L2-Muon Trigger Performance

Efficiency and Rejection

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- What is available in L2?
- Rejection
- L2-Mu versus Offline Muons
- What to expect in near future

An electronic copy of this presentation can be found in
`http://www-clued0.fnal.gov/~tim/l2/d0_munich_020411.ps`
and
`http://www-clued0.fnal.gov/~tim/l2/d0_munich_020411.pdf`

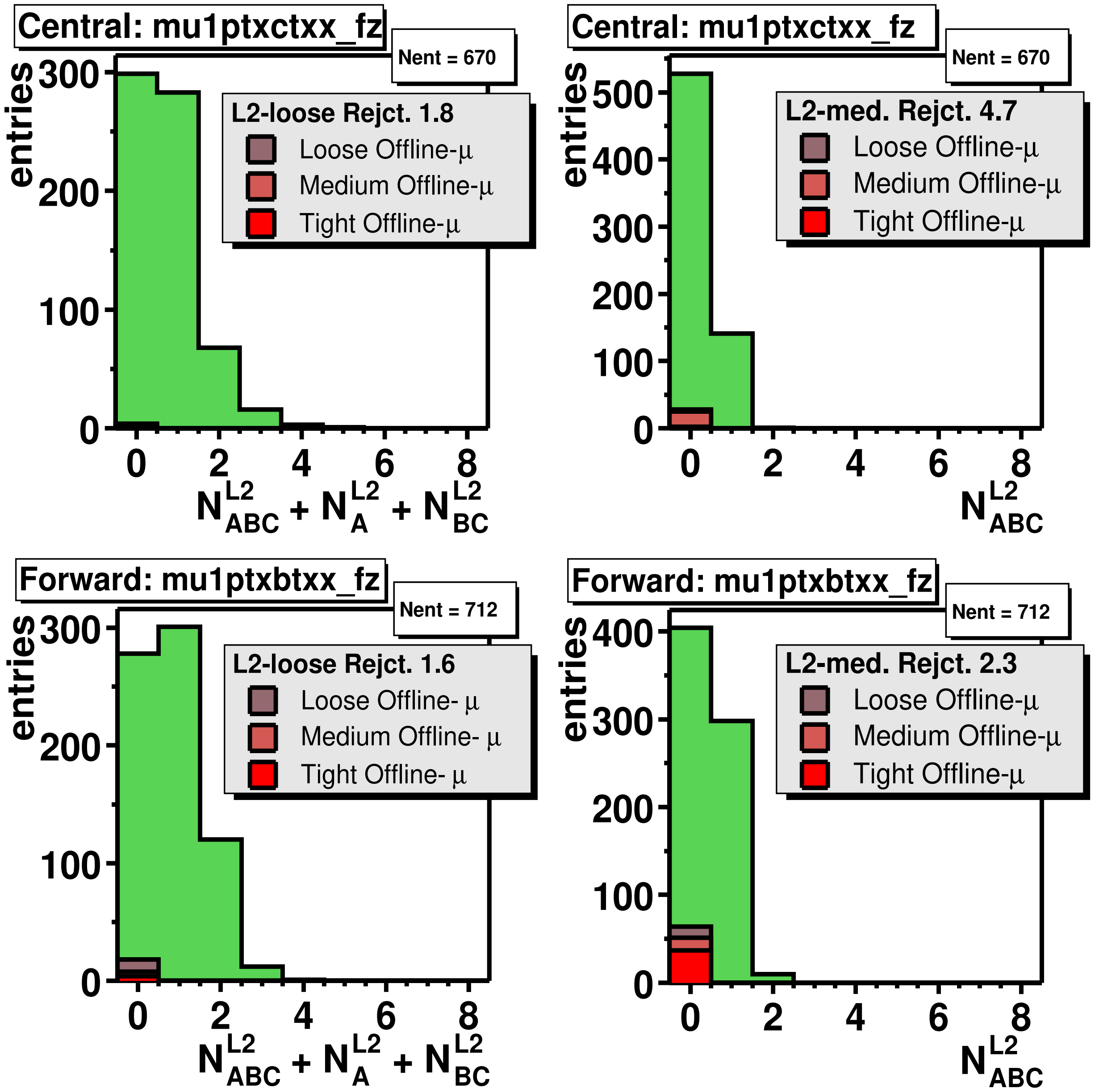
What is available in L2?

- L2-Online and L2-Offline for the 1^{st} time out of the box:
  Data taken with p11.**XX**.00
- L2-Muon workers (Central + forward) reliable, included in most runs
- L2-Muon performance is being thoroughly tested $\rightarrow$ better than pre-scaling
- L2-Global included in most Runs, fine-tuning, testing ...
- Latest tests: L2 rejected for the 1^{st} time with "random-reject" scripts
  (not only M&P) as well as physics scripts
- $\sim$ 1-2 weeks: run with beam: Physics scripts on L2-Global with real rejecion
  (probably simple μ-, EM- and jet-scripts)

Rejection in L2 I

Run 149852: 9335 events

For L1-triggered events: What did L2-μ find?

