



Recherche du Higgs dans le canal WH

- ◆ Publication avec 1 fb^{-1}
- ◆ Etat de l'analyse P20

23 juin 08
Jeremie Lellouch
pour le groupe WH

D0France Grenoble

Introduction

- ♦ P17 en revue EB pour publication
- ♦ Effort en cours pour integrer les donnees P20 pre- et post-shutdown pour ICHEP
- ♦ Effort en cours pour integrer le discriminant Matrix Element (developpe par U. Mich.) au reseau de neurones (LPNHE)

Plan

- ♦ Reweighting de la cinematique des jets dans ALPGEN (P17)
- ♦ K-factors (P17)
- ♦ Etat de l'analyse P20
- ♦ Matrix element vs Neural network

P17

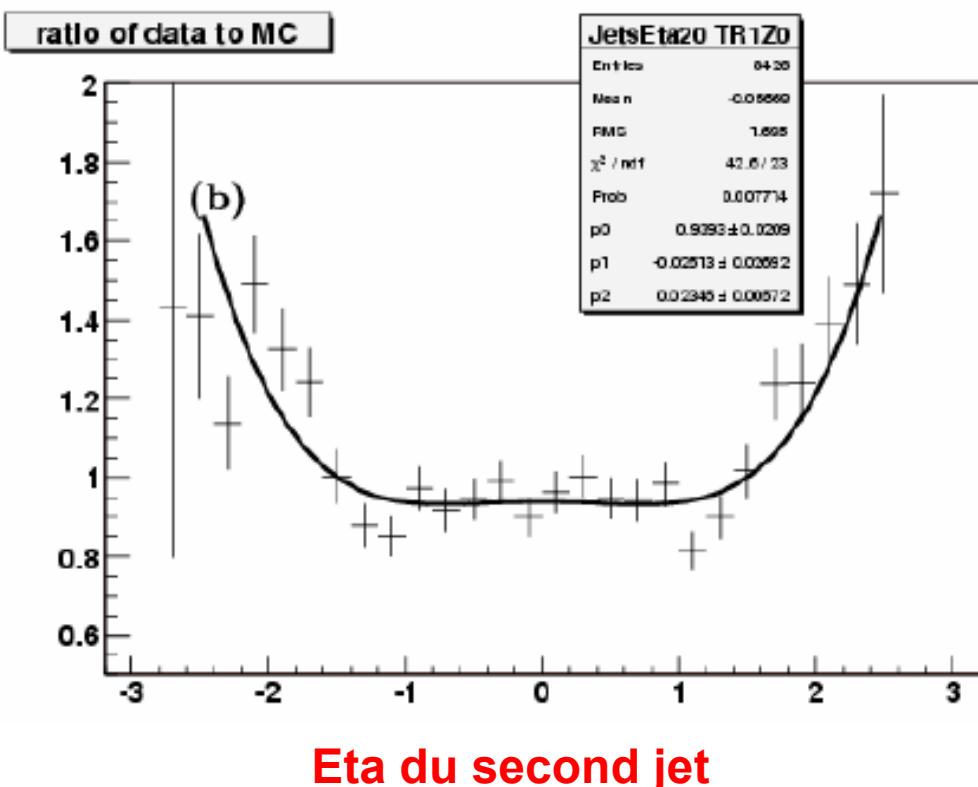
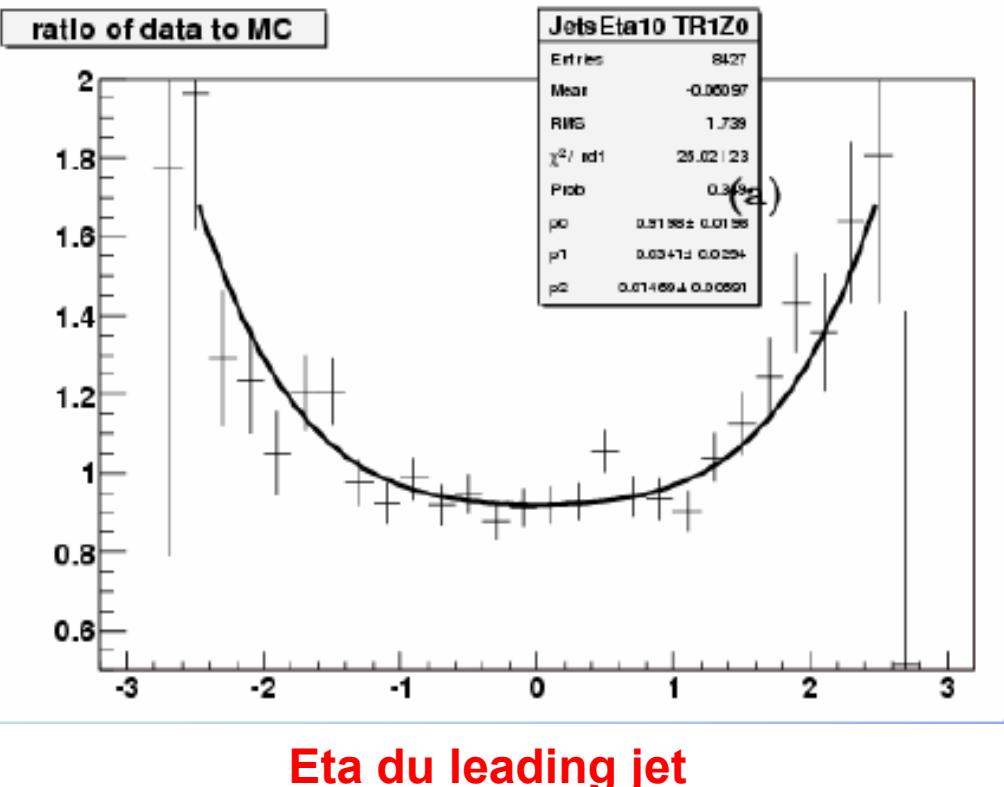
Reweighting de la cinématique des jets dans ALPGEN

- ◆ Desaccord Data/MC dans les distributions cinématiques des jets attribué à ALPGEN
- ◆ Reweighting de jets1.eta , jeta2.eta , deltaEta(jj) , deltaPhi(jj) dans la simulation ALPGEN V+jets
- ◆ Sont reweigted W/Z + lights et W/Z + heavy flavour
- ◆ Fonctions obtenues par un fit du rapport
$$[\text{Data} - (\text{Non-V+jets MC, QCD})] / \text{V+jets MC}$$
- ◆ Propagées comme un poids appliquée sur la simulation

Reweighting d'ALPGEN : jets eta (2 jets)

♦ Mis-modelling d'ALPGEN : pseudo-rapide des jets

♦ Correction symetrique par rapport a 0



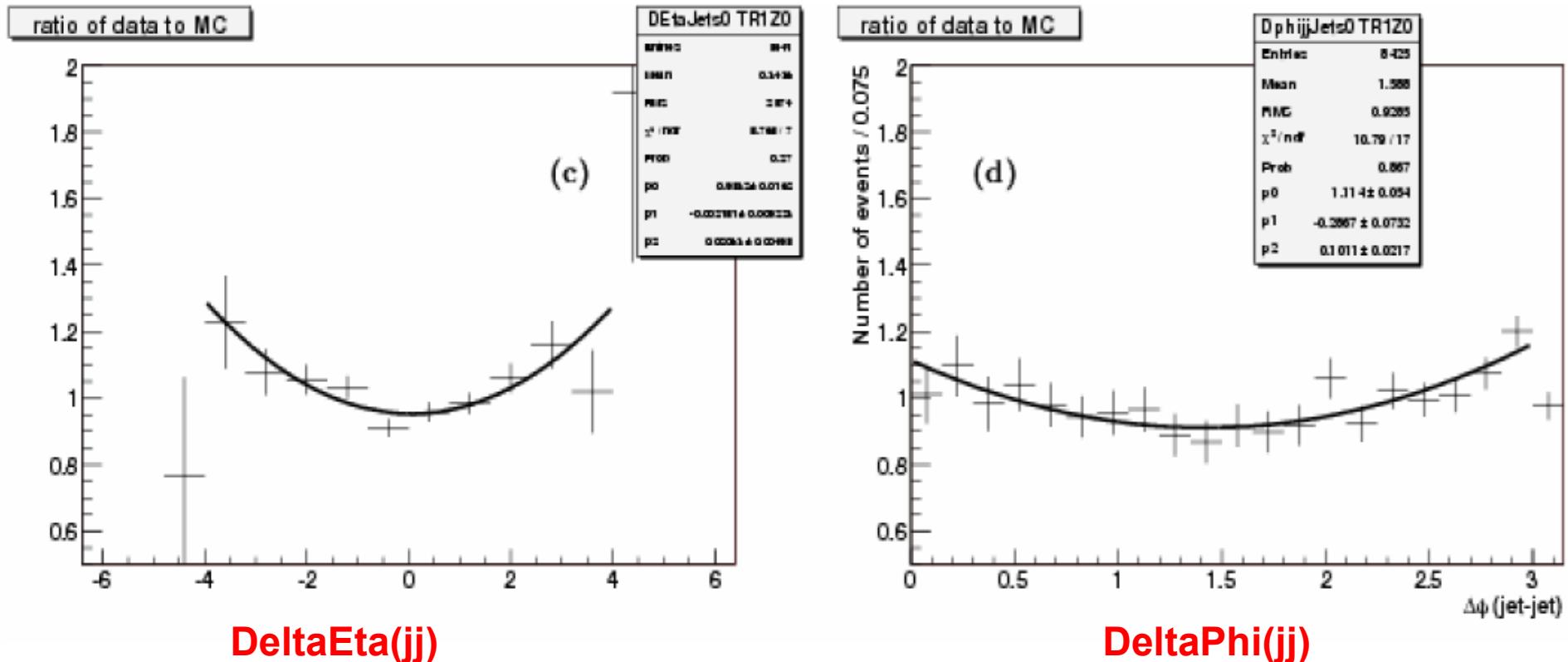
♦ Polynomes de 4e ordre sans termes asymetriques

$$W_{\eta_{j1}}^{2jet} = 0.920 + 0.0341\eta_{j1}^2 + 0.0147\eta_{j1}^4$$
$$W_{\eta_{j2}}^{2jet} = 0.939 - 0.0251\eta_{j2}^2 + 0.0234\eta_{j2}^4$$

Reweighting d'ALPGEN : dPhi_{jj}, dEta_{jj} (2 jets)

◆ Correction de toute la cinématique des jets

◆ Correction du désaccord résiduel après reweighting de eta1 et eta2

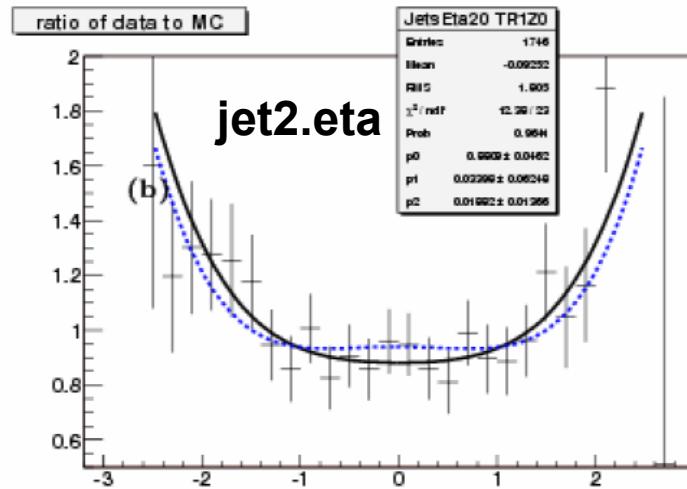
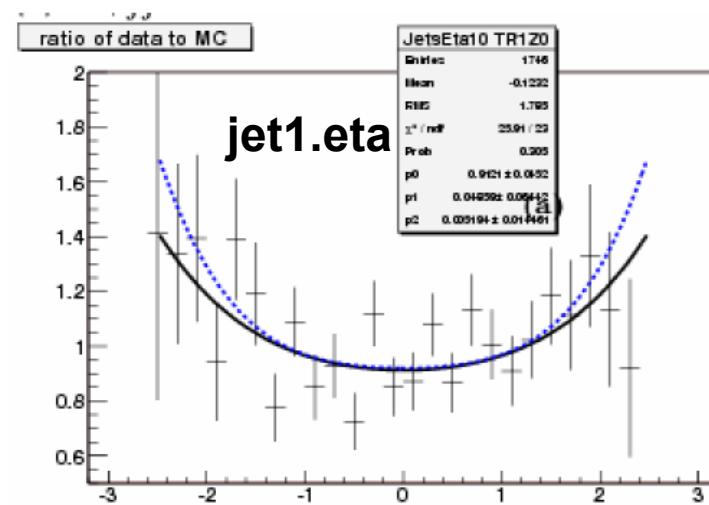


◆ Polynômes de 2e ordre

$$W_{\Delta\eta_{jj}}^{2jet} = 0.953 - 0.0022\Delta\eta_{jj} + 0.021\Delta\eta_{jj}^2$$
$$W_{\Delta\phi_{jj}}^{2jet} = 1.114 - 0.287 * \Delta\phi_{jj} + 0.101\Delta\phi_{jj}^2$$

