Muon Efficiencies for Period 9 Data using PerfIDia (blessing)

Simona Rolli

Muons

PerfIDia

http://ncdf70.fnal.gov:8001/PerfIDia/PerfIDia.html

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  - Post Shutdown data and efficiencies for Winter 2007 (Lepton Group, November 29 2006)
- Code:
  - Instructions on how to run the code
- Results (PRELIMINARY) :
  - Period 9 Data : Runs 222529 to 228596)
    - Root file of distributions
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  - Post Shut Down Data (June 2006 to September 2006): Runs 217990 to 222426
    - Root file of distributions
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  - Pre Shut Down Data (September 2005 to June 2006): Runs 203819 to 212133
    - Root file of distributions
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  - bhmu0h (December 2004 to September 2005): Runs 190697 to 203799
    - Root file of distributions
    - Efficiencies TeX file
  - bhmu0d bhel0d (2002 to August 2004) : Runs 138425 to 186598
    - Root file of distributions
    - Efficiencies TeX file

How to run the muon efficiency code on TopNtuple
The code lives in CVS (from the head of the repository) under /MuonUser/macros/MuonEffTopNt/.
setup a new test release:
source ~cdfsoft/cdf2.cshrc; setup cdfsoft2 6.1.4; newrel -t 6.1.4 newrel; cd newrel;
add from the head MuonUser and TopMods
addpkg -h MuonUser ; addpkg -h TopMods;
go to the area in MuonUser/macros/MuonEffTopNt/ which will be your working area.
cd MuonUser/macros/MuonEffTopNt/ ;

http://ncdf70.fnal.gov:8001/PerfIDia/PerfIDia.html

Muons

Dataset bhelmi: Runs 222529 to 228596
MC sample : zewkcm
GRL : goodrun_em_si_cmxignored.v15

Complete list used here:
http://ncdf70.fnal.gov:8001/PerfIDia/validation/bhmumi/bhmumi.rootlist
http://www-cdf.fnal.gov/internal/physics/top/RunIITopProp/gen6/filelists/gen6/bhmumi2_lepton.rootlist

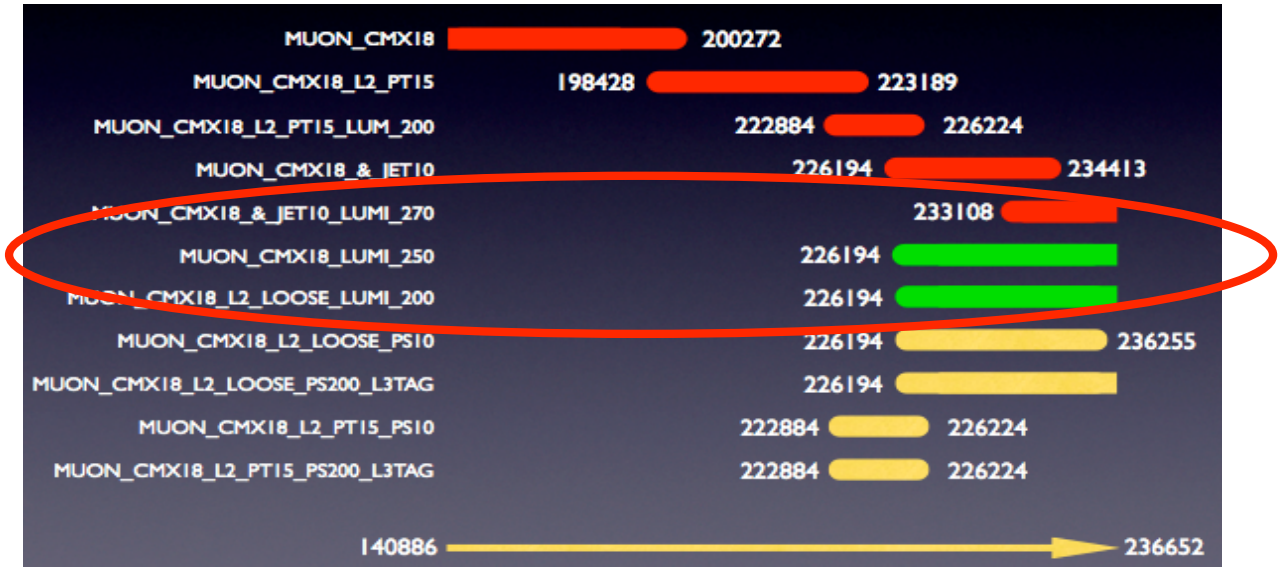
http://ncdf70.fnal.gov:8001/PerfIDia/validation/bhmumi/zewkcm.rootlist

Muon Triggers

The CMUP trigger stayed the same
The CMX trigger changed during period 9:
The CMX triggers were divided according to the following paths:

- CMX0: MUON_CMX18_LUMI (“old” CMX w/ SLAM confirmation)
- CMX1: MUON_CMX18_L2_LOOSE_LUMI (“old” CMX w/o SLAM conf)
- CMX1: MUON_CMX18_&_JET (new CMX + JET path)

- Each trigger was analyzed separately in the same fashion as the previous CMX trigger



Trigger Paths

	CMUP18 trigger path
Level 1	L1_CMUP6_PT4
Level 2	L2_AUTO_L1_CMUP6_PT4 (run≤152949) L2_TRK8_L1_CMUP6_PT4(152949<run≤179056) L2_CMUP6_PT8(181013≤run≥202717) L2_CMUP6_PT15(run≥198428)
Level 3	L3_MUON_CMUP18

	OLD CMX18 trigger path
Level 1	L1_CMX_PT8_PS1 (run≤152949) L1_CMX_PT8_CSX(_PS1) (run>152949)
Level 2	L2_AUTO_L1_CMX6_PT8(run≤152949) L2_AUTO_L1_CMX6_PT8_CSX(152525≤run≤179056) L2_AUTO_L1_CMX6_PT10(181013≤run≤202717) L2__L1_CMX6_PT15(run≥198428)
Level 3	L3_MUON_CMX_18

