HLT Workshop

Dimuons trigger

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HLT Workshop,

CERN 21 july 2000

Outline

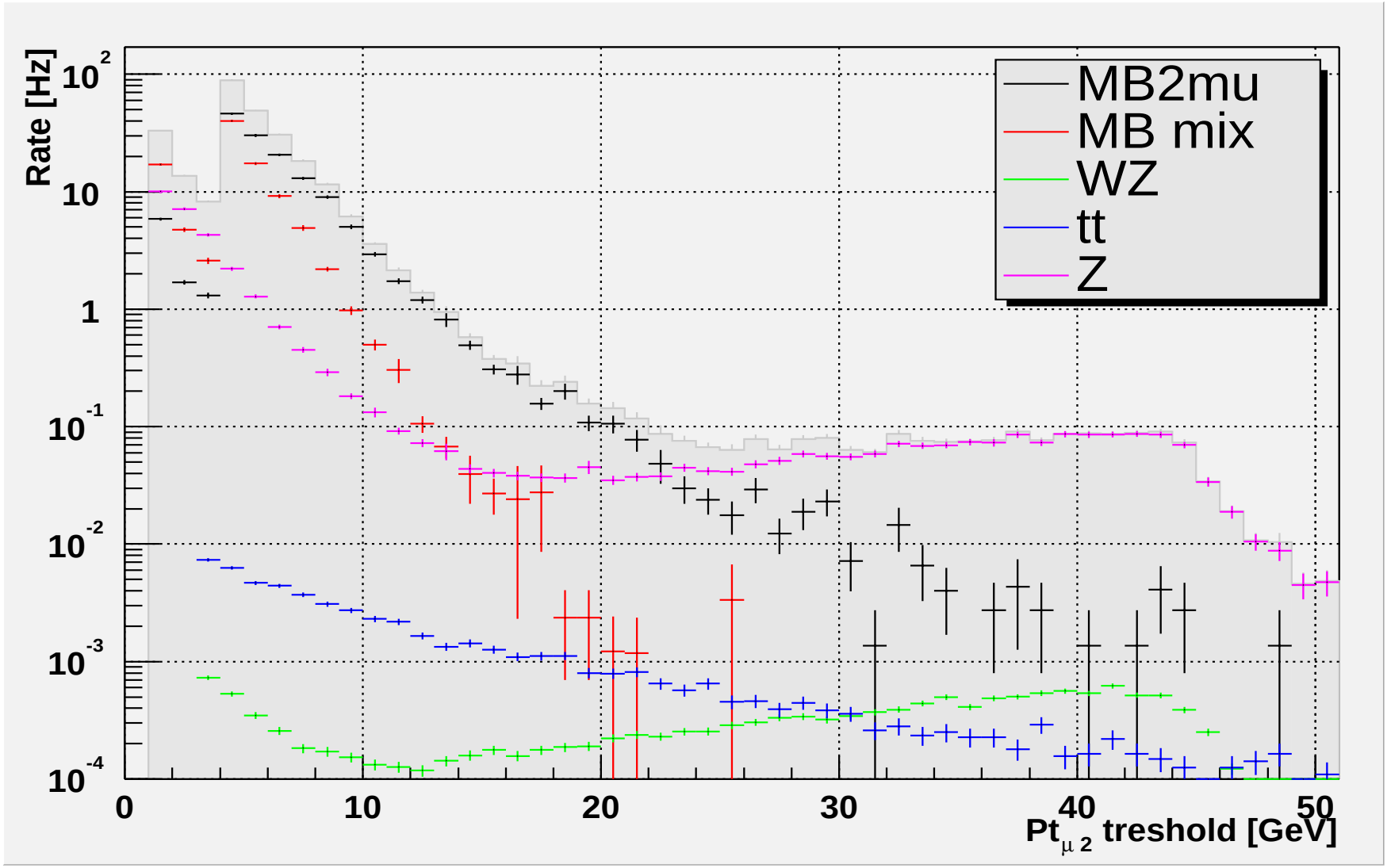
- dataset
- Generated rates
- Topology
- L1 & L2 rates - symmetric and asymmetic cut
- L1 & L2 Efficency
- $H \rightarrow WW \rightarrow 2\mu$ selection
- Conclusion

Data Sets

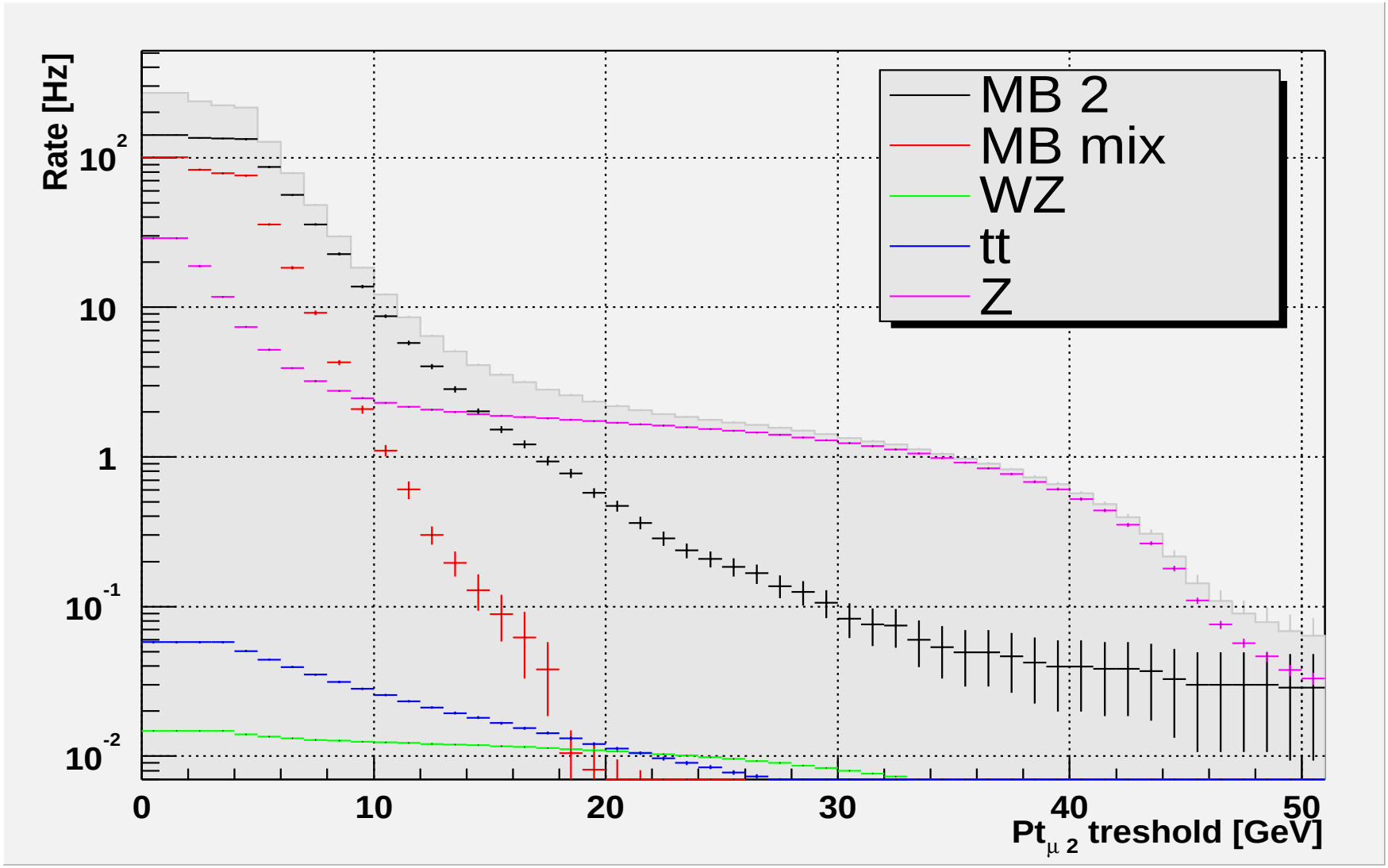
Di-muon topology:

