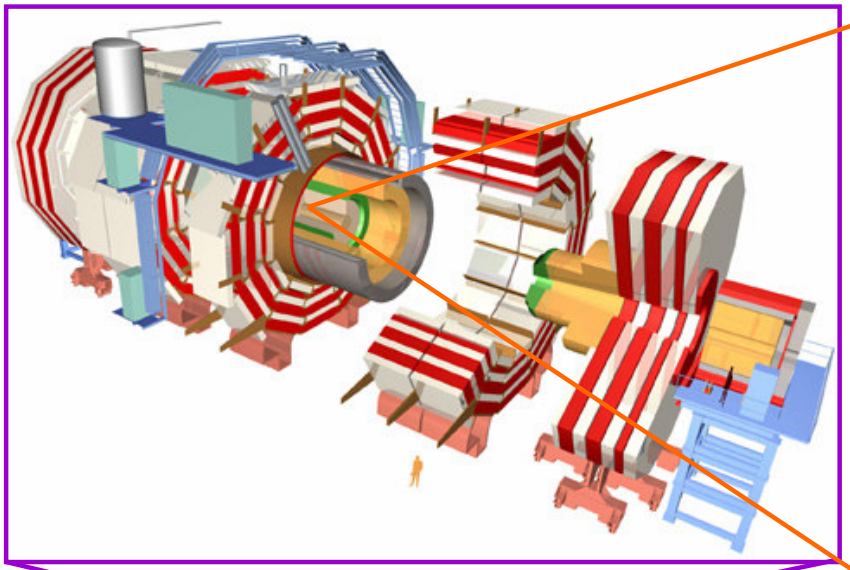
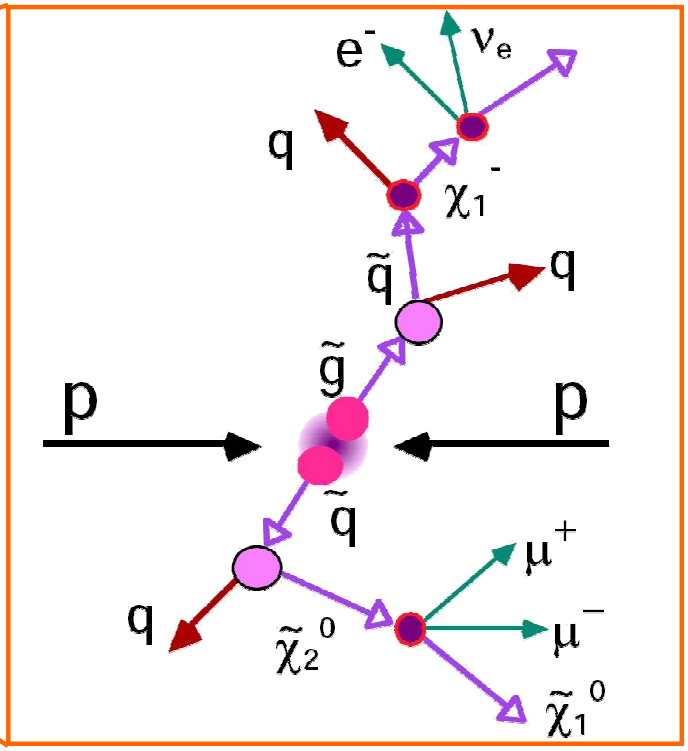
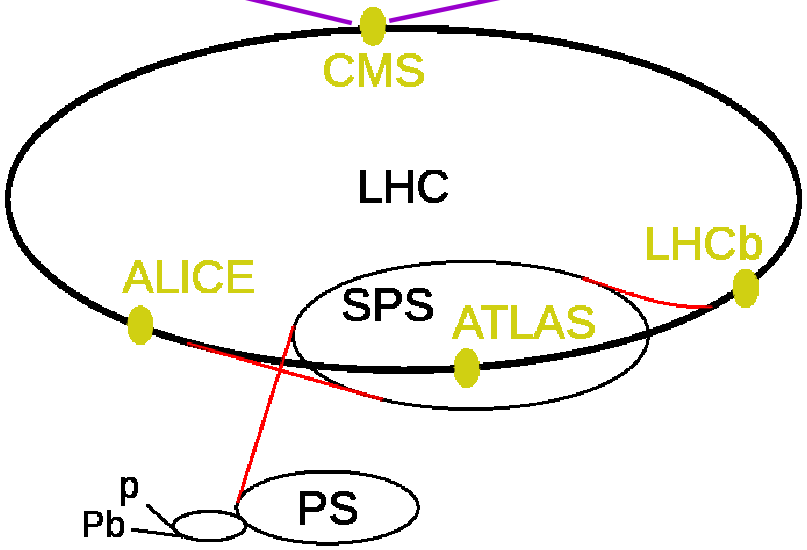
Muon ID for RA4 - Follow up







