H->ZZ->4l Update

Trying to re-do CSC note:

- MC Sample
- Trigger Eff.
- Electron Selection Eff.
- Muon Selection Eff.

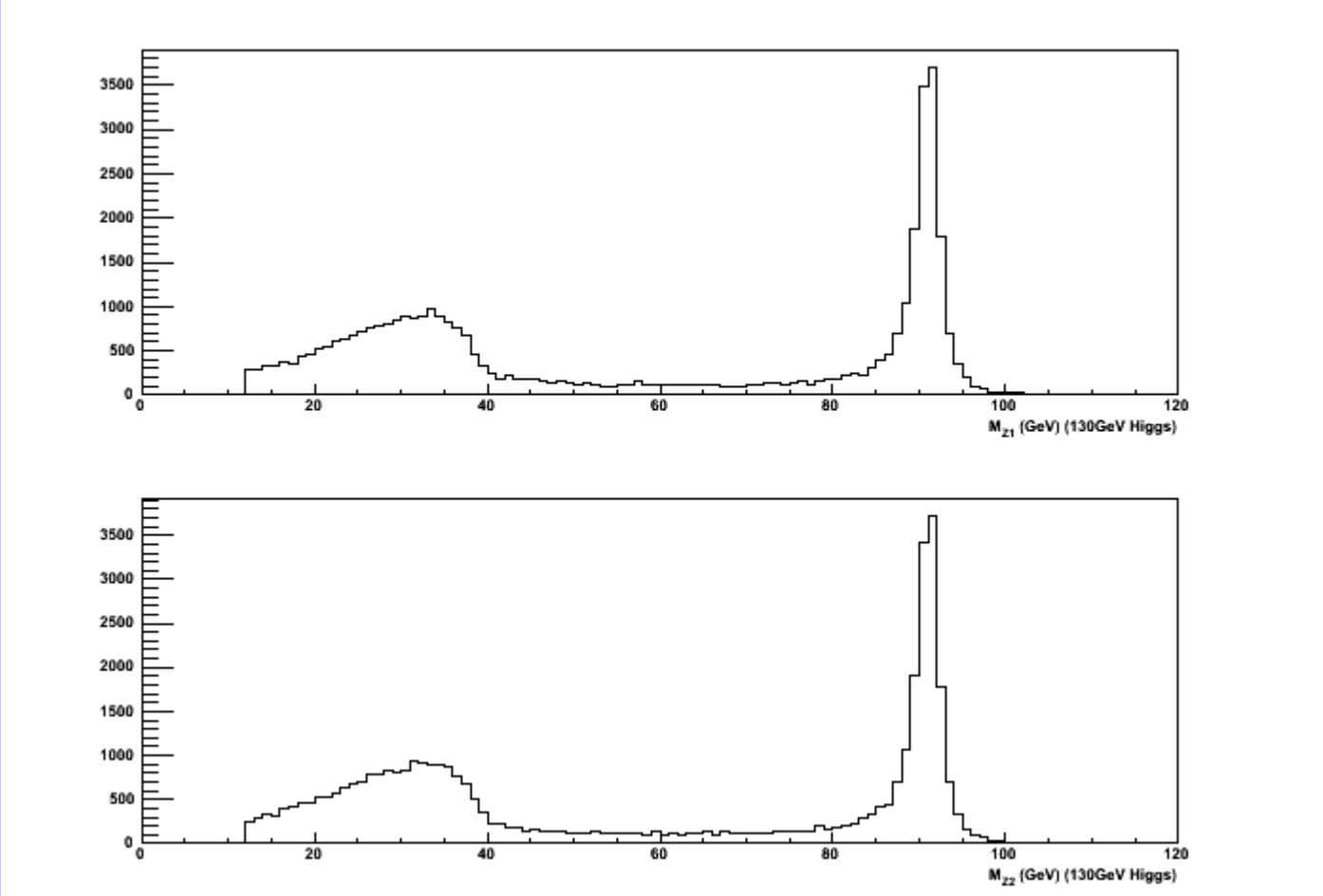
Monte Carlo Sample

H-> 4l (130GeV) generated with Pythia (38950 events)

Using the Truth Dumper we can find out what the sample is made up of:

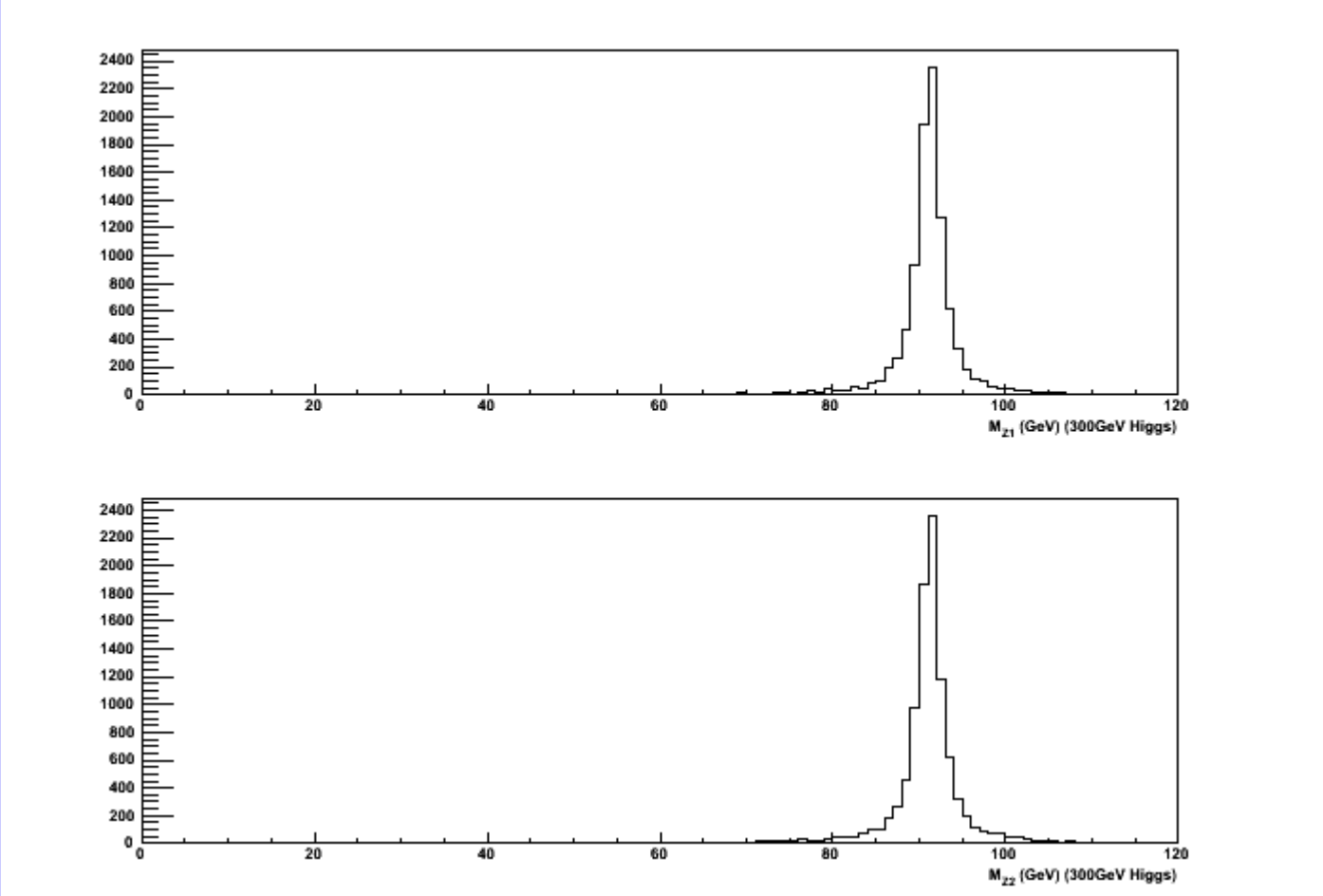
Event Type	Number of Events	Percentage
H → eeee	9671	24.8%
H → μμμμ	9813	25.2%
H → eeμμ	19466	50.0%
H → eeττ	0	0
H → μμττ	0	0
H → ττττ	0	0

