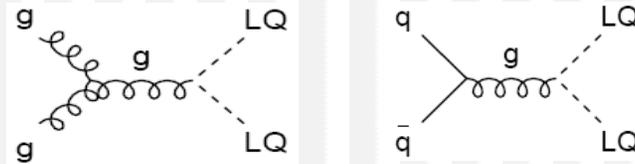


# LQ pairs sample studies

Simona Rolli

# The sample

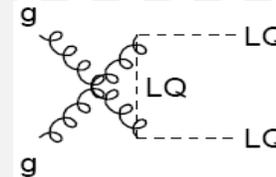
1 TeV LQ pairs



Generated with ComHEP, showering performed with Pythia

</usatlas/data02/prod/rome/datafiles/rome/recov10/rome.004677.recov10.LqLqtoqqe/>

961 events analyzed



Small ntuple produced, including AOD information:

ElectronContainer

JetContainer (Kt, cone07, cone04)

MCEventCollection (“TruthEvent”) - ESD

# Generator Level Info

There is no LQ decay performed in Pythia, hence there is no history of the decay - one would expect the full generated event history kept..

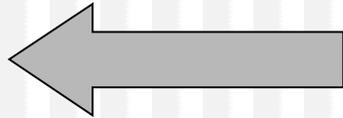
Expecting something like (this is a TeV event):

I	particle/jet	ISTHEP	IDHEP	JMOHEP	JDAHEP	PHEP(1,I)	PHEP(2,I)	PHEP(3,I)	PHEP(4,I)	PHEP(5,I)	
1	!p+	3	2212	0	0	0	0.00000	0.00000	979.99955	980.00000	0.93827
2	!p~!	3	-2212	0	0	0	0.00000	0.00000	-979.99955	980.00000	0.93827
3	!g!	3	21	1	0	0	-0.79224	0.15637	366.67311	366.67400	0.00000
4	!g!	3	21	2	0	0	0.44470	-0.05163	-102.90999	102.91096	0.00000
5	!g!	3	21	3	0	0	0.43600	-9.41590	126.20801	126.55952	0.00000
6	!g!	3	21	4	0	0	0.91861	7.79771	-94.16126	94.48804	0.00000
7	!LQ!	3	42	5	6	0	11.88370	-43.42764	12.05376	110.32894	100.00000
8	!LQ~!	3	-42	5	6	0	-10.52908	41.80945	19.99299	110.71862	100.00000
9	!b!	3	5	7	0	0	-38.33405	-6.27345	25.08934	46.49055	4.80000
10	!tau~!	3	15	7	0	0	50.21775	-37.15420	-13.03558	63.83840	1.77700
11	!b~!	3	-5	8	0	0	-19.37647	61.20276	44.44737	78.22937	4.80000

# Generator Level Info

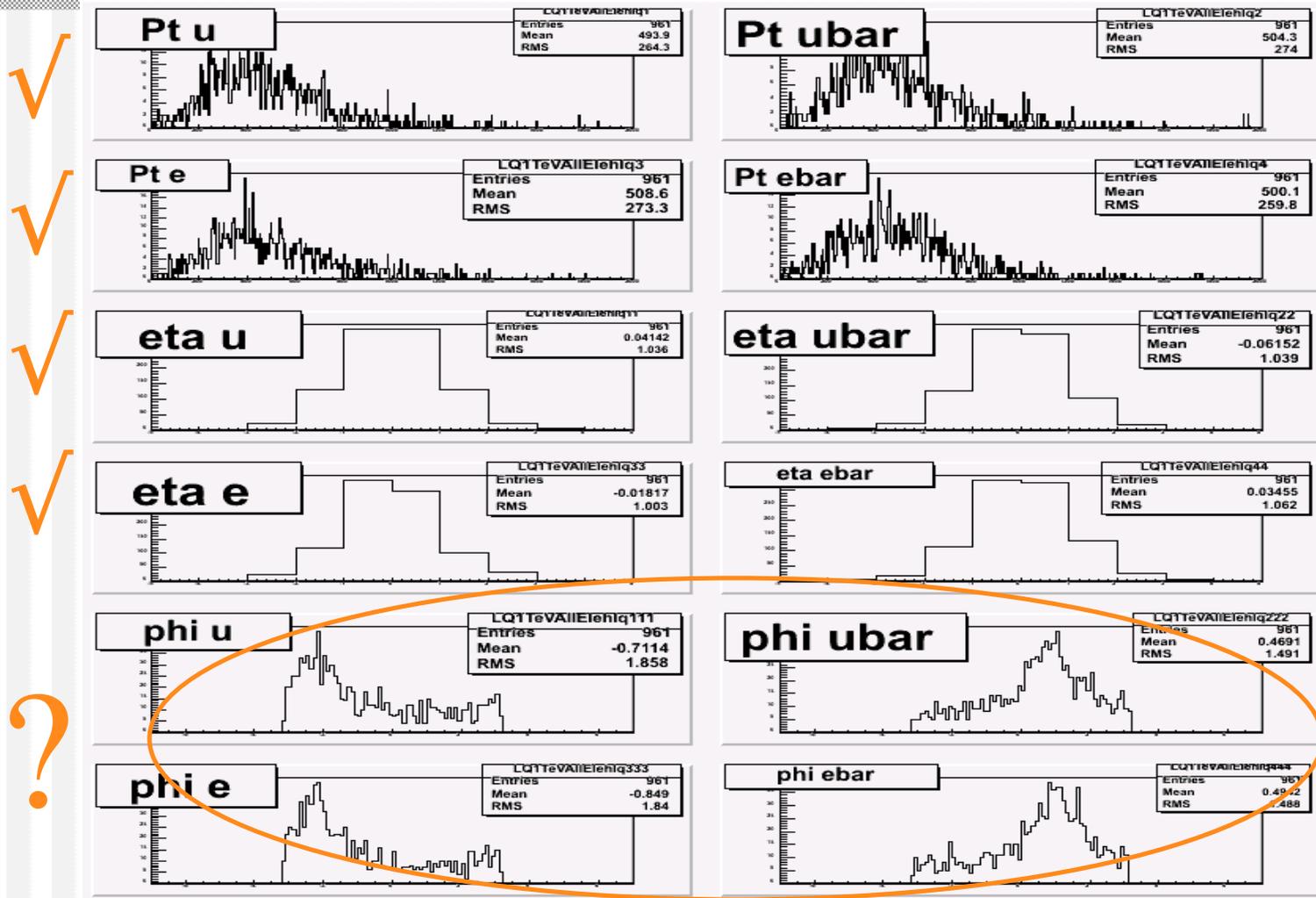
Found instead:

