

A Study of SiD Tracking Efficiency at High $|\cos(\theta)|$

June 8, 2010

Data Sets Utilized

*pythia_uds_nobeam_nobrem-0-500_SLIC-v2r5p2_geant4-v9r1p2_LCPhys_sido2_lcsim-recon-1_4.slcio

*pythia_uds_nobeam_nobrem-1-500_SLIC-v2r5p2_geant4-v9r1p2_LCPhys_sido2.slcio

*pythia_uds_nobeam_nobrem-2-500_SLIC-v2r5p2_geant4-v9r1p2_LCPhys_sido2.slcio

*pythia_uds_nobeam_nobrem-4-500_SLIC-v2r5p2_geant4-v9r1p2_LCPhys_sido2.slcio

Each file was run through JAS3 which generates a file called JASWriteOut.dat, an ASCII file of relevant tracking information abstracted from the JAS reconstruction (SiDSeedTracker). Each was consolidated into a single JASWriteOut.dat file. It was this concatenated file that was run through the C++ Track Analyzer program which creates histograms, drawing on coding located in Root.

Efficiency: A measure of the effectiveness of the detector to find the tracks of particles expected to appear, or the “findable particles”

Efficiency is a percentage, equal to the number of found particles divided by the number of findable particles, or

$$\frac{\text{Found Tracks}}{\text{Findable Particles}}$$

Seven cuts to consider a particle “findable”, we focus on two, $\cos\Theta$ and p_T

Two cuts that define an acceptable track, all of them were left static.

In order for particles/tracks to be calculated in efficiencies, they must pass each and every one of these cuts

Findable Particle Cuts

Radius of Origin maximum: 20.0 (mm)

Radius of Origin minimum: no cut

Cos(Theta) maximum: variable

Path length minimum: 1250.0 (mm)

Path length maximum: 99999.0 (mm)

pT minimum: variable (GeV)

