Preliminary study on HLT:

Summary:

I) Looking for a fast fitting algorithm for L2 trigger

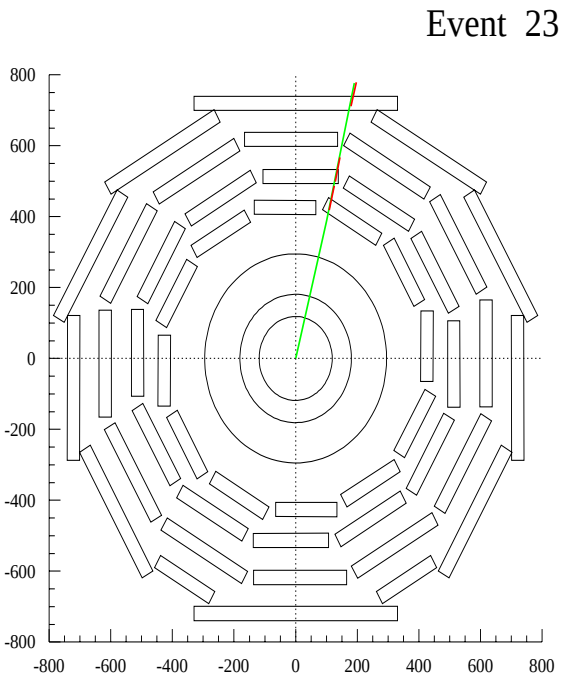
- Description of the algorithm,
- Momentum assignments, resolution,
- Applying the algo to minimum bias single muon events.
- Conclusion and future

II) L2 study on di-muons topology:

- Rates
- Expected efficiency for H->WW->2μ 2ν

Description of the algorithm:

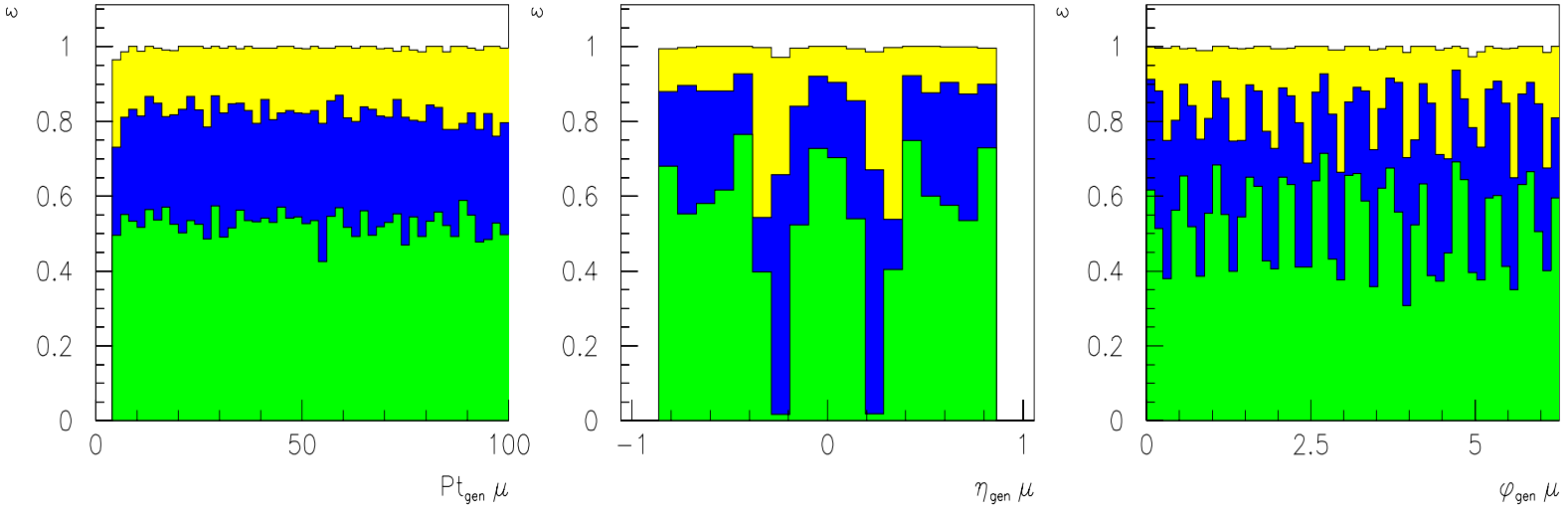
Algo develeped and studied with single muon sample, $|\eta|<0.8$; $5 < Pt < 100$ GeV



- Start from local pattern recognition on Muon Station (track elements TE's),
- Use information of position of TE's
- Search a pattern of 4 aligned TE's, then 3, then 2,
- The presence of (at least) 2 TE's validate the candidate.