pdgID[0] = 2212  
pdgID[1] = 2212  
pdgID[2] = 1  
pdgID[3] = 21  
pdgID[4] = 21  
pdgID[5] = 21  
pdgID[6] = 2  
pdgID[7] = -2  
pdgID[8] = 11  
pdgID[9] = -11

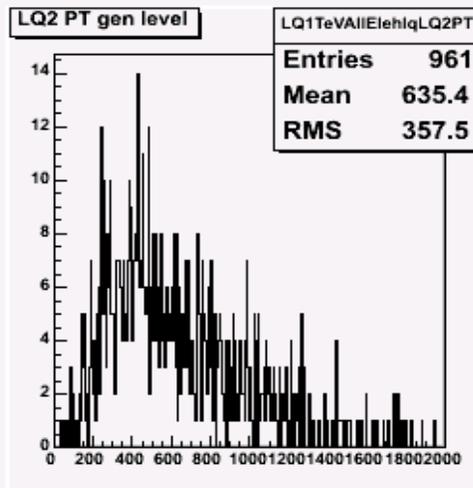
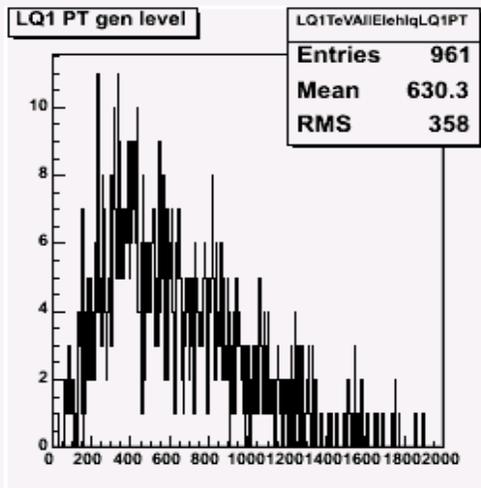
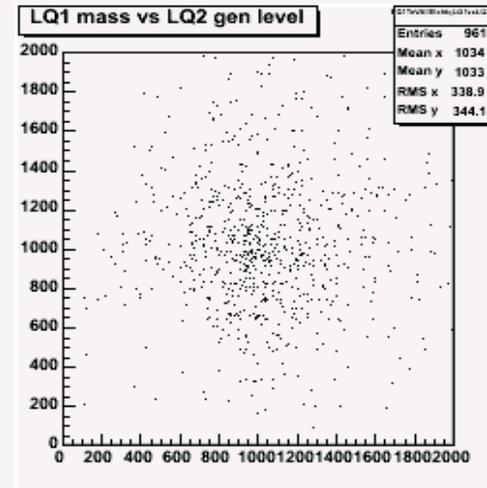
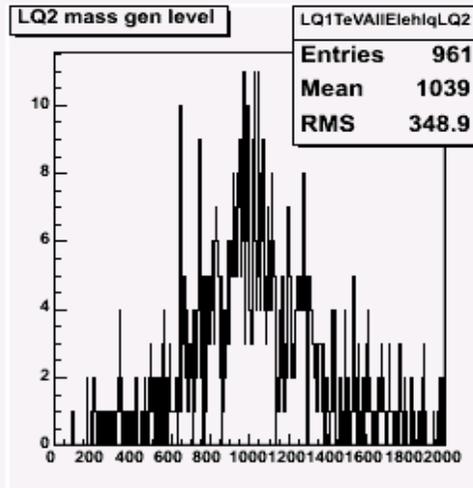
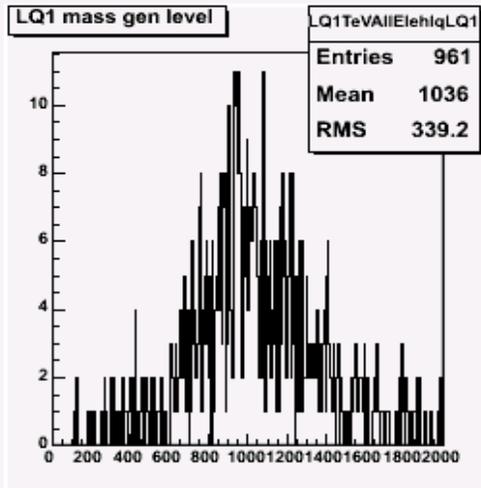


