DØ L2-Muon Trigger Studies

Performance & Comparison with L1-μ

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DØ Muon-ID Meeting, Collaboration Week

- First L2 vs. L1 studies
- What L2-μ doesn't see: towards rejection
- L2-μ and J/ψ's
- Algorithm Efficiency (MC)
- Measuring p_t with L2-μ

An electronic copy of this presentation can be found here:
http://www-clued0.fnal.gov/~tim/l2/d0week_tim_020213.pdf
http://www-clued0.fnal.gov/~tim/l2/d0week_tim_020213.ps

First Event

L2-μ results in forward

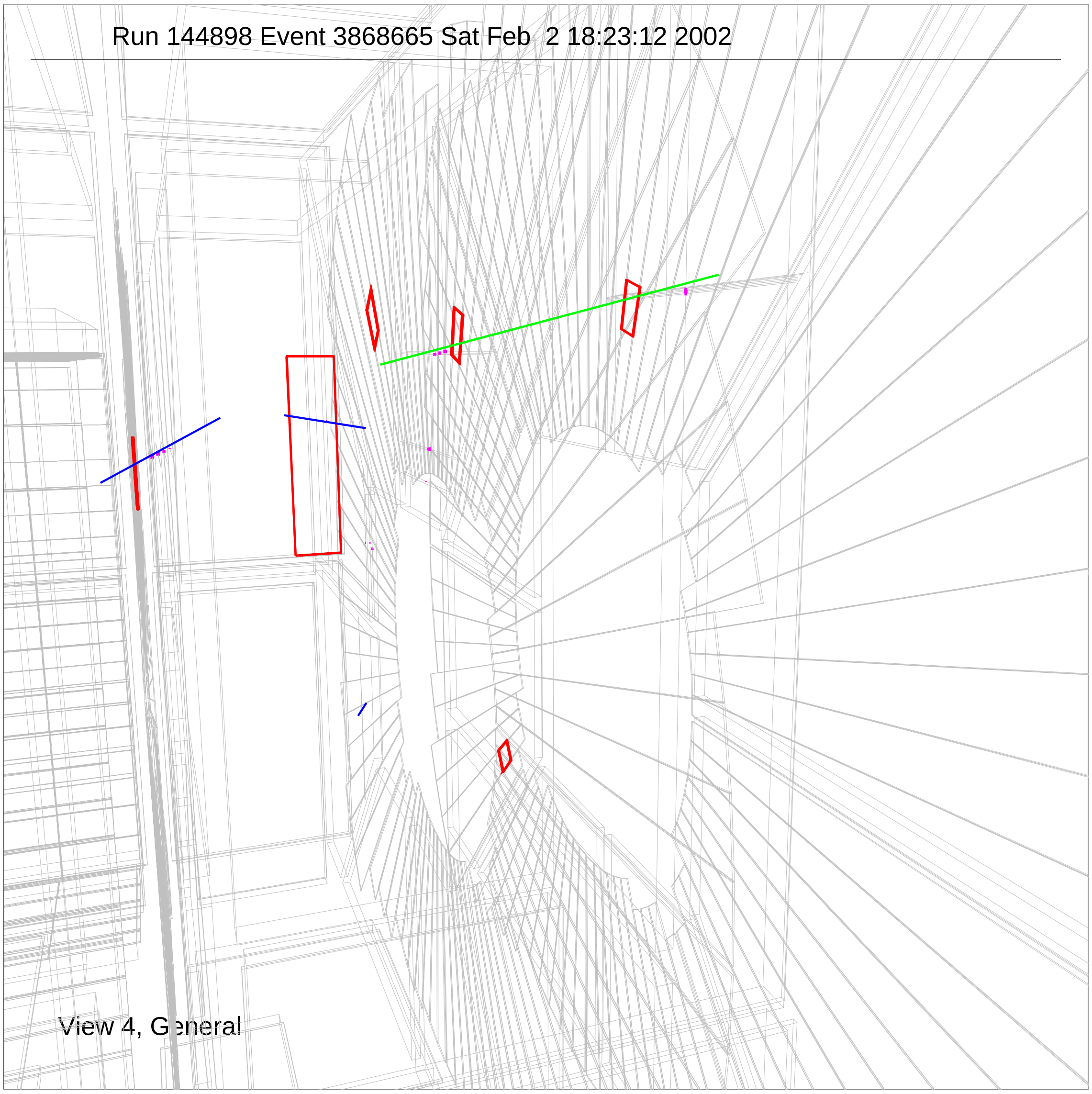
Forward-A Stubs

1. $\eta = 1.45$, $\phi = 108^o$
2. $\eta = 1.45$, $\phi = 108^o$

Forward-BC Stubs

1. $\eta = 1.60$, $\phi = 106^o$

And how the event looks like:



Blue and green lines don't indicate L2-μ stubs but reconstructed segments.
Red are scintillator hits and magenta denote hits in the drift tubes.

Second Event

L2-μ results in forward

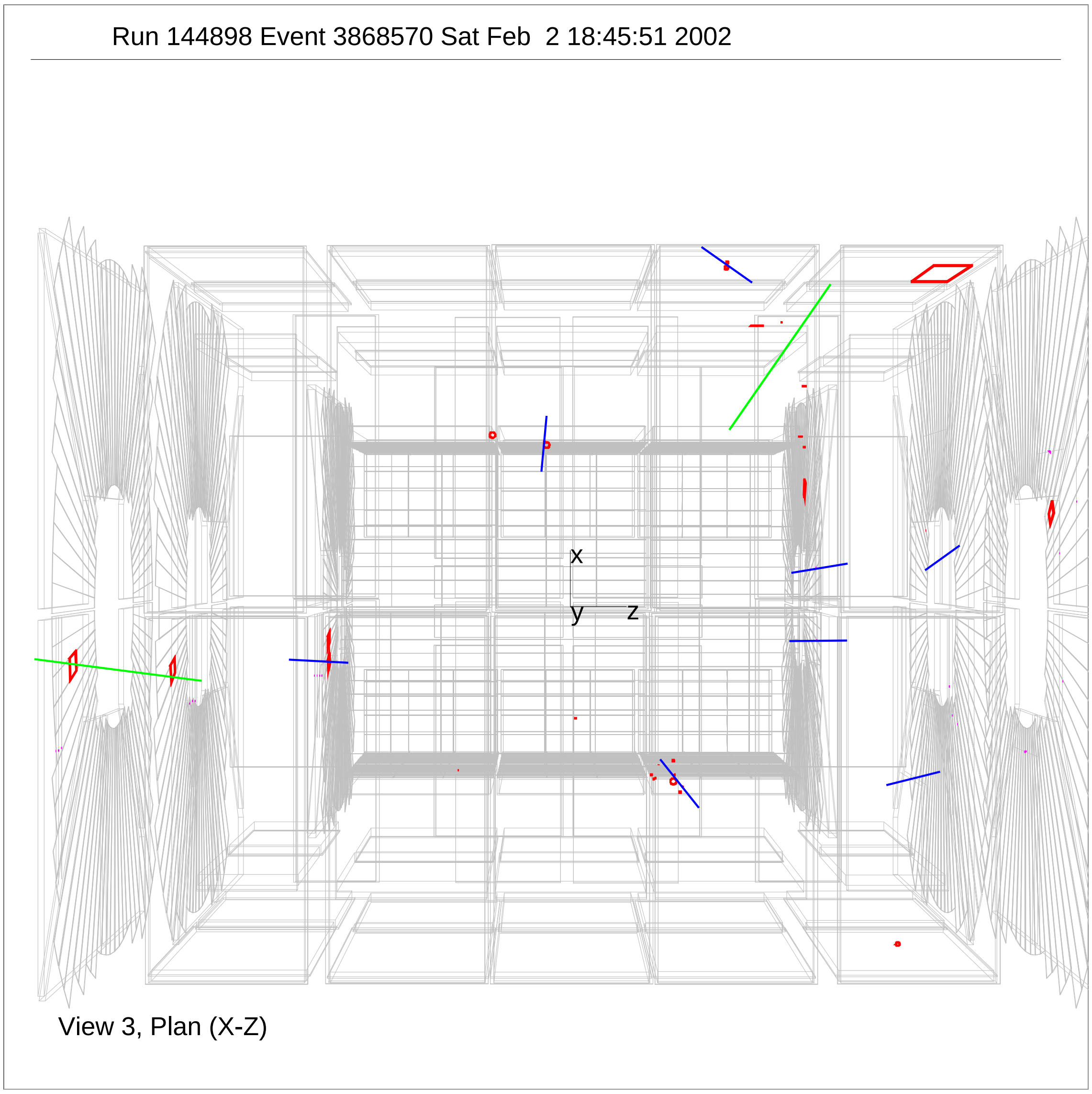
Forward-A Stubs

1. η = -1.25, $\phi = 108^o$
2. η = -1.25, $\phi = 108^o$
3. η = 1.80, $\phi = 63^o$

Forward-BC Stubs

1. η = -1.20, $\phi = 106^o$
2. η = -1.20, $\phi = 106^o$

And how the event looks like:



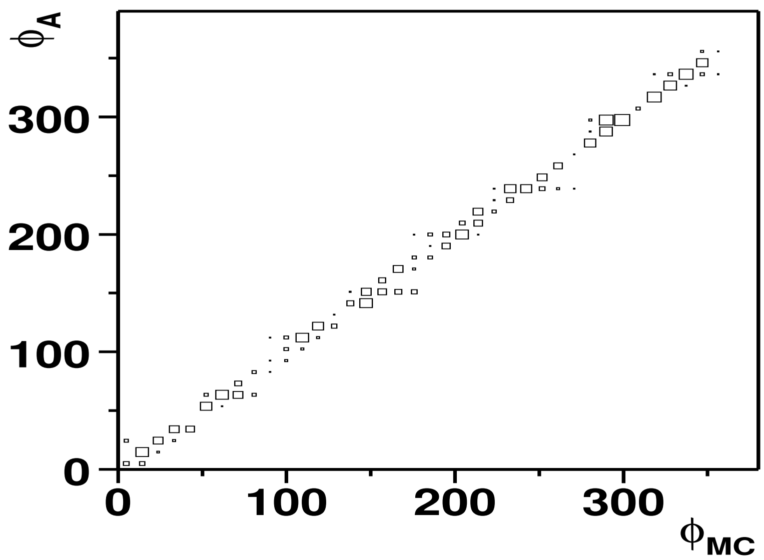
Blue and green lines don't indicate L2-μ stubs but reconstructed segments.
Red are scintillator hits and magenta denote hits in the drift tubes.

