Blessing of Period 12 High PT Lepton Eff and SF

Simona Rolli

Tufts

Electrons ID: Samples

Dataset bhelmj: Runs 237850-241664
MC sample : zewkeh (Sept 8 2007)
GRL :GRL v18 for Period 12
(http://www-cdf.fnal.gov/internal/dqm/goodrun/good.html)

Looked at 1035 files (as of Sept 5 2007):
fcdfdata153:/export/data8/cdfmc/tnt/bhelmj/
Also ran on skim lepton data:
http://www-cdf.fnal.gov/internal/physics/top/RunIITopProp/gen6/filelists/gen6/bhelmj_p12_lepton_dp.rootlist

Electron ID: Cuts

CEM Selection Cuts

Variable	Tight (CEM)
Region	== CEM
Fiducial	Fiducial == 1
E_T	$\geq$ 20 GeV
Track Z_0	$\leq$ 60 cm
Track p_T	$\geq$ 10 GeV/c
COT Ax. Seg.	≥ 3
COT St. Seg.	≥ 2
Conversion	$\neq 1$
Had/em	$\leq (0.055 + (0.00045 \times E))$
Isolation	≤ 0.1
LshrTrk	≤ 0.2
E/P	$\leq$ 2.0 unless $p_T \geq$ 50GeV/c
CES ΔZ	$\leq$ 3.0 cm
Signed CES ΔX	$-3.0 \leq q \times \Delta X \leq 1.5$
CES StripChi2	≤ 10.0

Plug Selection Cuts

Variable	PHX	PEM
E_T	$\geq$ 20GeV	$\geq$ 20GeV
Pes2dEta	$1.2 \leq \lvert\eta\rvert \leq 2.8$	$1.2 \leq \lvert\eta\rvert \leq 2.8$
Had/Em	≤ 0.05	≤ 0.05
Pem3x3FitTow	$\neq 0$	$\neq 0$
Pem3x3Chisq	≤ 10	≤ 10
Pes5by9U	≥ 0.65	≥ 0.65
Pes5by9V	≥ 0.65	≥ 0.65
Isolation	≤ 0.1	≤ 0.1
ΔR	$\leq$ 3.0 cm	$\leq$ 3.0 cm
PhxMatch	TRUE	-
N_{hits}^{Si}	≥ 3	-
$\lvert z_0^{PHX} \rvert$	$\leq$ 60 cm	-

Electron ID: Results

	Period 11		Period 12	
	Bhelmi(P11)	zewkee	Bhelmi(P12)	zewkeh
CEM Eff	0.7770+\-0.0042	0.7983 +\-0.0009	0.7717+\-0.0052	0.8027 +\-0.0011
CEM SF	0.97331 +\-0.00545	N/A	0.9613 +\-0.007	N/A
nisoCEM Eff	0.8116 +\-0.0040	0.8267 +\-0.0009	0.8051 +\-0.0049	0.8286 +\-0.0011
nisoCEM SF	0.9817 +\-0.0049	N/A	0.9716 +\-0.006	N/A
LooseCEM Eff	0.9091 +/- 0.0029	0.9090 +\-0.0009	0.9018 +/- 0.0037	0.9136 +\-0.0011
LooseCEM SF	1.00015 +\-0.003	N/A	0.9869 +\-0.004	N/A
nisolooseCEM Eff	0.9423+\-0.0024	0.9433 +\-0.0009	0.9401+\-0.0029	0.9452 +\-0.0011
nisoloostCEM SF	0.9988 +\-0.0027	N/A	0.9945 +\-0.0033	N/A

	PHX		PHX	
Eff |Eta| < 2.0	0.6904+\-0.0063	0.7472+\-0.0012	0.7016+\-0.008	0.7460+\-0.0015
SF |Eta| < 2.0	0.9239+\- 0.0085	NA	0.9280+\- 0.0100	NA

	PHX		PHX	
Eff |Eta| < 2.8	0.5992+\-0.0055	0.6442+\-0.0012	0.6155+\-0.0066	0.6589+\-0.0015
SF |Eta| < 2.8	0.9301+\- 0.0087	NA	0.9340+\- 0.0102	NA

CEM N-1 efficiencies

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Conversion N-1 efficiency = 5316/5510 = 0.964791 +/- 0.00248294
Fiducial N-1 efficiency = 5316/5385 = 0.987187 +/- 0.00153263
TrkAxSeg N-1 efficiency = 5316/5320 = 0.999248 +/- 0.000375798
TrkStSeg N-1 efficiency = 5316/5316 = 1 +/- 0
Hadem N-1 efficiency = 5316/5356 = 0.992532 +/- 0.00117642
Isol N-1 efficiency = 5316/5514 = 0.964091 +/- 0.00250568
LshrTrk N-1 efficiency = 5316/5369 = 0.990129 +/- 0.00134924
EP N-1 efficiency = 5316/5718 = 0.929696 +/- 0.00338095
DeltaZ N-1 efficiency = 5316/5335 = 0.996439 +/- 0.000815582
QxDeltaX N-1 efficiency = 5316/5320 = 0.999248 +/- 0.000375798
StripChi2 N-1 efficiency = 5316/5515 = 0.963917 +/- 0.00251131

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Conversion N-1 efficiency = 7337/7597 = 0.965776 +/- 0.00208585
Fiducial N-1 efficiency = 7337/7452 = 0.984568 +/- 0.0014279
TrkAxSeg N-1 efficiency = 7337/7348 = 0.998503 +/- 0.000451026
TrkStSeg N-1 efficiency = 7337/7337 = 1 +/- 0
Hadem N-1 efficiency = 7337/7380 = 0.994173 +/- 0.000885949
Isol N-1 efficiency = 7337/7618 = 0.963114 +/- 0.00215949
LshrTrk N-1 efficiency = 7337/7407 = 0.99055 +/- 0.0011242
EP N-1 efficiency = 7337/7900 = 0.928734 +/- 0.0028945
DeltaZ N-1 efficiency = 7337/7362 = 0.996604 +/- 0.000678009
QxDeltaX N-1 efficiency = 7337/7345 = 0.998911 +/- 0.000384872
StripChi2 N-1 efficiency = 7337/7591 = 0.966539 +/- 0.00206409

Electron Trigger: Tracking

1 electron with $E_T > 25GeV$
$\not{E}_T > 25GeV$
reject cosmic events

Table: Offline *W* selection.

Electron Variables	Current baseline cuts
E_T	> 20 GeV
p_T	> 10 GeV/c
N_{SL}^{axial} with 5 hits	≥ 3
N_{SL}^{stereo} with 5 hits	≥ 2
Fiducial	1
Had/Em	$< 0.055 + 0.00045E$
L_{shr}	< 0.2
E/p	< 2 (for $p_T < 50GeV$)
$\lvert Z_{vertex} \rvert$	< 60 cm
$\lvert \Delta X \rvert$	$-3.0 < Q_{trk}\Delta X < 1.5$ cm
$\lvert \Delta Z \rvert$	< 3 cm
χ^2_{strip}	< 10
Conversion	$\neq 1$ (not)

Table: Offline baseline cuts for central electrons.

