Studies on efficiency of cuts on Ch.Counters, beam purity, contamination and selection purity – CERN SPS data

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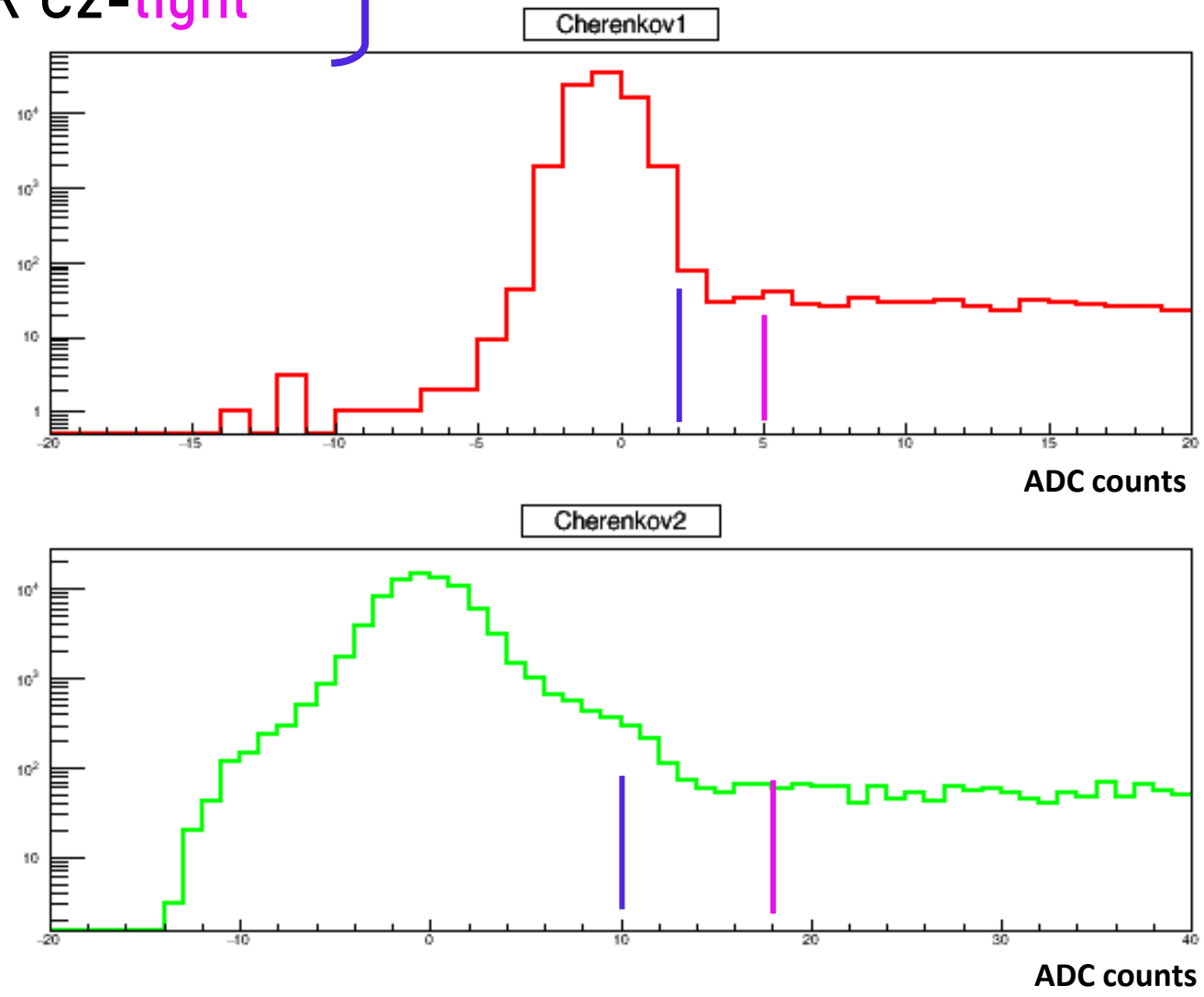
Efficiency of

- C1-loose OR C2-loose
- C1-tight OR C2-tight

The two cuts I am using for physics studies



$$\text{eff } X = \frac{\text{eff (X AND PS > 4.5MIPs)}}{\text{eff (PS > 4.5MIPs)}}$$

X = C1-loose OR C2-loose/C1-tight OR C2-tight

- Checking compatibility between these two

$$\text{eff } X = \frac{\text{eff (X AND calo > 0.8*beamE)}}{\text{eff (calo > 0.8*beamE)}}$$

- Verifying (for 6, 10, 20, 30, 40, 60 GeV):

eff (C1L OR C2L) = 1 – (1 - eff(C1L)) * (1 - eff(C2L))

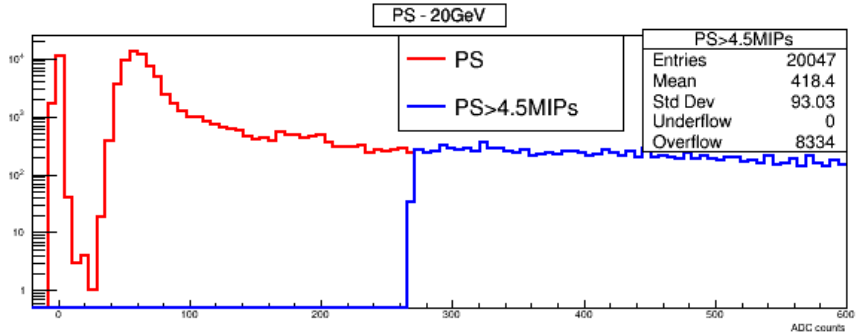
eff (C1T OR C2T) = 1 – (1 - eff(C1T)) * (1 - eff(C2T))

