

# **Summary of PRS/Muon Activities**

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# Focus of Work

L2 and L3 higher level triggers, in preparation for the DAQ TDR due out next year

→ Muon-Tracker matching

## Staging scenarios

→ Assume initial luminosity of  $2 \cdot 10^{33}$

→ DAQ input bandwidth reduced to 25 or 50 kHz

□ Apply safety factor of 3, and split equally among muon, e/gamma, and jet triggers (so BW could be as low as 2.5 kHz)

→ No ME 4

→ No RPC trigger in endcap

→ No readout for inner part of ME 1/1

□ Originally was strip “OR”

## Production

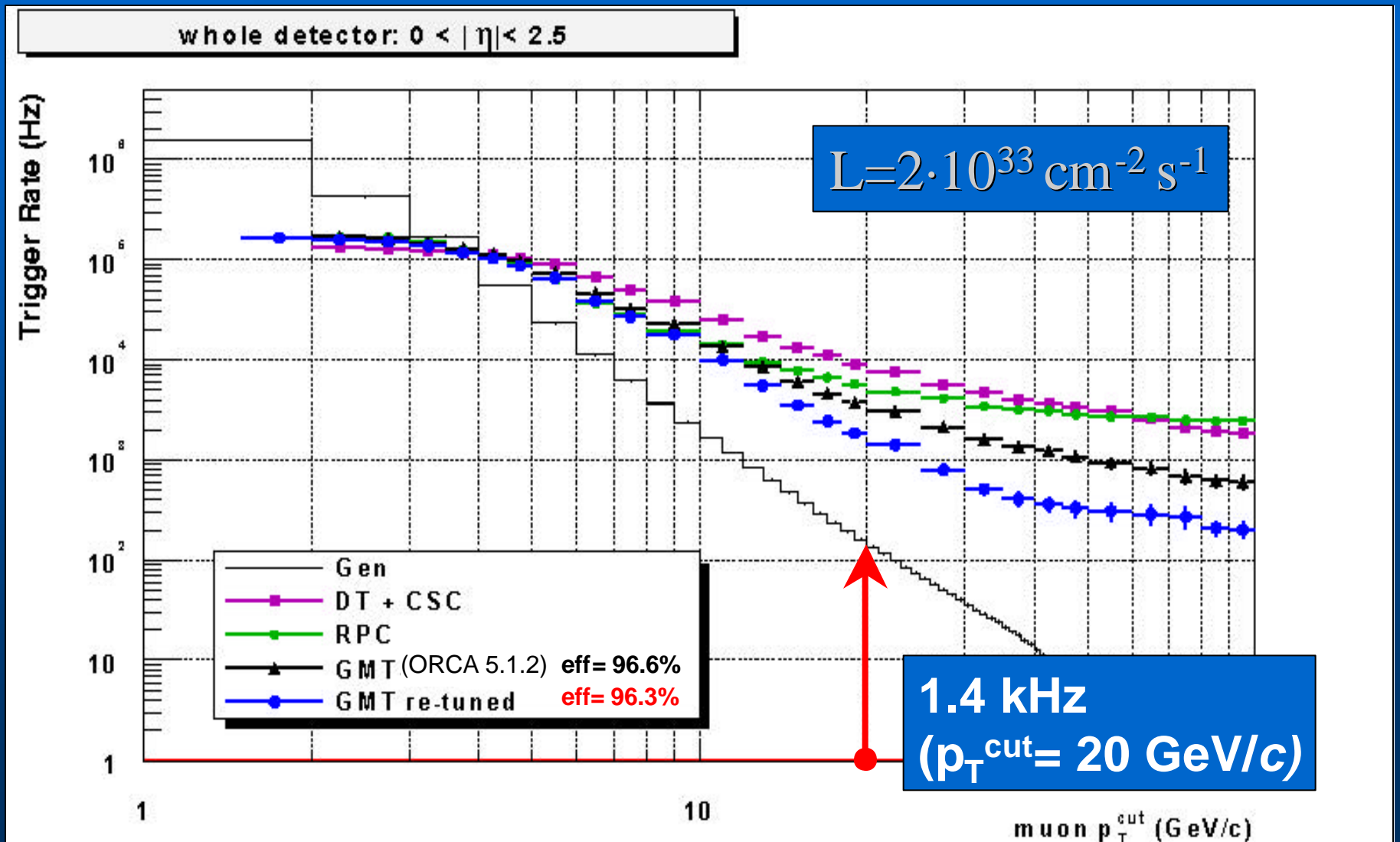
→ Many headaches for INFN production centers because of Objectivity problems and ORCA crashes