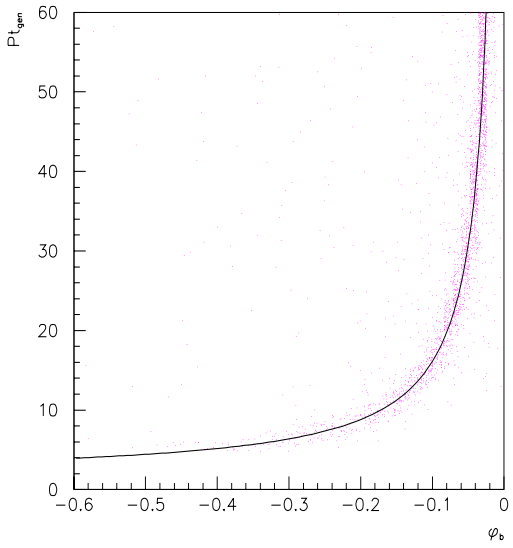
Efficiency for finding candidates:

- 4 TE's ε~53%
- 3 TE's ε~29%
- 2 TE's ε~17%
- TOTAL ε>99% (for pt>7~8GeV)



Angle - momentum correlation:

- In most of the cases a TE is present in MB1 (~71%), use this TE for Pt assignment
- Parametrize Pt_{gen} vs φ_b for MB1 (assuming muon from vertex),

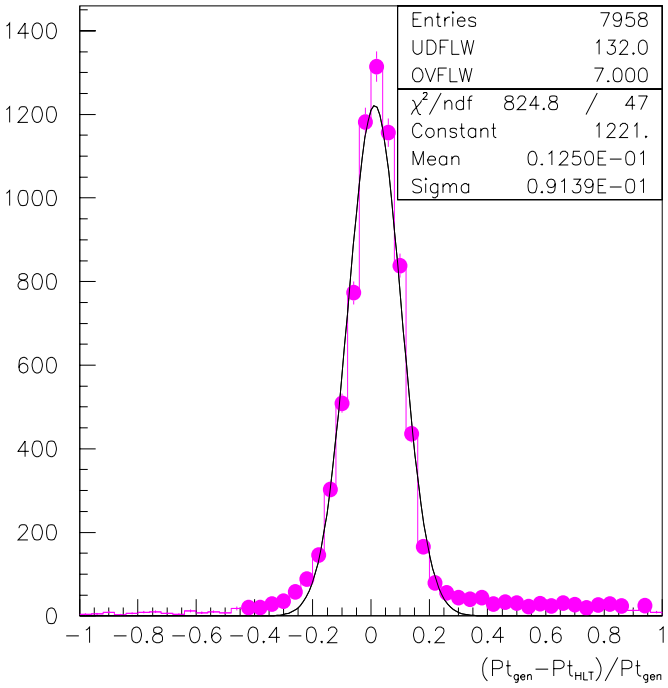


Use a simple parametrization

$$Pt = A - \frac{B}{\varphi b}$$

Assign pt to candidates according to this parametrization given φ_b measured @ MB1 (if present)

Momentum resolution:



- σ~ 9 %

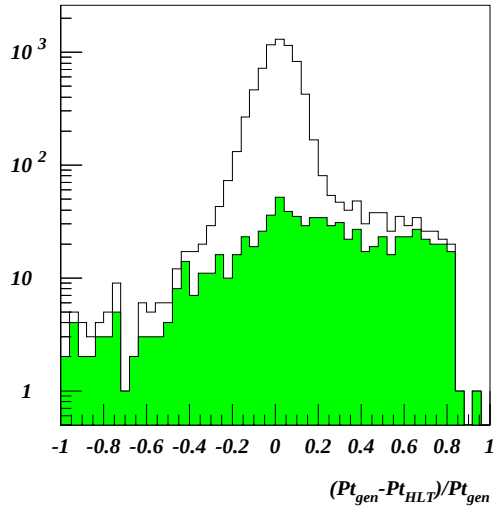
good!
comparable to off-line Kalman filter

Large non gaussian tail!

Which is the origin of this tail?

Origin of tail:

- Large fraction of tail comes from TE reconstructed with 4 or less hits, so probably 'bad quality' TE's (in green below)