Z mass for the H (130 GeV) Sample



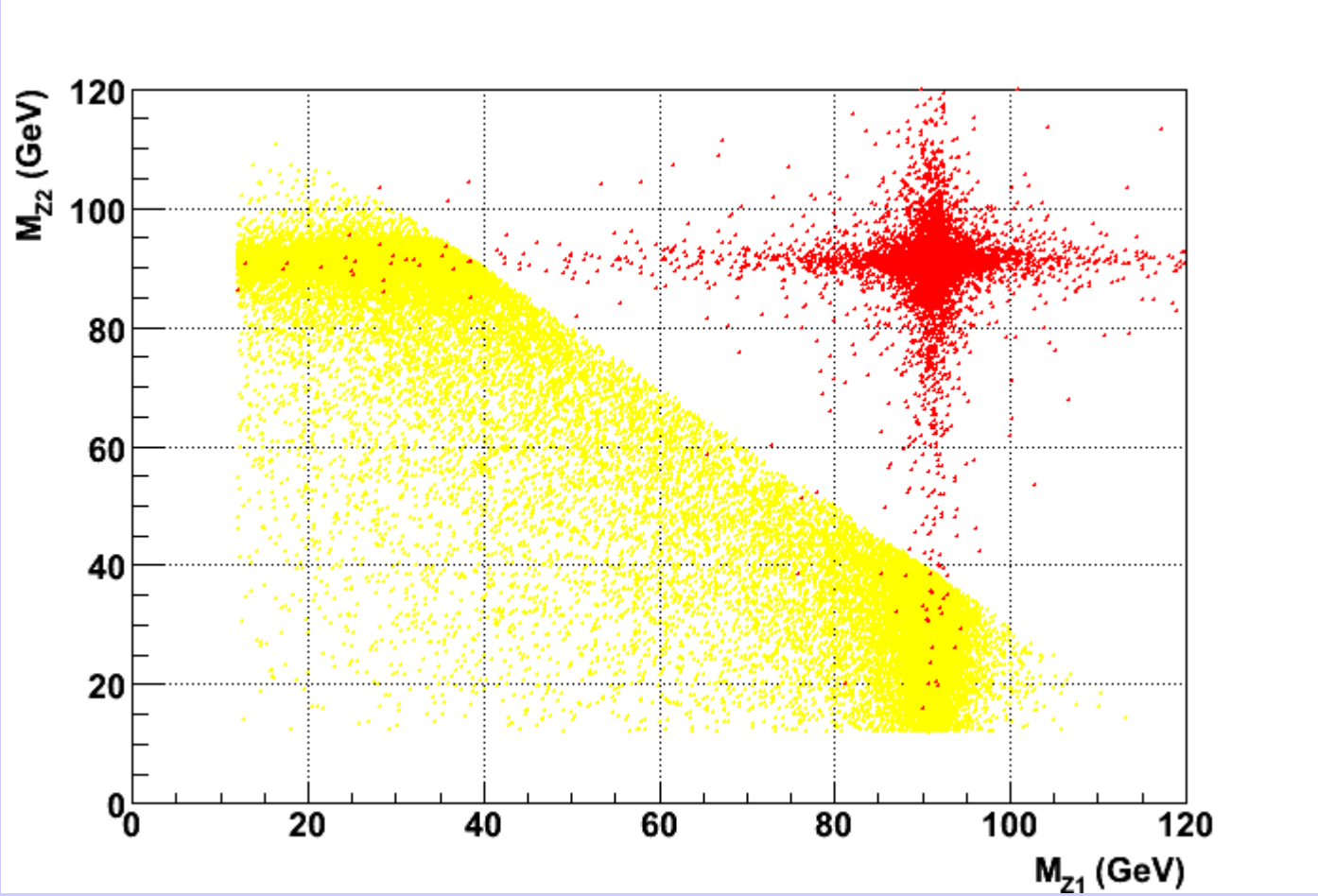
Notice the virtual Z at low mass

Z mass for the H (300 GeV) Sample



Both Zs are now real (this happens with a Higgs mass of 180GeV)

Scatter plot of the Z mass



Yellow (130GeV) and Red (300GeV)

Trigger Menu

Various lepton triggers were looked at in the CSC note:

1 20 GeV muon	(1μ20)
1 22 GeV Isolated electron	(1e22i)
2 15 GeV Isolated electrons	(2e15i)

Trigger Eff.

Trigger Eff = Number of events passing the trigger/Number of event type

Trigger	4e	4μ	2e2μ
1μ20	0.1%	95.3%	71.3%
1e22i	94.7%	0.4%	68.6%
2e15i	76.3%	0.0%	33.2%
1μ20 or 1e22i	94.7%	95.3%	95.7%

The 1μ20 or 1e22i trigger is used in the analysis

This is exactly the same as in the CSC note.