Acceptable Track Cuts

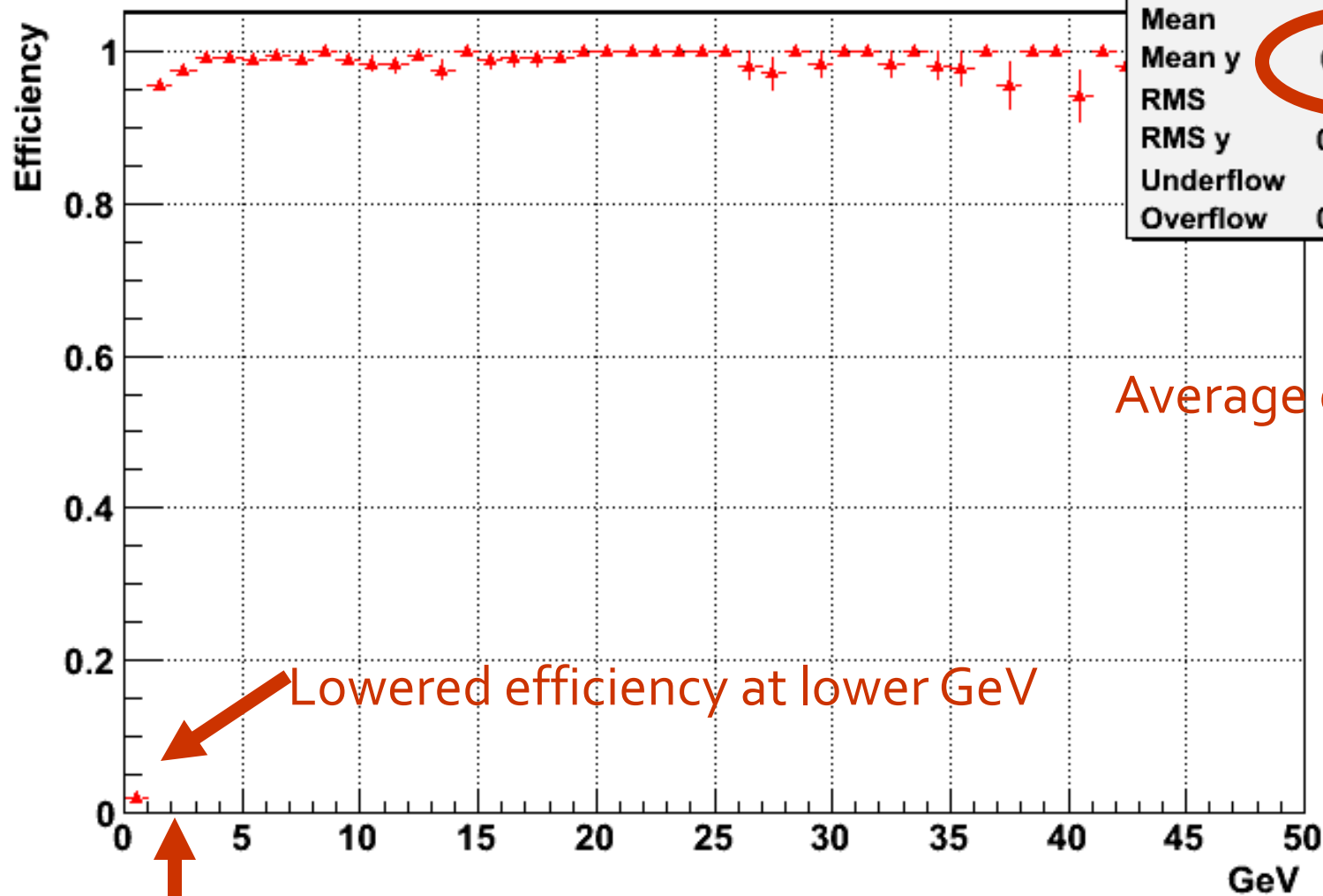
DCA Max: 100.0

pT minimum 0.5 (GeV)