Assuming these to be the  
LQ decay products

# Generator Level analysis



# Generator Level Masses



# Generator Level Matching

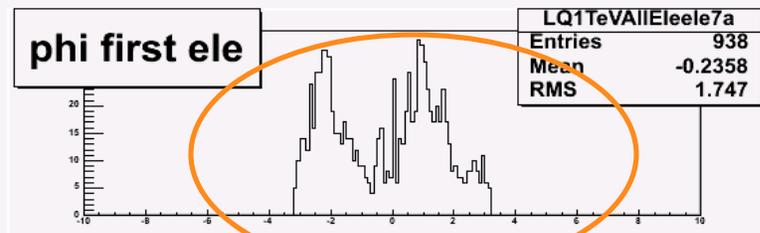
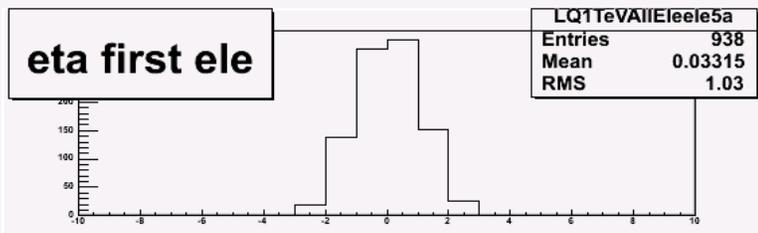
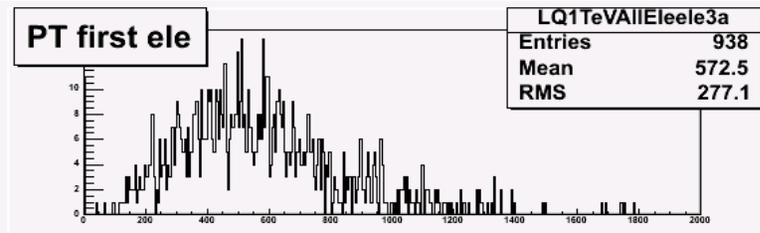
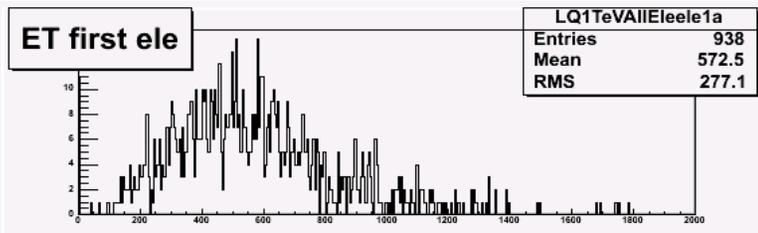
The reconstructed electrons are matched in

$$\Delta R = \sqrt{\Delta\varphi^2 + \Delta\eta^2} < 0.3$$

The reconstructed matched electrons are analyzed

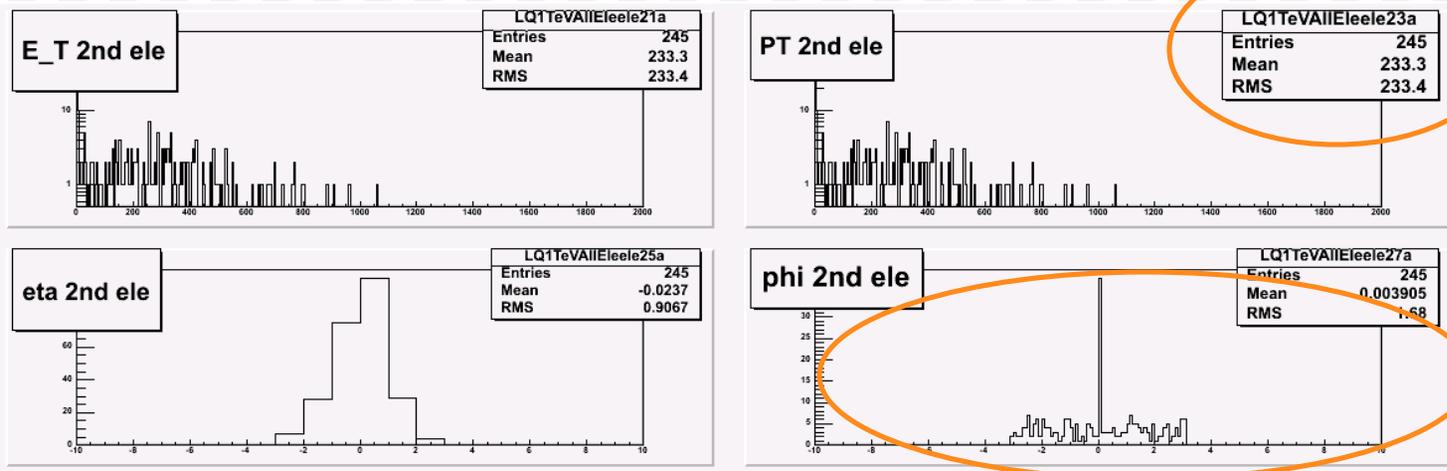
# Generator Level Matching

938 events have one reco  
electron matched to one of the 2 LQ decay electrons



# Generator Level Matching

245 events have a second reco  
ele matched to one of the two electrons from LQs



# Generator Level Matching

The efficiency to find a second match is very low:  
245/961 events. Too low

Question: is the second electron really reconstructed  
in the ElectronContainer?