(note this is with no cuts on the truth, the note says they have a 5GeV pt cut and a eta < 2.5. This gives a slightly different answer.)

Electron Eff.

We have various types of pre-selected electrons:

All have p_t > 5GeV and η < 2.5

Loose

Medium

Medium+CALOISO

Tight

Efficiency = number of reco electron (from Z) / number of true electrons (from Z)

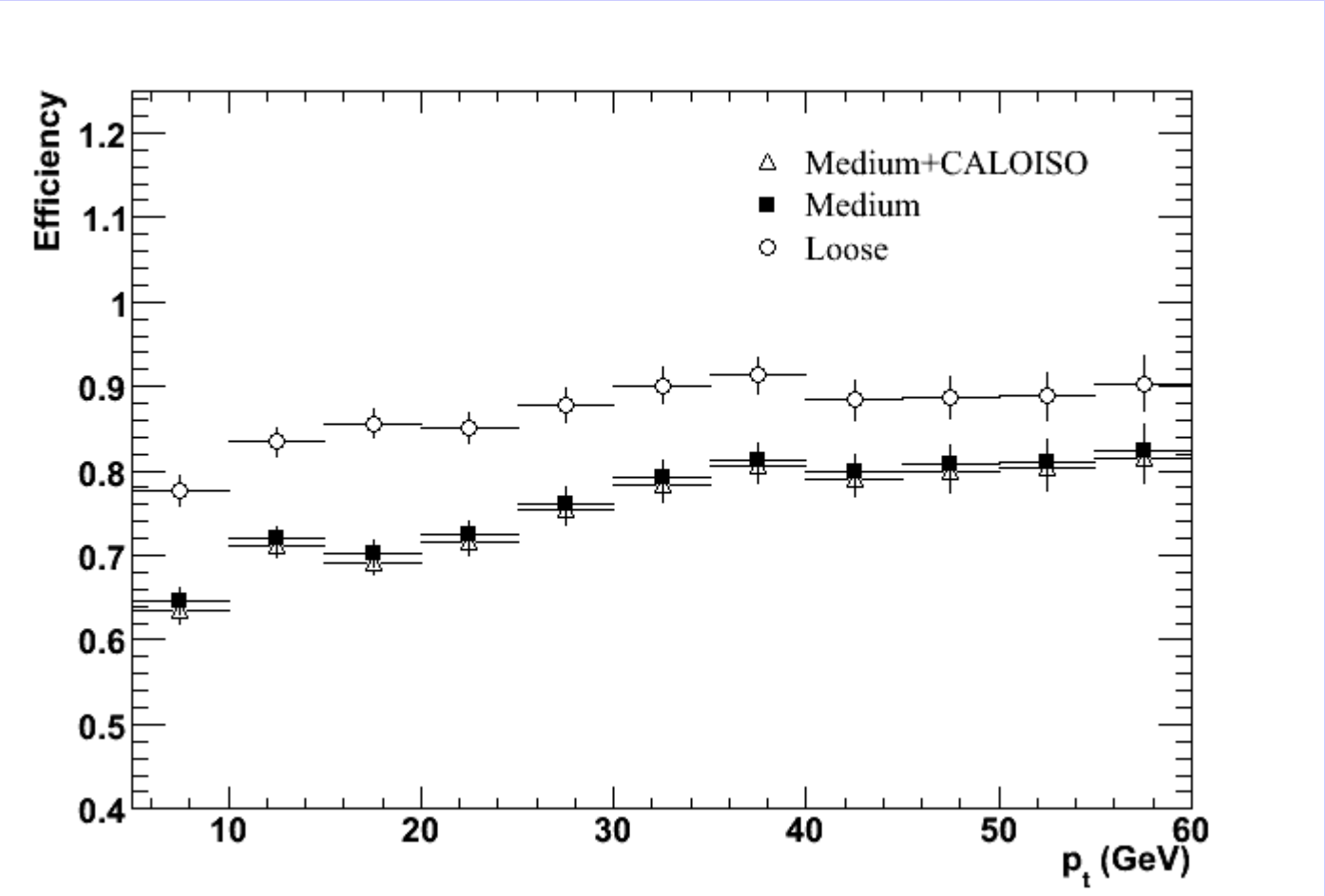
(from Z means dR < 0.02 for recontructed electrons)

Electron Eff.