The steps of these studies for 20 GeV

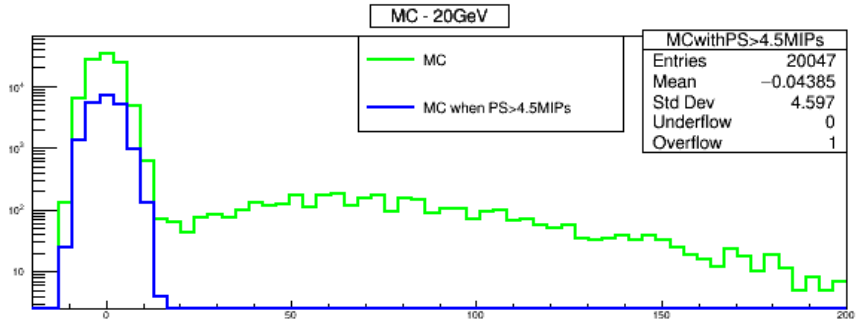
Then plots for 6 to 60 GeV

Ancillaries

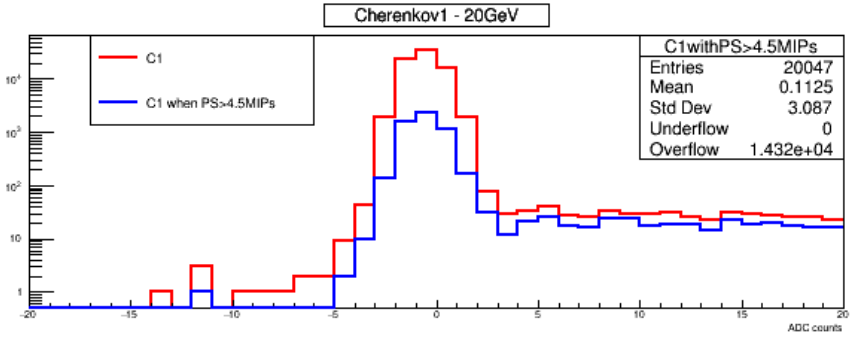
Preshower



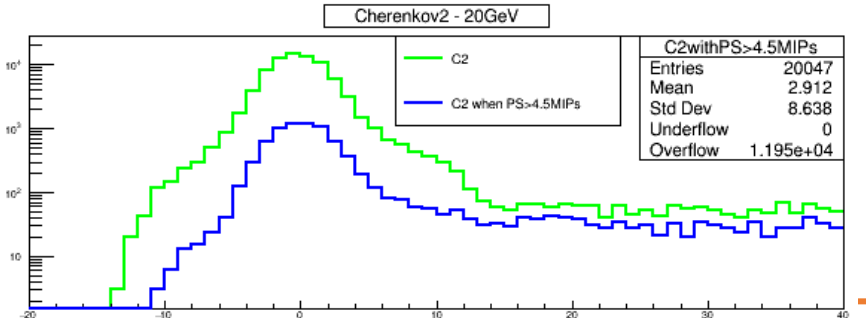
MCounter



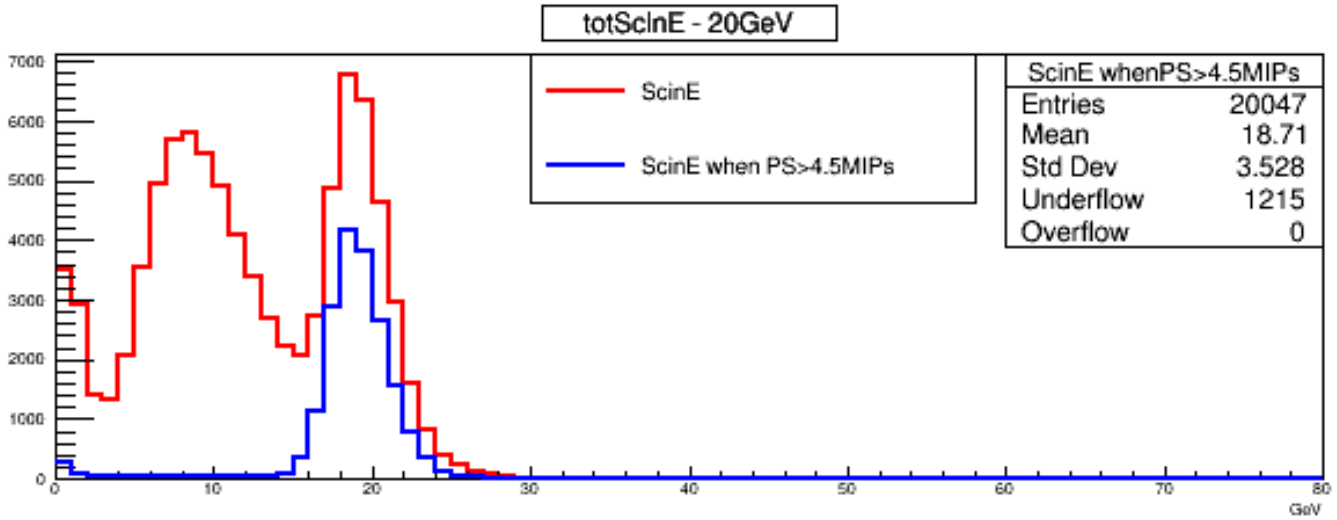
ChCounter1

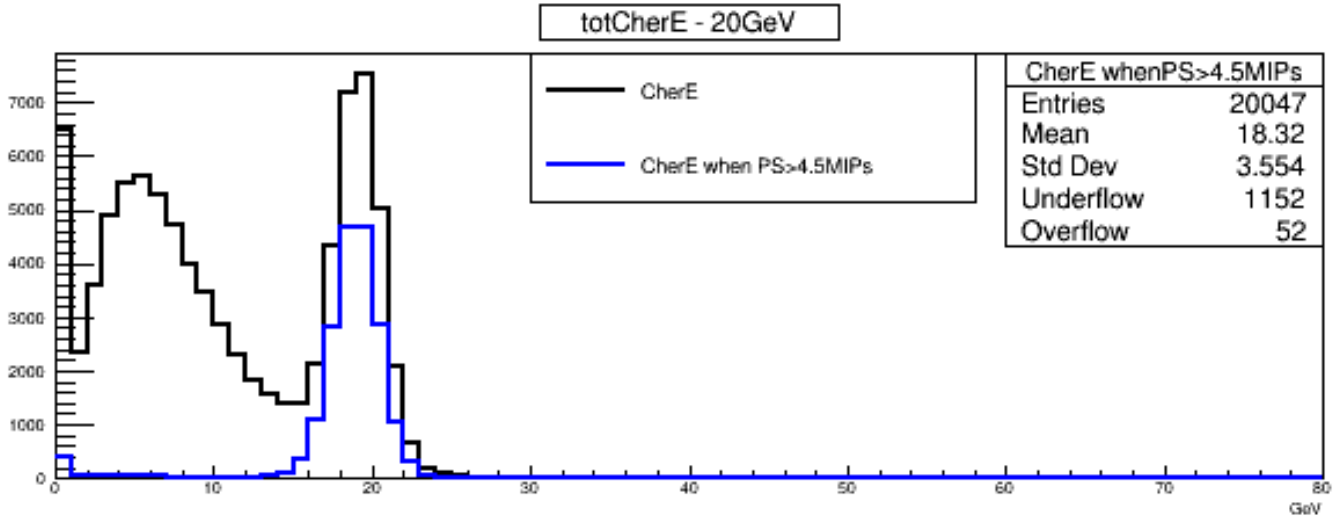


ChCounter2



Calorimeter

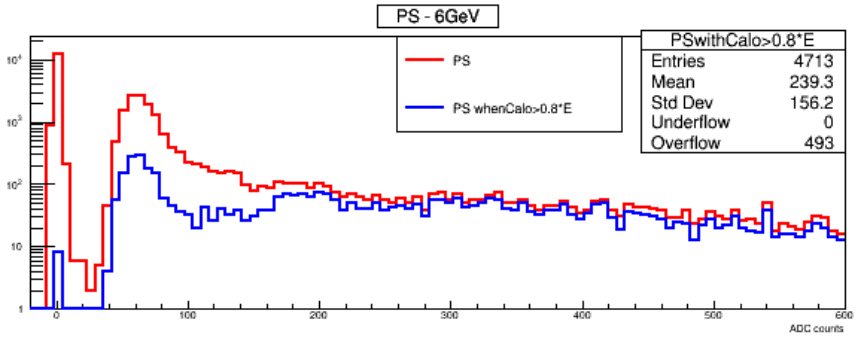




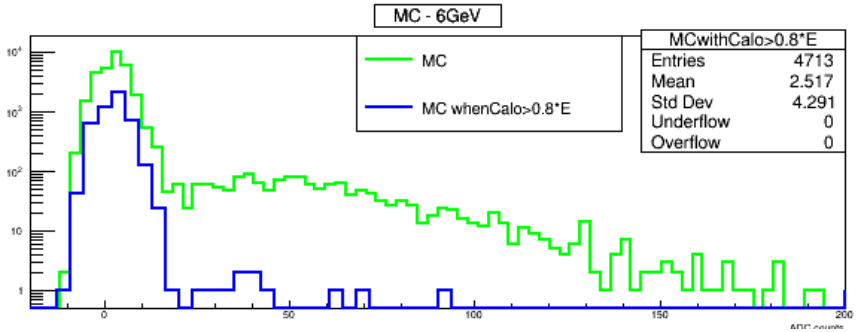
Subset of distribution with PS > 4.5 MIPs