→ Somewhat under control for ORCA5, samples now available and results are coming out

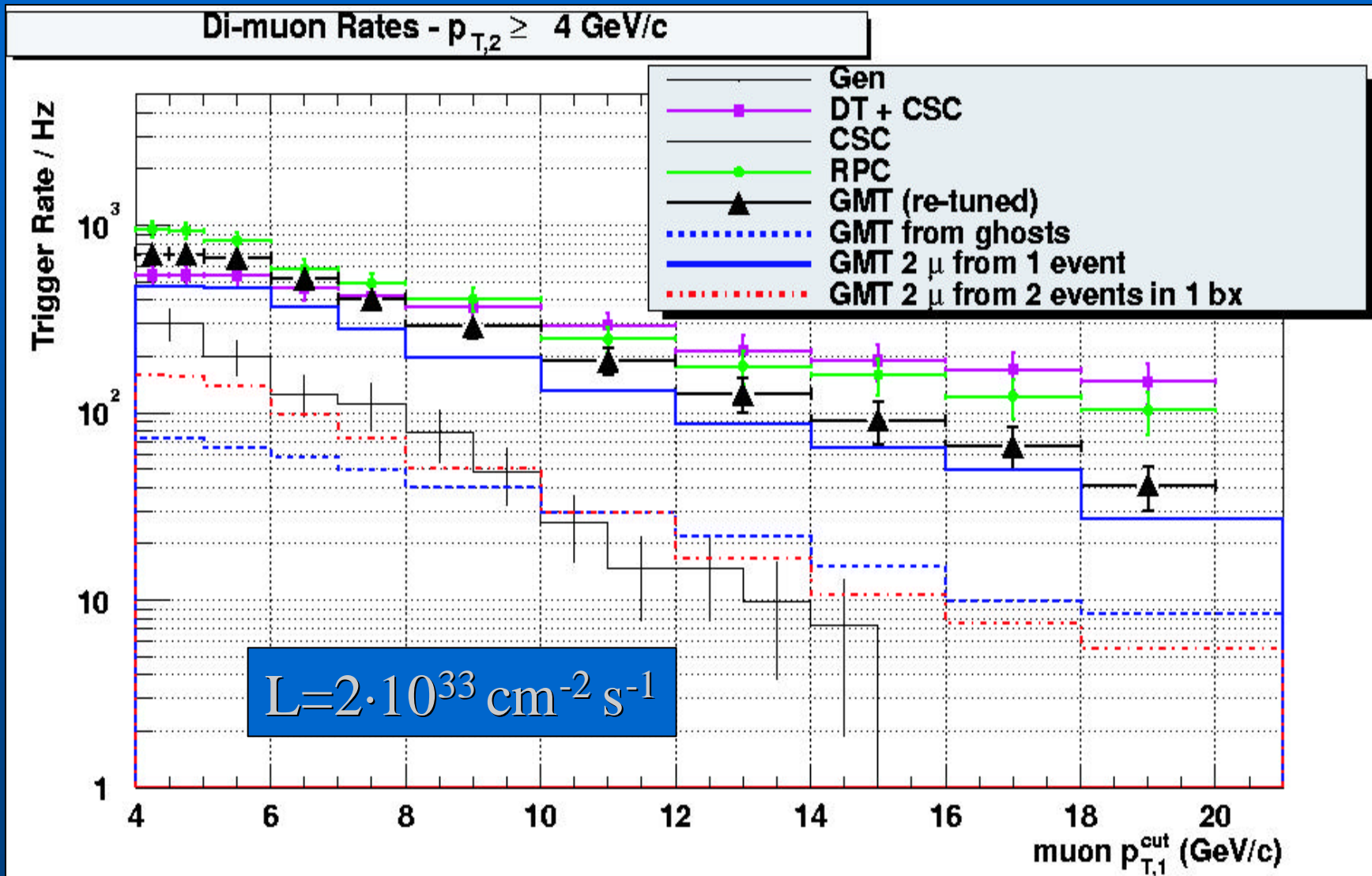
# Plan for Large 12M Event Production

- ECAL e/gamma group wants it for a calibration study
- Production will start ASAP at regional centers (including Florida)
- Production will not include pile-up (just single min bias events)
  - Otherwise production requires too much effort
- Events are **unbiased**, so a good cross check of our rates and punch-through
  - From unbiased samples in Florida, I've seen that the trigger rate is about the same whether you explicitly do the pile-up in CARF or whether you just scale the single event rate.
- Sample size prohibits storing all events in database, so we only get Ntuples
  - So we get just one shot at this
- PRS group is finalizing the Ntuple code
- Smaller 0.5Mevt sample will be kept in a database for further studies