Dataset	description	N. events	$\int \mathcal{L}dt\ [\text{nb}^{-1}]$
MB2mu	MB $\rightarrow 2\mu + X$ $p_t^{\mu 1} > 8$ GeV, $p_t^{\mu 2} > 4$ GeV	61911	72.84
MBmix_mu2	2 single muon MB events overlapped (same BX)		
	$p_t^{\mu 1} > 8$ GeV, $p_t^{\mu 2} > 4$ GeV	44237	5.79
WZ2mu	$W, Z \rightarrow 2\mu + X$	9999	$6.793 \cdot 10^5$
tt2mu	$t\bar{t} \rightarrow 2\mu + X$	9378	$1.624 \cdot 10^5$
Z_mu	$Z \rightarrow 1\mu$ (mostly $Z \rightarrow 2\mu$)	48981	898.
HWW2m	$H \rightarrow WW \rightarrow 2\mu$		
	($m_H = 120$GeV)	5000	$1.934 \cdot 10^8$
	($m_H = 140$GeV)	5000	$6.034 \cdot 10^7$
	($m_H = 160$GeV)	5000	$3.589 \cdot 10^7$
	($m_H = 200$GeV)	5000	$6.194 \cdot 10^7$
	($m_H = 300$GeV)	5000	$1.209 \cdot 10^8$

