i) Real electrons, non isolated, from jets
- isolation from identified jets
- isolation from hadronic energy
- impact parameter
- track isolation

ii) Direct pi0 production
- shower shape in strips
- track E/p
- quality of spatial track match

iii) Direct photon with random track
- require track match
- E/p
- quality of spatial track match

iv) Photon conversion
- IP
- ntracks in narrow cone
- E/p
- spatial track match

v) Single pi+/-
- TRT
- shower shape
- ratio of hadr/em energy
- track match quality

vi) Jets with high EM content, leading pi0
- track isolation (sum of track pT)
- shower shape
- fhadron/fem

1. El_author Algorithm used to generate electron candidate (=1 for E/gamma group)
2. El_ethad Et in the HCAL behind EM cluster
3. El_ethad1 Et in the 1st sampling of HCAL behind EM cluster
4. El_etcone Et in a DR=0.45 cone around shower (shower energy not included)
5. El_etcone20 Et in a DR=0.20 cone " "
6. El_etcone30 Et in a DR=0.30 cone " "
7. El_etcone40 Et in a DR=0.40 cone " "
8. El_emins1 E of strip with min E
9. El_emaxs1 E of strip with max E
10. El_wtots1 Total width in 20 strips
11. El_f1 fraction of energy in the 1st sampling
12. El_f1core e131/(e033+e1153+e335) so in 1st sampling
13. El_f3core e333/(e033+e1153+e335) so in 3rd sampling
14. El_pos7 diff. b/w shower cell and predicted track in +/- 7 cells
15. El_iso ratio of energy in 3x3/3x7
16. El_weta1 corrected lateral width with 3 strips
17. El_weta2 corrected lateral width in sample 2
18. El_widths2 uncorrected width in sample 2
19. El_e2ts1 energy in second maximum
20. El_e2tsts1 energy in 2nd most energetic strip maximum(?!)
21. El_fracs1 fraction of energy outside core in S1
22. El_widths1 width with 5 strips
23. El_NTRTHits number of TRT hits
24. El_NHighThresTRTHits number of TRT hits above high threshold
25. Track_El_eta, momentaX/Y/Z, p_T, phi, qOverP : fitted track parameters
26. Track_El_d0 distance of closest approach (xy), wrt to PV or (0,0,0)? **CHECK**
27. Track_El_z0 distance to the PV (z), wrt to PV or (0,0,0) ? **CHECK**
28. Track_El_ij Track error matrix

Bug?

El_widths2, El_iso, El_f1core, El_f3core
are not filled in the case El_author=1 (E/gamma group)…
(look ok for El_author!=1…)

El_f1	**Ok**
El_widths2	**problem**
Track_El_d0	**check definition**
El_ethad	**not in ntuple**

i) Real electrons, non isolated, from jets

- isolation from identified jets→ DR to closest ID jet*
- isolation from had energy → El_ethad, El_ethad1
- impact parameter → Track_El_d0 (check definition)
- track isolation → Sum of track pT in a 0.4 cone? Or alt.?

ii) Direct pi0 production

- shower shape in strips → El_emins1, El_emaxs1, El_wtots1, El_f1, El_f1core, El_weta1, El_e2tsts1, El_e2tsts1, El_fracs1, El_widths1
- track E/p → El_EoverP
- quality of spatial track match→ chi2 of track match:

$\chi 2 = (d\phi/\sigma\phi)^2 + (dz/\sigma z)^2$

$\chi 2 = (d\phi/\sigma\phi)^2 + (d\eta/\sigma\eta)^2$

iii) Direct photon with random track

- require track match → All track matched in ntuple used here!
- E/p → El_EoverP
- quality of spatial track match→ chi2 of track match

iv) Photon conversion

- impact parameter → Track_El_d0 (check definition)
- ntracks in narrow cone → missing
- track E/p → El_EoverP
- spatial track match → missing

