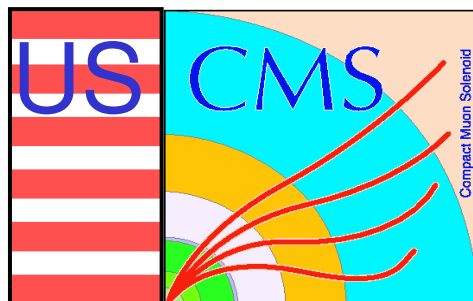


# *News from the LPC Muon Group*



**E. James, M. Mulders, N. Terentiev\***

*CMS EMU Meeting*

*University of California, Davis*

*Feb 25 - 26, 2005*



## *Outline*

- **General group status**
- **1/Pt resolution in ORCA\_8\_1\_3**
- **Updating to ORCA\_8\_7\_1 and using Stntuple**
- **Oct. 2004 test beam data vs ORCA simulation/digitization**
- **Future group plans**



## ***LPC Muon Working Group***

- **Have been meeting regularly (bi-weekly) for the past six months.**
  - See <http://agenda.cern.ch/displayLevel.php?fid=366>
- **Currently, group consists of a small core group of individuals (Eric J., Martijn M. and Nikolai T.) working with CMS muon software packages at Fermilab and a number of other interested individuals who attend meetings.**
  - see <http://www.uscms.org/LPC/LPC.htm> and [http://www.uscms.org/LPC/lpc\\_muon](http://www.uscms.org/LPC/lpc_muon)
- **As a starting point, have completed several simple studies of CMS muon reconstruction software to compare against benchmark results.**



# *1/Pt resolution*

- **Data**

- The single muon particle gun sample, Pt=100 GeV
- Flat in Phi over all Phi
- Flat in Eta from -2.5 to 2.5
- 1,000 events
- OSCAR\_3\_2\_2 and ORCA\_8\_1\_3

- **Selection**

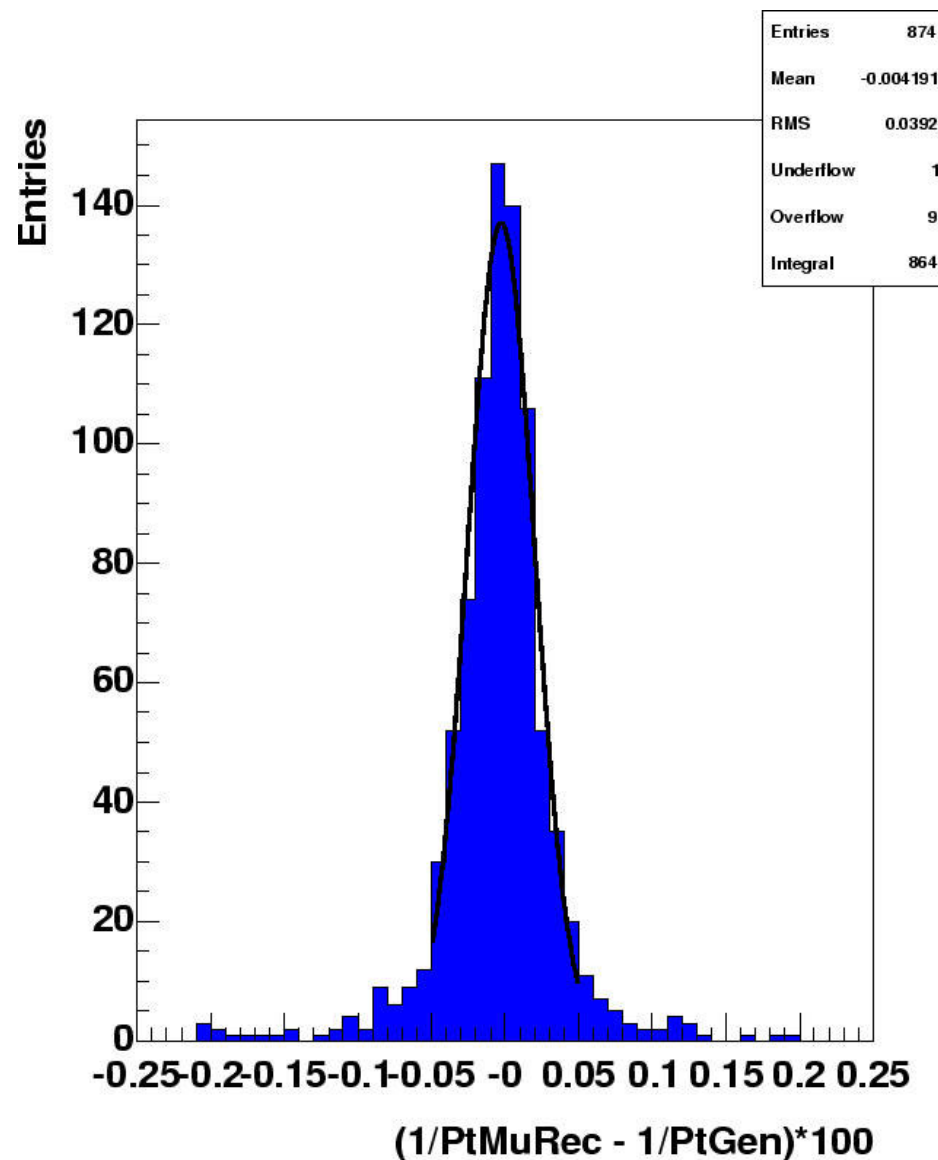
- One simulated muon in GEANT block (PtGen)
- One reconstructed muon track (PtMuRec)  
(Tracker and Muon Barrel / Muon Endcap)
- One reconstructed Tracker track (PtRec)