Differential rate $|\eta| < 2.4$

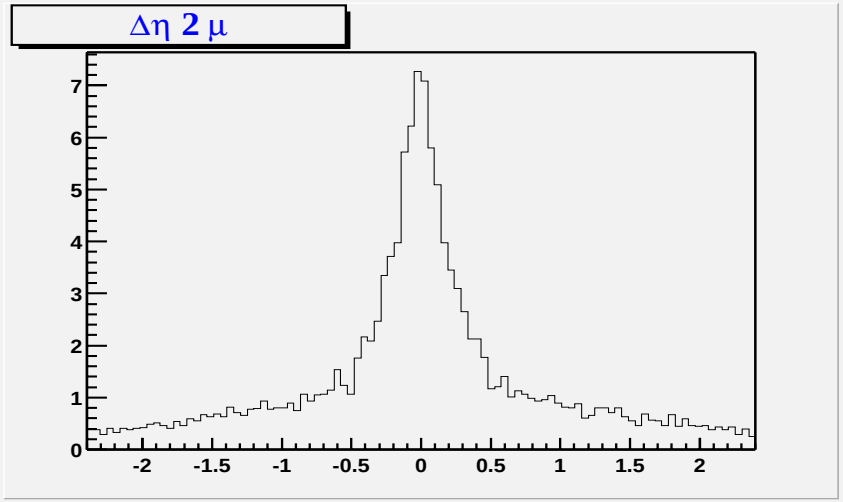


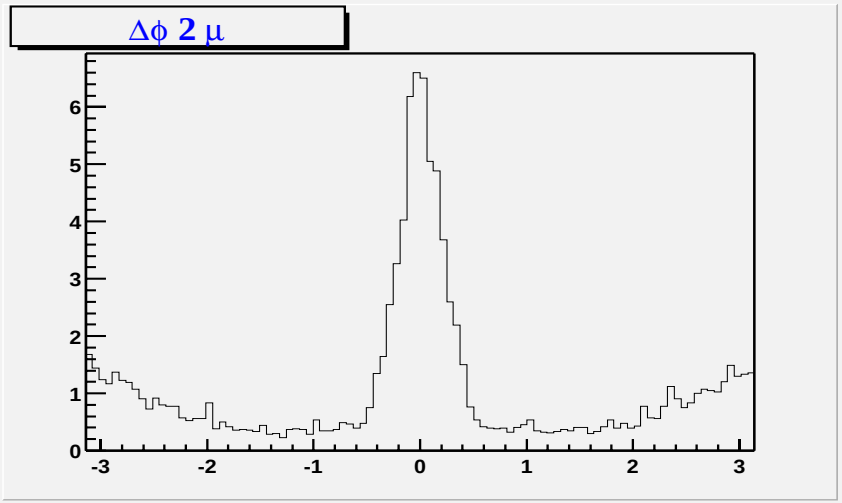
Integral rate $|\eta| < 2.4$



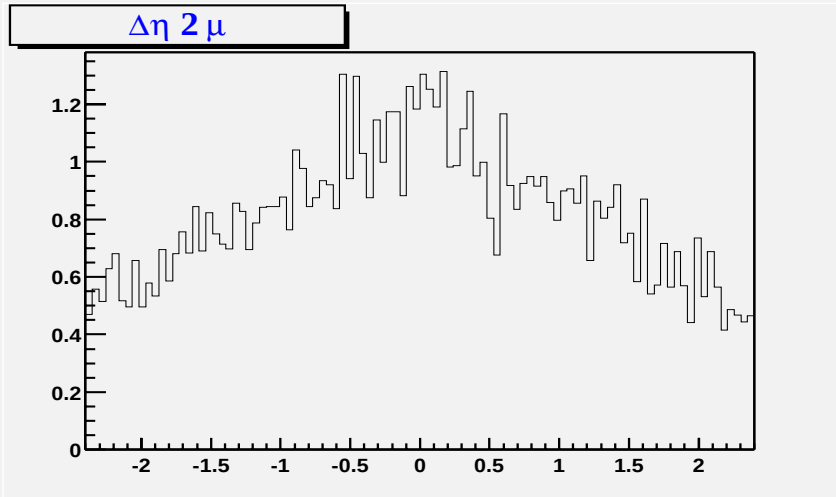
MB Topology

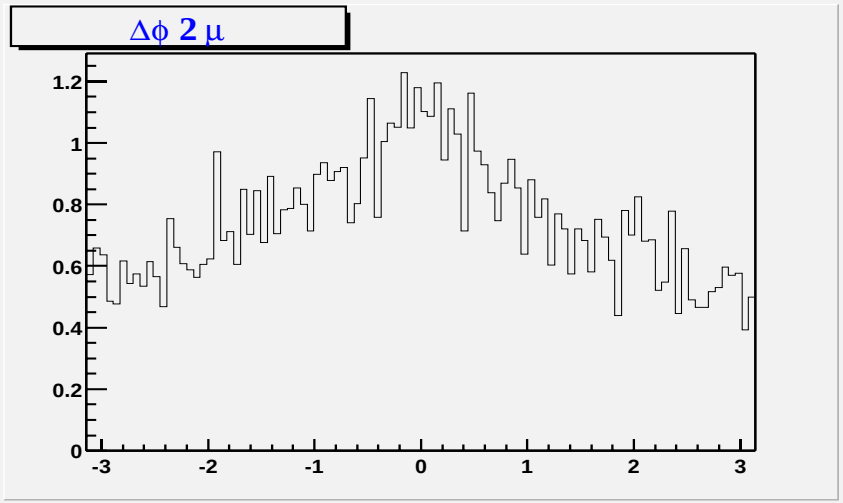