CosTheta Maximum: 0.7

pT minimum: no pT cut

Efficiency vs. pT no pT cut



Average efficiency

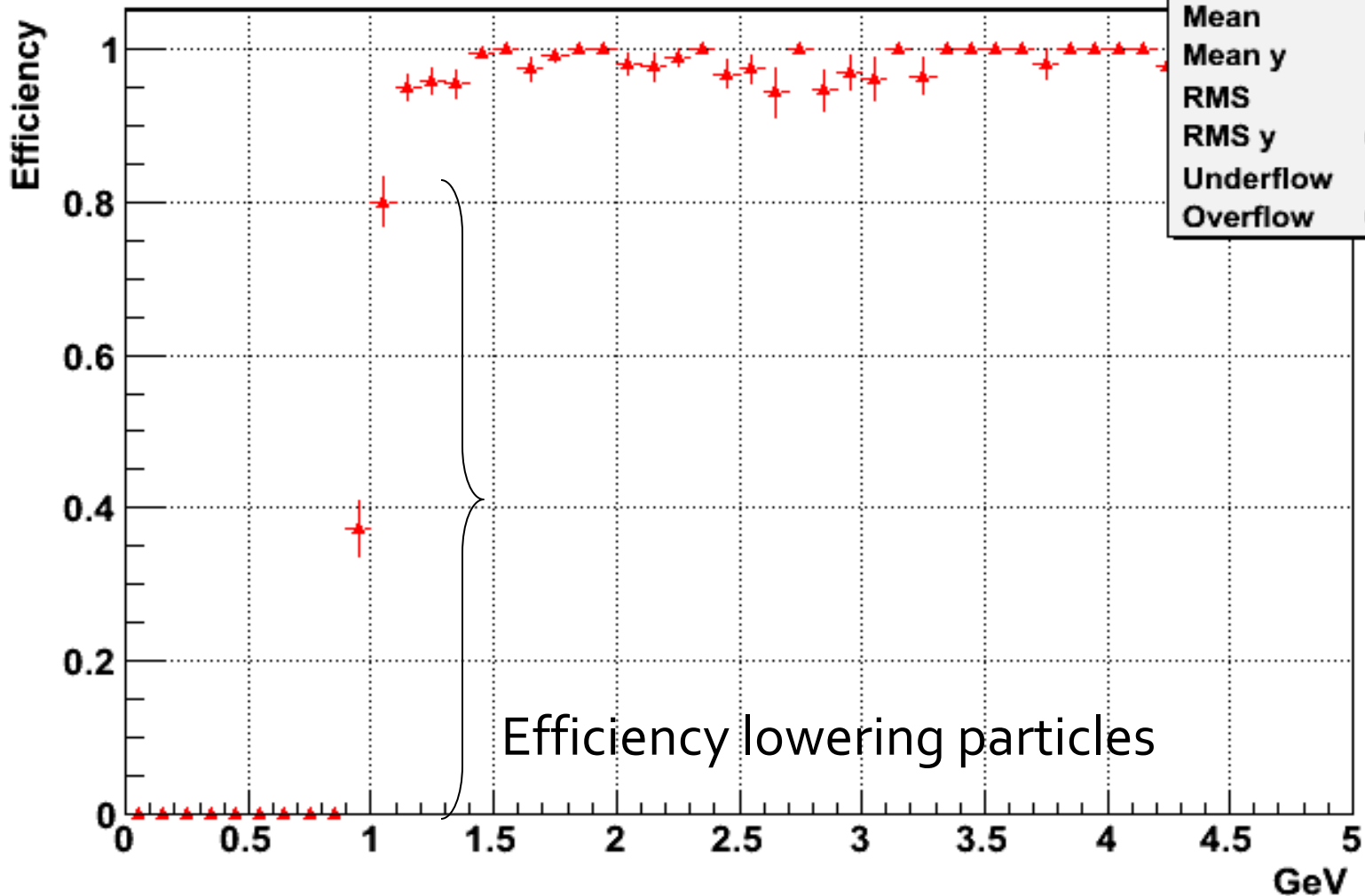
Lowered efficiency at lower GeV

2 GeV

CosTheta Maximum: 0.7

pT minimum: no pT cut

Efficiency vs. pT no pT cut