Electron Type	Number	% of Truth
Truth	75864	100%
Truth (eta < 2.5)	69057	97.7%
Reco (Preselected)	67306	89.0%
Loose	67306	86.7%
Medium	58733	75.6%
Medium+CALOISO	57910	74.6%
Tight	46339	59.7%

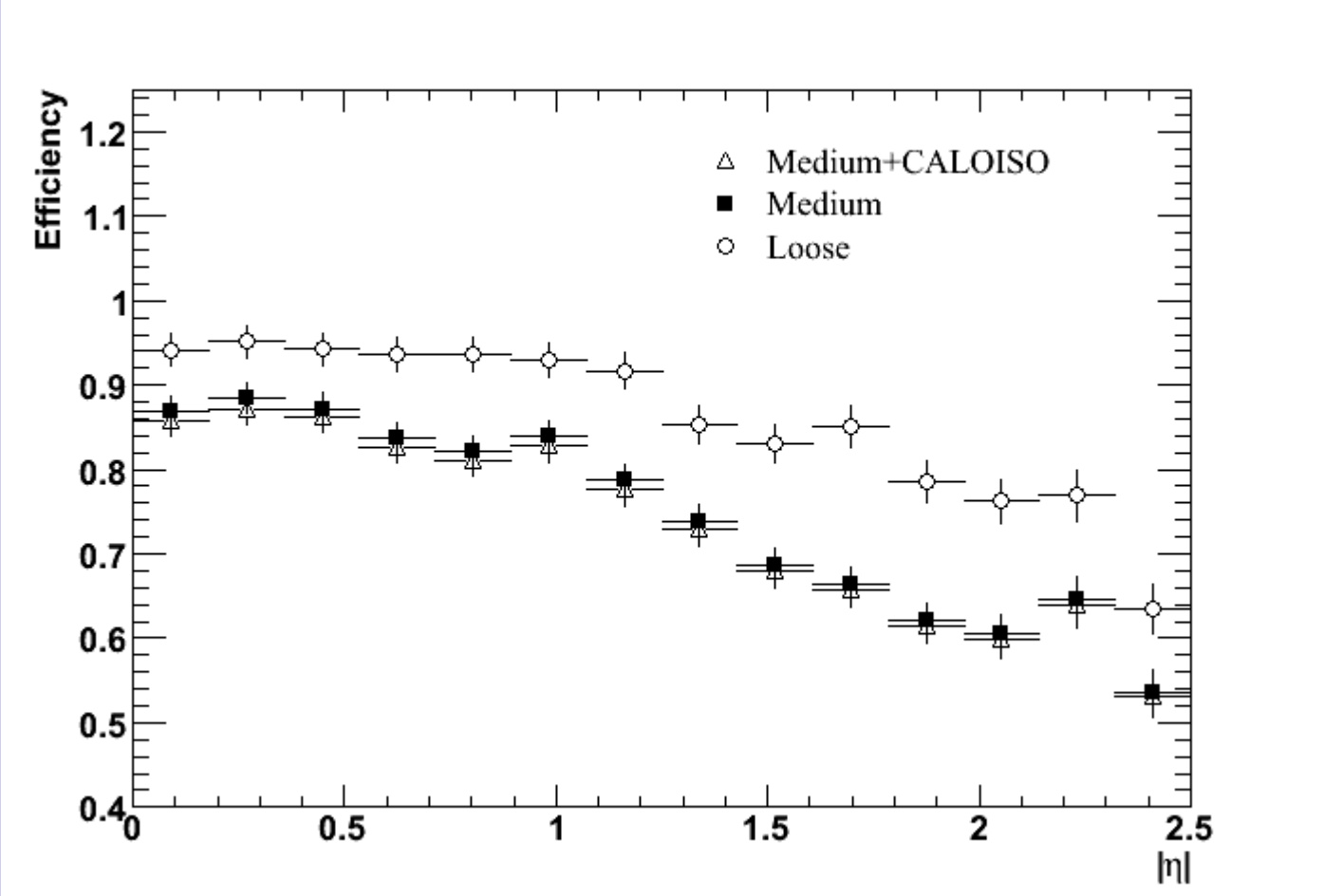
Preselected = eta<2.5 and pt>5GeV (this is applies to all types of electrons after the reco ones)

Electron Eff. as a function of p_t



This is similar but not quite the same as the CSC note. They seem to have more events

Electron Eff. as a function of eta



This is similar but not quite the same as the CSC note. They seem to have more events

Muon Eff.