- L1_CMX6_PT8_CSX_v-2/[28(15)]
  - L2_CMX6_PT15_3D_&_JET10_v-1/[55]
    - L3_MUON_CMX18_v-2
      - MUON_CMX18_&_JET10_v-1
        - HIGH_PT_MUON_1_v-16
  - L2_CMX6_PT15_3D_LUMI_250_v-1/[56]
    - L3_MUON_CMX18_v-2
      - MUON_CMX18_LUMI_250_v-1
        - HIGH_PT_MUON_1_v-16
  - L2_CMX6_PT15_LUMI_200_v-1/[57(4)]
    - L3_MUON_CMX18_v-2
      - MUON_CMX18_L2_LOOSE_LUMI_200_v-1
        - HIGH_PT_MUON_1_v-16

L1 Trigger Efficiency

ε^{L1}_{CMUP} is calculated from 2 independent samples

1)CMX-CMUP where the triggered leg is CMX and the probe leg is CMUP

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

2)CMUP-CMUP sample

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

From which the efficiency is derived

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

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

Trigger Eff L1

Period 9

1st leg	2nd leg	1st passes	both pass	Efficiency (%)
CMUP	CMUP	918	830	-
CMX	CMUP	1026	948	94.21 ± 0.45
CMUP	CMX	1060	948	-
CMX	CMX	359	272	88.49 ± 0.79
CMUP	ARCH	856	814	-
CMUP	MK	204	134	
ARCH	ARCH	251	217	-
ARCH	MK	86	44	
MK	ARCH	46	44	94.53 ± 0.62
MK	MK	20	11	75.53 ± 2.43

TABLE XI: Dataset bhmumi-1: Muon L1 trigger efficiencies

Level 1

	Efficiency (%)			
	bhmu0d	bhmu0h	bhmu0i	bhmu0i2
CMUP	90.49 ± 0.42	93.03 ± 0.33	92.80 ± 0.41	92.57 ± 0.51
CMX	96.77 ± 0.35	89.39 ± 0.49	89.36 ± 0.60	88.90 ± 0.77
Arches	96.77 ± 0.35	96.06 ± 0.35	95.57 ± 0.45	95.15 ± 0.58
Mini./Key.		77.36 ± 1.39	74.75 ± 1.83	75.98 ± 2.25

L3 Trigger Efficiency

CMX-CMUP events events where both legs pass the L1 trigger

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

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

MUON_CMX18_L2_LOOSE_LUMI

- L1_CMX6_PT8_CSX_v-2/[28(15)]
  - L2_CMX6_PT15_3D_&_JET10_v-1/[55]
    - L3_MUON_CMX18_v-2
      - MUON_CMX18_&_JET10_v-1
        - HIGH_PT_MUON_1_v-16
  - L2_CMX6_PT15_3D_LUMI_250_v-1/[56]
    - L3_MUON_CMX18_v-2
      - MUON_CMX18_LUMI_250_v-1
        - HIGH_PT_MUON_1_v-16
  - L2_CMX6_PT15_LUMI_200_v-1/[57(4)]
    - L3_MUON_CMX18_v-2
      - MUON_CMX18_L2_LOOSE_LUMI_200_v-1
        - HIGH_PT_MUON_1_v-16

No SLAM conf

Category	Events Passing	Efficiency (%)
Pass L2	948	-
CMUP	315	98.70 ± 0.65
CMX	308	96.51 ± 1.03
CMUP-CMX	304	-
CMUPA	272	-
CMUPMK	43	-
CMUPARCH	262	96.32 ± 1.14
CMUP-MK	42	97.67 ± 2.30

TABLE XIII: Dataset bhmumiCMX1-1: Muon L3 trigger efficiencies

MUON_CMX18_LUMI

- L1_CMX6_PT8_CSX_v-2/[28(15)]
  - L2_CMX6_PT15_3D_&_JET10_v-1/[55]
    - L3_MUON_CMX18_v-2
      - MUON_CMX18_&_JET10_v-1
        - HIGH_PT_MUON_1_v-16
  - L2_CMX6_PT15_3D_LUMI_250_v-1/[56]
    - L3_MUON_CMX18_v-2
      - MUON_CMX18_LUMI_250_v-1
        - HIGH_PT_MUON_1_v-16
  - L2_CMX6_PT15_LUMI_200_v-1/[57(4)]
    - L3_MUON_CMX18_v-2
      - MUON_CMX18_L2_LOOSE_LUMI_200_v-1
        - HIGH_PT_MUON_1_v-16

SLAM confirmation

Category	Events Passing	Efficiency (%)
Pass L2	948	-
CMUP	315	98.64 ± 0.67
CMX	295	92.38 ± 1.49
CMUP-CMX	291	-
CMUPA	272	-
CMUPMK	43	-
CMUPARCH	249	91.54 ± 1.69
CMUP-MK	42	97.67 ± 2.30

TABLE XIII: Dataset bhmumiCMX0-1: Muon L3 trigger efficiencies

MUON_CMX18_&_JET10_LUMI

- L1_CMX6_PT8_CSX_v-2/[28(15)]
  - L2_CMX6_PT15_3D_&_JET10_v-1/[55]
    - L3_MUON_CMX18_v-2
      - MUON_CMX18_&_JET10_v-1
        - HIGH_PT_MUON_1_v-16
  - L2_CMX6_PT15_3D_LUMI_250_v-1/[56]
    - L3_MUON_CMX18_v-2
      - MUON_CMX18_LUMI_250_v-1
        - HIGH_PT_MUON_1_v-16
  - L2_CMX6_PT15_LUMI_200_v-1/[57(4)]
    - L3_MUON_CMX18_v-2
      - MUON_CMX18_L2_LOOSE_LUMI_200_v-1
        - HIGH_PT_MUON_1_v-16

Category	Events Passing	Efficiency (%)
Pass L2	948	-
CMUP	41	100.00 ± 0.00
CMX	40	97.56 ± 2.41
CMUP-CMX	40	-
CMUPA	34	-
CMUPMK	7	-
CMUPARCH	33	97.06 ± 2.90
CMUP-MK	7	100.00 ± 0.00

TABLE XXVI: Dataset bhmumiCMX2-1: Muon L3 trigger efficiencies

MUON_CMX18_&_JET10_LUMI

Efficiency as function of jet Et cut

Category	Efficiency
Et > 10 GeV	75.00 ± 4.97
Et > 13 GeV	90.57 ± 4.02
Et > 14 GeV	93.75 ± 3.49
Et > 15 GeV	97.56 ± 2.41
Et > 20 GeV	96.55 ± 3.39
Et > 25 GeV	100 ± 0.0
Et > 30 GeV	100 ± 0.0