L1 Tracking Efficiency

$$\epsilon(\text{L1_XFT_PT8}) = \frac{\text{numW \& passed L1_CEM8_PT8}}{\text{numW}}$$

numW means the number of *W* candidates that passed the W-NOTRACK path.

L2 Tracking Efficiency

At L2, there is no additional tracking done except for receiving the XFT information from L1.

$$\epsilon(\text{L2_XFT_PT8}) = \frac{\text{numW \& passed L1_CEM8_PT8 \& passed L2_CEM16_PT8}}{\text{numW \& passed L1_CEM8_PT8}}$$

L3 Tracking Efficiency

$$\epsilon(\text{L3_PT9}) = \frac{\text{numW \& passed L1_CEM8_PT8 \& L2_CEM16_PT8 \& L3_CEM18_PT9}}{\text{numW \& passed L1_CEM8_PT8 \& L2_CEM16_PT8}}$$

Electron Trigger: Calorimeter

L2 Calorimeter Efficiency

- Require at least 1 electron satisfying the baseline cuts and $E_T >$ 18GeV.
- Use ELECTRON_CENTRAL_18_NO_L2 path.
- Efficiency reaches 100% at about 25 GeV.

$$\epsilon(\text{L2_CEM16}) = \frac{\text{numEl \& passed L1_CEM8_PT8 \& L2_PS \& L2_CEM16}}{\text{numEl \& passed L1_CEM8_PT8 \& L2_PS}}$$

L3 Calorimeter Efficiency

- Use the calibration dataset(blpc).
- Use ELECTRON_CENTRAL_8_NO_L2 path.
- Efficiency reaches 100% at about 20 GeV.

$$\epsilon(\text{L3_CEM18}) = \frac{\text{numEl \& passed EL_CENT_8_NO_L2 \& L2_CEM16 \& L3_CEM18}}{\text{numEl \& passed EL_CENT_8_NO_L2 \& L2_CEM16}}$$

Electron Trigger: Results

Analyzed about all data

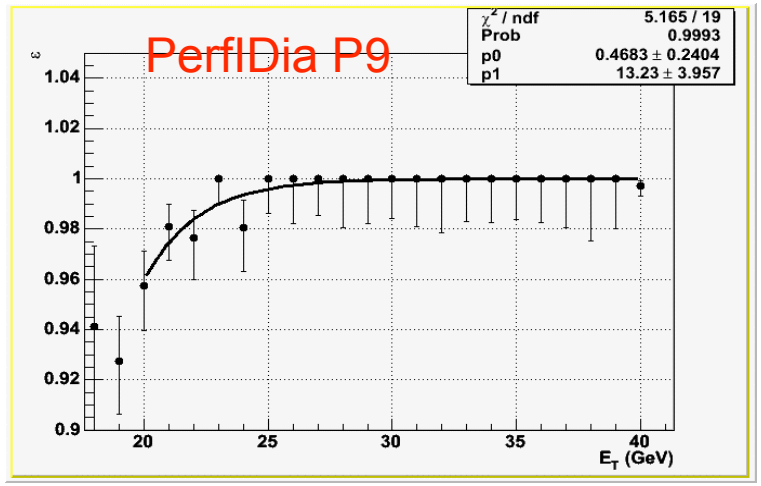
NofflW	84366
NcemL1	81569
NcemL2	81491
NcemL3	80995

Trigger	Period 9	Period 10A	Period 10B	Period 11
L1_XFT_PT8	0.9651(6)	0.9673(7)	0.9650(29)	0.9688(4)
L2_XFT_PT8	0.9992(1)	0.9993(1)	0.9992(5)	0.9988(4)
L3 tracking	0.9954(2)	0.9932(3)	0.9968(9)	0.9935(4)
Total Tracking	0.9598(7)	0.9600(8)	0.9611(31)	0.9614(4)