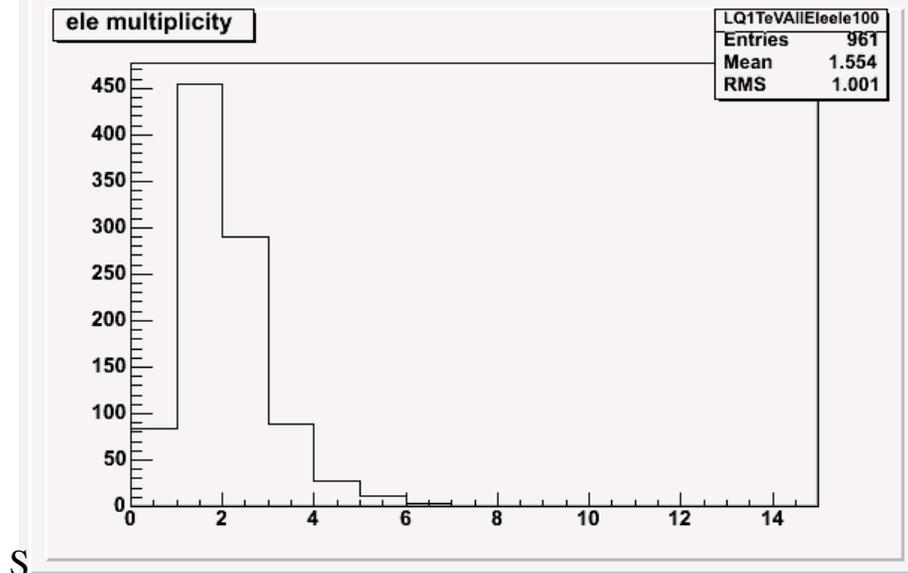
Let's look at the reconstructed electrons (no matching) ...

# Reco electron selection

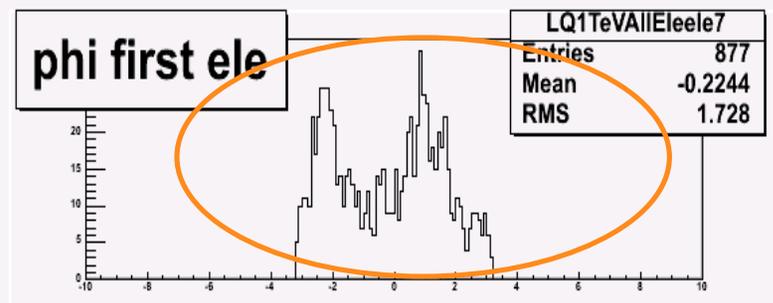
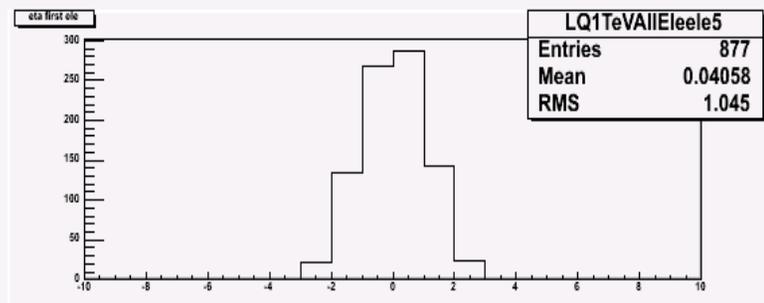
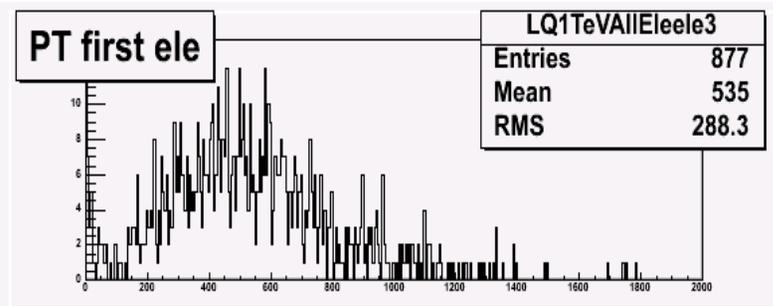
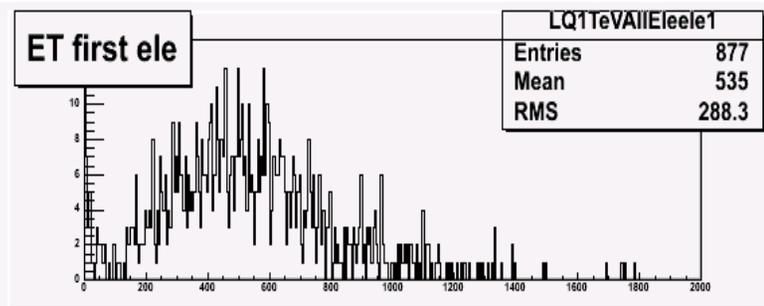
Two electrons are selected with the following criteria:

- $E_T > 30 \text{ GeV}$
- $\eta < 2.5$
- Likelihood

$$X = \text{ElecEMWeight}/(\text{ElecEMWeight}+\text{ElecPiWeight}) > 0.6$$

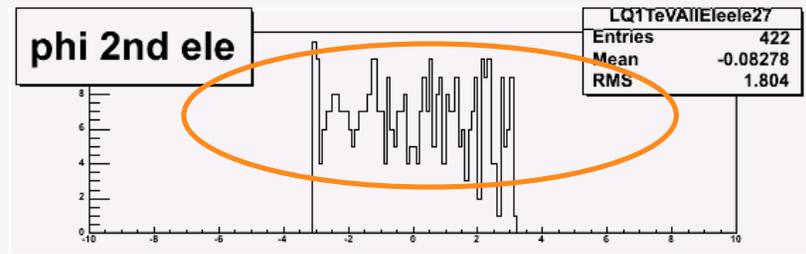
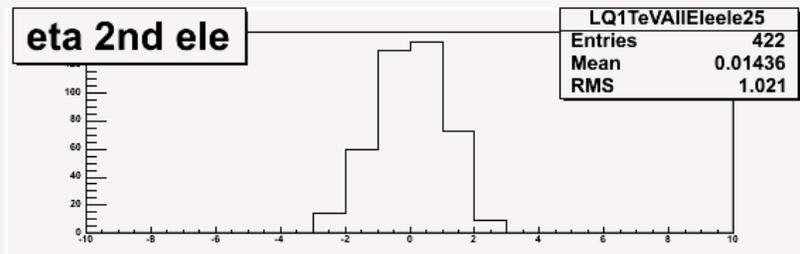
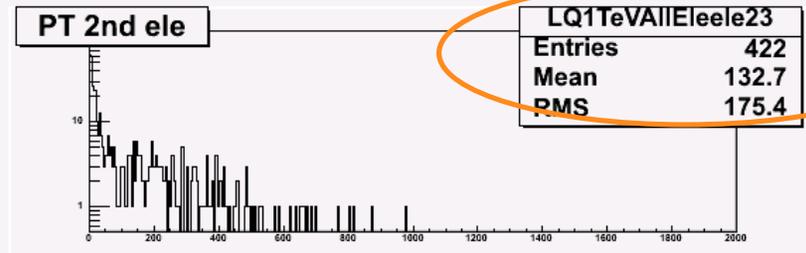
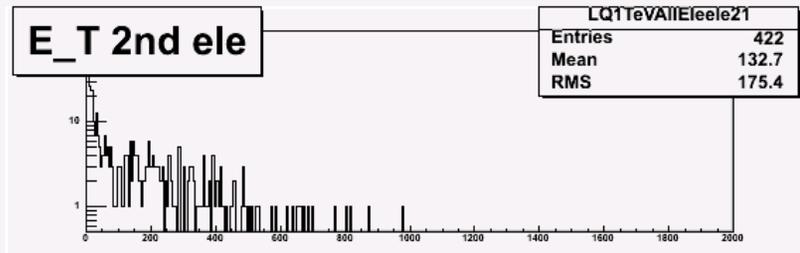


# Reco Electron Selection



Comments: this electron seems to be coming from the LQ  
The  $\varphi$  distribution is correctly wrong!

# Reco Electron Selection

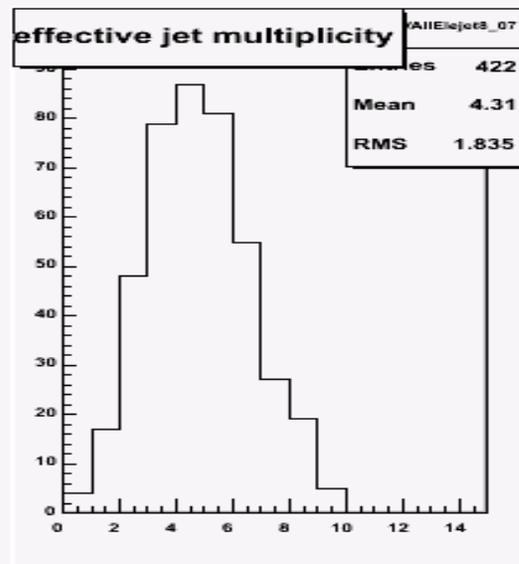
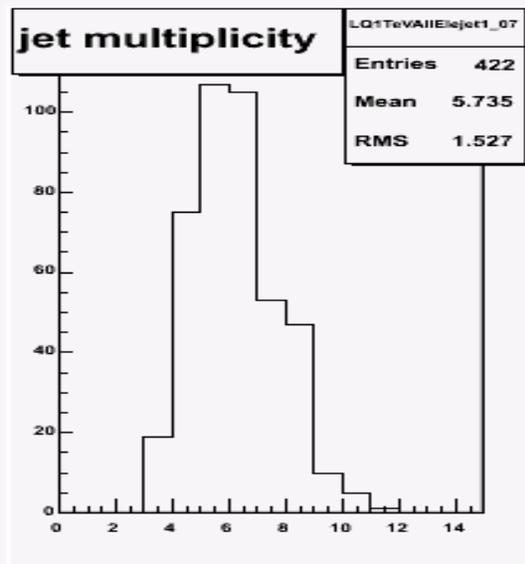


Comments: this electron does not seem to be coming from the LQ: very low mean  $E_T$ , the  $\varphi$  distribution is flatter....

# Jets

## Using Cone07 jets

The objects in the JetContainer are selected such that there is no overlap in  $\Delta R = 0.7$  with the 2 selected electrons (assuming here that we are selecting the correct eles....)

