

**CSC alignment:  
Feedback from the  $Z \rightarrow \mu^+ \mu^-$**

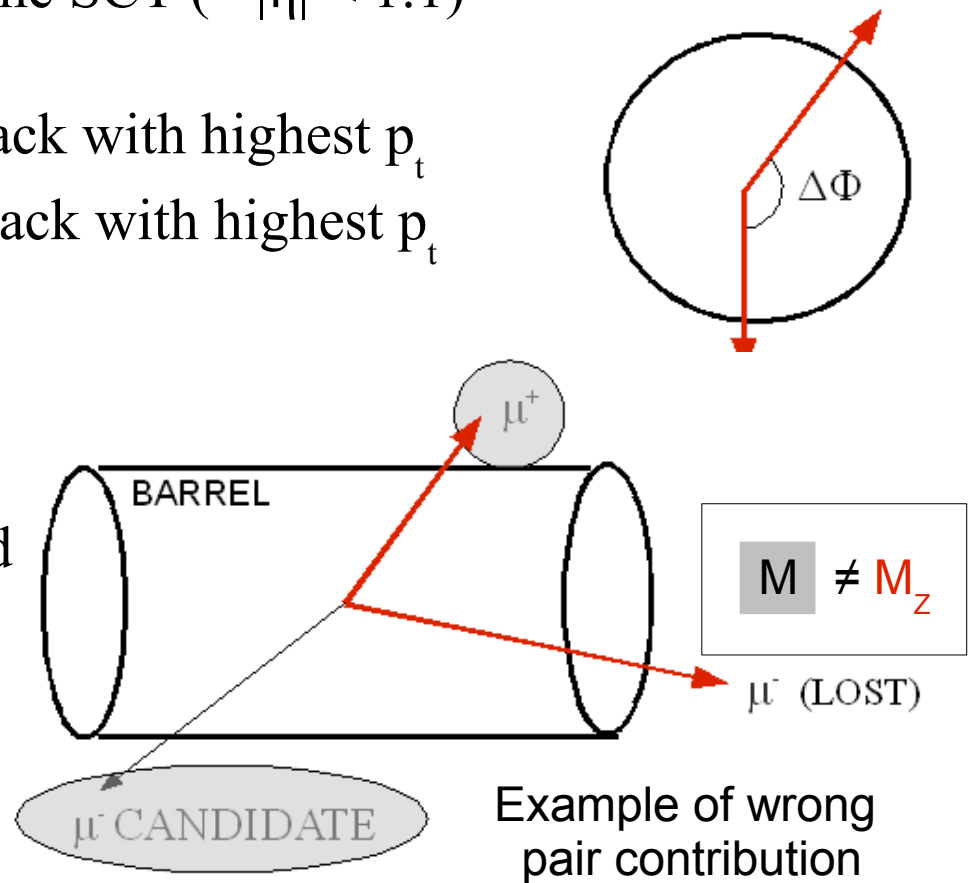
**Regina Moles  
IFIC-València  
18 October 2007**

# Introduction

- Last ID week up to 3 CSC ID alignments were available for PIX+SCT
  - **ROBUST (Full system)**: uses multimuons and TRT momentum constraint
    - <https://twiki.cern.ch/twiki/bin/view/Atlas/CSCAlignmentChallenge#Results>
  - **GX2 (Barrel)**: uses multimuons + cosmics
    - [https://twiki.ific.uv.es/twiki/bin/view/Atlas/SiAlignment#CSC\\_Alignment\\_Constants\\_Sets](https://twiki.ific.uv.es/twiki/bin/view/Atlas/SiAlignment#CSC_Alignment_Constants_Sets)
  - **GX2 (Full system)**: uses multimuons + beam spot constraint
    - [https://twiki.cern.ch/twiki/bin/view/Atlas/CSCAlignmentChallenge#A\\_beam\\_constraint\\_alignment\\_from](https://twiki.cern.ch/twiki/bin/view/Atlas/CSCAlignmentChallenge#A_beam_constraint_alignment_from)
- Test of those alignments constants sets with  $Z \rightarrow \mu^+ \mu^-$
- Sample properties (Dataset 5145) :
  - Cross section: 1497 pb
  - Number of events: 20K
  - Generation cuts:  $M_{\mu\mu} > 60\text{GeV}$  ;  $|\eta|_{\mu} < 2.8$  ;  $p_t > 5\text{GeV}/c$

