L3 Geometric Corrections : Comparisons with Reco

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A. Method – Framework

The goal of this study is to quantify the effects of geometric corrections implemented at L3 through comparisons between Trigsim and Reco outputs. These corrections affect only the electron candidate characteristics, namely ET (its transverse energy), kineX, kineY, kineZ and kineT(momentum).

The releases used are the following:

- Trigsim: p15.06.00 – trigger list: EM-PREP-P15-1.00[a]
- Trigsim: p16.01.00 – trigger list: L3p16_cert-1.00
- Reco: p14.05.01 – d0correct v00-00-06

We use p15.06.00 and p16.01.00 releases because geometric corrections were not implemented in the first but were present in the latter. We will thus compare results coming from both releases, assuming that the main effects on the variables we are looking at come from geometric corrections[b].

As far as events are concerned, the following samples were used:

- MC: Zee (p14) – 9200 to 9400 events
- Data: Anteshutdown run # 177318 - yyyyy events

A matching between the quantities of Trigsim and Reco may be necessary if one wants to compare both on a cluster by cluster basis. We decided to match Trigsim calorimeter clusters to Reco ones on the basis of a geometric criteria: for each Trigsim cluster defined by (η,Φ) the nearest Reco cluster according to $\Delta R=\sqrt{\Delta\eta^2+\Delta\Phi^2}$ is searched and matched. A Trigsim cluster can be associated to only one Reco cluster (and vice-versa). Only the "best" configuration (ie the ones with the smallest ΔR) is retained. No cut on ΔR was applied during the studies. Results obtained by this method are given on figure 1 for p16.01.00. With this matching, we will select Trigsim objects by setting criteria on associated Reco ones.

[a] This file was modified according to values of L3p16_cert-1.00

[b] Another big difference between p15.01.00 and p16.01.00 comes from modified rcp parameters related to calorimeter alignment and calorimeter unpacker. However for the variables of interest for this study, geometric corrections are the main effect. See the following talk for more information: http://www-d0.hef.kun.nl///askArchive.php?base=agenda&categ=a04280&id=a04280s1t41/transparencies/l3_p16_17feb2004.ppt

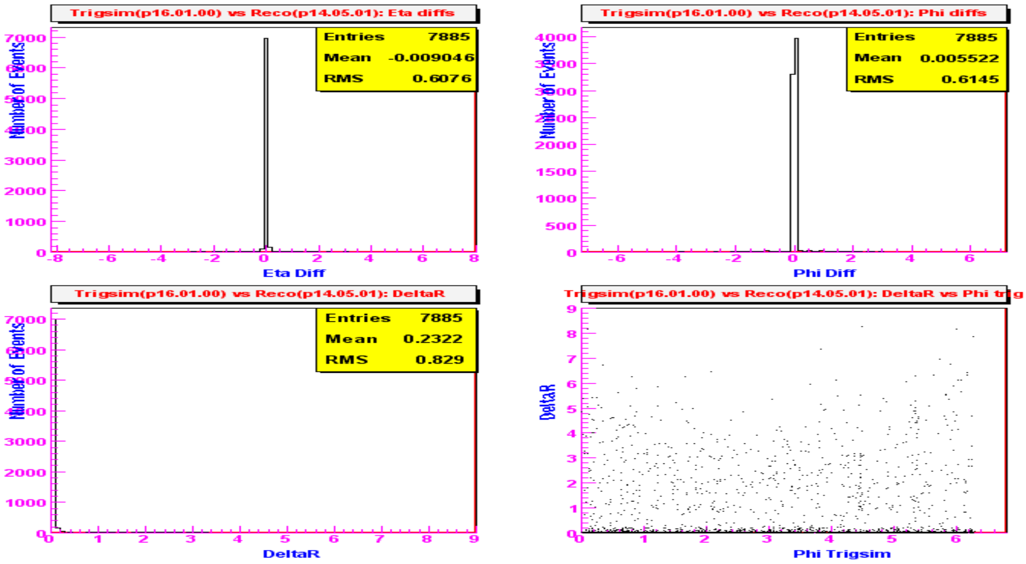

Figure 1: Δη (top left) ,ΔΦ (top right) and ΔR (bottom distributions for matched clusters Trigsim-Reco

B. MC Study

The electron tool choosen for the MC study is ELE_NLV_SHT whose characteristics are given at the end of this report.

a. Effects on ET

The ratio ET(Trigsim)/Et(Reco) is a good estimate of geometric correction effects. It was computed both for p15.06.00 (ie without geometric corrections) and p16.01.00 (ie with geometric corrections) for three configurations:

- Reco objects have an id equal to ±11 (figure 3)
- Reco objects are tagged as loose electrons (figure 4)
- Reco objects are tagged as tight electrons (figure 5)

For loose and tight electrons, we took the following definitions:

- Loose: pT>15 GeV, Emfrac>0.9, isolation<0.15 and χ^2(HM8)<20
- Tight: same as loose plus χ^2(probability)>0.01