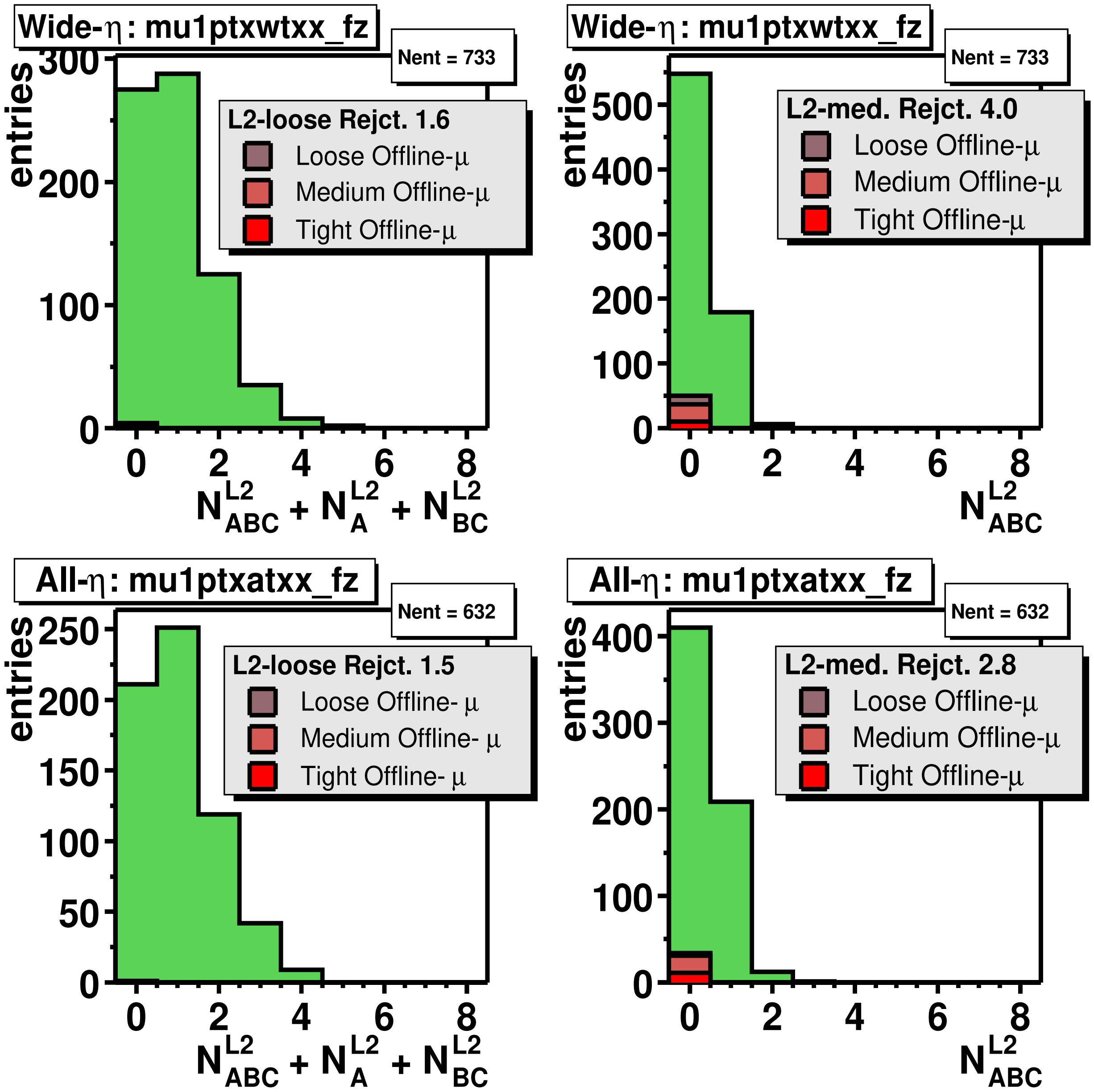


The overlaid red histograms show the amount of "L2-rejected" events (bin Ø) with ≥ 1 offline-mouns.

Rejection in L2 II

Run 149852: 9335 events

For L1-triggered events: What did L2-μ find?



L1-Wide: $-1.2 < \eta < 1.2$ (upper plots)

L1-All: $-2 < \eta < 2$ (lower plots)

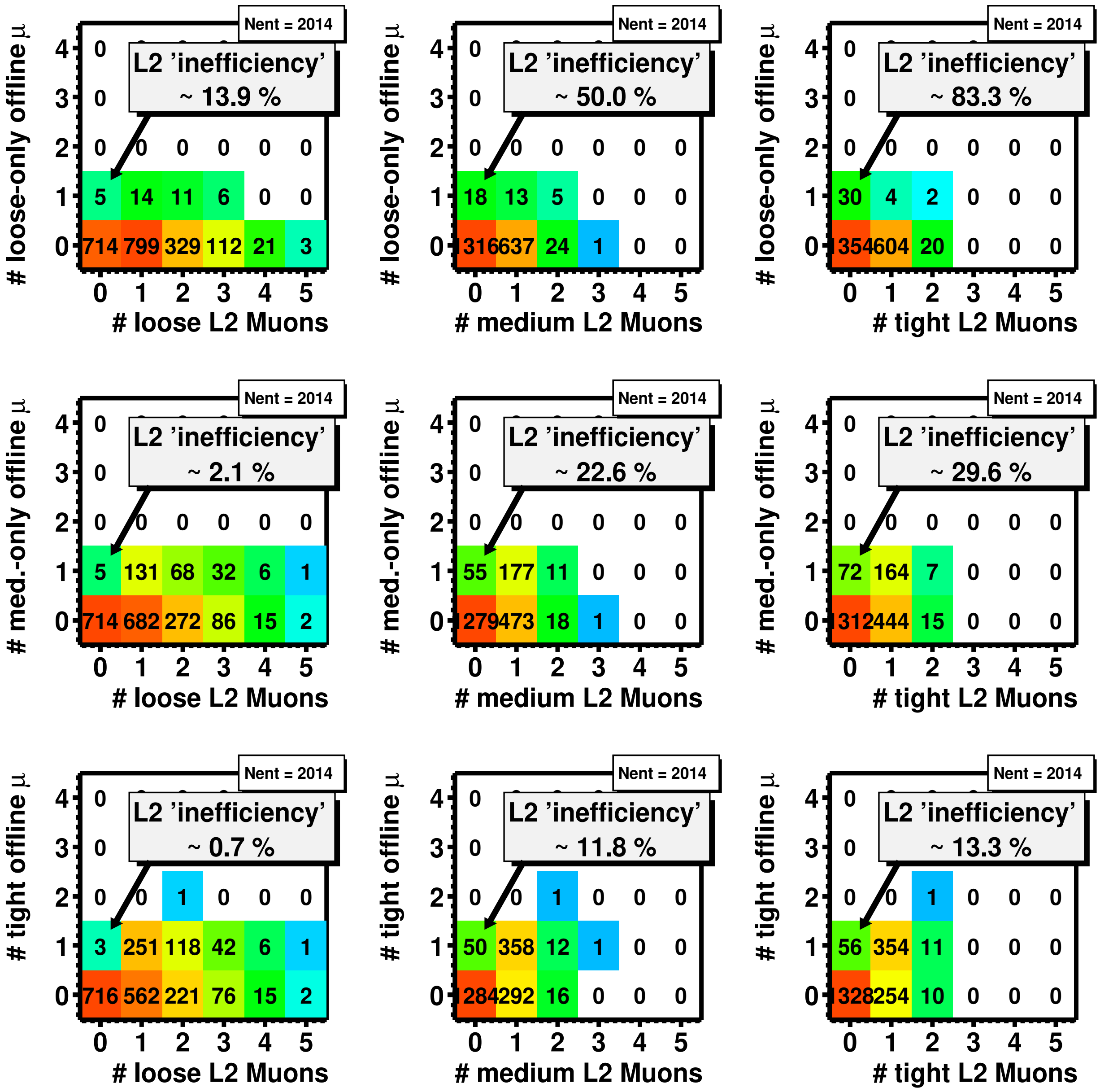
The overlaid red histograms show the amount of "L2-rejected" events (bin Ø) with ≥ 1 offline-mouns.