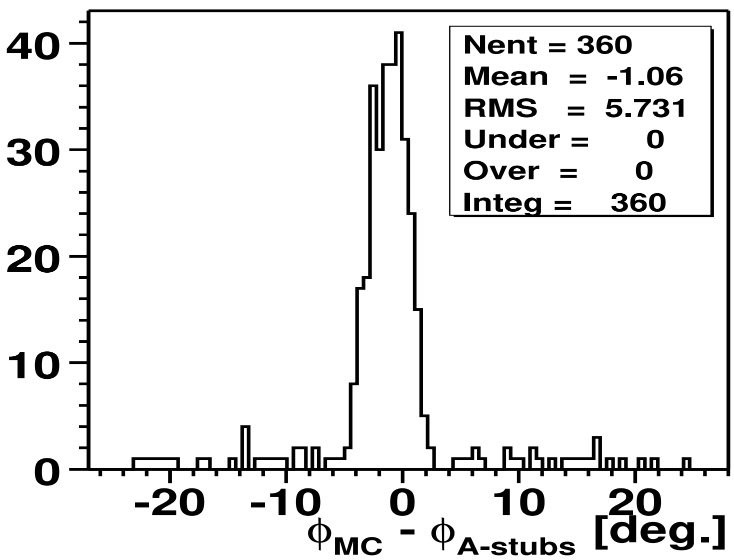
L2-μ Forward Algorithm

Single-μ Monte Carlo

$0.8 < |\eta| < 2.2$

1 GeV $< p_t <$ 10 GeV

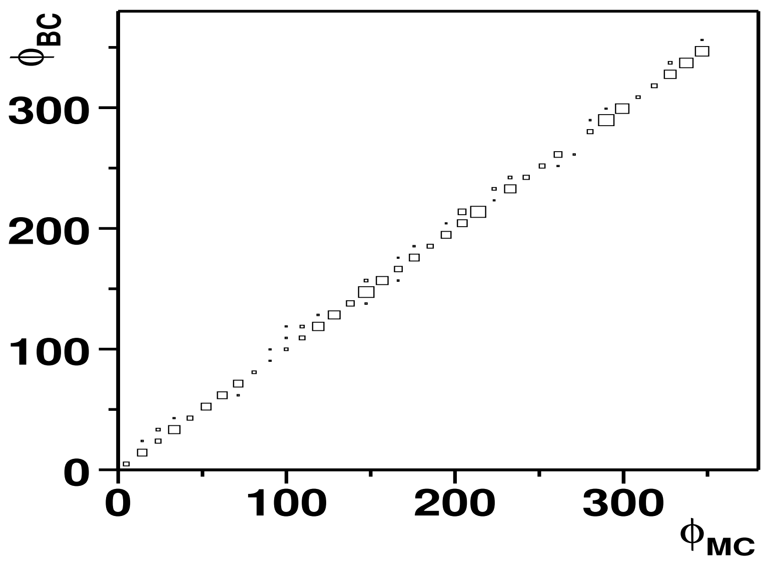


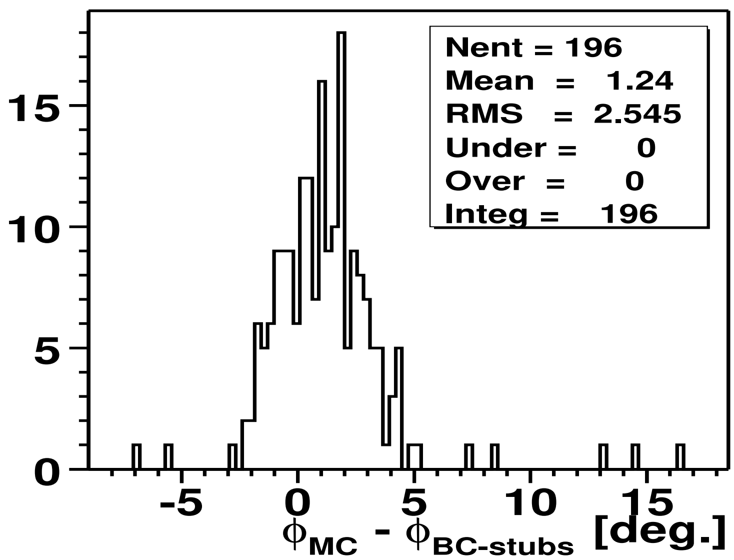


Single-μ Monte Carlo

$0.8 < |\eta| < 2.2$

$1 \text{ GeV} < p_t < 10 \text{ GeV}$



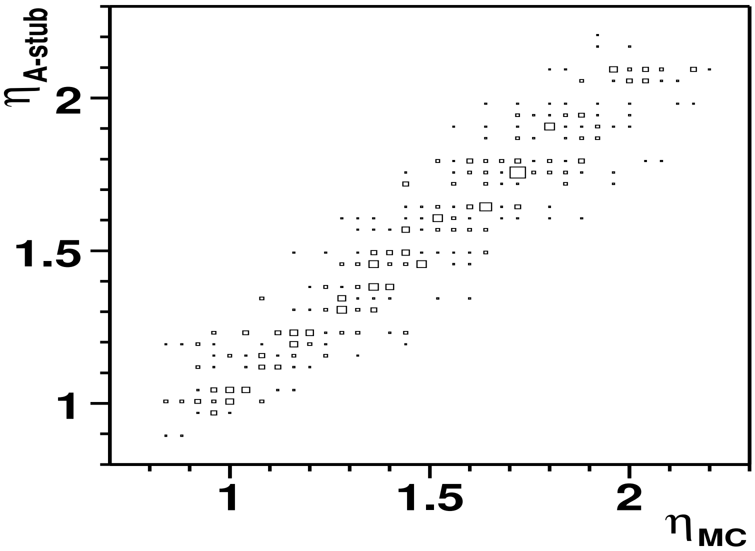


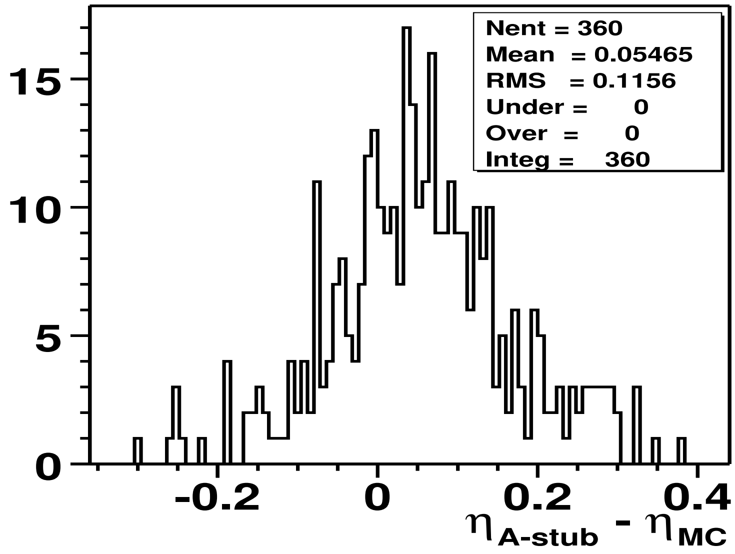
L2-μ Output in MC III

Single-μ Monte Carlo

$0.8 < |\eta| < 2.2$

1 GeV $< p_t <$ 10 GeV



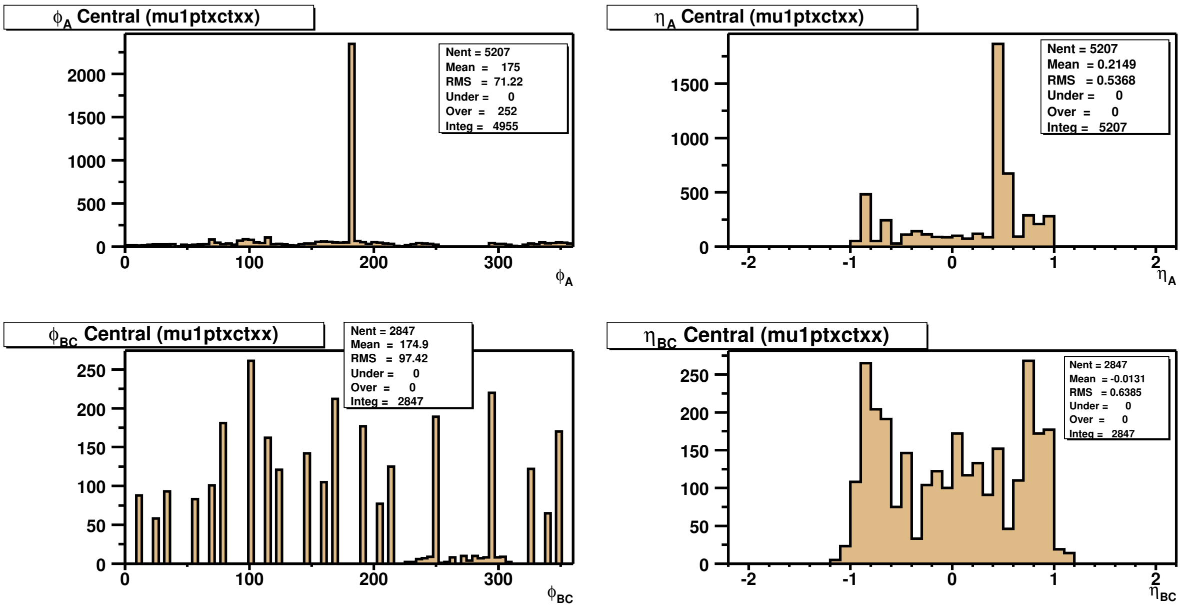


Shift in η ($\sim$ 1 bin in stub output) will be taken care of.