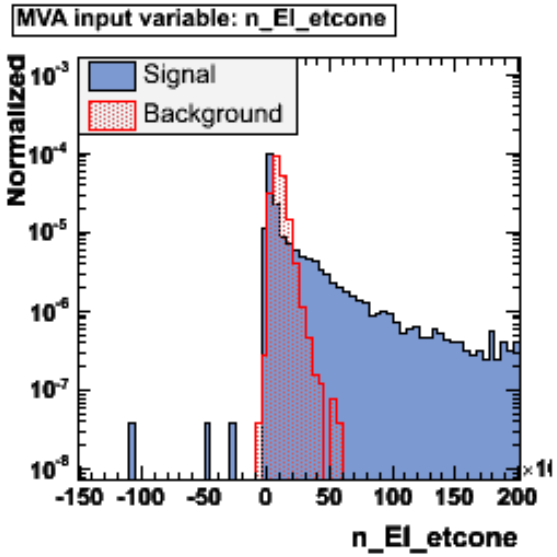
v) Single pi+/-

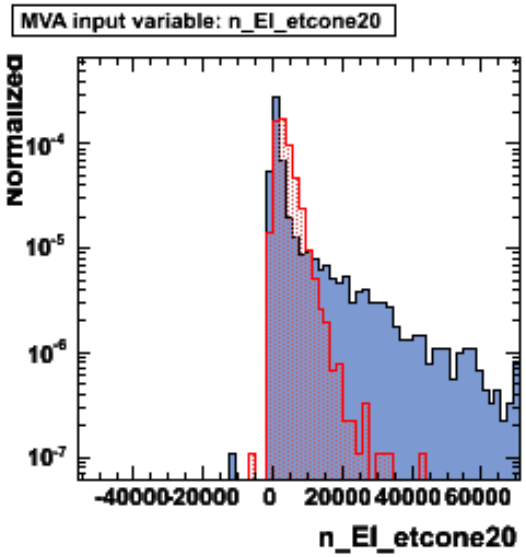
- TRT → El_NTRTHits, El_NHighThresTRTHits
- shower shape → strip info, El_iso, El_f3core, El_weta2, El_widths2, El_fracs1, other variables?
- ratio of hadr/em energy → El_ethad, El_ethad1
- track E/p → El_EoverP
- spatial track match → missing

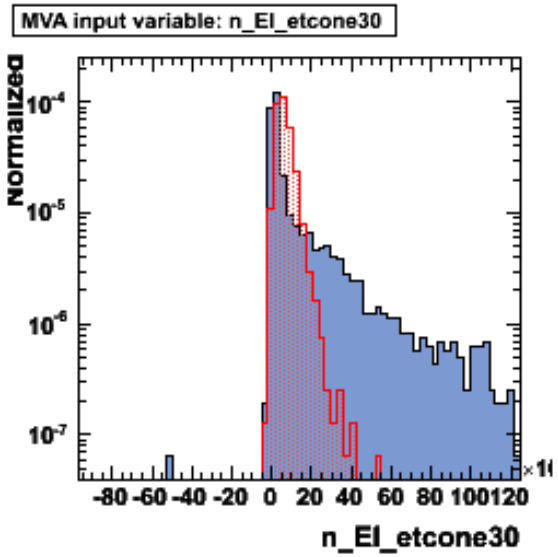
vi) Jets with high EM content, leading pi0

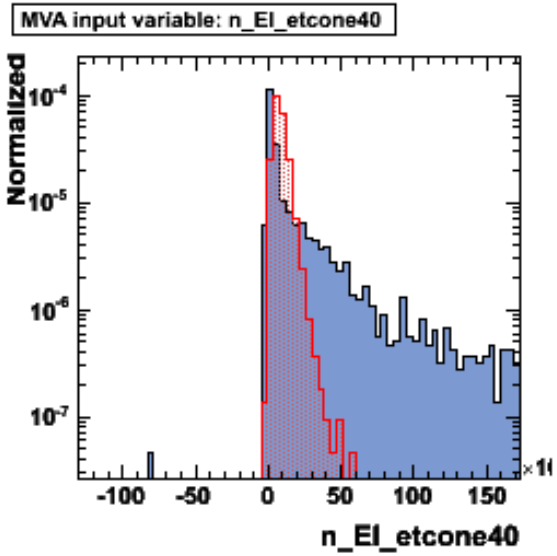
- track isolation (sum of track pT) → missing
- shower shape → see above
- ratio of hadr/em energy → El_ethad, El_ethad1

