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SDC-90-00038

SDC
SOLENOIDAL DETECTOR NOTES

STUDY OF TOP PAIR PRODUCTION IN ELECTRON-MUON EVENTS WITH SDC

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July, 1990

SDC-00038
Version 1.0 Draft

Study of Top pair production in Electron-Muon Events with SDC

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Abstract

A preliminary study at the generator level is done for top detection in the SDC by detection of large P_T electrons and muons. Background considered are $Z \rightarrow \tau\bar{\tau}$ and WW production with subsequent decays into electrons and muons

1 Details of Analysis

Production of $t\bar{t}$ pairs at 40 TeV is studied at generator level. The top signal is provided by isolated electrons and muons, originating from semileptonic decays of top into e, μ or τ.

The backgrounds considered are:

- Z^0 at high P_T, decaying into $\tau\bar{\tau}$ pairs, giving $e-\mu$ pairs
- WW production giving $e-\mu$

The ISAJET Monte Carlo was used for all processes. The following data samples were generated

Process	P_T range (GeV/c)	Sigma (nb)	Events	Luminosity (pb^{-1})	$e-\mu$ events
M_{top}=150 GeV	20-2500	12.3	55K	4.4	844
M_{top}=250 GeV	20-2500	1.6	45K	28.3	713
$Z \rightarrow \tau\bar{\tau}$	2-500	6.6	70K	10.5	336
$WW \rightarrow$leptons	20-2000	0.0146	10K	138.	237

The cross sections are those given by ISAJET and are assumed to be correct. We have checked that for CDF energies the cross sections are correct, including lepton branching ratios for Z and WW production. The P_T cuts chosen are not optimal, but the top P_T peaks at about M_{top} so these ranges are reasonable for this analysis.

The following requirements on the $e-\mu$ were imposed:

P_T (e and μ)	>	15 GeV	
$\lvert\eta(e)\rvert$	<	3.0	
$\lvert\eta(\mu)\rvert$	<	2.5	
E_T (cone DR=.2)	<	2 GeV	both electron and muon

First the highest P_T electron and muon were selected, then the isolation cut was imposed on each of them. The events shown in the table are isolated $e - \mu$ events.

For this analysis we have used efficiency and resolutions[1] as discussed in the EOI. The the electron and muon efficiencies have been taken to be 0.85 each.

REFERENCES

1. I.Hinchliffe, M.D. Shapiro, SDC-00035

FIGURE CAPTIONS

Fig. 1. It shows the spectra of the minimum P_T for the leptons of the four above processes. It is seen that a cut at 15 GeV for the M_{top}=150 GeV case gets rid of the background. For the 250 GeV mass a cut at P_{Tmin} of 30 GeV is necessary.

Fig. 1a. Integrated distribution of P_{Tmin}, i.e., same events as for Fig.1, with following modification: i. integral of all events with min lepton P_T above the abscissa P_{Tmin}, ii. efficiency for electron and muons taken to be .85 each.

Fig. 2. M_{top} = 150 GeV sample. Dphi and P_{Tmin} distribution for all the e-mu (a and b) and for the isolated e-mu only (c and d).

Fig. 3. M_{top} =150 GeV sample. Dphi and P_{Tmin} for e-mu's directly from the W that came from the top (a and b). Energy in a cone of DR=.2 for electrons (c) and muons(d) from the W.

Fig. 4. M_{top}= 150 GeV. E_T in cone of .2 for all electrons (a) and for all muons (b). Electron Et-vs Muon P_T for isolated leptons events (c) and P_{Tmin} vs Dphi for events with isolated leptons.

Fig. 5. M_{top} = 250 GeV sample. Same as Fig 2

Fig. 6. M_{top} = 250 GeV sample. Same as Fig 3

Fig. 7. M_{top} = 250 GeV sample. Same as Fig 4

Fig. 8. $Z \rightarrow \tau\bar{\tau}$. Same as Fig 2.

Fig. 9. $Z \rightarrow \tau\bar{\tau}$. Same as Fig 4

Fig. 10. $Z \rightarrow \tau\bar{\tau}$.(a) P_T of generated Z^0, (b) Z^0 mass, (c) eta of max E_T electron, (d) eta of max $P_T(\mu)$.

Fig. 11. pp→WW. Same as Fig 2.

Fig. 12. pp→WW. Same as Fig 4.