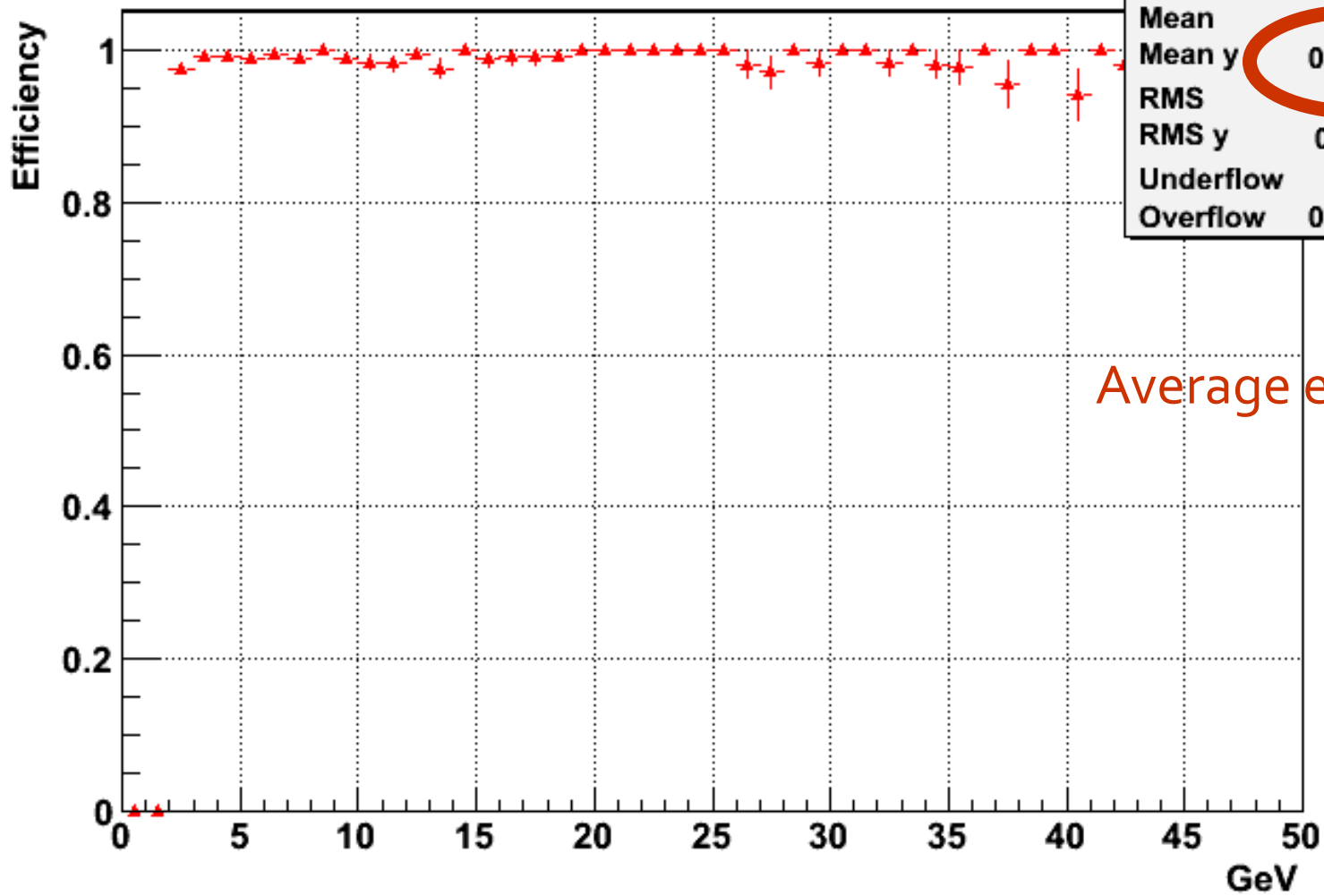


To exclude the efficiency lowering particles, make a 2.0 pT cut

CosTheta Maximum: 0.7

pT minimum: 2.0

Efficiency vs. pT



effpt	
Entries	7169
Mean	14.3
Mean y	0.9877
RMS	12.39
RMS y	0.1101
Underflow	0
Overflow	0.9946