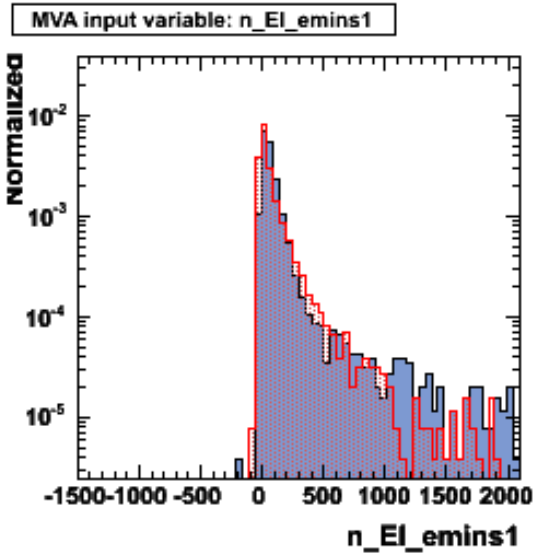
Calorimeter variables

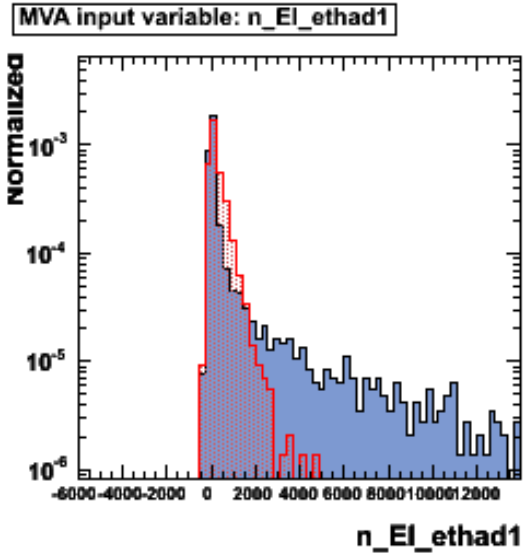




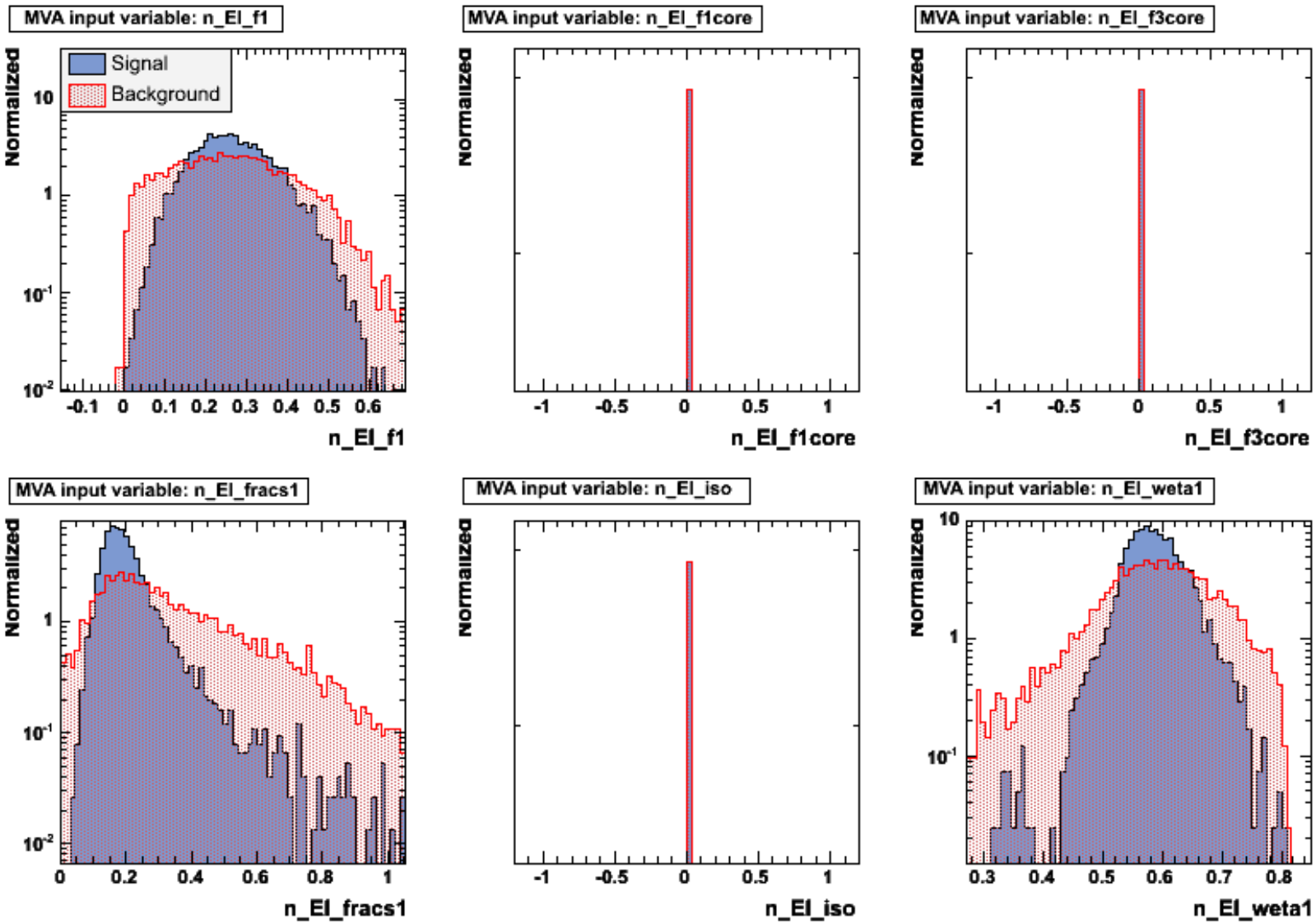




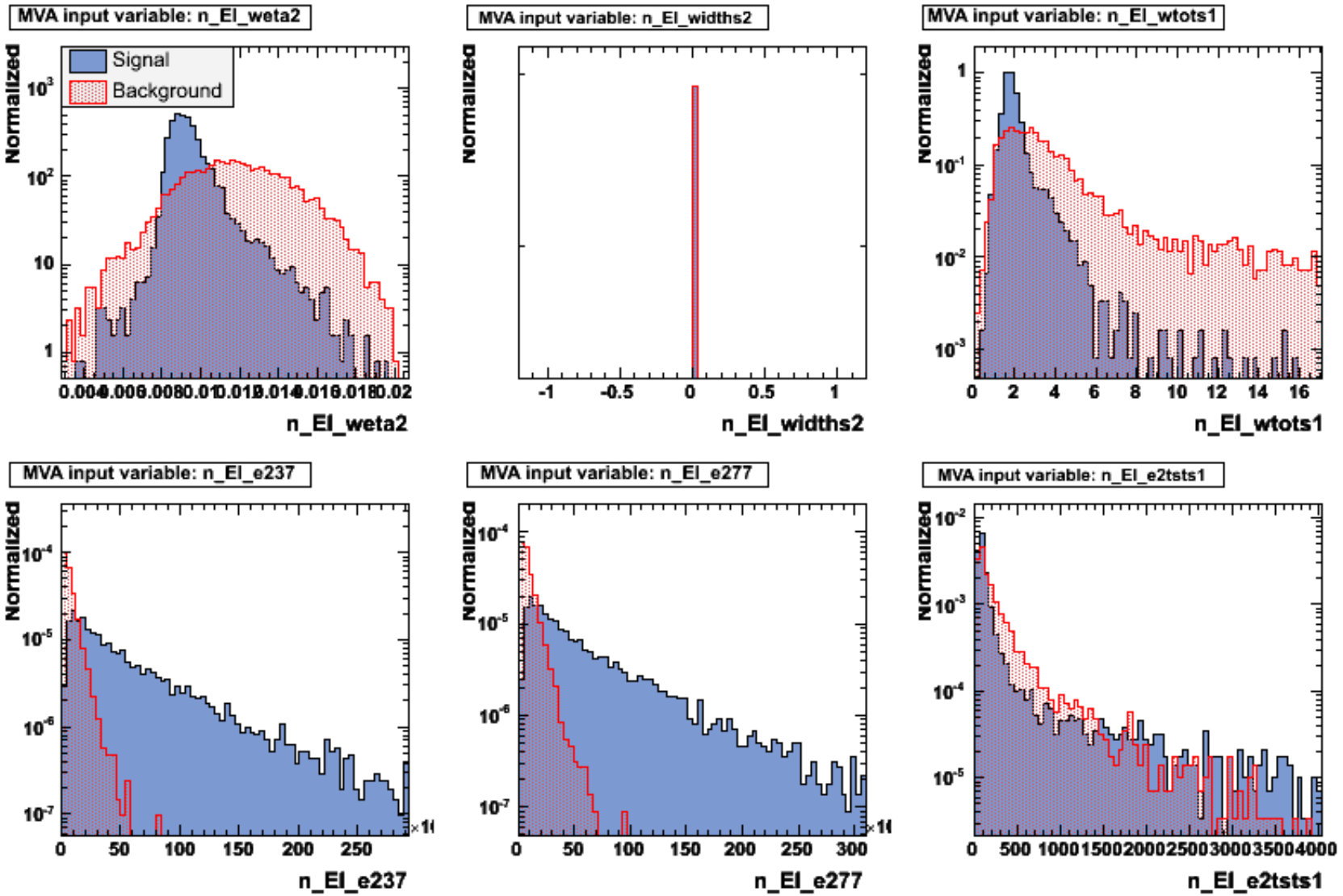




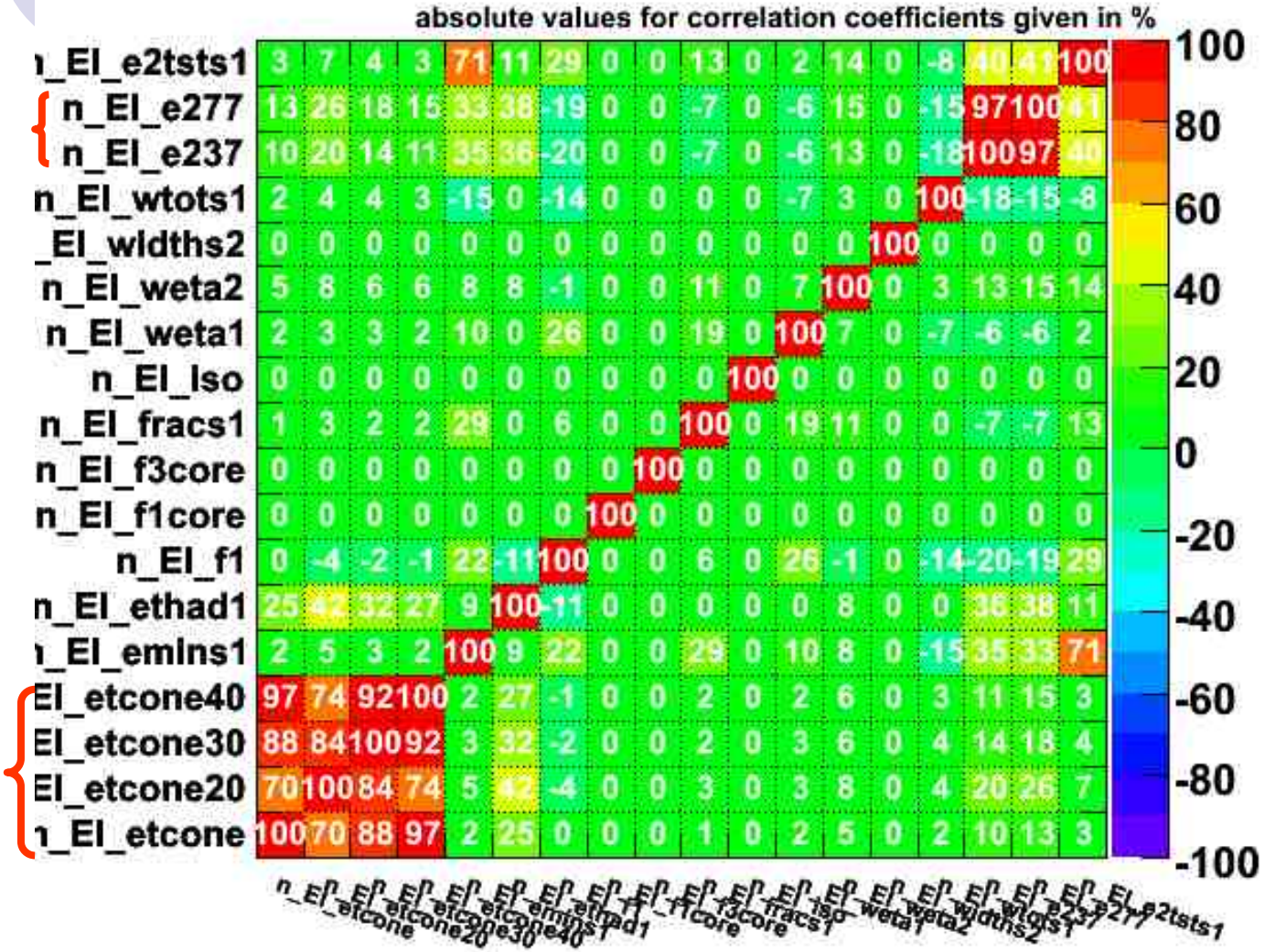
Calorimeter variables



Calorimeter variables