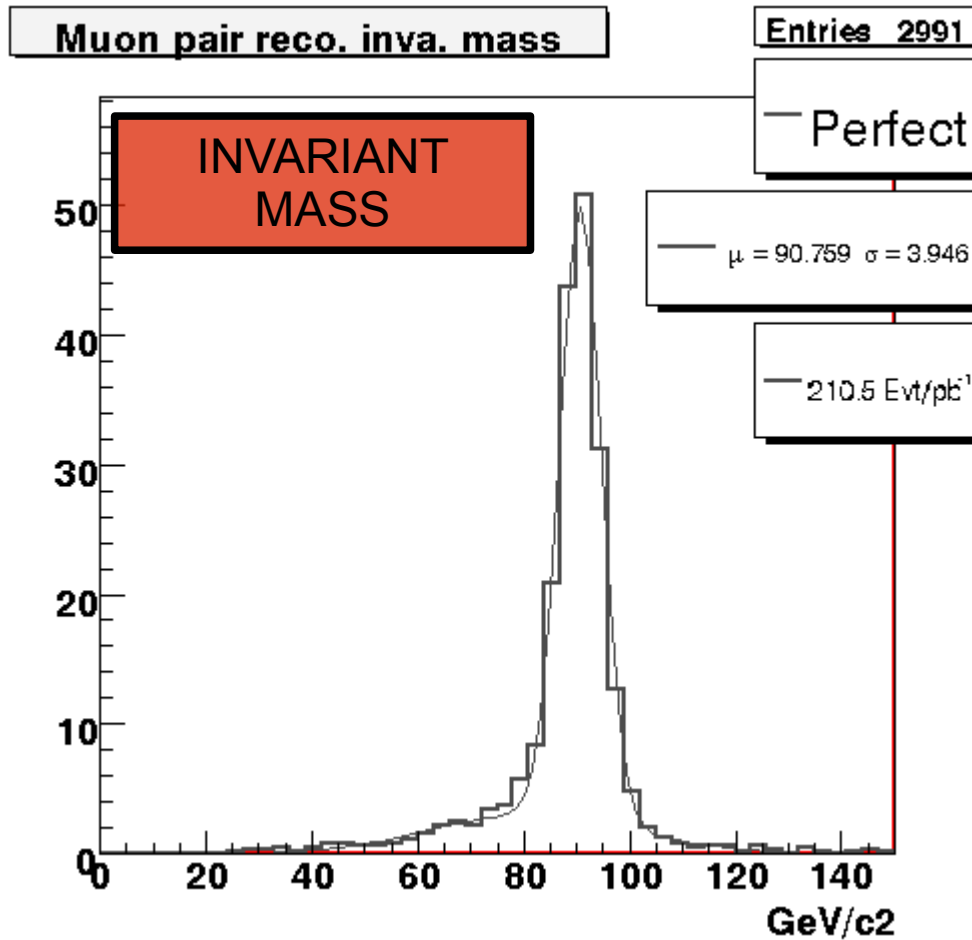
# $Z \rightarrow \mu^+ \mu^-$ analysis

- Goal is to reconstruct the  $Z$  mass:
  - PIX + SCT only tracks
  - This analysis uses barrel tracks only
    - Tracks with a hit in layer 3 of the SCT ( $\sim |\eta| < 1.1$ )
  - Track selection:
    - Choose the positive charged track with highest  $p_t$
    - Choose the negative charged track with highest  $p_t$
    - Both  $p_t > 15 \text{ GeV}/c$
    - $\Delta\Phi > 60 \text{ deg}$  in  $r\Phi$  plane
  - No  $\mu$  id is performed
    - Neither generation truth is used
- Distributions studied:
  - **Invariant mass**
  - **$p_t$  of individual  $\mu^+$  and  $\mu^-$**