Efficiency w.r.t. Offline I

Offline Muons vs. # L2 Muons

for events with ≥ 1 L1-single-μ trigger

(*forw.*, *centr.* or *all-η*)



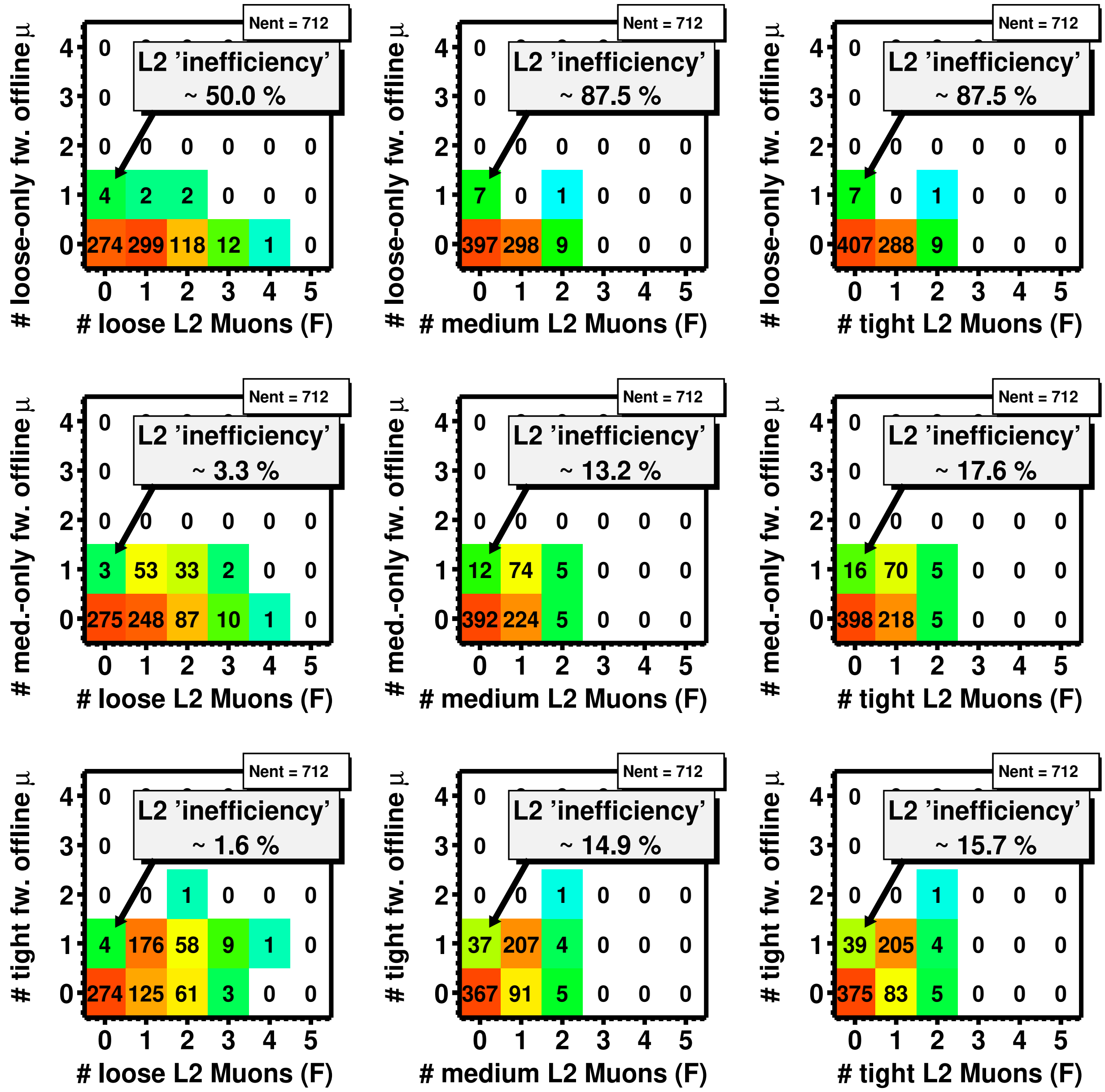
Run 149852: 9335 events

Offline reconstruction: `p10.15.01` with criteria as defined in the *certified Muon-ID note v1.1* (see Muon-ID web page).