$MB \rightarrow 2\mu$





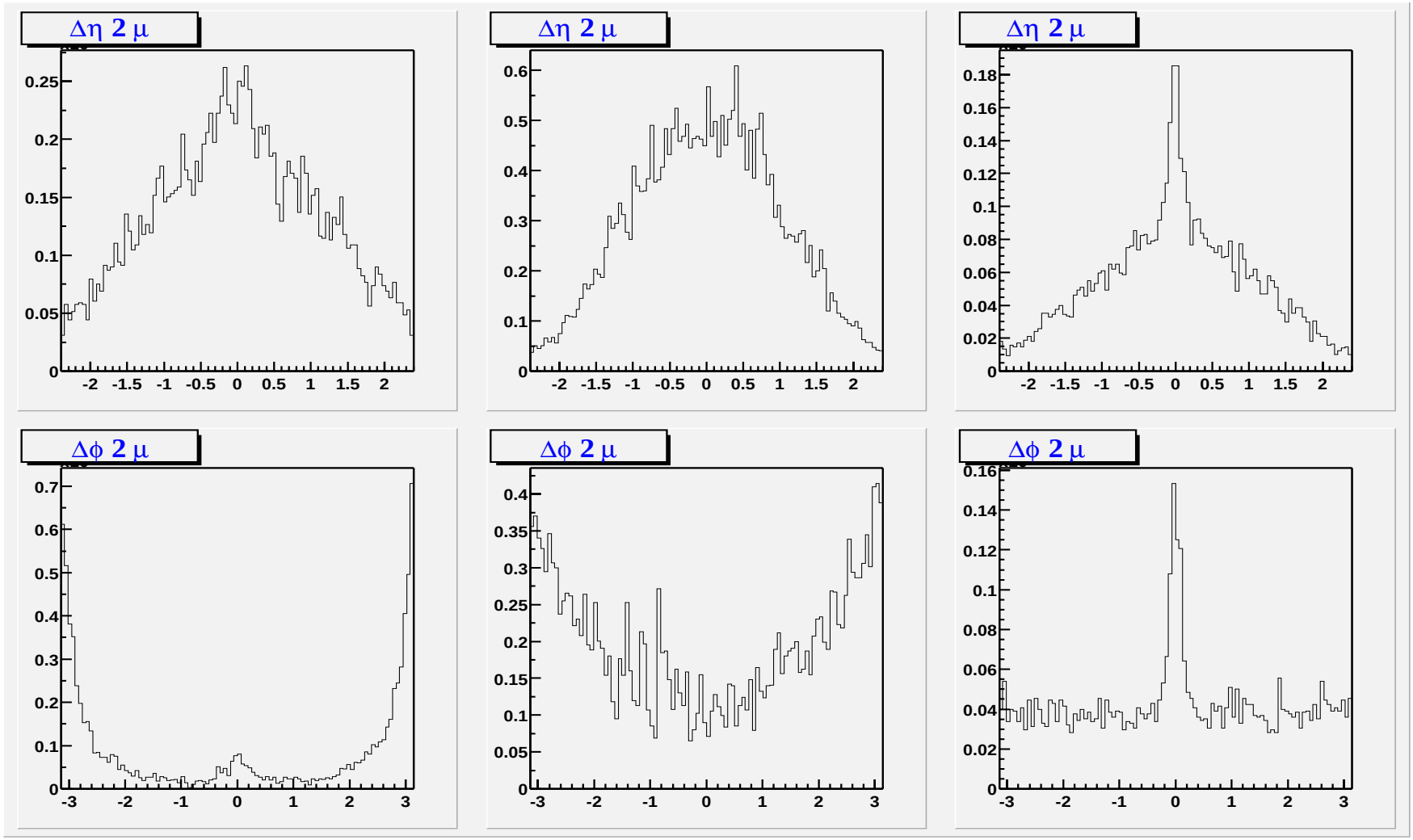
MB mixed



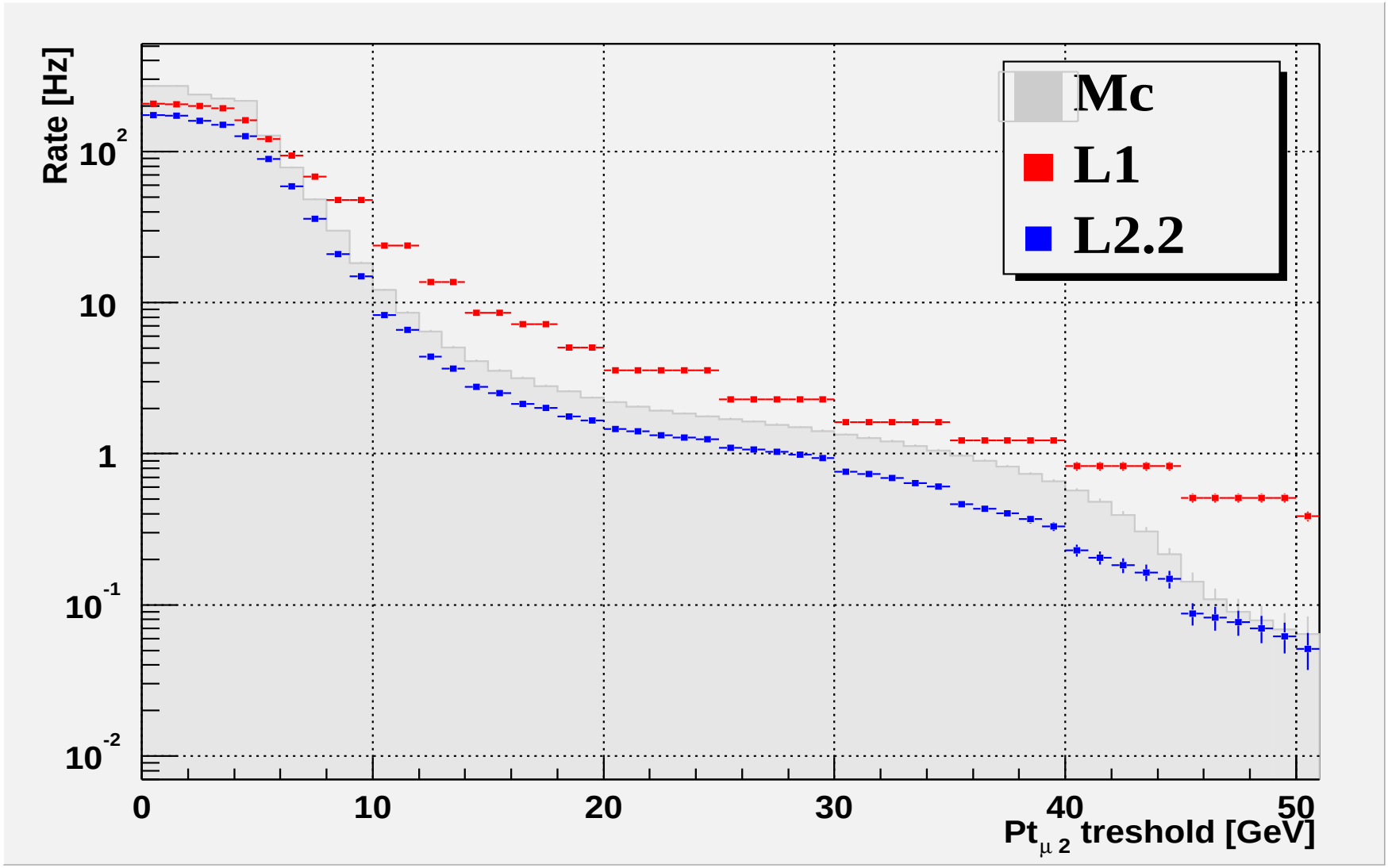


Signal Topology

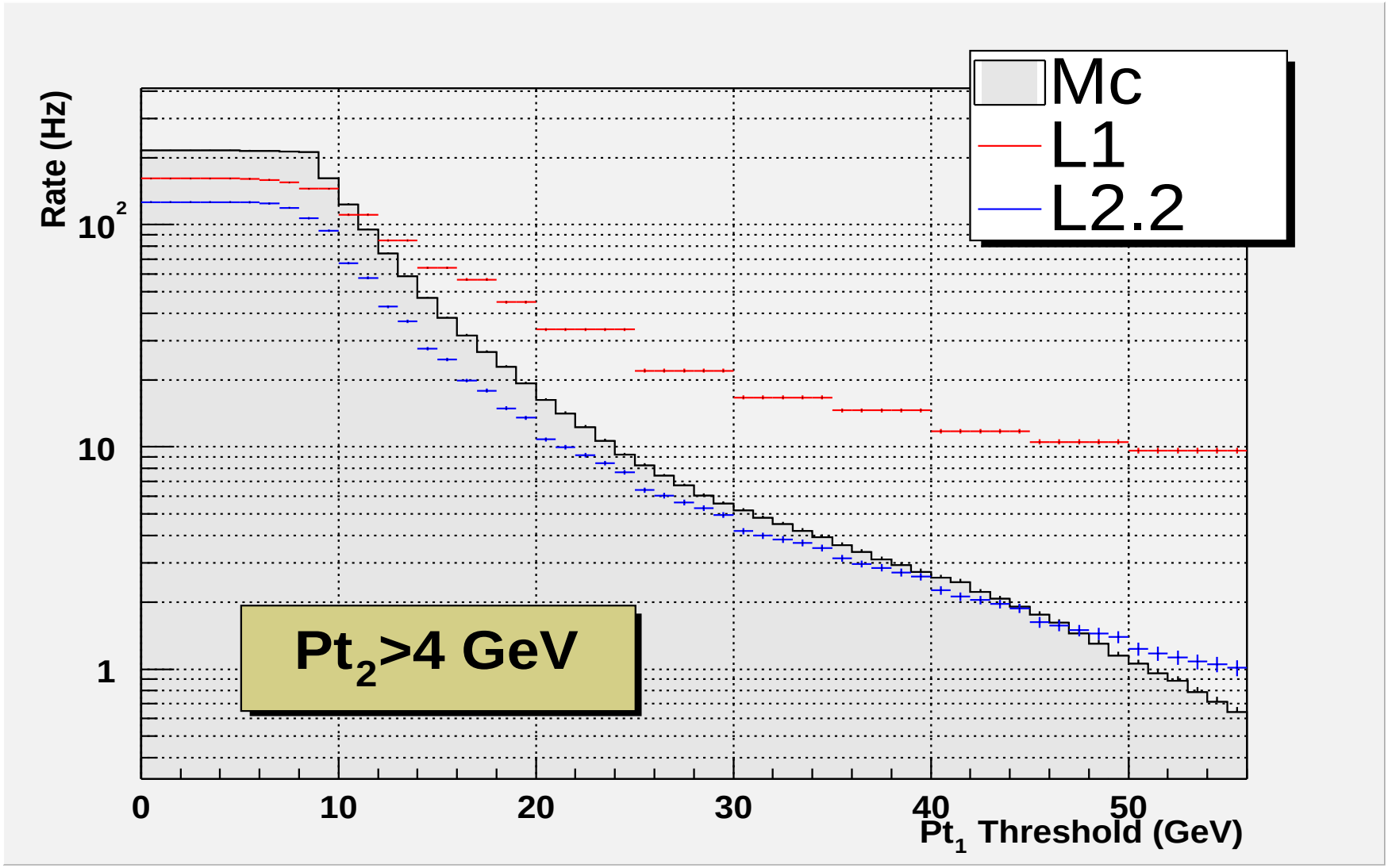
$WZ \to 2\mu$ | $Z \to 2\mu$ | $t\bar{t} \to 2\mu + X's$