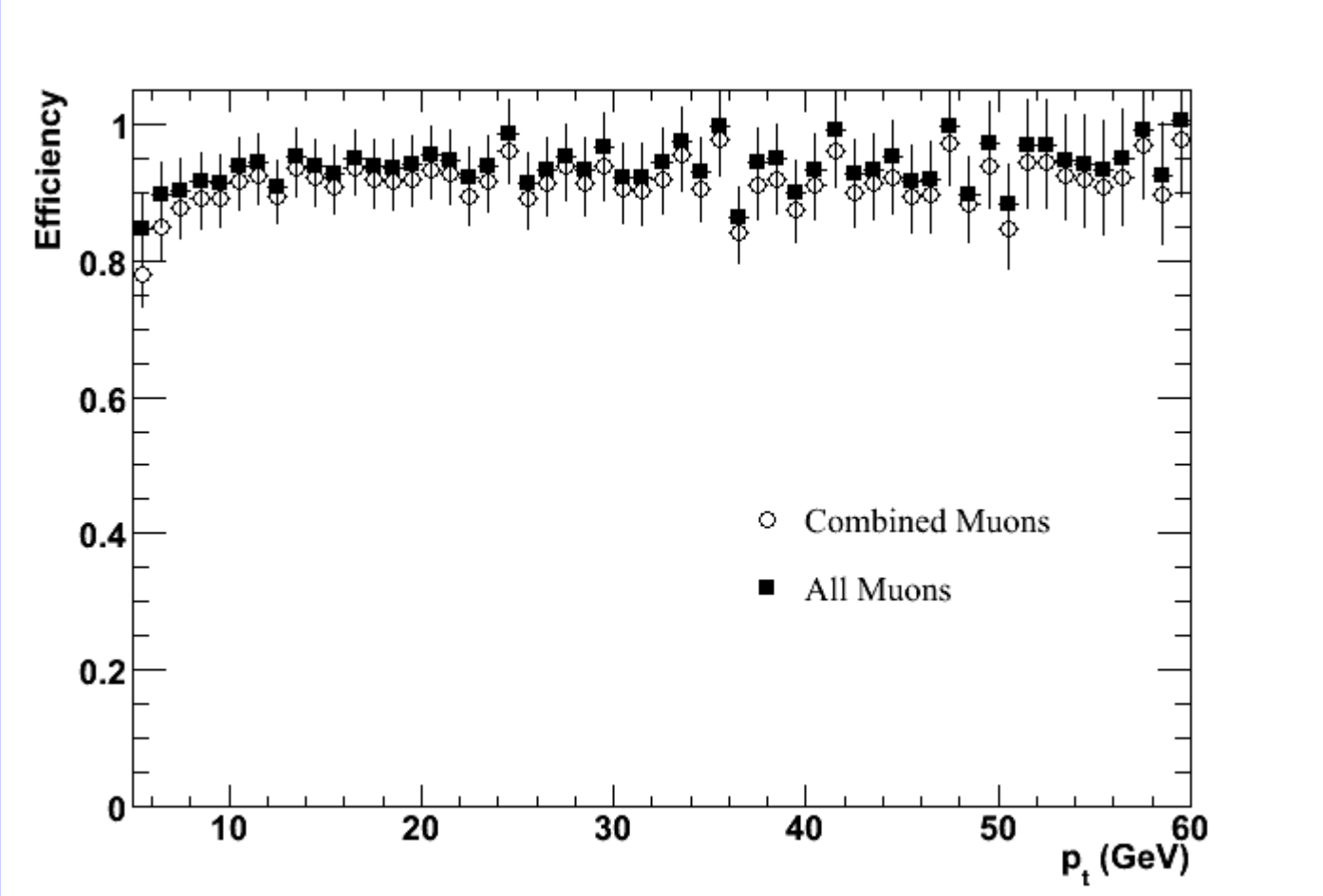
Using STACO muons:

All have p_t > 5GeV and η < 2.5
IsCombined

Efficiency = number of reco muons (from Z) / number of true muons (from Z)