Efficiency w.r.t. Offline II

Offline Muons vs. # L2 Muons

for events with $\geq$ 1 forward L1-single-μ trigger



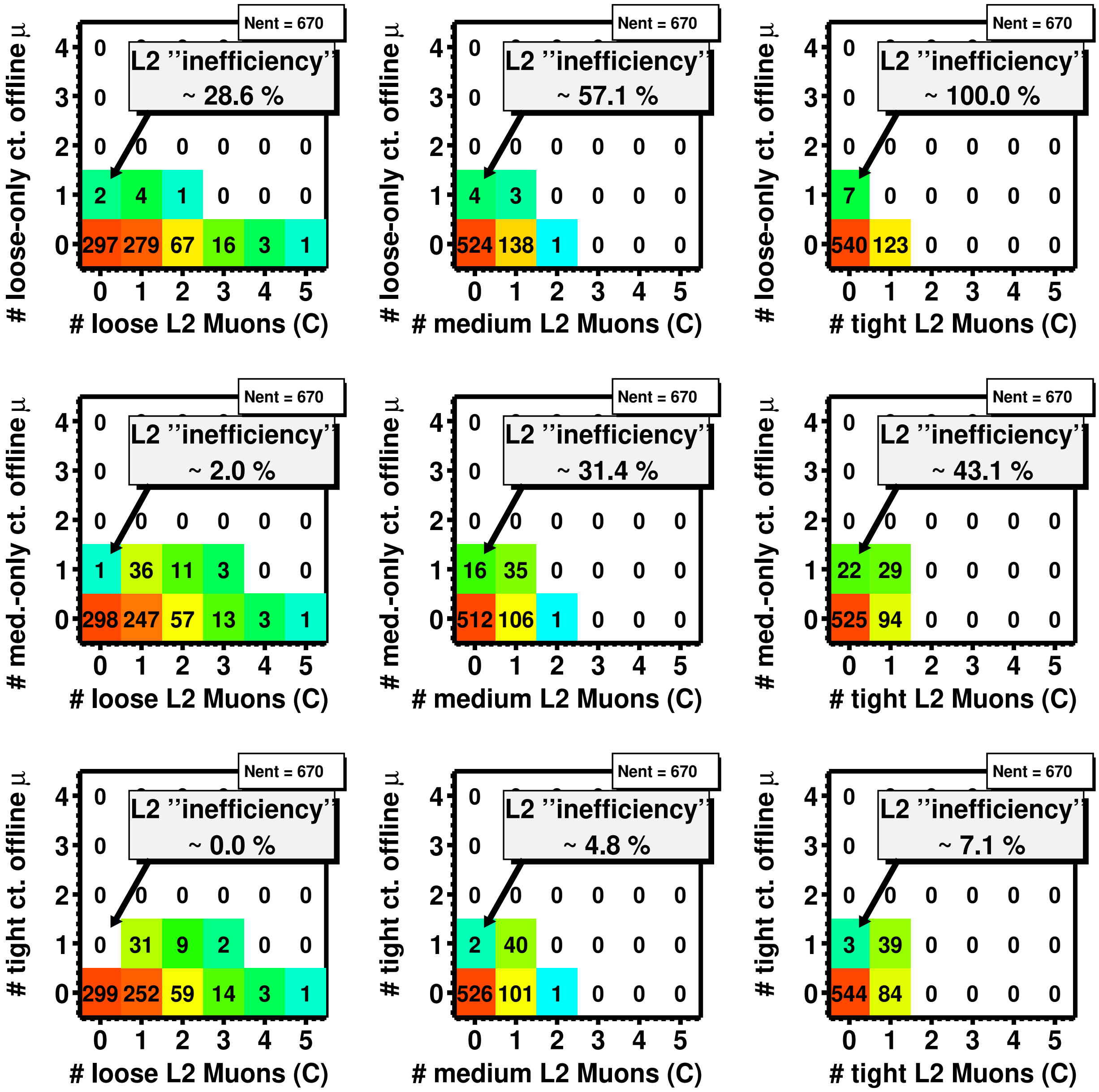
Run 149852: 9335 events

Offline reconstruction: `p10.15.01` with criteria as defined in the *certified Muon-ID note v1.1* (see Muon-ID web page).