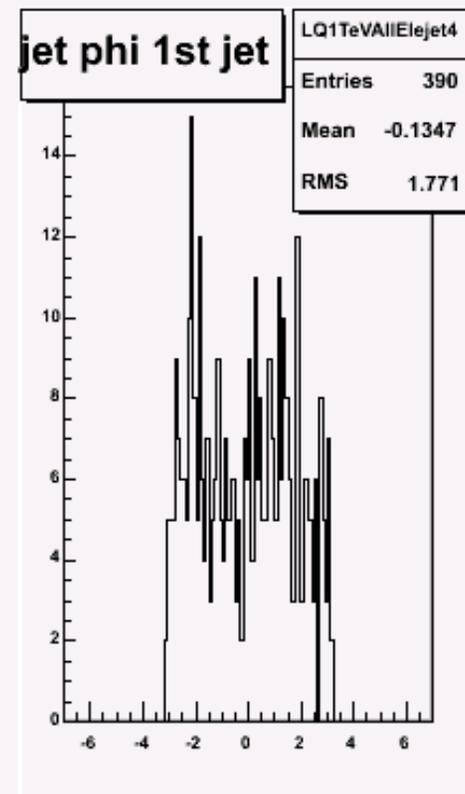
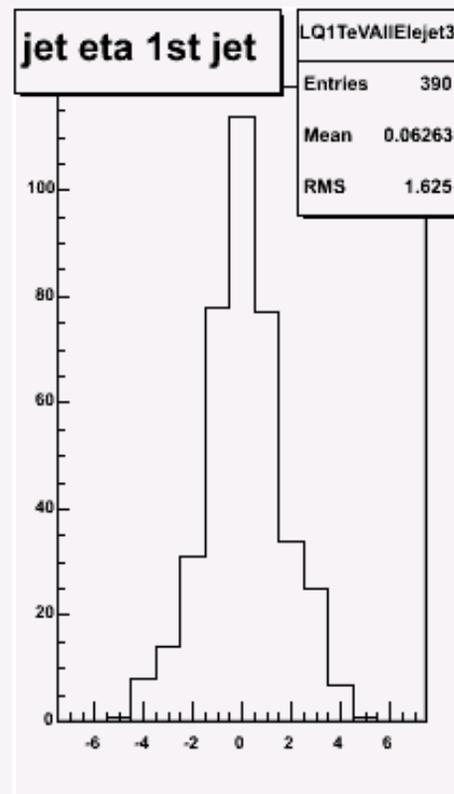
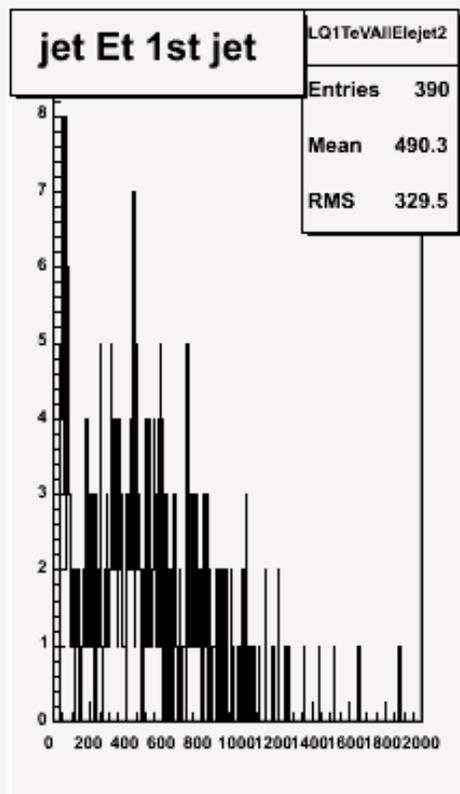