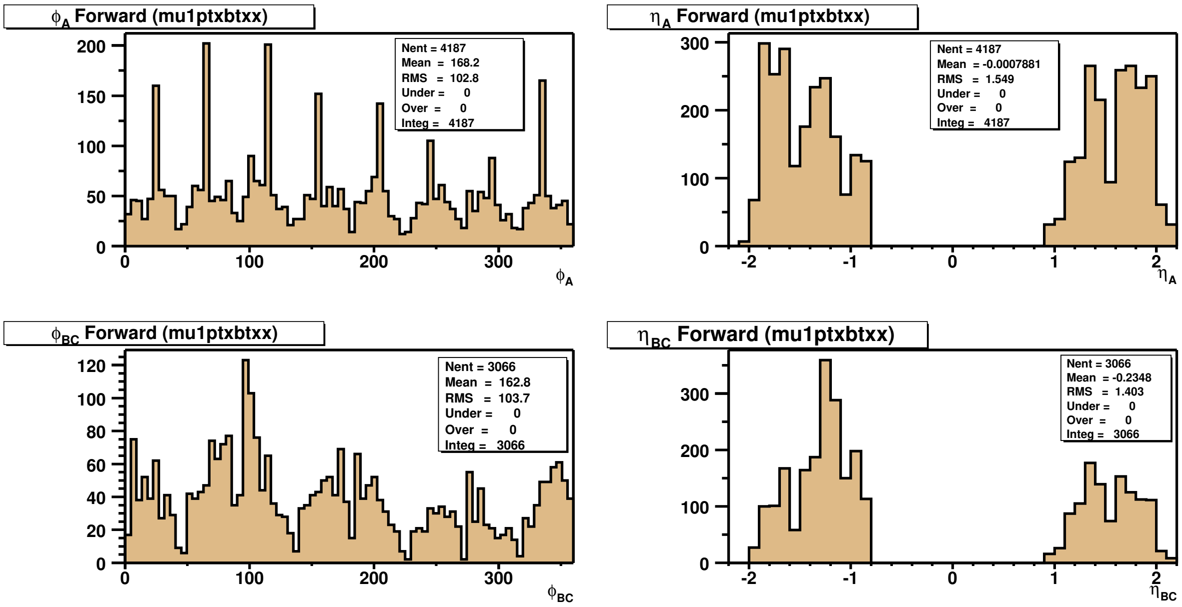
L2-μ on Real Data

Runs 144574 and 144898

Central L2-μ Stubs



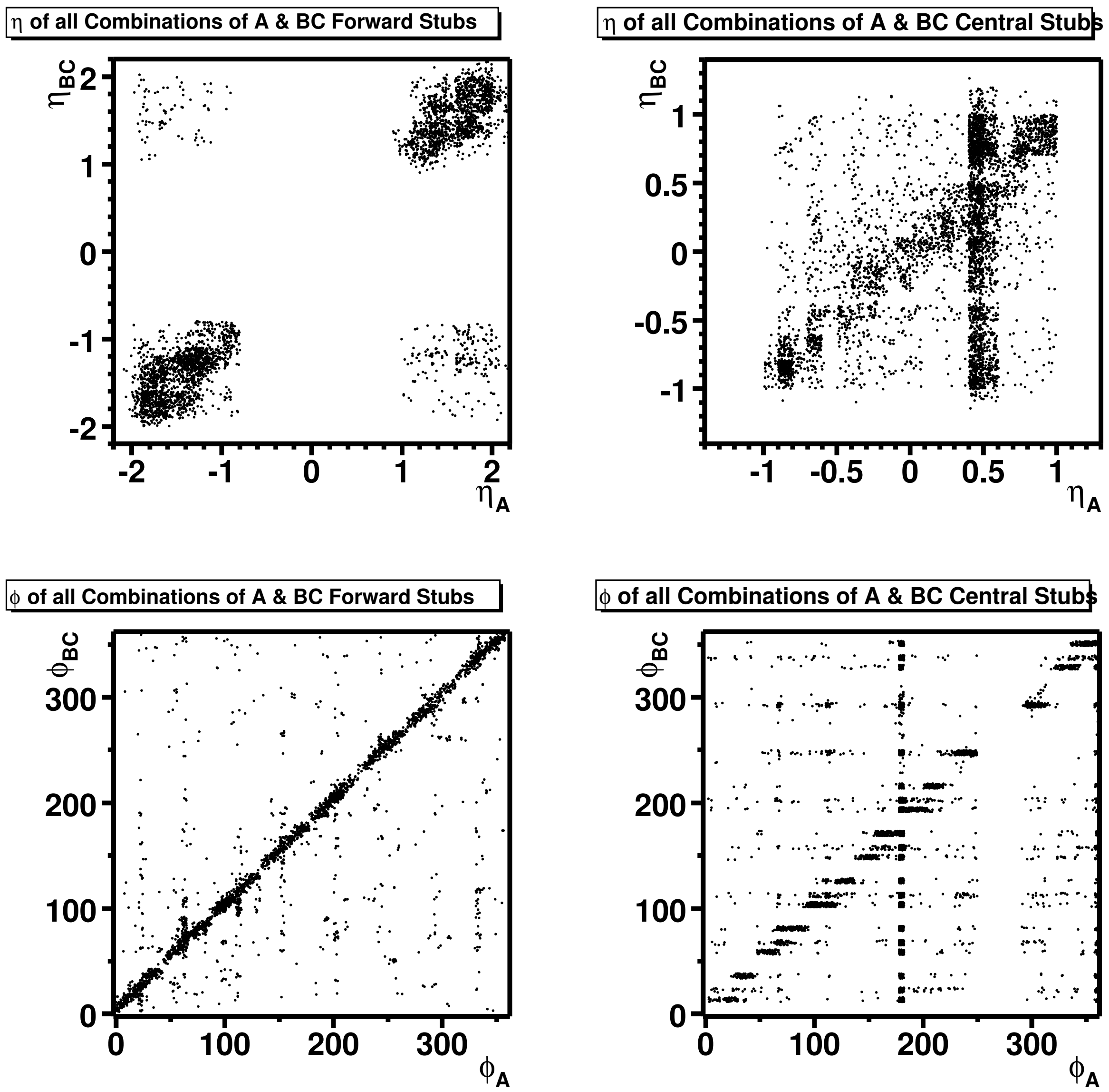
Forward L2-μ Stubs



"Matching" of A Stubs with BC Stubs

For these plots: simply take **ALL** A+BC combinations!