Efficiency w.r.t. Offline III

Offline Muons vs. # L2 Muons

for events with ≥ 1 central L1-single-μ trigger

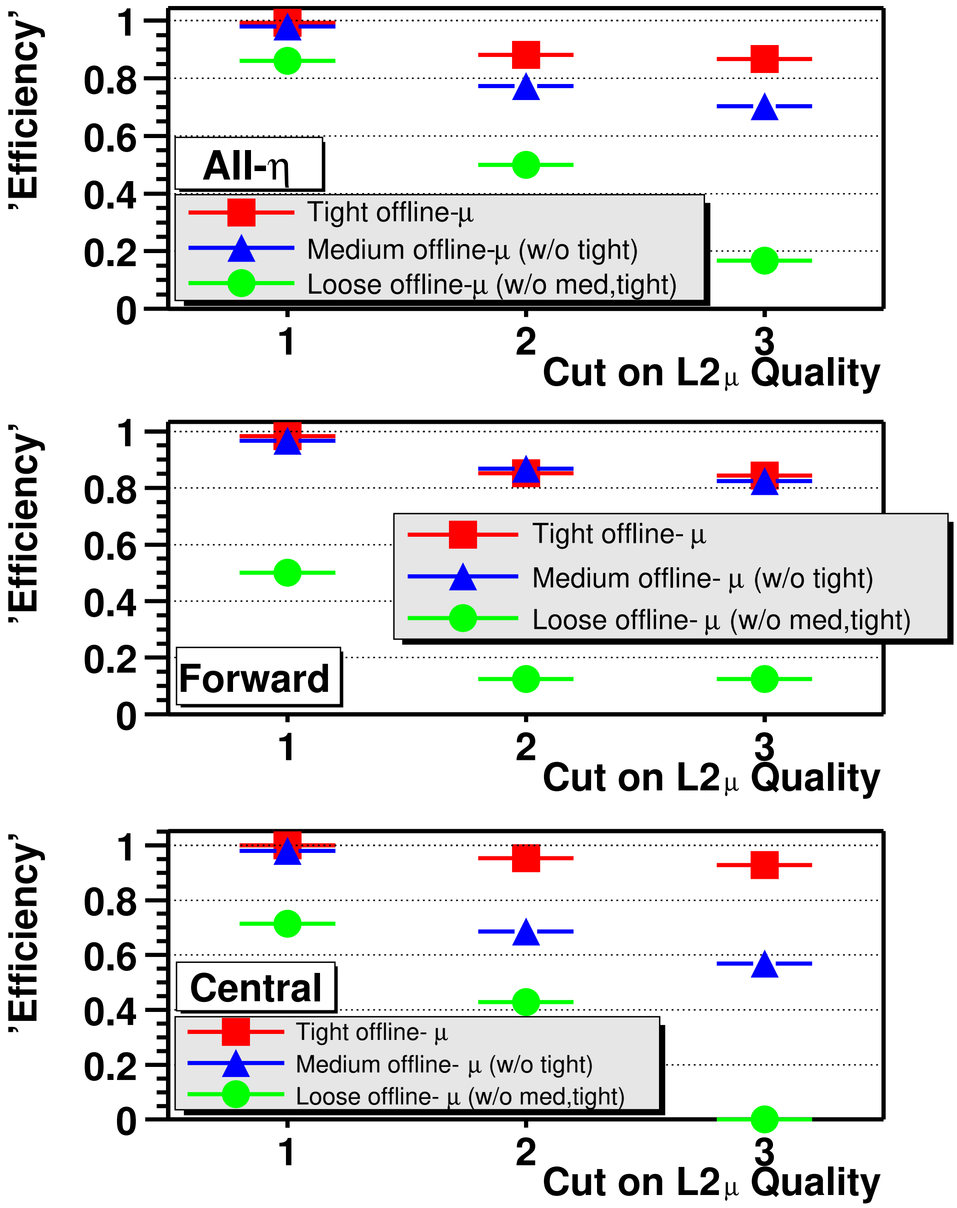


Run 149852: 9335 events

Offline reconstruction: `p10.15.01` with criteria as defined in the *certified Muon-ID note v1.1* (see Muon-ID web page).

Fraction of events containing offline-reconstructed muons with $N(L2) > 0$

Large errors associated (not shown in plot)!

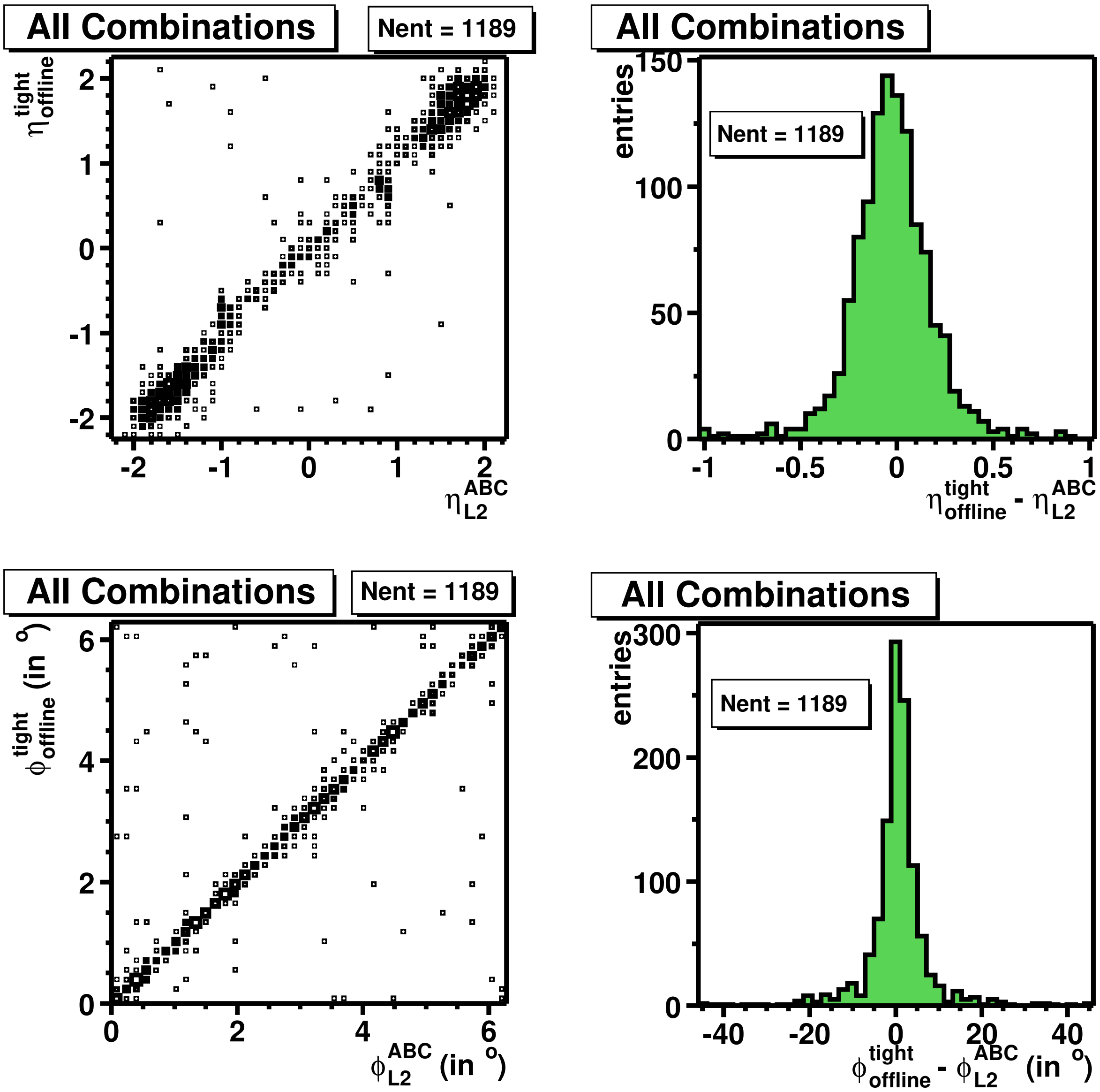


Run 149852: 9335 events

Offline reconstruction: p10.15.01 with criteria as defined in the *certified Muon-ID note v1.1* (see Muon-ID web page).