Ancillaries

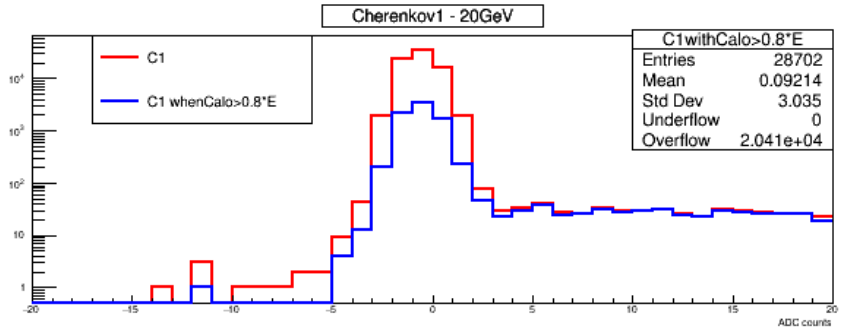
Preshower



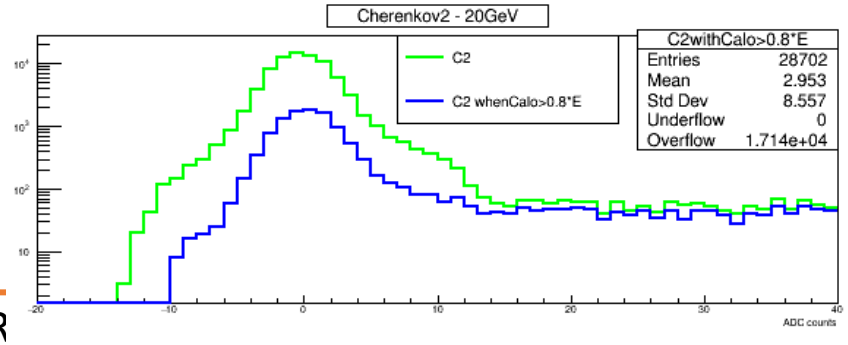
MCounter



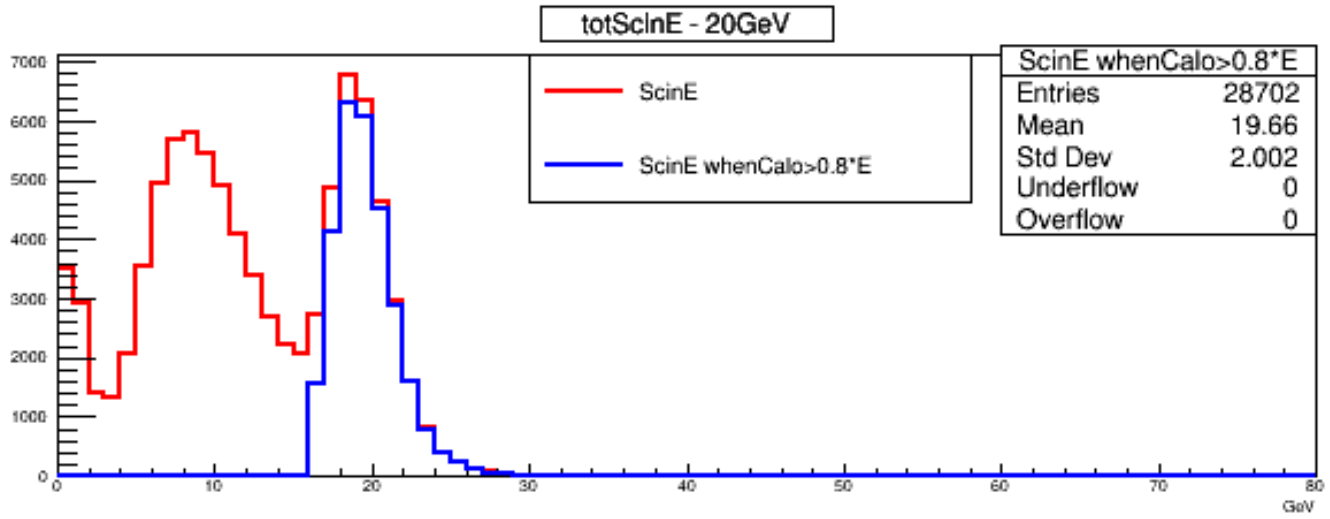
ChCounter1

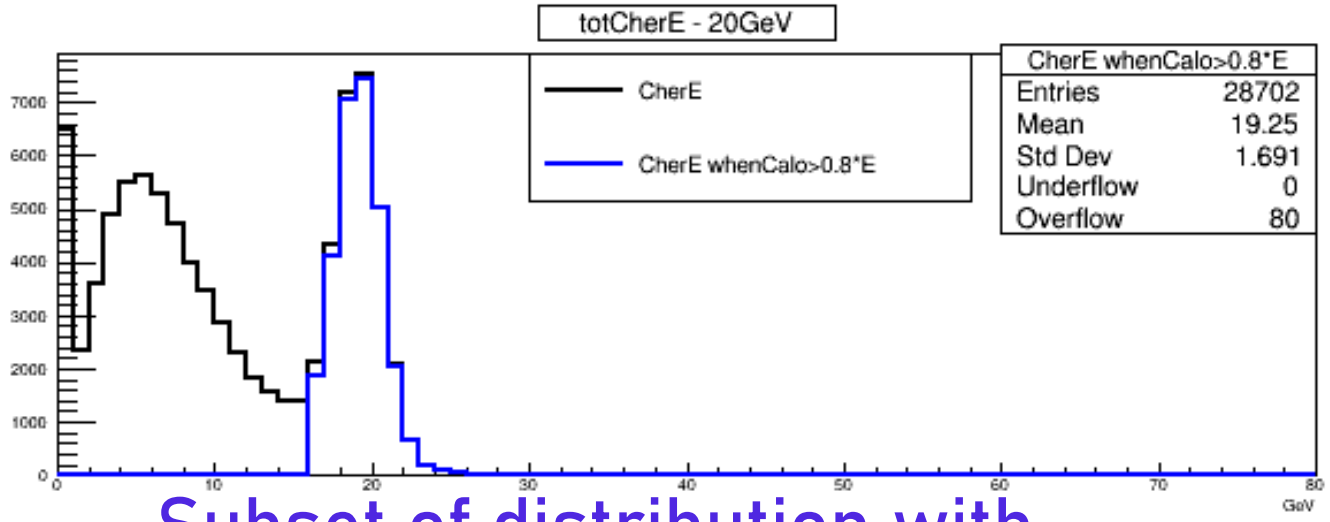


ChCounter2



Calorimeter





Subset of distribution with
ScinE > 0.8*E AND CherE > 0.8*E

$$\text{eff X} = \frac{\text{eff (X AND PS > 4.5MIPs)}}{\text{eff (PS > 4.5MIPs)}}$$

X = C1-loose OR C2-loose/C1-tight OR C2-tight

- Checking compatibility between these two

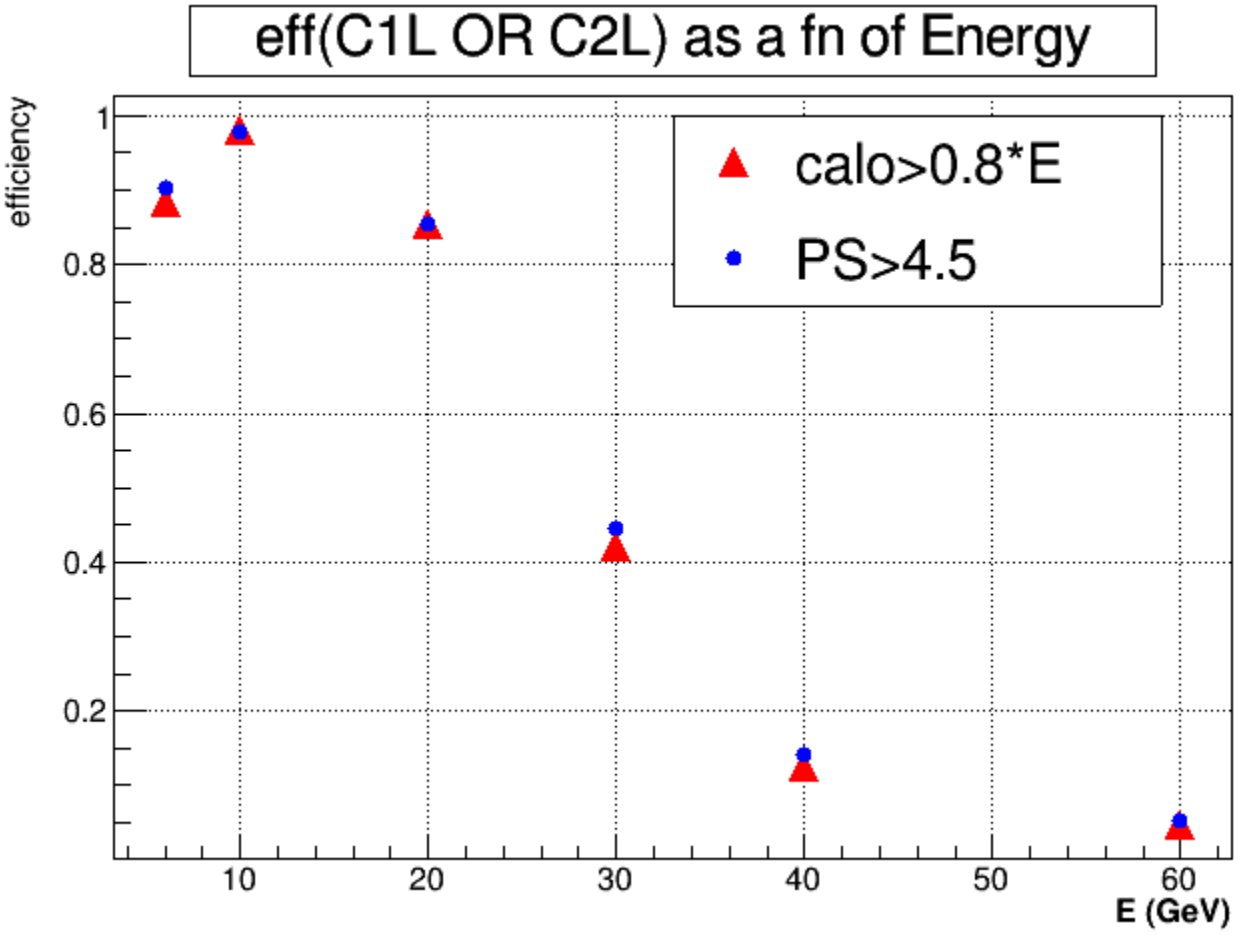
$$\text{eff X} = \frac{\text{eff (X AND calo > 0.8*beamE)}}{\text{eff (calo > 0.8*beamE)}}$$