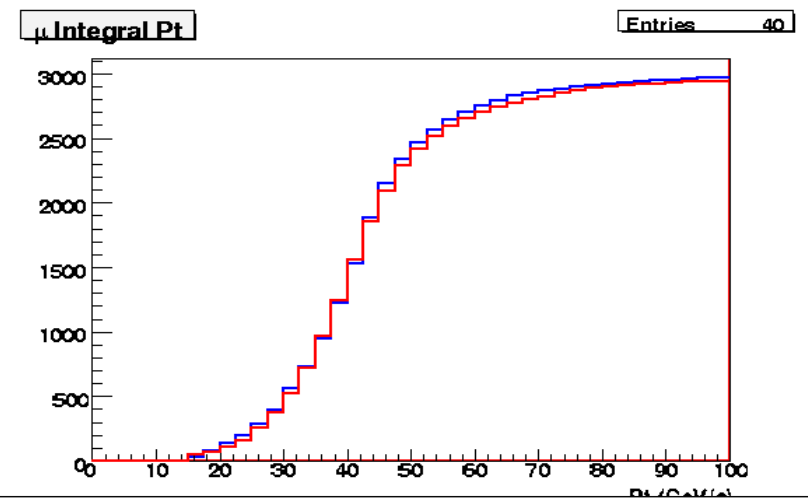
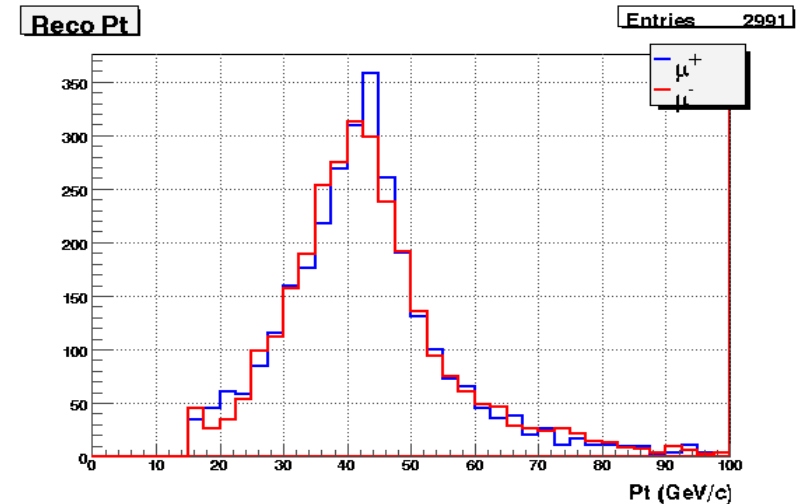


# Perfect Case

Reconstruct  $Z \rightarrow \mu^+ \mu^-$  events with a perfect knowledge of the CSC alignment constants