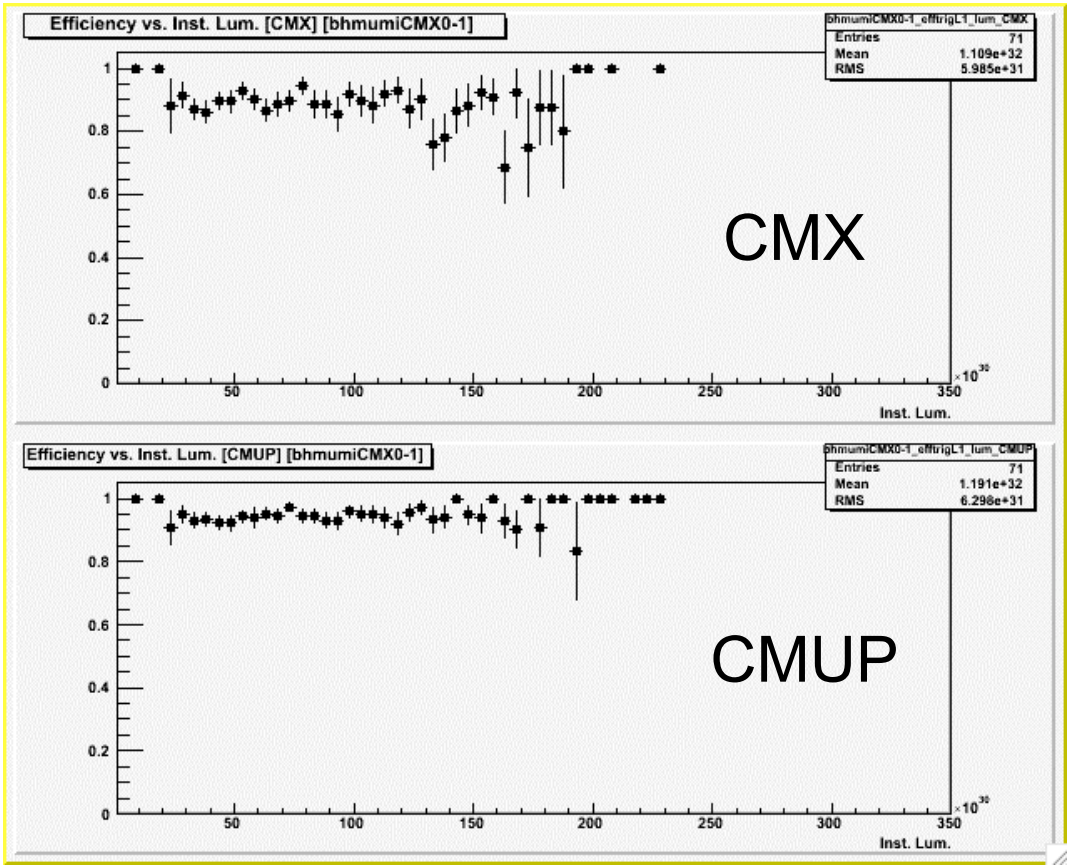
Conclusions on Trigger Eff

The right way to proceed is to start calculating the L2 trigger efficiency, since it is at L2 that we have implemented the new requirements (3D confirmation and jet).
We are doing it.
In this way L3 efficiency will be 100% relative to L2 which is what now we quoted as L3.

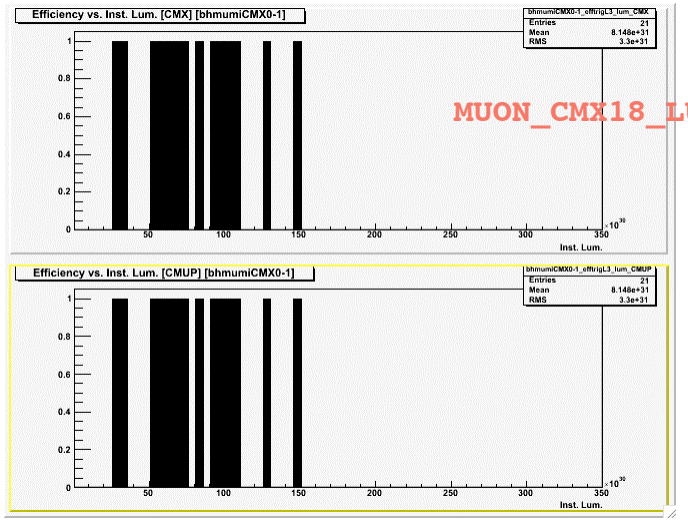
Preliminary results are indicating that the L2 efficiency for the SLAM confirmed CMX trigger is of order 97%