L1 & L2.2 Integral rate $|\eta| < 2.4$



L1 & L2.2 Integral rate Asymmetric cut $|\eta| < 2.4$



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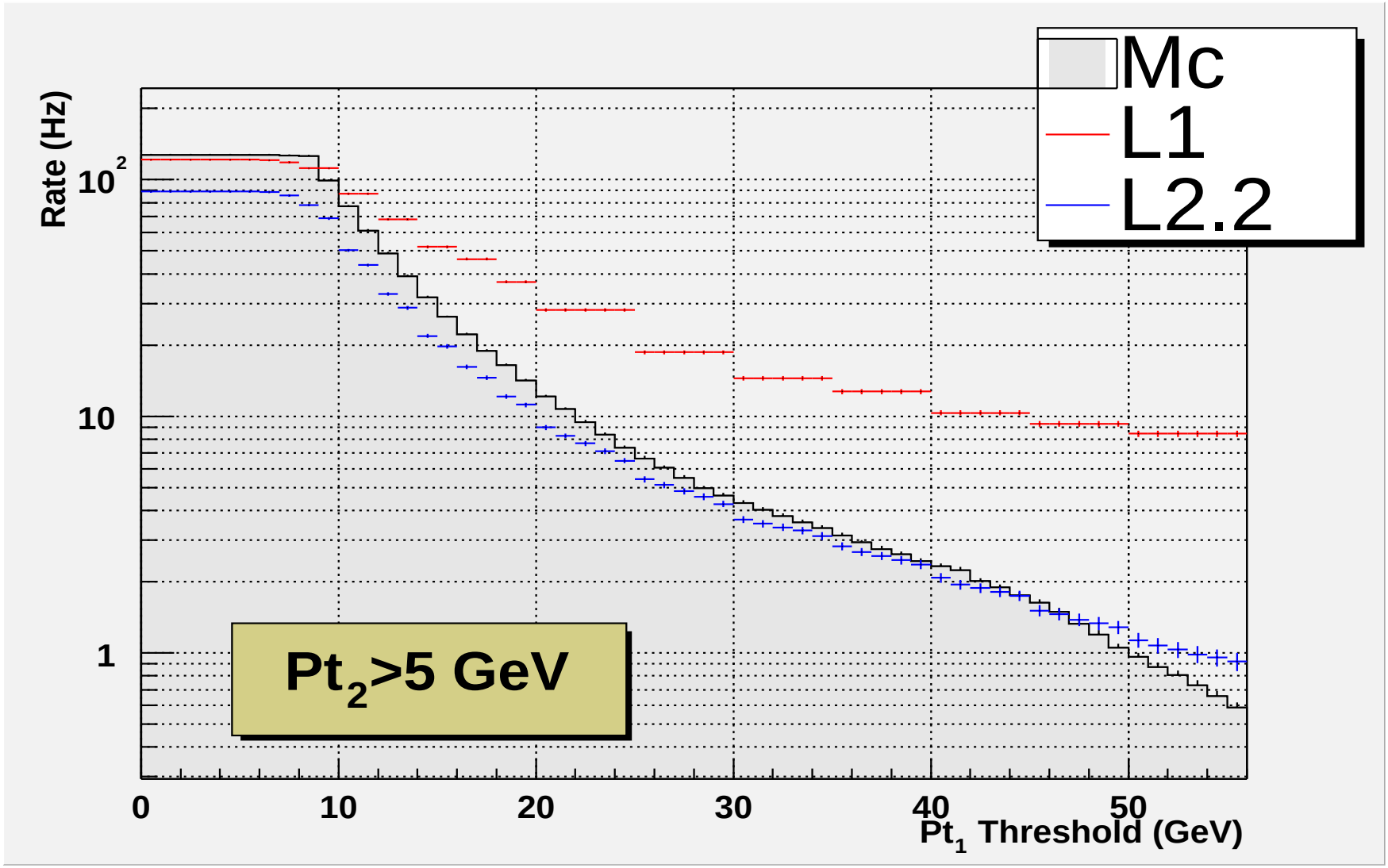

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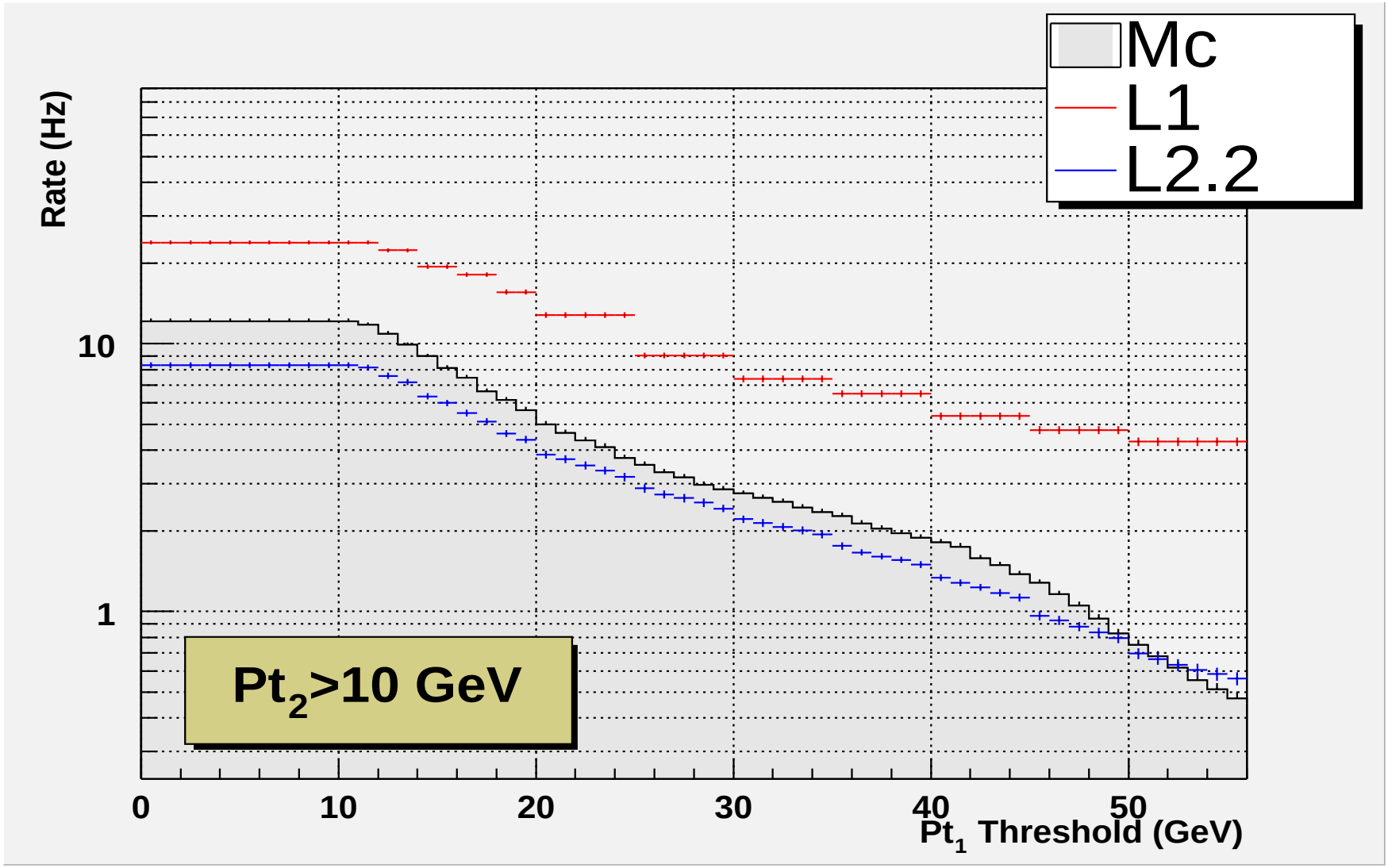