Period 12
0.96857 ± 0.003
0.9990 ± 0.003
0.9940 ± 0.003
0.9600 ± 0.003

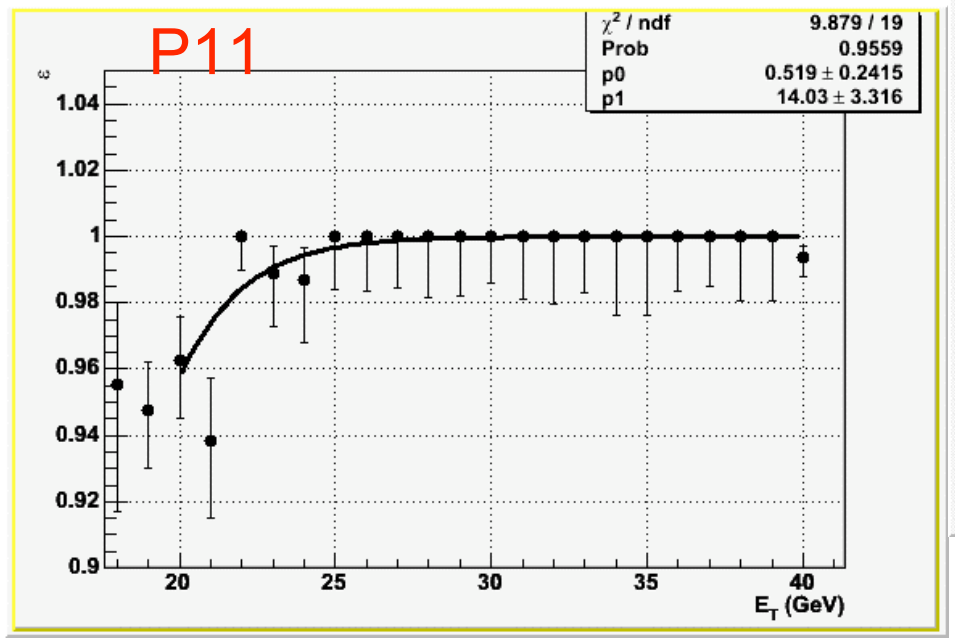
Consistent with previous periods

Electron Trigger : Results



L2_CEM16 calorimeter efficiency

$$\epsilon = \frac{1}{1 + e^{-\beta(E_T - \alpha)}}.$$



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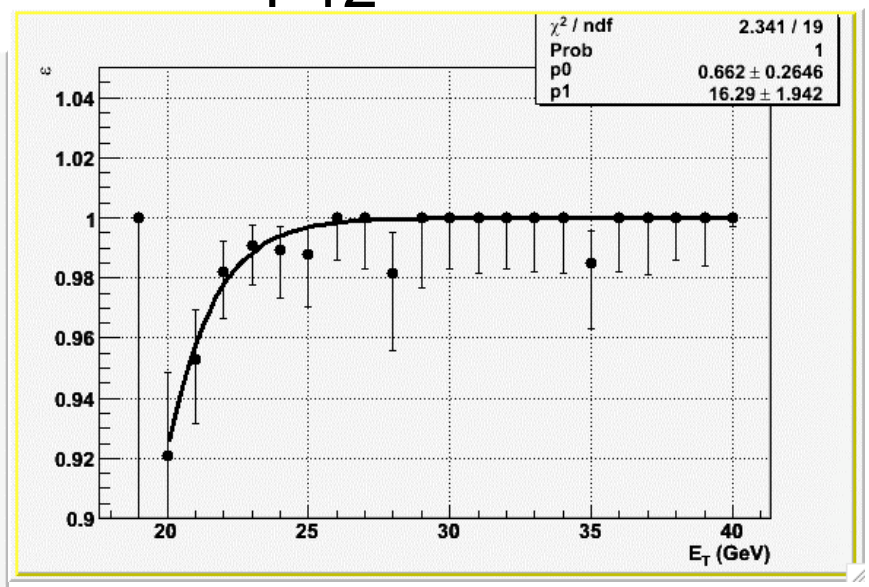

Muons

Dataset bhelmi: Runs 237850-241664
MC sample : zewkfm (Sept 10 2007)
GRL :V18 GRL

406 files: fcdfdata153:/export/data6/cdfmc/tnt/bhmumj/
Also ran on Skim data:
http://www-cdf.fnal.gov/internal/physics/top/RunIITopProp/gen6/filelists/gen6/bhmumj_p12_lepton_dp.rootlist

Trigger Efficiencies not corrected for livetimes

Trigger Efficiencies

Use the two legs from the reconstructed Z (both legs pass muon ID and fiducial cuts)

Level 1:

ε^{L1}_{CMUP} is calculated from 2 independent samples, using CMUP-CMUP and CMUP-CMX samples:

$$\varepsilon^{L1(A)}_{CMUP} = \frac{\#\text{ of events with both legs triggered}}{\#\text{ of events with 1 CMX leg triggered}}$$

$$\varepsilon^{L1(B)}_{CMUP} = \frac{2R}{1+R}$$

$$R = \frac{\#\text{ of events with both legs triggered}}{\#\text{ of events with} \geq 1\text{ CMUP leg triggered}}$$

The final efficiency is an average of $\varepsilon^{L1(A)}_{CMUP}$ and $\varepsilon^{L1(B)}_{CMUP}$ weighted by the errors.

Level 2: (both leg pass L1)

$$\varepsilon^{L2}_{CMUP} = \frac{\#\text{ of events pass both L2 triggers}}{\#\text{ of events pass L2 CMX trigger}}$$

Level 3: (both leg pass L2)

$$\varepsilon^{L3}_{CMUP} = \frac{\#\text{ of events pass both L3 triggers}}{\#\text{ of events pass L3 CMX trigger}}$$

CMX trigger efficiency is calculated in similar way.

Efficiencies not weighted for livetimes

1st leg	2nd leg	1st passes	both pass	Efficiency (%)
CMUP	CMUP	803	720	-
CMX	CMUP	868	818	$94.44^{+0.55}_{-0.49}$
CMUP	CMX	939	818	-
CMX	CMX	335	259	$87.15^{+0.99}_{-0.89}$
CMUP	ARCH	731	694	-
CMUP	MK	208	124	-
ARCH	ARCH	231	203	-
ARCH	MK	80	46	-
MK	ARCH	48	46	$94.61^{+0.77}_{-0.65}$
MK	MK	22	10	$70.36^{+2.87}_{-2.73}$

TABLE I: Dataset bhmumjP12-1: Muon L1 trigger efficiencies

Category	Events Passing	Efficiency (%)
Pass L2	729.000000	-
CMUP	725.000000	$99.72^{+0.19}_{-0.37}$
CMX	726.000000	$99.86^{+0.13}_{-0.31}$
CMUP SLAM	660.000000	$99.72^{+0.19}_{-0.37}$
CMX SLAM	692.000000	$99.86^{+0.13}_{-0.31}$
CMUPMK	112.000000	-
CMUPARCH	612.000000	$99.84^{+0.13}_{-0.39}$
CMUP-MK	112.000000	$100.00^{+0.00}_{-1.63}$

TABLE III: Dataset bhmumjP12-1: Muon L3 trigger efficiencies

Category	Events Passing	Efficiency (%)
Pass L1	818.000000	-
CMUP	772.000000	$98.12^{+0.47}_{-0.63}$
CMX	743.000000	$94.43^{+0.83}_{-0.92}$
CMUP SLAM	699.000000	$89.37^{+0.47}_{-0.63}$
CMX SLAM	708.000000	$90.03^{+0.83}_{-0.92}$
CMUPMK	121.000000	-
CMUPARCH	615.000000	$94.47^{+0.89}_{-1.06}$
CMUP-MK	114.000000	$94.21^{+2.07}_{-2.91}$

TABLE II: Dataset bhmumjP12-1: Muon L2 trigger efficiencies

Category	Efficiency (%)
CMUP	$92.41^{+0.72}_{-0.84}$
CMX	$82.18^{+1.18}_{-1.19}$
CMUP SLAM	$84.17^{+0.68}_{-0.80}$
CMX SLAM	$78.35^{+1.15}_{-1.16}$
ARCH	$89.23^{+1.12}_{-1.23}$
MK	$66.29^{+3.07}_{-3.46}$

: Dataset bhmumjP12-1: Muon combined trigger efficiencies

Muon ID Efficiency: ID Cuts

For all events:

No cosmic tag.

For all muon types (including stubless muons):

P_T	$>$	20 GeV/c
E_{EM}	$<$	2+max(0, $(p-100)\cdot 0.0115$) GeV
E_{HAD}	$<$	6+max(0, $(p-100)\cdot 0.028$) GeV
$E_T^{isol.}/P_T$	$<$	0.1
Number of axial SL with $\geq$ 5 hits	$\geq$	3
Number of stereo SL with $\geq$ 5 hits	$\geq$	2
$\lvert z_0 \rvert$	$<$	60 cm
Tracks w/ no silicon hits: $\lvert d_0 \rvert$	$<$	0.2 cm
Tracks w/ silicon hits: $\lvert d_0 \rvert$	$<$	0.02 cm

Additionally for tight CMUP muons:

$\lvert \Delta x_{CMU} \rvert$	$<$	7 cm
$\lvert \Delta x_{CMP} \rvert$	$<$	5 cm
No bluebeam muons, run	$<$	154449

Additionally for tight CMX muons:

$\lvert \Delta x_{CMX} \rvert$	$<$	6 cm
Run	$>$	150144
No miniskirt or keystone muons, run	$<$	190697
No muons in wedge 14 west, runs	$\geq$	190697 and $\leq$ 209760

Table 1: Standard muon ID cuts for 6.1.4 data MC.