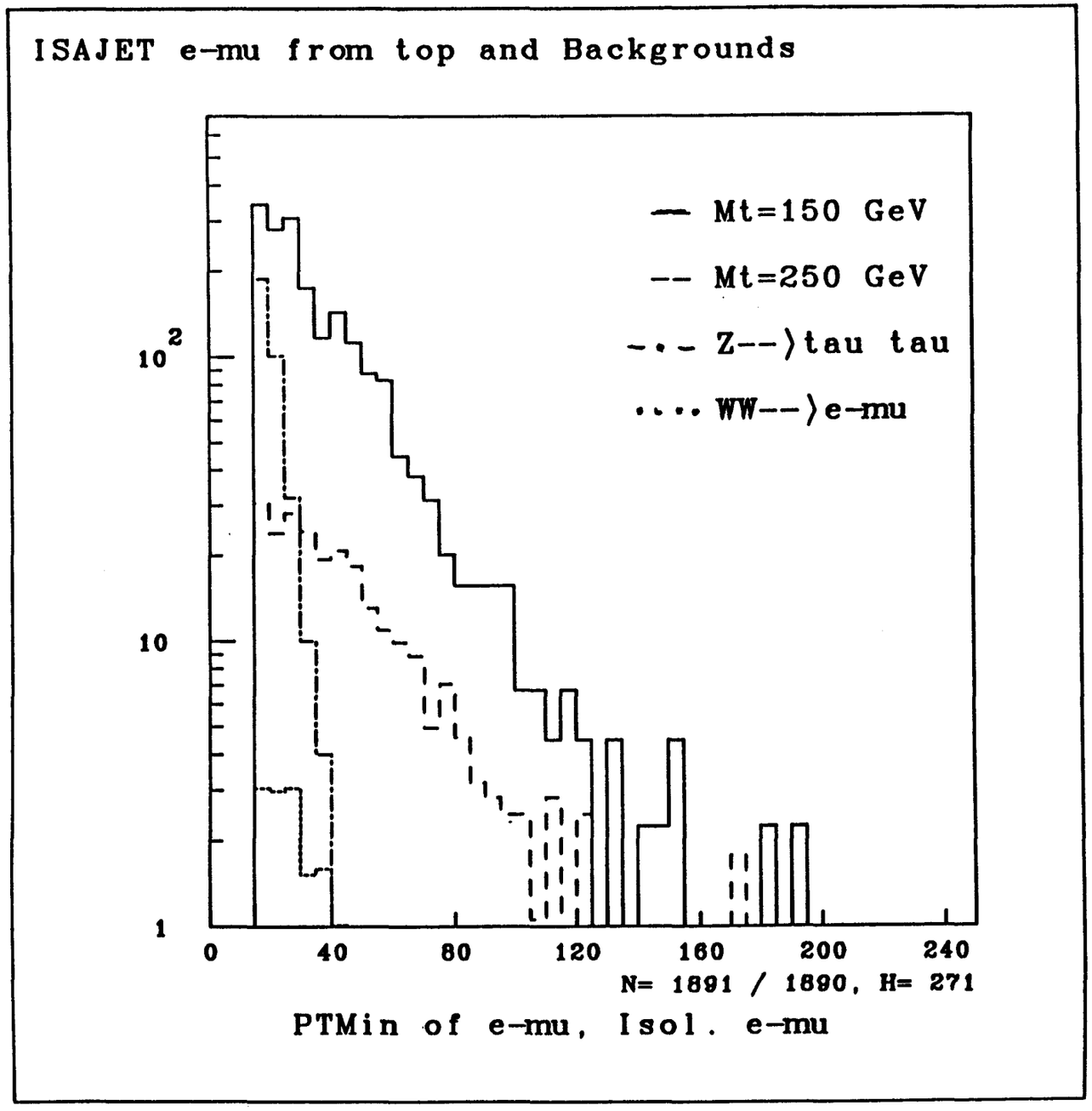
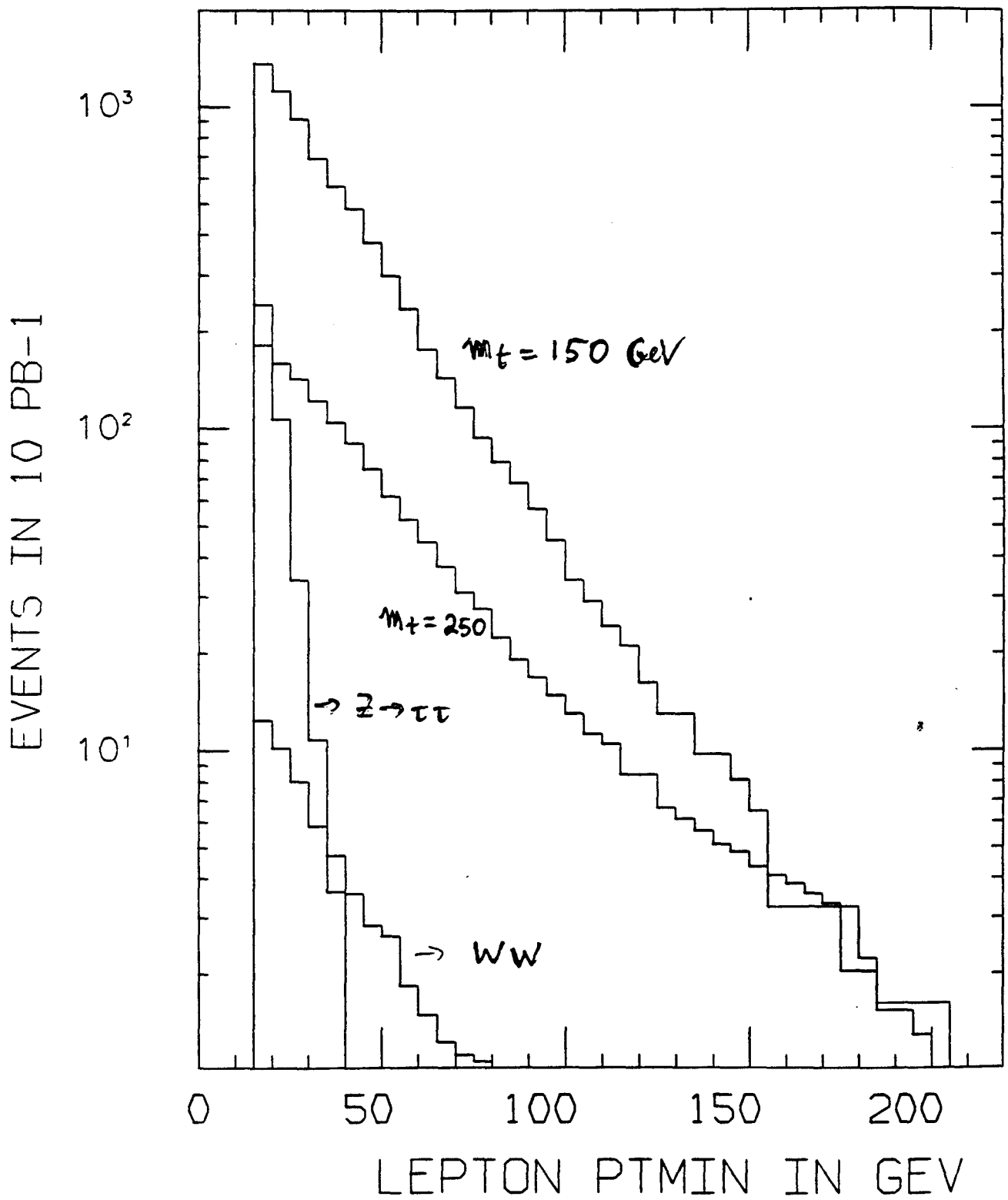

ISAJET e-mu from top and Backgrounds
Mt=150 GeV
Mt=250 GeV
Z--)tau tau
WW--)e-mu
10^2
10
1
0
40
80
120
160
200
240
N= 1891 / 1890, H= 271
PTMin of e-mu, Isol. e-mu