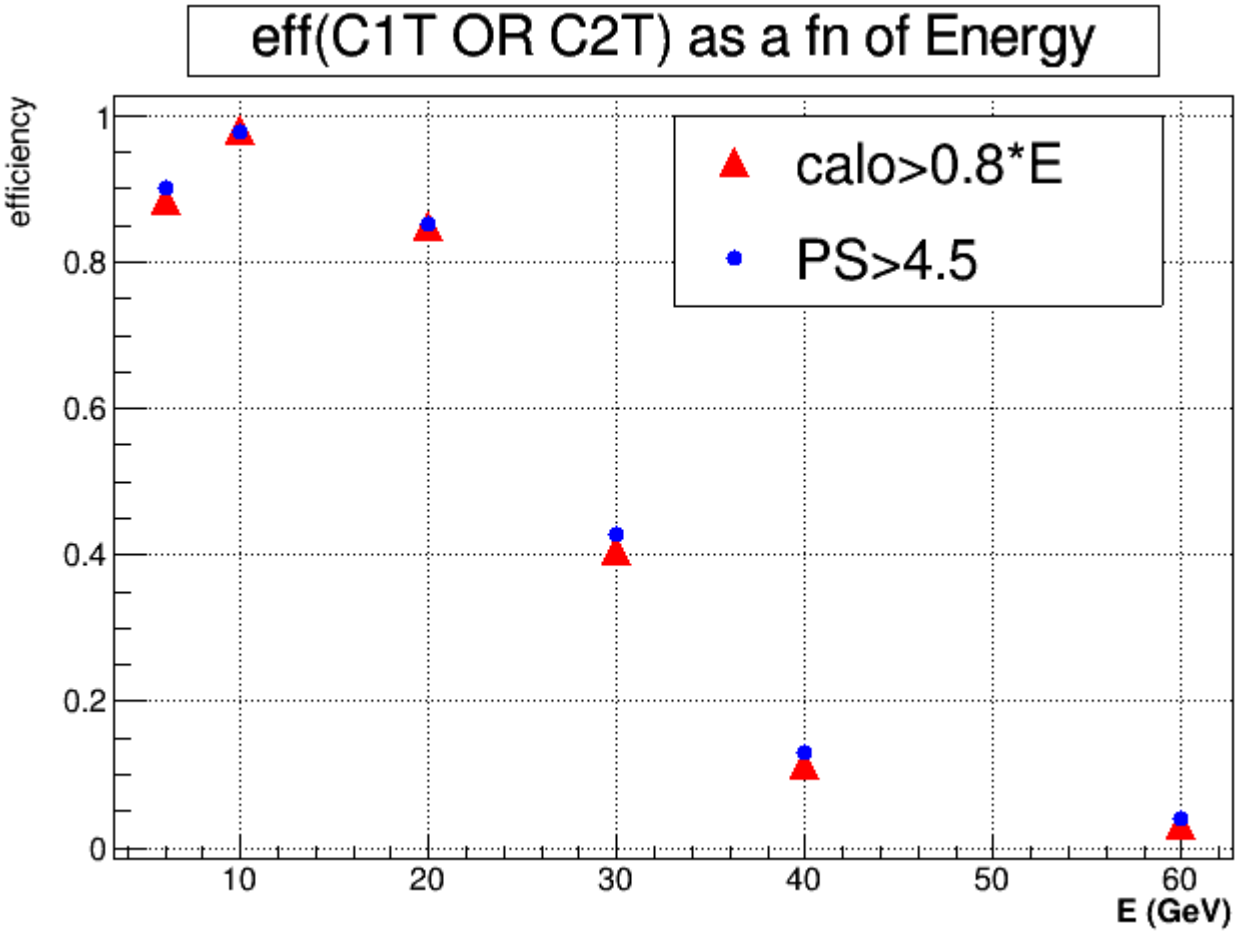
20 GeV	PS > 4.5MIPs	calo > 0.8*beamE
eff (C1L OR C2L) %	85.5	85.3
eff (C1T OR C2T) %	85.1	84.9

$$\text{eff X} = \frac{\text{eff (X AND Y)}}{\text{eff (Y)}}$$

X = C1-loose OR C2-loose/C1-tight OR C2-tight

Y = PS>4.5MIPs OR calo>0.8*E





20 GeV	LHS of the formula	RHS of the formula
eff (C1L OR C2L) %	85.5	90.5
eff (C1T OR C2T) %	85.1	90.0

- Verifying (for 6, 10, 20, 30, 40, 60 GeV):

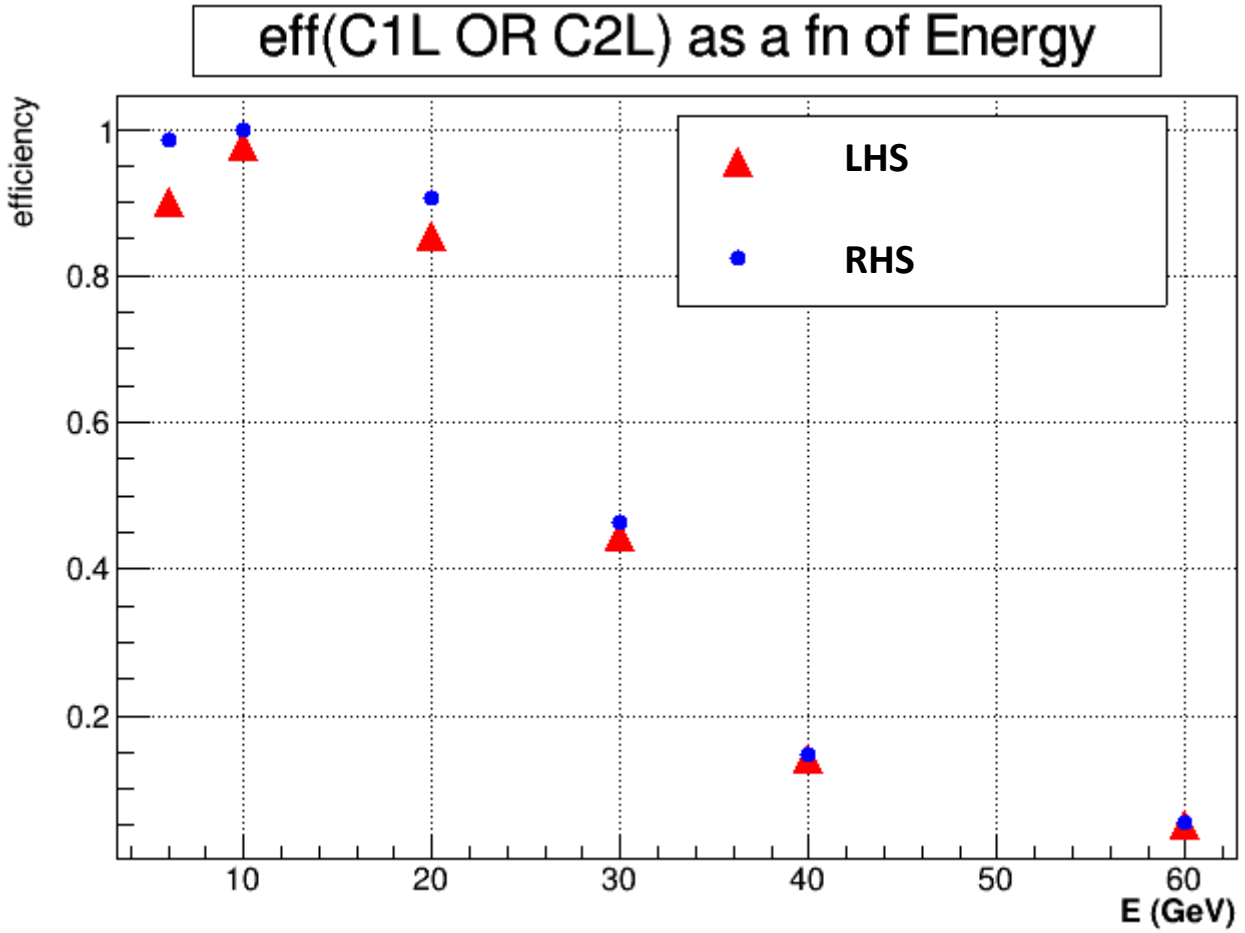
eff (C1L OR C2L) = 1 – (1 - eff(C1L)) * (1 - eff(C2L))

