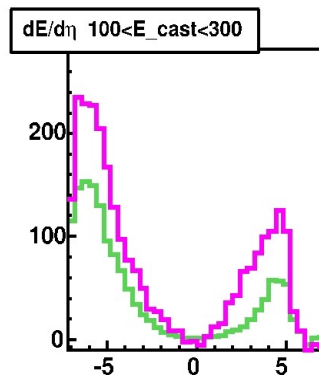
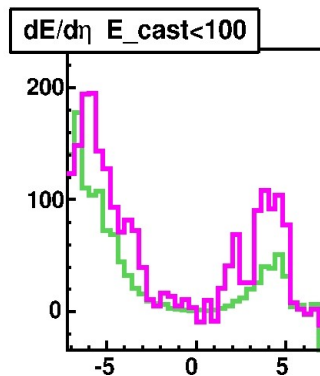
(hadronic)

MI - noMI:



(leptonic)

MI - noMI:



Conclusions

- ▶ Differences between UE in Min.Bias and Top production seen in almost all eta trigger regions
 - ▶ forward eta: small $E_t(\text{jet})$, large E_{sum}
 - ▶ central eta: small $E_t(\text{jet})$, small E_{sum}
- ▶ The top decay channel doesn't play a role