(1) Proposal for MuonID
(2) Jet Issues
(3) SUSYPAT

Reference Analysis - MuonID

Muon Selection

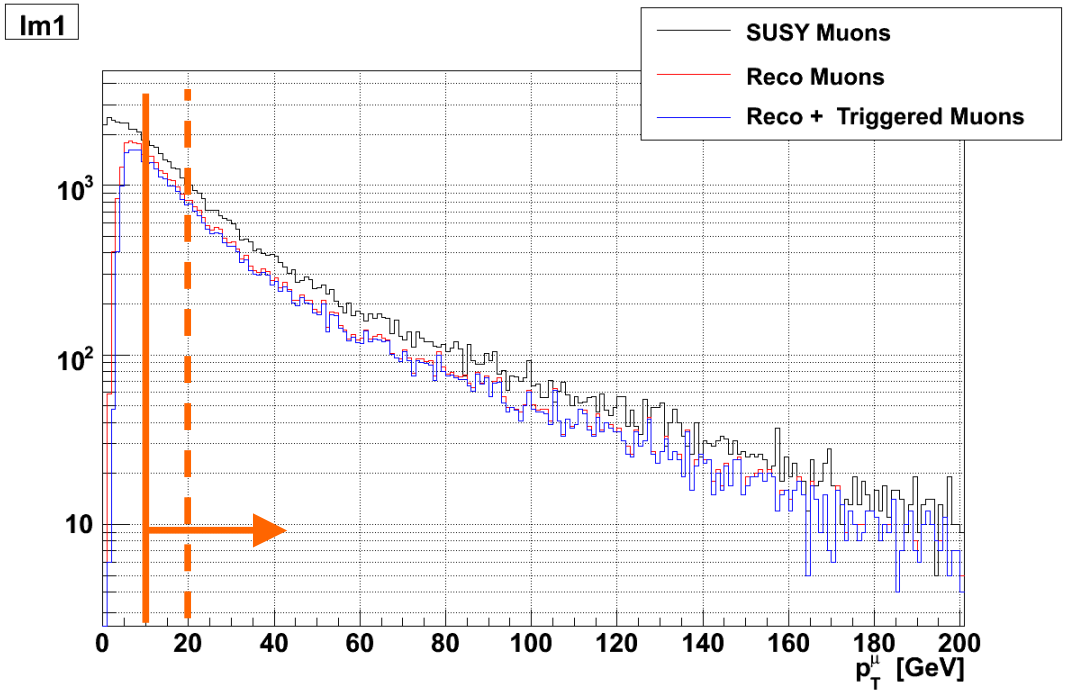
- Below are initial muon selection cuts that can be used as a reference for "Synchronization" of analysis codes.
- These cuts are taken from Finn's talk along with the V+jets baseline cuts.

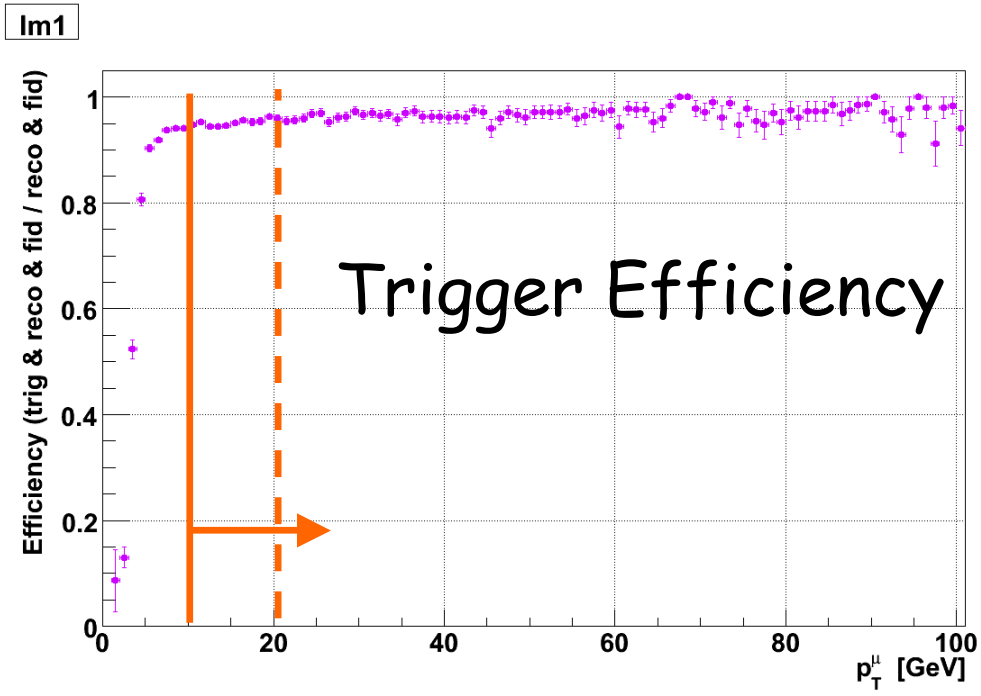
Quantity	PAT Object and Member Function	Cut	Comment
Mu type	pat::Muon => isGood("GlobalMuonPromptTight")	GlobalMuonPromptTight	OK
p_T	pat::Muon => pt()	≥ 20 GeV	
abs(eta)	pat::Muon => eta()	≤ 2.1	OK
Rel. Isolation	pat::Muon => caloIso(), ecalIso(), trackIso(), pt()	< 0.1	
chi^2/dof	pat::Muon => combinedMuon()->chi2(), combinedMuon() ->ndof()	< 10	OK
abs(d_0)	pat::Muon => track()->d0 *	< 0.2 cm	OK
N hits	pat::Muon => track()->numValHits()	≥ 11	OK
HCal E	pat::Muon => hcalIsoDeposit->candEnergy()	< 6	
ECal E	pat::Muon => ecalIsoDeposit->candEnergy()	< 4	

→ Improvement possible & necessary

See also :
http://indico.cern.ch/getFile.py/access?contribId=3&resId=0&materialId=slides&confId=57465

Muon pT Threshold (again...)





Most of the signal efficiency lost due to pT > 20 GeV
→ Go to pT > 10 GeV
- Trigger OK
- Reco OK
- Backgrounds OK → e.g. QCD killed by isolation, $\Delta\phi$