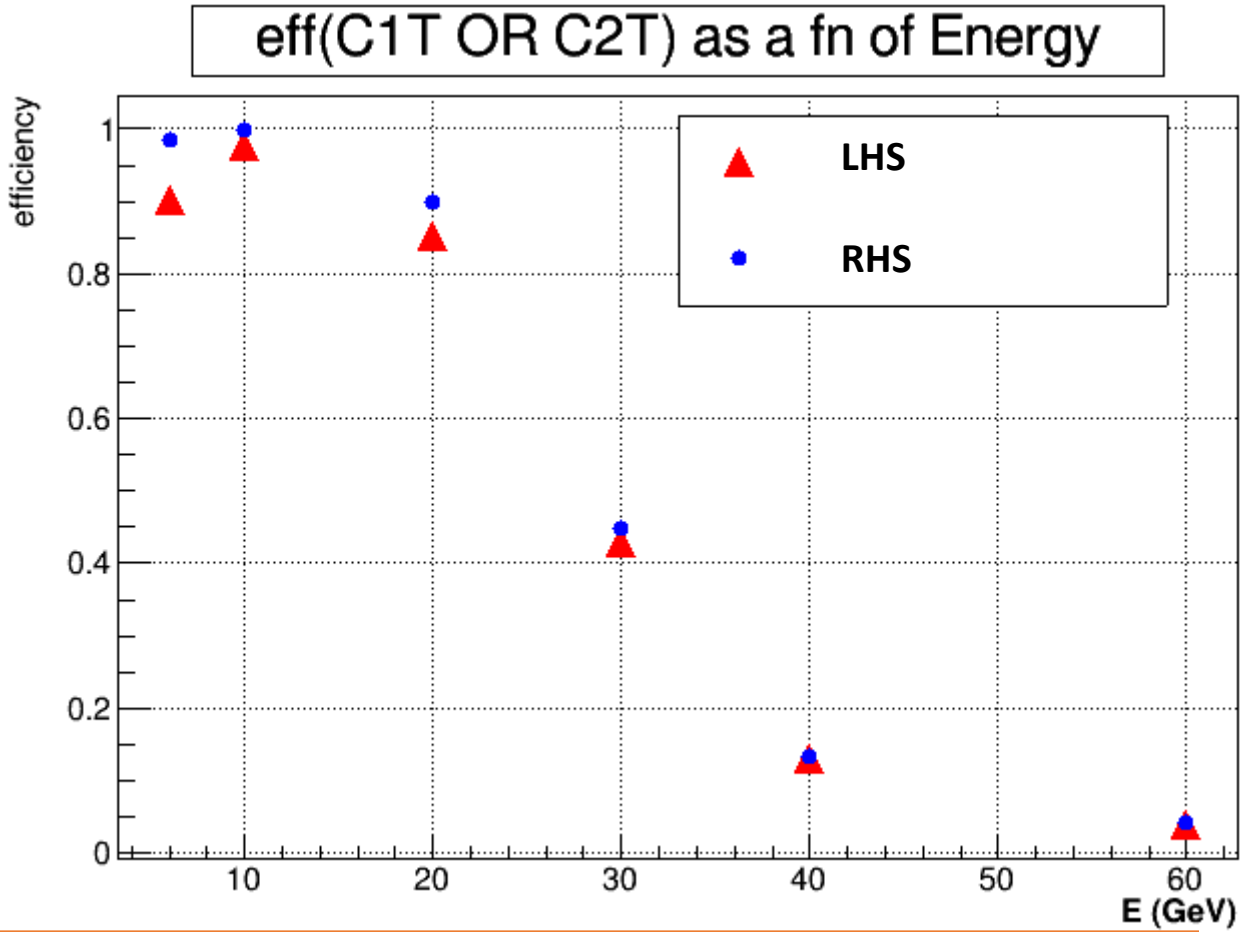
eff (C1T OR C2T) = 1 – (1 - eff(C1T)) * (1 - eff(C2T))

eff (C1L OR C2L) = 1 – (1 - eff(C1L)) * (1 - eff(C2L))

eff (C1T OR C2T) = 1 – (1 - eff(C1T)) * (1 - eff(C2T))

$$\text{eff X} = \frac{\text{eff (X AND PS > 4.5MIPs)}}{\text{eff (PS > 4.5MIPs)}}$$





Measurement of beam purity

$$\text{Beam purity} = \frac{\text{Nof selected events with Only (X)}}{\text{eff (X)}} * \frac{1}{\text{totEvents}}$$

$$\text{eff X} = \frac{\text{eff (X AND PS > 4.5MIPs)}}{\text{eff (PS > 4.5MIPs)}}$$

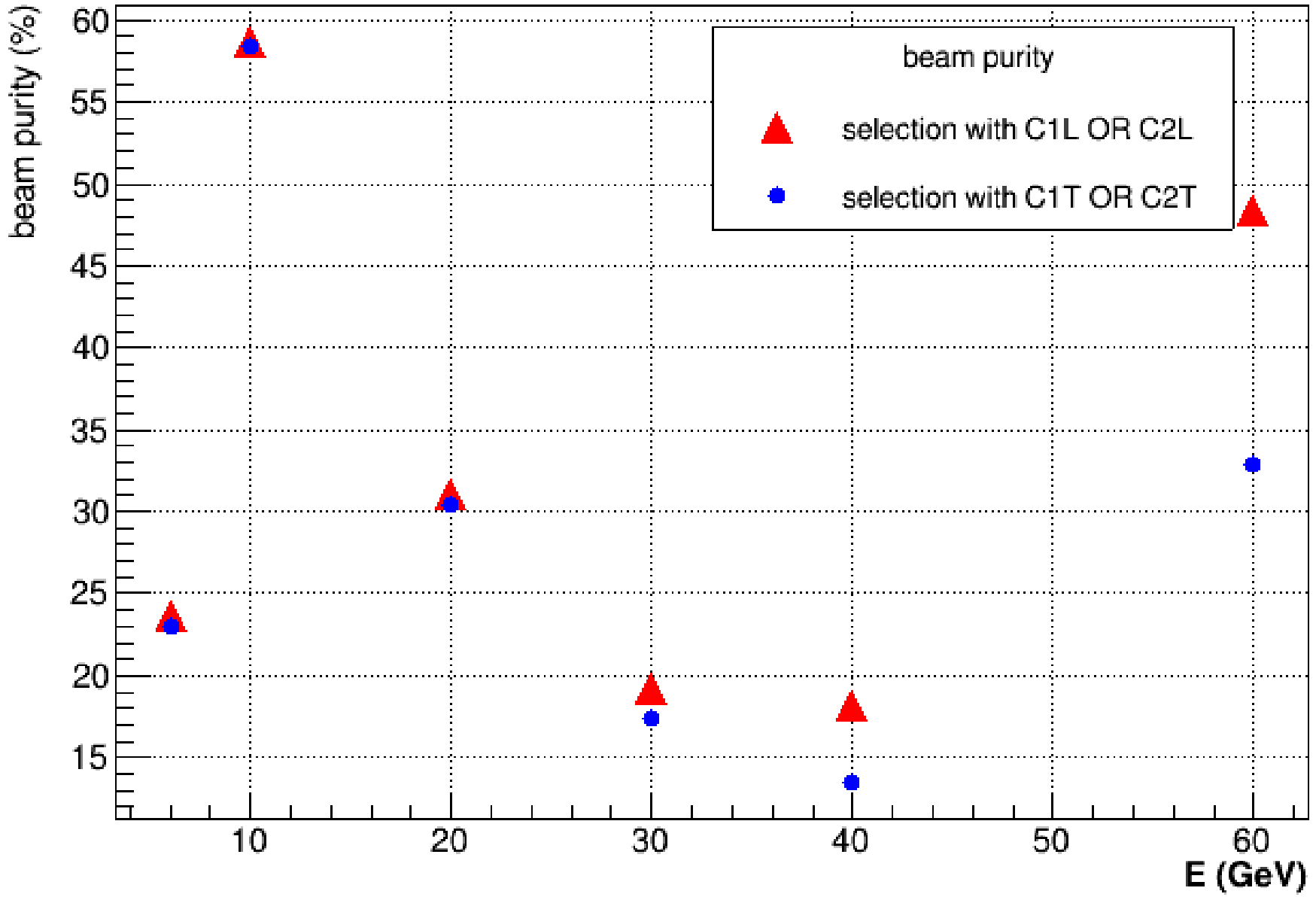
X = C1-loose OR C2-loose/C1-tight OR C2-tight

Measurement of beam purity (20 GeV)