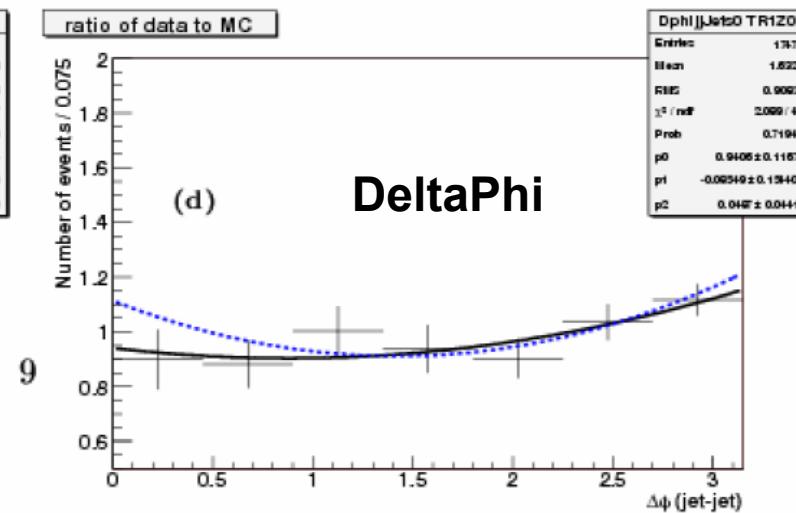
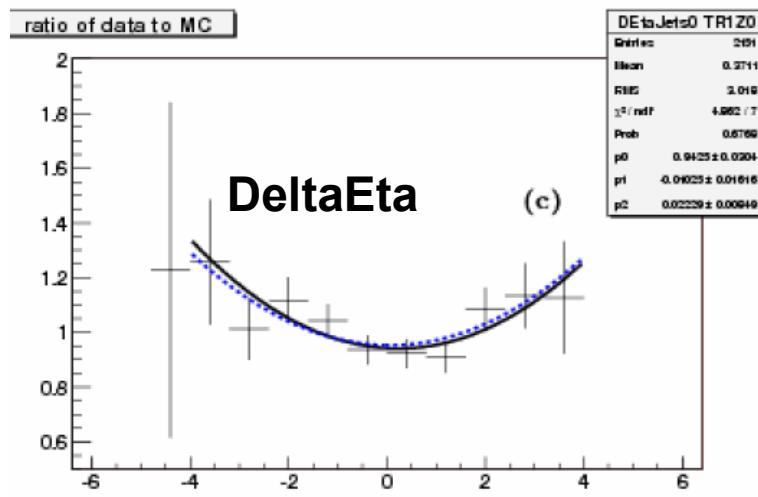
2-jet vs. 3-jet

- ◆ Pas de reweighting de jet3.eta
- ◆ Fonctions compatibles entre elles dans les échantillons 2 jets et 3 jets
- ◆ On utilise la détermination à haute stat. de l'échantillon à 2 jets sur l'échantillon 3 jets



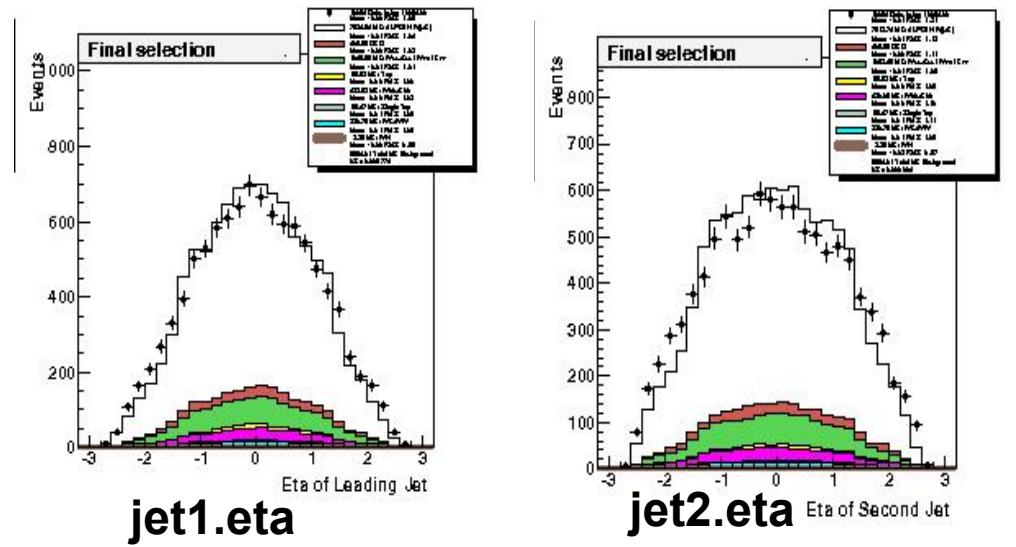
blue: from 2-jet sample

black: from 3-jet sample

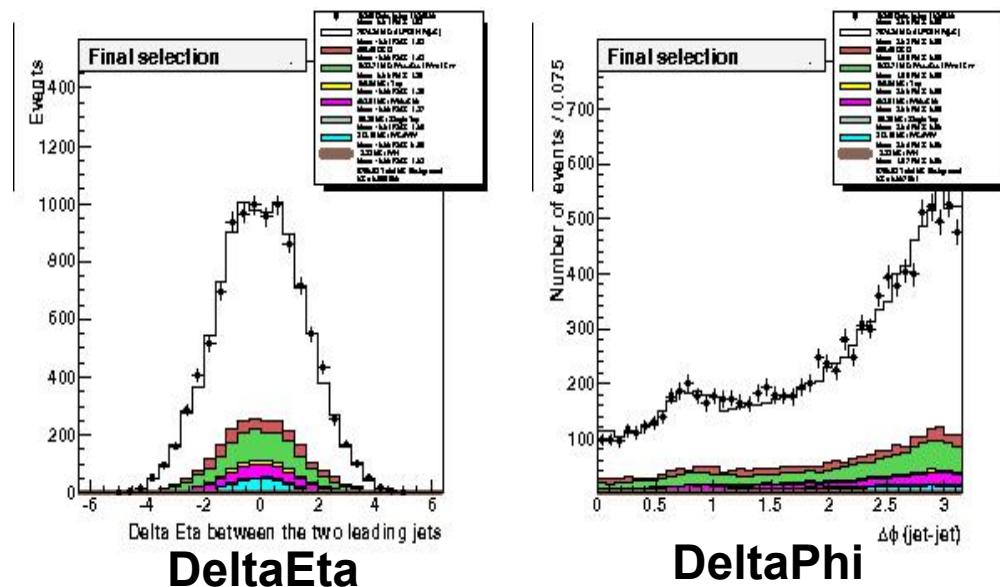
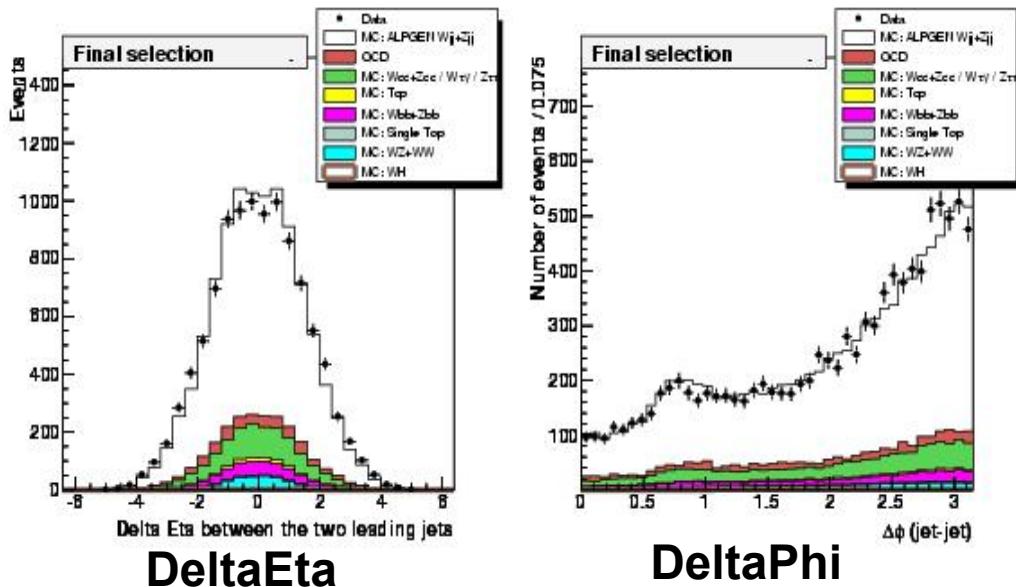
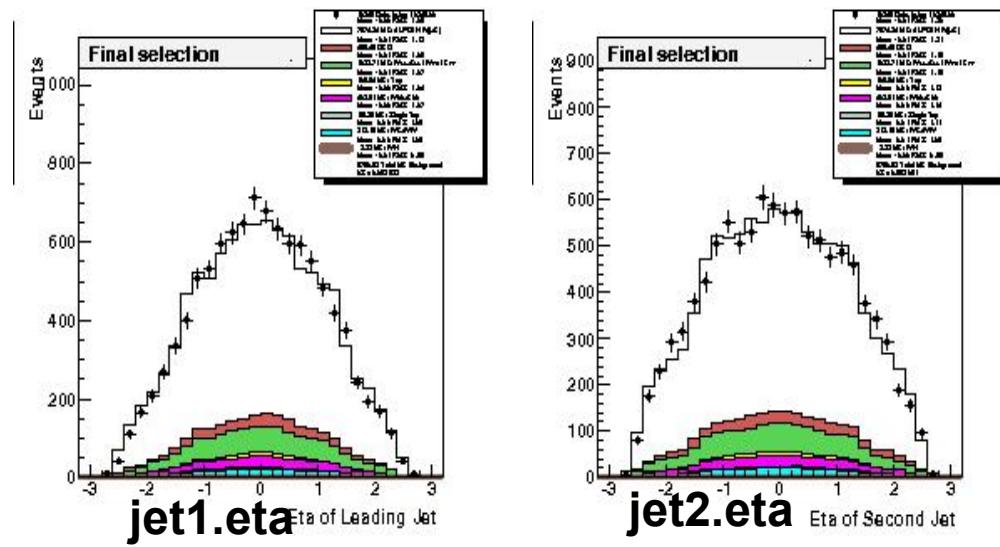


Effet du reweighting (2 jets, canal muon)

Sans reweighting

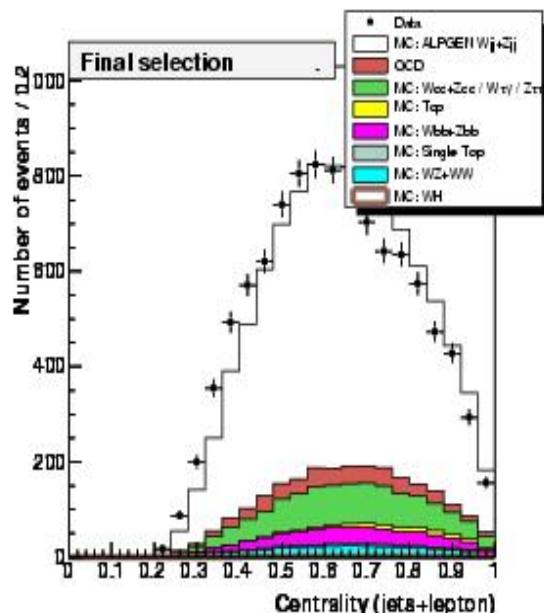


Avec reweighting

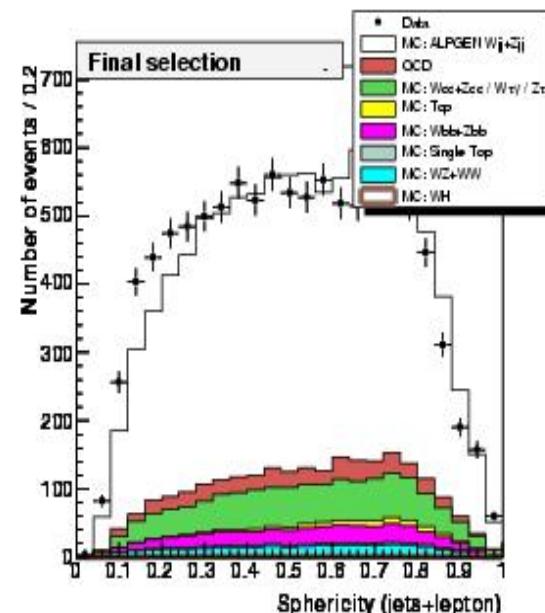


Effet du reweighting (2 jets, canal muon)