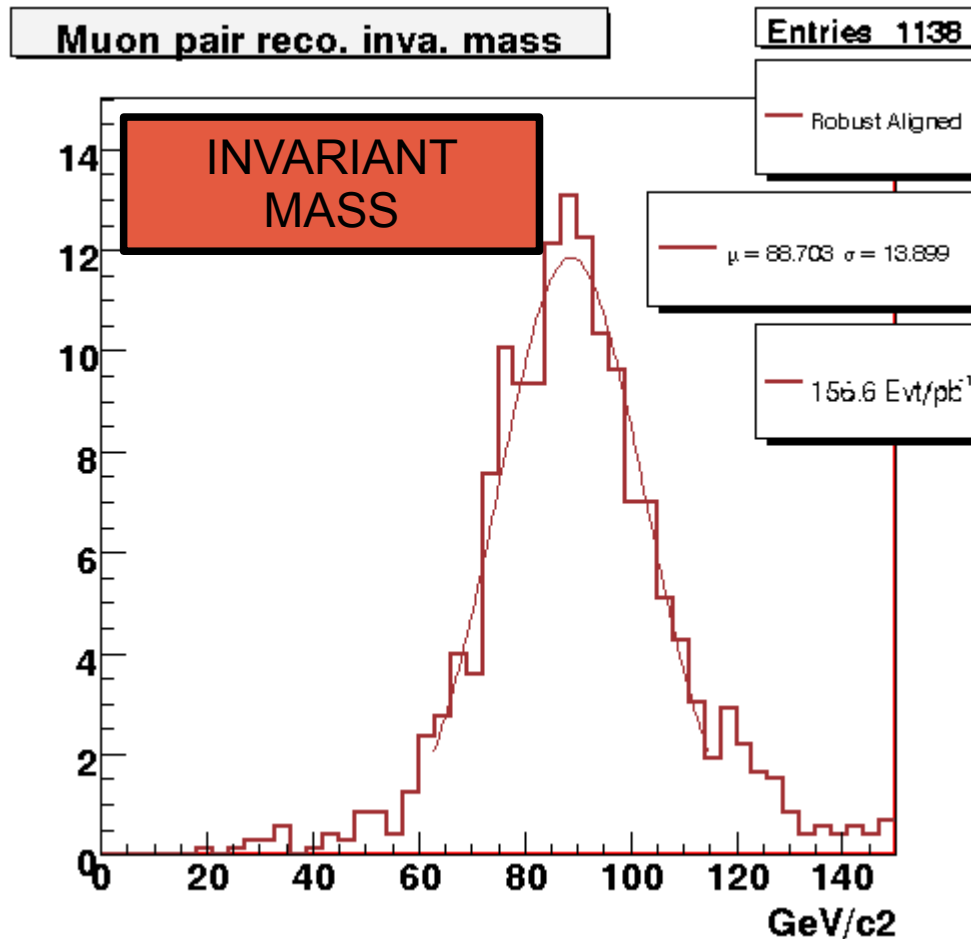


## $p_t$ of individual $\mu^+$ and $\mu^-$

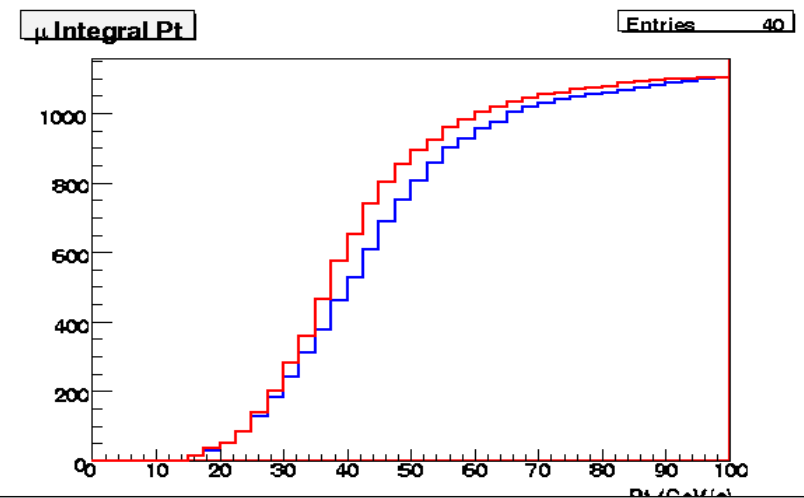
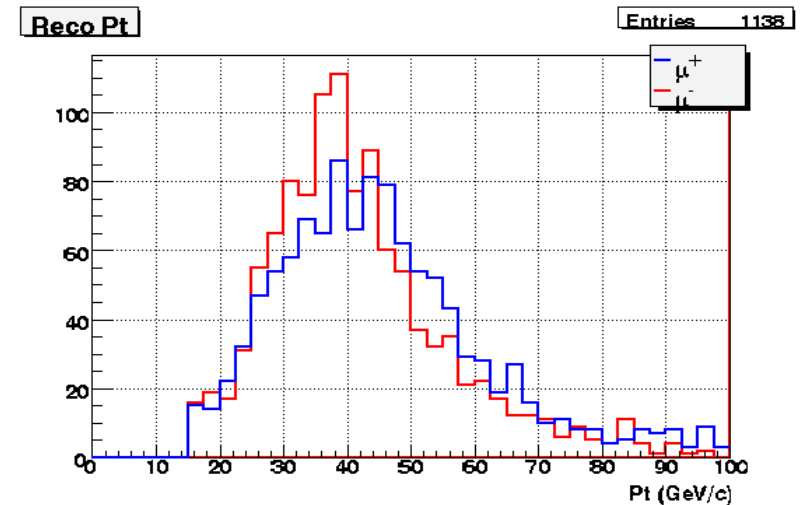