Fiducial cuts

For CMUP muons:

Fiducial distance from CMU:		
x-fid	$<$	0 cm
z-fid	$<$	0 cm
Fiducial distance from CMP:		
x-fid	$<$	0 cm
z-fid	$<$	-3 cm
No muons from bluebeam region for run $<$ 154449		

For CMX muons:

ρ_{COT}	$>$	140 cm
Fiducial distance from CMX:		
x-fid	$<$	0 cm
z-fid	$<$	-3 cm
No muons from keystone region for run $<$ 190697		
No muons from miniskirt region for run $<$ 190697		
No muons wedge 14 west for runs $\geq$ 190697 and $\leq$ 209760		

Table 2: Suggested muon fiducial cuts for tight muons in release 6.1.4.

Arches:
$0^\circ \leq \phi \leq 75^\circ$ or $105^\circ \leq \phi \leq 225^\circ$ or $315^\circ \leq \phi < 360^\circ$
Additionally, for runs 190697 - 209760, remove:
$210^\circ < \phi \leq 225^\circ$ if $\eta < 0$
Keystone:
$75^\circ < \phi < 105^\circ$ and $\eta < 0$
Miniskirt:
$225^\circ < \phi < 315^\circ$

Table 3: Cuts on ϕ for distinguishing parts of the CMX detector when determining reconstruction efficiencies.

ID Efficiency Calculation

- A first leg must be a CMUP or CMX muon passing all the cuts given in Tables 1 and 2.
- A second leg must be a muon with a CMUP or CMX stub and satisfy:
  - $P_T > 20$ GeV.
  - fiducial requirements in Table 2.
- The event must not have a cosmic tag.
- The z_0 of the two legs must pass: $|z_0^{(1)} - z_0^{(2)}| < 4$ cm.
- The invariant mass of the two tracks must pass: $81 < m(\mu^+\mu^-)$ GeV/$c^2 < 101$.

We then test the second leg to determine if it passes each of the muon ID cuts given in Table 1.

CMUP ID Efficiency

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Cut	Count	Efficiency (%)
No cut	3530	
E_{EM} cut	3414	$96.71^{+0.28}_{-0.35}$
E_{HAD} cut	3454	$97.85^{+0.24}_{-0.28}$
COT hits cut	3529	$99.97^{+0.02}_{-0.06}$
d_0 cut	3507	$99.35^{+0.13}_{-0.17}$
Isolation cut	3378	$95.69^{+0.33}_{-0.36}$
Δx_{CMU} cut	3514	$99.55^{+0.12}_{-0.14}$
Δx_{CMP} cut	3463	$98.10^{+0.23}_{-0.26}$
All above cuts	3117	$88.30^{+0.54}_{-0.58}$
All cuts excl. isol.	3246	$91.95^{+0.45}_{-0.48}$
Sliding isol. cut	3417	$96.80^{+0.30}_{-0.34}$
All cuts (sliding isol.)	3151	$89.26^{+0.51}_{-0.57}$
χ^2 cut	3530	$100.00^{+0.00}_{-0.05}$
All cuts (χ^2)	3117	$88.30^{+0.54}_{-0.58}$
All track cuts	3188	$90.31^{+0.48}_{-0.54}$
All trk cuts excl. isol.	3320	$94.05^{+0.41}_{-0.42}$

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Cut	Count	Efficiency (%)
No cut	2378	
E_{EM} cut	2297	$96.59^{+0.35}_{-0.43}$
E_{HAD} cut	2342	$98.49^{+0.27}_{-0.32}$
COT hits cut	2378	$100.00^{+0.00}_{-0.08}$
d_0 cut	2371	$99.71^{+0.11}_{-0.16}$
Isolation cut	2288	$96.22^{+0.39}_{-0.44}$
Δx_{CMU} cut	2364	$99.41^{+0.16}_{-0.20}$
Δx_{CMP} cut	2329	$97.94^{+0.28}_{-0.36}$
All above cuts	2118	$89.07^{+0.63}_{-0.64}$
All cuts excl. isol.	2198	$92.43^{+0.59}_{-0.58}$
Sliding isol. cut	2306	$96.97^{+0.37}_{-0.41}$
All cuts (sliding isol.)	2133	$89.70^{+0.59}_{-0.68}$
χ^2 cut	2378	$100.00^{+0.00}_{-0.08}$
All cuts (χ^2)	2118	$89.07^{+0.63}_{-0.64}$
All track cuts	2177	$91.55^{+0.59}_{-0.58}$
All trk cuts excl. isol.	2260	$95.04^{+0.45}_{-0.48}$

CMUP ID SF

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Cut	Scale Factor
No cut	
E_{EM} cut	$1.0050^{+0.0030}_{-0.0037}$
E_{HAD} cut	$0.9951^{+0.0024}_{-0.0028}$
COT hits cut	$0.9998^{+0.0002}_{-0.0006}$
d_0 cut	$0.9950^{+0.0013}_{-0.0017}$
Isolation cut	$0.9886^{+0.0034}_{-0.0037}$
Δx_{CMU} cut	$0.9956^{+0.0012}_{-0.0014}$
Δx_{CMP} cut	$0.9865^{+0.0023}_{-0.0027}$
All above cuts	$0.9696^{+0.0060}_{-0.0065}$
All cuts excl. isol.	$0.9790^{+0.0049}_{-0.0051}$
Sliding isol. cut	$0.9919^{+0.0031}_{-0.0035}$
All cuts (sliding isol.)	$0.9725^{+0.0056}_{-0.0063}$
χ^2 cut	$1.0000^{+0.0000}_{-0.0005}$
All cuts (χ^2)	$0.9696^{+0.0060}_{-0.0065}$
All track cuts	$0.9861^{+0.0054}_{-0.0060}$
All trk cuts excl. isol.	$0.9956^{+0.0044}_{-0.0045}$

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Cut	Scale Factor
No cut	
E_{EM} cut	$1.0052^{+0.0038}_{-0.0045}$
E_{HAD} cut	$1.0009^{+0.0028}_{-0.0033}$
COT hits cut	$1.0001^{+0.0000}_{-0.0008}$
d_0 cut	$0.9984^{+0.0011}_{-0.0016}$
Isolation cut	$0.9910^{+0.0041}_{-0.0046}$
Δx_{CMU} cut	$0.9942^{+0.0016}_{-0.0020}$
Δx_{CMP} cut	$0.9857^{+0.0028}_{-0.0036}$
All above cuts	$0.9765^{+0.0070}_{-0.0071}$
All cuts excl. isol.	$0.9852^{+0.0063}_{-0.0063}$
Sliding isol. cut	$0.9925^{+0.0038}_{-0.0043}$
All cuts (sliding isol.)	$0.9773^{+0.0065}_{-0.0076}$
χ^2 cut	$1.0000^{+0.0000}_{-0.0008}$
All cuts (χ^2)	$0.9765^{+0.0070}_{-0.0071}$
All track cuts	$0.9973^{+0.0066}_{-0.0064}$
All trk cuts excl. isol.	$1.0064^{+0.0048}_{-0.0052}$