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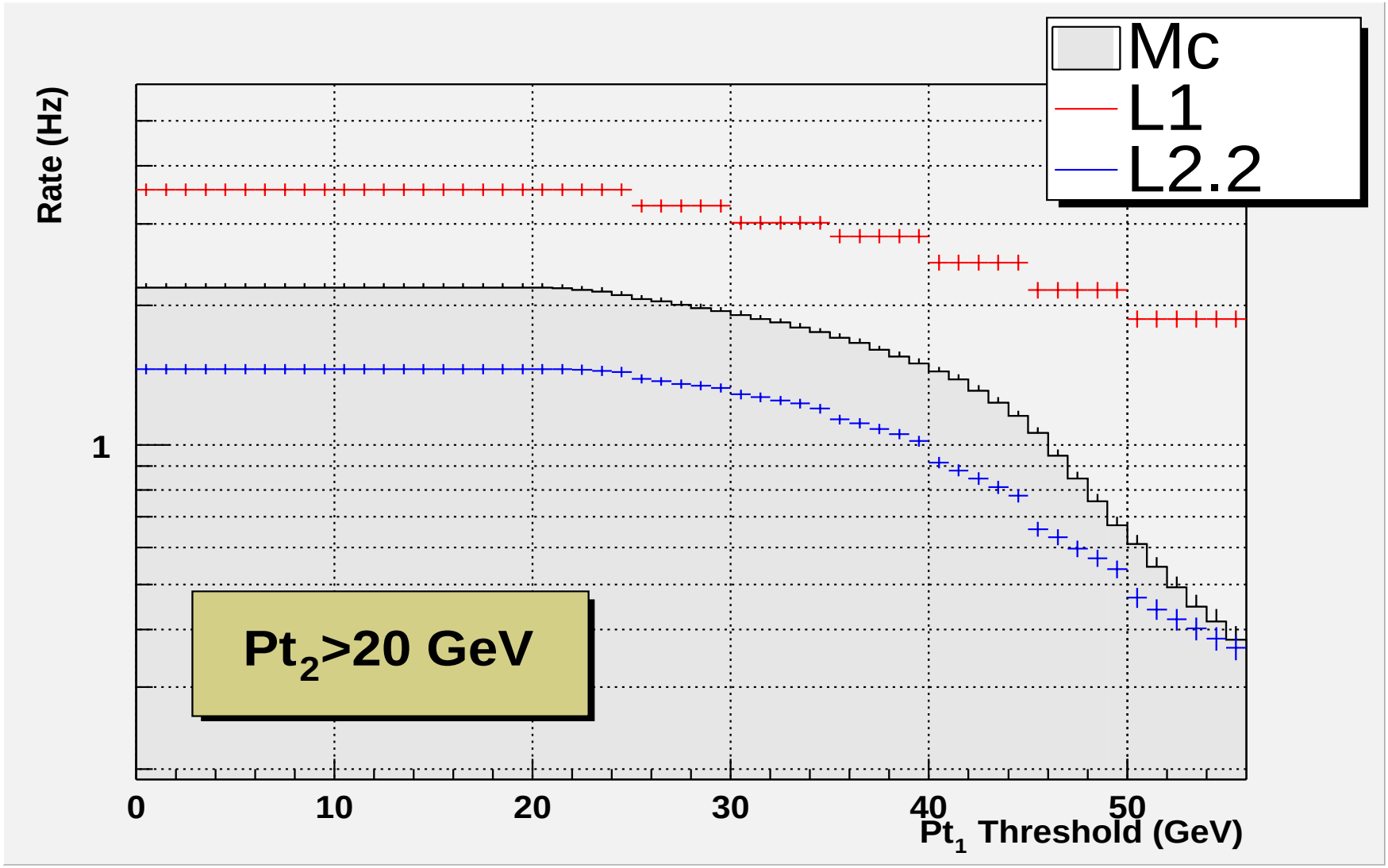
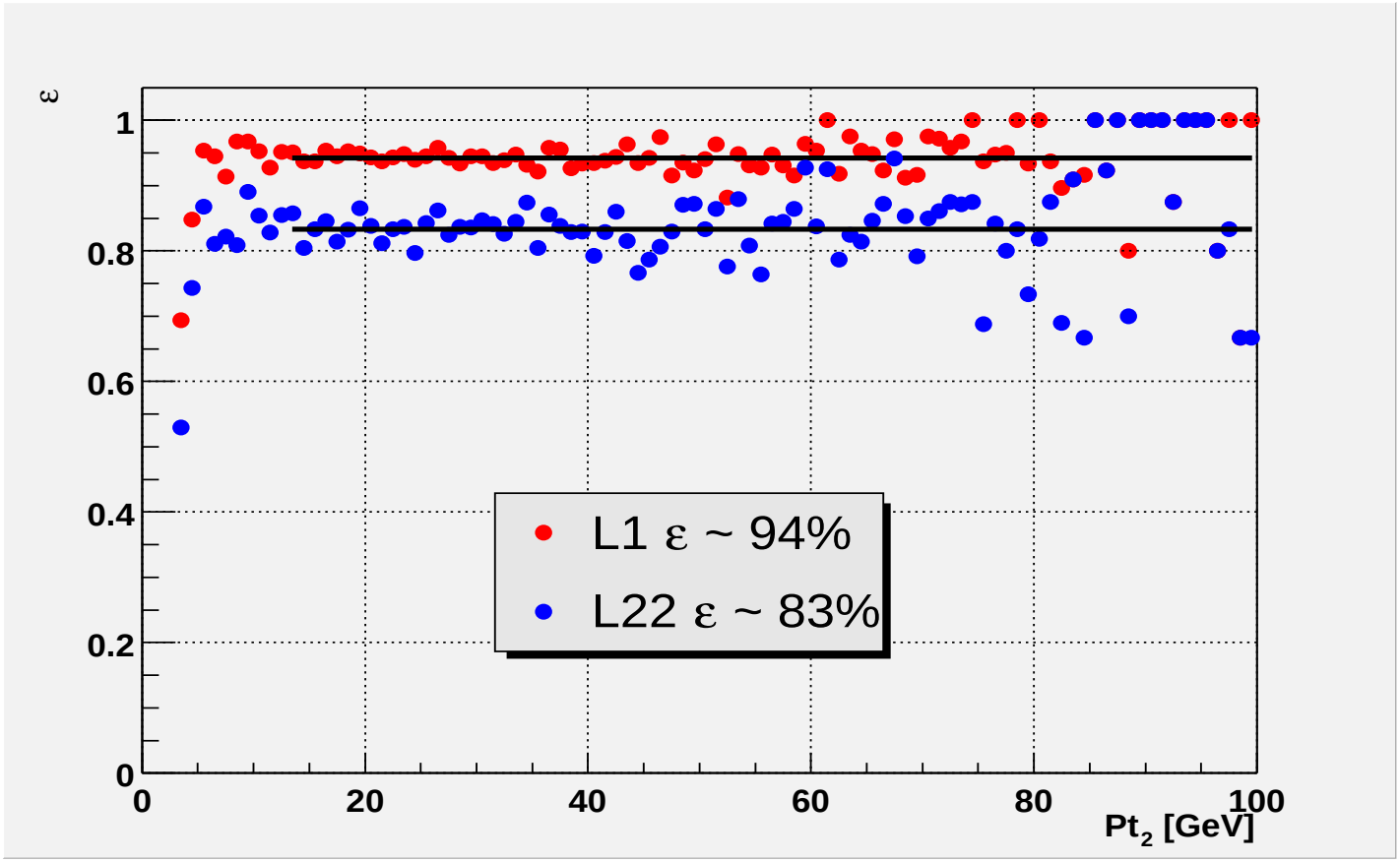