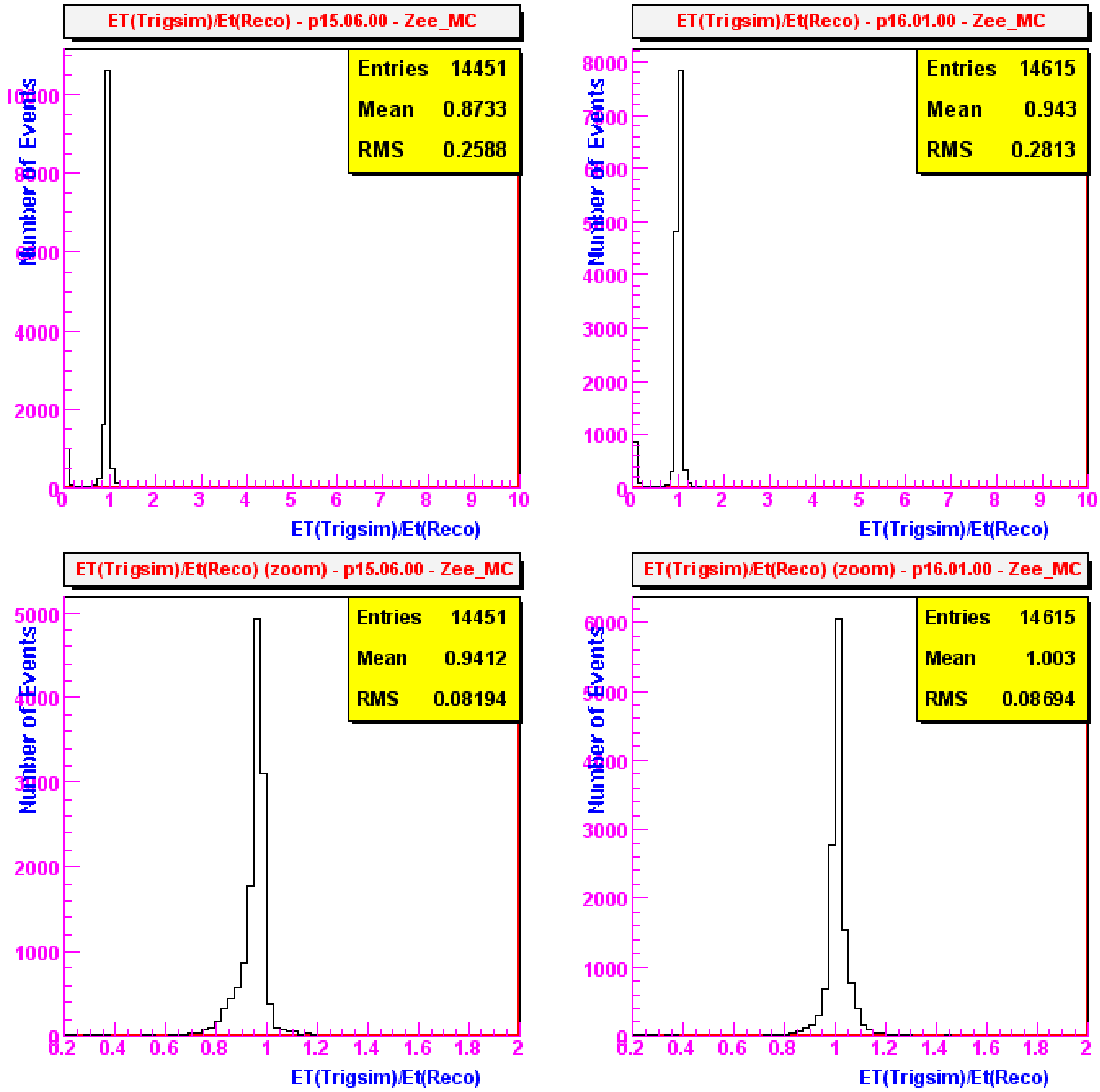

Figure 2: ET(Trigsim)/Et(Reco) distribution for p15.06.00 (left side) and p16.01.00(right side) for reco objects having id=±11. Bottom plots are just zooms of top ones.

Effects of geometric corrections can be seen: for the three cases, the mean of ET(Trigsim)/Et(Reco) is closer to one for p16.01.00 (ie with geometric corrections).
Furthermore the distributions tend to be more symmetric around the mean value for p16.01.00: the low value tail (for ET/Et less than 0.9 typically), present for p15.06.00, disappears for p16.01.00. This tendency is confirmed by computing the fraction of objects having values lower than mean-rms or bigger than mean+rms (see table 1): a clear asymmetry is observed for p15.06.00.

	P15.06.00		P16.01.00	
	Mean-rms	Mean+rms	Mean-rms	Mean+rms
Id=±11	8.9%	2.7%	4.5%	4.3%
Loose electrons	11.8%	4.1%	6.3%	8.5%
Tight electrons	12.1%	4.3%	5.9%	8.5%

Table 1: fraction of (matched) objects having ET/Et values lower than mean-rms or bigger than mean+rms

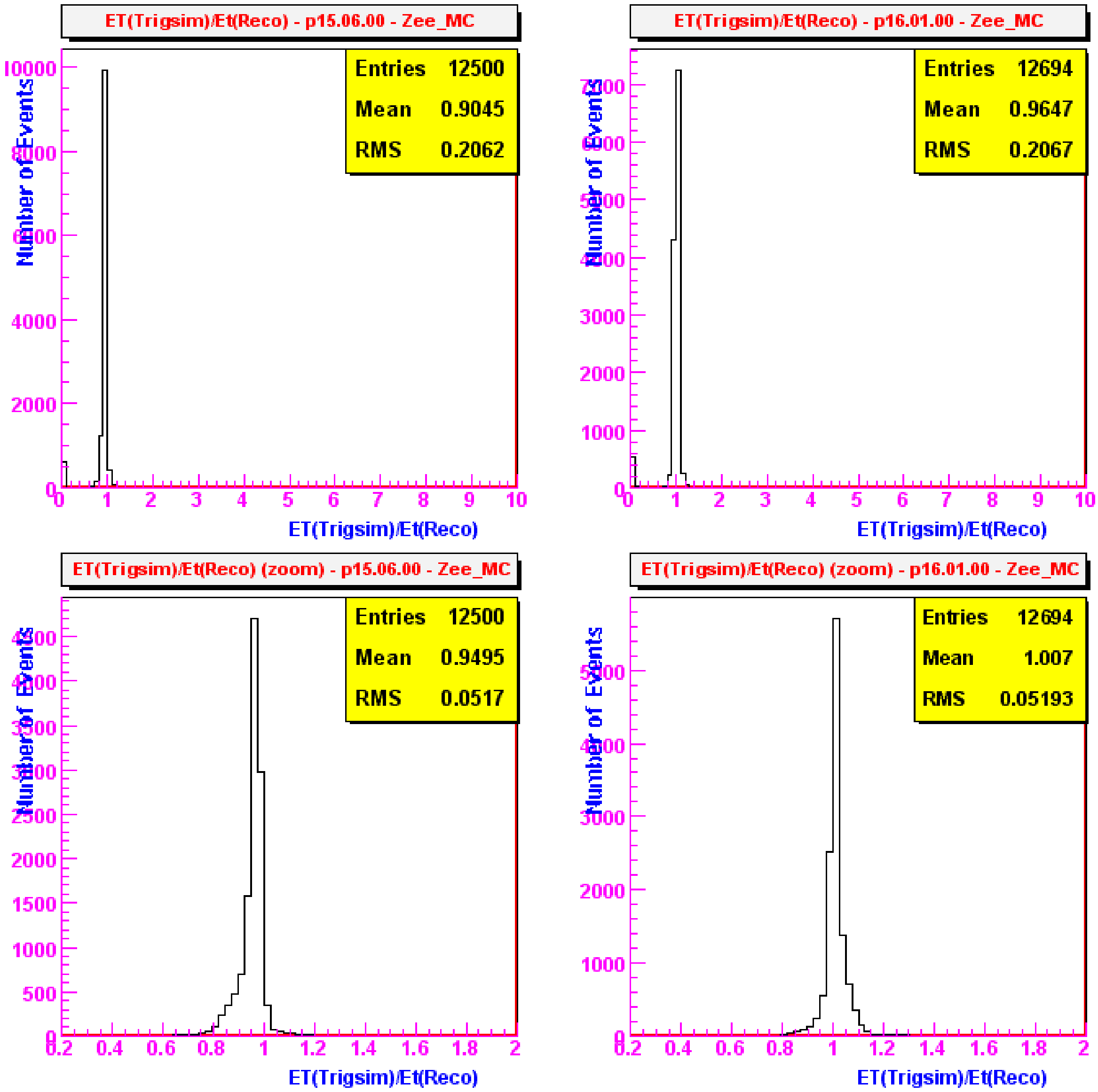

Figure 3: ET(Trigsim)/Et(Reco) distribution for p15.06.00 (left side) and p16.01.00(right side) for reco objects tagged as loose electrons. Bottom plots are just zooms of top ones.