# Robust Case

- Reconstruct  $Z \rightarrow \mu^+ \mu^-$  events with Robust method of the CSC alignment constants

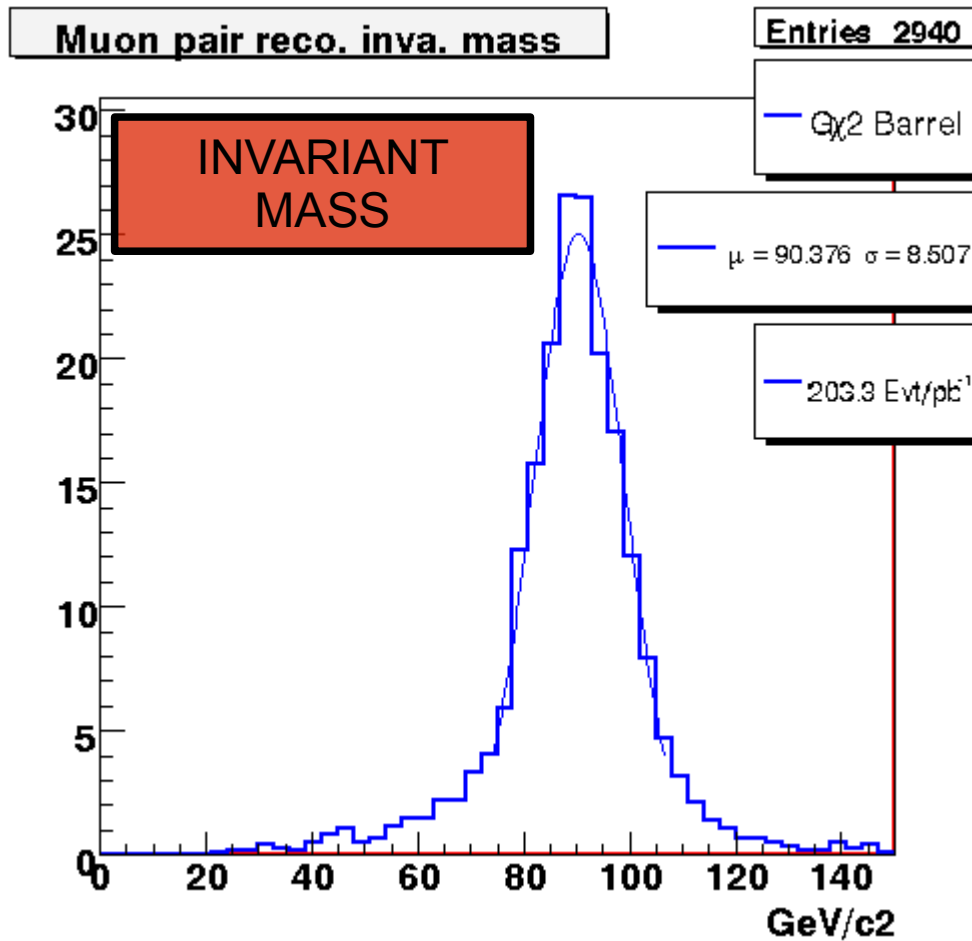


## $p_t$ of individual $\mu^+$ and $\mu^-$