Fig. 1

Integrated (e−mu) Signal for Top and Backgrc



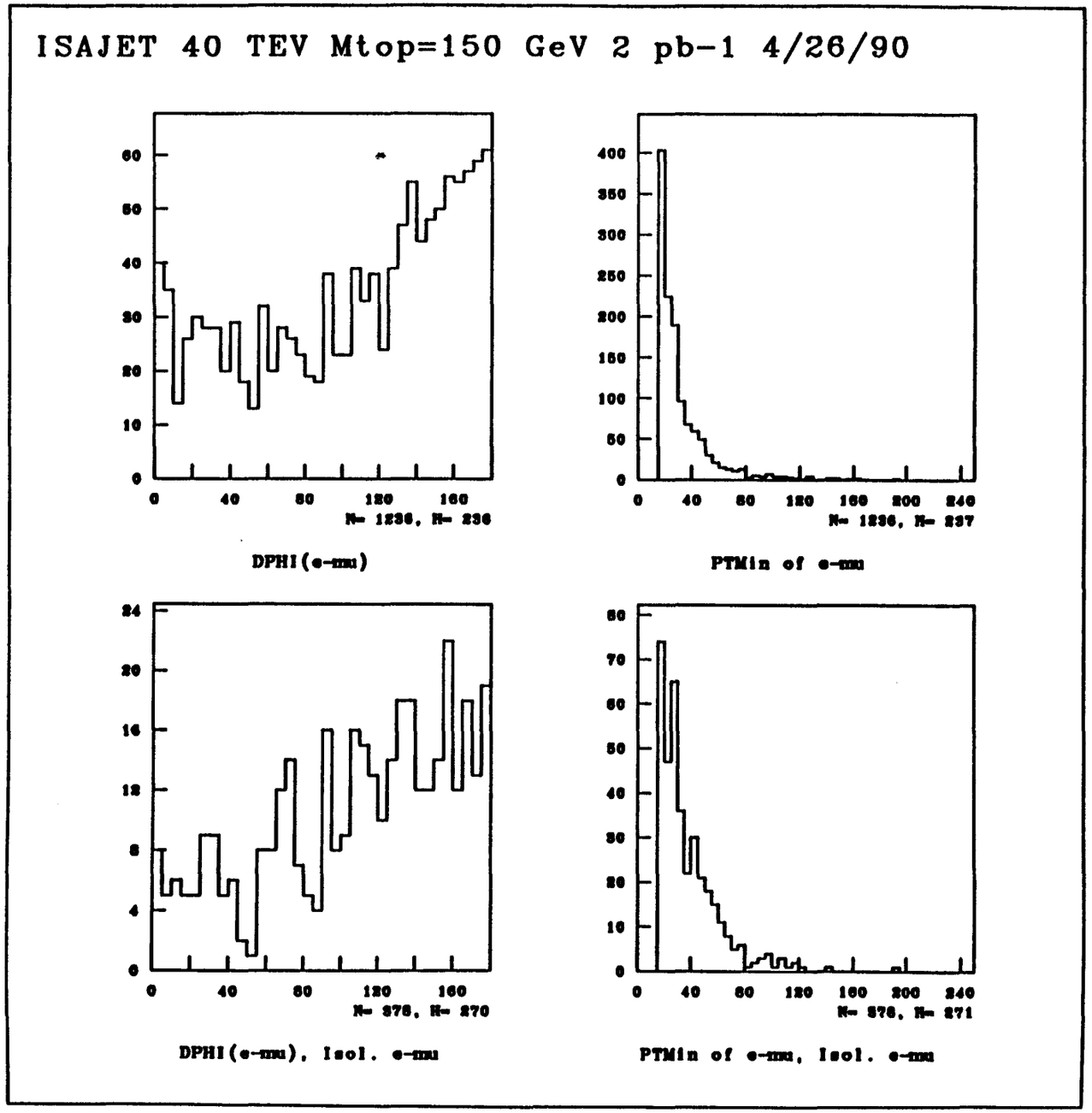

ISAJET 40 TEV Mtop=150 GeV 2 pb-1 4/26/90
N= 1236, M= 236
DPHI(e-mu)
N= 1236, M= 237
PTMin of e-mu
N= 276, M= 270
DPHI(e-mu), Isol. e-mu
N= 276, M= 271
PTMin of e-mu, Isol. e-mu

Fig. 2

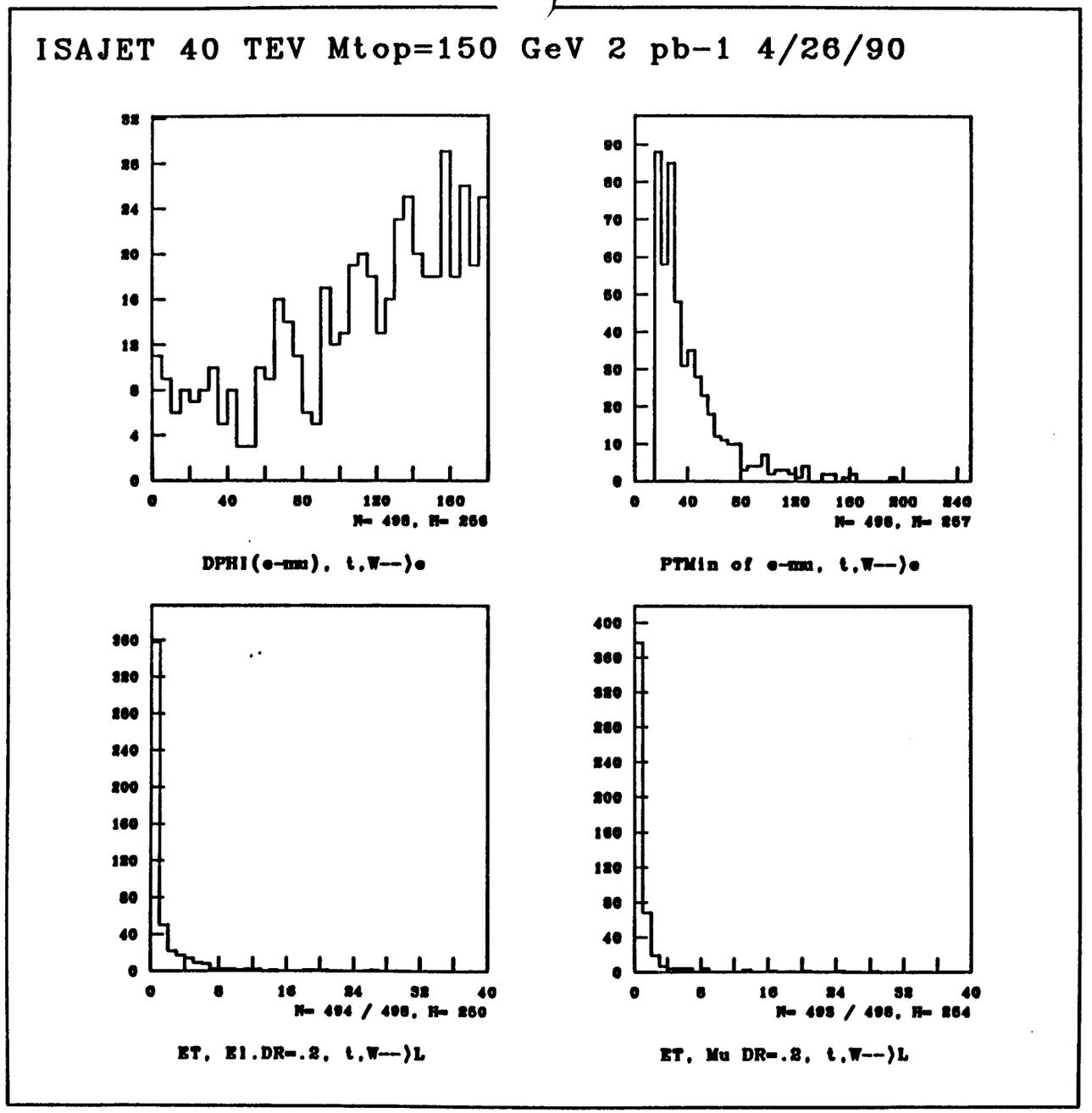

ISAJET 40 TEV Mtop=150 GeV 2 pb-1 4/26/90
N= 496, M= 256
DPHI(e-mu), t,W--)e
N= 496, M= 257
PTMin of e-mu, t,W--)e
N= 494 / 496, M= 250
ET, El.DR=.2, t,W--)L
N= 493 / 496, M= 254
ET, Mu DR=.2, t,W--)L