CMX ID Efficiencies

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Cut	Count	Efficiency (%)
No cut	2296	
E_{EM} cut	2219	$96.65^{+0.40}_{-0.43}$
E_{HAD} cut	2245	$97.78^{+0.29}_{-0.34}$
COT hits cut	2296	$100.00^{+0.00}_{-0.08}$
d_0 cut	2288	$99.65^{+0.12}_{-0.18}$
Isolation cut	2215	$96.47^{+0.38}_{-0.45}$
Δx_{CMX} cut	2294	$99.91^{+0.06}_{-0.11}$
All above cuts	2082	$90.68^{+0.58}_{-0.69}$
All cuts excl. isol.	2159	$94.03^{+0.47}_{-0.55}$
Sliding isol. cut	2240	$97.56^{+0.32}_{-0.37}$
All cuts (sliding isol.)	2107	$91.77^{+0.57}_{-0.61}$
χ^2 cut	2296	$100.00^{+0.00}_{-0.08}$
All cuts (χ^2)	2082	$90.68^{+0.58}_{-0.69}$
All track cuts	2084	$90.77^{+0.59}_{-0.68}$
All trk cuts excl. isol.	2161	$94.12^{+0.48}_{-0.54}$

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Cut	Count	Efficiency (%)
No cut	1491	
E_{EM} cut	1447	$97.05^{+0.44}_{-0.49}$
E_{HAD} cut	1468	$98.46^{+0.30}_{-0.39}$
COT hits cut	1491	$100.00^{+0.00}_{-0.12}$
d_0 cut	1489	$99.87^{+0.09}_{-0.18}$
Isolation cut	1436	$96.31^{+0.49}_{-0.53}$
Δx_{CMX} cut	1485	$99.60^{+0.17}_{-0.24}$
All above cuts	1368	$91.75^{+0.68}_{-0.78}$
All cuts excl. isol.	1417	$95.04^{+0.52}_{-0.65}$
Sliding isol. cut	1463	$98.12^{+0.34}_{-0.44}$
All cuts (sliding isol.)	1394	$93.49^{+0.60}_{-0.67}$
χ^2 cut	1491	$100.00^{+0.00}_{-0.12}$
All cuts (χ^2)	1368	$91.75^{+0.68}_{-0.78}$
All track cuts	1373	$92.09^{+0.74}_{-0.73}$
All trk cuts excl. isol.	1422	$95.37^{+0.58}_{-0.60}$

CMX ID SF

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Cut	Scale Factor
No cut	
E_{EM} cut	$1.0031^{+0.0042}_{-0.0046}$
E_{HAD} cut	$0.9995^{+0.0031}_{-0.0036}$
COT hits cut	$1.0002^{+0.0001}_{-0.0008}$
d_0 cut	$0.9977^{+0.0012}_{-0.0018}$
Isolation cut	$0.9937^{+0.0040}_{-0.0047}$
Δx_{CMX} cut	$1.0006^{+0.0006}_{-0.0012}$
All above cuts	$0.9921^{+0.0065}_{-0.0077}$
All cuts excl. isol.	$1.0003^{+0.0052}_{-0.0060}$
Sliding isol. cut	$0.9976^{+0.0033}_{-0.0038}$
All cuts (sliding isol.)	$0.9970^{+0.0063}_{-0.0067}$
χ^2 cut	$1.0000^{+0.0000}_{-0.0008}$
All cuts (χ^2)	$0.9921^{+0.0065}_{-0.0077}$
All track cuts	$0.9917^{+0.0066}_{-0.0075}$
All trk cuts excl. isol.	$0.9998^{+0.0053}_{-0.0058}$

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Cut	Scale Factor
No cut	
E_{EM} cut	$1.0048^{+0.0046}_{-0.0052}$
E_{HAD} cut	$1.0073^{+0.0031}_{-0.0040}$
COT hits cut	$1.0002^{+0.0001}_{-0.0012}$
d_0 cut	$0.9997^{+0.0009}_{-0.0018}$
Isolation cut	$0.9906^{+0.0051}_{-0.0056}$
Δx_{CMX} cut	$0.9975^{+0.0017}_{-0.0025}$
All above cuts	$1.0013^{+0.0076}_{-0.0087}$
All cuts excl. isol.	$1.0094^{+0.0057}_{-0.0071}$
Sliding isol. cut	$1.0038^{+0.0036}_{-0.0046}$
All cuts (sliding isol.)	$1.0149^{+0.0067}_{-0.0075}$
χ^2 cut	$1.0000^{+0.0000}_{-0.0012}$
All cuts (χ^2)	$1.0013^{+0.0076}_{-0.0087}$
All track cuts	$1.0035^{+0.0082}_{-0.0081}$
All trk cuts excl. isol.	$1.0114^{+0.0062}_{-0.0065}$

Reconstruction Efficiency

The reconstruction efficiency is defined as the probability to find a muon stub and link it to a track. First, to know whether we should find a stub or not we have to know that the muon is fiducial in any of the muon chambers. We use the **MuonFiducialTool** class for this purpose. We define a track as being fiducial in a given muon system if it passes the cuts defined in Tables 2 and 3 for that system.

Events Selection
No cosmic tag and 2 tracks passing the following:

- Oppositely charged.
- $|z_0^{(1)} - z_0^{(2)}| < 4$ cm.
- $81\ \mathrm{GeV}/c^2 < m(\mu^+\mu^-) < 101\ \mathrm{GeV}/c^2$
- The first leg must be a reconstructed **CdfMuon** passing all the ID and fiducial cuts given in Tables 1 and 2. It must also match to the level 1 trigger information.
- The second leg must be fiducial in both the CMU and CMP sub-detectors (or the CMX sub-detector) and satisfy:
  - $P_T > 20$ GeV.
  - $E_{EM} < 1.5 \cdot (2+\max(0, (p-100) \cdot 0.0115))$ GeV
  - $E_{HAD} < 1.5 \cdot (6+\max(0, (p-100) \cdot 0.028)$ GeV

$$\varepsilon_{Reco} = \frac{\#\text{tracks fiducial and linked to a stub}}{\#\text{ tracks fiducial}}$$

Reconstruction Efficiency

The first leg must pass all the ID and Fid. cuts and must match to the level 1 trigger information. If the second leg is Fiducial, and pass "P_T, E_{EM}, E_{HAD}" cuts, we examine this track to see if is linked to a muon stub or not.

