Baseline muon selections for Run-I

WARNING! This page refers to Run-1 recommendations!
For up-to-date instructions on Run-2 muon ID definitions
and software, please refer to this page.

Contents:

This page contains the description of a few baseline muon selections recommended by the muon POG and currently recommended working points for muon isolation. Corresponding efficiency measurements can be found on MuonReferenceEffs twiki.

Recommendations for **muon momentum assignment** are summarized in MuonReferenceResolution.

The selections described here assume to start from the basic object `reco::Muon` or `pat::Muon`, which have equivalent functionalities.

Baseline muon selections for 2012 data (CMSSW 52X and above)

From `CMSSW_5_3_10` all the standard muon IDs are available as boolean selectors, as described HERE. The most widely used selections are the Loose and the Tight ID. Both of them are using the Particle-Flow event description. Please start considering these two options if your analysis makes use of the Particle-Flow algorithm.

Loose Muon

```
bool muon::isLooseMuon (const reco::Muon & recoMu);
```

Particle identified as a muon by the Particle Flow event reconstruction. Studied in MUO-10-004.

Plain-text description	Technical description	Comments
Particle-Flow muon id	`recoMu.isPFMuon()`	Can be complemented by muon quality cuts similar to those used in the Tight Muon selection.
Is Global OR Tracker Muon	`recoMu.isGlobalMuon() || recoMu.isTrackerMuon()`	Avoid using muons which are only Standalone Muons. (~0.01% of PF muons)

Note: For multi-muon analysis the Loose Muon id should be complemented with a DeltaR cut between the muon pairs (DeltaR<0.02) in order to suppress contribution from split tracks. (See details on G. Petrucciani's talk)

Soft Muon

New Version (*recommended*)

Developed in BPH. For more details, see I. Krätschmer's talk.

Please consider this option ONLY if you do not make use of the Particle-Flow event description in your analysis. In case you do, start from the Loose ID and then evaluate possible further quality cuts.

WARNING: please note that the boolean selector muon::isSoftMuon(...) should **not** be used for CMSSW versions before CMSSW_5_3_28 (nor in any other release series prior to CMSSW_7_2_5 or CMSSW_7_3_0), since an old and deprecated selection is implemented then. For any analysis based on CMSSW versions prior to CMSSW_5_3_28 , please use the list of cuts below instead.

Plain-text description	Technical description	Comments
Tracker track matched with at least one muon segment (in any station) in both X and Y coordinates (< 3σ) (`TMOneStationTight`) and arbitrated	`muon::isGoodMuon(recoMu, TMOneStationTight)`	Loose requirement, which can be tightened further (e.g., by requiring at least two matched segments) if needed
Cut on number of tracker layers with hits > 5	`recoMu.innerTrack()->hitPattern().trackerLayersWithMeasurement() > 5`	To guarantee a good p_T measurement, for which some minimal number of measurement points in the tracker is needed. Also suppresses muons from decays in flight.
Number of pixel layers > 0	`recoMu.innerTrack()->hitPattern().pixelLayersWithMeasurement() > 0`	To further suppress muons from decays in flight.
Track high-purity flag	`recoMu.innerTrack()->quality(reco::TrackBase::highPurity)`	Rejects bad quality tracks, basically just few outliers
Loose transverse and longitudinal impact parameter cuts, d_{xy} < 0.3 cm and d_z < 20 cm w.r.t. the primary vertex	`fabs(recoMu.innerTrack()->dxy(vertex->position())) < 0.3 && fabs(recoMu.innerTrack()->dz(vertex->position())) < 20.`	Loose compatibility with the PV or rather with the beamspot

Old Version (*deprecated*)

```
bool muon::isSoftMuon(const reco::Muon & recoMu, const reco::Vertex & vtx);
```

Tight Muon

```
bool muon::isTightMuon(const reco::Muon & recoMu, const reco::Vertex & vtx);
```

Global muon with additional muon quality requirements. Studied in MUO-10-002 and MUO-10-004; widely used in physics analyses. Tight Muon ID selects a subset of the Particle-Flow muons.