Comparison

ACIIIA :	
RelIso	./.
TrkIso	< 6 GeV
ECalIso	< 6 GeV
HCalIso	< 6 GeV

RA4 :	
RelIso	< 0.1
TrkIso	./.
ECalIsoDep	< 4 GeV
HCalIsoDep	< 6 GeV

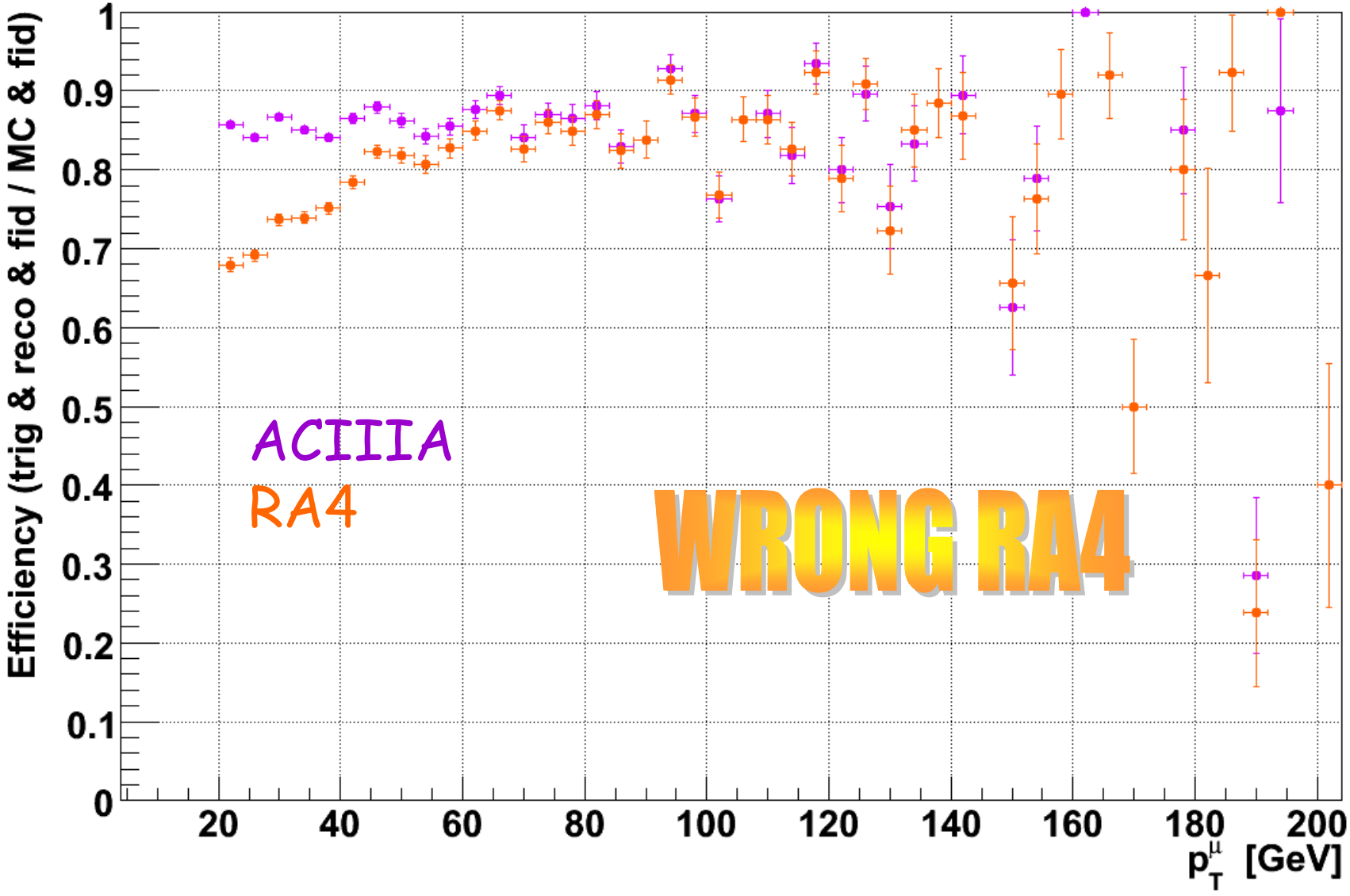
$$\text{RelIso} = \frac{\text{SumIso}}{p_T} = \frac{\text{TrkIso} + \text{ECalIso} + \text{HCalIso}}{p_T}$$