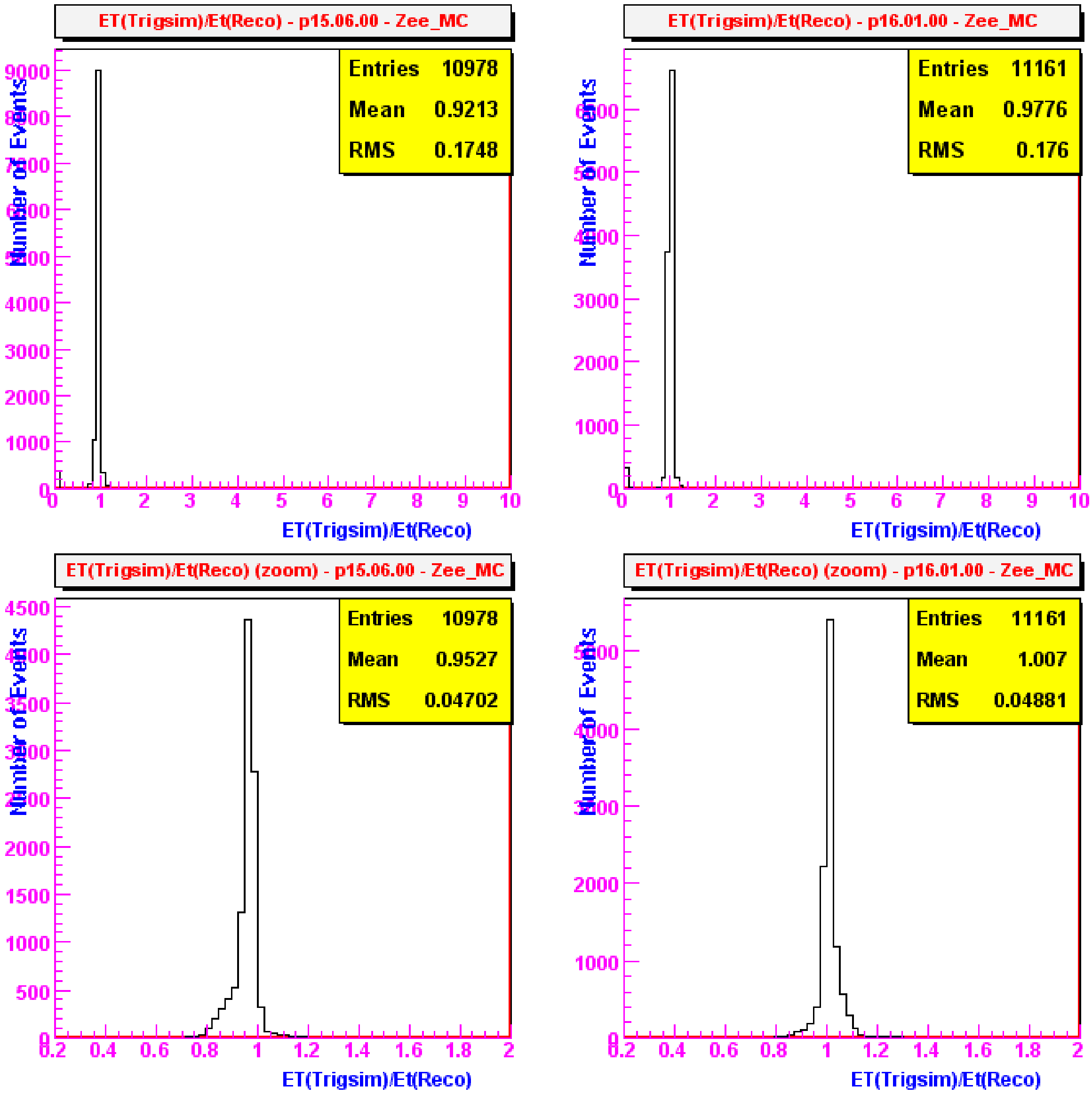

Figure 4: ET(Trigsim)/Et(Reco) distribution for p15.06.00 (left side) and p16.01.00(right side) for reco objects tagged as tight electrons. Bottom plots are just zooms of top ones.

b. <u>Uniformity vs Eta and Phi</u>

The variations of ET(Trigsim)/Et(Reco) as function of Eta (Trigsim) and CalPhi(Trigsim) were also looked at. Plots are given on figures 5 and 6 for the three configurations described above. At first sight, a better uniformity is observed for p16.01.00 in particular versus Eta. To quantify this effect, a quadratic was performed for both releases and the three configurations for the region $-1< \eta < 1$. The contributions of the linear part (ie p_1*CalEta/(p_0+p_1*CalEta+p_2*CalEta^2)) and the quadratic part are given on figure 7. One concludes that the non-constant contribution (ie linear and quadratic parts) is always smaller for p16.01.00 and does not exceed 2%. For p15.06.00, the quadratic part tends to supersede the linear one. It thus seems that geometric corrections improves uniformity versus Eta. The conclusion is not so clear for Phi. A similar fit was performed in the region $0 < \Phi < 2\pi$ and we can not see major differences between p15.06.00 and p16.01.00 (see figure 8).