Plain-text description	Technical description	Comments
The candidate is reconstructed as a Global Muon	`recoMu.isGlobalMuon()`	
Particle-Flow muon id	`recoMu.isPFMuon()`	the exclusive effect of this requirement is very small, i.e. PFMuon is keeping almost all Tight Muons without this cut
χ^2/ndof of the global-muon track fit < 10	`recoMu.globalTrack()->normalizedChi2() < 10.`	To suppress hadronic punch-through and muons from decays in flight (see CMS AN 2008/098). This cut might need to be re-tuned due to the change to fully segment based global fit in 50X releases and later. It will need a retuning when muon APEs will be activated in the global track fit.
At least one muon chamber hit included in the global-muon track fit	`recoMu.globalTrack()->hitPattern().numberOfValidMuonHits() > 0`	To suppress hadronic punch-through and muons from decays in flight.
Muon segments in at least two muon stations This implies that the muon is also an arbitrated tracker muon, see SWGuideTrackerMuons	`recoMu.numberOfMatchedStations() > 1`	To suppress punch-through and accidental track-to-segment matches. Also makes selection consistent with the logic of the muon trigger, which requires segments in at least two muon stations to obtain a meaningful estimate of the muon p_T.
Its tracker track has transverse impact parameter d_{xy} < 2 mm w.r.t. the primary vertex	`fabs(recoMu.muonBestTrack()->dxy(vertex->position())) < 0.2` Or `dB() < 0.2` on `pat::Muon` [1]	To suppress cosmic muons and further suppress muons from decays in flight (see CMS AN 2008/098). The 2 mm cut preserves efficiency for muons from decays of b and c hadrons. It is a loose cut and can be tightened further with minimal loss of efficiency for prompt muons if background from cosmic muons is an issue. Another way to obtain a better cosmic-ray suppression is to complement the d_{xy} cut with a cut on the opening angle α or use a dedicated cosmic-id algorithm (see Section 7.1 of MUO-10-004). innerTrack() is also supported for dxy cut, as the performance of the two is very close.
The longitudinal distance of the tracker track wrt. the primary vertex is d_z < 5 mm	`fabs(recoMu.muonBestTrack()->dz(vertex->position())) < 0.5`	Loose cut to further suppress cosmic muons, muons from decays in flight and tracks from PU. innerTrack() is also supported for dz cut, as the performance of the two is very close.
Number of pixel hits > 0	`recoMu.innerTrack()->hitPattern().numberOfValidPixelHits() > 0`	To further suppress muons from decays in flight.
Cut on number of tracker layers with hits >5	`recoMu.innerTrack()->hitPattern().trackerLayersWithMeasurement() > 5`	To guarantee a good p_T measurement, for which some minimal number of measurement

		points in the tracker is needed. Also suppresses muons from decays in flight.

- [1] The most accurate way of computing this value is by using IPTools (example). The `dB()` method of the `pat::Muon` uses the version in IPTools, so there are tiny differences between the values returned by `dxy(vertex->position())` and `dB()`.

To further suppress muons from decays in flight, a cut on kink finder χ^2/ndof<20 is a good option. It is a loose cut with efficiency close to 100% and DIF rejection about 5%. For more details see talk by G. Petrucciani in muon POG. This cut is considered to become part of Tight Muon in summer. Feedback from its use is appreciated.

HighPT Muon

This selection does not use the Particle Flow algorithm. It is aimed to the best reconstruction of the muon track parameters for high-pt muons (pT > 200 GeV) without relying on external informations on the event. In this high-pt region the muon detectors can improve the momentum resolution of the inner tracker. Please consider this option ONLY if you do not use the Particle Flow event description in your analysis. If you do, start from the Loose (or Tight) ID and then evaluate possible addition (or removal) of further quality cuts . The best possible pt assignment as obtained from the (new) TuneP can be used anyway independently of the adopted selection.

New HighPT Version (*recommended*)

```
bool muon::isHighPtMuon(const reco::Muon & recoMu, const reco::Vertex & vtx);
bool muon::isHighPtMuon(const reco::Muon & recoMu, const reco::Vertex & vtx, muon::TunePType = muon::improvedTuneP);
```

WARNING: the HighPt selector uses by default the new Tune P momentum assignment. The last (optional) parameter: `enum TunePType{defaultTuneP, improvedTuneP}` is used to choose between old and new Tune P, but it defaults to new Tune P. To have access to the best muon track determined by the new Tune P algorithm you can use the function:

```
reco::TrackRef muon::improvedMuonBestTrack(const reco::Muon & recoMu, muon::improvedTuneP);
```

Please pay attention that `reco::Muon::muonBestTrack()` will continue to give the best track determined by the OLD Tune P, as the other methods retrieving the kinematical variables like `reco::Muon::p4()`, `reco::Muon::pt()`, etc... Hence when you use the New Tune P and the New HighPt Muon selector you have to obtain the muon momentum from the correct muon track by the `improvedMuonBestTrack` method.