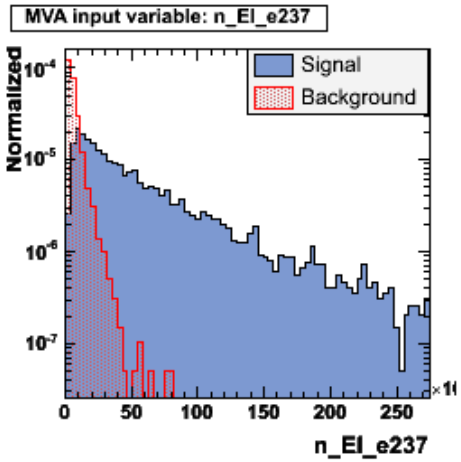


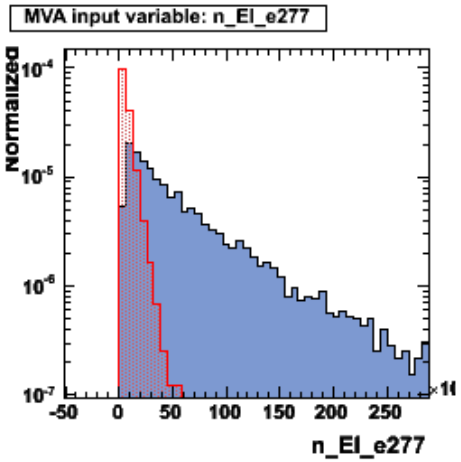
Correlation Matrix (background)

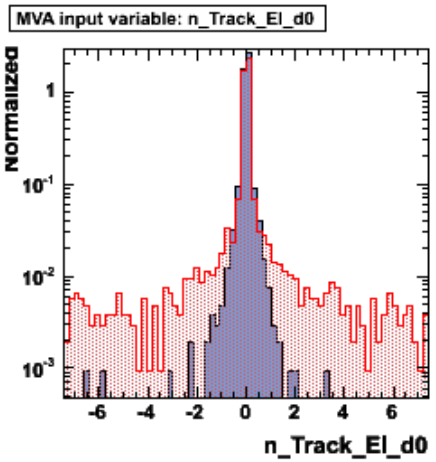


1. El_EoverP
2. El_ethad1 Et in the 1st sampling of HCAL behind EM cluster
3. El_etcone Et in a DR=0.45 cone around shower (shower energy not included)
4. El_emins1 E of strip with min E
5. El_wtots1 Total width in 20 strips
6. El_f1 fraction of energy in the 1st sampling
7. El_weta1 corrected lateral width with 3 strips
8. El_weta2 corrected lateral width in sample 2
9. El_e2tsts1 energy in 2nd most energetic strip maximum(?!)
10. El_fracs1 fraction of energy outside core in S1
11. El_NTRTHits number of TRT hits
12. El_NHighThresTRTHits number of TRT hits above high threshold
13. El_e237
14. El_e277
15. Track_El_d0 distance of closest approach (xy), wrt to PV or (0,0,0)