"Global" Runs 144574 and 144898



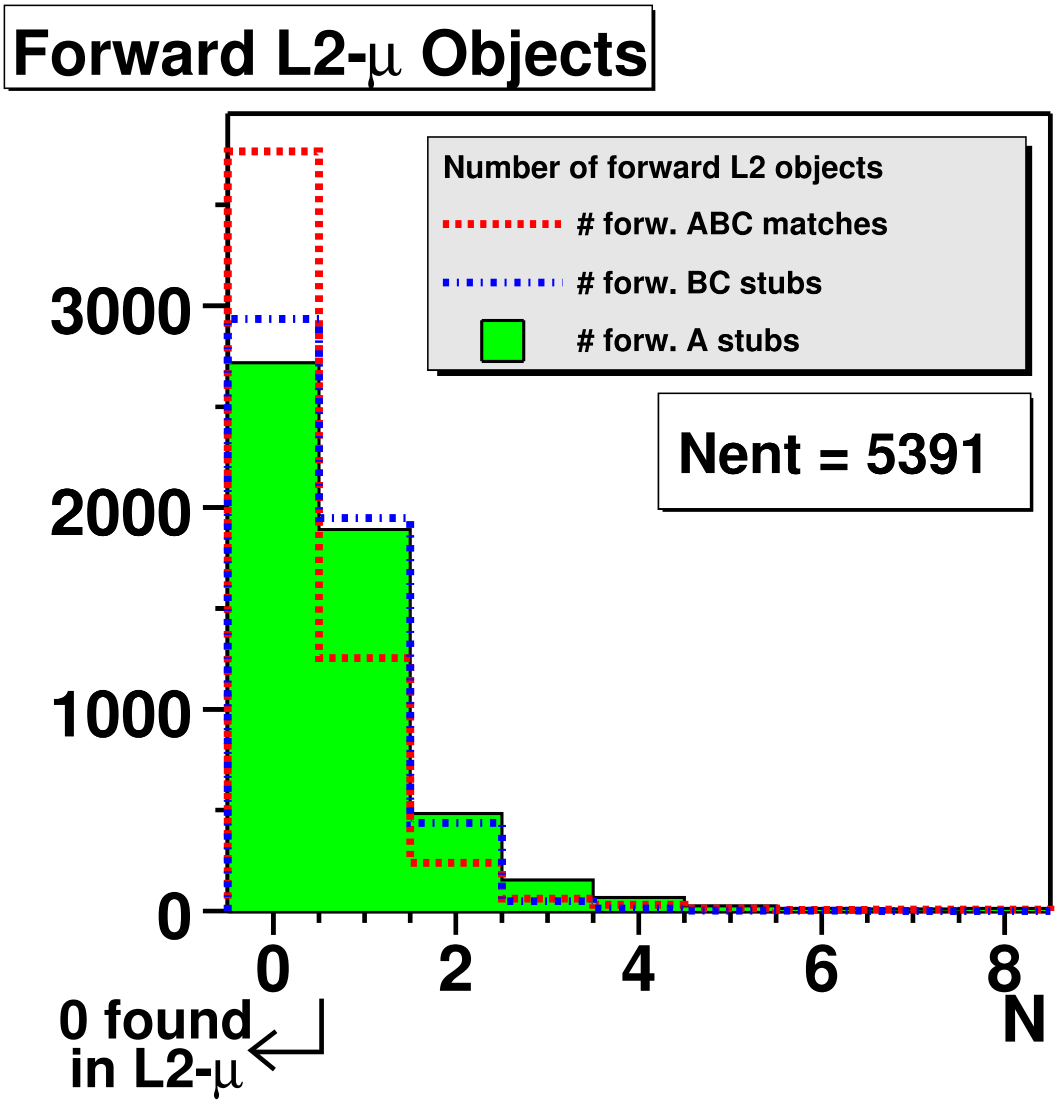
Forward   Central

L2-μ on Real Data

Runs 144574 and 144898

L2-μ simulation over raw data while extracting L1-μ information (Johannes Elmsheuser):

- "mu1ptxbtxx": forward single-μ scintillator trigger w/o p_t cut (A+B coincidence)



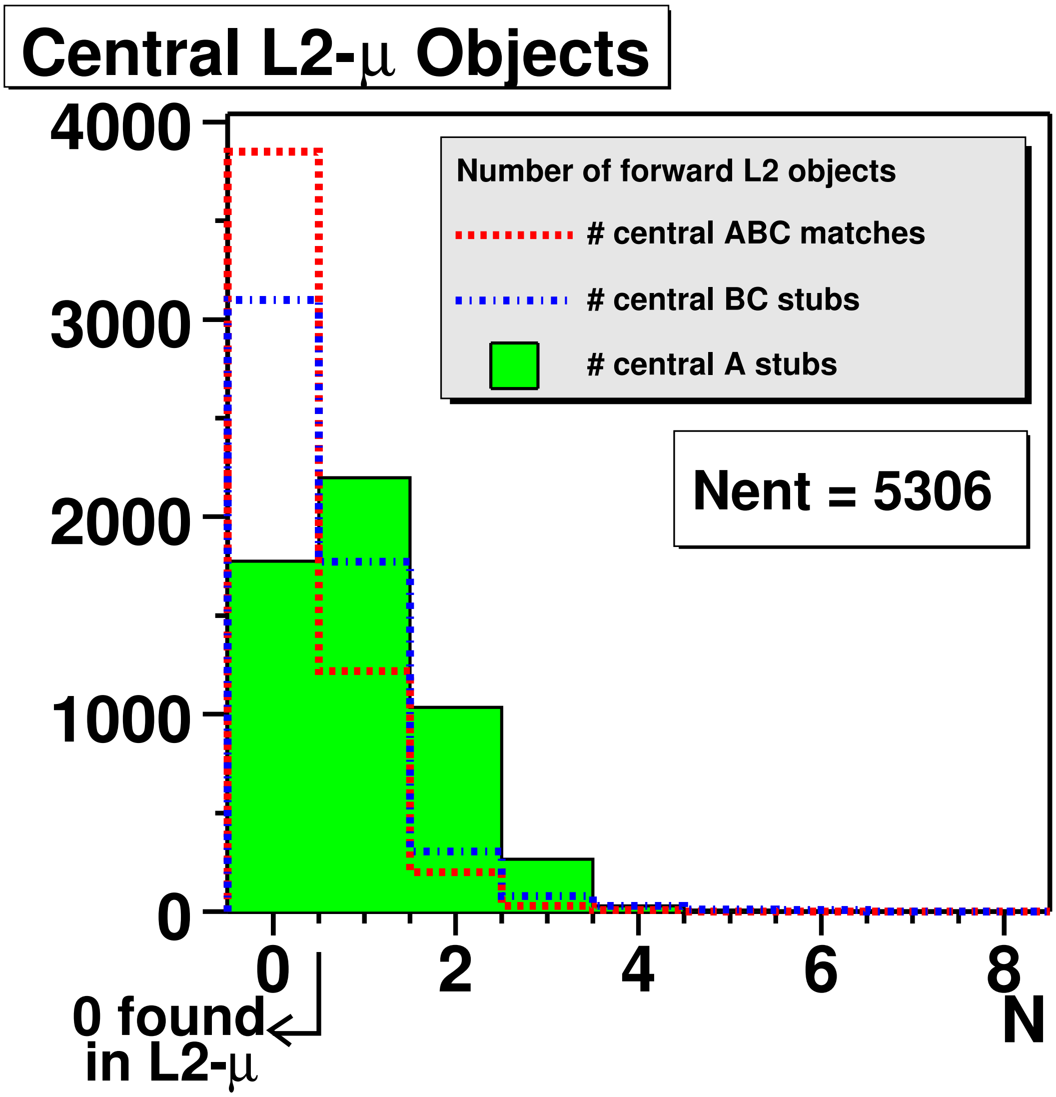
Number of L2-μ objects for all events firing mu1ptxbtxx.

L2-μ on Real Data

Runs 144574 and 144898

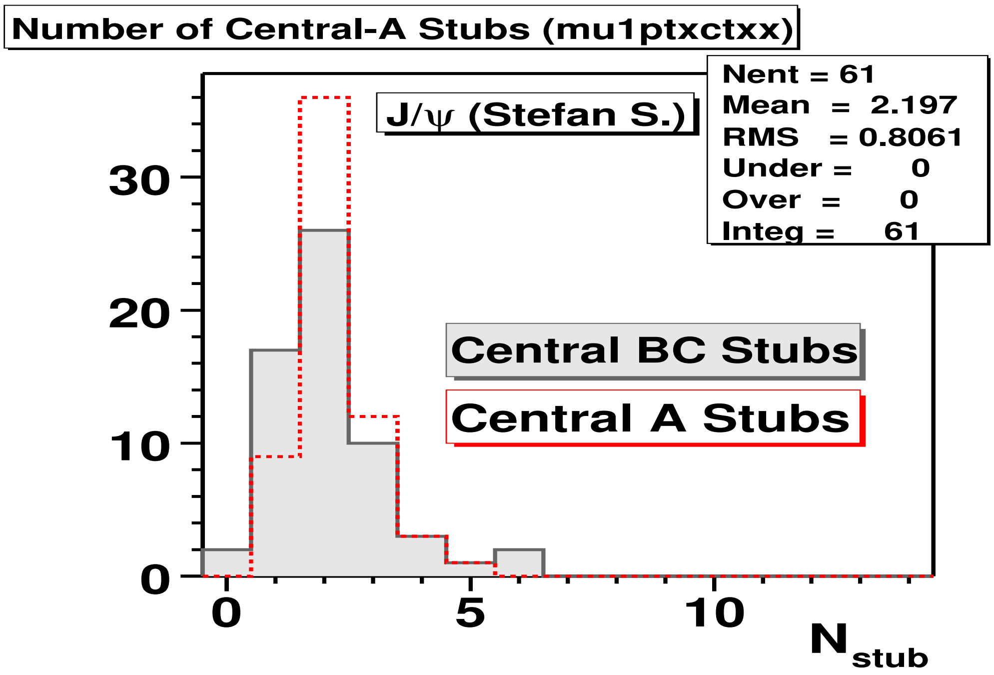
- “mu1ptxctxx”: central single-μ scintillator trigger

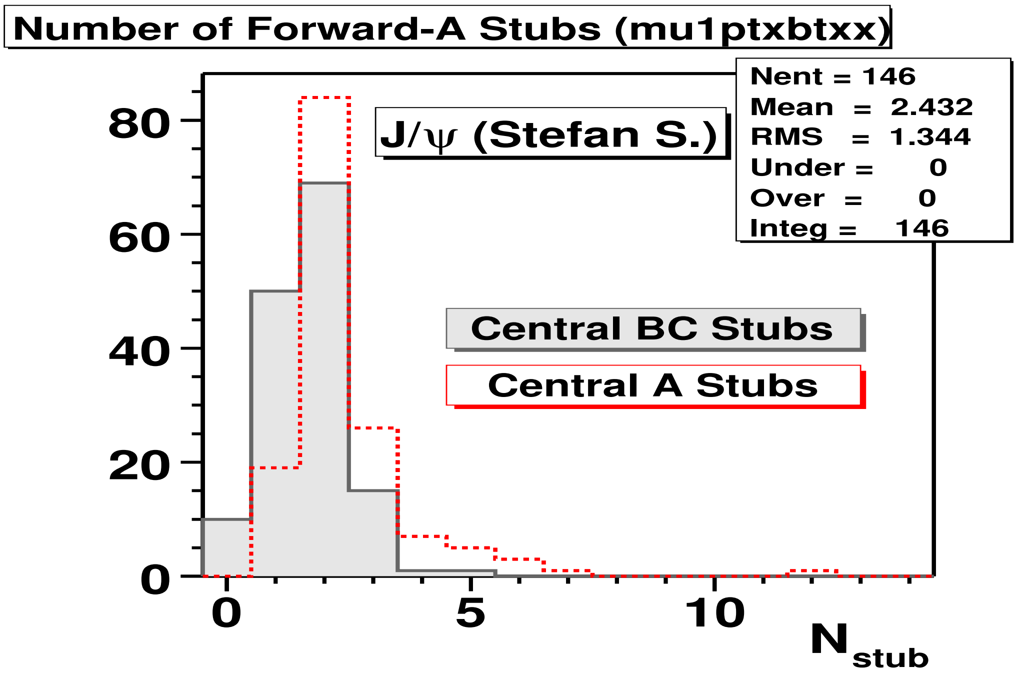
(Sergey Uzunyan)



Number of L2-μ objects for all events firing mu1ptxctxx.