# 1/Pt resolution

- **1/Pt residual fit**

- Fit  $\Delta(\text{Pt})/\text{Pt}$  as the residual  $\text{PtGen} * (1/\text{PtMuRec} - 1/\text{PtGen})$  by a Gaussian
- Limit fit to  $|\text{residual}| < 0.05$  to use a single Gaussian
- $\sigma = 0.023 \pm 0.001$   
 $\text{Chi}^2/\text{NDF} = 9.5/7$

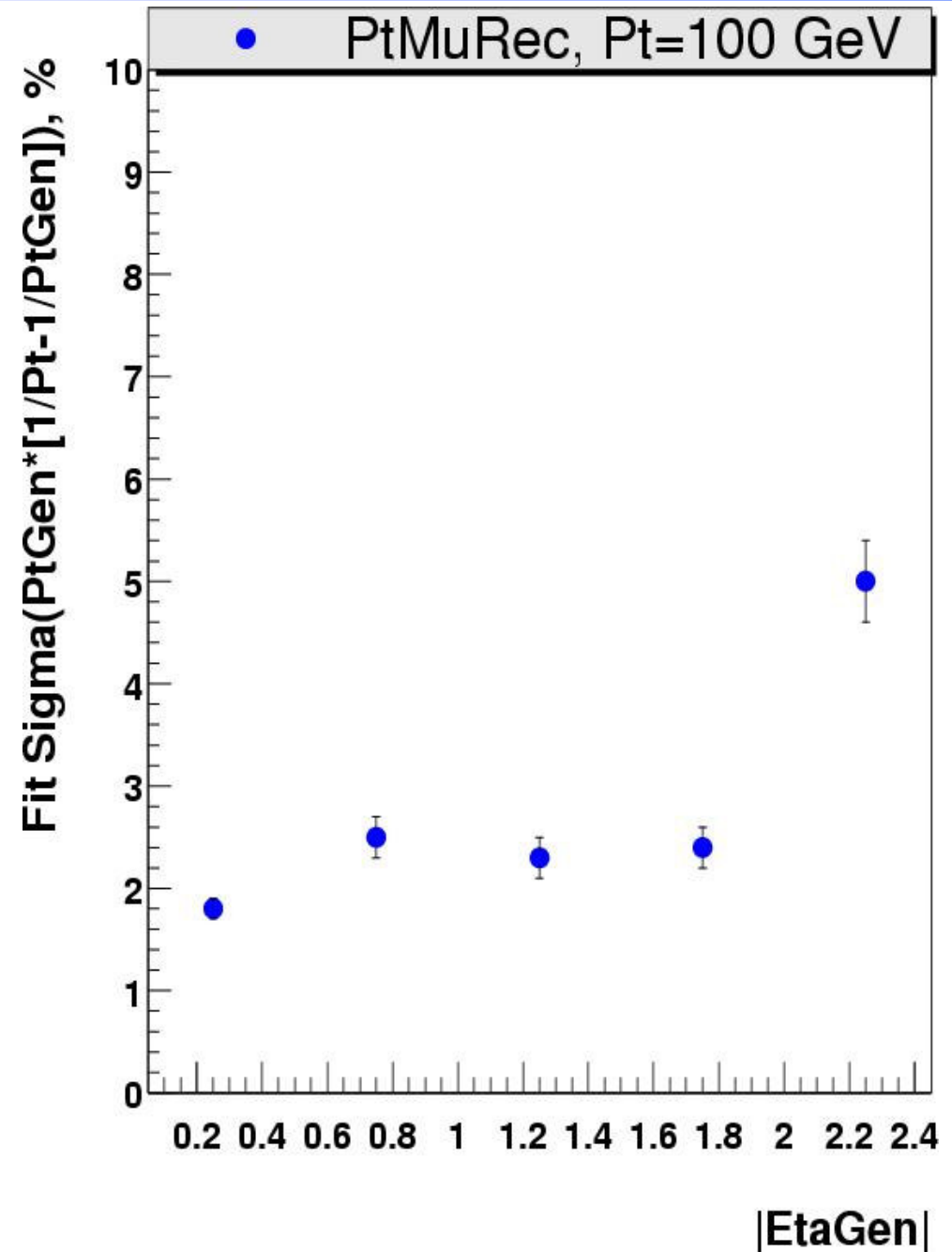