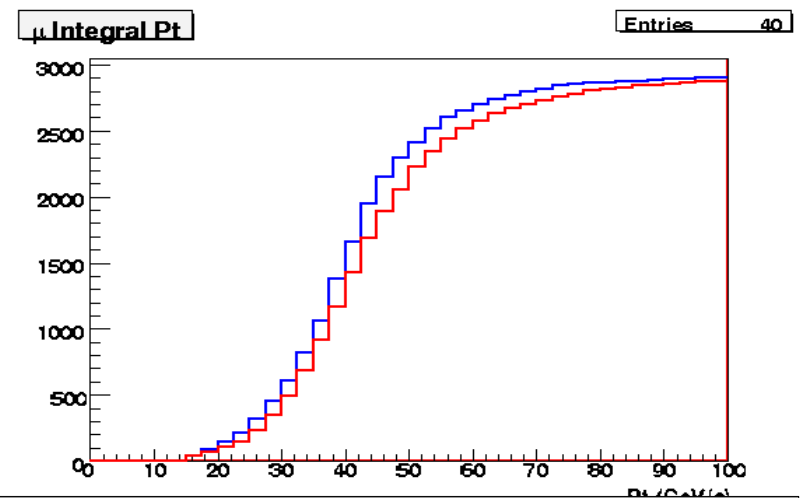
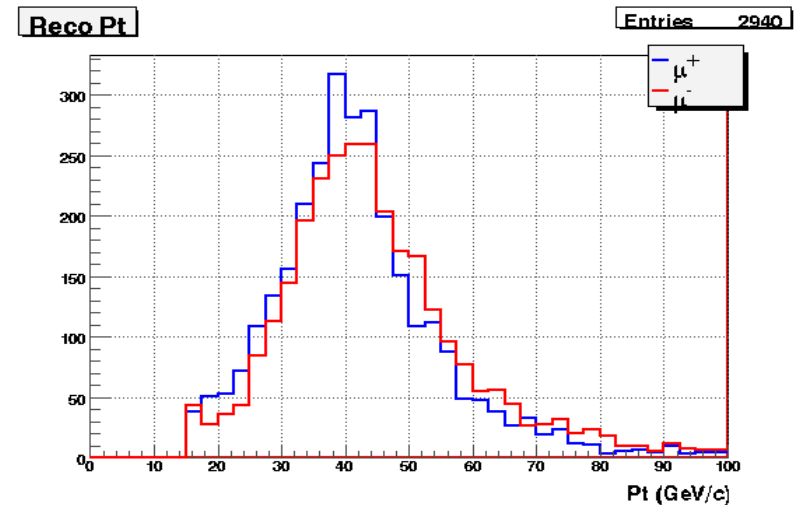


# GX2 Barrel Case

- Reconstruct  $Z \rightarrow \mu^+ \mu^-$  events with GX2 method of the CSC alignment constants for the barrel part