Fig. 3

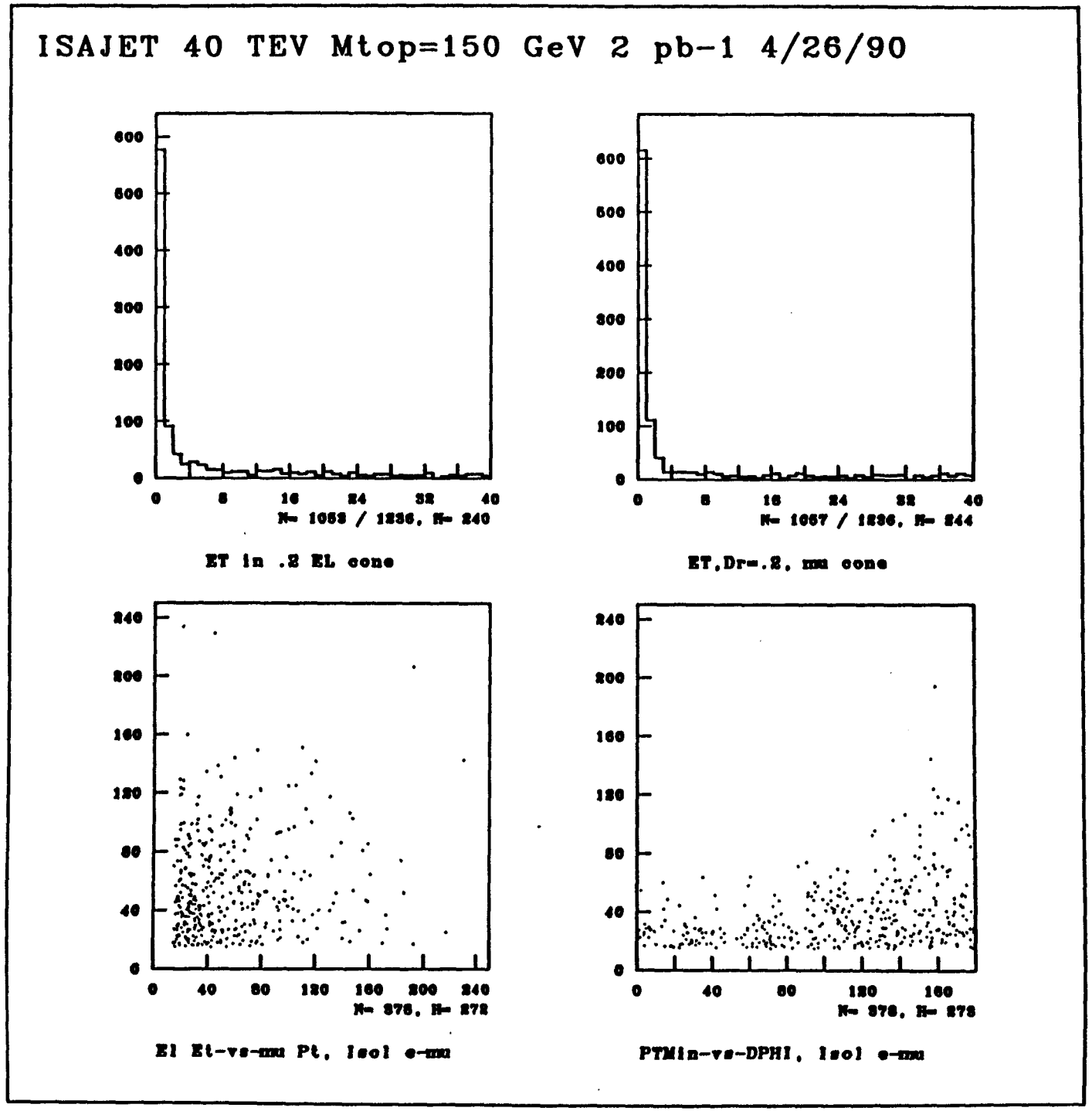

ISAJET 40 TEV Mtop=150 GeV 2 pb-1 4/26/90
N= 1053 / 1236, M= 240
ET in .2 EL cone
N= 1057 / 1236, M= 244
ET,Dr=.2, mm cone
N= 376, M= 272
El Et-vs-mm Pt, Isol e-mm
N= 376, M= 273
PTMin-vs-DPHI, Isol e-mm

Fig 4

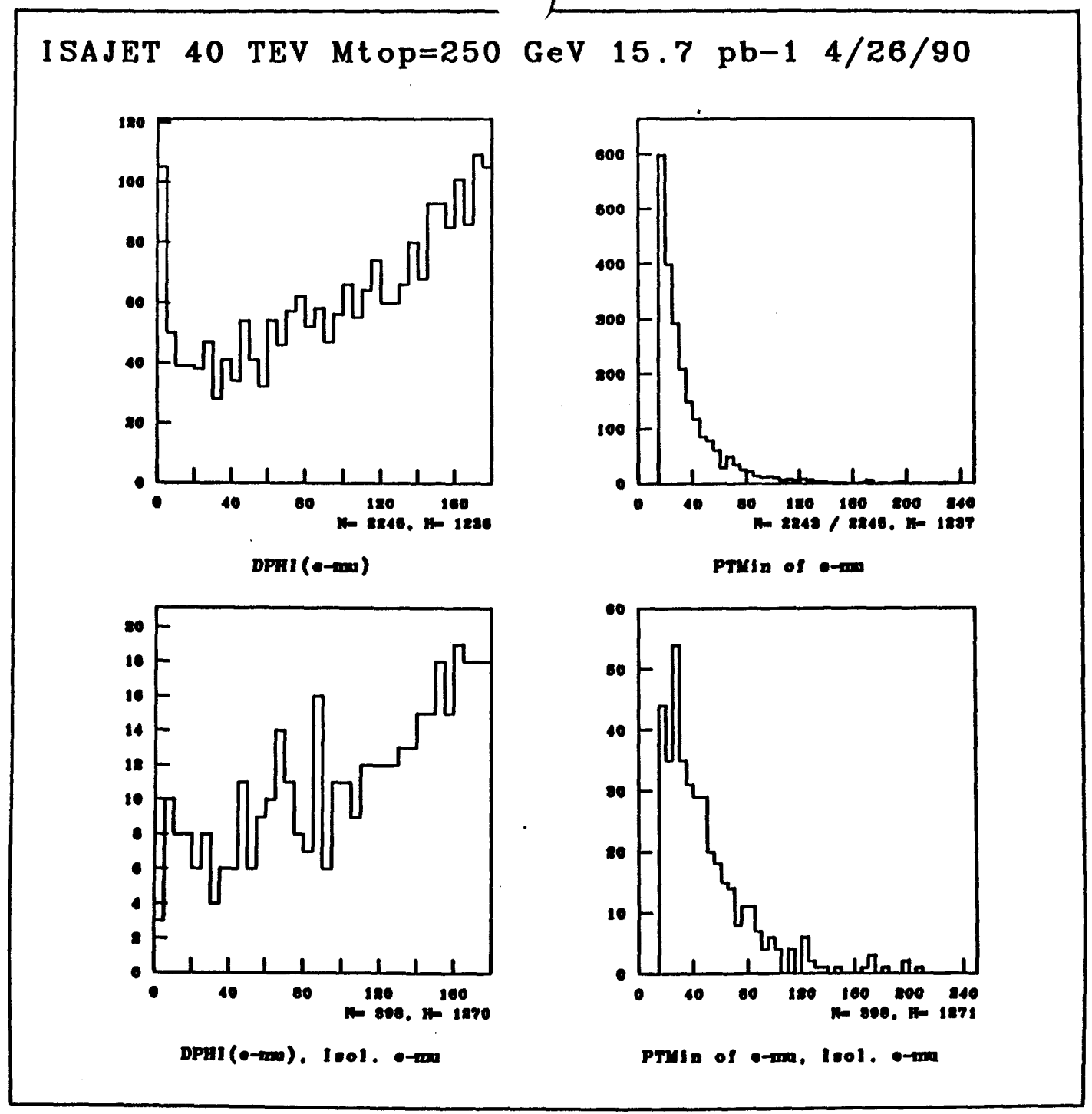

ISAJET 40 TEV Mtop=250 GeV 15.7 pb-1 4/26/90
N= 2246, M= 1236
DPHI(e-mu)
N= 2243 / 2246, M= 1237
PTMin of e-mu
N= 396, M= 1270
DPHI(e-mu), Isol. e-mu
N= 396, M= 1271
PTMin of e-mu, Isol. e-mu