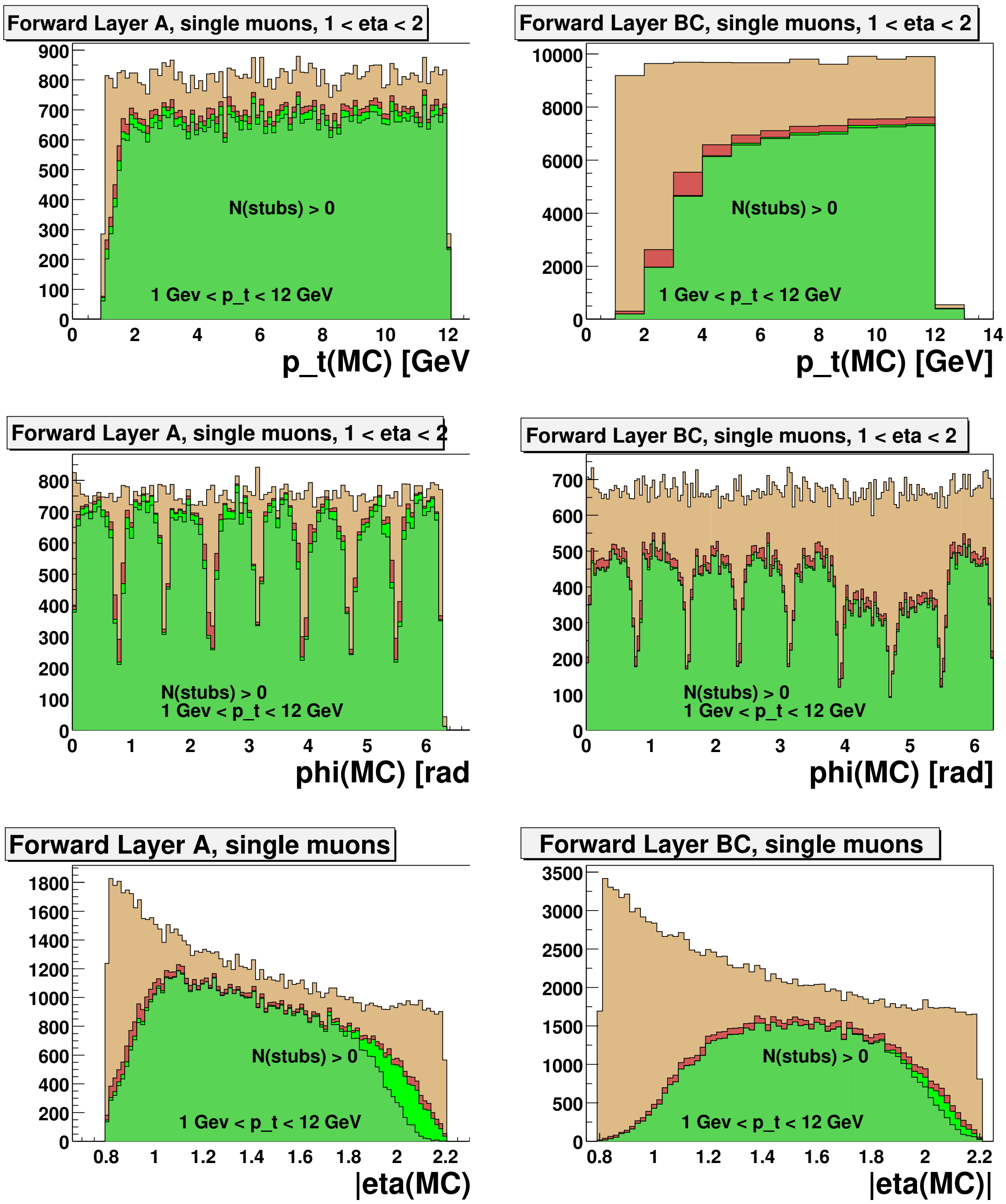
How good is L2-μ in finding stubs in "handpicked" J/ψ samples?





Forward-L2-μ Tracking Efficiency

(just a reminder: plots from stand-alone MC tests in April 2001)



Red areas: at least 1 MDT hit in each considered layer, but no stub found. The brown areas show what was generated.

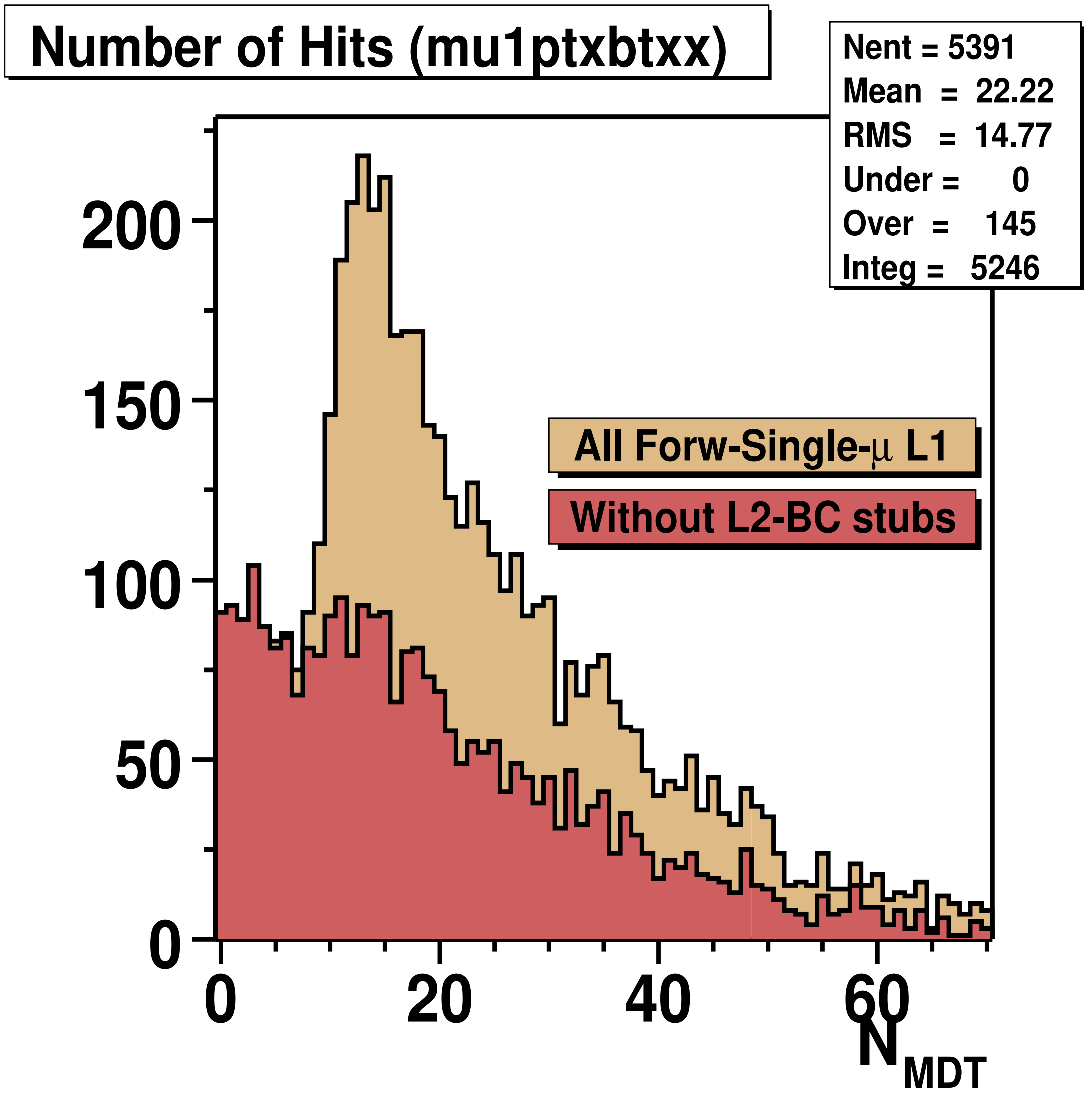
Upper green areas: stubs without matching pixel hits.

Similarly high algorithm efficiencies for central (Sergey U.)

What L2-μ rejects ...