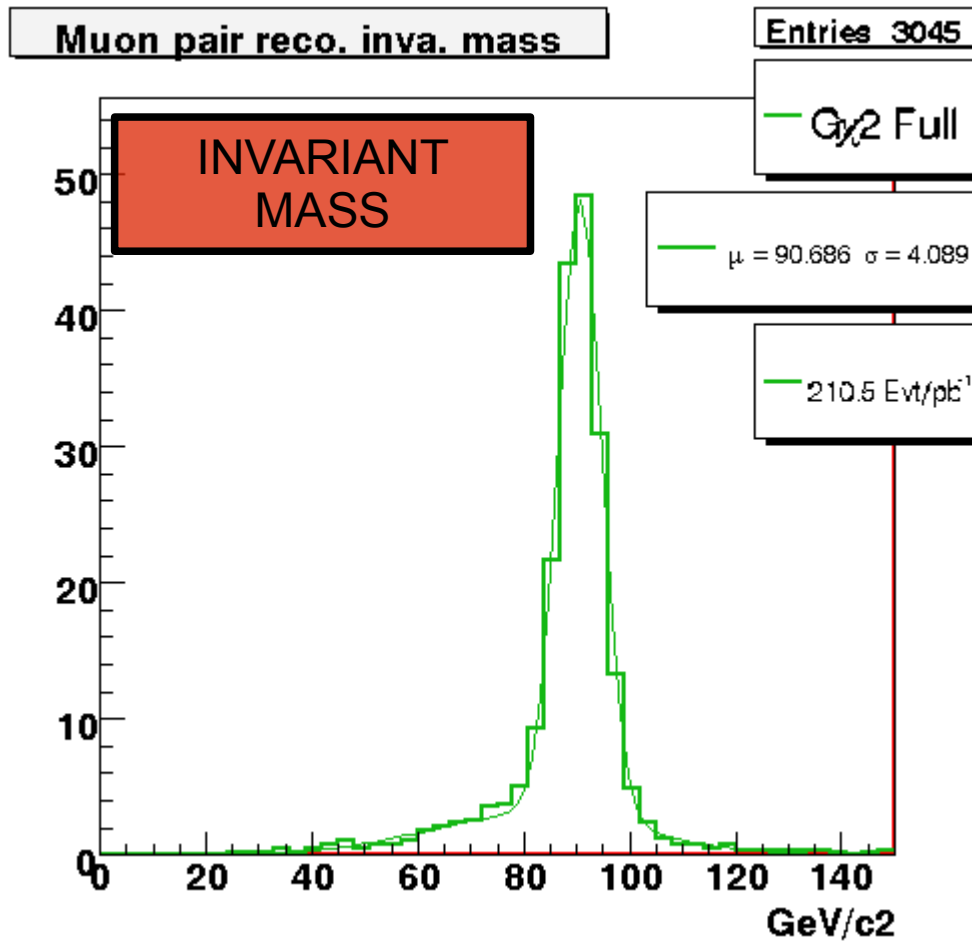


**$p_t$  of individual  $\mu^+$  and  $\mu^-$**

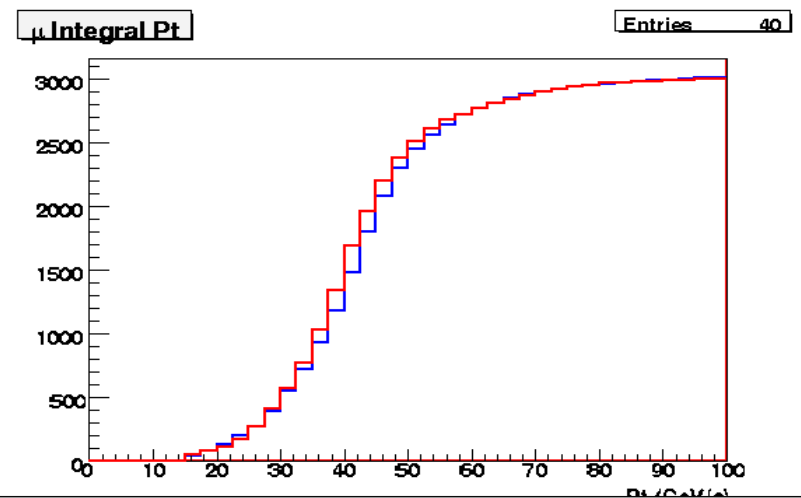
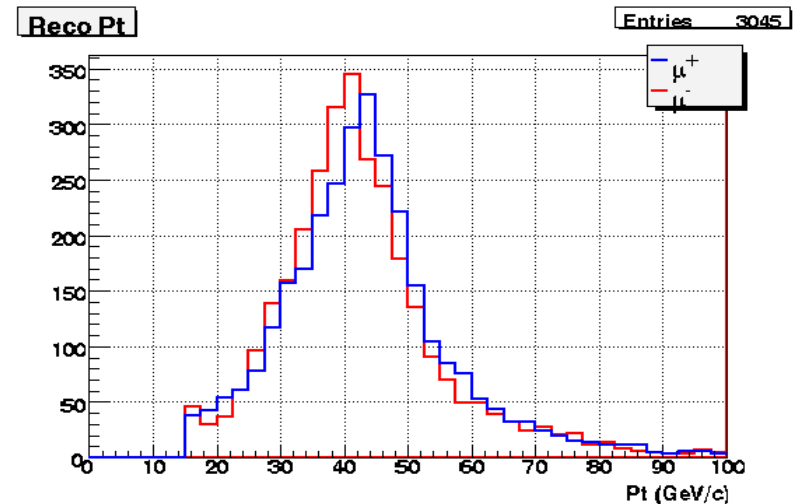