Sans reweighting

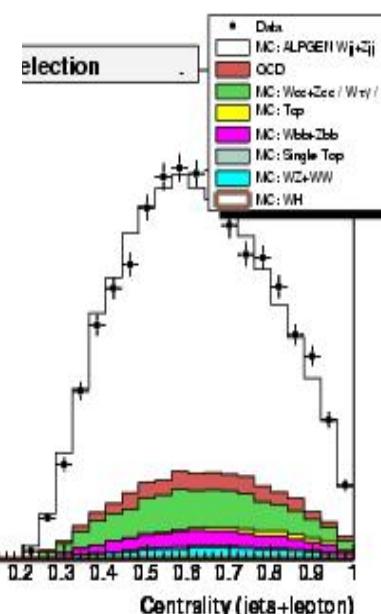


centralite

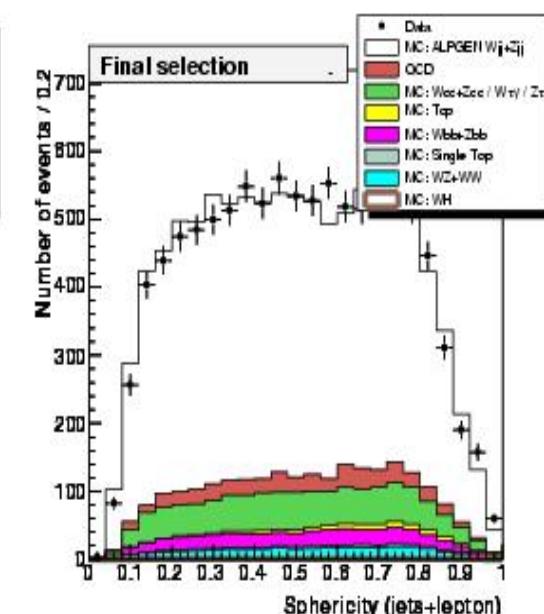


sphericite

Avec reweighting



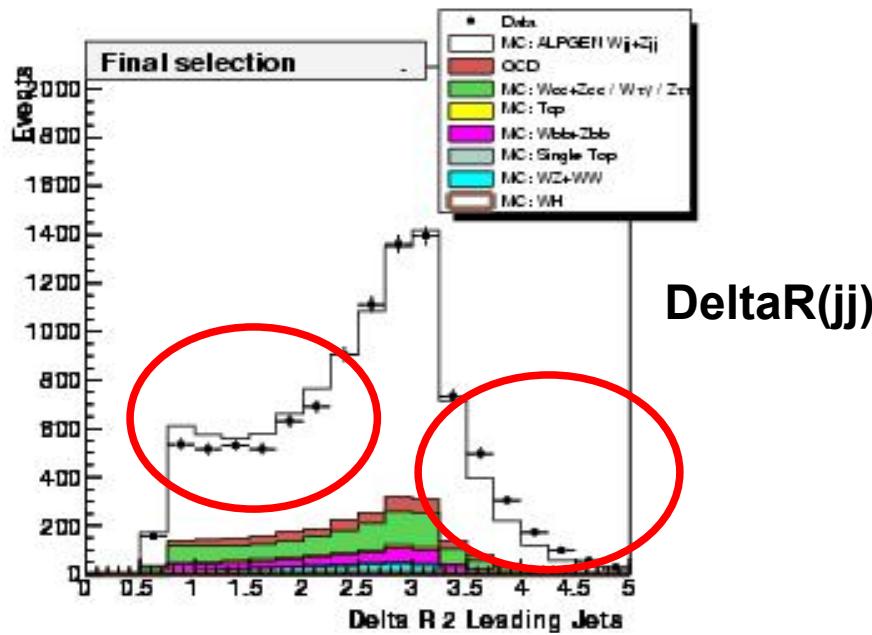
centralite



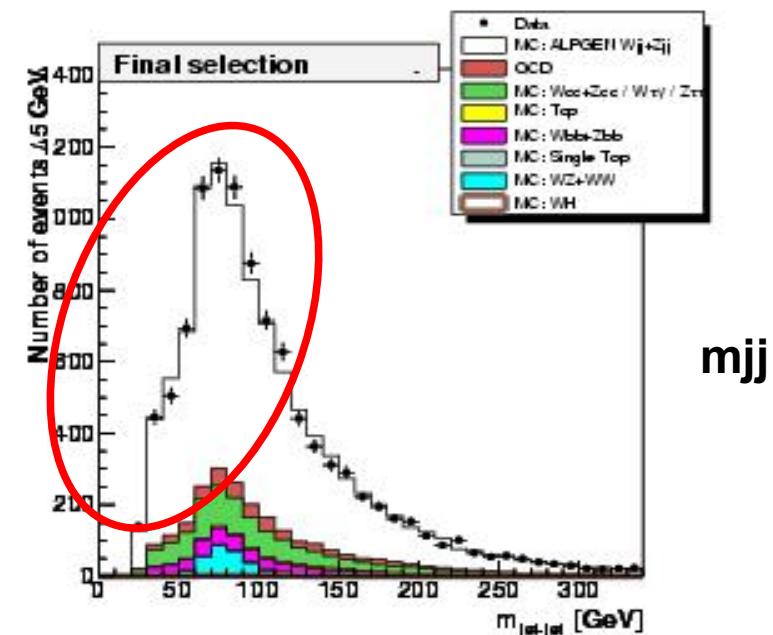
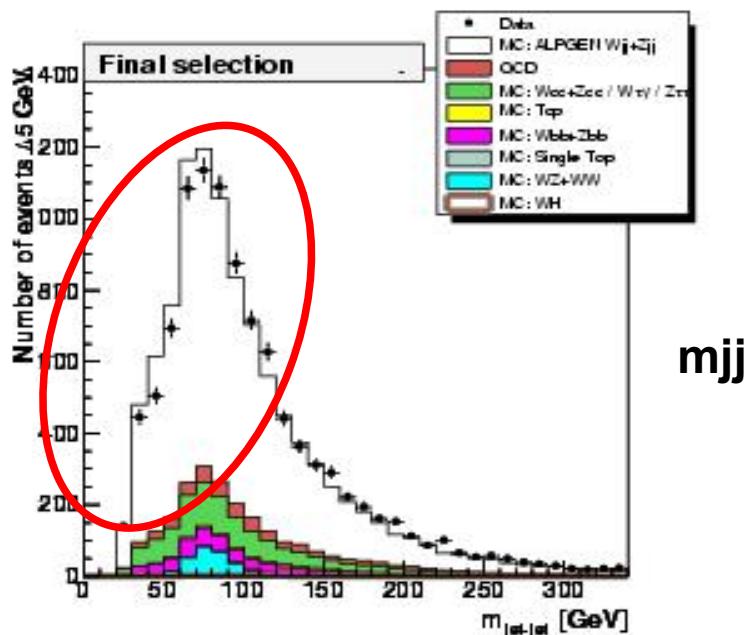
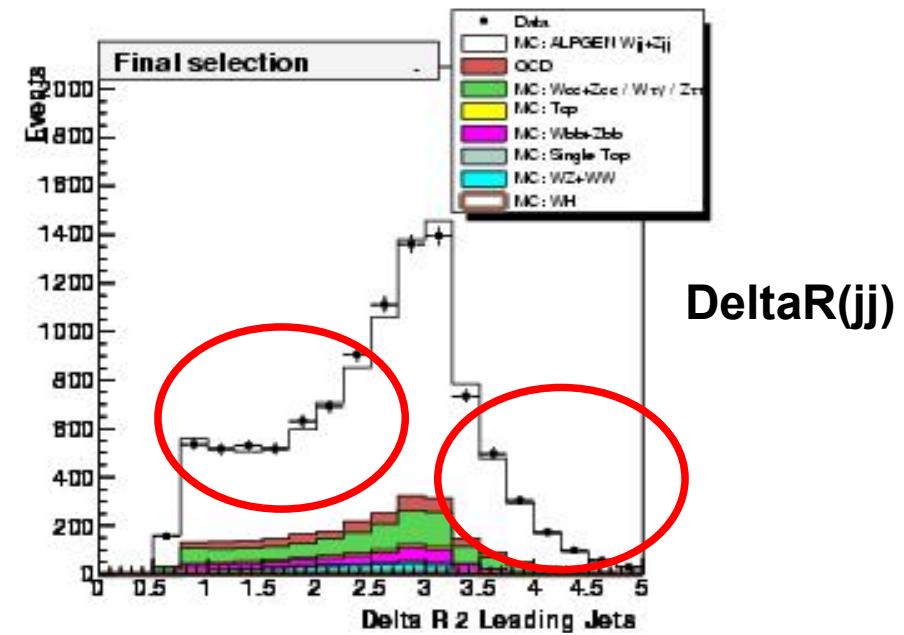
sphericite

Effet du reweighting (2 jets, canal muon)

Sans reweighting



Avec reweighting

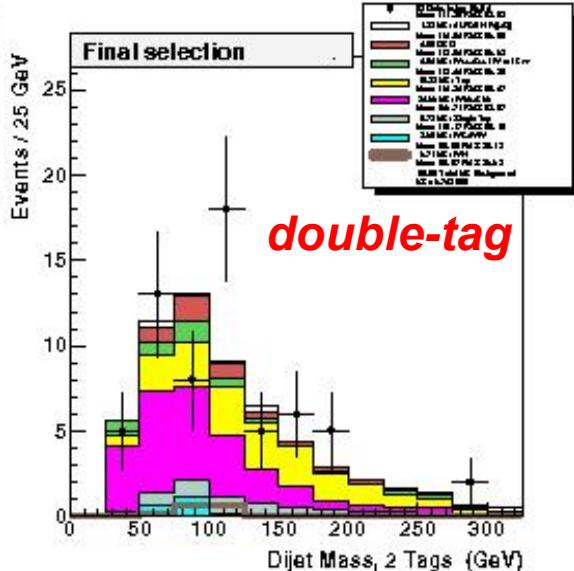
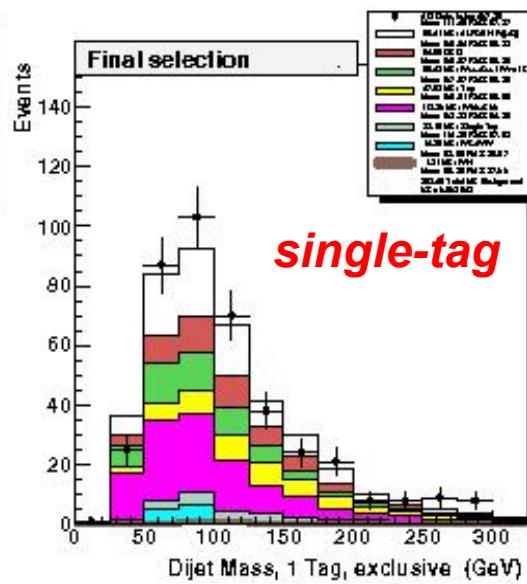


K-factors

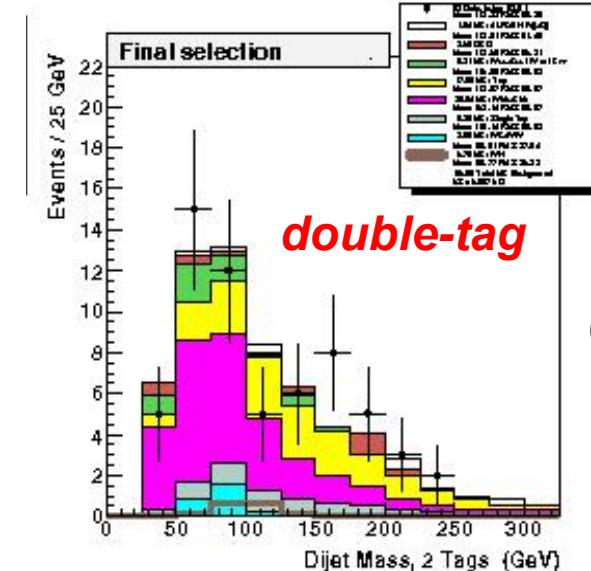
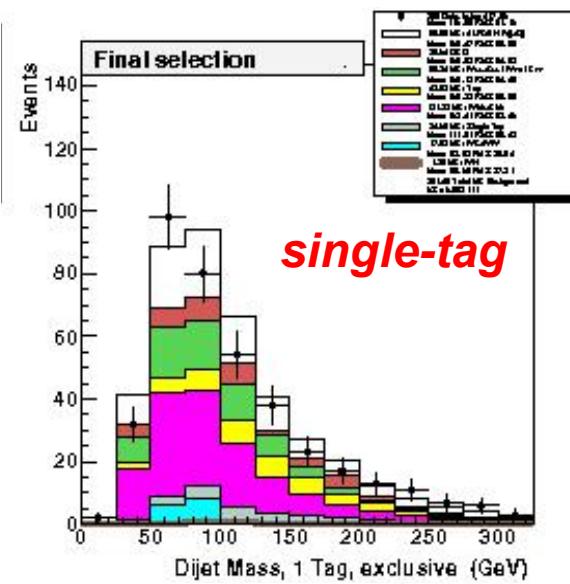
- ◆ Derive them with a method similar to what used by the single-top group, ie
 - ★ Perform overall normalisation of V + jets (LF and HF) to data at the pre-tag level
 - ★ Then use data to determine factor
- ◆ For the NN-tagger operating points VeryTight, Tight, Loose and L4, use the **0-tag sample** – calculate the heavy-flavour scale-factor we need to apply on top of the light-flavour k-factor needed to get $\text{Sum(expectation)} = \text{Data}$
- ◆ Average 2- and 3-jet multiplicity bins; we find 1.01 in the 2-jet bin, 1.04 in the 3-jet bin
- ◆ *We find an experimental HF scale-factor of ~ 1.02 in P17*, consistent in both the electron and muon channel. We use an *experimental light k-factor of 1.7*, e and mu normalisation factor within 2%
- ◆ Stable against possible signal events – if we multiply our 115 GeV signal by a factor 10, the heavy-flavour k-factor change is 2%
- ◆ Next page show the final b-tagged di-jet mass distributions. *Reminder: we require two loose tags OR one exclusive tight tag, and we tag the Monte-Carlo (we use TSF)*