Number of MDT Hits per event

Runs 144574 and 144898



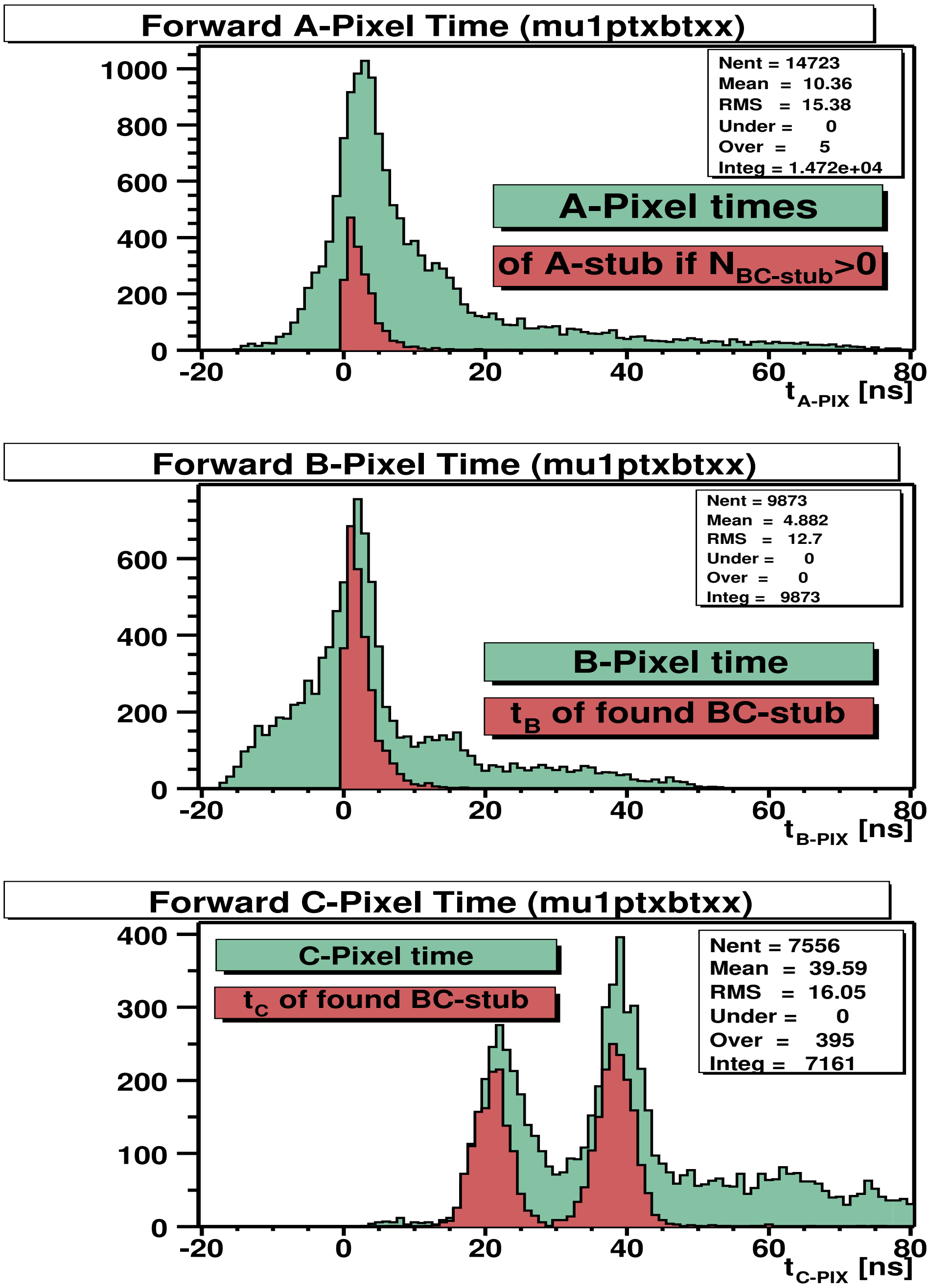
Red areas are events w/o forward L2-μ stub in layers BC, i.e. red area would be rejected by forward-L2-μ if $N_{BC} > 0$ required.

Forward L2-μ algorithms

Times of all Pixels and those from L2-stubs

"all" times are taken from `L1MuonPIX_Atof[..]`, right place?

Runs 144574 and 144898



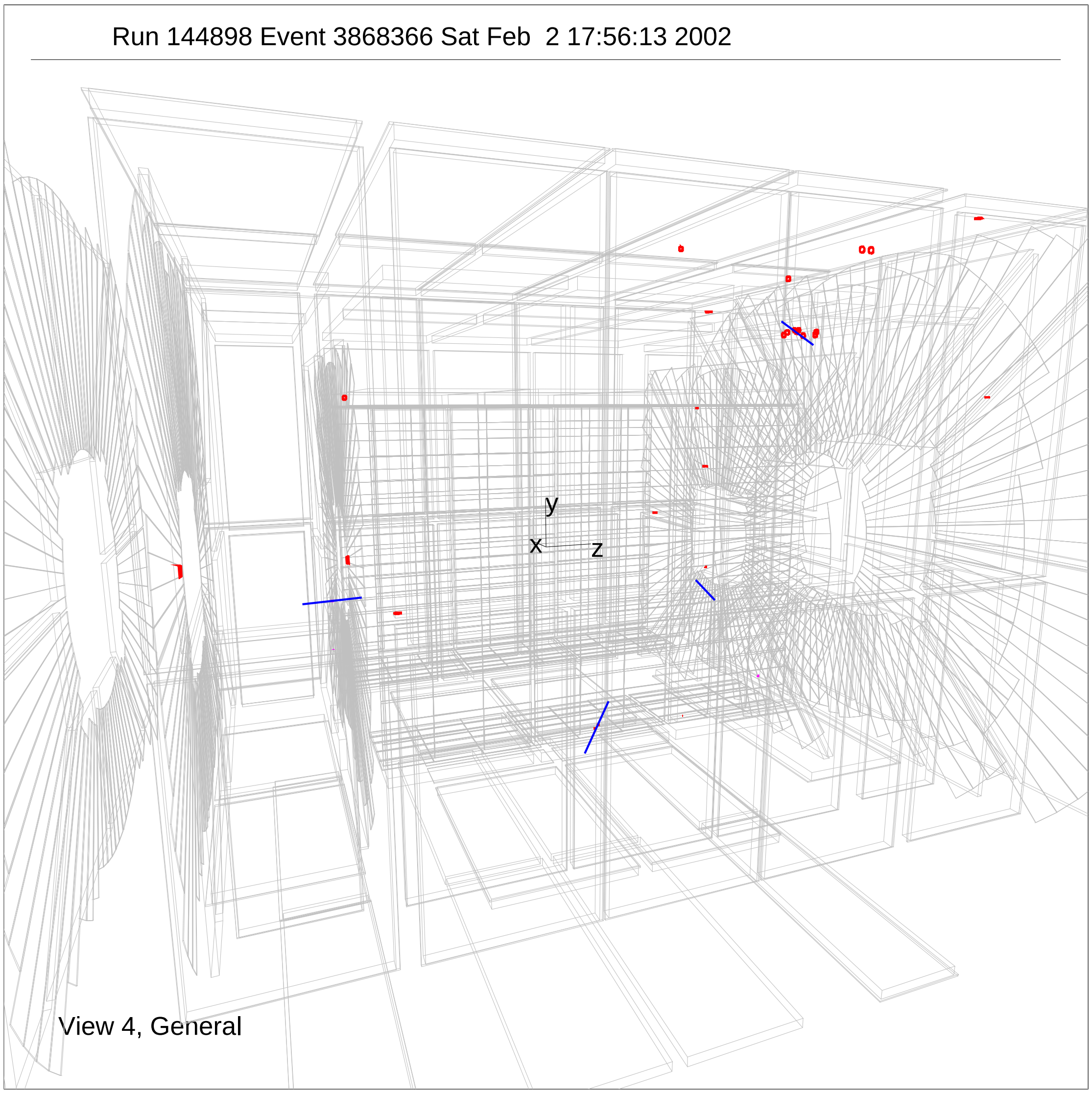
Bug: *cut-off* at 0 already corrected (does not affect efficiency).

Example I

Single- & Di-Muon L1 trigger fired (forward)

`mu1ptxbtxx + mu2ptxbtxx`

L2-μ found Ø A-stubs and Ø BC-stubs in forward (central: 1 $\times$ A-stub).