Trigger Eff vs Inst Luminosity

L1 Trigger Efficiency vs Inst Lumi

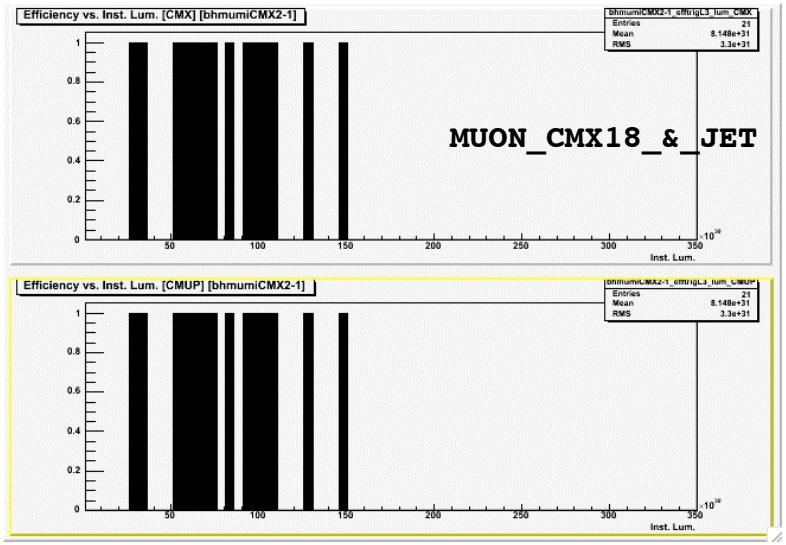


Trigger Eff vs Inst Luminosity



MUON_CMX18_LUMI_250_v-1

L3



MUON_CMX18_&_JET

MUON_CMX18_L2_LOOSE_LUMI_200_v-1

Overall Trigger Efficiency

The overall trigger efficiency is the product of L1xL2xL3 (for now L1xL3

Category	L1	L3 CMX18 no 3D	Overall	L3 CMX18 3D	Overall	L3 CMX18 & Jet10	Overall
CMUP	94.21 ± .45	98.70 ± .65	93.01± 0.79	98.64 ± 0.67	92.92 ± 0.79	100 ± 0	94.21±.45
CMX18 no 3D	88.49 ± .79	96.51 ± 1.03	85.40 ± 1.29				
CMX18 3d	88.49 ± 0.79			92.38 ± 1.49	81.74 ± 2.58		
CMX18 & Jet10	88.49 ± .79					97.56± 2.41	86.33 ±2.5
Arch	94.53 ± .62	96.32 ± 1.14	91.05 ±1.29	91.54 ± 1.69	86.53 ±1.70	97.06± 2.90	91.75±2.95
MK	75.53 ± 2.43	97.67 ± 2.30	73.77 ±2.30	97.67 ± 2.30	73.77 ±2.30	100 ± 0	75.53±2.43

	Efficiency (%)			
	bhmu0d	bhmu0h	bhmu0i	bhmu0i2
CMUP	90.15 ± 0.44	91.91 ± 0.39	91.79 ± 0.48	91.30 ± 0.61
CMX	96.65 ± 0.36	88.92 ± 0.51	89.17 ± 0.61	88.43 ± 0.79
Arches	96.65 ± 0.36	95.50 ± 0.39	95.41 ± 0.46	94.67 ± 0.63
Mini./Key.		77.18 ± 1.40	74.44 ± 1.85	75.54 ± 2.28

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.

ID Efficiencies: data

Cut	Count	Efficiency (%)
No cut	2777	
E_{EM} cut	2703	97.34 ± 0.31
E_{HAD} cut	2731	98.34 ± 0.24
COT hits cut	2775	99.93 ± 0.05
d_0 cut	2763	99.50 ± 0.13
Isolation cut	2690	96.87 ± 0.33
Δx_{CMU} cut	2770	99.75 ± 0.10
Δx_{CMP} cut	2722	98.02 ± 0.26
All above cuts	2510	90.39 ± 0.56
All cuts excl. isol.	2584	93.05 ± 0.48
Sliding isol. cut	2720	97.95 ± 0.27
All cuts (sliding isol.)	2538	91.39 ± 0.53
χ^2 cut	2777	100.00 ± 0.00
All cuts (χ^2)	2510	90.39 ± 0.56
All track cuts	2568	92.47 ± 0.50
All trk cuts excl. isol.	2645	95.25 ± 0.40

TABLE I: Dataset bhmumi-1: Muon ID efficiencies for CMUP

Cut	Count	Efficiency (%)
No cut	1642	
E_{EM} cut	1599	97.38 ± 0.39
E_{HAD} cut	1607	97.87 ± 0.36
COT hits cut	1642	100.00 ± 0.00
d_0 cut	1638	99.76 ± 0.12
Isolation cut	1593	97.02 ± 0.42
Δx_{CMX} cut	1632	99.39 ± 0.19
All above cuts	1516	92.33 ± 0.66
All cuts excl. isol.	1558	94.88 ± 0.54
Sliding isol. cut	1599	97.38 ± 0.39
All cuts (sliding isol.)	1521	92.63 ± 0.64
χ^2 cut	1642	100.00 ± 0.00
All cuts (χ^2)	1516	92.33 ± 0.66
All track cuts	1523	92.75 ± 0.64
All trk cuts excl. isol.	1565	95.31 ± 0.52

TABLE II: Dataset bhmumi-1: Muon ID efficiencies for CMX

		Efficiency (%)			
		bhmu0d	bhmu0h	bhmu0i	bhmu0i2
CMUP	All above cuts	91.03 ± 0.40	91.09 ± 0.36	89.84 ± 0.47	89.53 ± 0.58
	All cuts excl. isol.	92.93 ± 0.36	93.51 ± 0.31	92.73 ± 0.41	92.34 ± 0.51
CMX	All above cuts	93.52 ± 0.49	91.75 ± 0.44	92.27 ± 0.52	92.22 ± 0.66
	All cuts excl. isol.	95.21 ± 0.42	94.38 ± 0.36	94.23 ± 0.45	94.08 ± 0.58

ID Efficiencies MC (zewkcm)

Cut	Count	Efficiency (%)
No cut	59264	
E_{EM} cut	57021	96.22 ± 0.08
E_{HAD} cut	58264	98.31 ± 0.05
COT hits cut	59261	99.99 ± 0.00
d_0 cut	59185	99.87 ± 0.01
Isolation cut	57627	97.24 ± 0.07
Δx_{CMU} cut	59256	99.99 ± 0.00
Δx_{CMP} cut	58927	99.43 ± 0.03
All above cuts	54221	91.49 ± 0.11
All cuts excl. isol.	55673	93.94 ± 0.10
Sliding isol. cut	57877	97.66 ± 0.06
All cuts (sliding isol.)	54446	91.87 ± 0.11
χ^2 cut	59264	100.00 ± 0.00
All cuts (χ^2)	54221	91.49 ± 0.11
All track cuts	54532	92.02 ± 0.11
All trk cuts excl. isol.	55997	94.49 ± 0.09

TABLE I: Dataset zewkcm-1: Muon ID efficiencies for CMUP

Cut	Count	Efficiency (%)
No cut	37280	
E_{EM} cut	35907	96.32 ± 0.10
E_{HAD} cut	36488	97.88 ± 0.07
COT hits cut	37279	100.00 ± 0.00
d_0 cut	37235	99.88 ± 0.02
Isolation cut	36323	97.43 ± 0.08
Δx_{CMX} cut	37216	99.83 ± 0.02
All above cuts	34193	91.72 ± 0.14
All cuts excl. isol.	35041	93.99 ± 0.12
Sliding isol. cut	36465	97.81 ± 0.08
All cuts (sliding isol.)	34319	92.06 ± 0.14
χ^2 cut	37280	100.00 ± 0.00
All cuts (χ^2)	34193	91.72 ± 0.14
All track cuts	34253	91.88 ± 0.14
All trk cuts excl. isol.	35103	94.16 ± 0.12