The above code is EQUIVALENT to the recipe which has been existing since quite some time and is given here below.

The updated version of the muon momentum assignment logic (i.e. new Tune P) is available starting from CMSSW_5_3_6_patch1 and CMSSW_5_3_7 (backports to 5XY and 44X are also available, see below). Thanks to internal rejection of misreconstructed tracks based on dpT/pT this has much improved handling of momentum misassignment, which makes it possible to loosen the cut on tracker layers to 5, which is the value used in the Tight muon ID.

To use the new version of TuneP you have to follow these steps:

1. Either run CMSSW_5_3_6_patch1 (or newer) or if you need to keep using an older CMSSW_5XY version check out `V09-04-03-02 DataFormats/MuonReco` (if you have problems getting CMSSW to compile please do also `addpkg RecoMuon/MuonIdentification`).
2. `#include "DataFormats/MuonReco/interface/MuonCocktails.h"` add this to your analysis code
3. `reco::TrackRef cktTrack = (muon::tevOptimized(*recoMu, 200, 17., 40., 0.25)).first;` call to get the optimal muon track
4. `cktTrack->pt()` - to get the pT of the muon.

Running in CMSSW_44X requires two small modifications to the above procedure:

1. The code to check out is `V09-01-05-01 DataFormats/MuonReco`.
2. the call to the tevOptimized function should be `reco::TrackRef cktTrack = (muon::tevOptimized(*recoMu, 200, 30., 0., 0.25));`.

Then you can apply the new HighPT ID, which still differs from Tight Muon selection in the following points:

- The Particle-Flow muon id is not required
- The cut χ^2/ndof of the global-muon track fit < 10 is not applied
- An additional requirement of dpT/pTfor the track used for momentum determination is applied, i.e. `cktTrack->ptError()/cktTrack->pt()<0.3`
- The cuts applied on `recoMu.muonBestTrack` (impact parameter cuts) need to be applied to `cktTrack` since this is the new best track now.

About the `tevOptimized` function istelf: The modified TuneP algorithm adds track selection based on track dpT/pT, the threshold for this cut is controlled by the last (fifth) parameter of `muon::tevOptimized`. *This parameter is only present in the new version of the code.* The recommended value is 0.25. Passing a value of -1 will switch the dpT/pT cut off altogether, effectively reverting to the old version of TuneP. Parameters #3 and #4 are thresholds for switching between track fits in the TuneP logic. In CMSSW_53X the default values of the parameters are `muon::tevOptimized(*recoMu, 200, 4., 6., -1.)`, which exactly reproduces the old behavior of the algorithm, 4 and 6 are the old thresholds.

Old HighPT Version (*deprecated*)

```
bool muon::isHighPtMuon(const reco::Muon & recoMu, const reco::Vertex & vtx, muon::TunePType = muon::defaultTuneP);
```

The old HighPT Muon selection differs from the Tight Muon selection in 3 points:

- The Particle-Flow muon id is not required
- The cut χ^2/ndof of the global-muon track fit < 10 is not applied
- The cut `track()->hitPattern().trackerLayersWithMeasurement() > 8` is applied in order to suppress muons with largely mis-measured pT
  - this cut is known to introduce inefficiency of about 5% due to tracking changes in CMSSW 52X. Please switch to the new HighPT definition in which the efficiency loss is recovered.

Muon Isolation

Recommended working points:

Algorithm	Type	Expression	PU correction	Cone size (ΔR)	Tight cut	Loose cut
Subdetector based	Tracker relative	$(\sum p_T(TRK))/p_T$	none	0.3	0.05	0.10
PF based	Combined relative	$(\sum E_T$(chHad from PV)$+\sum E_T$(neutHad)$+\sum E_T$(photons))$/p_T$	Reference correction using DeltaB corrections (for reference see here)	0.4	0.12	0.20
PF based	MVA	converging on set of variables				

Accessing PF Isolation from reco::Muon

- The PF based isolation can be accessed by the reco::Muon using the following methods

```
const MuonPFIsolation& pfIsolationR03() ///Cone of 0.3
const MuonPFIsolation& pfIsolationR04() /// Cone of 0.4-Suggested
```