μ "Matching": L2 $\leftrightarrow$ Offline

All combinations of **Tight Offline** and **L2-ABC** Muons (*medium*)



Run 149852: 9335 events

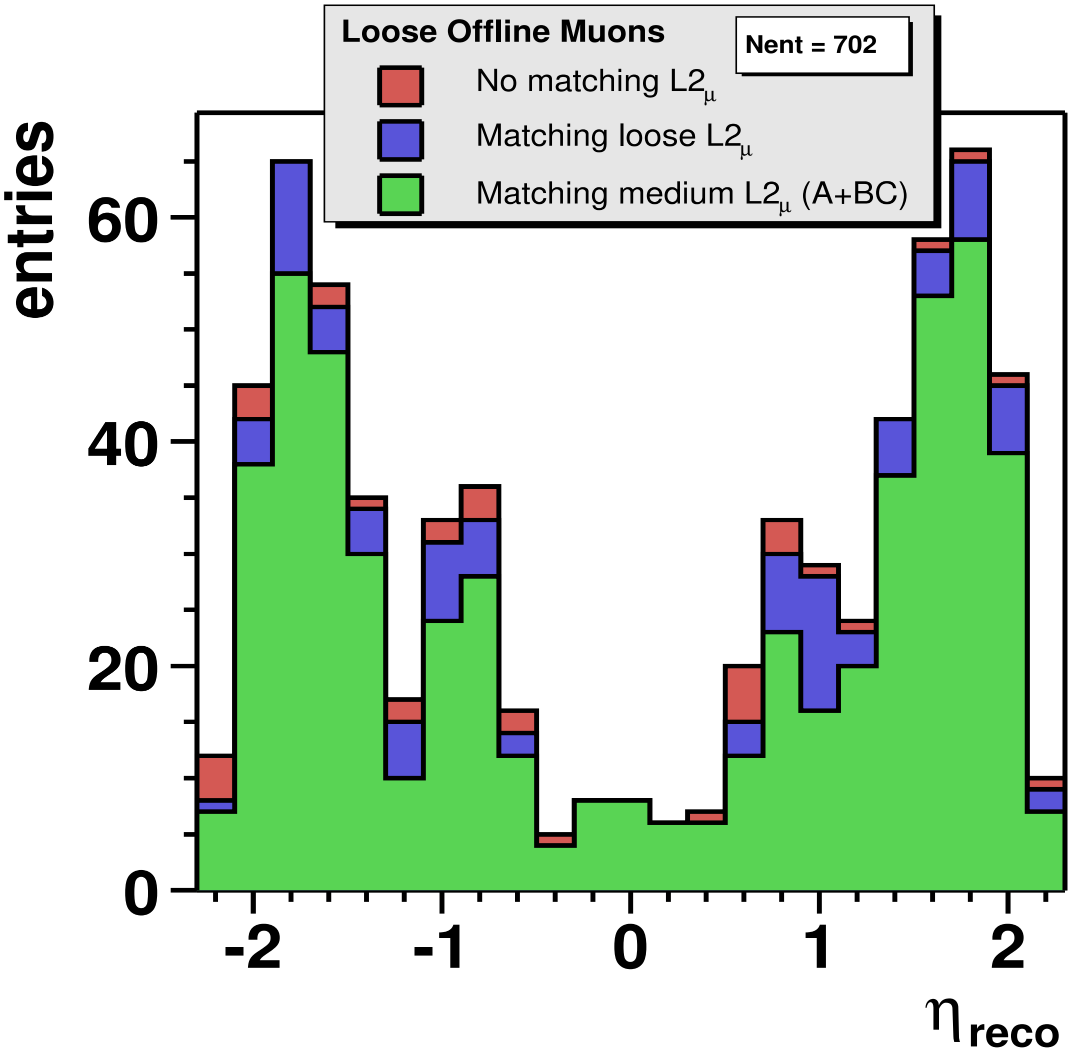
Efficiency per Offline-Muon I

Where do we find "matching" L2-Muons?