Average efficiency

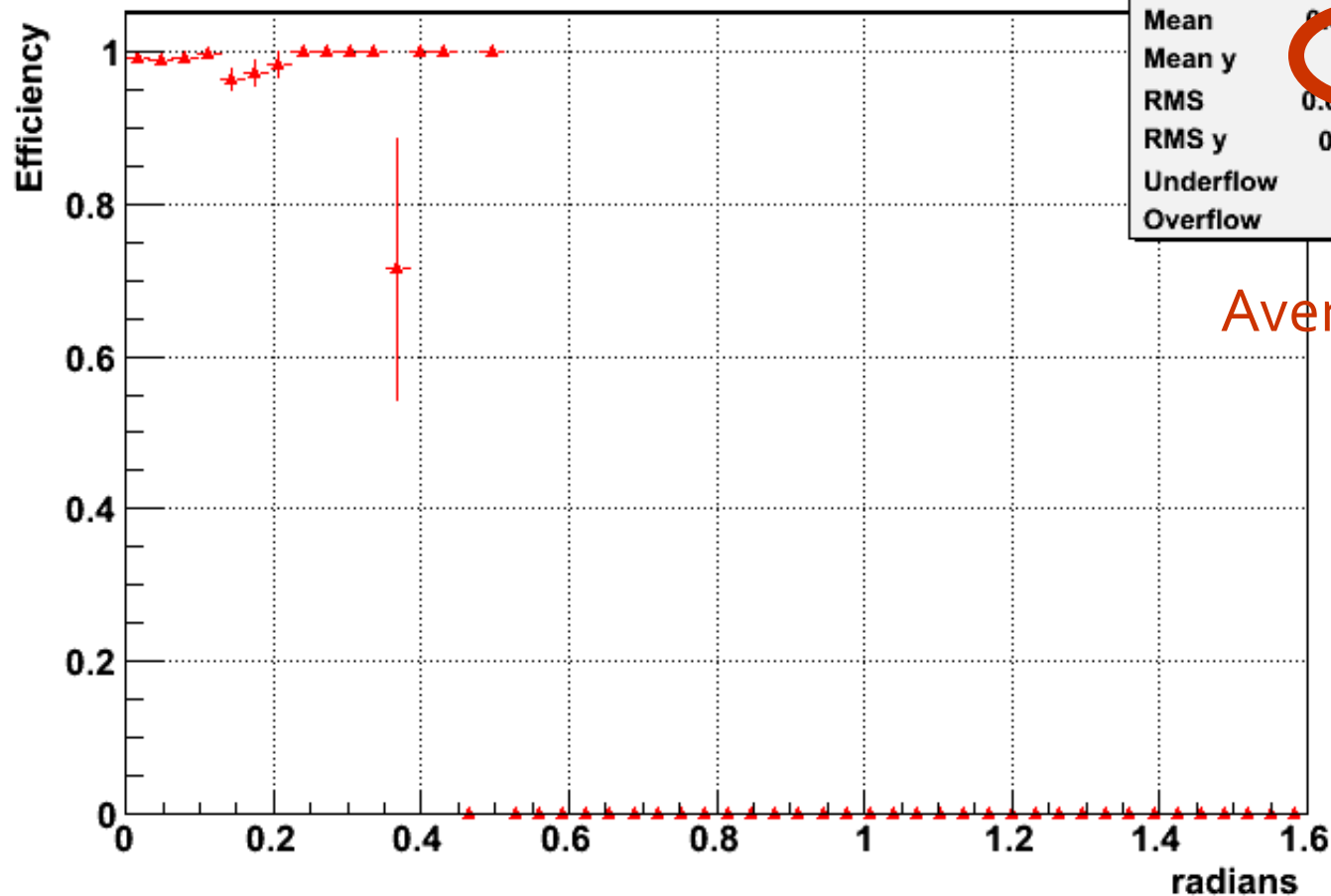
Inefficiency : 1.2%

CosTheta Maximum: 0.7

pT minimum: 2.0

Alpha = angle of track from jet axis

Efficiency vs. Abs(α)



effalpha	
Entries	7169
Mean	0.93831
Mean y	0.989
RMS	0.01044
RMS y	0.1044
Underflow	0
Overflow	0