Fig. 5

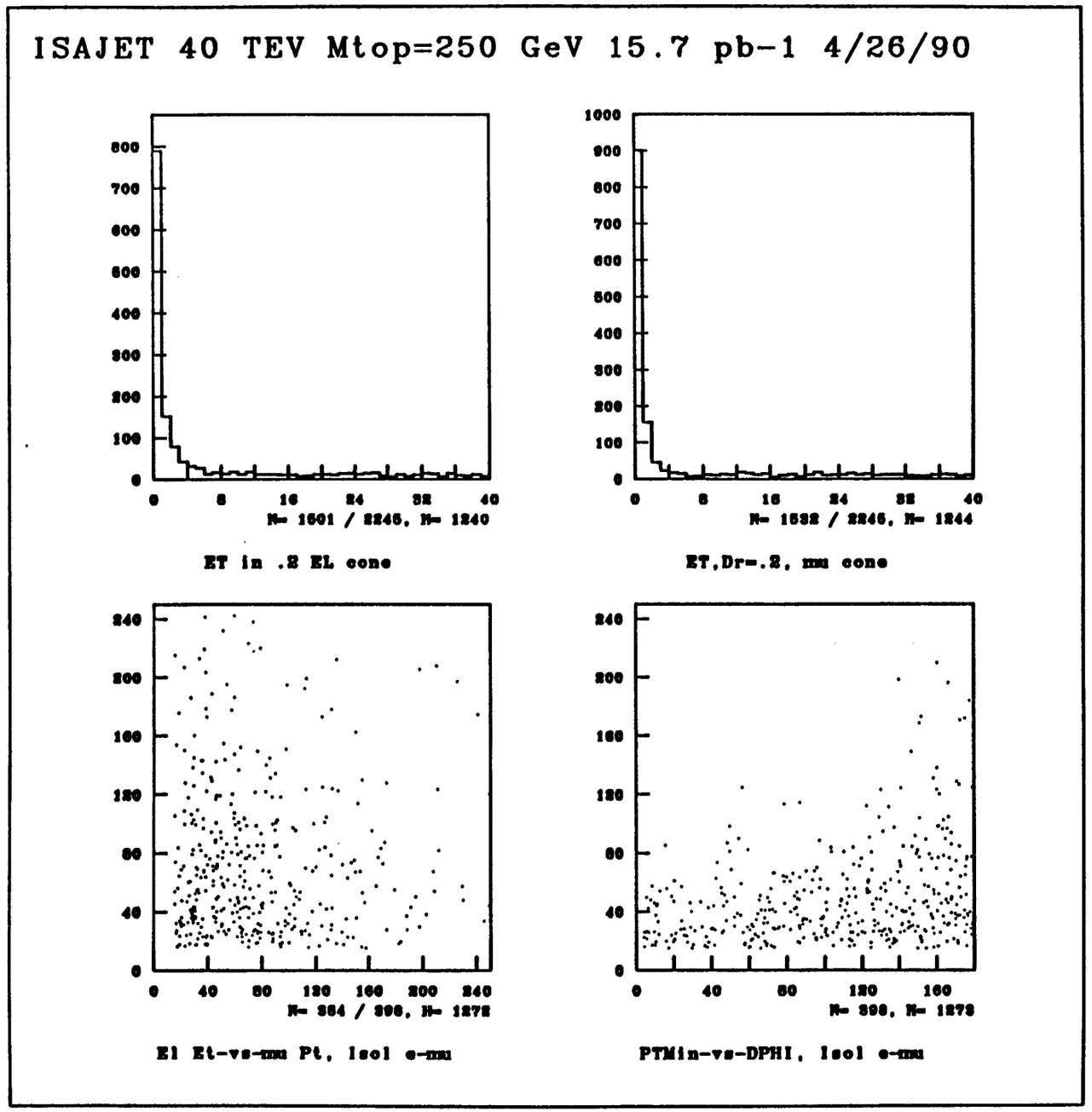

ISAJET 40 TEV Mtop=250 GeV 15.7 pb-1 4/26/90
N= 1601 / 2246, N= 1240
ET in .2 EL cone
N= 1532 / 2246, N= 1244
ET,Dr=.2, mm cone
N= 384 / 398, N= 1272
El Et-vs-mm Pt, Isol e-mm
N= 398, N= 1272
PTMin-vs-DPHI, Isol e-mm