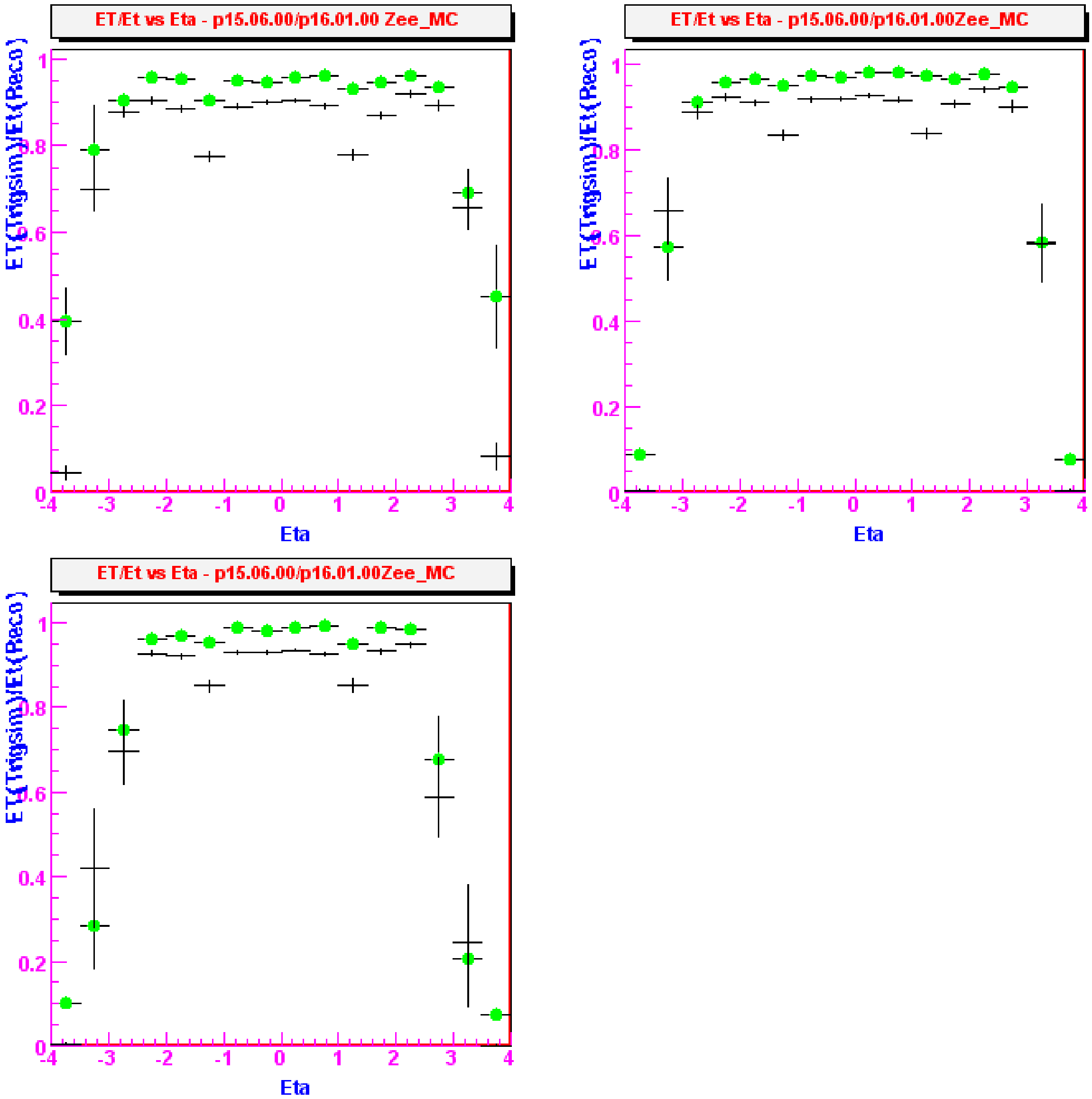

Figure 5: ET(Trigsim)/Et(Reco) versus Eta for three cases: reco objects with id=±11 (top left), reco objects tagged as loose electrons (top right) and reco objects tagged as tight electrons (bottom left). Green bullets are for p16.01.00 and black crosses for p15.06.00.