TABLE II: Dataset zewkcm-1: Muon ID efficiencies for CMX

Period 9

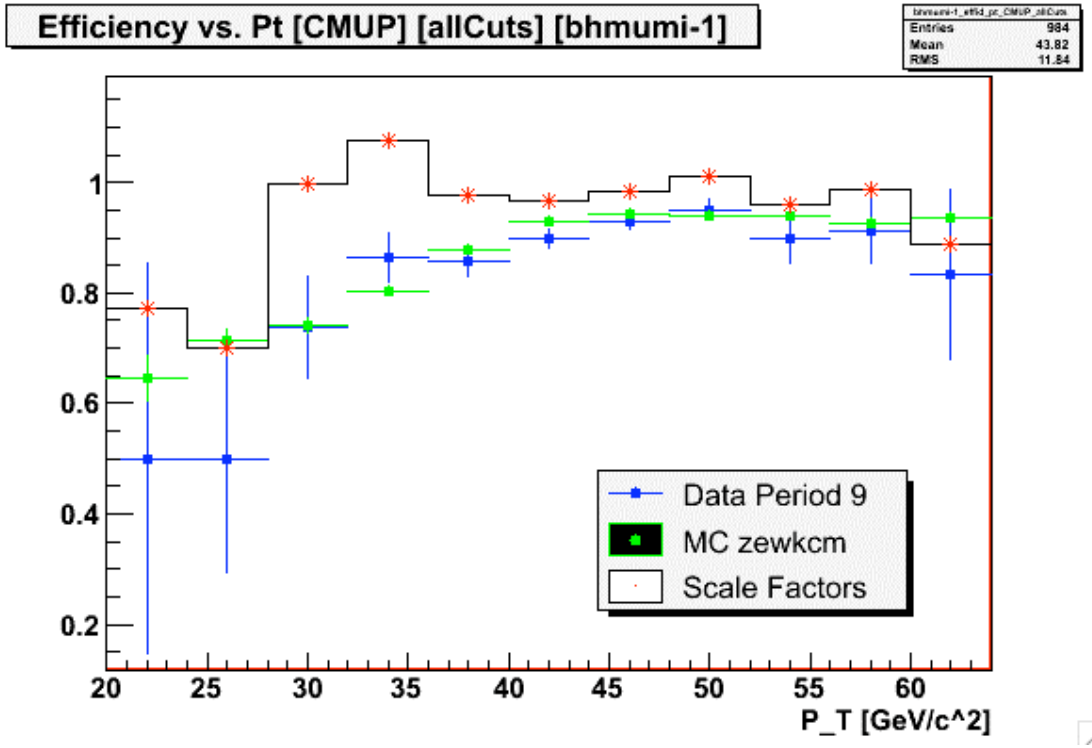
SF	CMUP	CMX
All Cuts	0.9882 ± 0.0062	0.9955 ± 0.0041
All Cuts excl isol	0.9908 ± 0.0052	1.0099 ± 0.0059

Period 8

	Factor	
Category	bhmu0i	bhmu0i2
CMUP	0.9753 ± 0.0052	0.9751 ± 0.0064
Excl. isol.	0.9854 ± 0.0044	0.9821 ± 0.0055
Sliding isol.	0.9804 ± 0.0050	0.9776 ± 0.0063
CMX	1.0012 ± 0.0057	1.0001 ± 0.0073
Excl. isol.	1.0010 ± 0.0049	0.9989 ± 0.0063
Sliding isol.	1.0020 ± 0.0056	1.0028 ± 0.0070