# Jet Selection

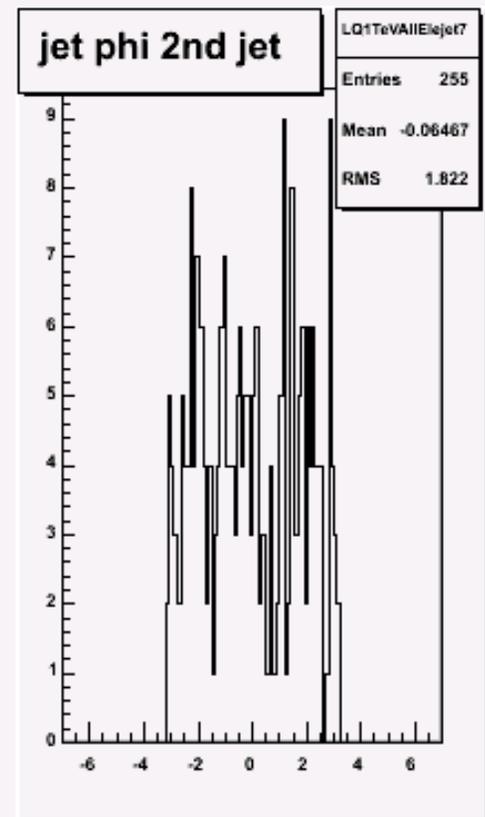
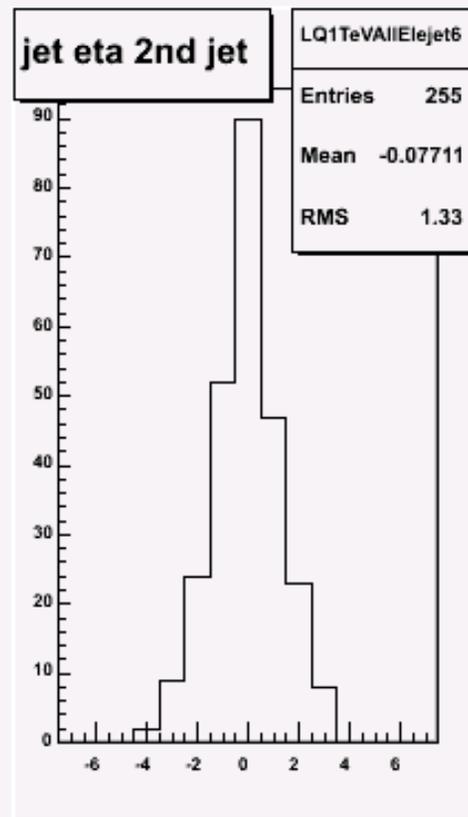
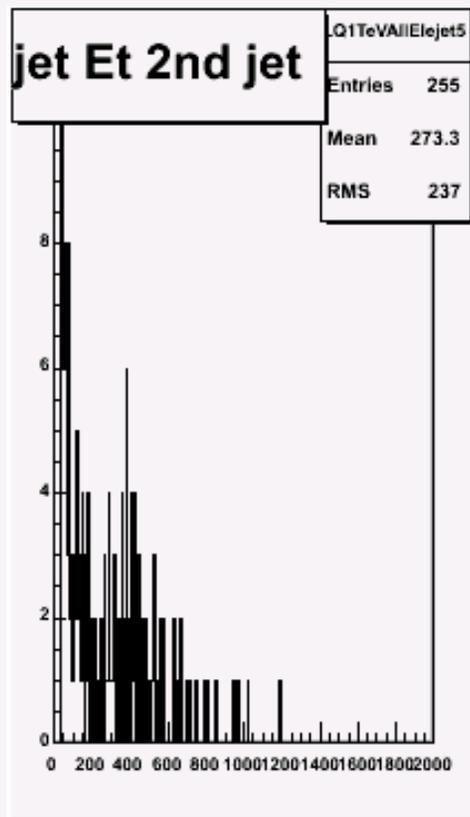
Events are selected with 2 jets with

- $E_T > 30 \text{ GeV}$  and
- $\eta < 5.0$
- no overlap with electrons

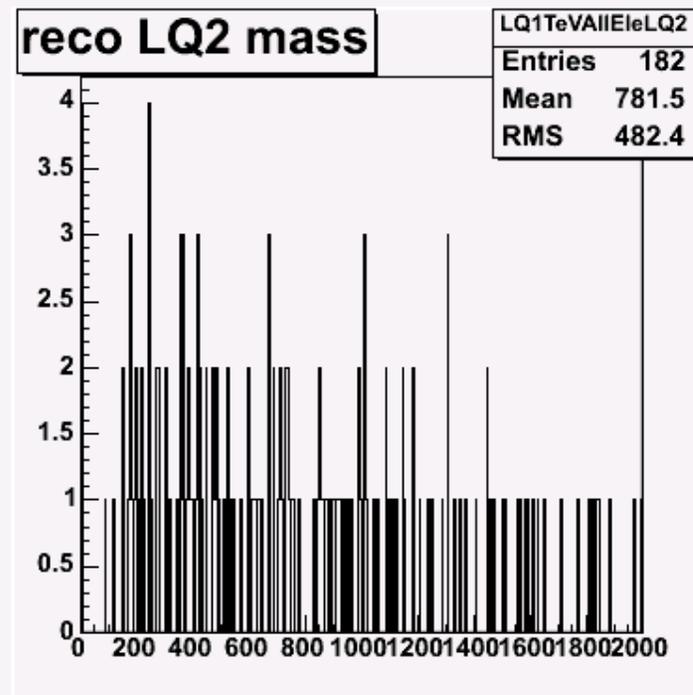
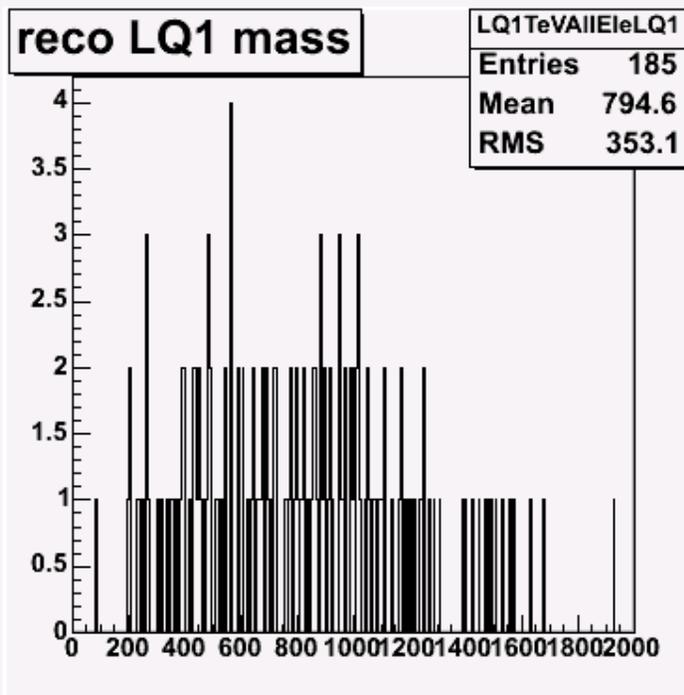
# First Jet