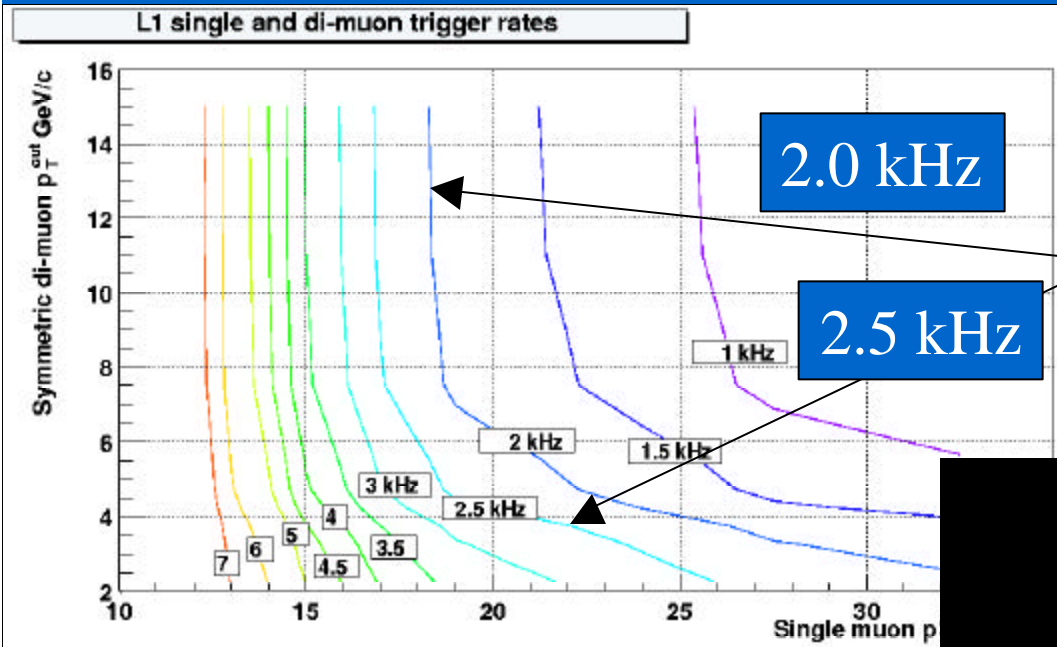
# L1 single muon trigger rates



# L1 di-muon trigger rates, $p_{T,2} \geq 4 \text{ GeV}/c$



# Playing the game of thresholds



'Iso-rate' lines for single muon and di-muon Minimum Bias events

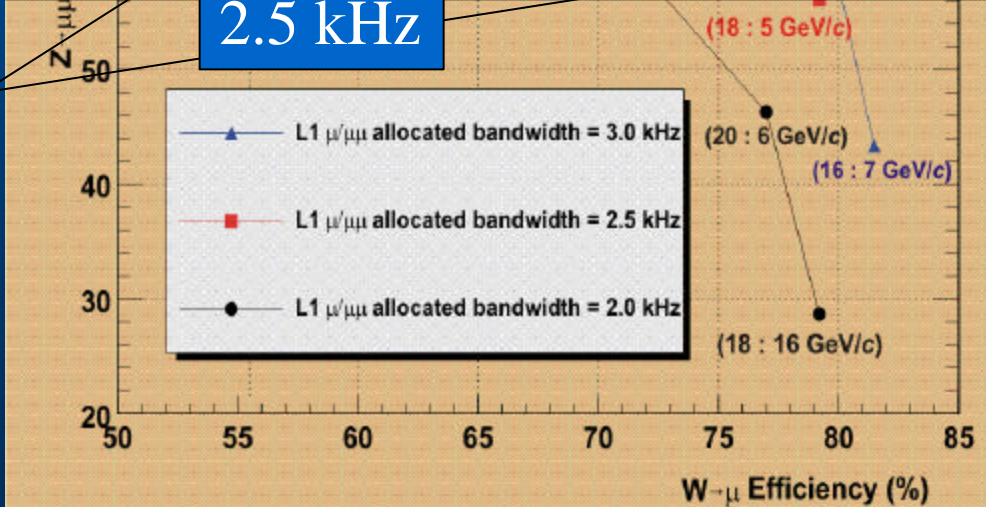
2.0 kHz

2.5 kHz

2.0 kHz

2.5 kHz

Efficiencies for  $W \rightarrow \mu$  and  $Z/\gamma \rightarrow \mu\mu$  signals for a fixed L1 output bandwidth

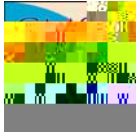


# Combined Rate Results

$$L = 2 \cdot 10^{33} \text{ cm}^{-2} \text{ s}^{-1}$$

	DAQ Bandwidth = 50kHz (L1 m = 6 kHz)			DAQ Bandwidth = 37.5 kHz (L1 m = 4 kHz)			DAQ Bandwidth = 25 kHz (L1 m = 2.5 kHz)			
	(muon, calo) cuts (GeV)	Ind. Rates (kHz)	Cum. Rates (kHz)	(muon, calo) cuts (GeV)	Ind. Rates (kHz)	Cum. Rates (kHz)	(muon, calo) cuts (GeV)	Ind. Rates (kHz)	Cum. Rates (kHz)	
Muon	16	2.5		18	1.9		18	1.9		
Di-muon	(4, 4)	0.73	0.65	(6, 6)	0.17	0.14	(8, 8)	0.05	0.03	
m $\bar{A}$ Isol e/g	(6, 8)	1.90	1.65	(8, 15)	0.13	0.10	(14, 20)	0.02	0.01	
m $\bar{A}$ t jets	(6, 65)	0.61	0.36	(8, 70)	0.32	0.23	(14, 75)	0.10	0.04	
m $\bar{A}$ Jets	(6, 100)	0.18	0.01	(8, 100)	0.15	0.01	(14, 100)	0.06	0.00	
<b><u>L1 Total Rate</u></b>			<b><u>5.2</u></b>				<b><u>2.4</u></b>	<b><u>2.0</u></b>		