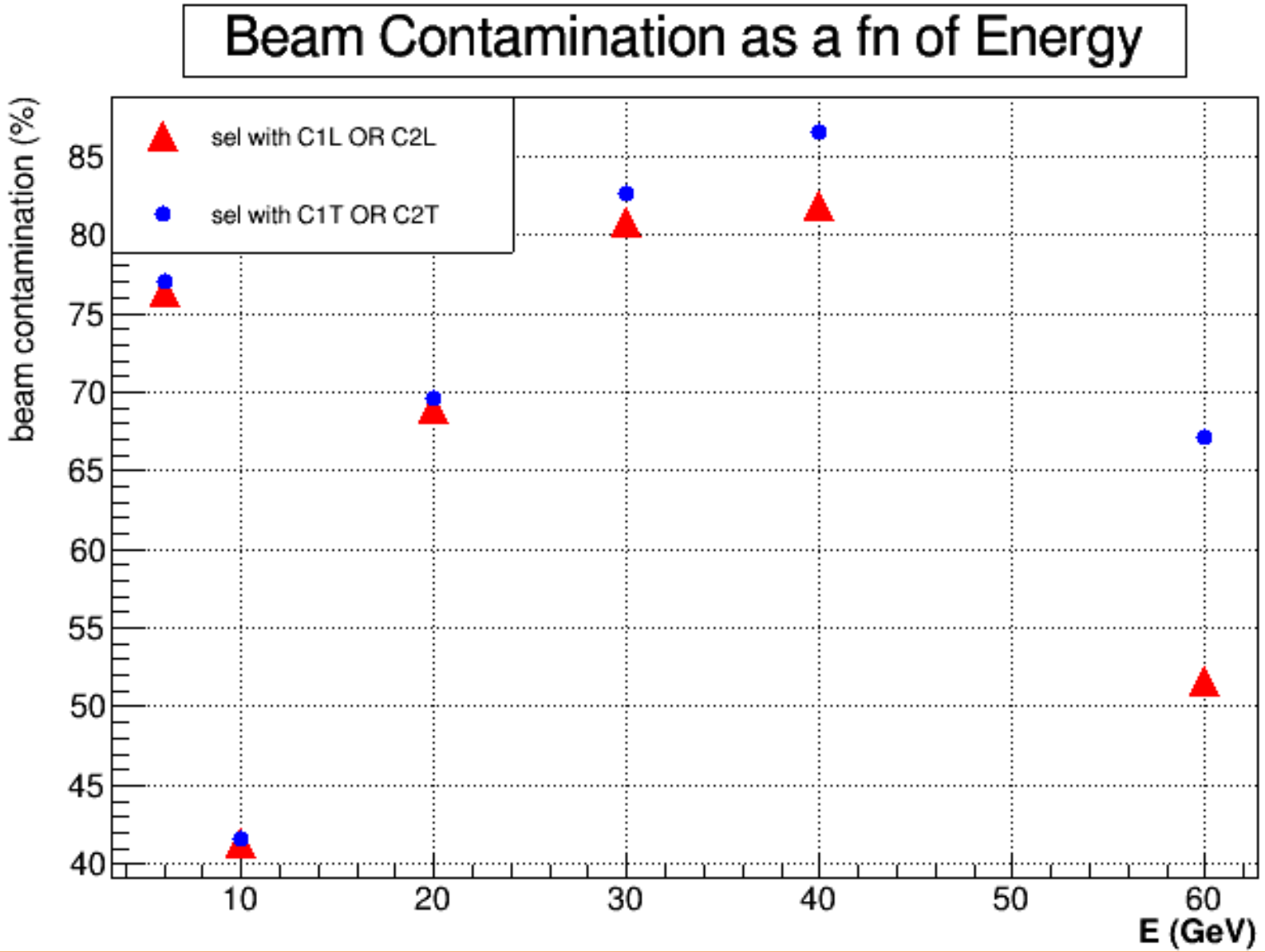
20 GeV Sel made with C1L OR C2L	totEvenets	Nof e^- = N_{sel}/eff(X)	Beam purity	Nof muons, hadrons	Beam contamination
	101191	31368	31.0%	69823	69.0%

20 GeV Sel made with C1T OR C2T	totEvenets	Nof e^- = N_{sel}/eff(X)	Beam purity	Nof muons, hadrons	Beam contamination
	101191	30743	30.4%	70448	69.6%

Beam Purity as a fn of Energy



Measurement of beam contamination



Purity and contamination of selection based on C1L OR C2L/C1T OR C2T

$$\text{Rejection factor} = \frac{\text{Nof muons}}{\text{Nof muons with cut X}}$$

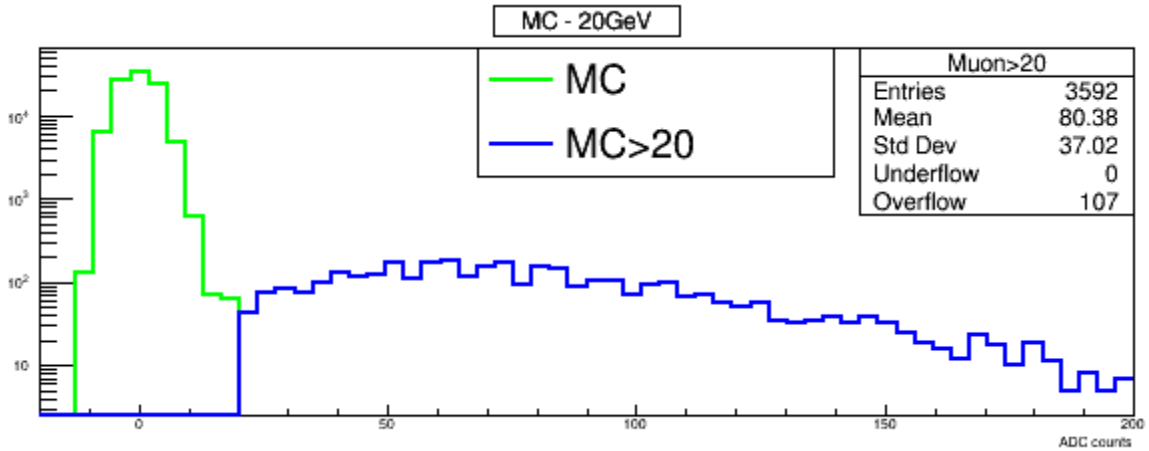
X = C1-loose OR C2-loose/C1-tight OR C2-tight

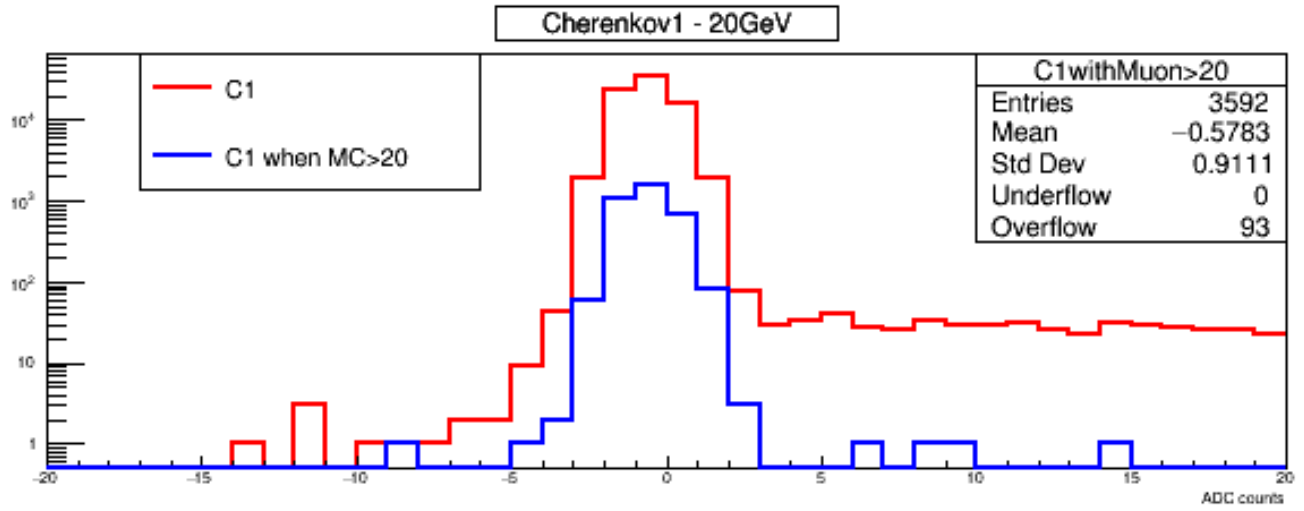
Selection of muons: MuonCounter > 20

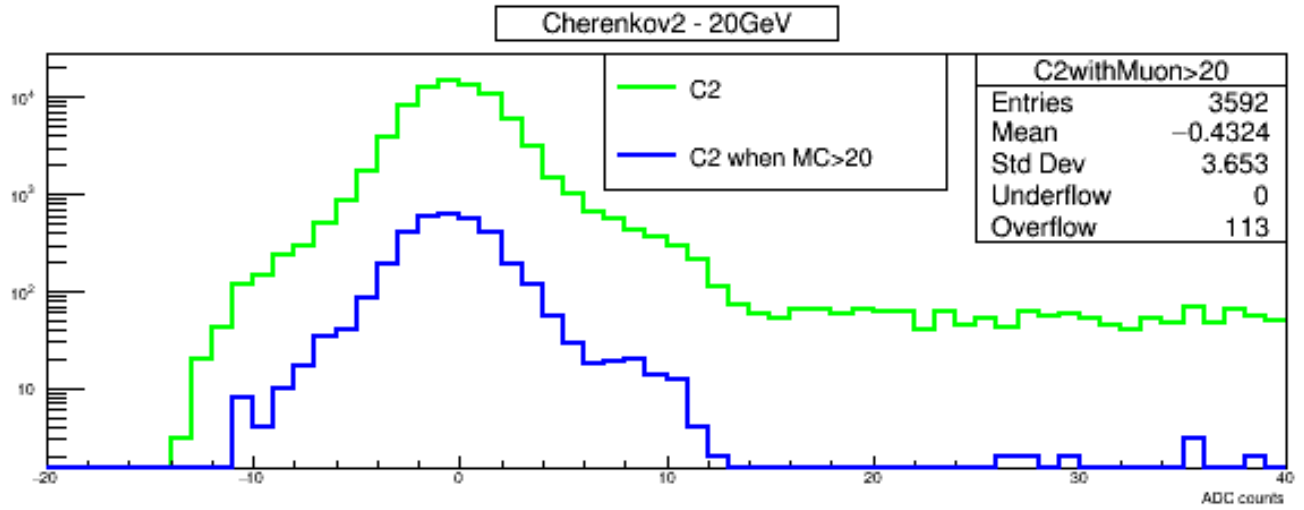
Let's suppose R. factor for muon is same for that for hadrons

$$\text{Contamination}_{\text{selection}} = \frac{\text{Contamination}_{\text{beam}}}{\text{R. factor}}$$

$$\text{Purity}_{\text{selection}} = 1 - \frac{\text{Contamination}_{\text{selection}}}{\text{Nof selection}}$$