In the last presentation had a bug : *CalIso instead of *CalIsoDep

The *CalIsoDep cuts introduce an additional inefficiency of 5 - 10 %

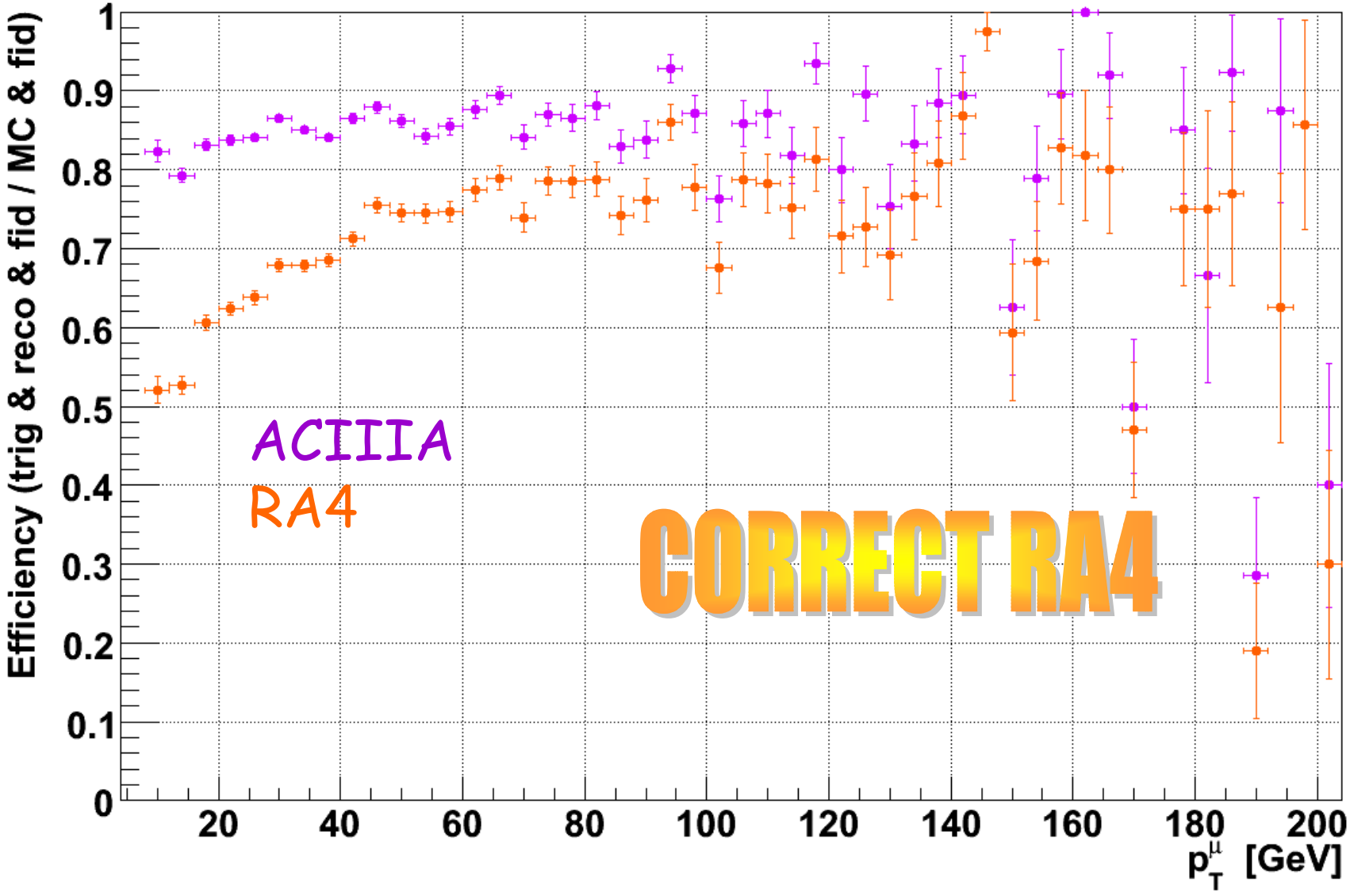
Clean W + Jets Muon - Efficiency

wj

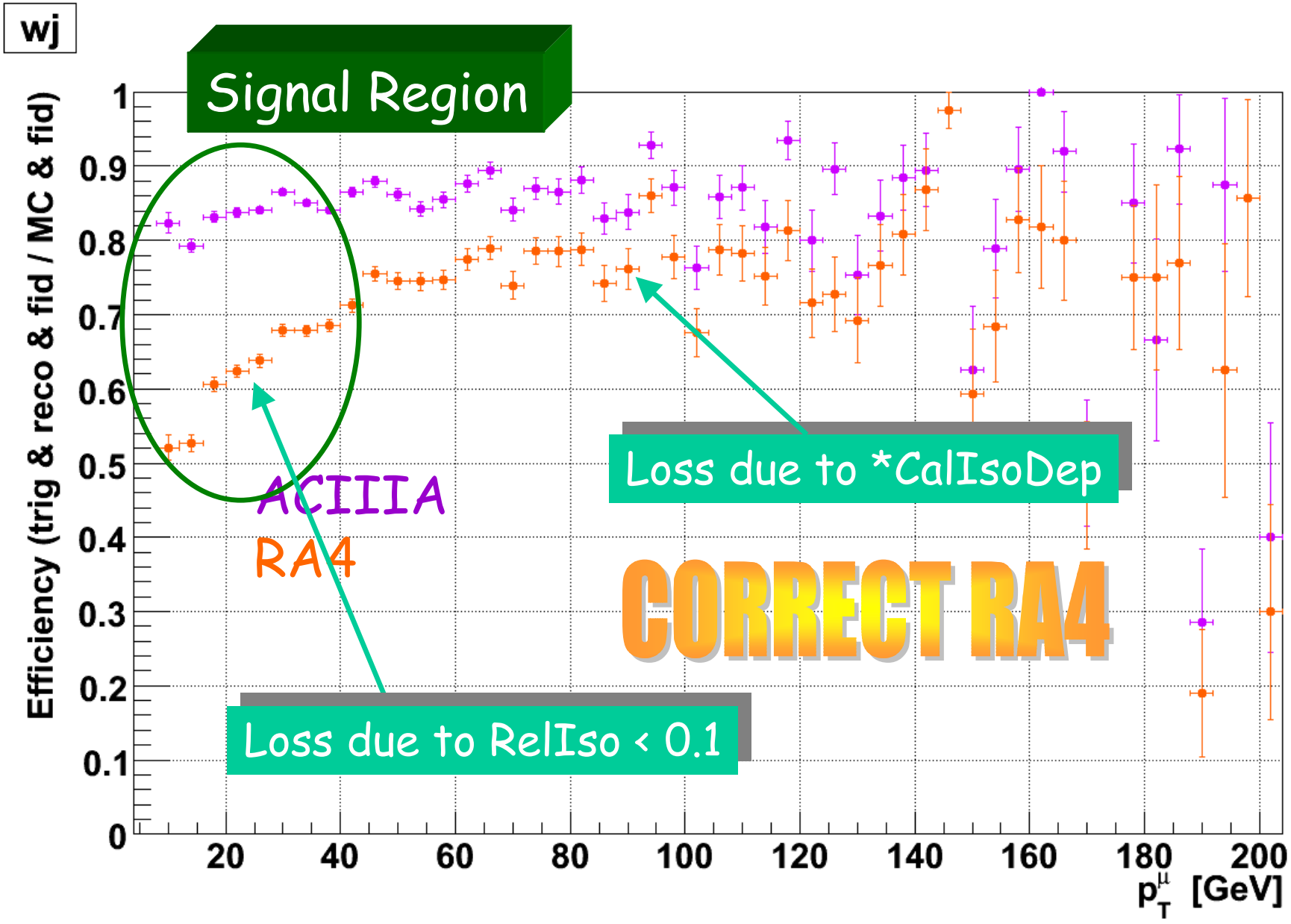


Clean W + Jets Muon - Efficiency

wj

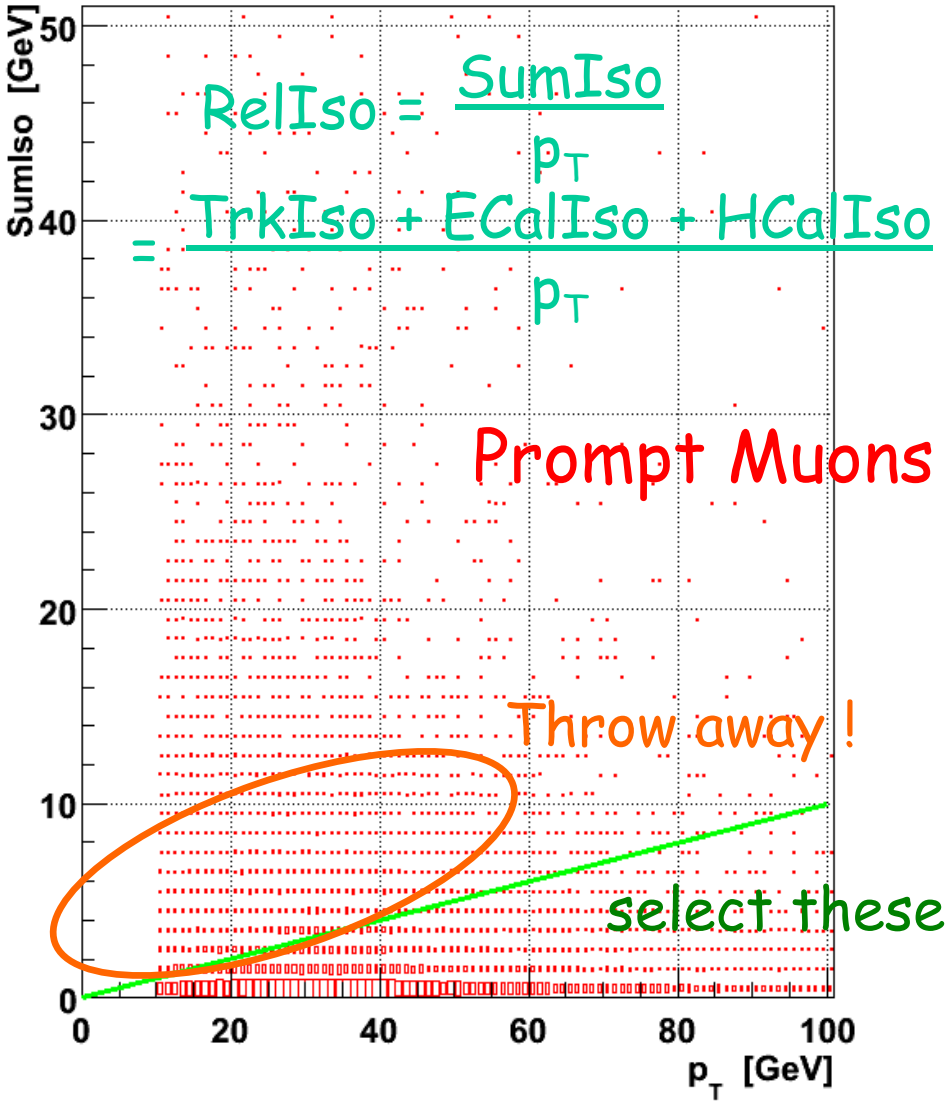


Clean W + Jets Muon - Efficiency