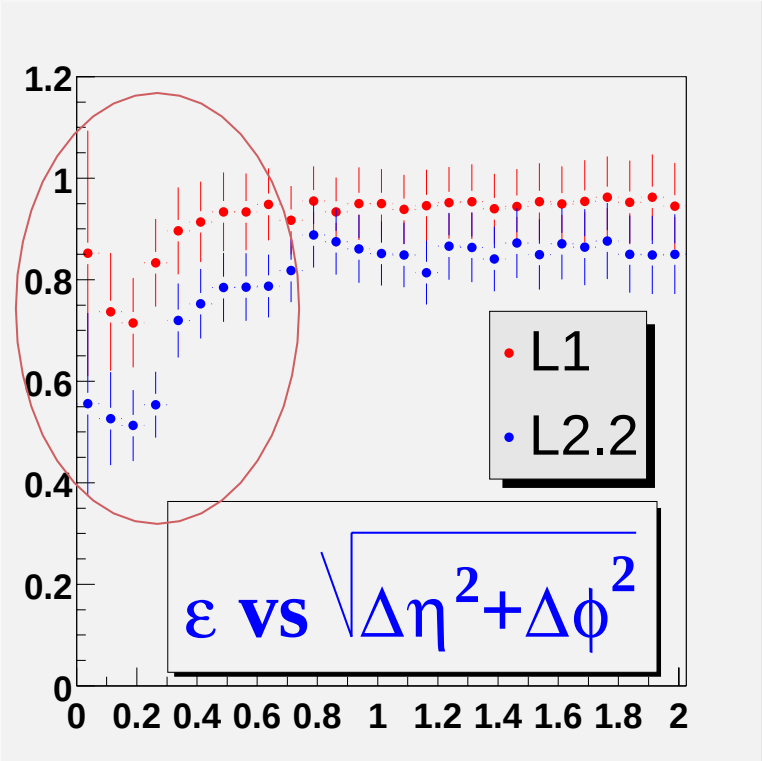
Rates

Tresholds	L1 ϵ	L2.2 ϵ
$Pt_{\mu 1} > 8\ Pt_{\mu 2} > 4$	145 Hz	108 Hz
$Pt_{\mu 1} > 10\ Pt_{\mu 2} > 5$	87 Hz	50 Hz
$Pt_{\mu 1} > 10\ Pt_{\mu 2} > 10$	24 Hz	8 Hz
$Pt_{\mu 1} > 15\ Pt_{\mu 2} > 10$	19 Hz	6 Hz

Efficency vs Pt_2



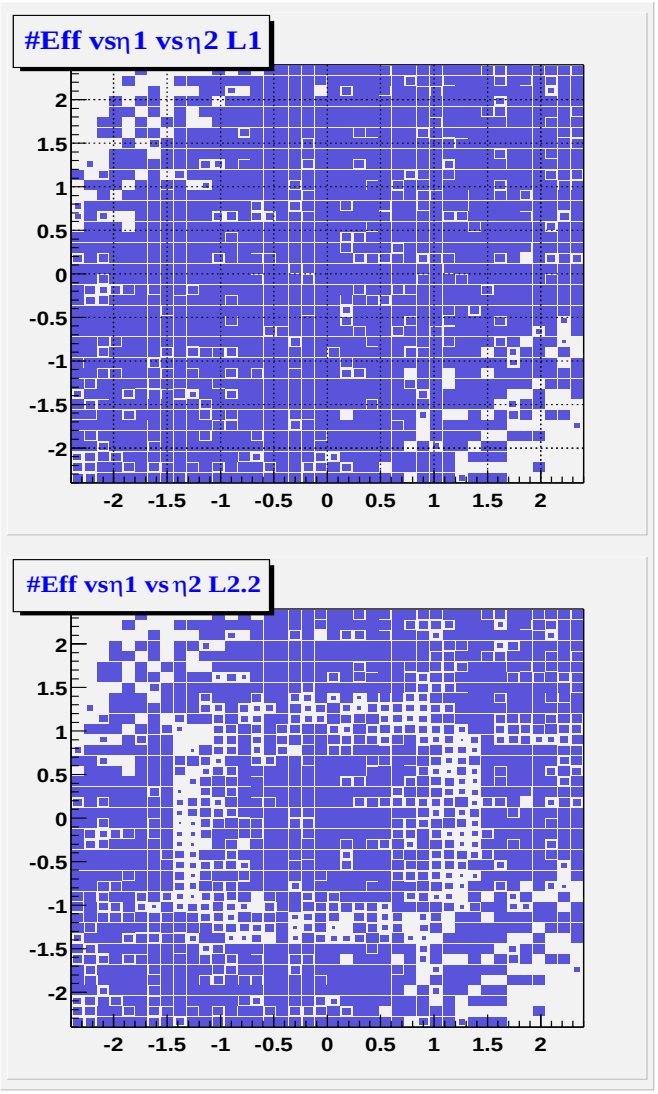
Efficency vs $\Delta\eta$ and $\Delta\phi$



If 2 muons close in $\eta - \phi$ efficency decrease.

Important for muons coming from same b (or c) cascade (ex $t\bar{t} \rightarrow 2\mu + X's$)

Regional Efficency



$$Z \rightarrow \mu\mu$$

$$Pt_{\mu}(1,2) > 10\mathrm{GeV}$$

	Barrel $\lvert\eta\rvert < 0.8$	Overlap $0.8 < \lvert\eta\rvert < 1.2$	Endcap $\lvert\eta\rvert > 1.2$
Barrel	14 94 92	14 92 78	33 91 80
Overlap		3 89 63	16 87 73
Endcap			20 87 84

Fraction of events % L1 ϵ % L2.2 ϵ %

Efficency

Dataset	$Z \rightarrow$	$\mu\mu$	$t\bar{t} \rightarrow$	$\mu\mu + X$
cut	L1 ϵ	L2.2 ϵ	L1 ϵ	L2.2 ϵ
$Pt_{\mu 1} > 8\ Pt_{\mu 2} > 4$	92%	75%	87%	78%
$Pt_{\mu 1} > 10\ Pt_{\mu 2} > 5$	92%	83%	87%	76%
$Pt_{\mu 1} > 10\ Pt_{\mu 2} > 10$	90.5%	80.6%	84%	72%
$Pt_{\mu 1} > 15\ Pt_{\mu 2} > 10$	91%	80.0%	83.5%	72%

$H \rightarrow WW \rightarrow 2\mu$ selection

Let's look at true signal:

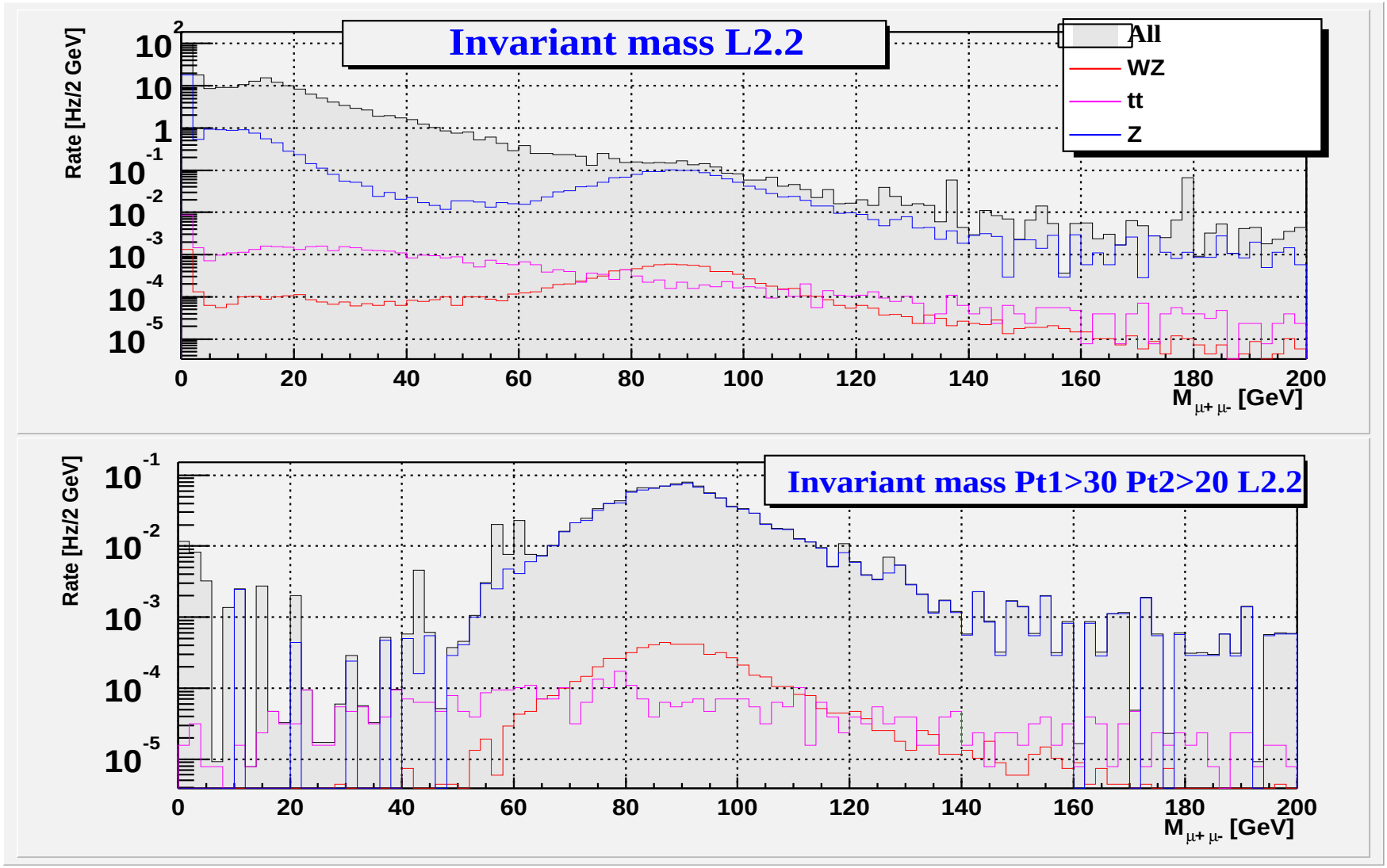
$H \rightarrow WW \rightarrow 2\mu$

Ask at L2.2 :

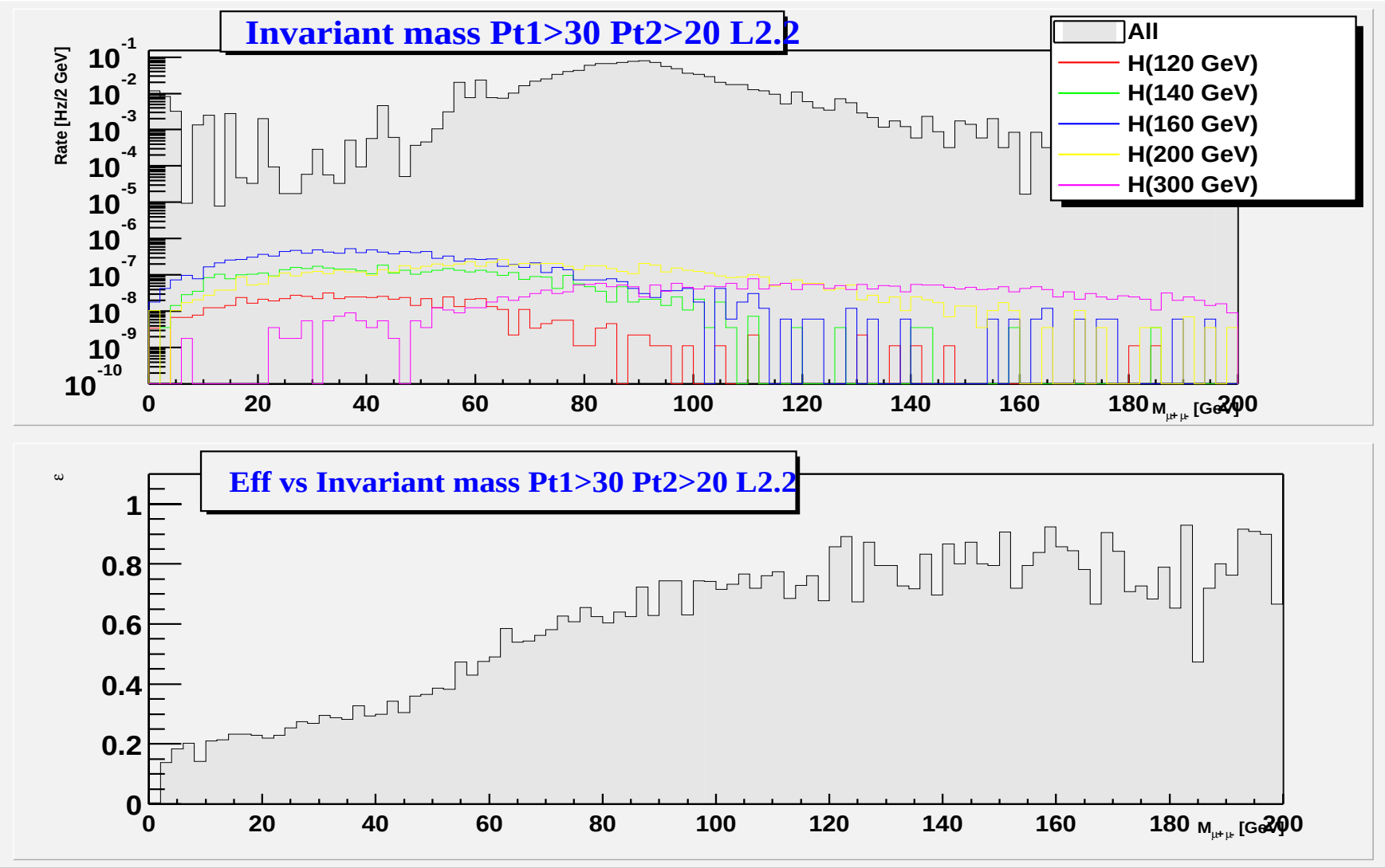
2 Opposite charged muons with $Pt_1 > 30$ & $Pt_2 > 20$

Look at background rate reduction and Higgs efficency (vs Minv $\mu^+\mu^-$)

$H \rightarrow WW \rightarrow 2\mu$ selection



$H \rightarrow WW \rightarrow 2\mu$ selection



Conclusion

- ◇ A large number of evens with di-muons topology has been produced;
- ◇ L1 & L2.2 rate has been shown for all muon system;
- ◇ Problem with inefficencies on overlap and endcap for L2.2, should we use also RPC for L2.2, how?;
- ◇ Tools are avalable for studing reduction based on event topology;