B-tagged di-jet mass, 2 jets

electron channel



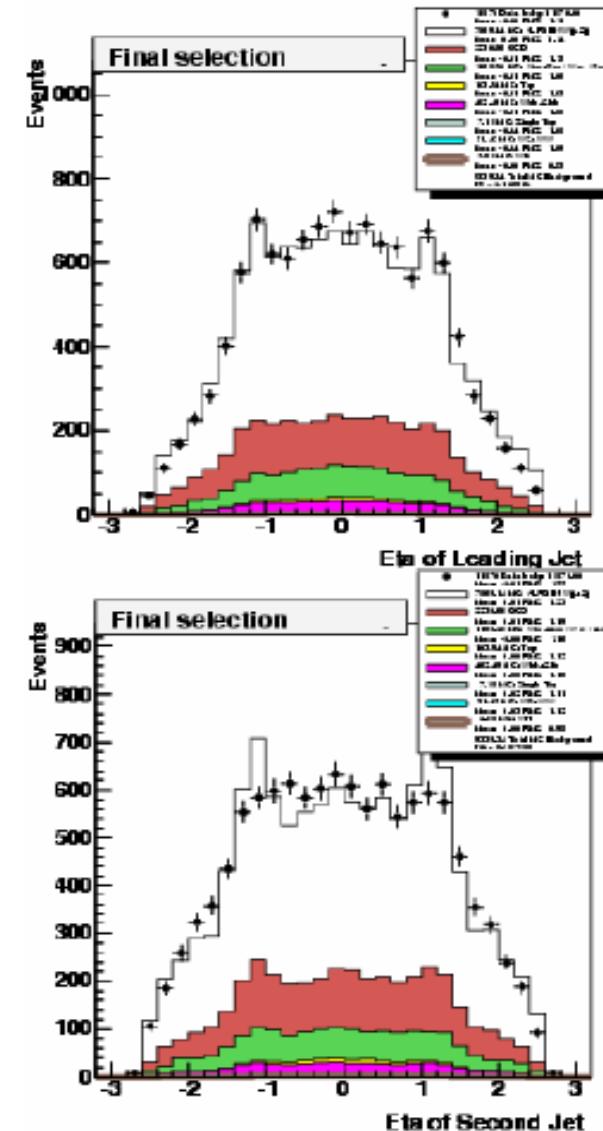
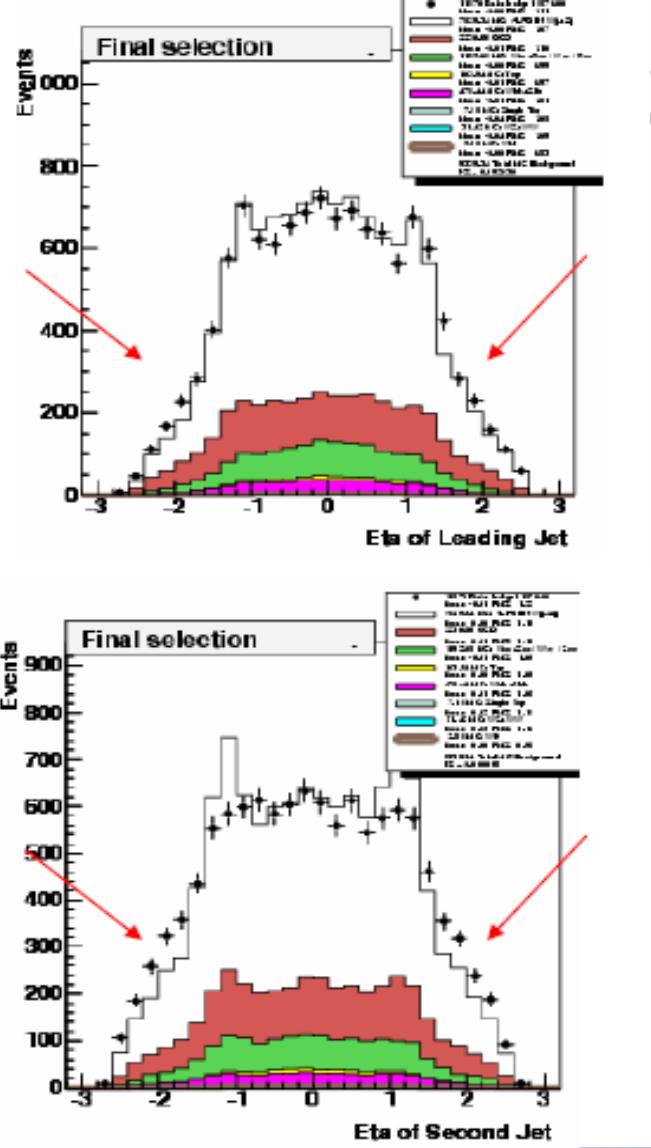
muon channel



P20

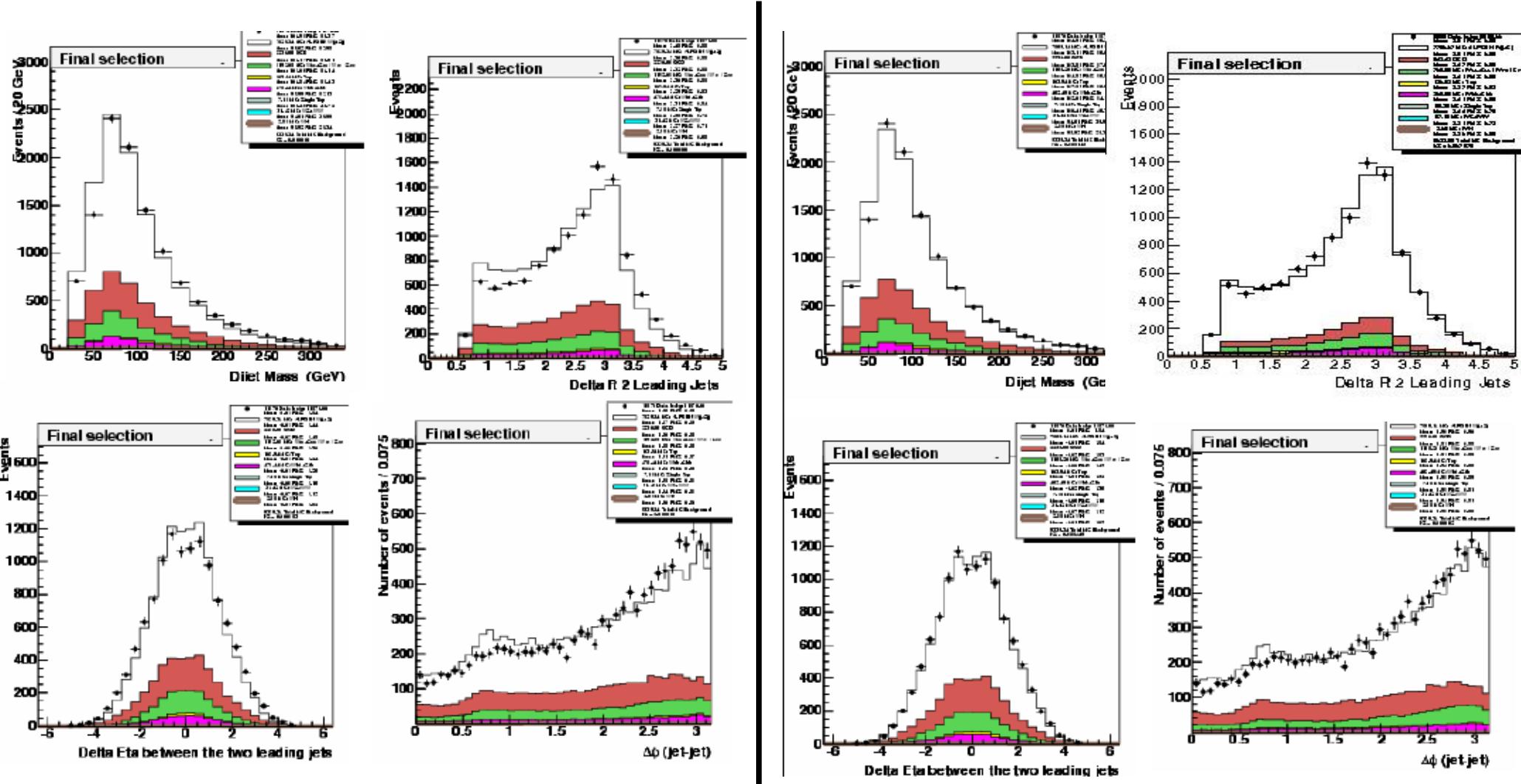
Effet du reweighting sur P20 canal electron, 2 jets

Let's apply the same functions on the P20 data. Here are plots from the e channel