P11

Category	Fiducial	w/ Stub	Efficiency (%)
CMUP	3769	3412	$90.53^{+0.46}_{-0.51}$
CMX	2333	2221	$95.20^{+0.43}_{-0.50}$
CMX Arches	1829	1796	$98.20^{+0.32}_{-0.37}$
CMX Miniskirt	422	346	$81.99^{+1.90}_{-2.01}$
CMX Keystone	82	79	$96.34^{+1.90}_{-3.47}$
CMU-only	957	840	$87.77^{+1.04}_{-1.10}$
CMP-only	1120	1015	$90.62^{+0.83}_{-0.93}$

P12

Category	Fiducial	w/ Stub	Efficiency (%)
CMUP	2534	2311	$91.20^{+0.55}_{-0.62}$
CMX	1524	1455	$95.47^{+0.57}_{-0.60}$
CMX Arches	1165	1144	$98.20^{+0.41}_{-0.47}$
CMX Miniskirt	283	238	$84.10^{+2.13}_{-2.56}$
CMX Keystone	76	73	$96.05^{+2.19}_{-3.67}$
CMU-only	651	567	$87.10^{+1.28}_{-1.45}$
CMP-only	606	558	$92.08^{+1.18}_{-1.16}$
CMX MiniKey	359	311	$86.63^{+1.75}_{-1.96}$

Reconstruction SF

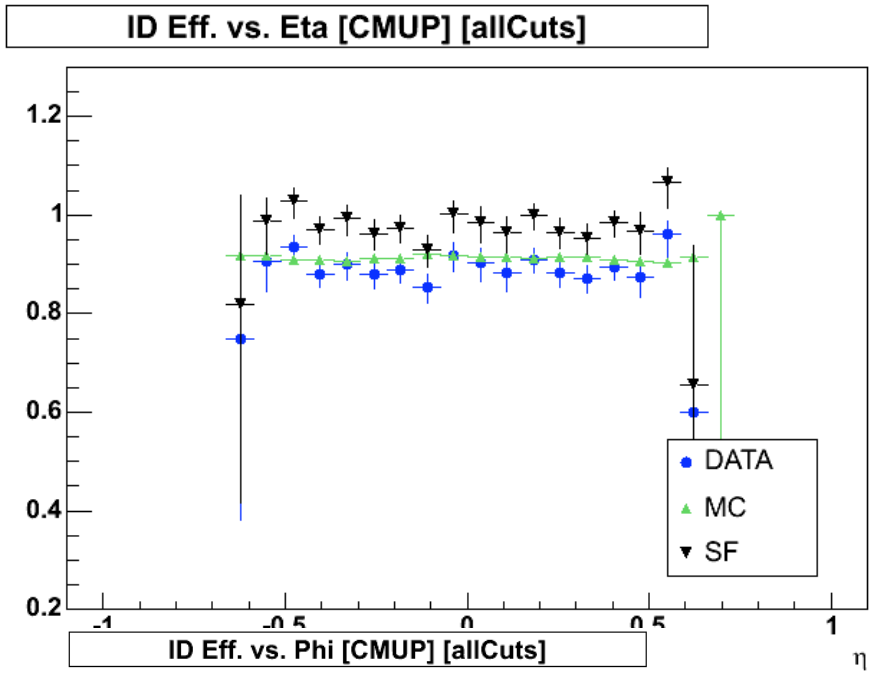
Category	Scale Factor
CMUP	$0.9276^{+0.0048}_{-0.0053}$
CMX	$0.9557^{+0.0043}_{-0.0050}$
CMX Arches	$0.9840^{+0.0032}_{-0.0037}$
CMX Miniskirt	$0.8277^{+0.0192}_{-0.0203}$
CMX Keystone	$0.9736^{+0.0193}_{-0.0351}$
CMU-only	$0.8991^{+0.0107}_{-0.0114}$
CMP-only	$0.9224^{+0.0085}_{-0.0095}$
CMX MiniKey	$0.8515^{+0.0173}_{-0.0173}$