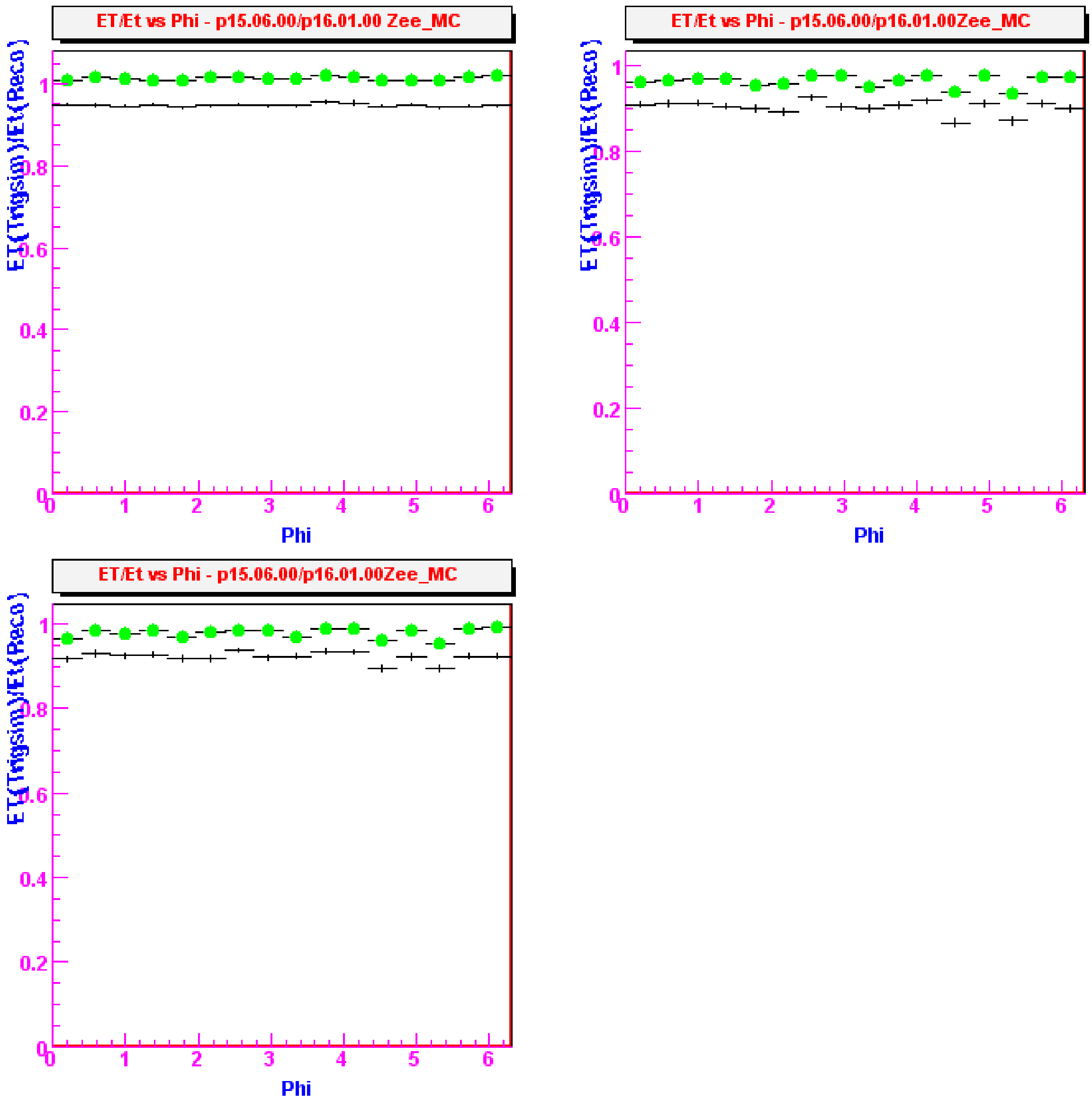

Figure 6: ET(Trigsim)/Et(Reco) versus CalPhi for three cases: reco objects with id=±11 (top left), reco objects tagged as loose electrons (top right) and reco objects tagged as tight electrons (bottom left). Green bullets are for p16.01.00 and black crosses for p15.06.00.

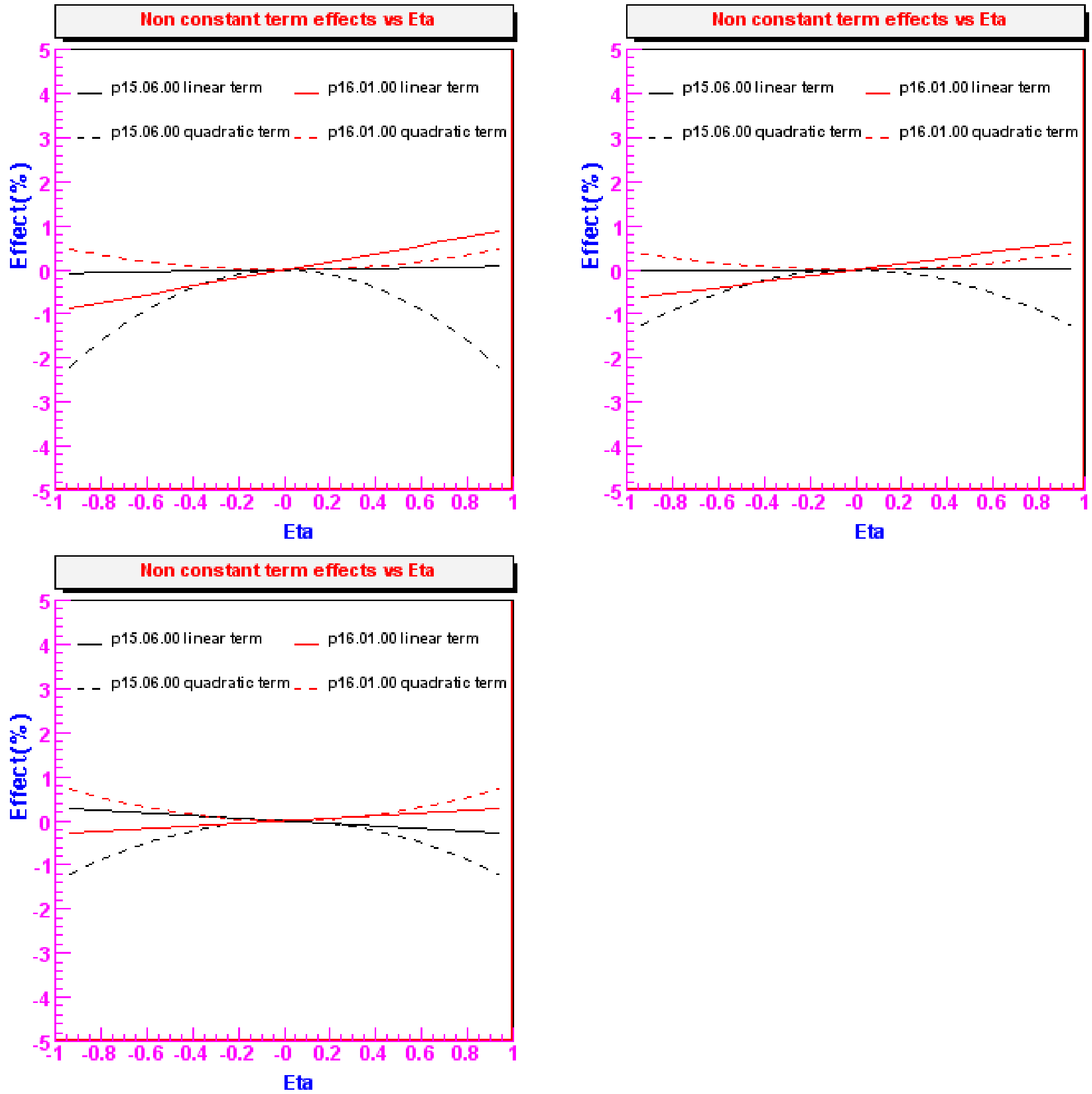

Figure 7: Linear (lines) and quadratic (dashed lines) contributions from the fit of ET/Et versus Eta for the two releases (p15.06.00 in black and p16.01.00 in red) and for three cases: reco object having id=±11 (top left), reco objects tagged as loose electrons (top right) and reco objects tagged as tight electrons (bottom left)