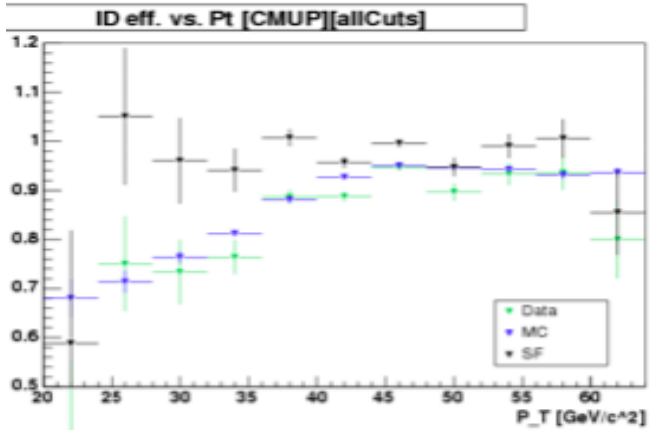
Muons: ID Efficiencies

CMUP



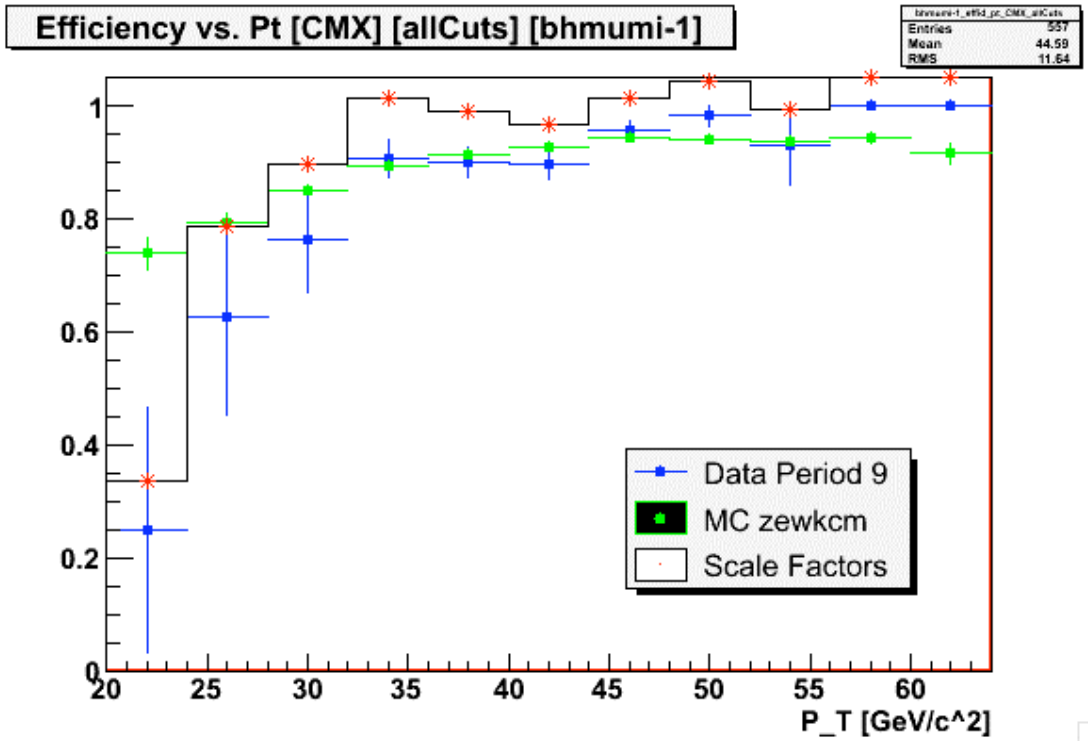
Period 9

Period 8



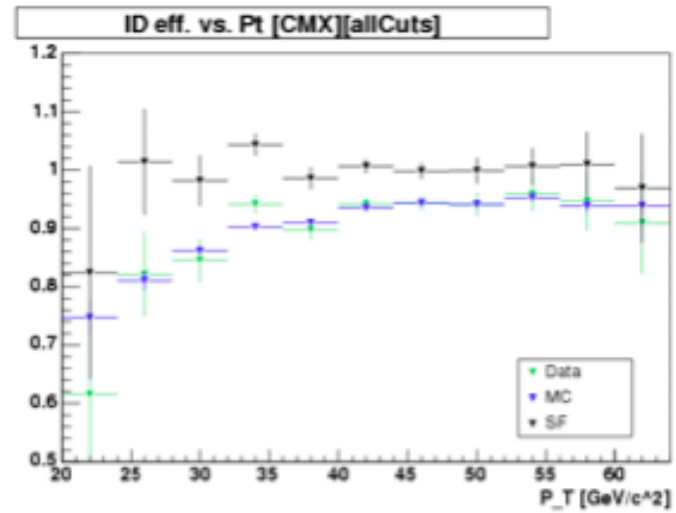
Muons: ID Efficiencies

CMX



Period 9

Period 8



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

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

Muons: Reconstruction Eff

Category	Fiducial	w/ Stub	Efficiency (%)
CMUP	2930	2717	92.73 ± 0.48
CMX	1680	1597	95.06 ± 0.53
CMX Arches	1322	1296	98.03 ± 0.38
CMX Miniskirt	296	243	82.09 ± 2.23
CMX Keystone	62	58	93.55 ± 3.12
CMU-only	728	652	89.56 ± 1.13
CMP-only	743	674	90.71 ± 1.06

TABLE X: Dataset bhmumi-1: Muon reconstruction efficiencies

	Efficiency (%)			
Category	bhmu0d	bhmu0h	bhmu0i	bhmu0i2
CMUP	92.71 ± 0.35	91.63 ± 0.34	91.78 ± 0.42	93.04 ± 0.47
CMX	99.36 ± 0.16	97.47 ± 0.25	97.39 ± 0.31	96.67 ± 0.44
Arches	99.36 ± 0.16	99.07 ± 0.18	98.68 ± 0.25	98.91 ± 0.29
Miniskirt		92.57 ± 0.94	92.62 ± 1.18	87.96 ± 1.81
Keystone		91.67 ± 2.13	94.50 ± 2.18	95.77 ± 2.39

Category	Scale Factor
CMUP	0.9518 ± 0.0050
CMX	0.9537 ± 0.0053
CMX Arches	0.9822 ± 0.0039
CMX Miniskirt	0.8265 ± 0.0225
CMX Keystone	0.9478 ± 0.0317
CMU-only	0.9173 ± 0.0117
CMP-only	0.9234 ± 0.0108
CMX MiniKey	0.8475 ± 0.0196

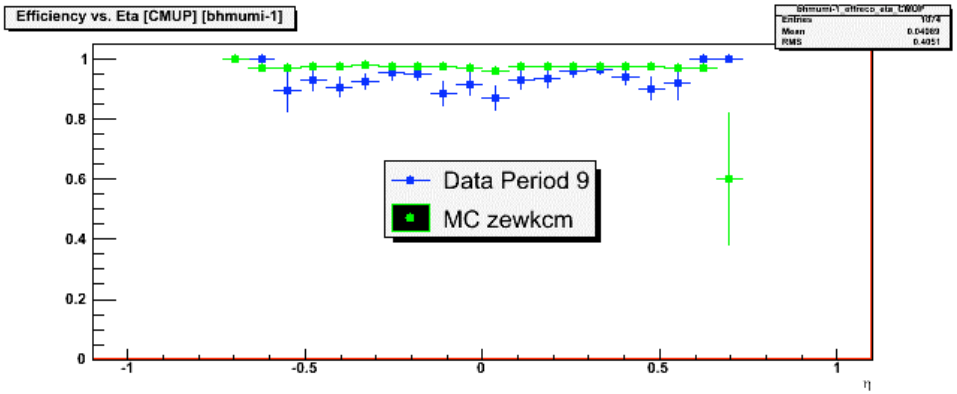
Category	Fiducial	w/ Stub	Efficiency (%)
CMUP	58947	57426	97.42 ± 0.07
CMX	36213	36086	99.65 ± 0.03
CMX Arches	27747	27692	99.80 ± 0.03
CMX Miniskirt	6853	6802	99.26 ± 0.10
CMX Keystone	1613	1592	98.70 ± 0.28
CMU-only	13547	13225	97.62 ± 0.13
CMP-only	16909	16631	98.36 ± 0.10

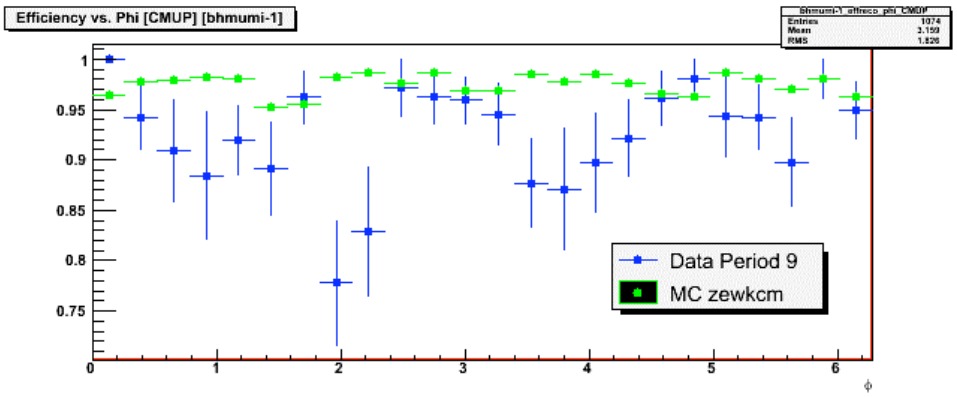
TABLE X: Dataset zewkcm-1: Muon reconstruction efficiencies