Efficiency per Muon: η

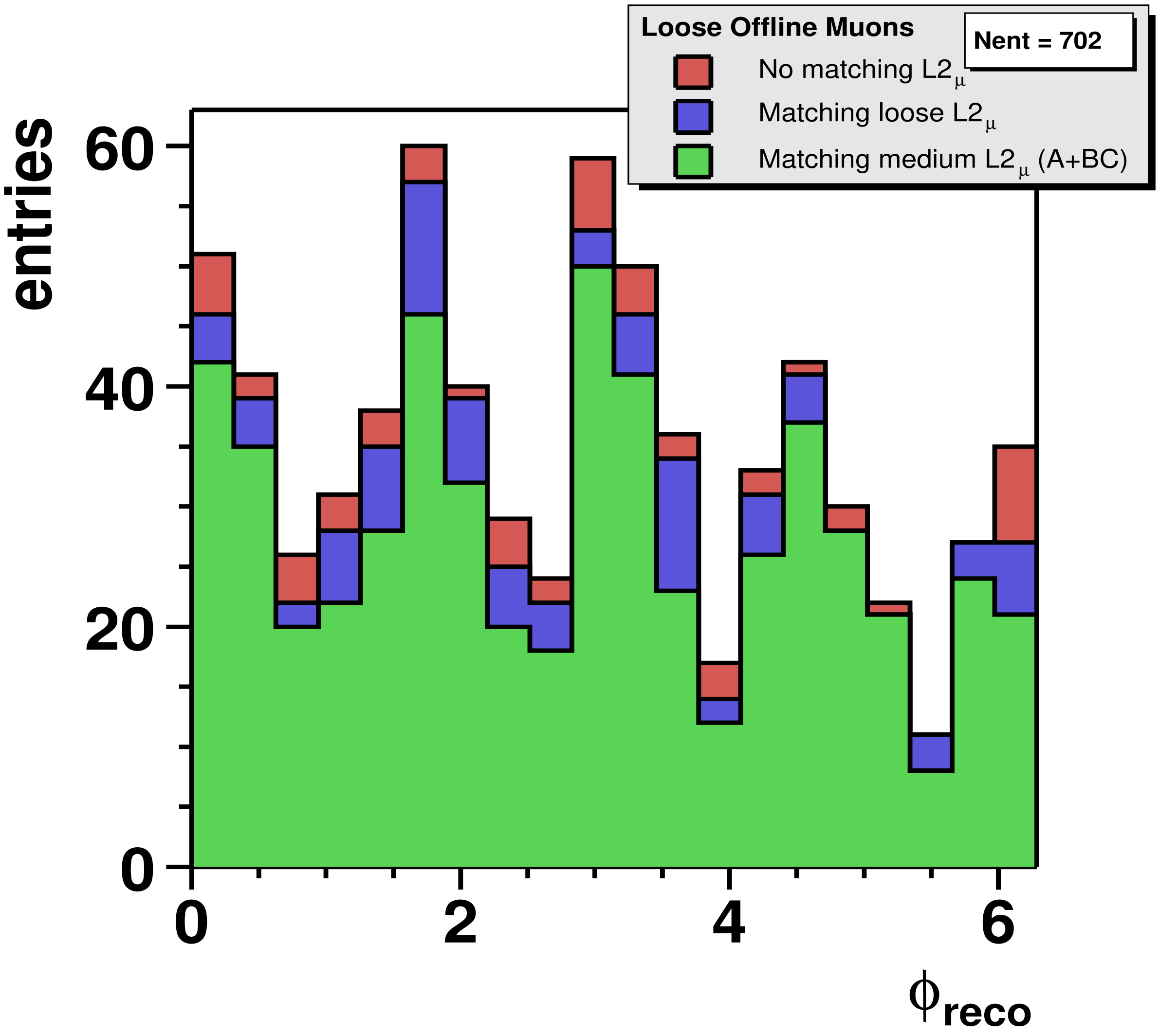
(not per event like before)