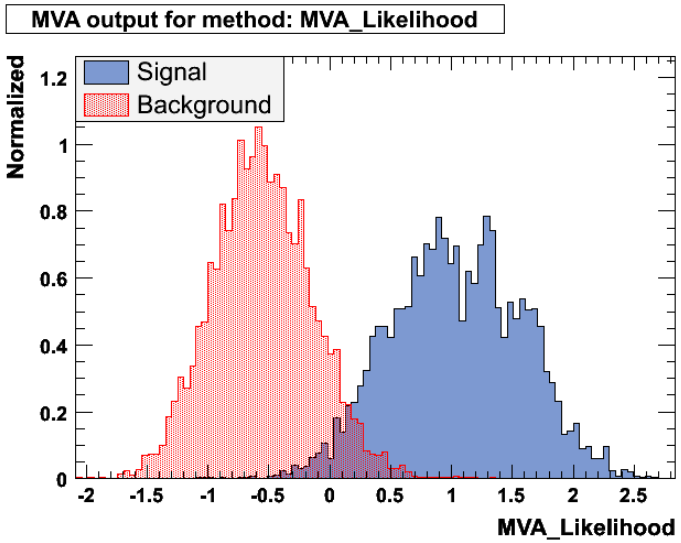
Some other variables

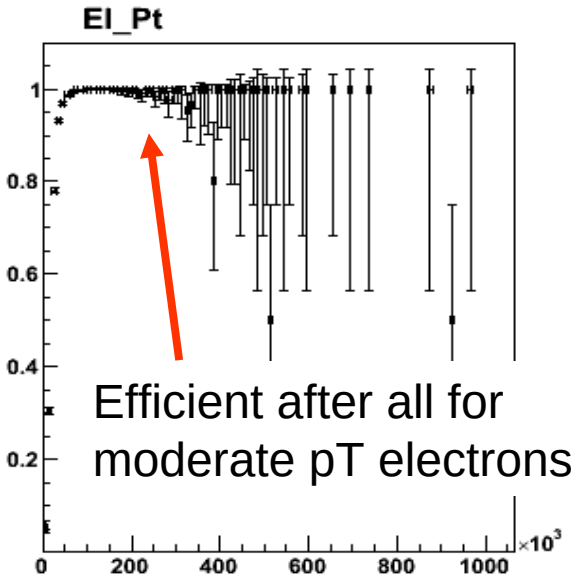




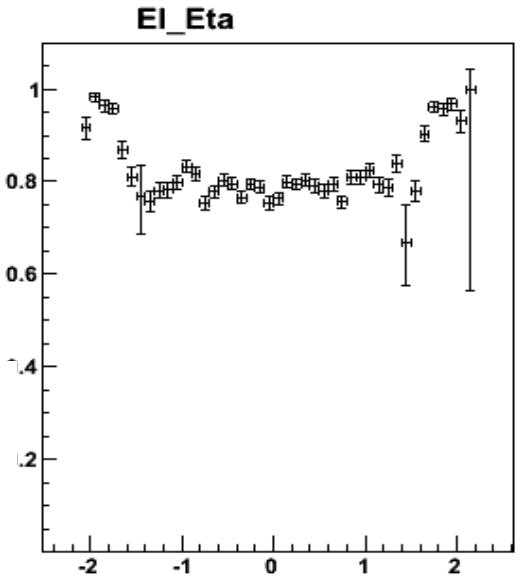


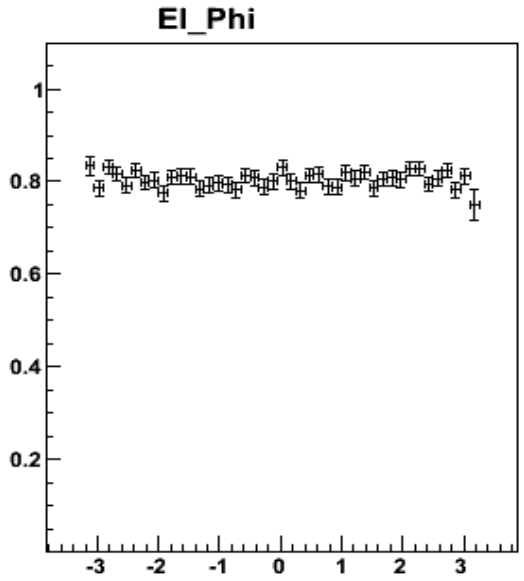
85% efficient (*) for R=100
(*) after precuts...
Not good!

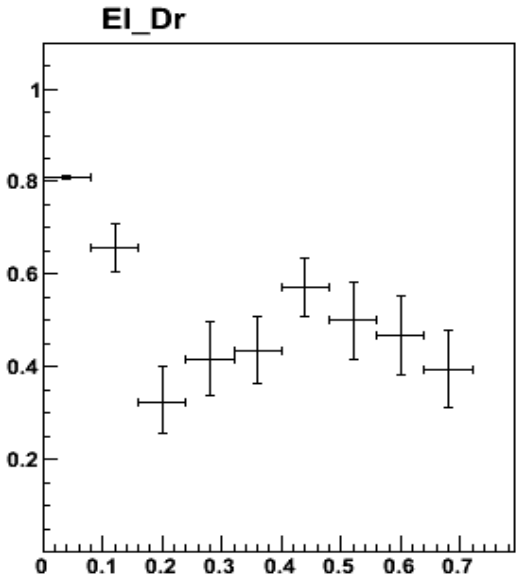


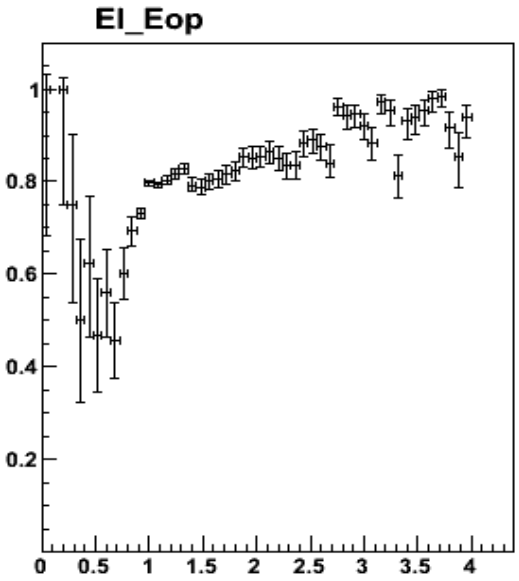


Efficient after all for moderate pT electrons ...









Efficiency w.r.t precuts v.s.
- El_pt
- El_eta
- El_phi
- El_Dr
- El_EoverP

Would be nice to have:
njets, MET, topo vars,
DR to closest jet...

- To avoid too much redundancy, remove highly correlated variables
  - El_e237/El_e277 instead of El_e237 & El_e277 (as done by E/gamma group)
  - El_etcone instead of 4 El_etcone variables
  - El_e2tsts1 & El_emins1 $\rightarrow$ replace/test E/gamma group proposed variables
- Also add:
  - Track isolations, ntrack in narrow cone, quality of track match
  - Fix the showe shape variables that seem to be broken

Proposed by E/gamma group (note com-phys-2004-074)

"Electron/jet separation with DC1 Monte Carlo"

- ET(hadronic)/ET(em)
- Rη(37)=El_e237/El_e277
- $\omega_{\eta 2}$ = El_weta2 = lateral width (RMS of energy weighted η in 2nd sampling)
- DE = Emax2 –Emin (in the strips, E of 2nd most energetic strip minus Emin, energy of the least energetic strip located b/w the first and 2nd maximum)
- …