Effet du reweighting sur P20 canal electron, 2 jets

Let's apply the same function on the P20 data. Here are plots from the e channel

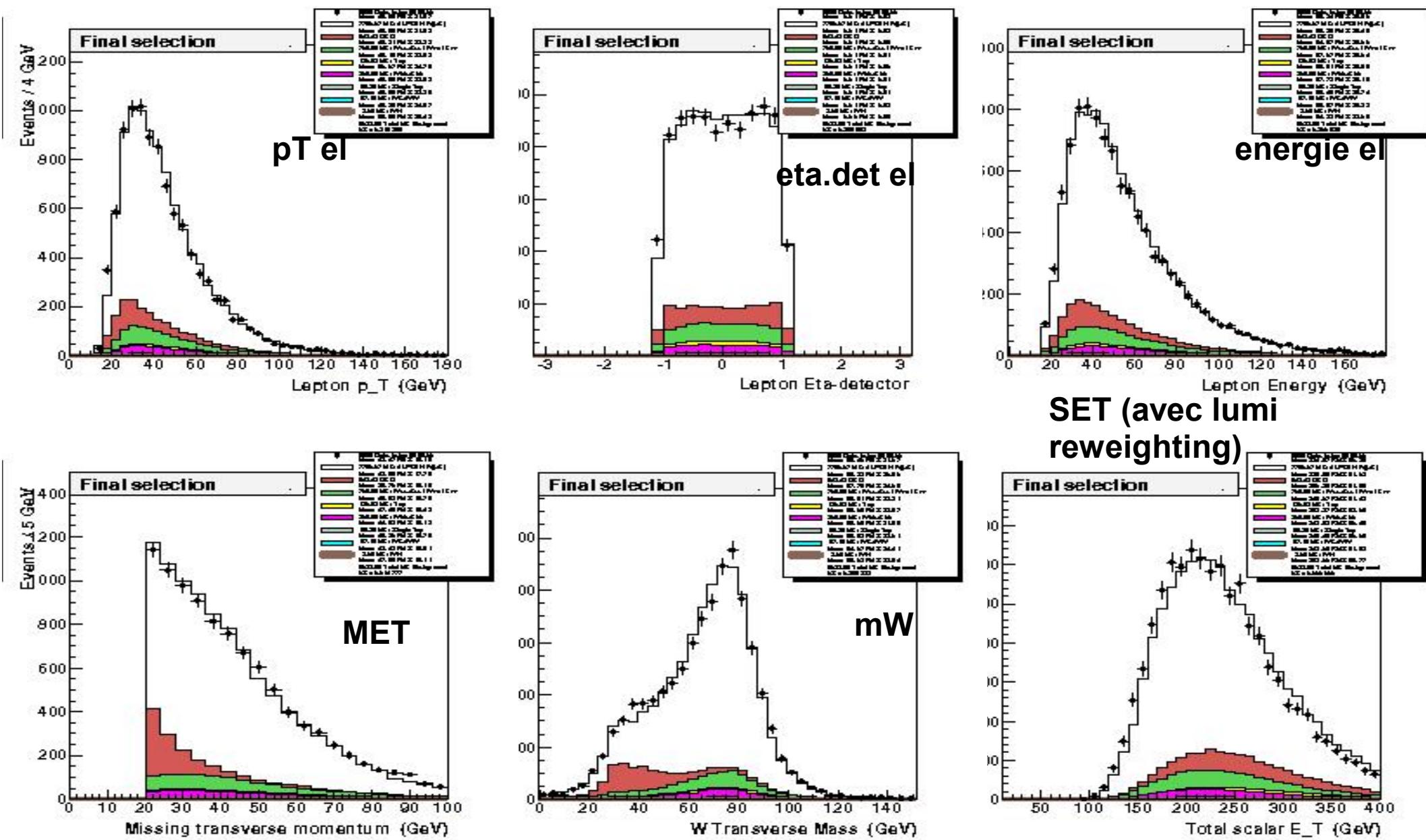


No reweighting

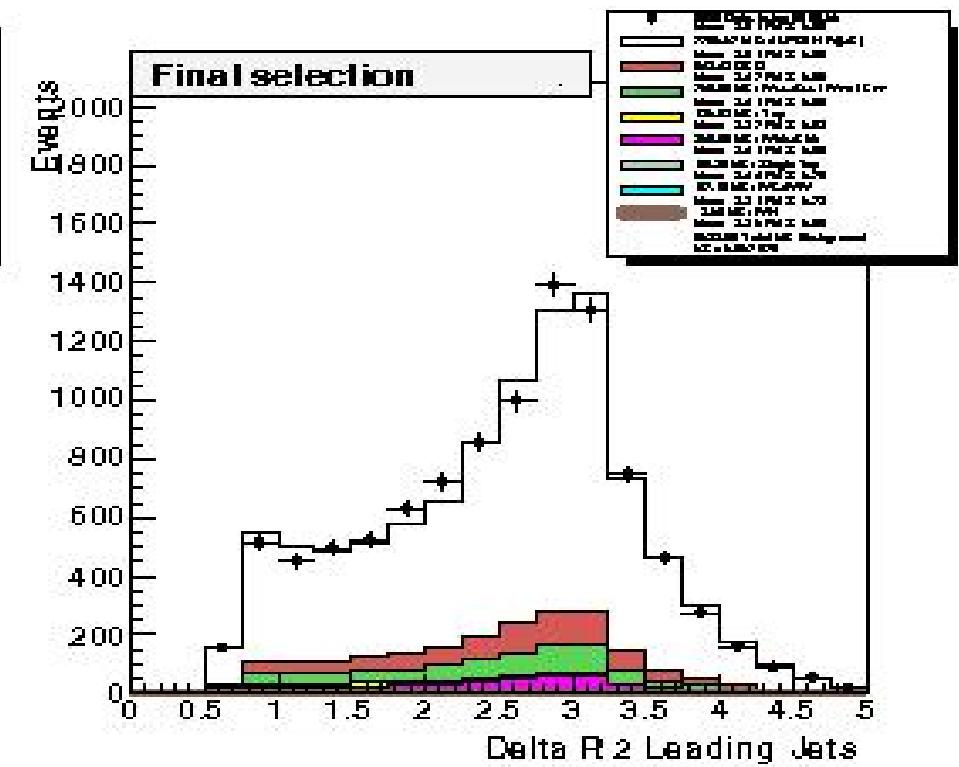
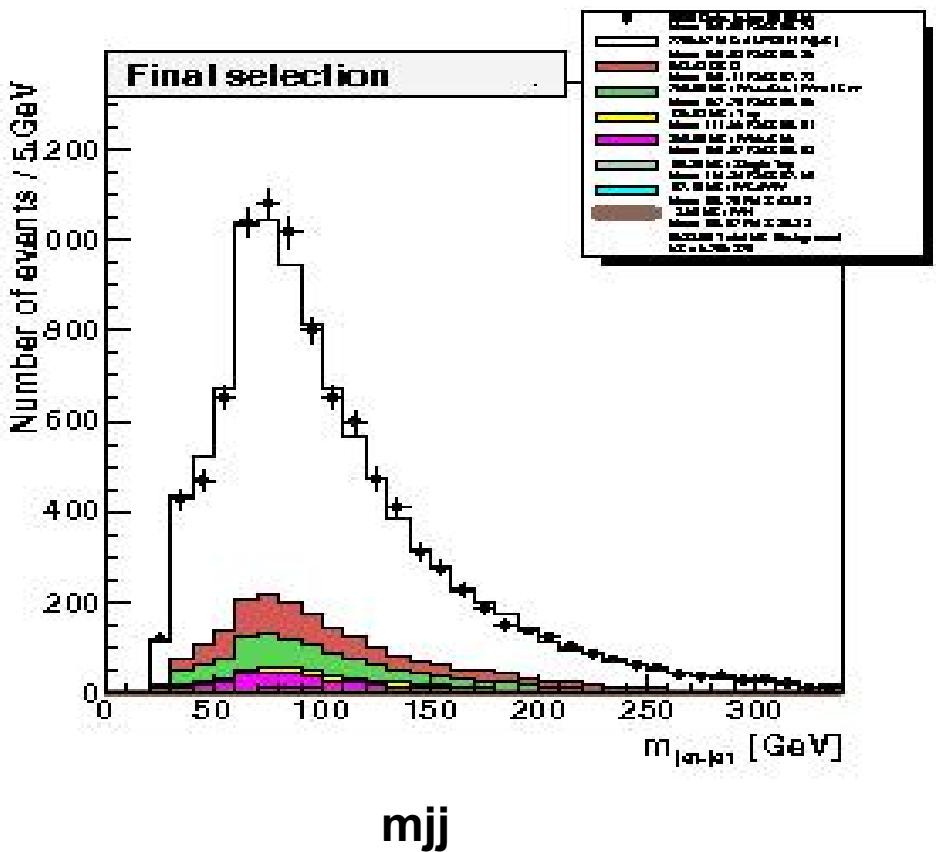
Use P17 reweighting

Not perfect, but we do get a much better agreement

Accord Data/MC canal electron, 2 jets

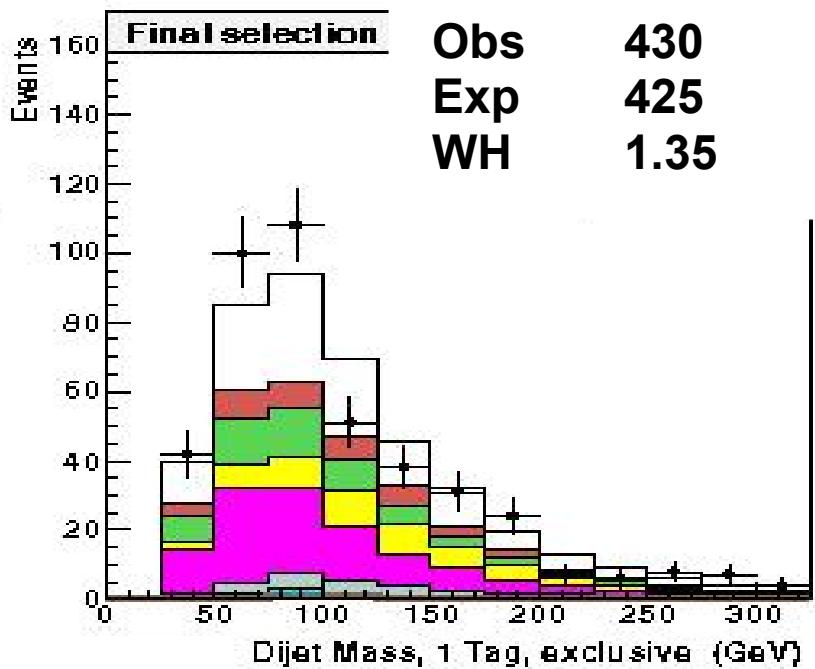


Accord Data/MC pre-shutdown canal electron, 2 jets

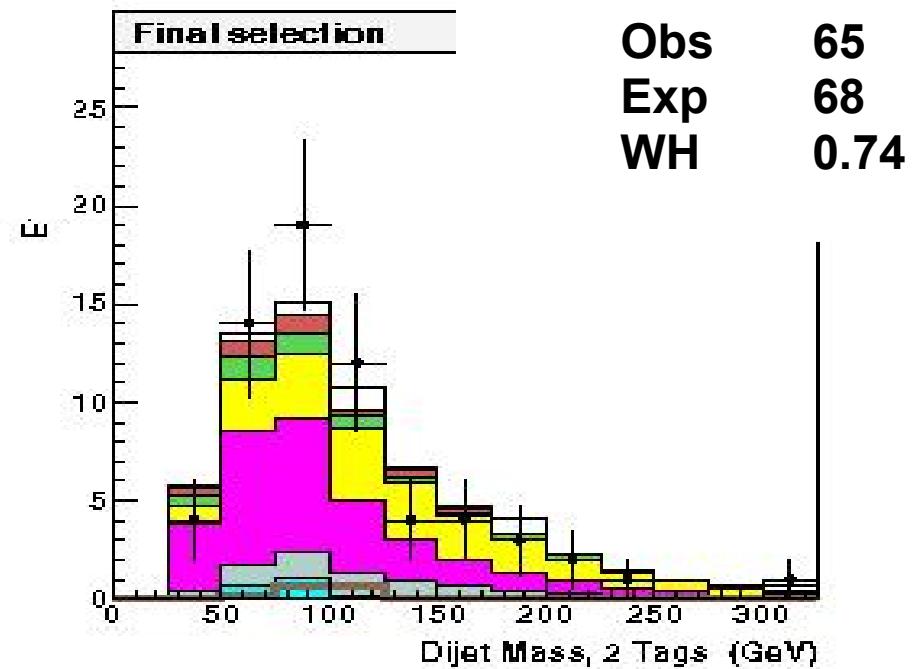


- ♦ Reweighting “P17” ameliore l'accord
 - ♦ Accord Data/MC P20 pre-tag comparable a celui obtenu en P17

b-tagging canal electron, 2 jets



Single-tag



Double-tag

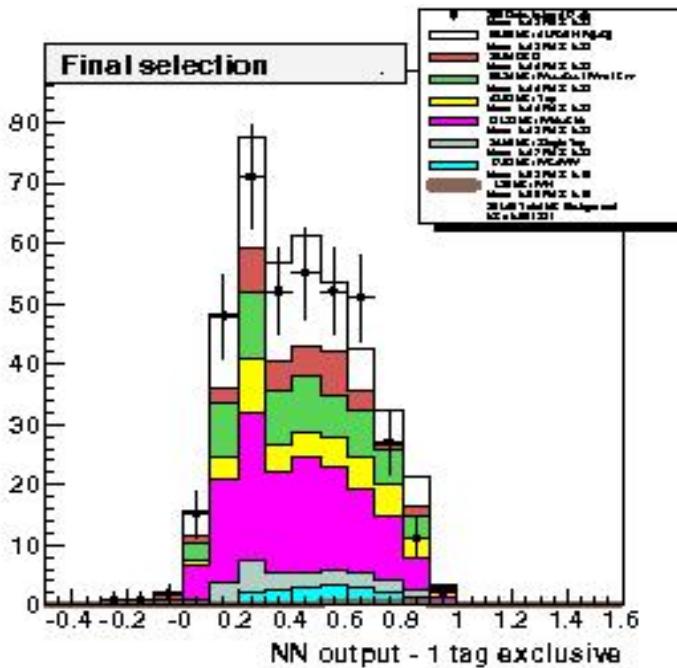
- ♦ Meme technique de normalisation qu'en P17

- ♦ Light k-factor = 1.9, HF k-factor = 1.33 (preliminaire)

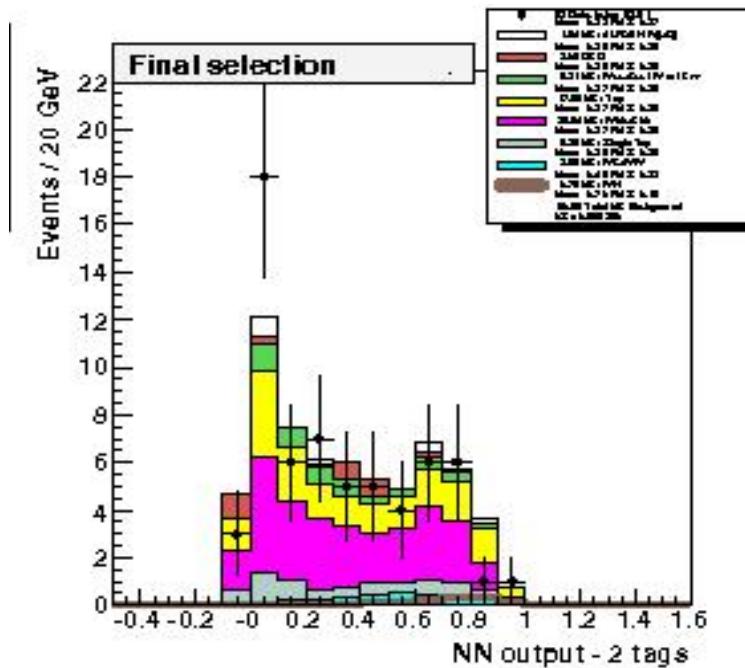
Matrix element vs. Neural network (P17)

Reseau de neurones

- ◆ Développement d'un reseau de neurones au LPNHE : + ~15% en sensibilite
- ◆ Entraîne séparement sur single-tag et double-tag ; entraîne sur Wbb et WH, puis applique à tous les bruits de fond. Un entraînement par masse du Higgs testée
- ◆ Sept variables d'entrée : pT(jet1), pT(jet2), pT(jj), dPhi(jj), dR(jj), mjj, pT(W)