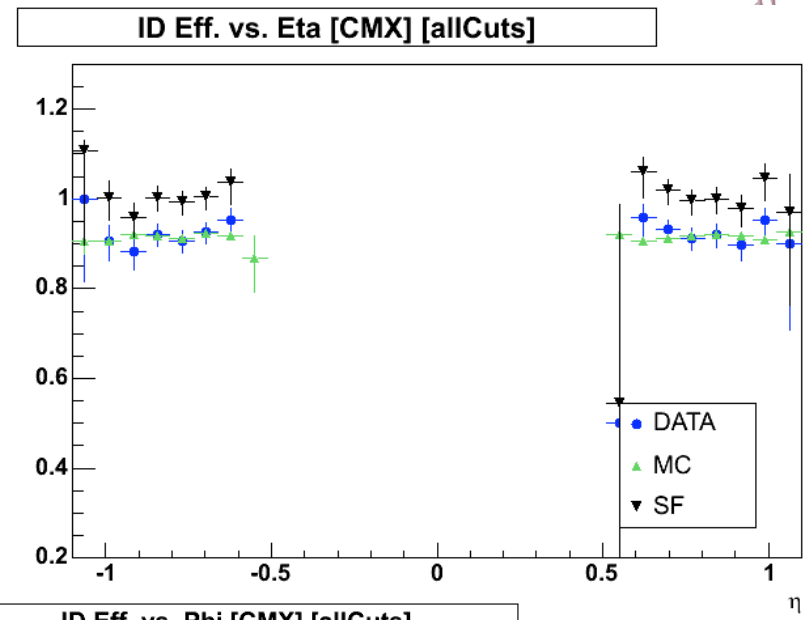
P11

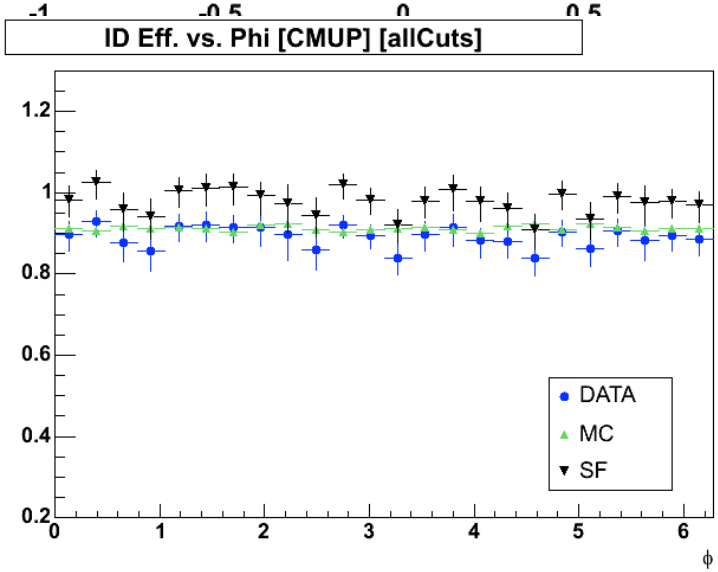
P12

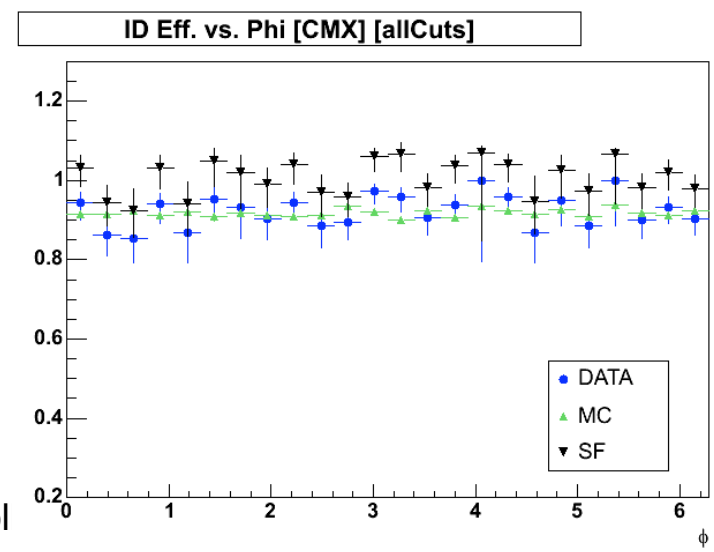
Category	Scale Factor
CMUP	$0.9345^{+0.0056}_{-0.0064}$
CMX	$0.9584^{+0.0058}_{-0.0060}$
CMX Arches	$0.9840^{+0.0041}_{-0.0047}$
CMX Miniskirt	$0.8490^{+0.0215}_{-0.0258}$
CMX Keystone	$0.9706^{+0.0222}_{-0.0372}$
CMU-only	$0.8921^{+0.0132}_{-0.0149}$
CMP-only	$0.9372^{+0.0121}_{-0.0118}$
CMX MiniKey	$0.8747^{+0.0177}_{-0.0177}$