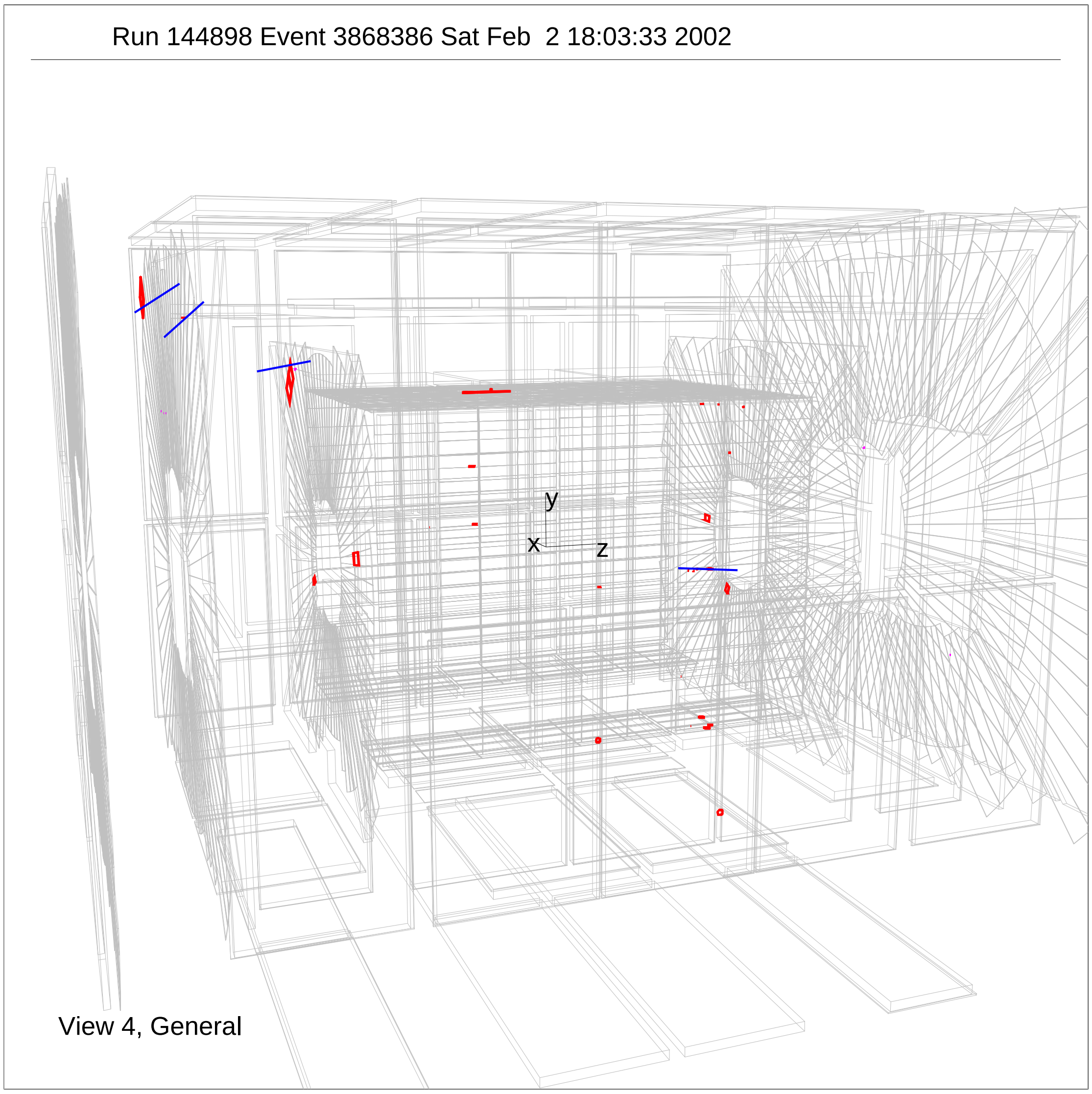


(Event **not** handpicked, this is first event with `mu1ptxbtxx` = `mu2ptxbtxx` = 1 but nothing in forward L2-μ)

Example II

Single-Muon L1 trigger fired (forward)
`mu1ptxbtxx`

L2-μ found Ø A-stubs and Ø BC-stubs in forward (central: $2 \times$ A-stub).



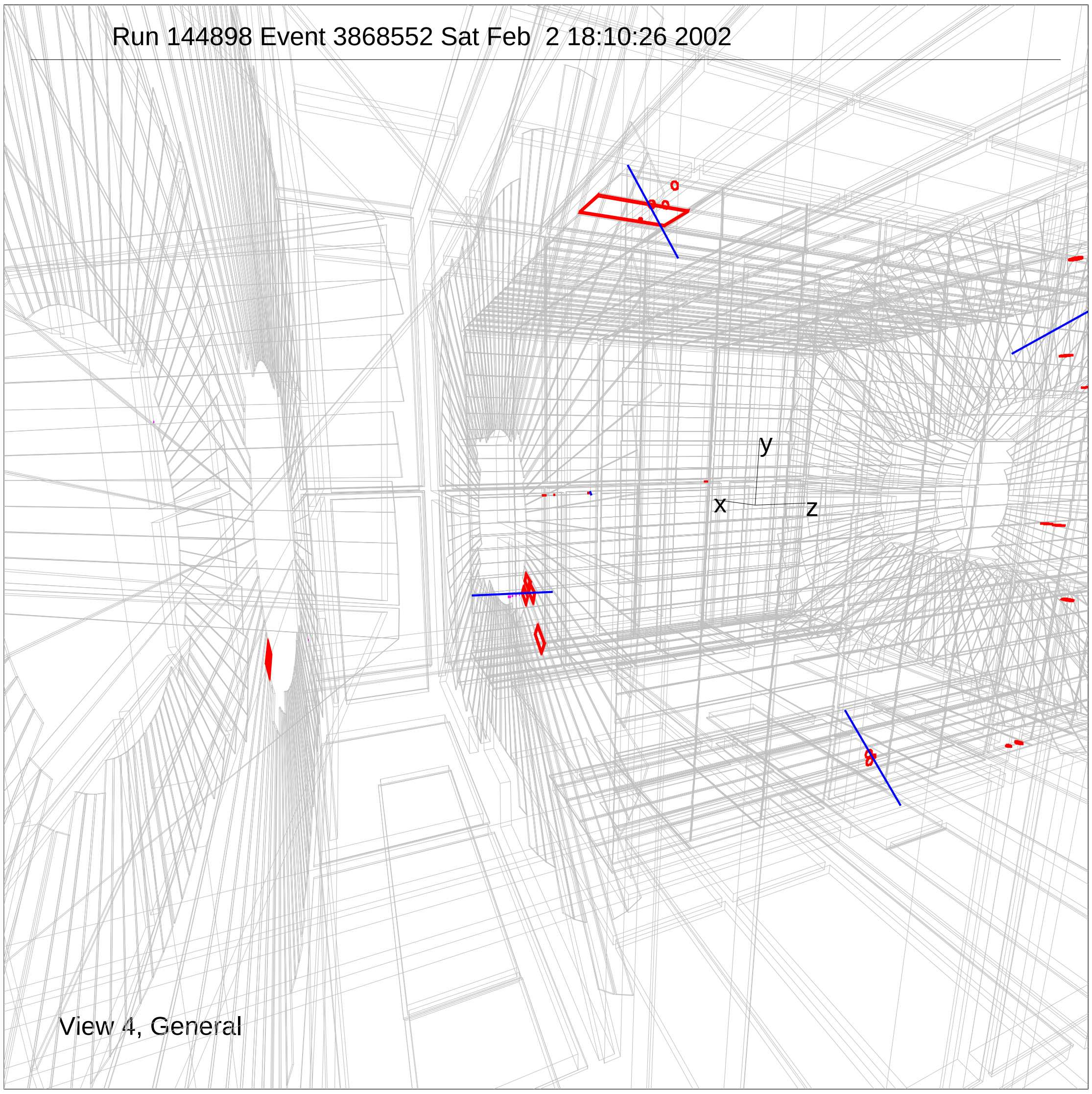
(Event **not** handpicked, this is the next event without any forward L2-μ (BC-)stubs)

Example III

Single- & Di-Muon L1 trigger fired (forward)

`mu1ptxbtxx + mu2ptxbtxx`

L2-μ found 1 A-stubs, but Ø BC-stubs in forward (central: 1 $\times$ A-stub).



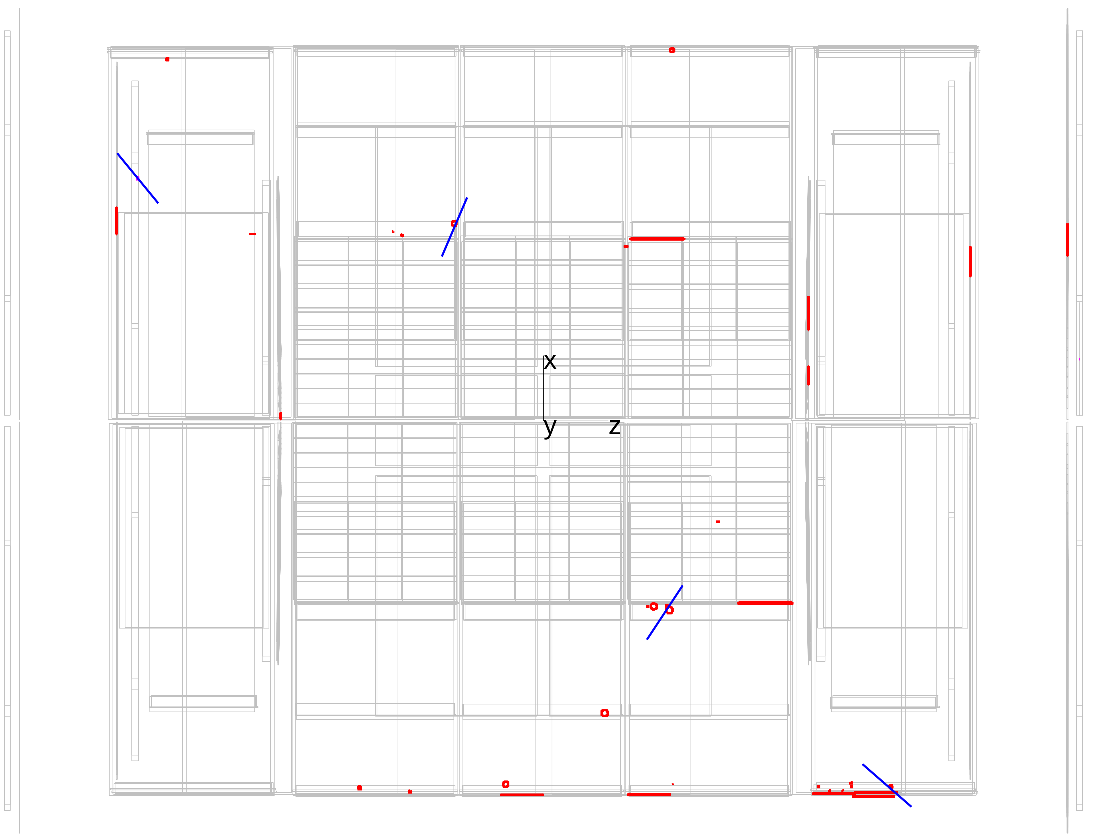
(First event with `mu1ptxbtxx` = `mu2ptxbtxx` = 1 but only A-stub (no BC) in forward L2-μ)

Single- & Di-Muon L1 trigger fired (forward)

`mu1ptxbtxx + mu2ptxbtxx`

L2-μ found Ø A-stubs and Ø BC-stubs in forward (No stubs in central).