Single-tag

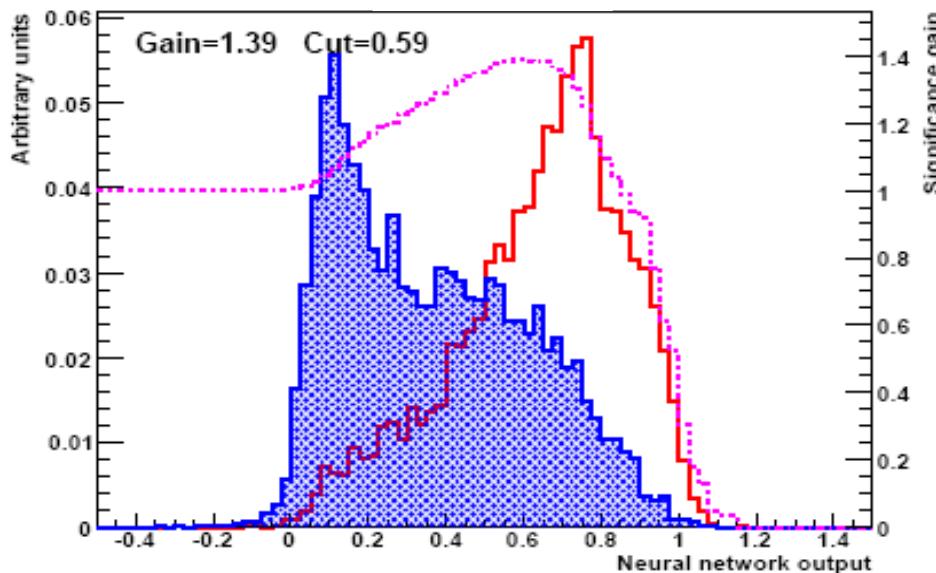


Double-tag

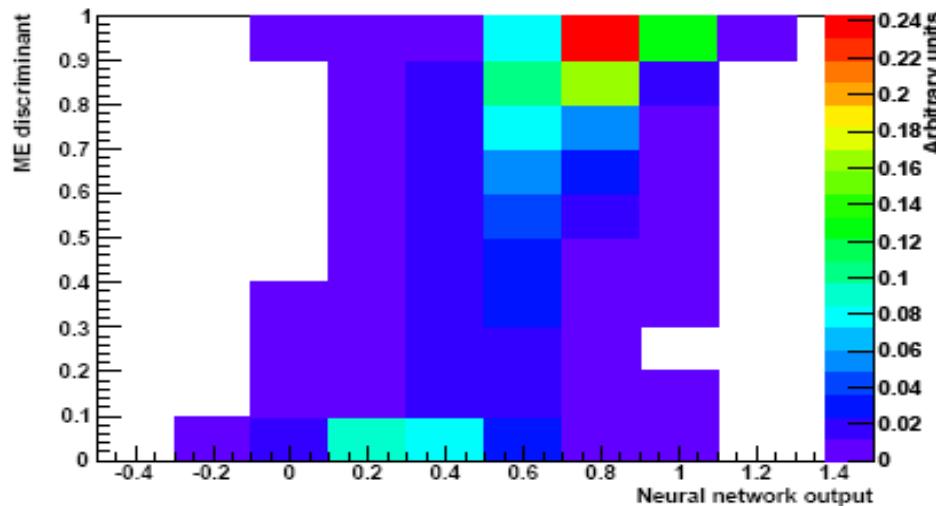
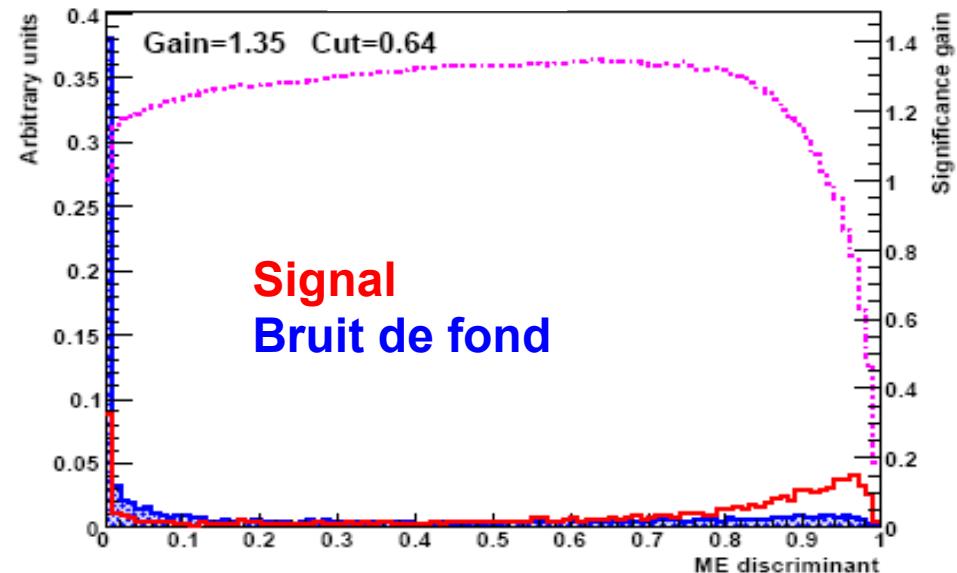
Matrix element developpe par U. Mich (Jianming et al.) --> utiliser le discriminant ME comme entree du NN, ou construire un discriminant 2D NN vs. ME

Single-tag : ME vs NN (115GeV)

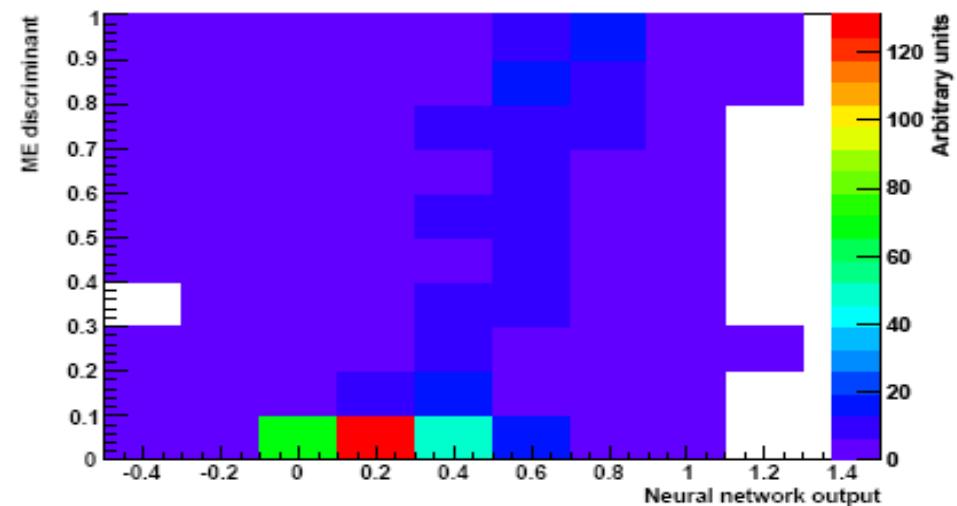
Reseau de neurones



Matrix element



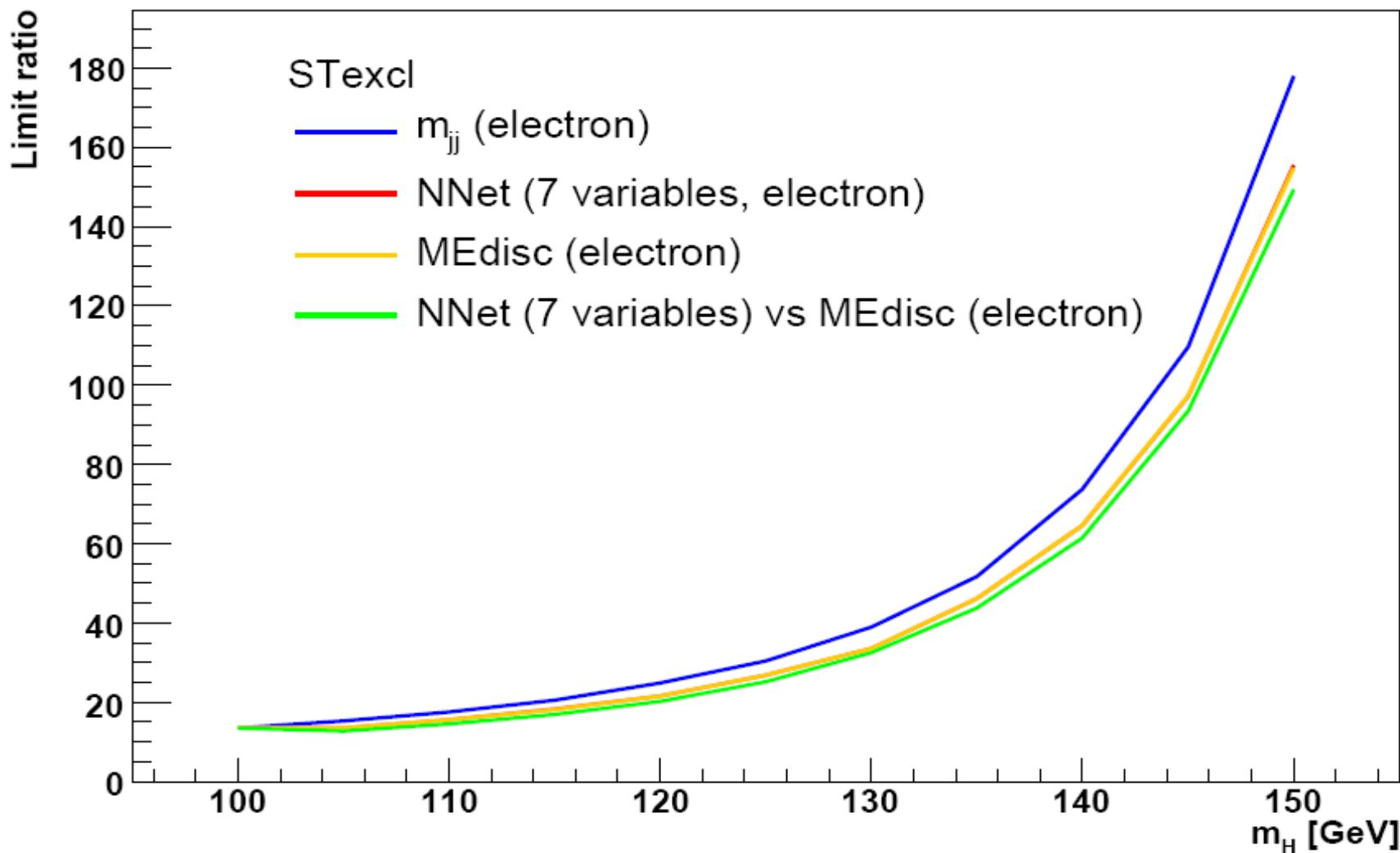
ME vs. NN : signal



ME vs. NN : bruit de fond

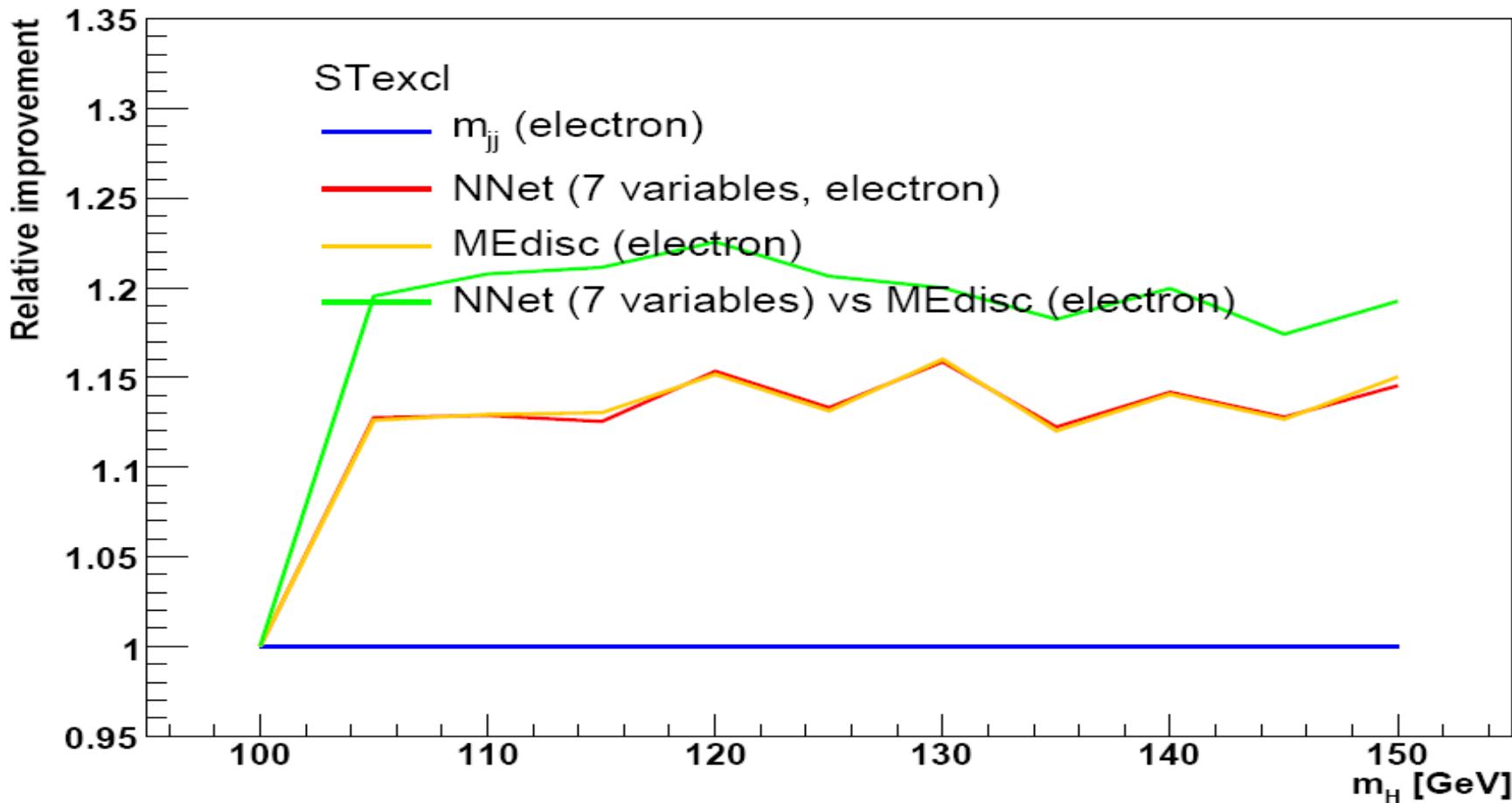
Single-tag : ME vs NN (115GeV)

- ◆ Quantification de l'amélioration : calcul de limite sans systématiques (CLFast, Collie)



- ◆ Matrix element et Neural net ont exactement la même performance
- ◆ Amélioration lorsque le discriminant 2D est utilisé

Single-tag : ME vs NN (115GeV)