Fig. 6

ISAJET 40 TEV Mtop=250 GeV 15.7 pb-1 4/26/90

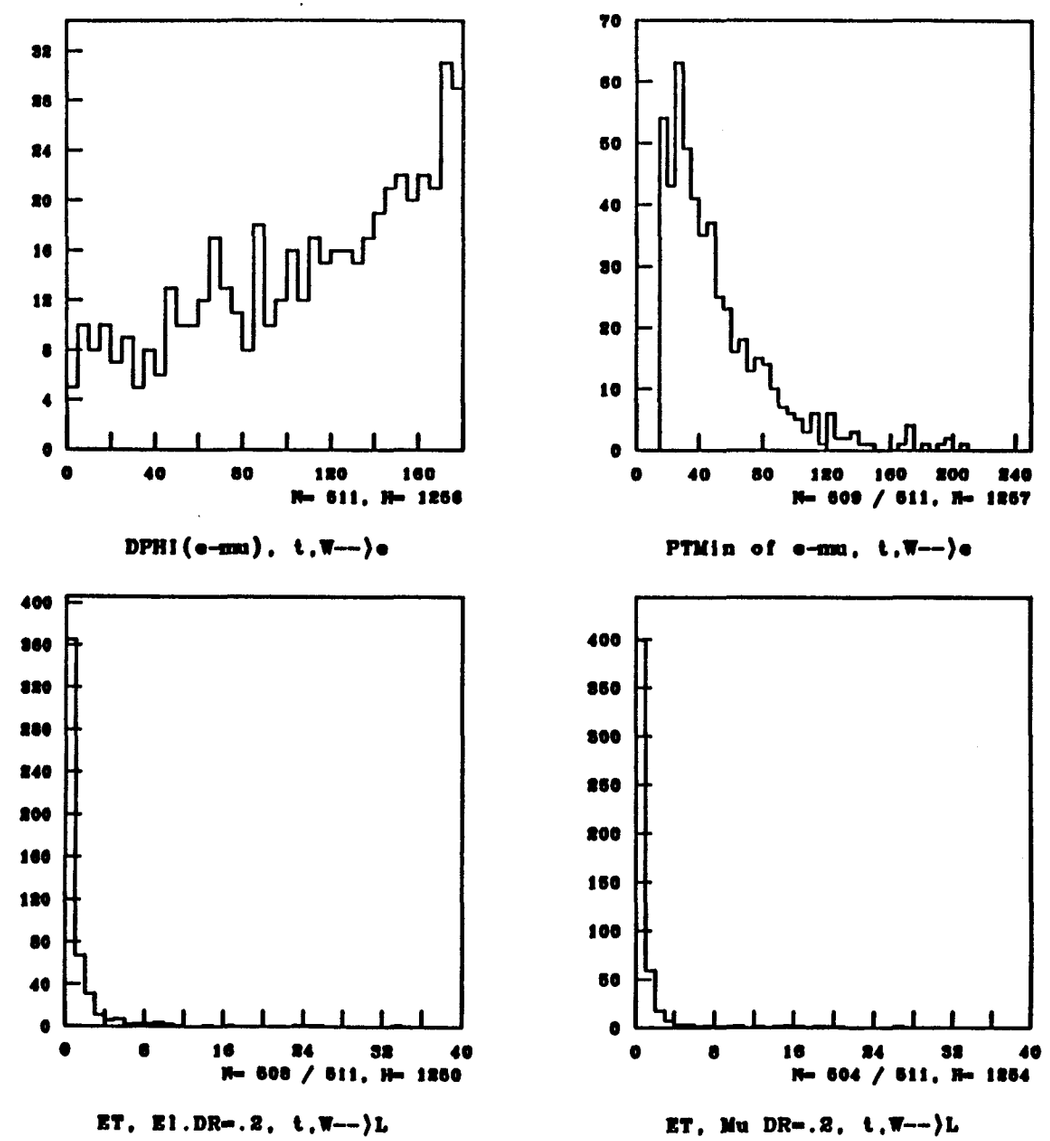
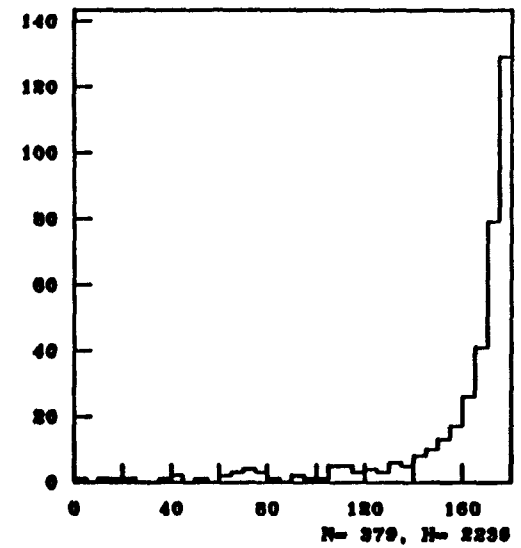
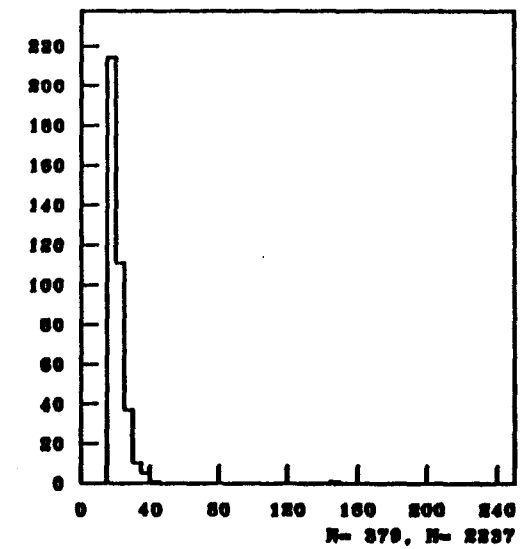


Fig. 7

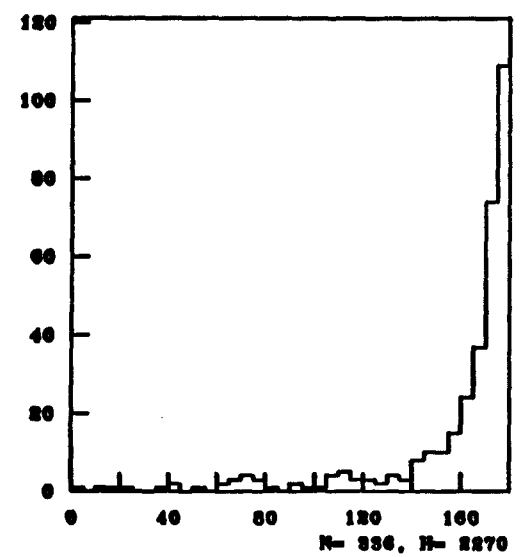
ISAJET 40 TEV Z--⟩tau tau, 10.5 pb-1 4/26/90



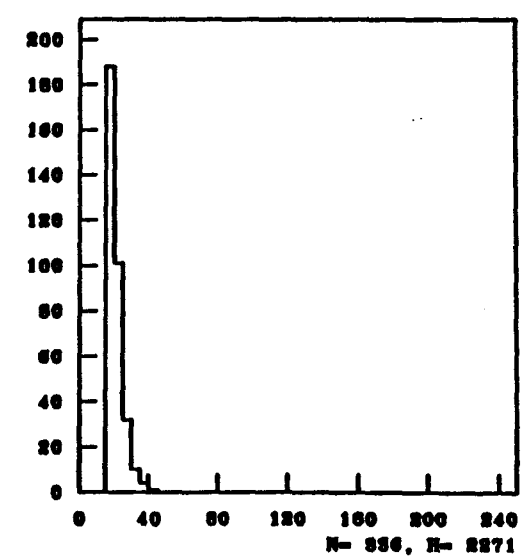
DPHI(e-mu)