# L3 Seed Generation

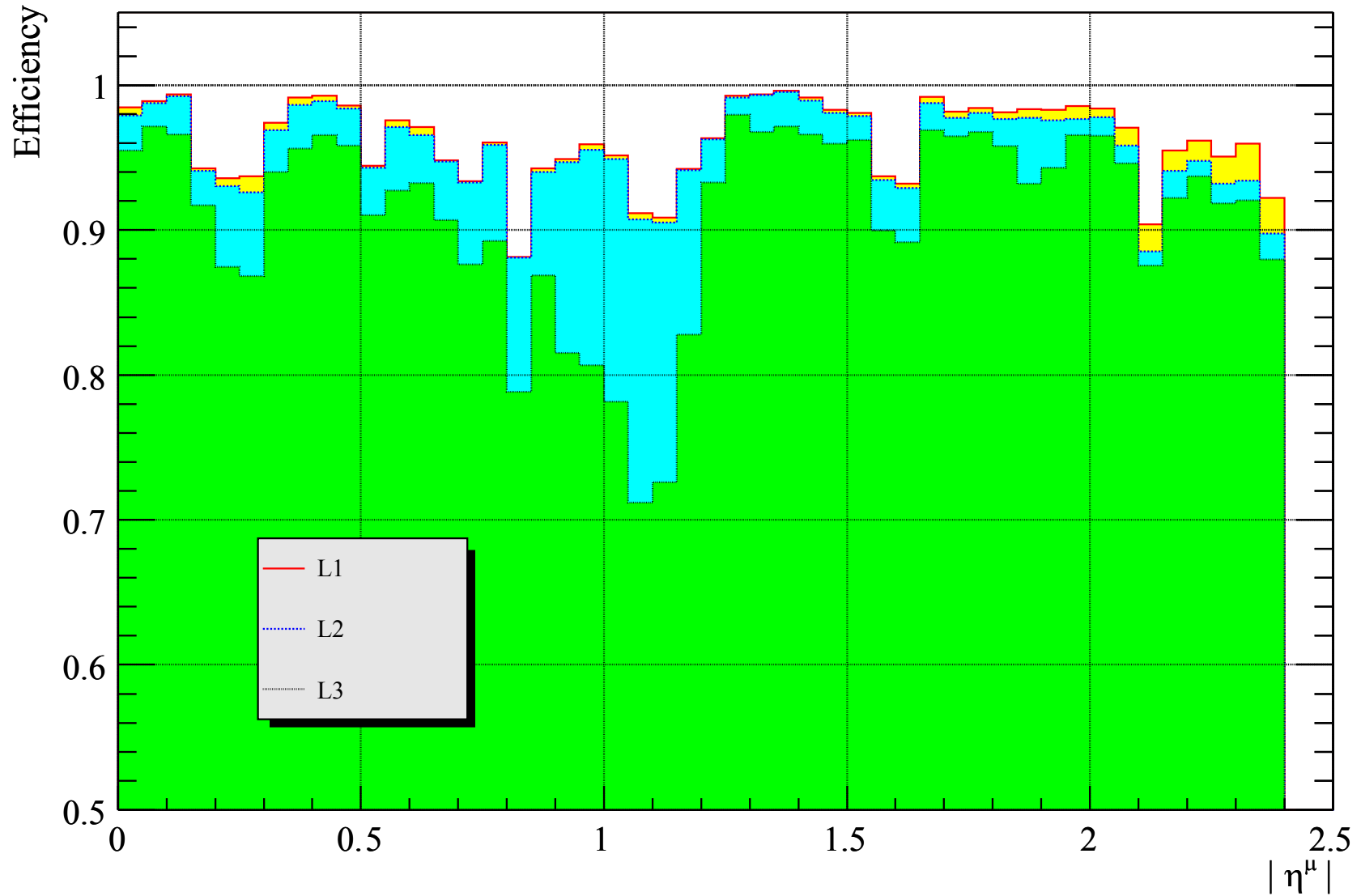
## Start from L2 reconstructed muons:

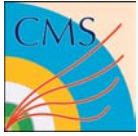
- Get muon trajectory at innermost muon station
  - from local muon reconstruction
- Propagate to outer tracker surface
  - use GeaneWrapper
- Rescale errors
  - open window for track reconstruction
- Find start layer(s) inside tracker
  - 2 options : outside-in , inside-out
- Get compatible hits from the layer
  - if there are no compatible hits go to next layer
- Create one or more seeds for each L2 muon
  - set max. number of seed layers for each L2 muon (default = 3)