	Efficiency (%)		
Category	zewkam	zewk9m	zewkbm
CMUP	97.53 ± 0.05	97.57 ± 0.03	97.43 ± 0.06
CMX	99.81 ± 0.02	99.61 ± 0.02	99.62 ± 0.03
Arches	99.84 ± 0.02	99.79 ± 0.02	99.80 ± 0.03
Miniskirt		99.06 ± 0.06	99.07 ± 0.12
Keystone		98.99 ± 0.13	98.90 ± 0.26

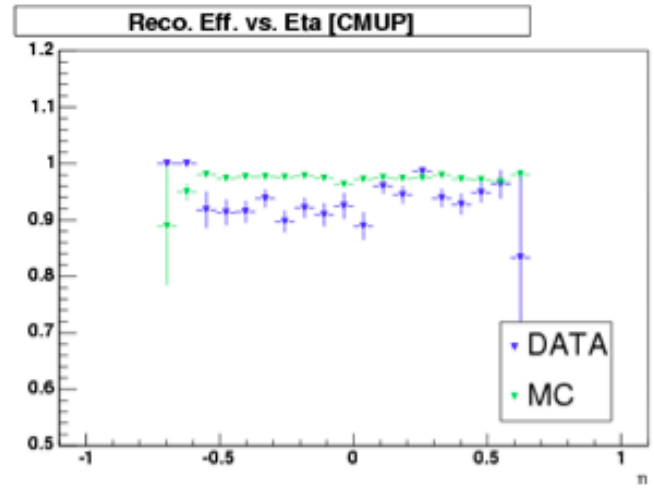
Muons: Reconstruction Eff

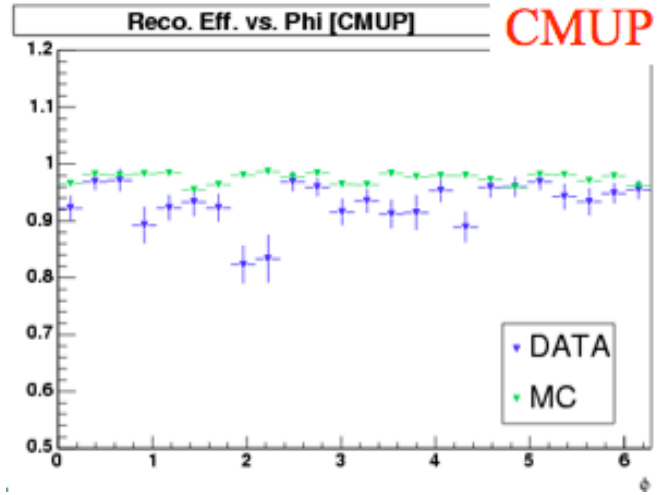
Period 9





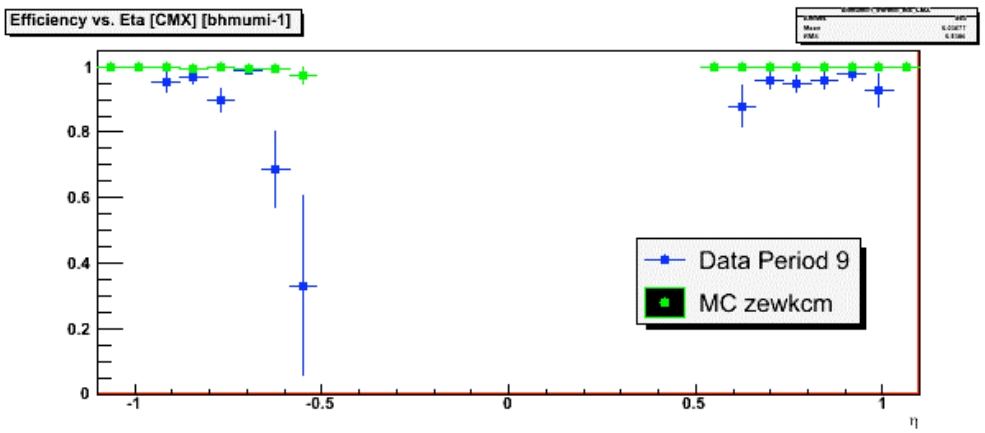
Period 8

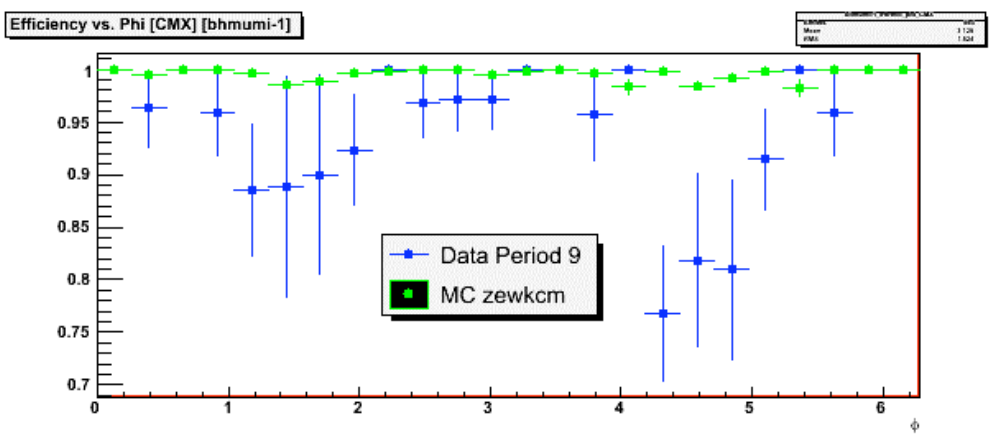




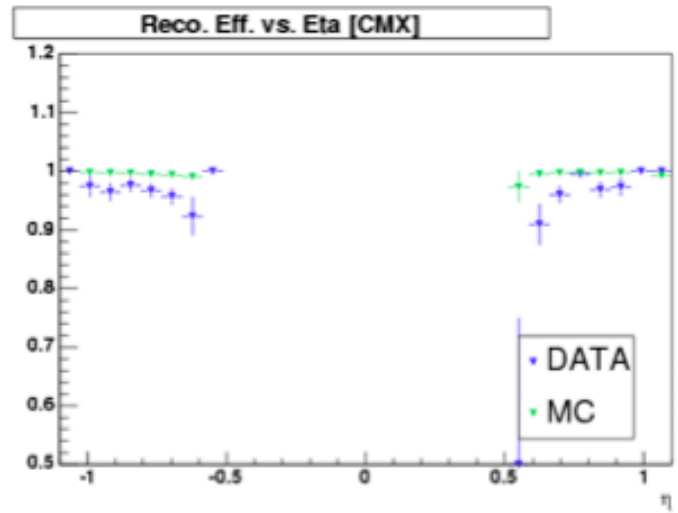
Muons: Reconstruction Eff

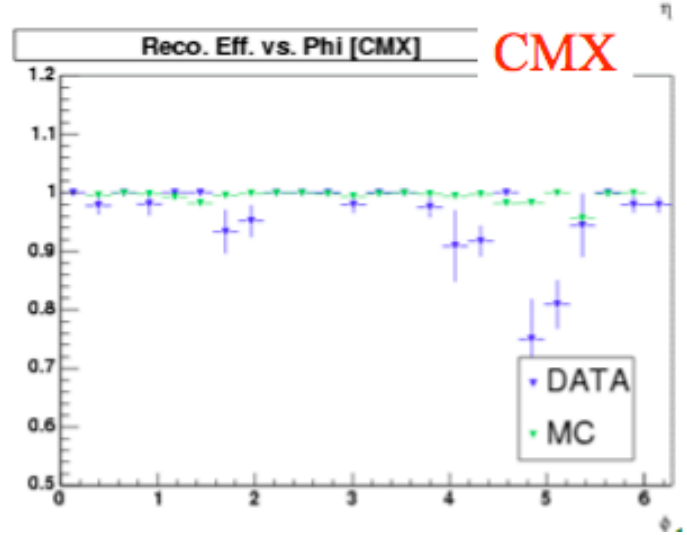
Period 9





Period 8





Reco/ID overall efficiency

Category	Scale Factor	
CMUP	all	0.9406 ± 0.0077
CMUP	excliso	0.9431 ± 0.0070
CMUP	sliso	0.9472 ± 0.0075
CMX	all	0.9603 ± 0.0088
CMX	excliso	0.9632 ± 0.0078
CMX	sliso	0.9600 ± 0.0087
CMX Arches	all	0.9917 ± 0.0088
CMX Arches	excliso	0.9971 ± 0.0073
CMX Arches	sliso	0.9913 ± 0.0086
CMX Miniskirt	all	0.8282 ± 0.0276
CMX Miniskirt	excliso	0.8185 ± 0.0265
CMX Miniskirt	sliso	0.8256 ± 0.0275
CMX Keystone	all	0.9160 ± 0.0527
CMX Keystone	excliso	0.9249 ± 0.0474
CMX Keystone	sliso	0.9278 ± 0.0505
CMU-only	all	0.9075 ± 0.0163
CMU-only	excliso	0.9105 ± 0.0151
CMU-only	sliso	0.9147 ± 0.0159
CMP-only	all	0.9139 ± 0.0148
CMP-only	excliso	0.9200 ± 0.0133
CMP-only	sliso	0.9236 ± 0.0143
CMX Mini/Key	all	0.8434 ± 0.0246
CMX Mini/Key	excliso	0.8370 ± 0.0235
CMX Mini/Key	sliso	0.8433 ± 0.0244

Conclusions

- We have calculated Trigger/ID/Reco Efficiencies for high Pt muons for Period 9 data
  - Major trigger changes for CMX
    - Trigger efficiency redefined and recalculated