  The MuonPFIsolation struct includes the following members:
  - sumChargedHadronPt: Sum Pt of the charged Hadrons
  - sumChargedParticlePt: Sum Pt of all charged particles (including PF electrons and muons). Not suggested for cases like H->WW /ZZ where two muons can fall in the same cone
  - sumNeutralHadronEt: Sum Et of the neutral hadrons
  - sumPhotonEt: Sum Et of PF photonds
  - sumNeutralHadronEtHighThreshold: Sum of the neutral hadron Et with a higher threshold for the candidates(1 GeV instead of 0.5)
  - sumPhotonEtHighThreshold: Sum of the PF photons Et with higher threshold (1 GeV instead of 0.5)
  - sumPUPt; Sum Pt of the charged particles in the cone of interest but with particles not originating from the primary vertex(for PU corrections)

- **Proposed Configuration(DeltaBeta corrections)at cone of 0.4: I = [sumChargedHadronPt+ max(0.,sumNeutralHadronPt+sumPhotonPt-0.5sumPUPt]/pt**
  - The factor 0.5 corresponds to a naive average of neutral to charged particles and it has been measured in jets in PFT-10-002 etc. See also this talk by M. Bachtis at the Muon POG
  - Reference efficiency measurements will be provided for this definition of PFIsoCorr.

- **Alternatively, for analysis using rho correction, Effective Areas are also provided using following prescription**:
  - Correction to be done as PFIsoCorr = PF(ChHad PFNoPU) + Max ((PF(Nh+Ph) - ρ'EACombined),0.0)) where ρ'=max(ρ,0.0) and with a 0.5 GeV threshold on neutrals
  - Rho is neutral rho, defined in full tracker acceptance, with a 0.5 GeV threshold on neutrals. This can be taken, starting from 50X, from the event directly (double_kt6PFJetsCentralNeutral_rho_RECO.obj) For its exact definition see [2].
  - Values of Effective Areas EACombined are provided in this link, page 9 (see PF Combined Column, DeltaR >0/4)
  - [2] kt6PFJetsCentralNeutral = kt6PFJets.clone(src = cms.InputTag("pfAllNeutralHadronsAndPhotons"), Ghost_EtaMax = cms.double(3.1), Rho_EtaMax = cms.double(2.5), inputEtMin = cms.double(0.5))

Along with EGM POG we do not intend to support subdetector based combined relative isolation anymore since it has in general worse performance than PF based combined relative isolation (see e.g. MUO-10-004) and is less convenient to use (PU corrections, lepton subtraction).

Basline muon selections for 2011 data (CMSSW 44X and below)

Tight Muon selection

Global muon with additional muon quality reqirements. Studied in MUO-10-002 and MUO-10-004; widely used in physics analyses. Starting from 50X release this set of selection is into an omni-comprehensive selector in `DataFormats/MuonReco/interface/MuonSelectors.h`

Plain-text description	Technical description	Comments
The candidate is reconstructed as a Global Muon	`recoMu.isGlobalMuon()`	Requiring that this muon is also PF muon leads to PFTight selection
χ^2/ndof of the global-muon track fit < 10	`recoMu.globalTrack()->normalizedChi2() < 10.`	To suppress hadronic punch-through and muons from decays in flight (see CMS AN 2008/098). As showering muons typically have larger χ^2/ndof (see Section 2.4.1 of CMS AN 2011/278), this cut should be loosened or dropped for high-p_T muons.
At least one muon chamber hit included in the global-muon track fit	`recoMu.globalTrack()->hitPattern().numberOfValidMuonHits() > 0`	To suppress hadronic punch-through and muons from decays in flight [1].
Muon segments in at least two muon stations This implies that the muon is also an arbitrated tracker muon, see SWGuideTrackerMuons	`recoMu.numberOfMatchedStations() > 1`	To suppress punch-through and accidental track-to-segment matches. Also makes selection consistent with the logic of the muon trigger, which requires segments in at least two muon stations to obtain a meaningful estimate of the muon p_T.
Its tracker track has transverse impact parameter d_{xy} < 2 mm w.r.t. the primary vertex [2]	`fabs(recoMu.innerTrack()->dxy(vertex->position())) < 0.2` Or `dB() < 0.2` on `pat::Muon` [3]	To suppress cosmic muons and further suppress muons from decays in flight (see CMS AN 2008/098). The 2 mm cut preserves efficiency for muons from decays of b and c hadrons. It is a loose cut and can be tightened further with minimal loss of efficiency for prompt muons if background from cosmic muons is an issue. Another way to obtain a better cosmic-ray suppression is to complement the d_{xy} cut with a cut on the opening angle α or use a dedicated cosmic-id algorithm (see Section 7.1 of MUO-10-004).
Number of pixel hits > 0	`recoMu.innerTrack()->hitPattern().numberOfValidPixelHits() > 0`	To further suppress muons from decays in flight.
Number of tracker layers with hits > 8 [4]	`track()->hitPattern().trackerLayersWithMeasurement() > 8`	To guarantee a good p_T measurement, for which some minimal number of measurement points in the tracker is needed. Also suppresses muons from decays in flight.