# Global Efficiency

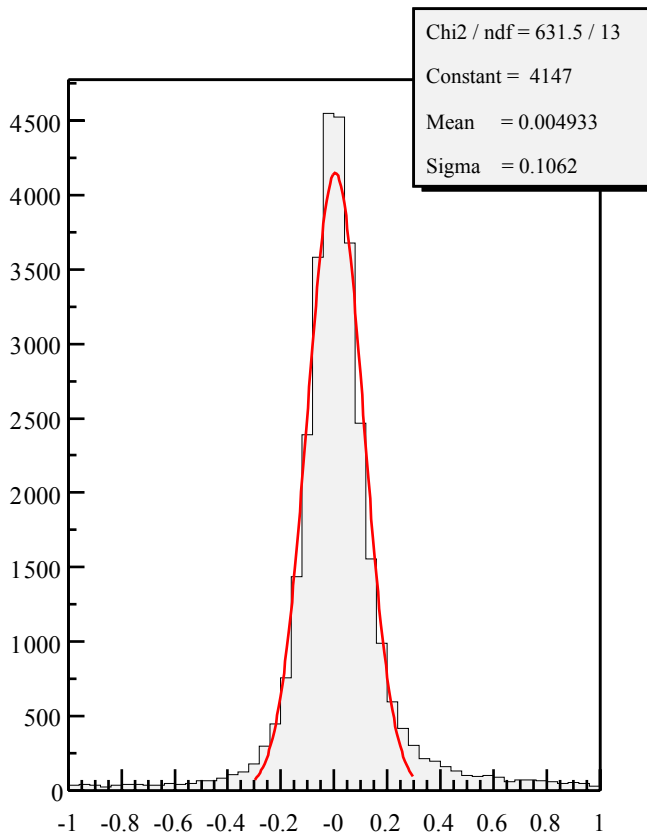




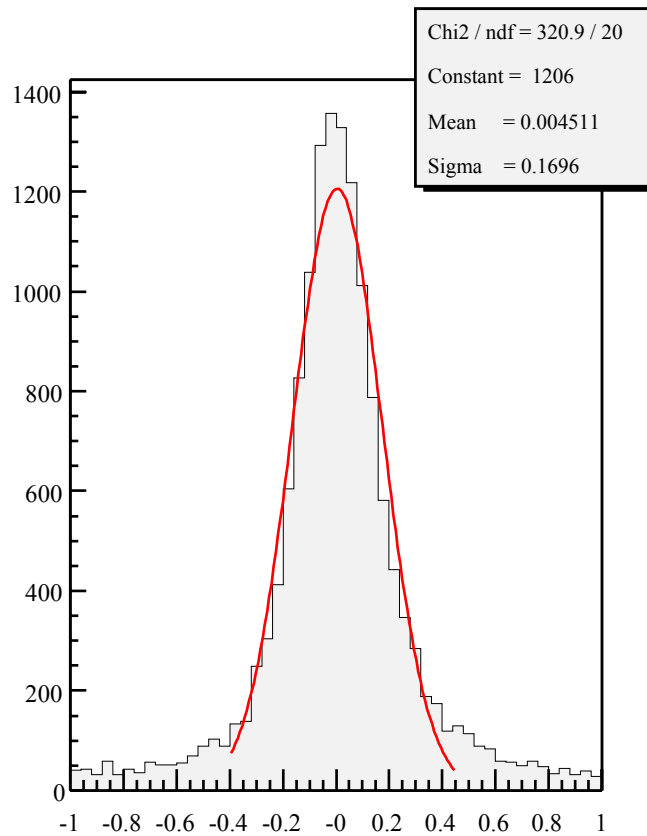
# L2 $p_T$ Resolution

## L2 : $1/p_T$ resolution

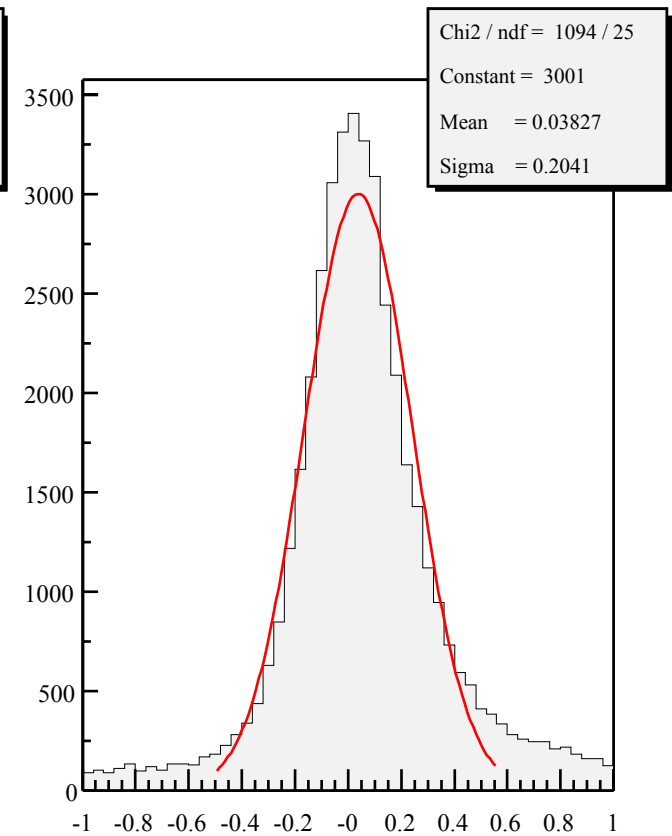
barrel

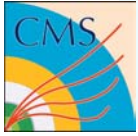


overlap



endcaps





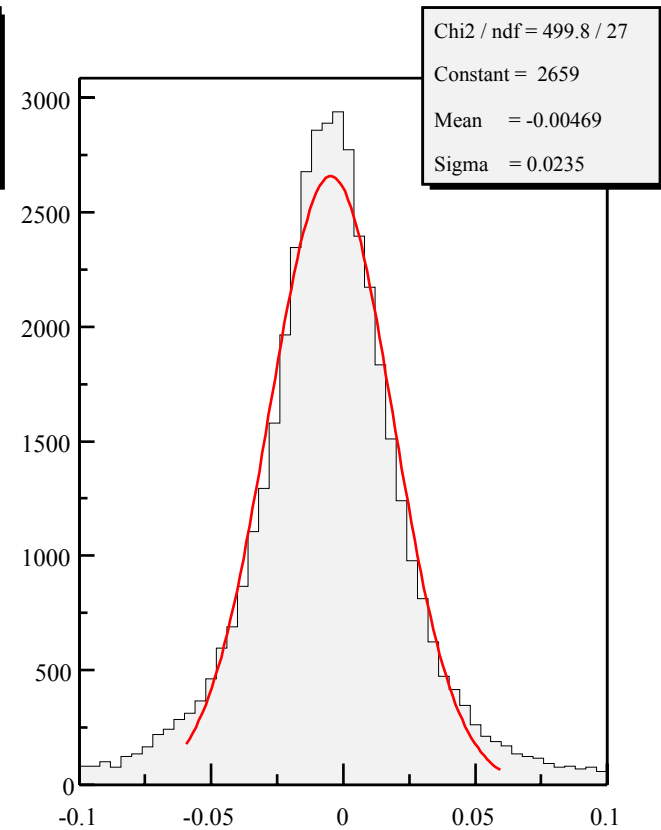
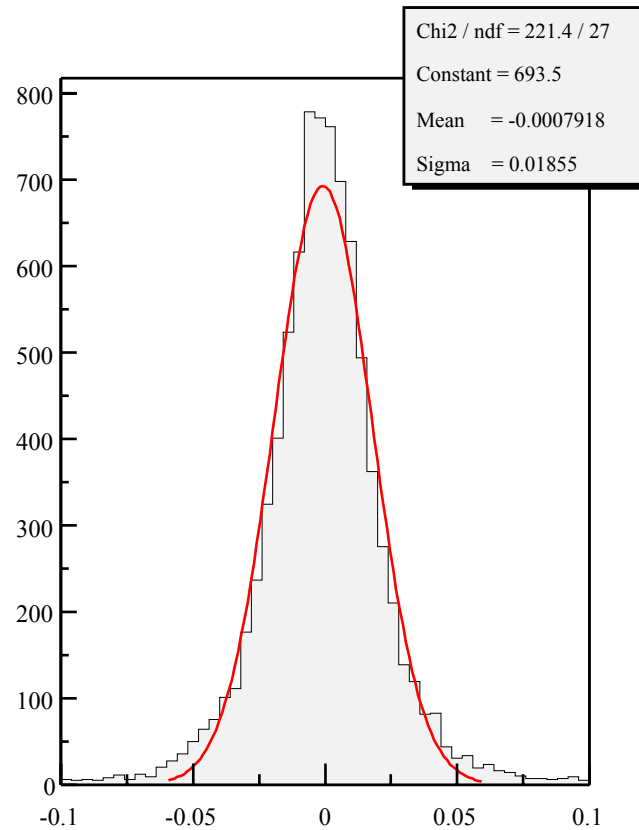