# GX2 Full Detector Case

- Reconstruct  $Z \rightarrow \mu^+ \mu^-$  events with GX2 method of the CSC alignment constants for the full detector

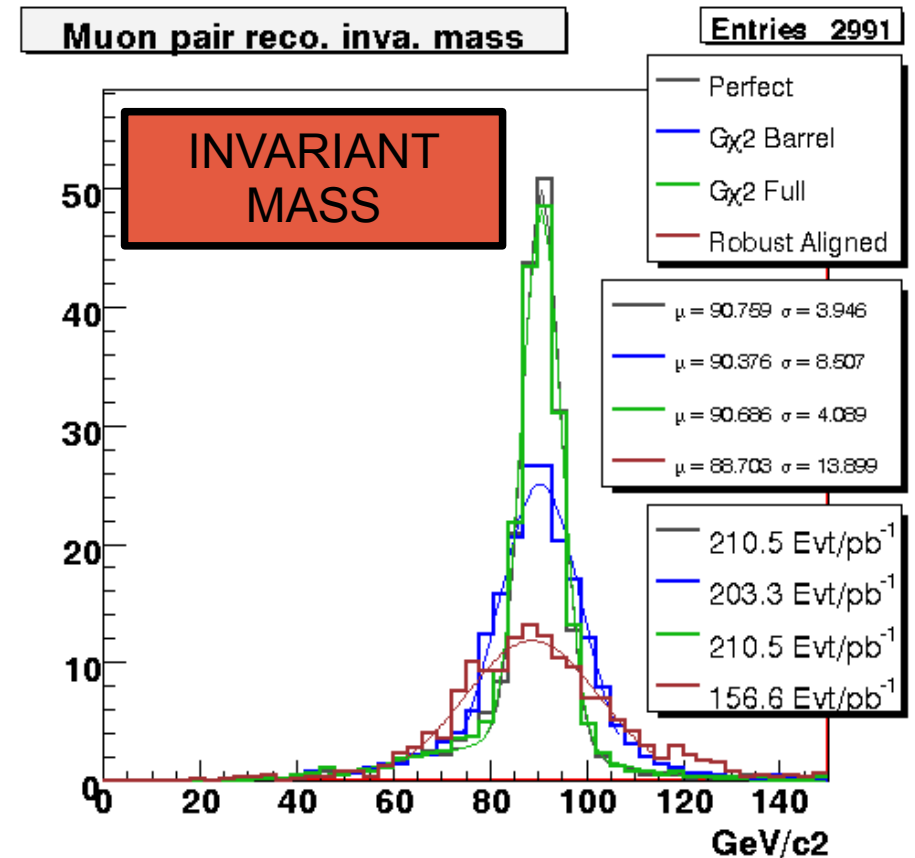


## $p_t$ of individual $\mu^+$ and $\mu^-$



# Summary

- A study  $Z \rightarrow \mu^+ \mu^-$  performed with the CSC alignment constants for PIX+SCT
  - Robust
  - GX2 Barrel
  - GX2 Full System
- Invariant mass looks fine
  - All methods peak at the right value
  - Width is method dependent
- Individual  $p_t$  spectrum
  - Reconstructed  $p_t$  depends on charge  
(True also for the perfect case)



$$m_Z^2 = 2 p_1 p_2 (1 - \cos \alpha)$$