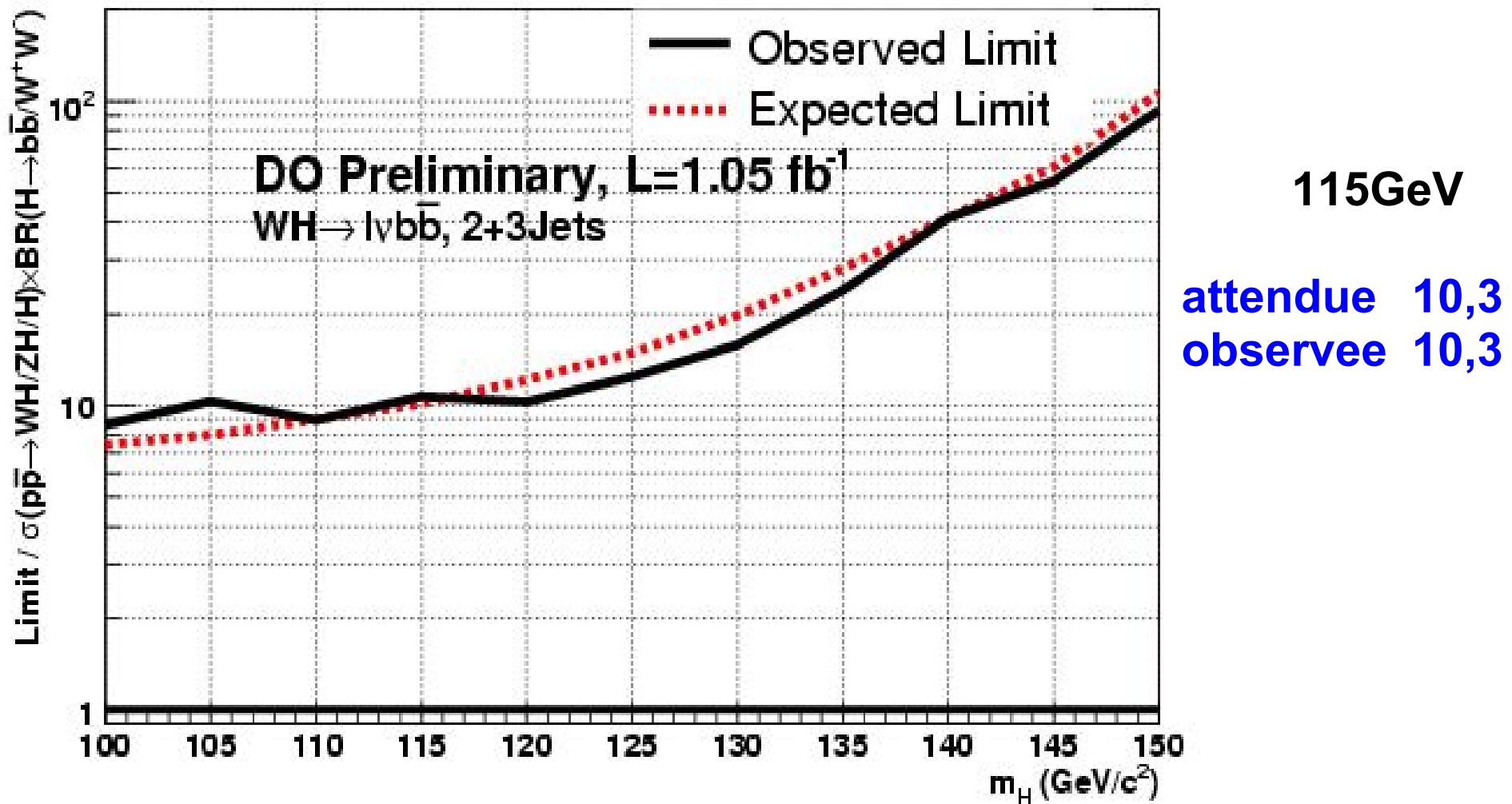
- Matrix element et Neural net apportent ~13-15% par rapport a m_{jj} (pas de matrix element pour $m_H = 100\text{GeV}$, point non-teste)
- ME vs. NN apporte **5% supplémentaires, soit 30% sur le gain / m_{jj}** (meme amelioration si ajout du ME comme entree du NN – etudes en cours – J. Brown)
- Gain total de ~20% / m_{jj} . Non negligable!**

Conclusion (I)

- ◆ P17 en revue EB pour publication, devrait etre prochainement en collaboration review
- ◆ Reweighting de la cinematique des jets dans ALPGEN derivee sur P17, amelioration de l'accord Data/MC si applique sur P20
- ◆ Prescription pour calculer les k-factors, chiffres preliminaires sur P20
- ◆ P20 pre-tag essentiellement bien compris, etudes en cours apres b-tagging
- ◆ Utilisation du matrix element comme entree du reseau de neurones, ou construction d'un discriminant 2D : +30% sur le gain par rapport a la masse du di-jet. **Gain total ~20%**
- ◆ Effort en cours pour sortir P17 + P20 a ICHEP

Conclusion (II)

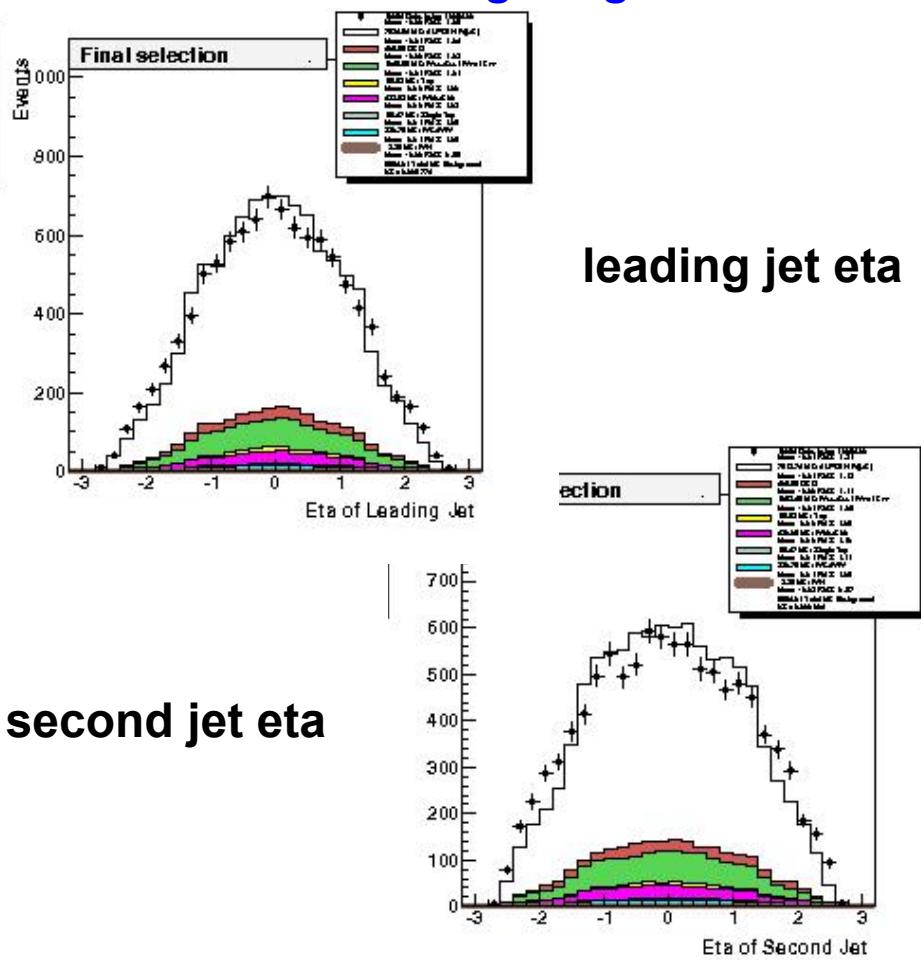
- Limite sur la section efficace de production du Higgs avec P17 (electron + muon, 2 jets + 3 jets, reseau de neurones 7 variables) – rapport limite calculee / prediction du MS



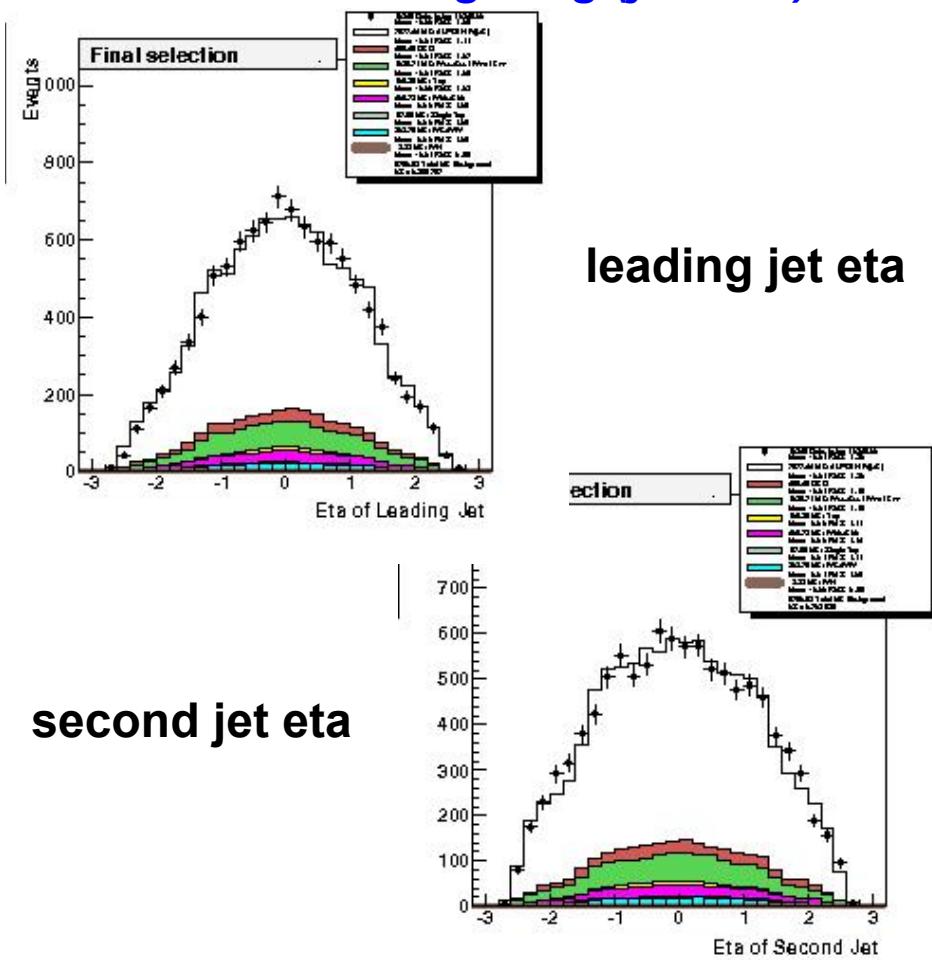
BACKUP

Step 1 : effect of reweighting - jets.eta (mu channel)

Before reweighting

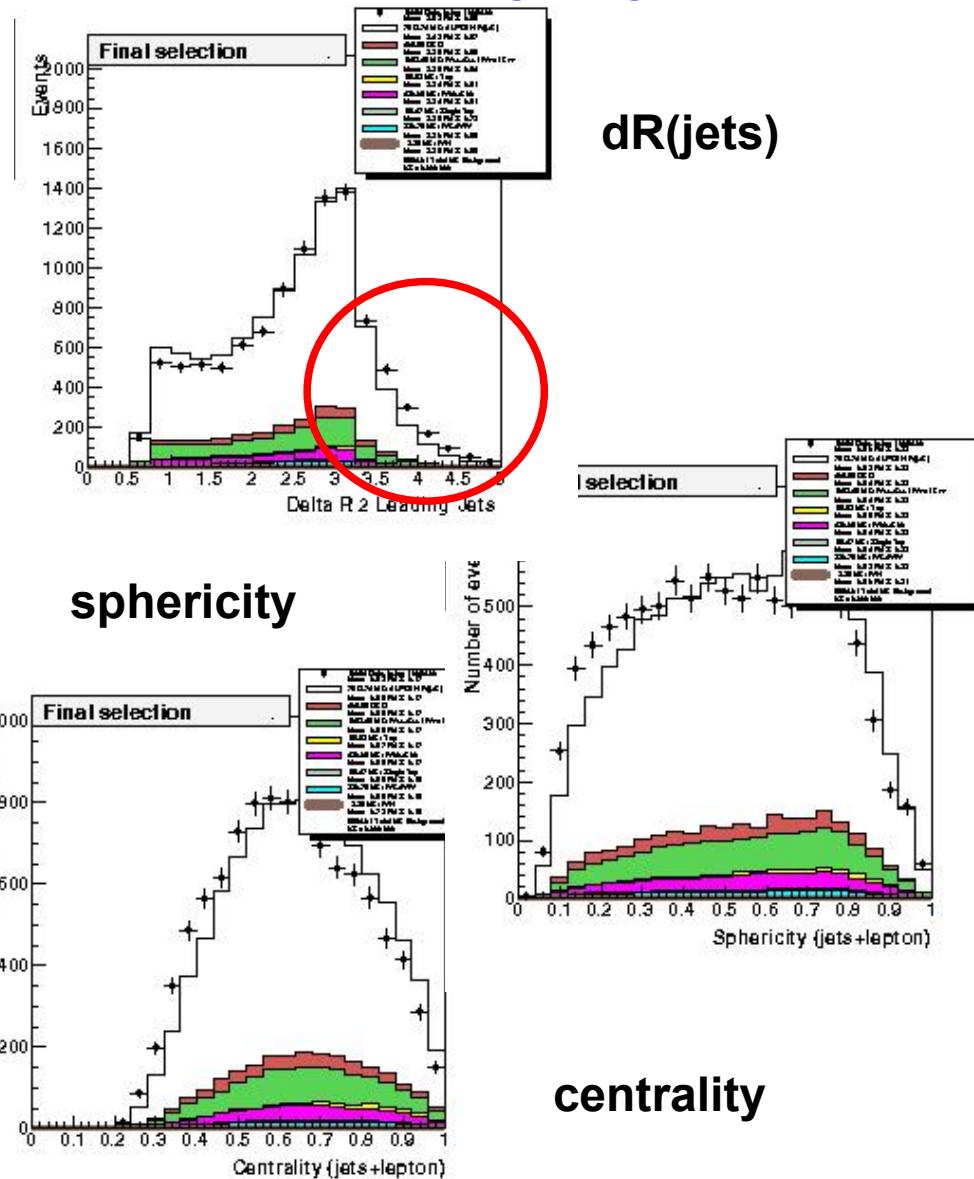


After reweighting (jets eta)