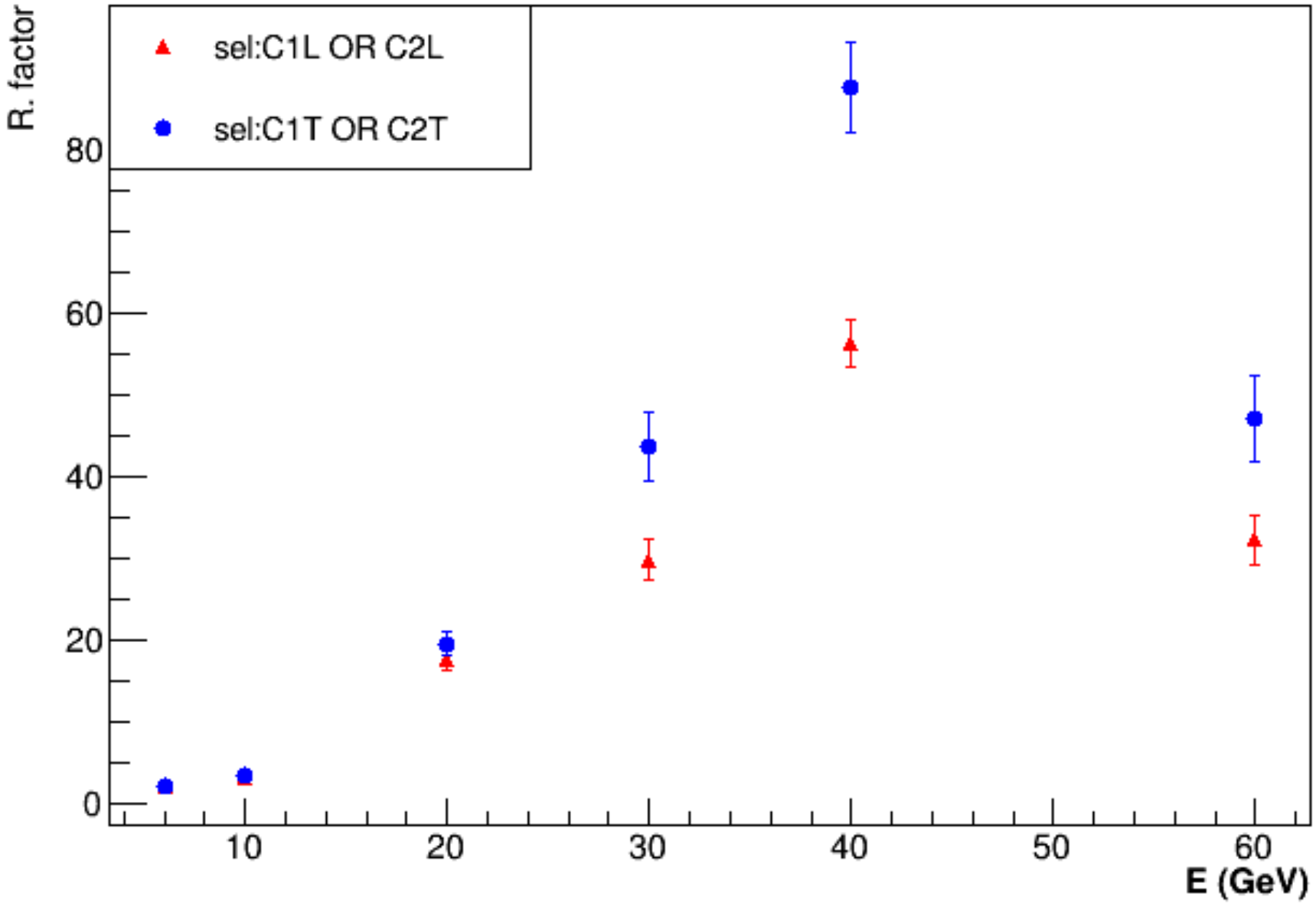
Subset of distribution with MC > 20

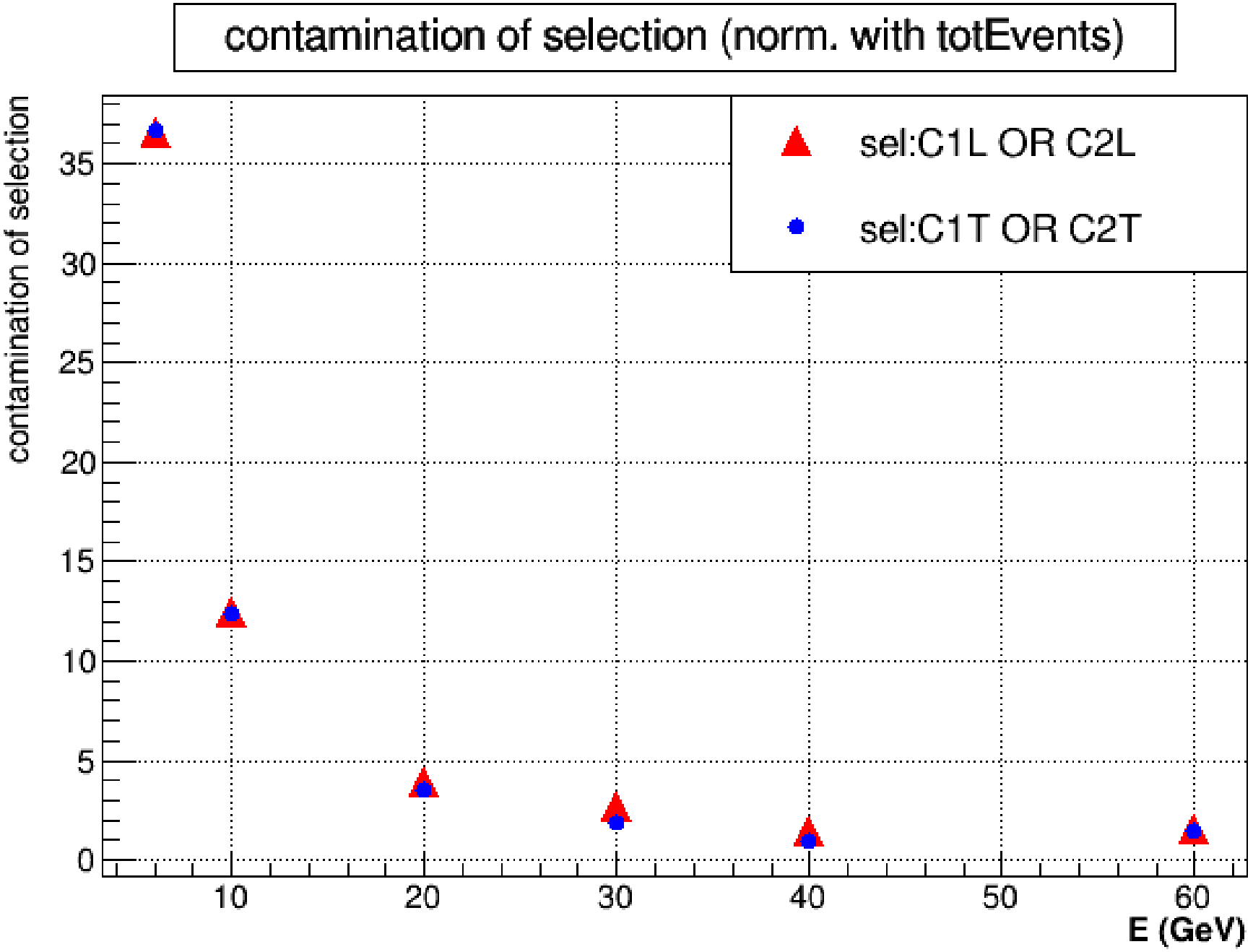
Measurement of selection purity (20 GeV)