# Second Jet



# Reco Masses



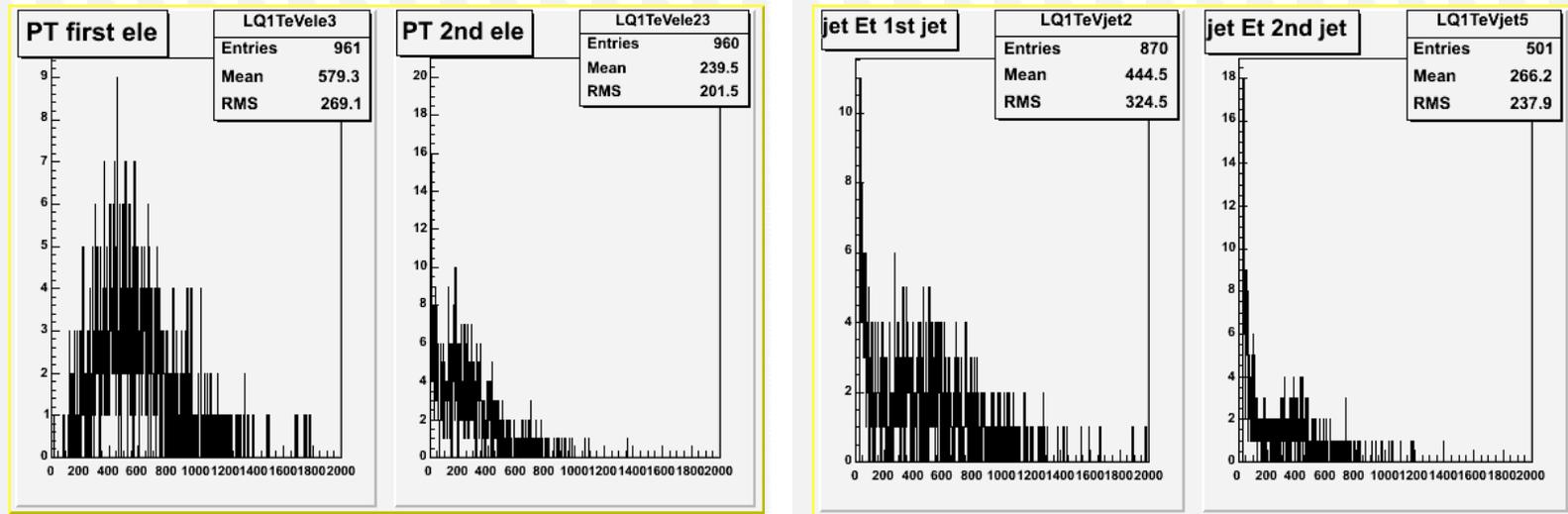
# Numbers

Number of processed events	961	
Number of events with one ele matched	938	(0.97)
Number of events with two eles matched	245	(0.25)
Number of events with one tight ele- fidele	877	(0.91)
Number of events with two tight ele- central or plug	422	(0.44)
Number of events with on jet	390	(0.40)
Number of events with two jet	255	(0.26)

This efficiency is low...

# Previous check

Not looking at GEN level info,  
Selecting 2 eles with  $E_T > 30$  and  $\eta < 2.5$ , no ID  
and 2 not overlapping jets -  $E_T > 30$  and  $\eta < 5$



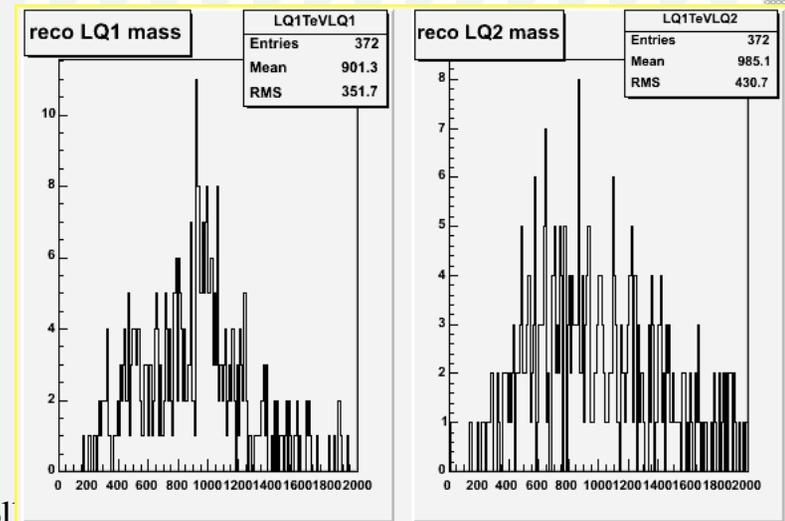
# Previous check

Signal efficiency for preliminary selection:

2 ele  $ET > 30$ ,  $\eta < 2.5$  (no ID applied)

2 jets  $ET > 30$ ,  $\eta < 5.0$  not overlapping

**X-sec expected :  $0.50 \times 8.36 \text{ fb} = 4.2 \text{ fb}$  (vs 5)**



# Conclusions

- 1) Generator level problem with phi distribution  
Rashid noticed the same on the single LQ sample  
missing phi randomization in CompHEP/Pythia?
- 2) Electron Reconstruction...Likelihood ID not  
completely understood