"Matching" means: $\Delta\phi < 45^o$ and $\Delta\eta < 0.7$



Run 149222: 2512 events

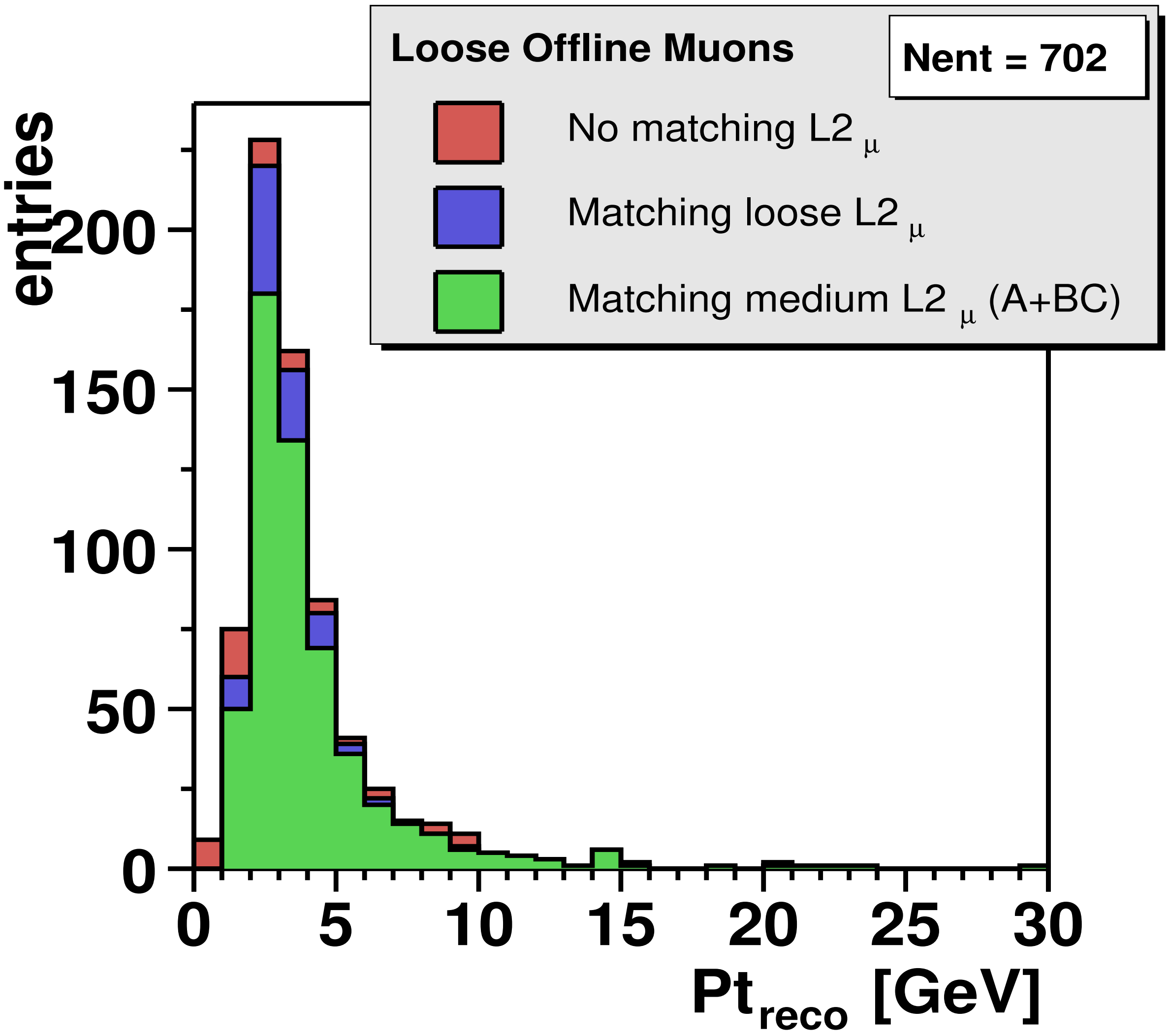
Efficiency per Muon: ϕ



Run 149222: 2512 events

Efficiency per Offline-Muon III

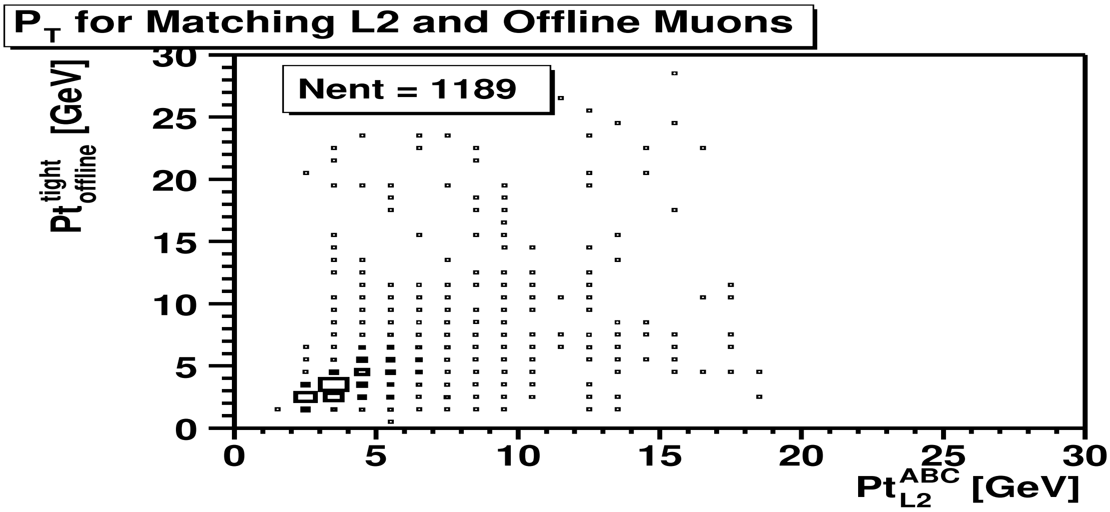
Efficiency per Muon: P_T

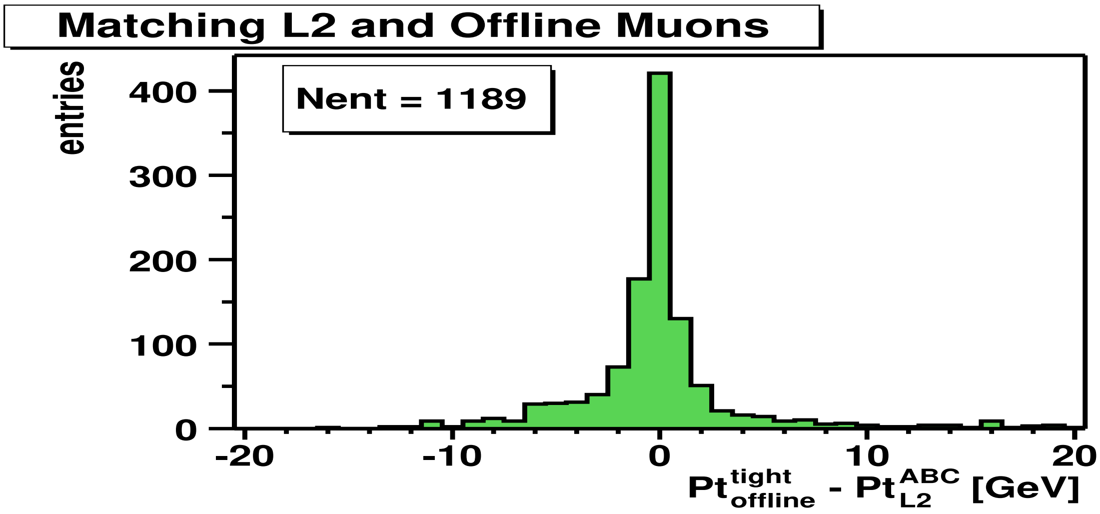


Run 149852: 9335 events

P_T Measurement in L2

Transverse Momentum of Muons (all combinations): P_T





Run 149852: 9335 events

Summary I

- L1 Single-Muon triggers are usually prescaled by $10 - 30$
- Using the loosest criteria for a muon in L2 (i.e. ≥ 1 A or BC segment with lowest quality) the rejection becomes
  $\frac{L1accepts}{L2accepts} \sim 1.7$ for $-2 < \eta < 2$.
- Criterion for L2(-μ) (Trigger Board): Be better than a random prescale:

$$\boxed{\varepsilon_{L2\mu} > \frac{1}{Rejection}}$$

- With an efficiency (w.r.t. offline muons) of $\varepsilon_{L2\mu} \sim 98\%$, L2-$\mu$ will provide a much **purer** and **richer** sample of Muons than simple prescaling:

$$\varepsilon_{L2\mu} \approx 0.98 > 0.59 \approx \frac{1}{Rejection}$$

`L2 throws away` $\sim 40\%$ `of single-`μ `events triggered by L1 while being` $> 98\%$ `efficient.`

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Summary II

- Efficiencies and Rejections of L2-μ:

	Offline Muons			L1 Single Muon Triggers			
	loose	medium	tight	Cent.	Forw.	Wide	All
Loose L2μ	$98\%^*$	$99\%^*$	$99\%^*$	1.8	1.6	1.6	1.5
Medium L2μ	$82\%^*$	$84\%^*$	$88\%^*$	4.7	2.3	4.0	2.8
Tight L2μ	$78\%^*$	$81\%^*$	$87\%^*$				

* these are only estimates, coming from an `.OR.` of all L1-sigle-μ triggers, since: different L1 triggers have different prescales!

- A few more ideas...
  - Optimize L2 criterion: It is very loose $\rightarrow$ quality cuts
  - Using P_T for higher rejections (yet to be studied)
  - ...