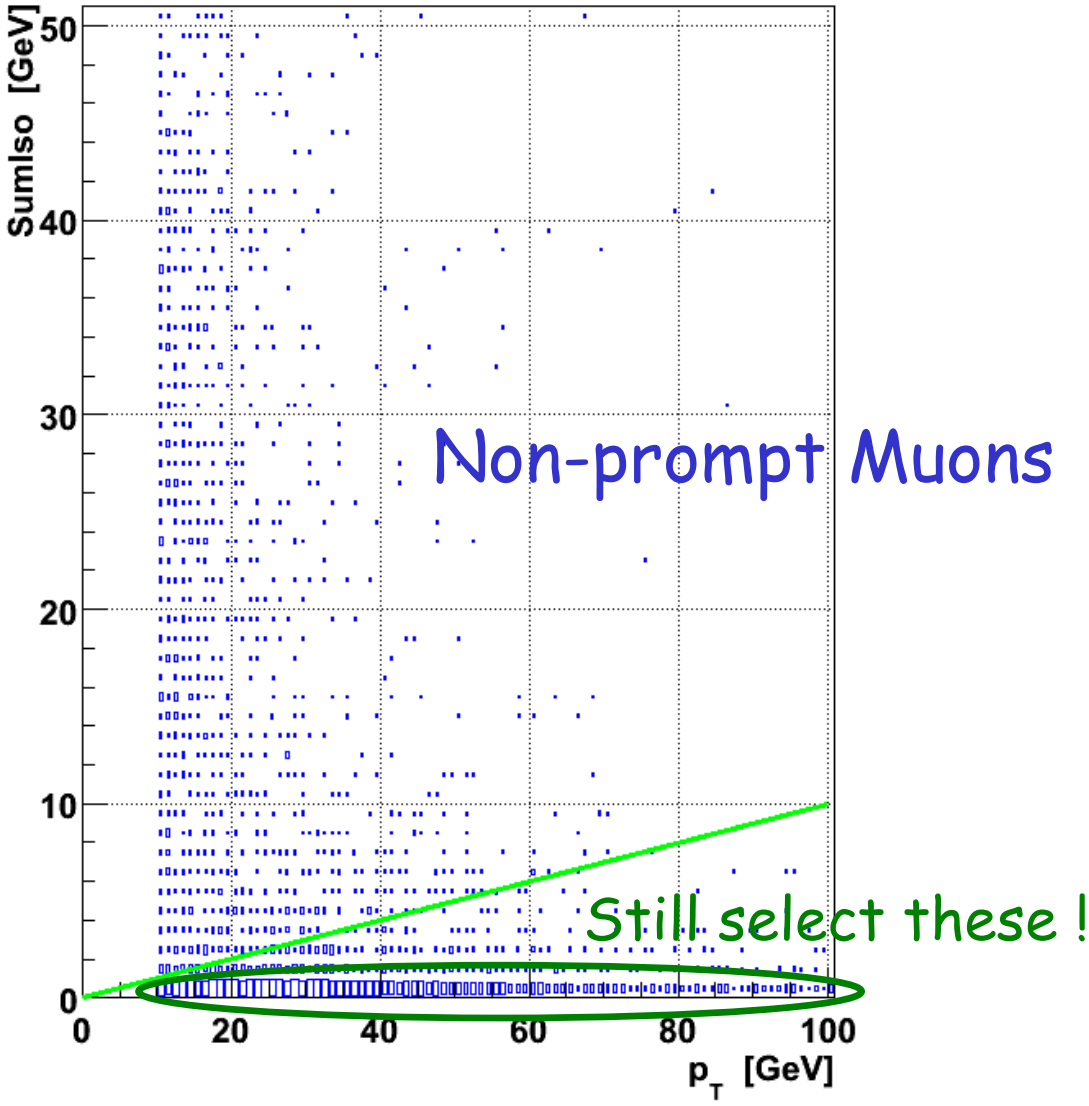


Clean W + Jets Muon - Comparison

wj : Before Isolation Cuts



wj : Before Isolation Cuts



Summary MuonID

RA4 Cuts are **not optimal** for RA4/MU analysis

→ efficiency not flat, decrease where signal sits

→ difficult to invert cut, since many real muons (small pt) have rather high values of RelIso