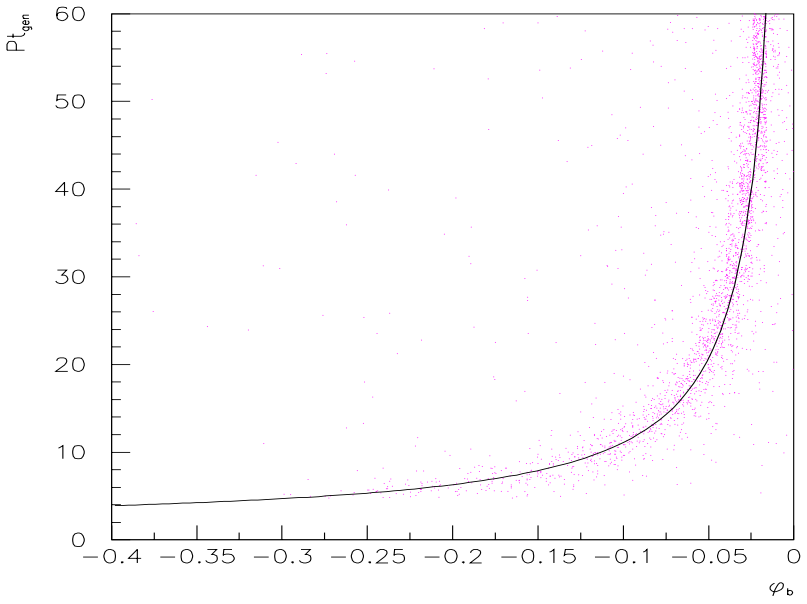
This tail can be reduced
with a better local reconstruction
(see A.Vitelli talk),

or/and

with a independent pt assignment
(e.g. using MB2 if present - see below)

Using MB2

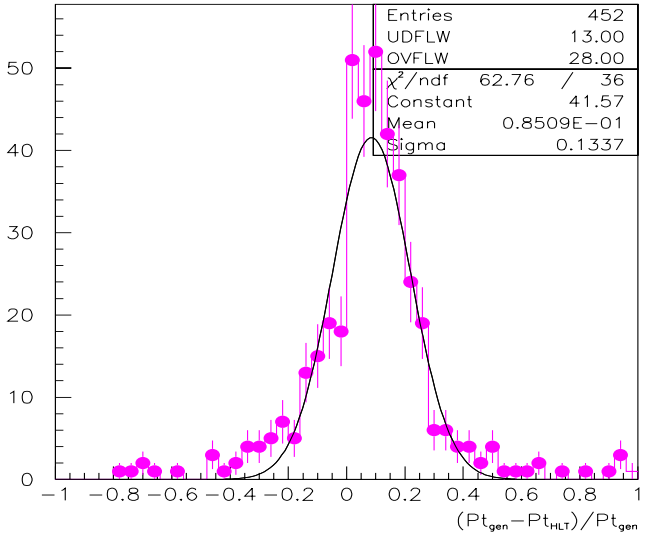
- MB1 TE is present only ~71% of the times (geometrical efficiency),
- MB2 TE is present in ~19% of remnants case,
- Use the same method to assign pt from MB2, with similar parametrization.



Resolution @ MB2

- Bending angle @ MB2 smaller (bending between MB1 and MB2),
- More material in front (~30 cm Iron), more multiple scattering,