- [1] The combination of this and above two requirements is implemented in the `reco::Muon` as `GlobalMuonPromptTight` selector, which is returned by `muon::isGoodMuon(recoMu, GlobalMuonPromptTight)`. More details can be found in the WorkBook section on muon identification.
- [2] Some analyses use the cut w.r.t. the beam spot position. Since the 2 mm cut is very loose, this makes no difference.
- [3] To be pedantic, the most accurate way of computing this value is by using ÏPTools (example). The `dB()` method of the `pat::Muon` uses the version in ÏPTools, so there are tiny differences between the values returned by `dxy(vertex->position())` and `dB()`.
- [4] The older version of this cut is `recoMu.innerTrack()->hitPattern().numberOfValidTrackerHits() > 10` and is also supported to ease the transition:
  - the cut on Nlayers > 8 has almost the same efficiency as the cut on Nhits > 10,
  - at the same time, it gives a better rejection of muons with grossly mismeasured p_T: e.g., the fraction of simulated 50 GeV muons reconstructed with p_T > 100 GeV drops by a factor of 2 compared with the cut on Nhits > 10.
    For details, see talks by C. Jarvis at the muon POG meetings on June 16, 2011 and Sept. 5, 2011.

OLD Soft Muon selection (being phased out)

Tracker muon with additional requirements. Studied in MUO-10-002 and MUO-10-004. Has efficiency higher than that of global muons at low (< 10 GeV) p_T and for muons having other muons in the vicinity (e.g., muons from J/ψ decays and hypothetical collimated muons); as a result, used in B physics analyses and some searches conducted in Exotica group.

Plain-text description	Technical description	Comments
Tracker track matched with at least one muon segment (in any station) in both X and Y coordinates (< 3σ) (`TMOneStationTight`) and arbitrated	`muon::isGoodMuon(recoMu, TMOneStationTight)`	Loose requirement, which can be tightened further (e.g., by requiring at least two matched segments) if needed

A large number of other selectors for tracker muons is available, see SWGuideTrackerMuons. A systematic study of signal efficiency vs background rejection given by these selectors is very welcome.

Soft Muon selection (NEW)

Developed in BPH, represents the old Soft Muon selection plus additional quality cuts.

Plain-text description	Technical description	Comments
Tracker track matched with at least one muon segment (in any station) in both X and Y coordinates (< 3σ) (`TMOneStationTight`) and arbitrated	`muon::isGoodMuon(recoMu, TMOneStationTight)`	Loose requirement, which can be tightened further (e.g., by requiring at least two matched segments) if needed
Number of hits in the tracker > 10	`recoMu.innerTrack()->hitPattern().numberOfValidTrackerHits() > 10`	To guarantee a good p_T measurement, for which some minimal number of measurement points in the tracker is needed. Also suppresses muons from decays in flight.
Number of pixel layers > 1	`recoMu.innerTrack()->hitPattern().pixelLayersWithMeasurement() > 1`	To further suppress muons from decays in flight.
χ^2/ndof of the tracker-muon track fit < 1.8	`recoMu.innerTrack()->normalizedChi2() < 1.8`	To suppress hadronic punch-through and muons from decays in flight
Loose transverse and longitudinal impact parameter cuts, d_{xy} < 3 cm and d_z < 30 cm w.r.t. the primary vertex	`fabs(recoMu.innerTrack()->dxy(vertex->position())) < 3.` && `fabs(recoMu.innerTrack()->dz(vertex->position())) < 30.`	To further suppress muons from decays in flight.

More details can be found at .

Particle-Flow Muon selection

Particle identified as a muon by the particle-flow event reconstruction. Studied in MUO-10-004. Used typically for muons in jets, without applying isolation criteria.