→ additional ECalIsoDep/HCalIsoDep cuts destroy the advantage of RelIso at high pt

ACIIIA Cuts have same efficiency & comparable fake rate

→ flat in pt, significantly higher where signal sits

→ allows individual treatment of 3 types of isolation

→ no problems with QCD estimation/cut inversion

References :
Feb 26, 2009, „Baseline MuonID for SUSY selection", CM
May 7, 2009, „Study of MuonID for RA4", CM

Jets

From the RA4 TWiki :
Many people (including Aachen) are using **iterativeCone5** Jets

Please note (HN) :
„After consultation with PAGs and POGs, the JetMET group suggests to concentrate on just **one** clustering algorithm combination with first data, **siscone R=0.5**, and to **eliminate IC5** from the list of supported algorithms for physics analysis."

Proposal

Muon Selection

final

- Below are initial muon selection cuts that can be used as a reference for "Synchronization" of analysis codes.
- These cuts are taken from Finn's talk along with the V+jets baseline cuts

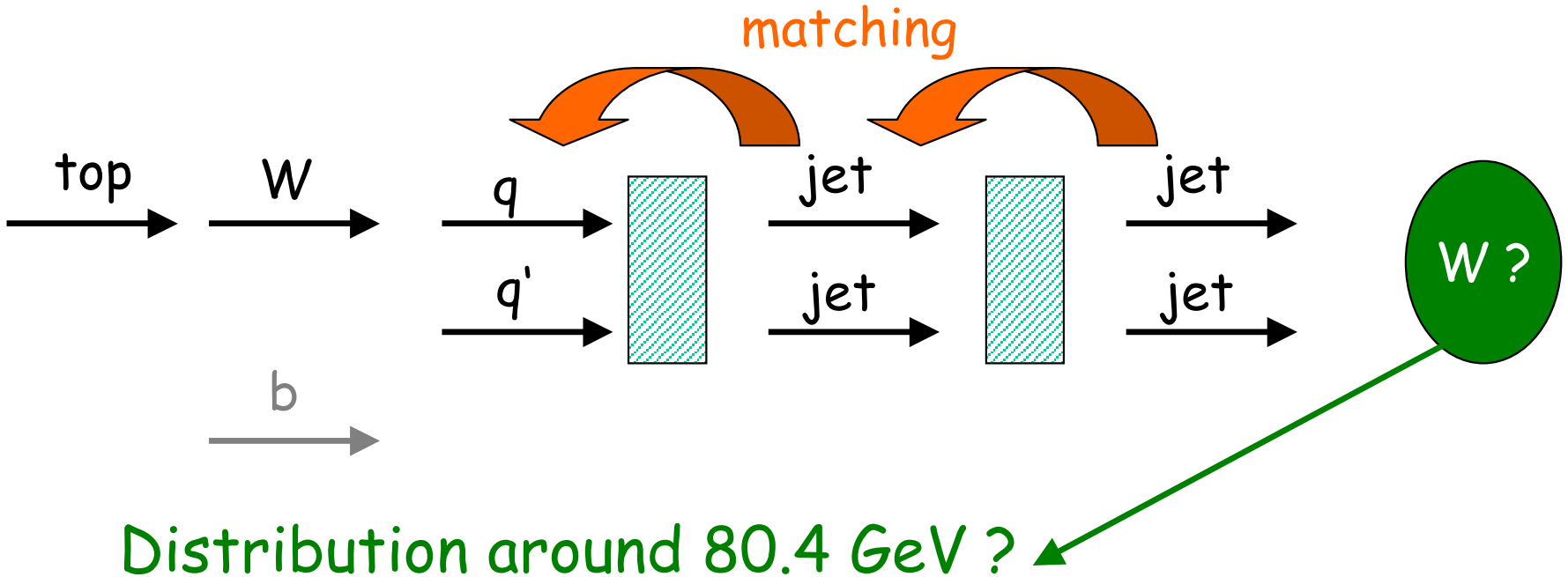
Quantity	PAT Object and Member Function	Cut	Comment
Mu type	pat::Muon => isGood("GlobalMuonPromptTight")	GlobalMuonPromptTight	OK
p_T	pat::Muon => pt()	~~≥ 20 GeV~~ > 10 GeV	
abs(eta)	pat::Muon => eta()	≤ 2.1	OK
~~Rel. Isolation~~	~~pat::Muon => calolso(), ecallso(), trackIso(), pt()~~	~~< 0.1~~	
chi^2/dof	pat::Muon => combinedMuon()->chi2(), combinedMuon() ->ndof()	< 10	OK
abs(d_0)	pat::Muon => track()->d0 *	< 0.2 cm	OK
N hits	pat::Muon => track()->numvalhits()	≥ 11	OK
~~HCal E~~	~~pat::Muon => hcallsoDeposit >candEnergy()~~	~~< 6~~	
~~ECal E~~	~~pat::Muon => ecallsoDeposit >candEnergy()~~	~~< 4~~	

TrkIso	pat::Muon->trackIso()	< 6 GeV
ECalIso	pat::Muon->ecalIso()	< 6 GeV
HCalIso	pat::Muon->hcalIso()	< 6 GeV