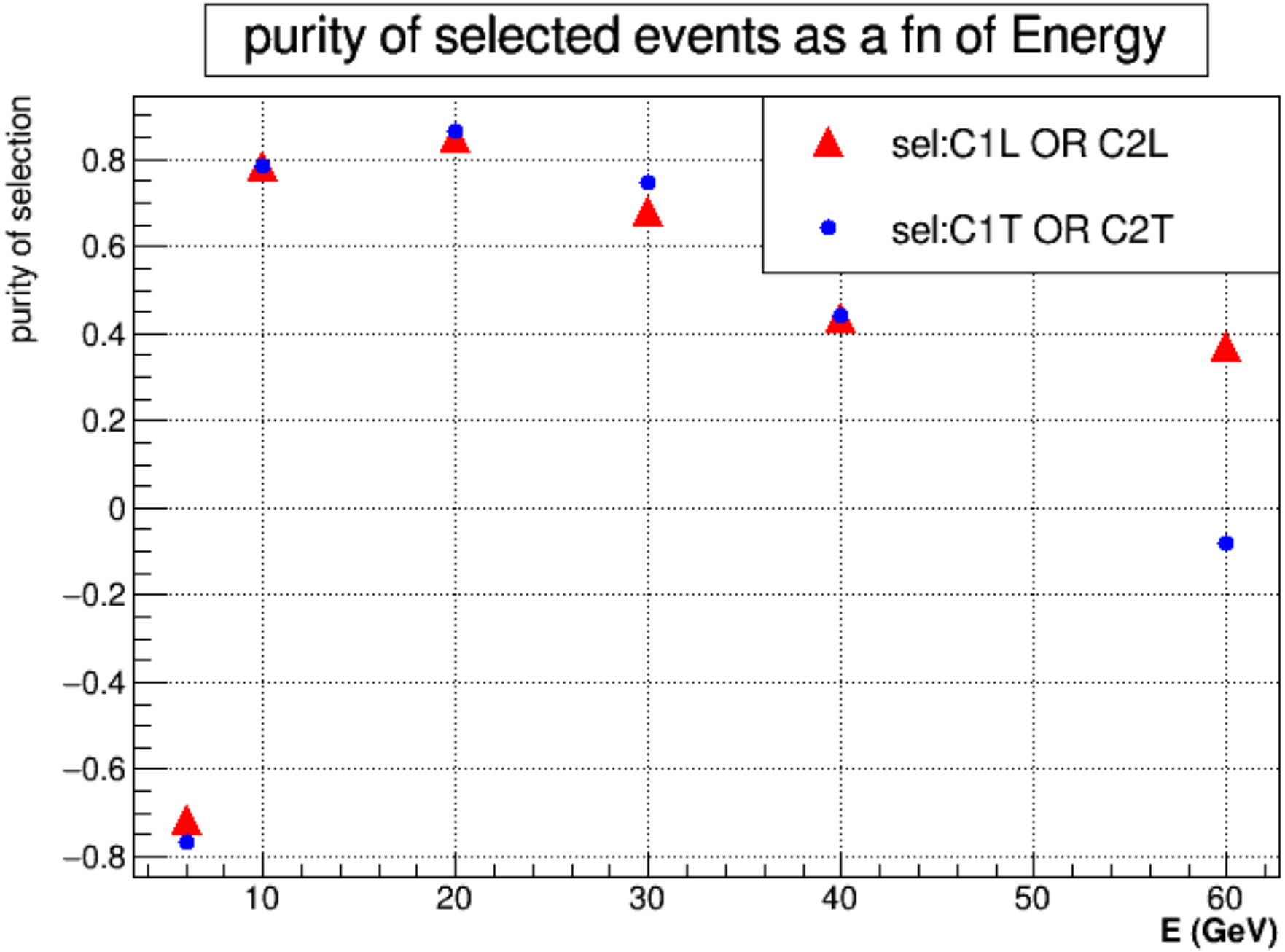
20 GeV Sel made with C1L OR C2L	Nof selection	Nof muons	Nof muons With C1L OR C2L	R. factor	Nof contamination in beam	Nof contamination in selection	Purity of selection
	26824	3592	204	17.61	69823	3965	0.85

20 GeV Sel made with C1T OR C2T	Nof selection	Nof muons	Nof muons With C1T OR C2T	R. factor	Nof contamination in beam	Nof contamination in selection	Purity of selection
	26158	3592	183	19.61	70448	3592	0.86

Rejection factor as a fn of Energy




contamination of selection (norm. with totEvents)
contamination of selection
sel:C1L OR C2L
sel:C1T OR C2T
0
5
10
15
20
25
30
35
10
20
30
40
50
60
E (GeV)



Numbers are calculated by counting only muons

In reality the purity of selections are lesser

Thank You!

Back Ups

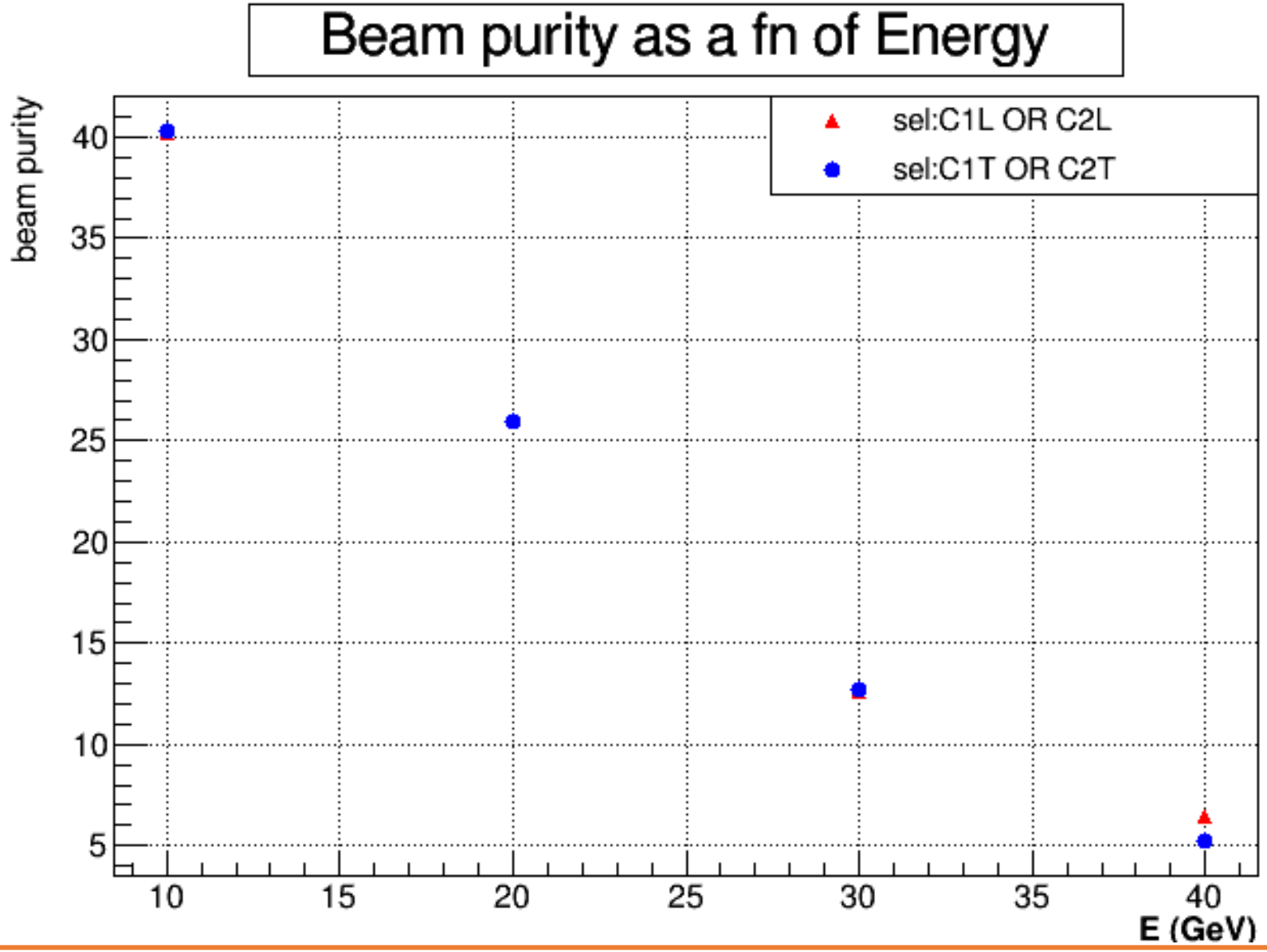
Measurement of beam purity – corrected with muon efficiency

$$\text{Purity}_{\text{electron}} = \frac{(N_{\text{selected events}}/N_{\text{tot events}})}{\text{eff (el)}}$$

$$\text{Purity}_{\text{electron}} = \frac{(N_{\text{selected events}}/N_{\text{tot events}}) - \text{eff(muons)}}{\text{eff (el)} - \text{eff(muons)}}$$

Corrected

Measurement of beam purity – corrected with muon efficiency



Values decreased significantly