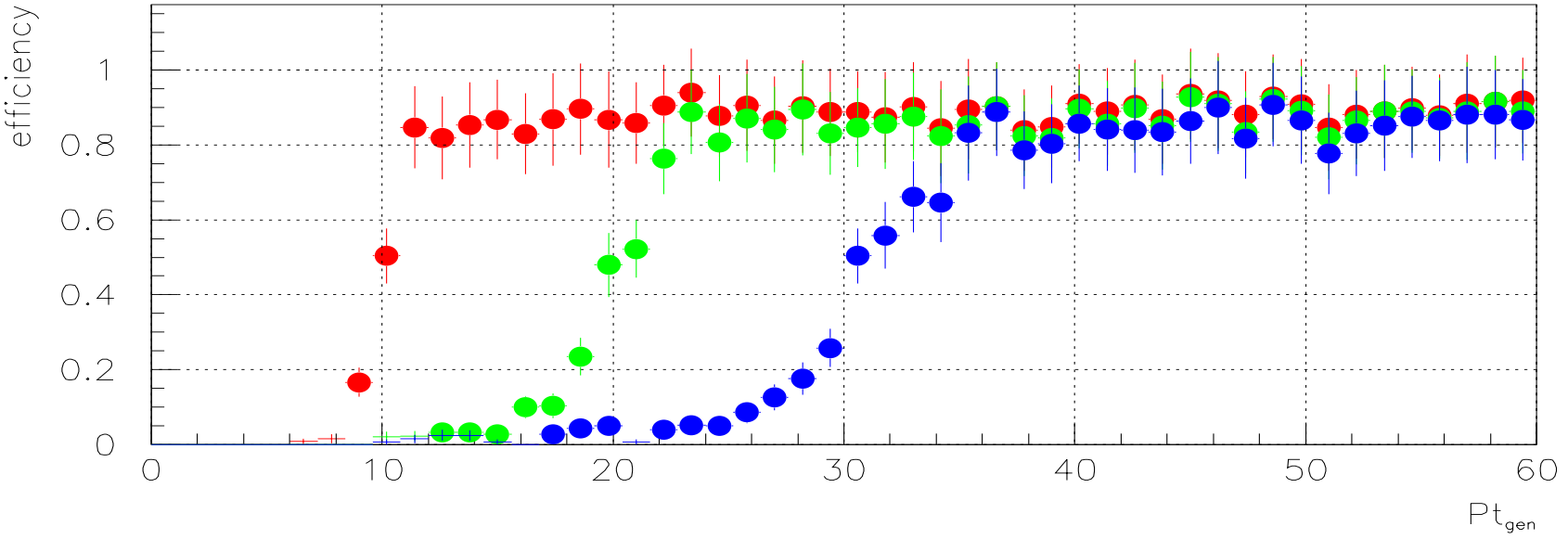
→ Worse resolution



σ~ 13 % still good!

No hope to use (with this method) MB3 or 4

Efficiency:

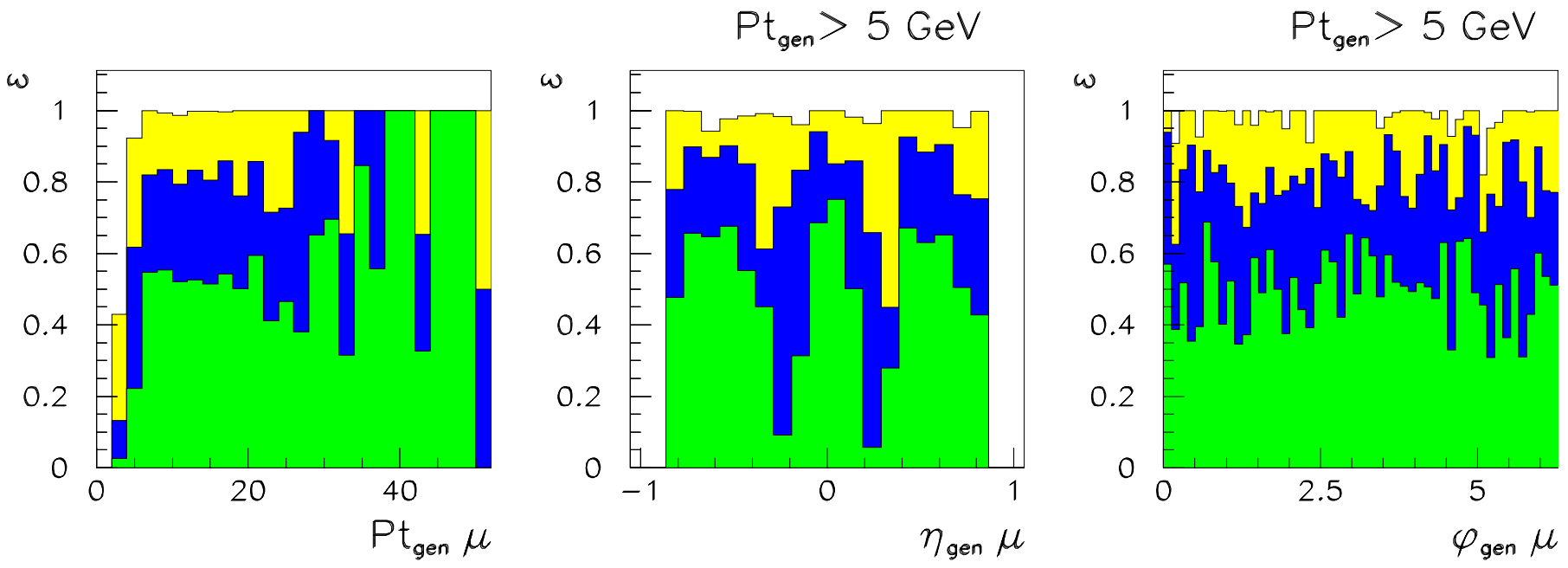


Pt threshold on Pt_HLT: 10 , 20 and 30 GeV
10% inefficency for not considering MB3

Example: application to minimum bias events

- So far, results on single muon events:
- Try (as exercise) to apply the same HLT algorithm to realistic events: minimum bias with 1 muon:
- Look at efficiency, resolution, tail and effect on rate:

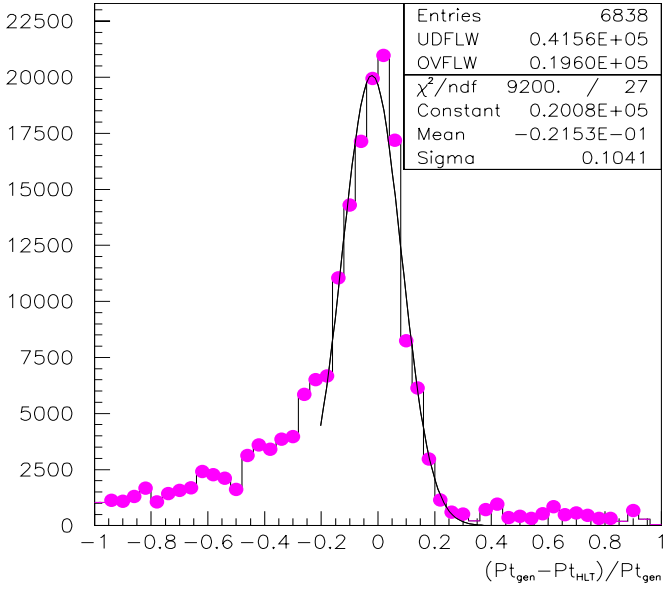
Efficiency:



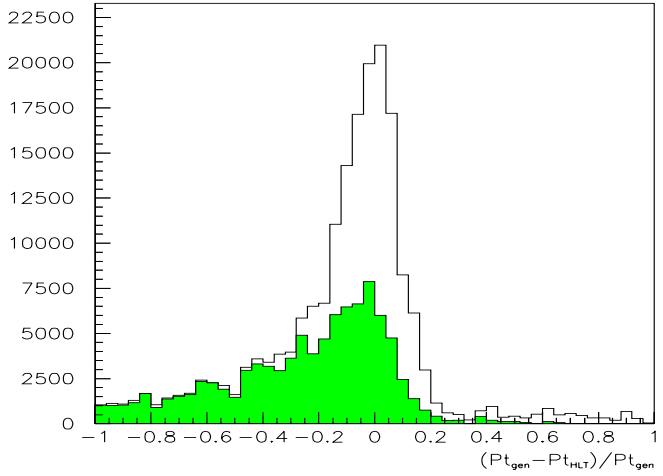
- 4 TE's ε~51%
- 3 TE's ε~22%
- 2 TE's ε~18%

for Pt>5 GeV

Resolution:

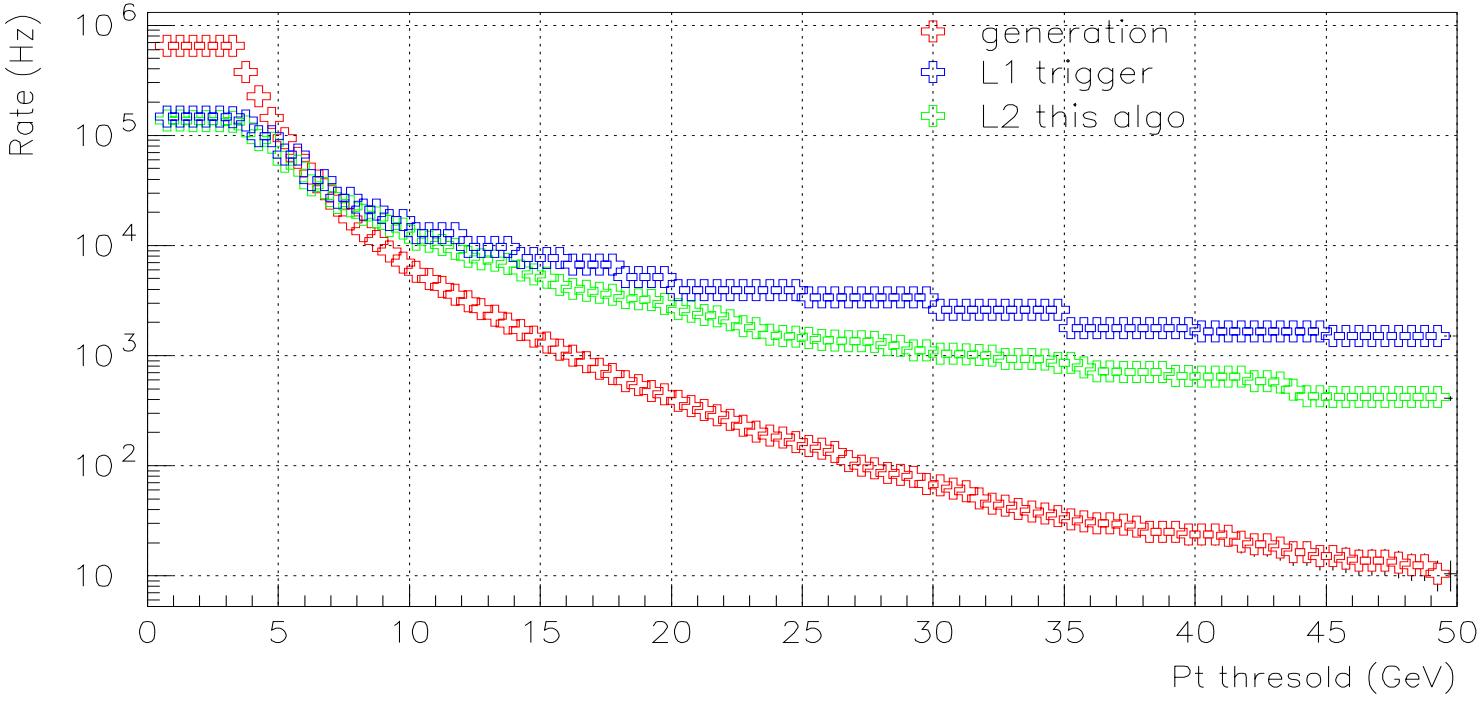


Large tail, pt overestimated
Contribution from *non-prompt muons*



For this (non-prompt) muon, the algorithm doesn't work !

Rate:


Rate (Hz)
10 6
10 5
10 4
10 3
10 2
10
0
5
10
15
20
25
30
35
40
45
50
Pt thresold (GeV)
generation
L1 trigger
L2 this algo