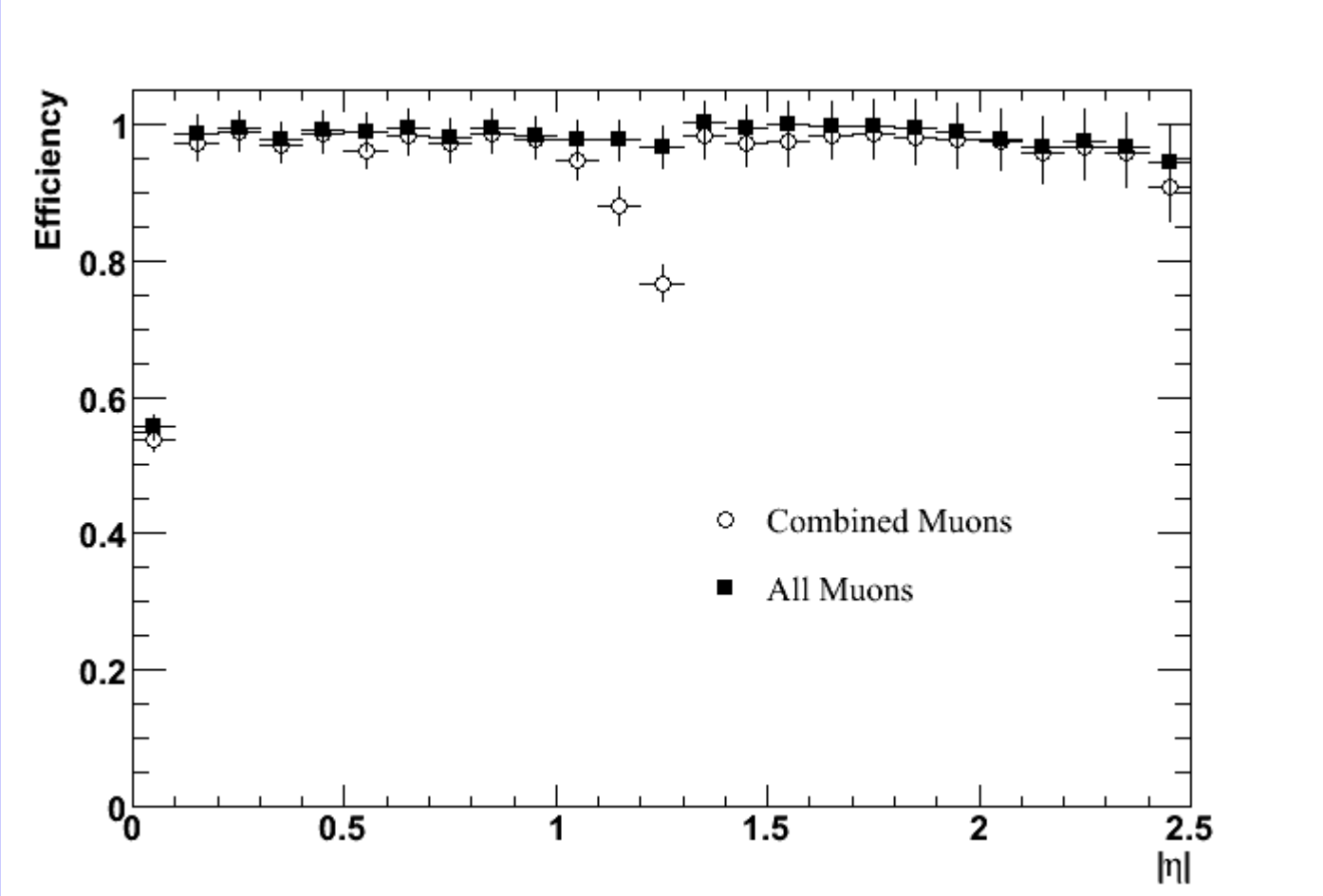
(from Z means dR < 0.02 for recontructed electrons)

Muon Eff. as a function of p_t



This is very similar but not quite the same as the CSC note.

Muon Eff. as a function of eta



This is very similar but not quite the same as the CSC note.

Lots still to do

For background rejection:

Need to look at Impact Parameters (Peter)
Also need to look closer at Isolation (track and calorimeter)

Event Selection:

Extra cuts on leptons (at least 4 with pt > 7GeV and 2 of these with 20GeV)

Z Candidates:

Need two Z per event (mass window depends on H mass)

H Candidates:

Formed from the “good” Zs

All this needs more code!