Plain-text description	Technical description	Comments
Particle-Flow muons out-of-the-box	PFCandidate that has `pdgId = ±13` and `muonRef()` pointing to this muon Starting from CMSSW_4_4_0, can be accessed via `isPFMuon()` flag implemented in `reco::Muon`	Can be complemented by muon quality cuts similar to those used in the Tight Muon selection by accessing the muonRef() in reco or by using PAT

Muon Isolation

Recommended working points based on studies for MUO-10-004:

Algorithm	Type	Expression	Pile Up Correction	Cone size (ΔR)	Tight cut	Loose cut
Subdetector based	Combined relative	$(\sum p_T(TRK)+\sum E_T(ECAL)+\sum E_T(HCAL))/p_T$	None	0.3	0.10	0.15
Subdetector based	Tracker relative	$(\sum p_T(TRK))/p_T$	None	0.3	0.05	0.10
PF based	Combined relative	$(\sum E_T$(chHad from PV)$+\sum E_T$(neutHad)$+\sum E_T$(photons))$/p_T$	Reference correction using DeltaB (for reference see here)	0.4	0.12	0.20

Accessing PF Isolation from reco::Muon(starting 44X)

- The PF based isolation can be accessed by the reco::Muon using the following methods

```
const MuonPFIsolation& pfIsolationR03() ///Cone of 0.3
const MuonPFIsolation& pfIsolationR04() /// Cone of 0.4-Suggested
```

  The MuonPFIsolation struct includes the following members:
  - sumChargedHadronPt: Sum Pt of the charged Hadrons
  - sumChargedParticlePt: Sum Pt of all charged particles (including PF electrons and muons). Not suggested for cases like H->WW /ZZ where two muons can fall in the same cone
  - sumNeutralHadronEt: Sum Et of the neutral hadrons
  - sumPhotonEt: Sum Et of PF photonds
  - sumNeutralHadronEtHighThreshold: Sum of the neutral hadron Et with a higher threshold for the candidates(1 GeV instead of 0.5)
  - sumPhotonEtHighThreshold: Sum of the PF photons Et with higher threshold (1 GeV instead of 0.5)
  - sumPUPt; Sum Pt of the charged particles in the cone of interest but with particles not originating from the primary vertex(for PU corrections)

- **Proposed Configuration(DeltaBeta corrections)at cone of 0.4: I = [sumChargedHadronPt+ max(0.,sumNeutralHadronPt+sumPhotonPt-0.5sumPUPt]/pt**
  - The factor 0.5 corresponds to a naive average of neutral to charged particles and it has been measured in jets in PFT-10-002 etc.
  - Reference efficiency measurements will be provided for this definition of PFIsoCorr.

- **Alternatively, for analyses using rho correction, Effective Areas are also provided using following prescription**:
  - Correction to be done as PFIso = PF(ChHad PFNoPU) + Max ((PF(Nh+Ph) - ρ'EA),0.0)) where ρ'=max(ρ,0.0) and with a 0.5 GeV threshold on neutrals
  - Rho is full rho, based on charged plus neutral hadrons plus photons, defined in full tracker acceptance, without any threshold on neutrals. For its exact definition see [2].
  - Values of Effective Areas EA are provided in this link, page 11 (see PF Combined Column, DeltaR < 0.4)
  - [2] rho=process.kt6PFJets.clone(Rho_EtaMax = cms.double(2.5), Ghost_EtaMax = cms.double(2.5))

Accessing PF isolation in PAT in 42X (TBD)

The PF isolation is available in reco::Muon in 44X . For 42X the isolation deposits can be easily constructed in PAT level with the followign prescription(determining tagset+testing)

Contacts

- **Subgroup home page**: Muon POG
- **Conveners**: cms-pog-conveners-muo@cernSPAMNOT.ch
- **Hypernews forum**: hn-cms-muon@cern.ch

Review status

Reviewer/Editor and Date (copy from screen)	Comments

Responsible: MuonPOG
Last reviewed by: Most recent reviewer

I	Attachment	History	Action	Size	Date	Who	Comment
	eff_all.png	r1	manage	25.7 K	2011-10-26 - 15:58	SlavaValuev	Efficiencies for various cuts on Nhits and Nlayers, for 50 GeV simulated muons

Topic revision: r60 - 2015-06-26 - DanieleTrocino