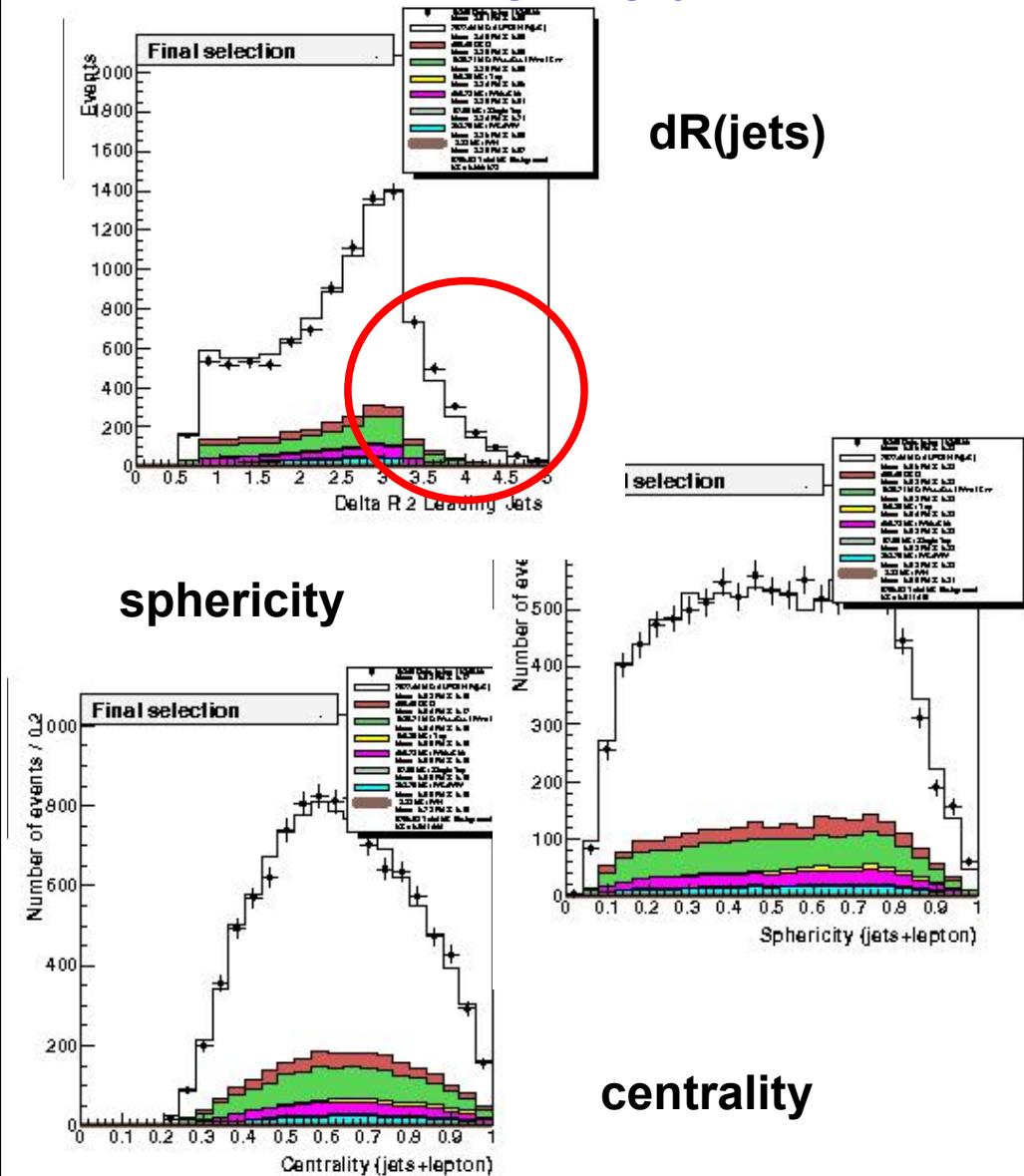


Step 1 : effect of reweighting - jets.eta (mu channel)

Before reweighting

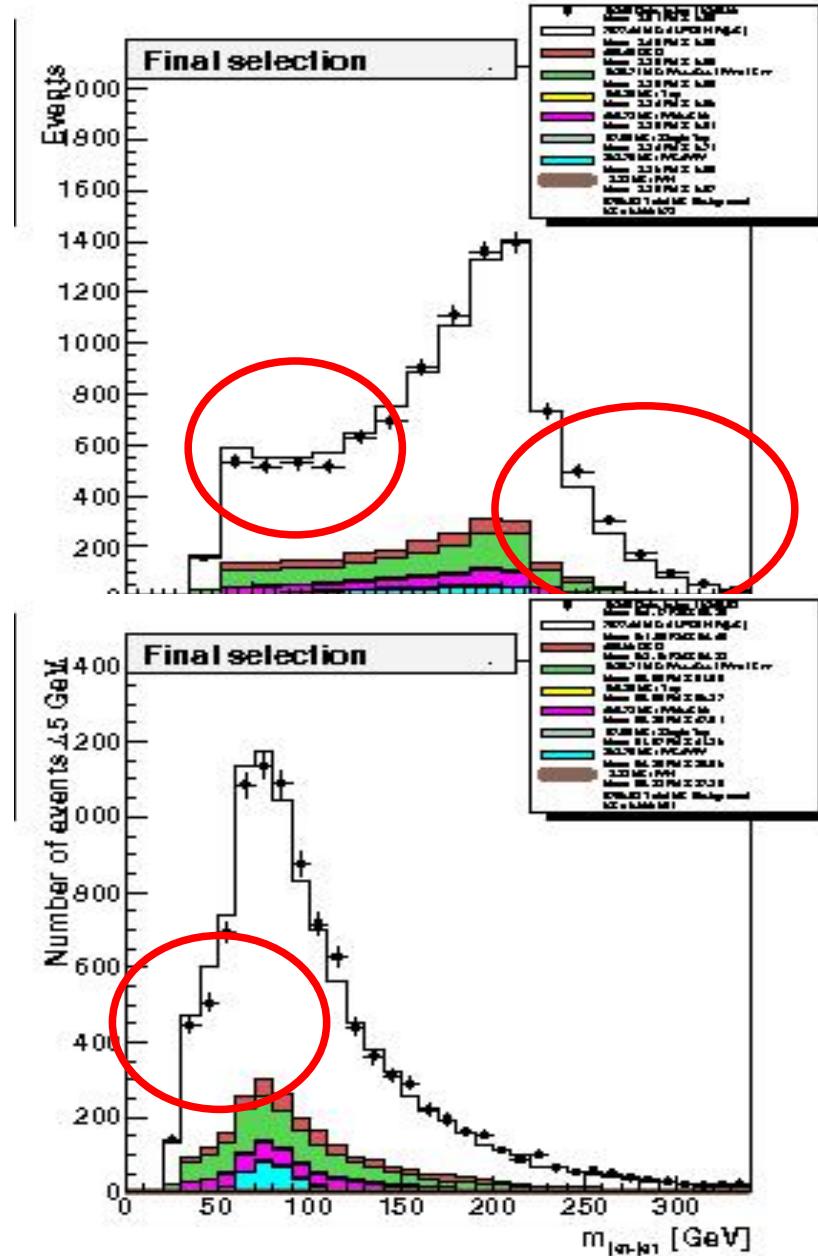


After reweighting (jets eta)



After jets.eta reweighting...

- ♦ DeltaR(jj) and mjj can still be improved

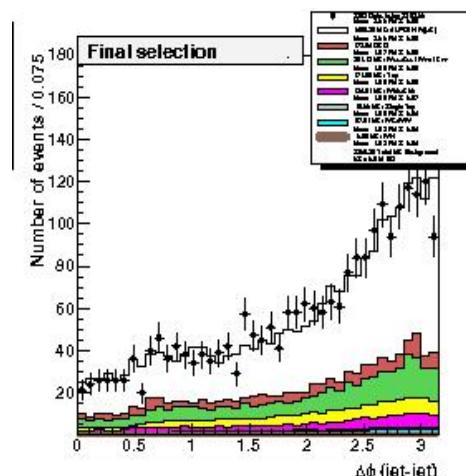
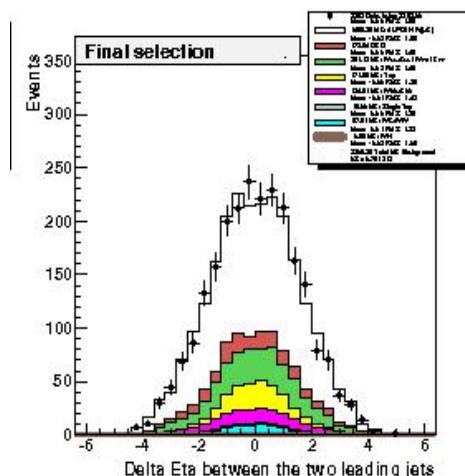
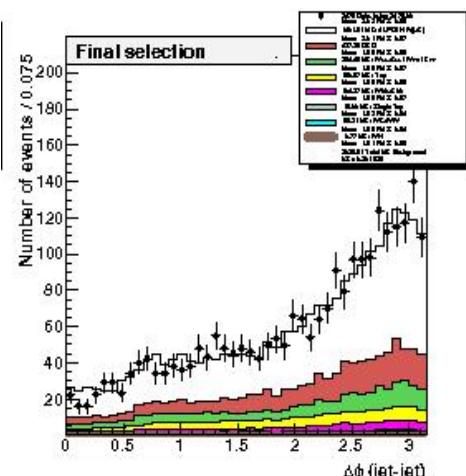
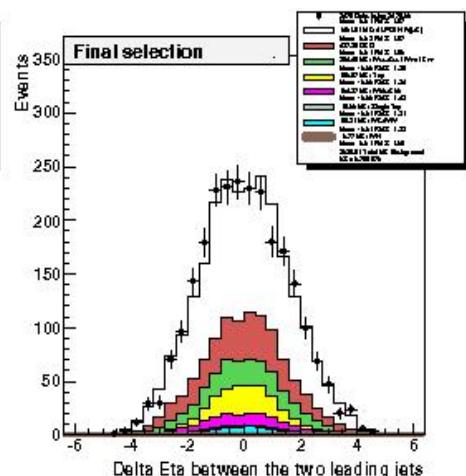
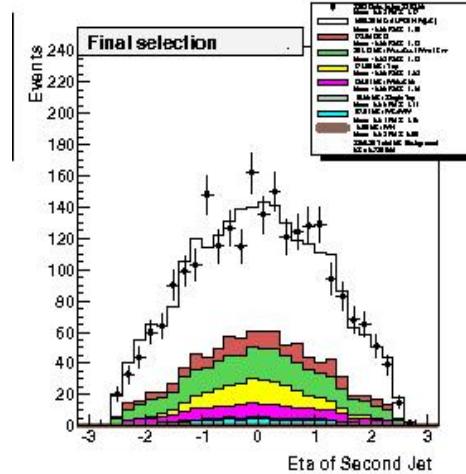
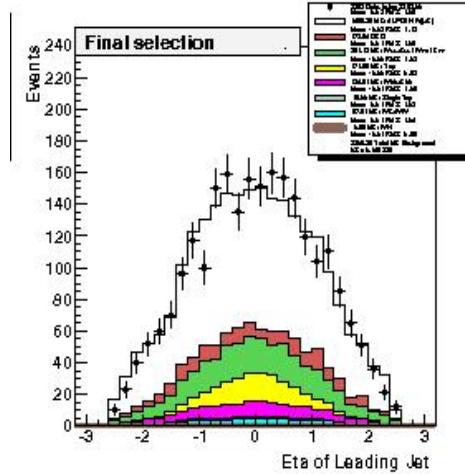
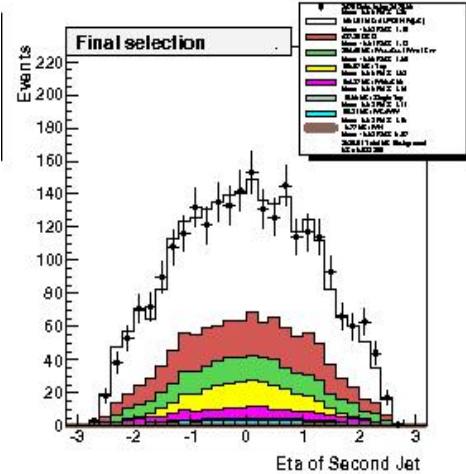
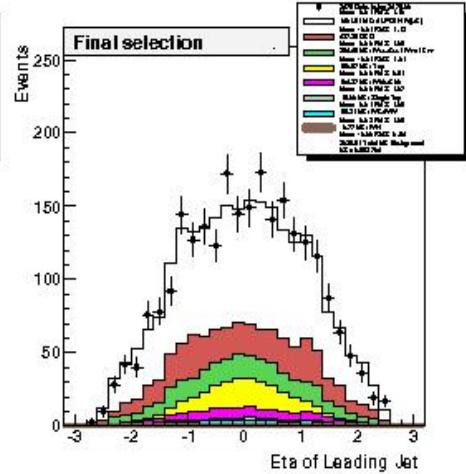


- Reweighting the jets' eta is not enough to correct the jets kinematics
- Reweight deltaPhi(jj) and deltaEta(jj) as well

e

Distributions (3 jets)

mu



Distributions (3 jets)

e

mu