+ JETS : sisCone5

Jet Energy Scale Issue

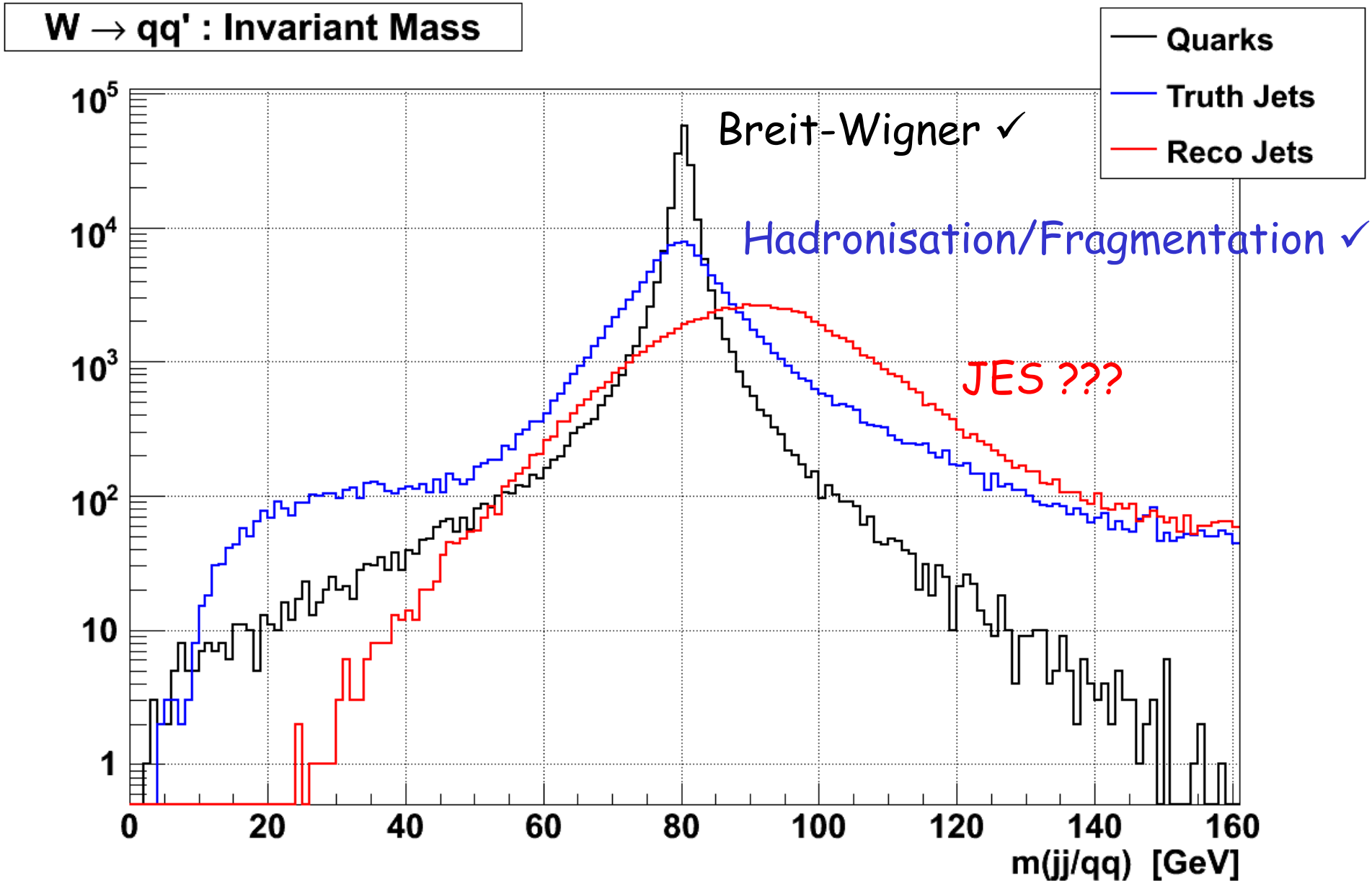
„Top box method" (see Talk from Walter Bender) requires W reconstruction



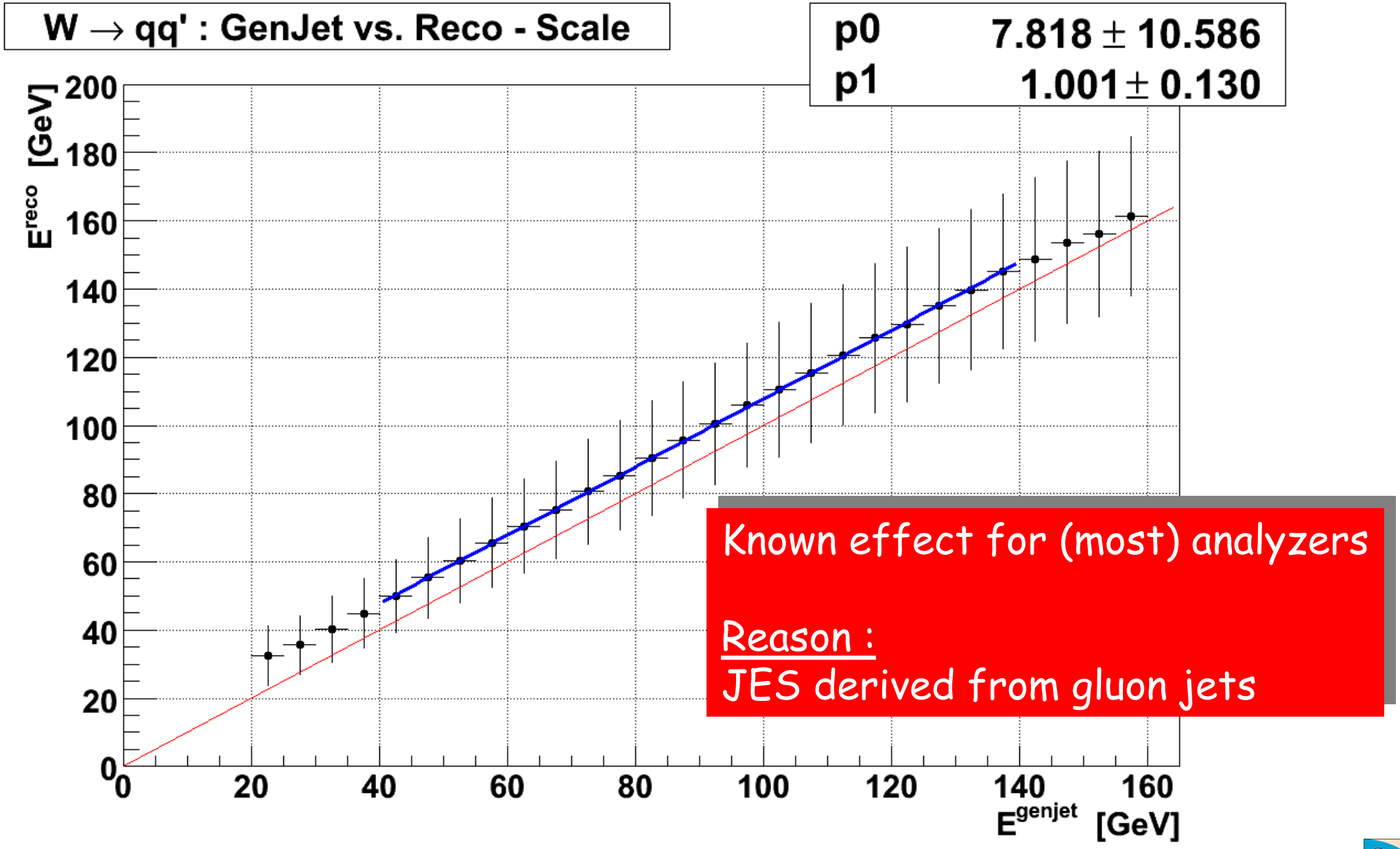
Distribution around 80.4 GeV ?
Fix this (see RA4 Twiki) @ 80.4 GeV ?