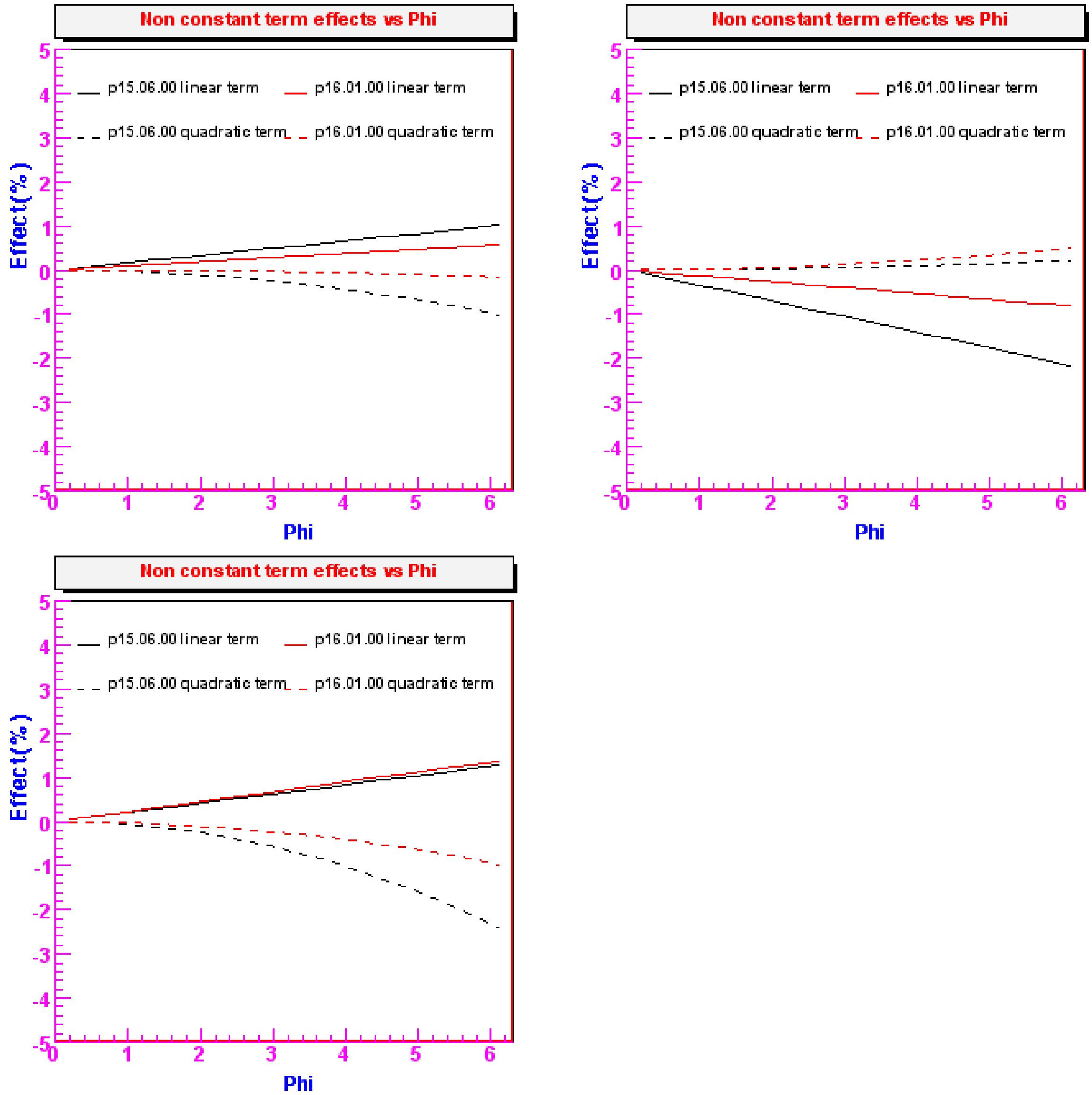

Figure 8: Linear (lines) and quadratic (dashed lines) contributions from the fit of ET/Et versus Phi for the two releases (p15.06.00 in black and p16.01.00 in red) and for three cases: reco object having id=±11 (top left), reco objects tagged as loose electrons (top right) and reco objects tagged as tight electrons (bottom left).

c. Trigger

ET is a quantity directly involved in L3 filters: for some electron triggers it is even the only selection criteria. We may thus expect impact on triggers from modification of ET.

To illustrate this point, we took the so-called E1_SHT15 trigger which uses the L3Ele tool ELE_NLV_SHT. A display of the trigger efficiency as a function of Eta, for all the trigsim candidate (ie not only those matching to Reco) is given on figure 9. A few percent gain is obtained for p16.01.00.