Average efficiency

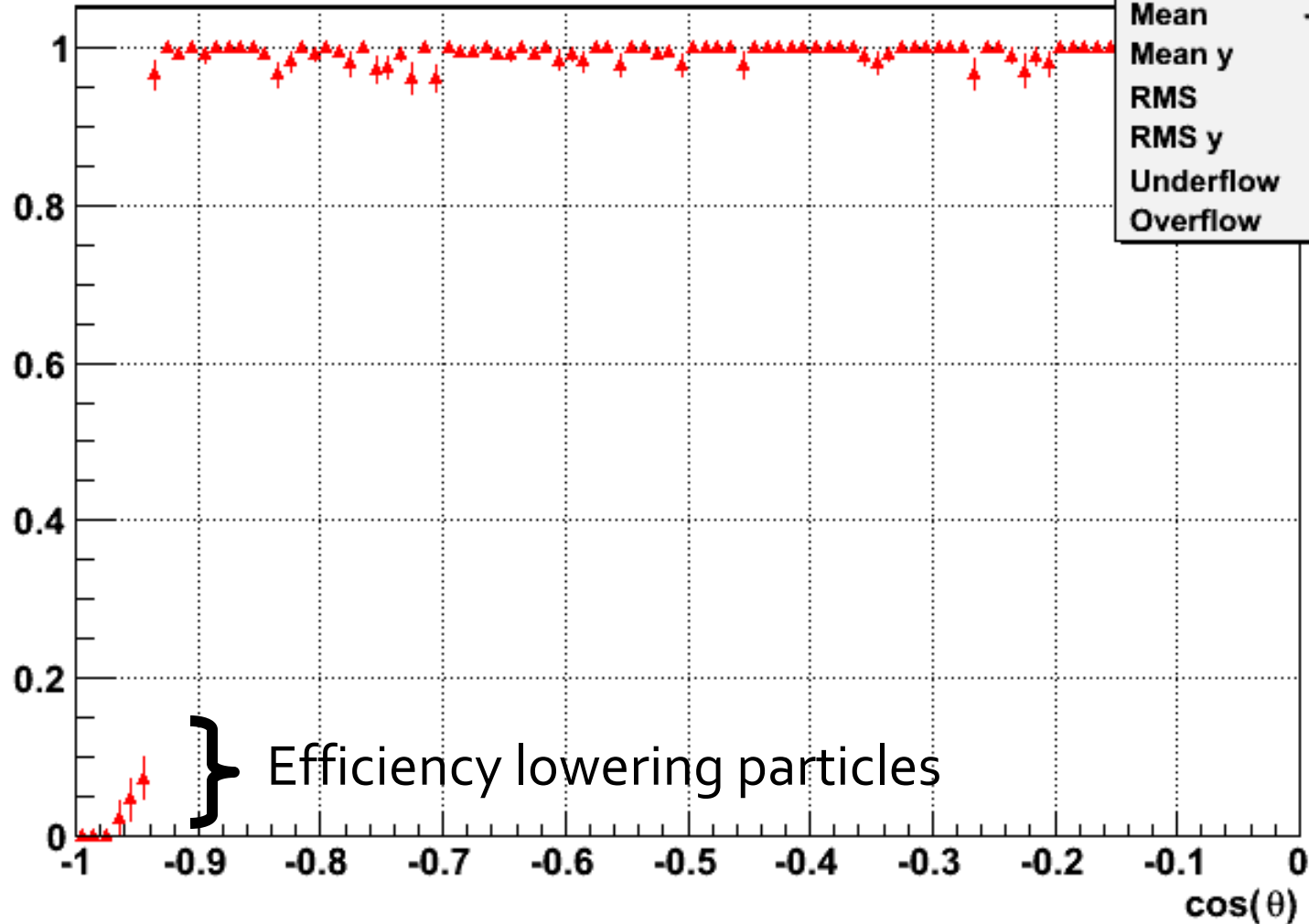
And, moving onto the higher cos(theta)....

CosTheta Maximum: 1.0

pT minimum: 2.0

Efficiency vs. Cos(θ)