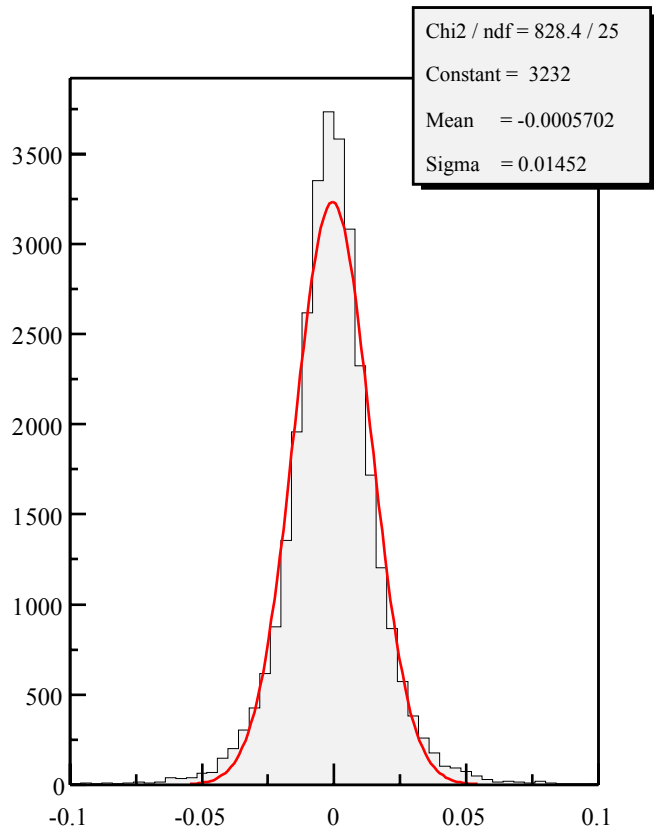
# L3 $p_T$ Resolution

## L3 : $1/p_T$ resolution

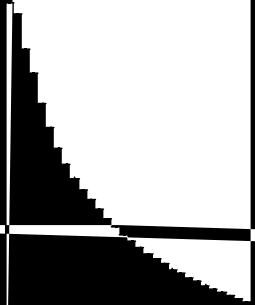
barrel

overlap

endcaps



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PRS Report

CMS A - L B - L

# Summary

**Group is very active, but not much U.S. involvement beyond L1**

**Code and tools are in pretty good shape**

**→ First pass at reconstruction software**

**Don't need to know C++ to participate, you can work from standard Ntuples produced by the group**

**We need more help! Lots of staging studies to do, HLT studies, etc.**

**Meetings are bi-weekly, you can connect from your PC using VRVS software**

**→ Next one is this Tuesday, 10:30 EDT**