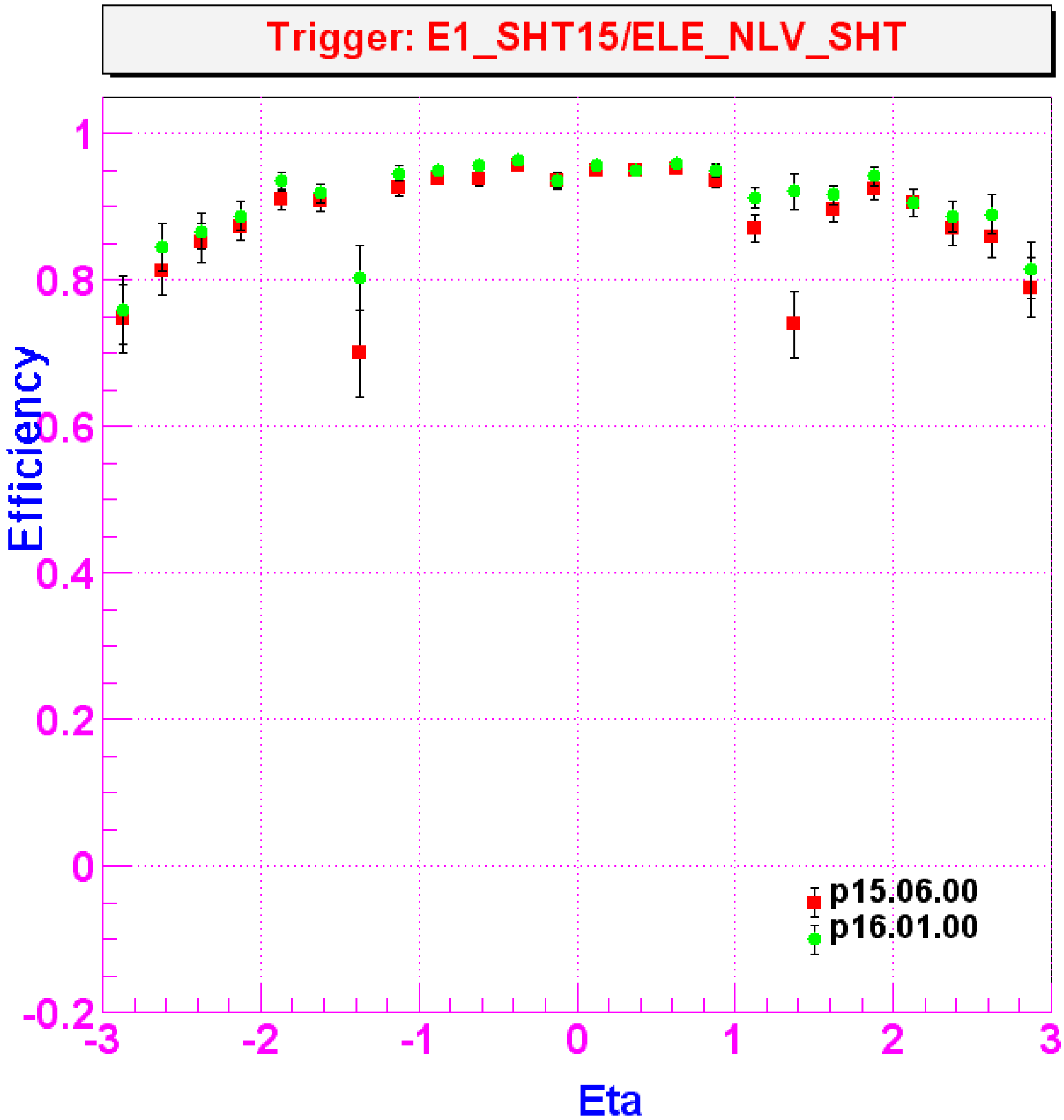

Figure 9: E1_SHT15 trigger efficiency vs Eta for p15.06.00 and p16.01.00

Even more striking is the effect of geometric corrections the turn-on curves (these curves were obtained assuming a L1 efficiency of 100%). On figure 10 is drawn the trigger efficiency as a function of the Reco Et for E1_SHT20. We see that thresholds can be lowered with p16.01.00 of about 1 GeV compared to those of p15.06.00. Other illustrations of geometric corrections on turn-on curves are shown on figures 11 and 12 for E1_SH15 and E1_SH30 respectively.

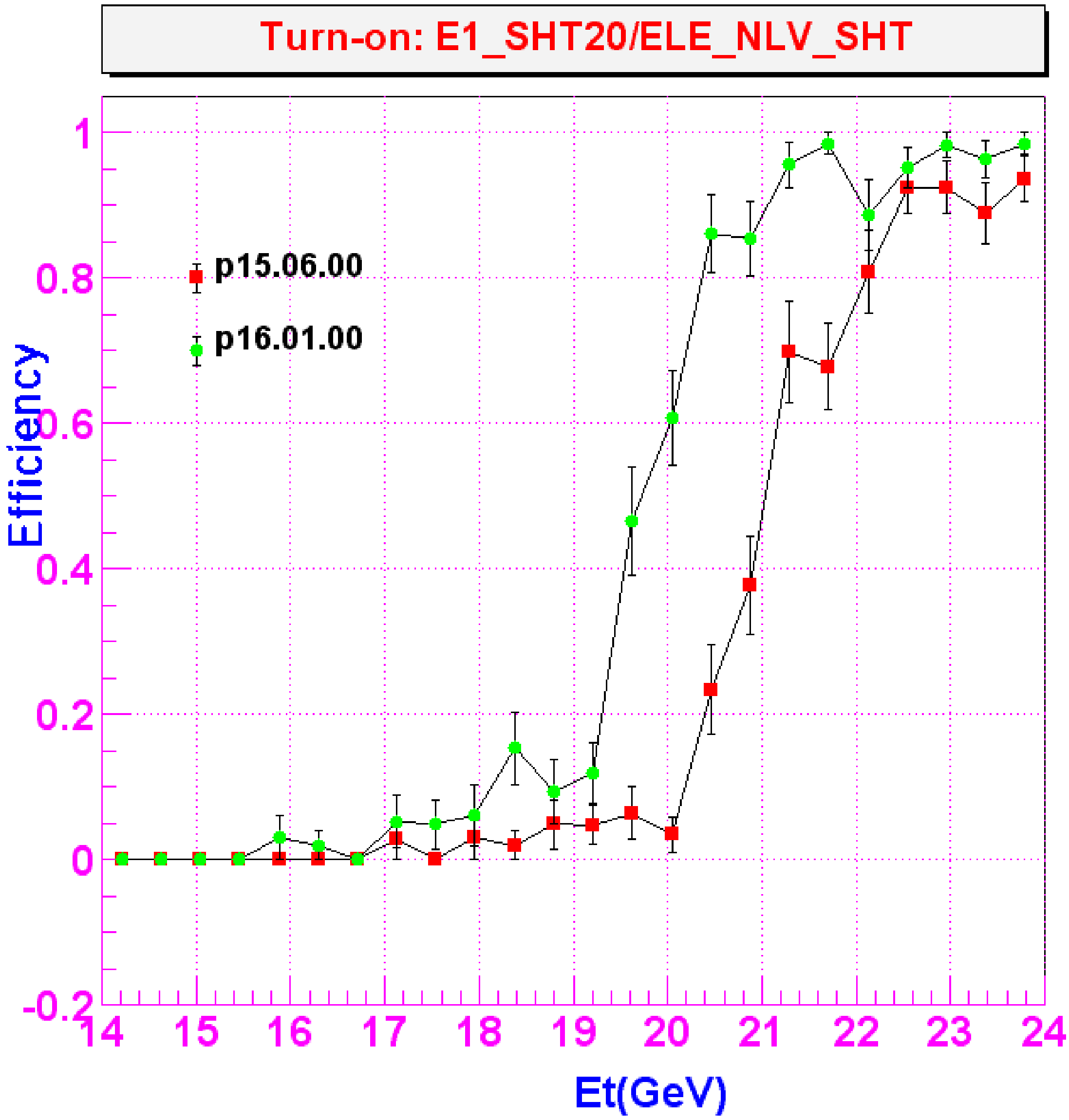

Figure 10: Turn-on curve for E1_SHT20 for p15.06.00 (red boxes) and p16.01.00 (green bullets). Et is the transverse Reco energy.