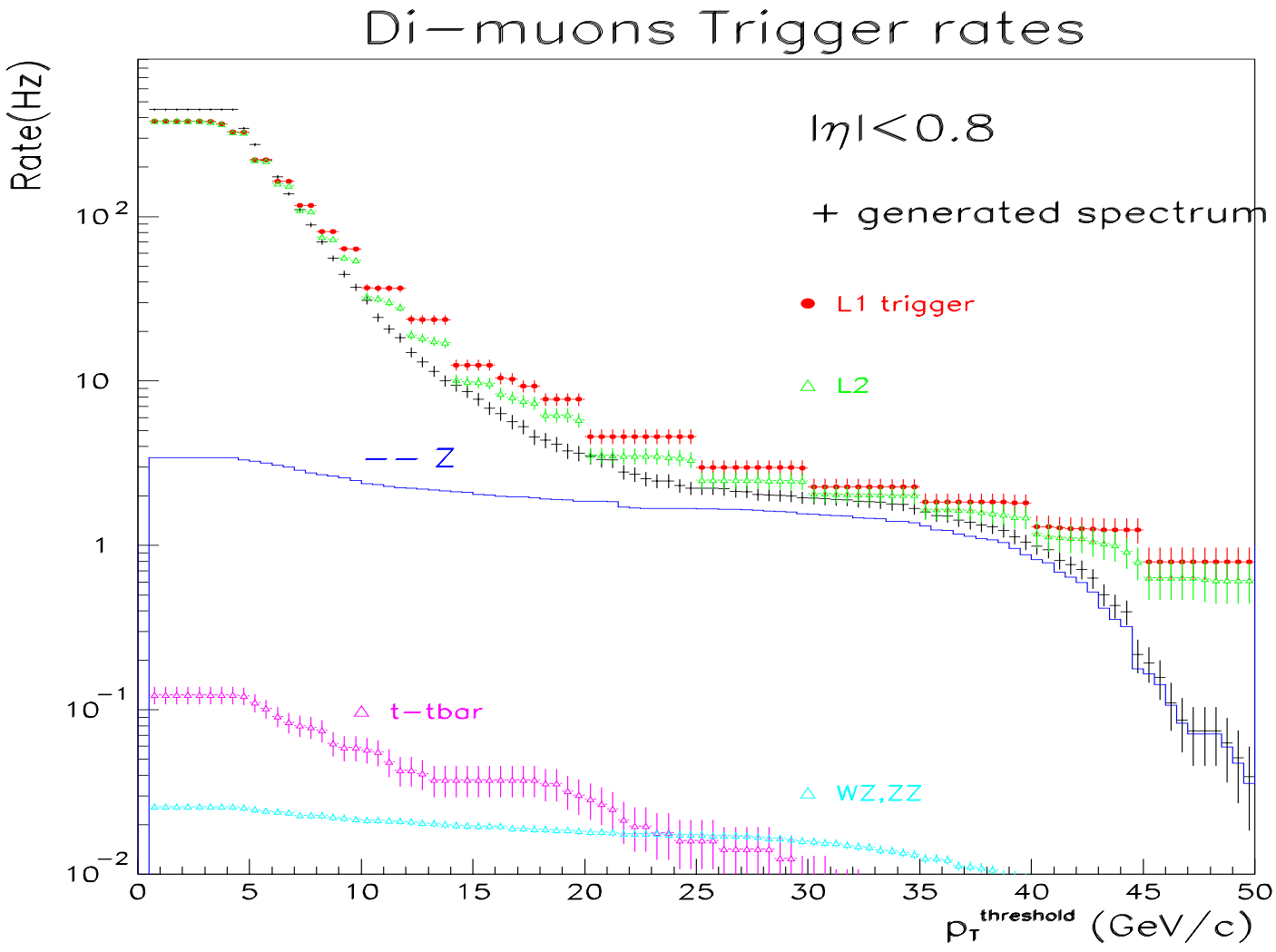
Conclusion

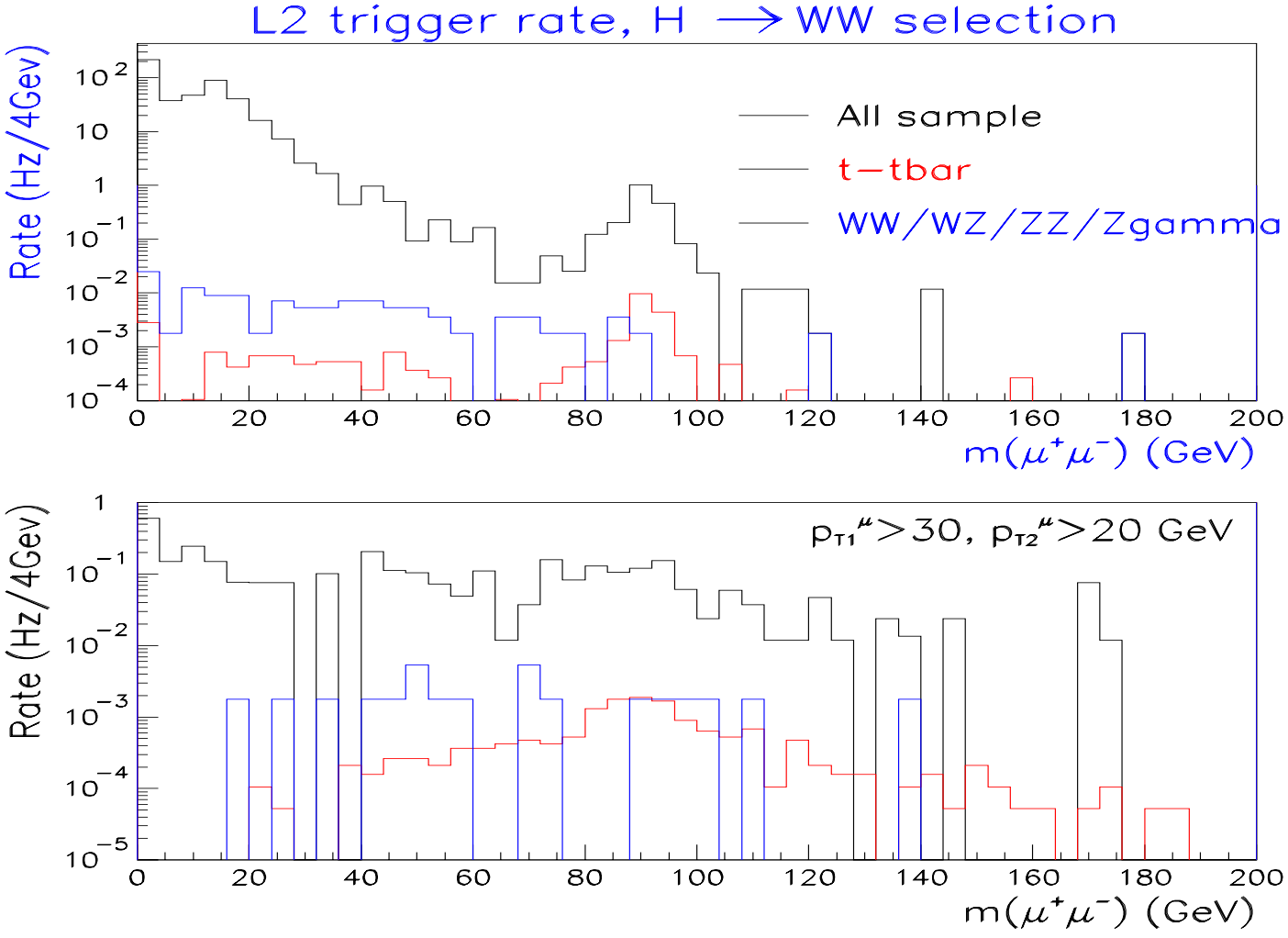
Work in progress, first results seems promising,