Run 144898 Event 3868637 Sat Feb 2 18:17:35 2002



View 3, Plan (X-Z)

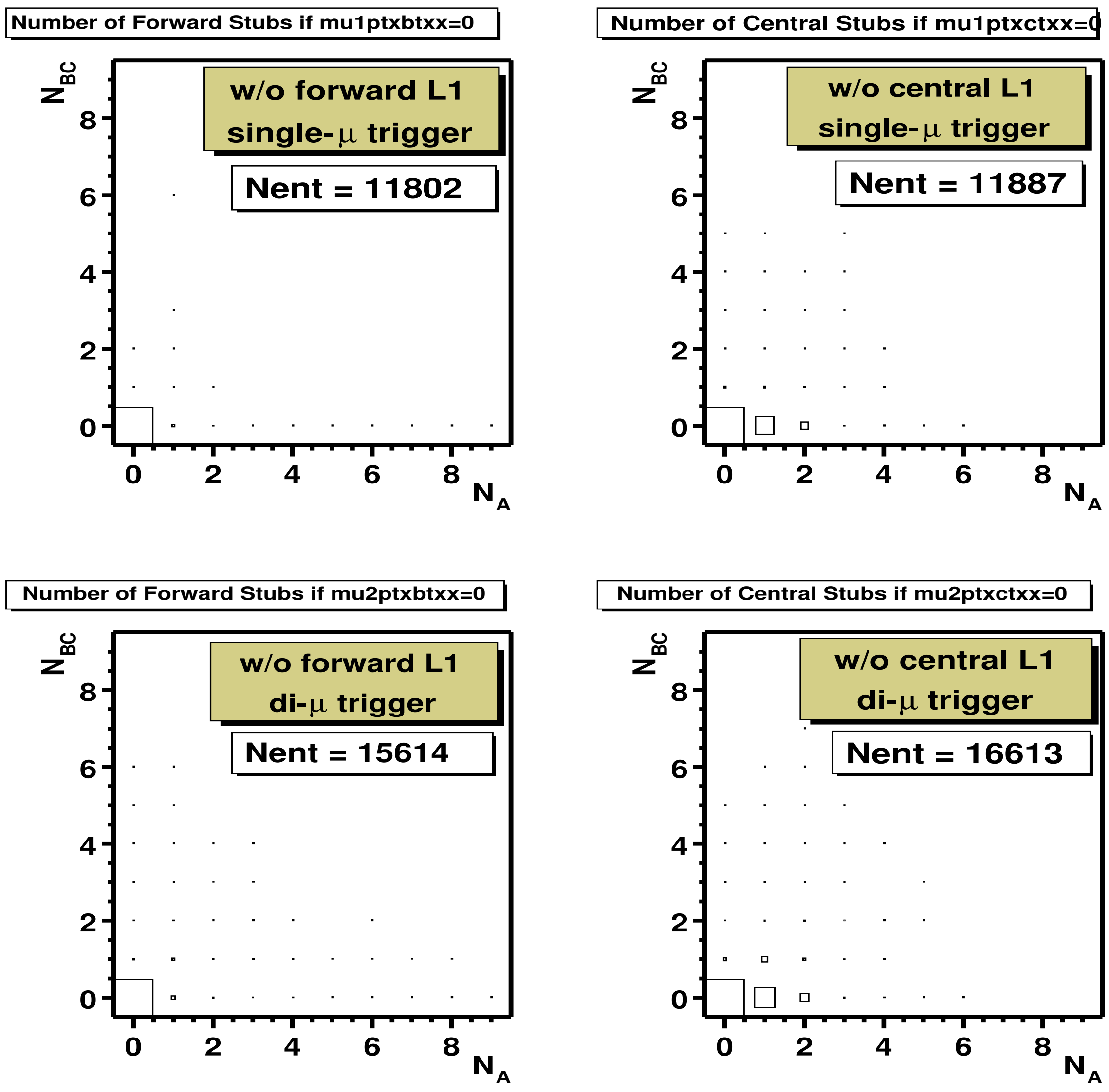
(First event without any L2-μ stubs, though `mu1ptxbtxx` = `mu2ptxbtxx` = 1)

L2-μ if .NOT.(L1-μ)

L2-μ algorithms

What happens if L1-Triggers have *NOT* fired?

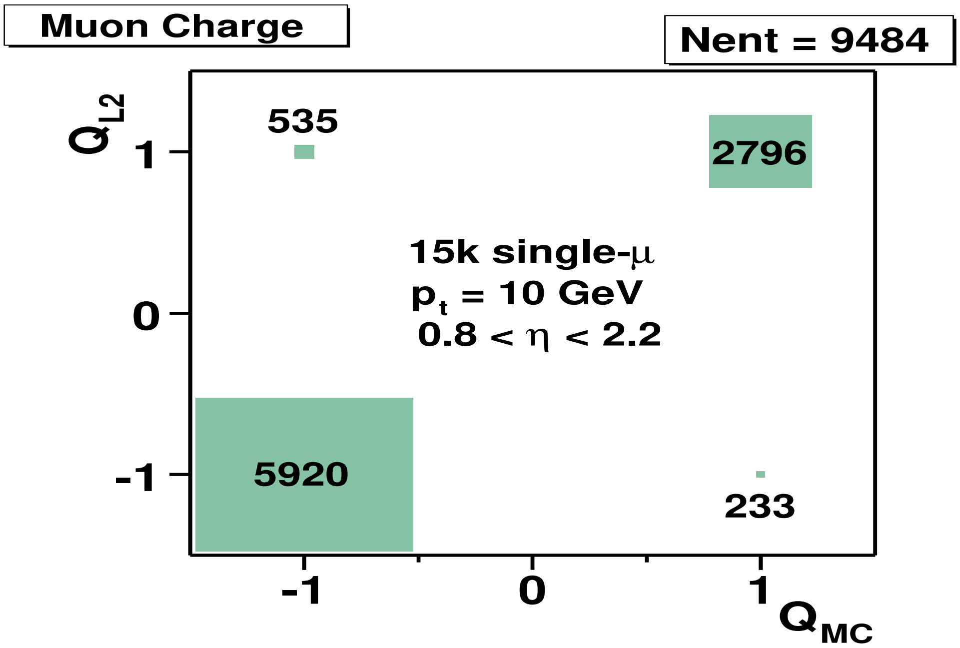
Runs 144574 and 144898

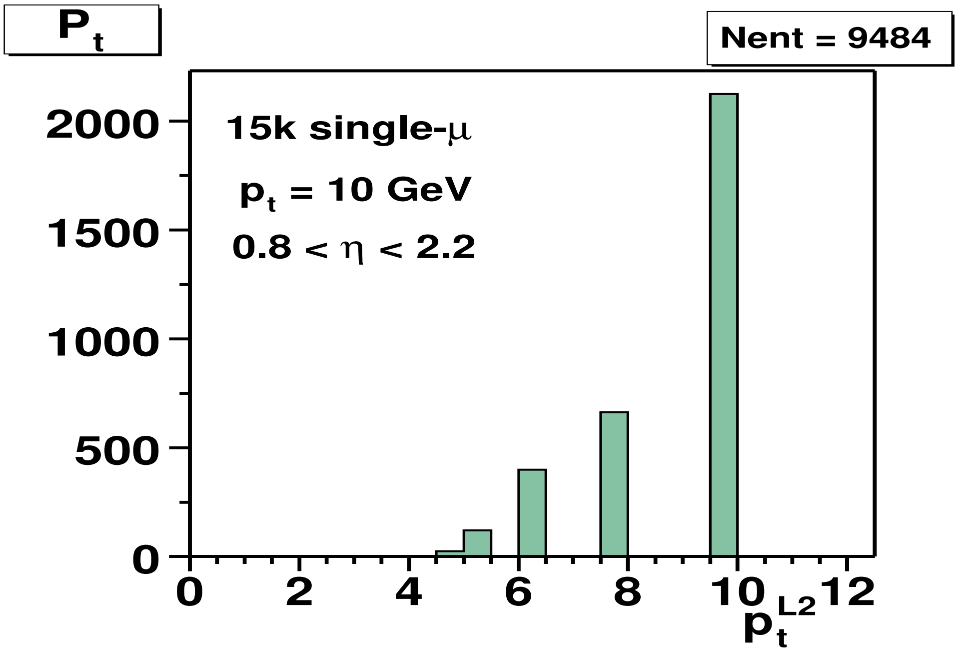


L2-μ measures P_t

(Christos Leonidopoulos)

Single-μ Monte Carlo: 10k μ^- + 5k μ^+





- L2-μ in good shape
  - runs smoothly on- and offline (~ identical code!)
  - We just have the tools now to study L2 performance, especially versus L1
  - L2-μ is reasonably efficient, even in it's unoptimized version (see below)
  - L2-μ is capable of rejecting against L1-muo (and this is only L2-μ so far: $\rightarrow$ + CAL + CFT ...?)
  - On the way of reading L2-μ in raw data
  - Adding t_{scint} (so far unused) + Measuring p_t $\rightarrow$ valuable for rejection!
- L2-μ-forward to-do list
  - correct ϕ and η of stubs $\rightarrow p_t$
  - report BC-slope in other units than η
  - understand distribution of reported Pixel times (shift of peak?!)

- study/optimize algorithm by allowing lose stubs (e.g. B (or C)-only stubs, stubs with fewer hits etc.)

✦ More items for L2-μ

- debug/finish L1-algorithms (L2 “translators” of L1 objects)
- Compare online vs. offline results
- study/eliminate double counting (very nearby μ-tracks)
- study forward & central algorithms extensively $\rightarrow$ Efficiency, Rejection
- Algorithms don’t yet use Scintillator times, the shown times are simply reported downstream $\rightarrow$ more potential?
- ...