PTMin of e-mu



DPHI(e-mu), Isol. e-mu



PTMin of e-mu, Isol. e-mu

Fig. 8

ISAJET 40 TEV Z--⟩tau tau, 10.5 pb-1 4/26/90

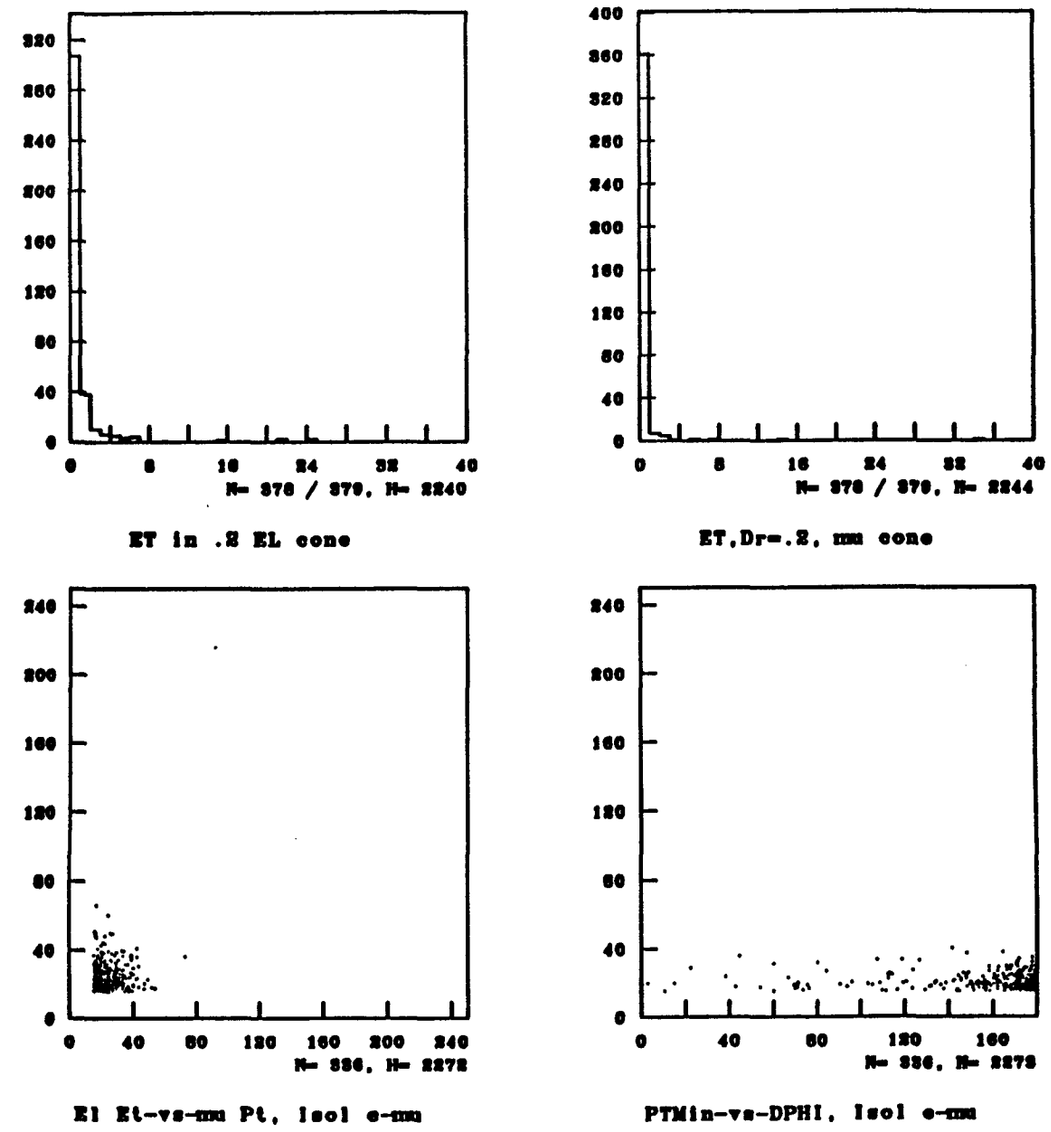


Fig 9

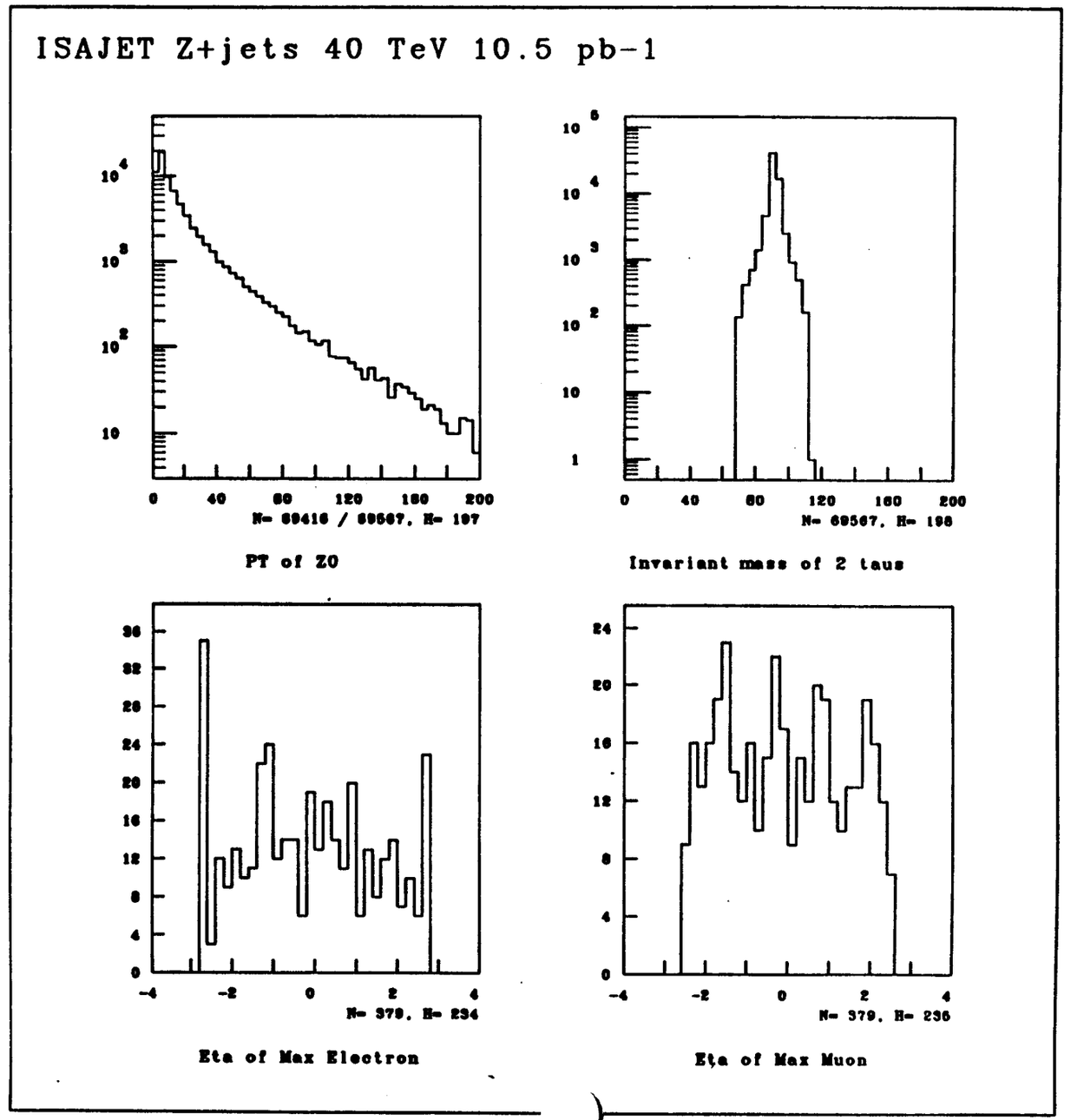

ISAJET Z+jets 40 TeV 10.5 pb-1
N= 69416 / 69567, M= 197
PT of Z0
N= 69567, M= 198
Invariant mass of 2 taus
N= 379, M= 234
Eta of Max Electron
N= 379, M= 236
Eta of Max Muon