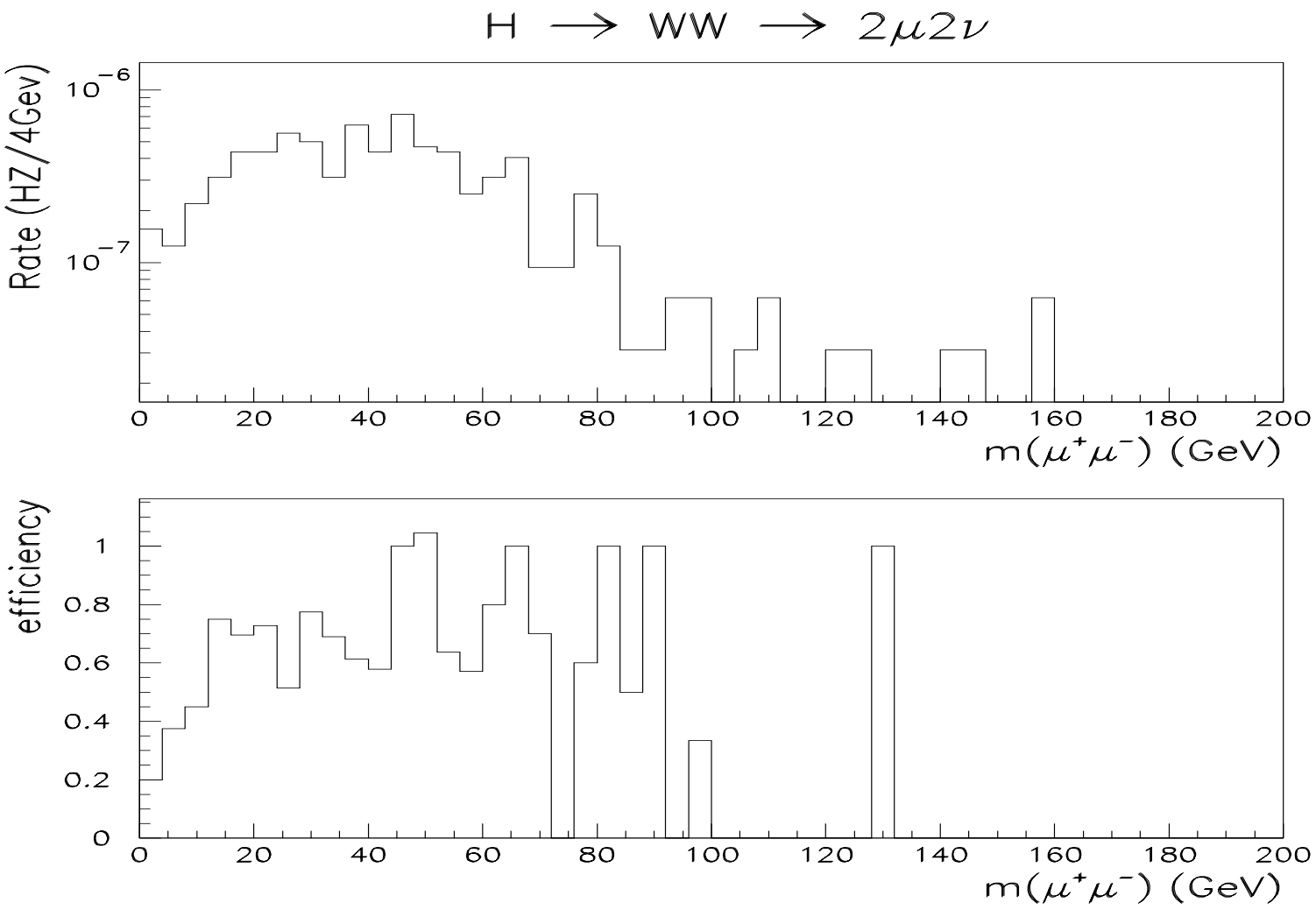
Further (essential) improvements:

- improve local reconstruction (TE's),
- use MBx to assign pt without vertex constrain,
- use the full pattern, not only the innermost station,
- improve efficiency,
- ...

This measurements can be used as first estimate to be passed to Kalman filter


Di−muons Trigger rates
Rate(Hz)
|η|<0.8
+ generated spectrum
L1 trigger
L2
Z
t−tbar
WZ,ZZ
10^2
10
1
10^{-1}
10^{-2}
0
5
10
15
20
25
30
35
40
45
50
$p_T^{threshold}$ (GeV/c)


L2 trigger rate, H → WW selection
Rate (Hz/4Gev)
All sample
t−tbar
WW/WZ/ZZ/Zgamma
m(μ⁺μ⁻) (GeV)
pT1μ>30, pT2μ>20 GeV
Rate (Hz/4Gev)
m(μ⁺μ⁻) (GeV)


H → WW → 2μ2ν
Rate (HZ/4Gev)
10⁻⁶
10⁻⁷
0
20
40
60
80
100
120
140
160
180
200
m(μ⁺μ⁻) (GeV)
efficiency
1
0.8
0.6
0.4
0.2
0
0
20
40
60
80
100
120
140
160
180
200
m(μ⁺μ⁻) (GeV)