    - Next time we will present also L2 efficiencies
  - ID/Reco ok

Code to retrieve the trigger info

Outside the even loop

```
if(dataFlag){
      mytool->GetTriggerBitL3("MUON_CMX18_LUMI",
                              "MUON_CMX18_L2_LOOSE_LUMI",
                              "MUON_CMX18_&_JET",
                              chain, evtA,trnmA,"TrigOutput");
   }
```

Inside the event loop:

```
if(dataFlag){
    L3_CMUP0 = (((mytrigInfo->summaryWord >> 1) & 0x1) == 1);
    L3_CMUP1 = (((mytrigInfo->summaryWord >> 1) & 0x1) == 1);
    L3_CMUP2 = (((mytrigInfo->summaryWord >> 1) & 0x1) == 1);

    fired_cmx0 = mytool->testTriggerBitL3(event->runNumber,mytrigInfo,0);
    L3_CMX0  = fired_cmx0;
    fired_cmx1 = mytool->testTriggerBitL3(event->runNumber,mytrigInfo,1);
    L3_CMX1  = fired_cmx1;
    fired_cmx2 = mytool->testTriggerBitL3(event->runNumber,mytrigInfo,2);
    L3_CMX2  = fired_cmx2;

   }
```

Code (cont'd)

```
if(event->runNumber < CMX_FIRST_RUN)
                          {L3_CMX0 = false;L3_CMX1 = false ;L3_CMX2 = false;}

// Three different runs for the following conditions

 if ( event->runNumber > 226194 && event->runNumber!= 226336 && event->runNumber!=227723
    && event->runNumber!=227884) {
// SLAM trigger
    L3_CMX = L3_CMX0; // MUON_CMX18_LUMI_250_v-1
    L3_CMUP = L3_CMUP0;

// NO SLAM trigger
    L3_CMX = L3_CMX1; // MUON_CMX18_L2_LOOSE_LUMI_200_v-1
    L3_CMUP = L3_CMUP1;

// jet trigger
       if ( nAllJet > 0 && AllJet[0]->Et > 15) {
          L3_CMX = L3_CMX2; // MUON_CMX18_&_JET
          L3_CMUP = L3_CMUP2;
       } // if ( nAllJet > 0 && AllJet[0]->Et > 15)

    } // if ( event->runNumber > 226194 )
```