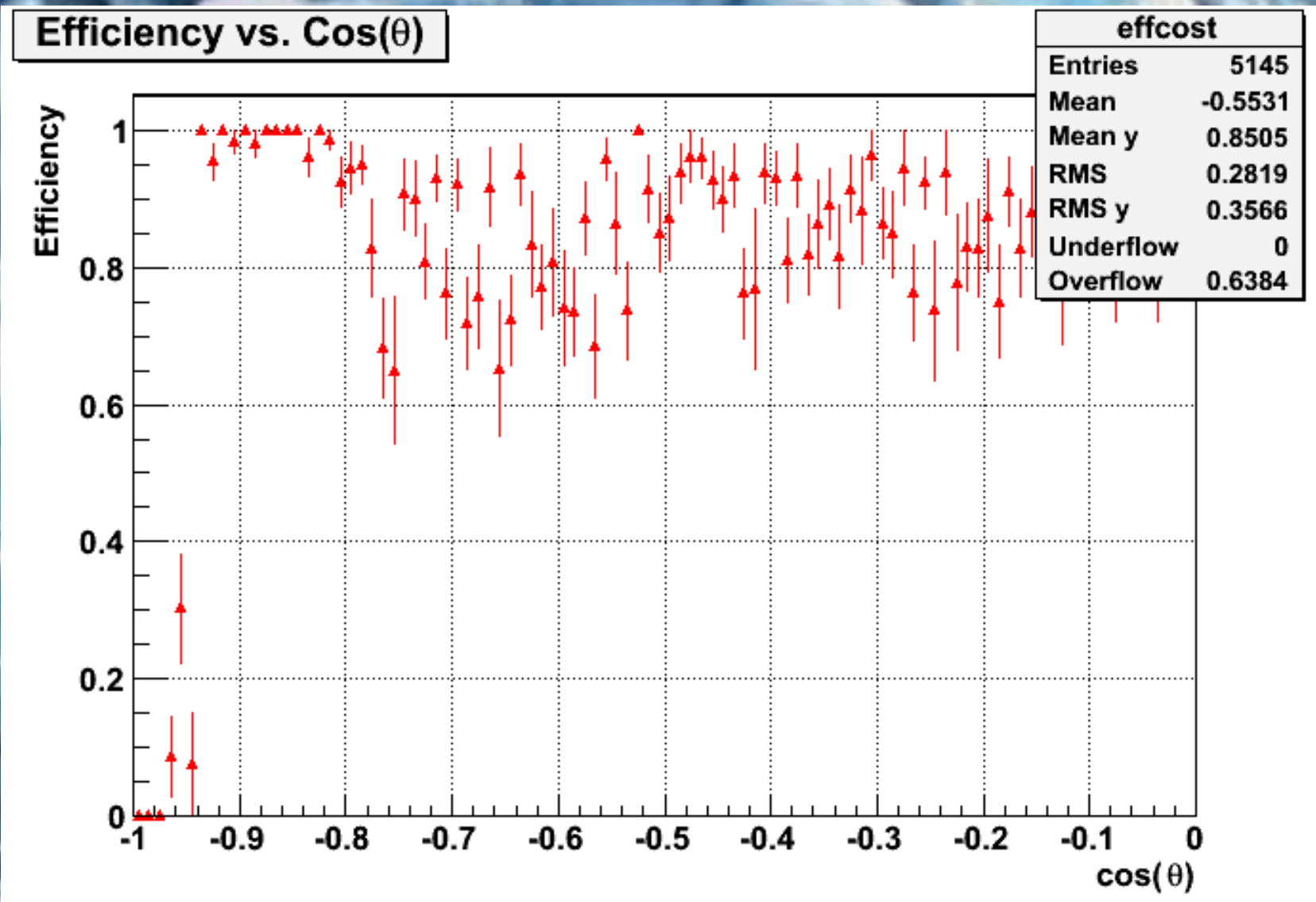
Efficiency



} Efficiency lowering particles

CosTheta Maximum: 1.0

pT range: $0.7 < pT < 2.0$



- Efficiency is high in central regions of the detector ($\cos(\theta) < 0.7$), but not as high as expected, (Inefficiency of 1.2%) if $p_T > 2.0$
- Efficiency is low for particles between p_T values of 0.7 GeV to about 1.5 GeV.
- At $p_T > 2.0$, the efficiency of finding particles is efficient until about 0.95 $\cos(\theta)$
- At all p_T , including between 0.7 and 1.5 GeV, efficiency of reconstructing particles between 0.8 and 0.95 $\cos(\theta)$ is high.