$$\chi^2 = (M_{j_1 j_2} - M_W)^2/\sigma_{jj}{}^2 + (M_{j_1 j_2 j_3} - M_t)^2/\sigma_{jjj}{}^2 + (M_{W_t j_4} - M_t)^2/\sigma_{\mu\nu j}{}^2$$

W Mass Peak in ttbar Events



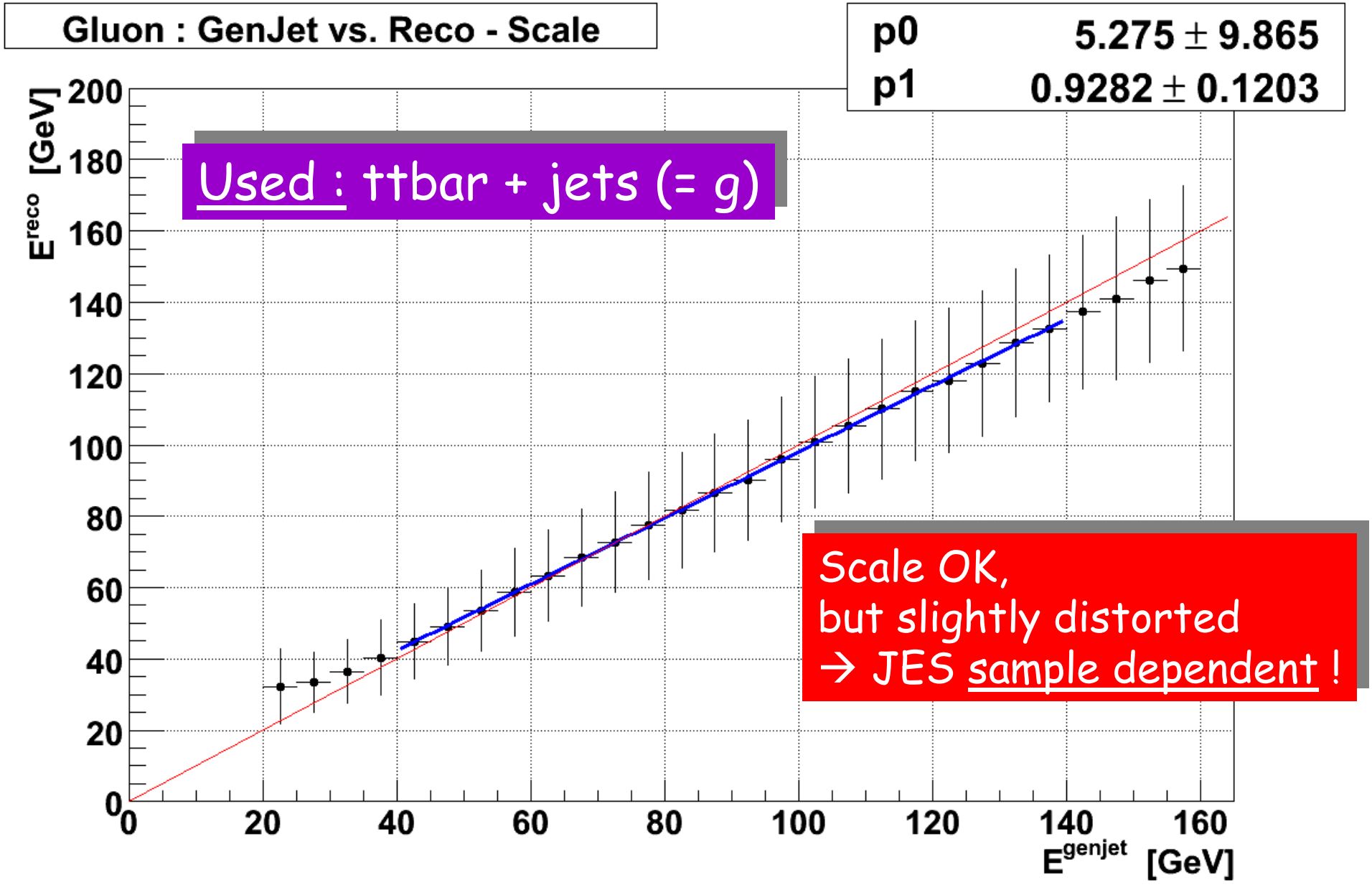
Observe Shift of 7.8 GeV



Known effect for (most) analyzers

Reason :
JES derived from gluon jets

JES for Gluons in ttbar Events



Summary JES

This study was triggered by a guy asking about a shift in W recontruction on HN and our own top box studies. Not everybody seems to be aware of this fact.

→ Should keep in mind this features when optimizing jet cuts, skimming, background estimation . . . .

Summary SUSYPAT

We (Aachen) already switched to PATv2
→ SUSYPAT V5 not compatible with our Filler/Analyzer

However, our first check of SUSYPAT samples in May showed compatibility with our Analyzer - despite some missing information which is in now.

I am in contact with Mariarosaria concerning trigger information in SUSYPAT V6;
I already sent the necessary cfg snippet.

⇒ we will use SUSYPAT samples in the future