Reco and ID Plots

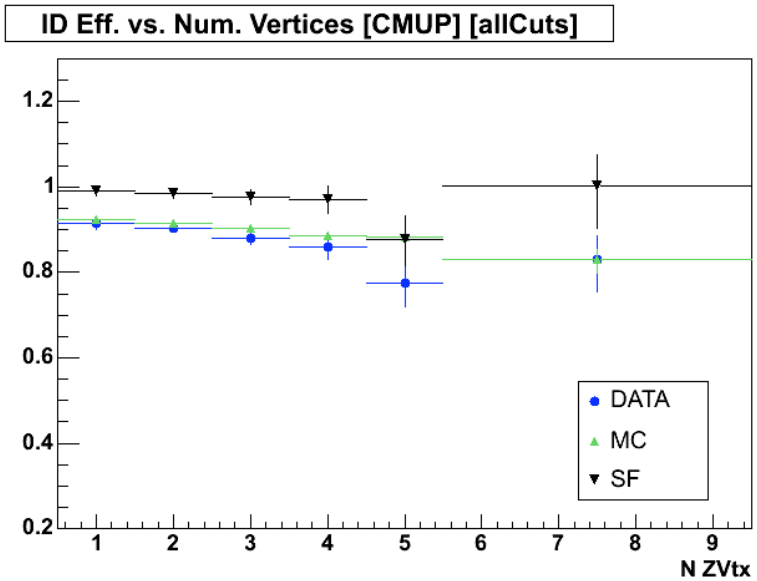


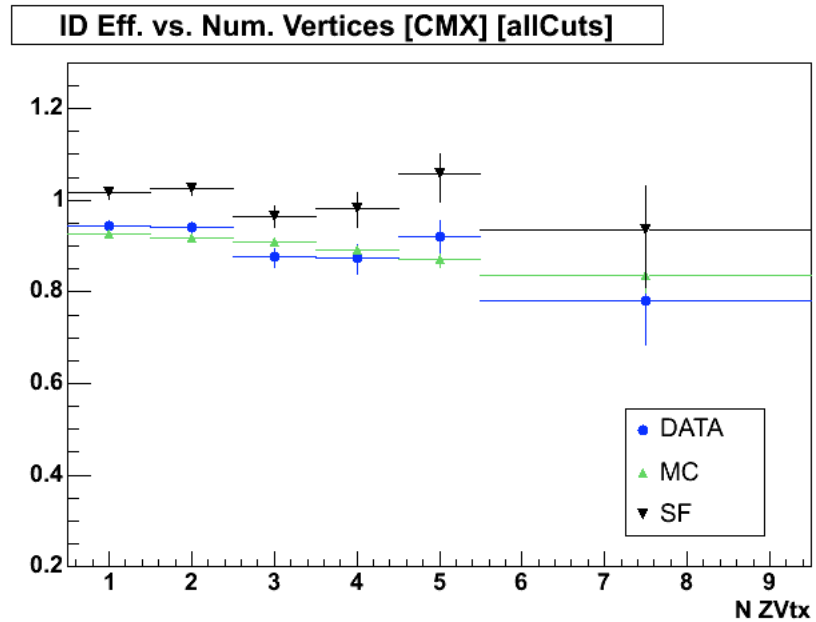


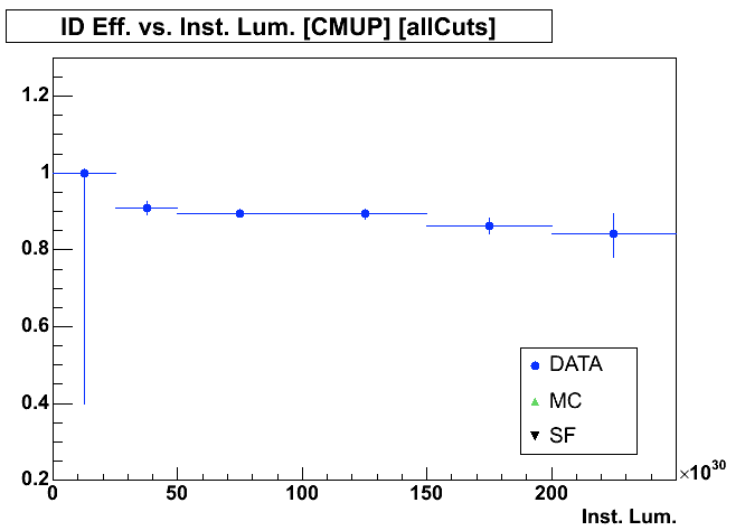


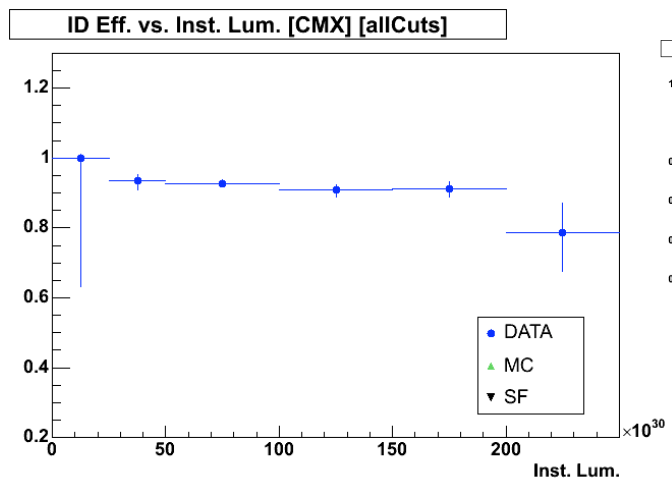


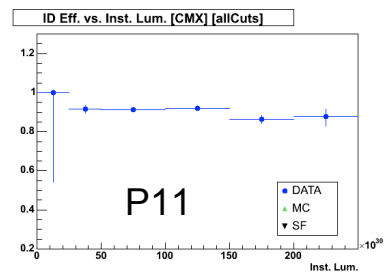
Reco and ID Plots



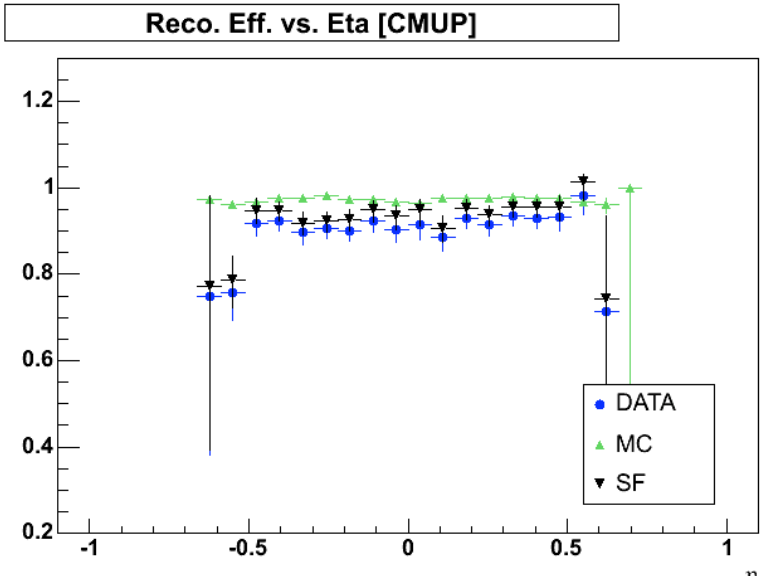


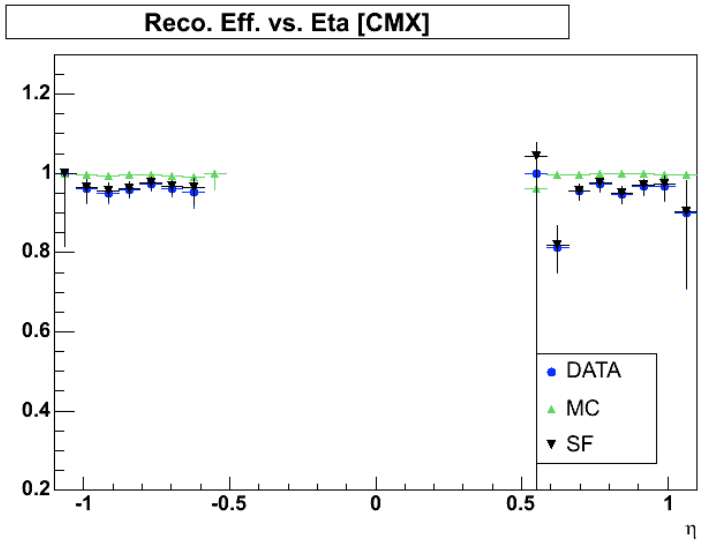


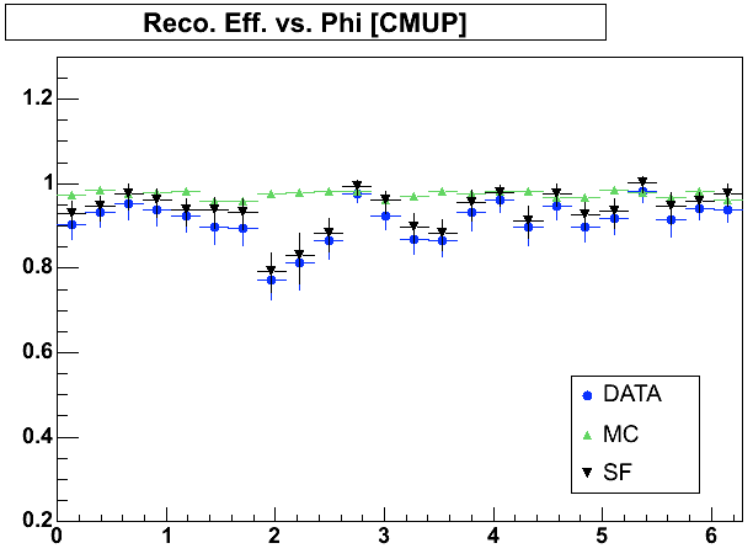


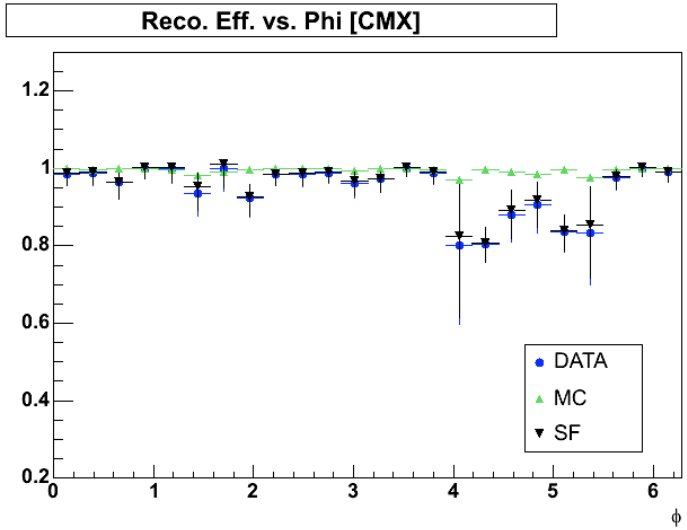


Reco and ID Plots









Conclusions

- Efficiencies and SF for high PT leptons in P12 have been produced:
  - No suprises compared with previous period.
  - Sign off ok