Fig. 10

ISAJET 40 TEV pp--⟩WW, 138 pb-1 4/26/90

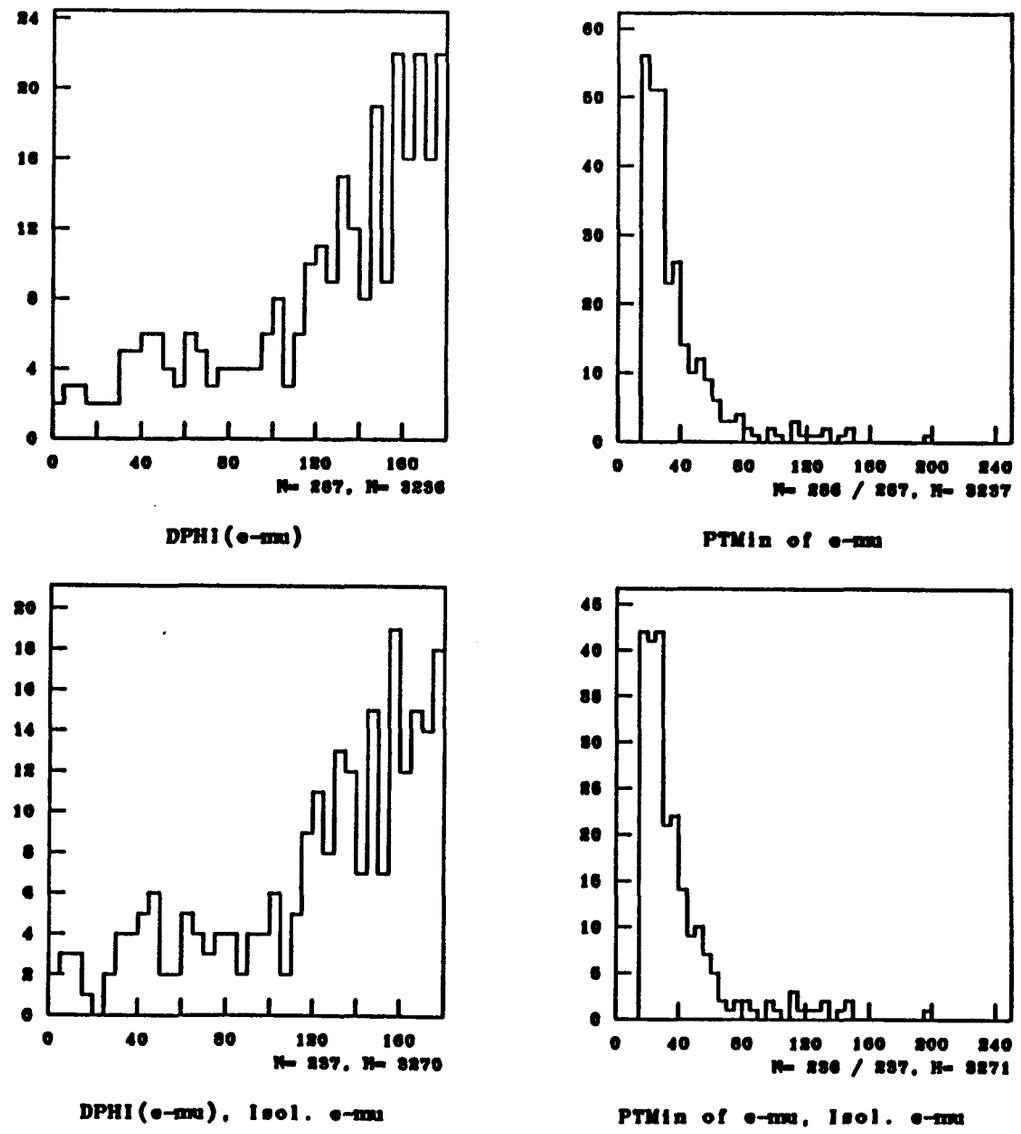


Fig. 11

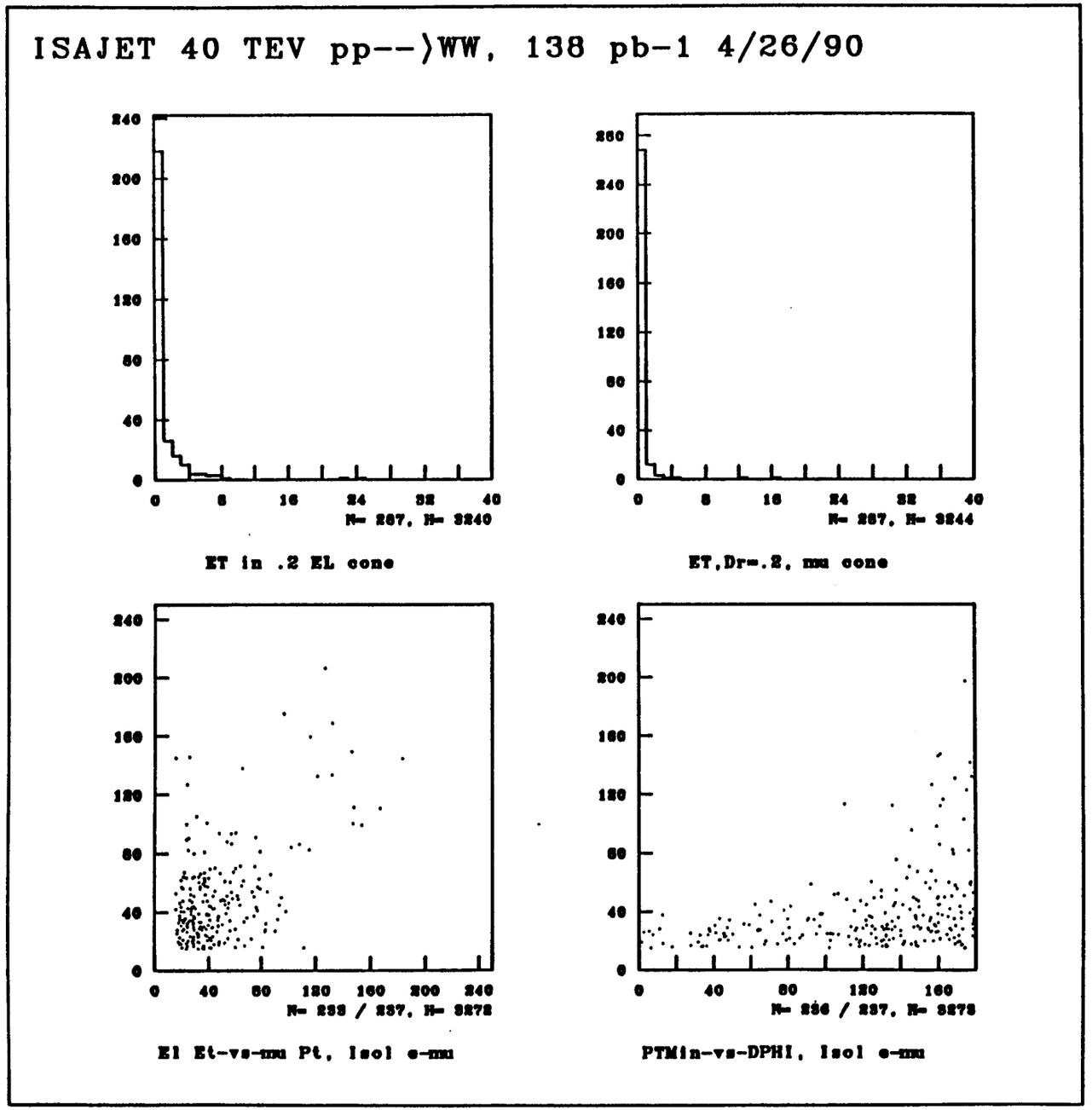

ISAJET 40 TEV pp--⟩WW, 138 pb-1 4/26/90
N= 267, M= 3240
ET in .2 EL cone
N= 267, M= 3244
ET,Dr=.2, mu cone
N= 233 / 237, M= 3278
El Et-vs-mu Pt, Isol e-mu
N= 236 / 237, M= 3278
PTMin-vs-DPHI, Isol e-mu

Fig. 12