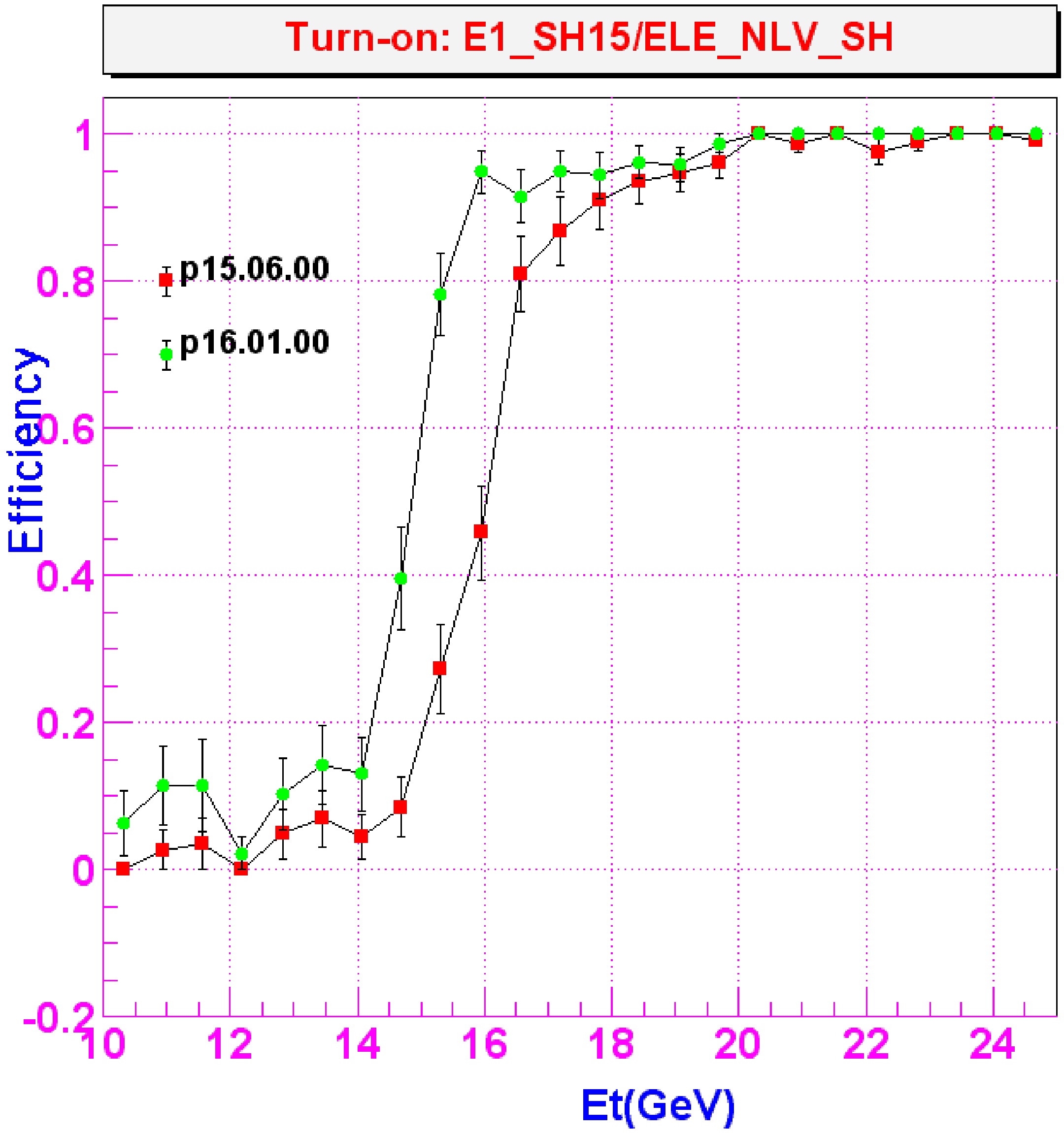

Figure 11: Turn-on curve for E1_SH15 for p15.06.00 (red boxes) and p16.01.00 (green bullets). Et is the transverse Reco energy.

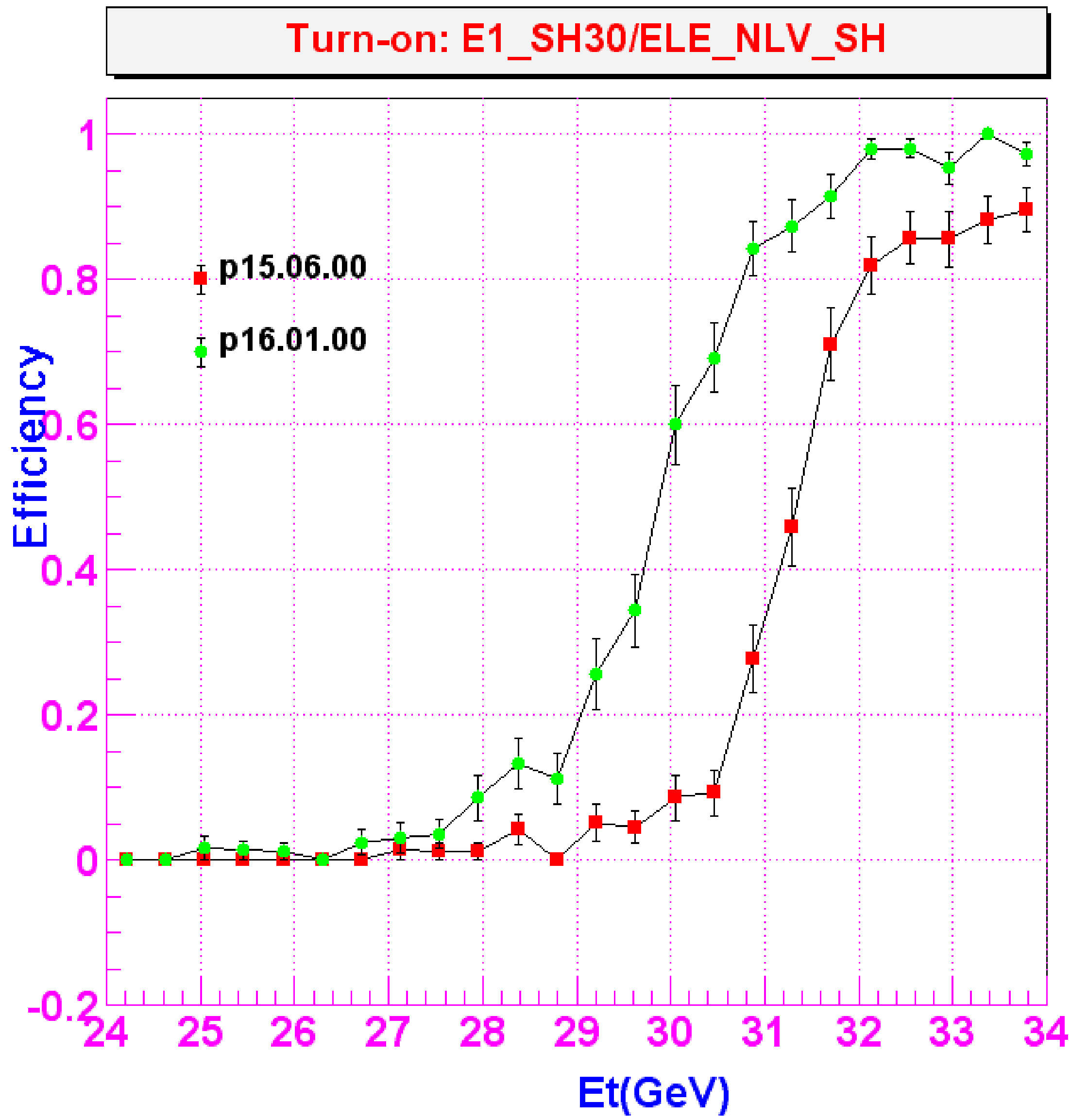

Figure 12: Turn-on curve for E1_SH30 for p15.06.00 (red boxes) and p16.01.00 (green bullets). Et is the transverse Reco energy.