# 1/Pt resolution

- **Muon+Tracker Pt momentum resolution vs EtaGen**

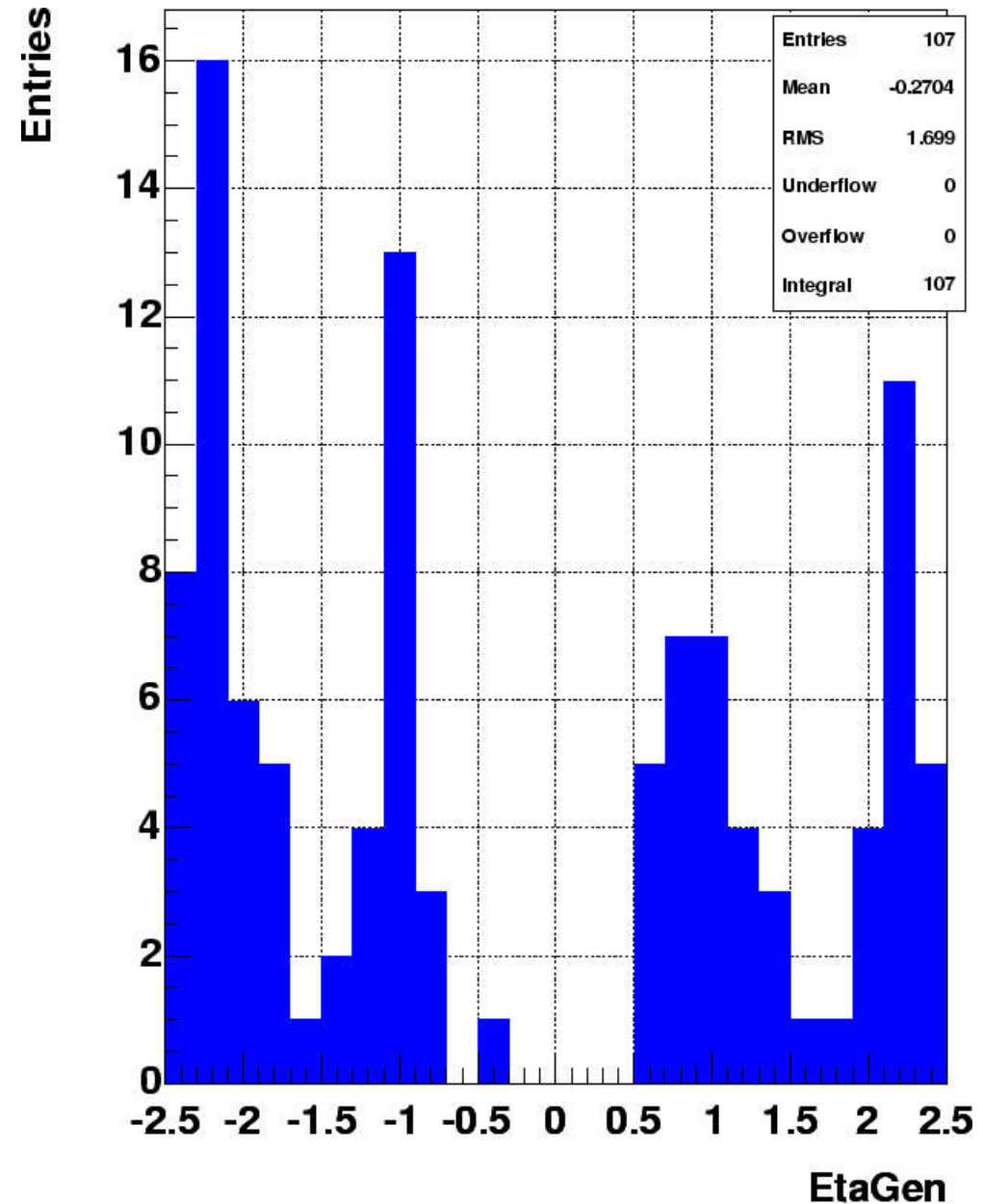
- ~ constant at EtaGen <1.6 (full bending power of the magnetic field + multiple scattering)
- degrades at higher EtaGen (tracks exit the end of solenoid, weaker bending)





# 1/Pt resolution

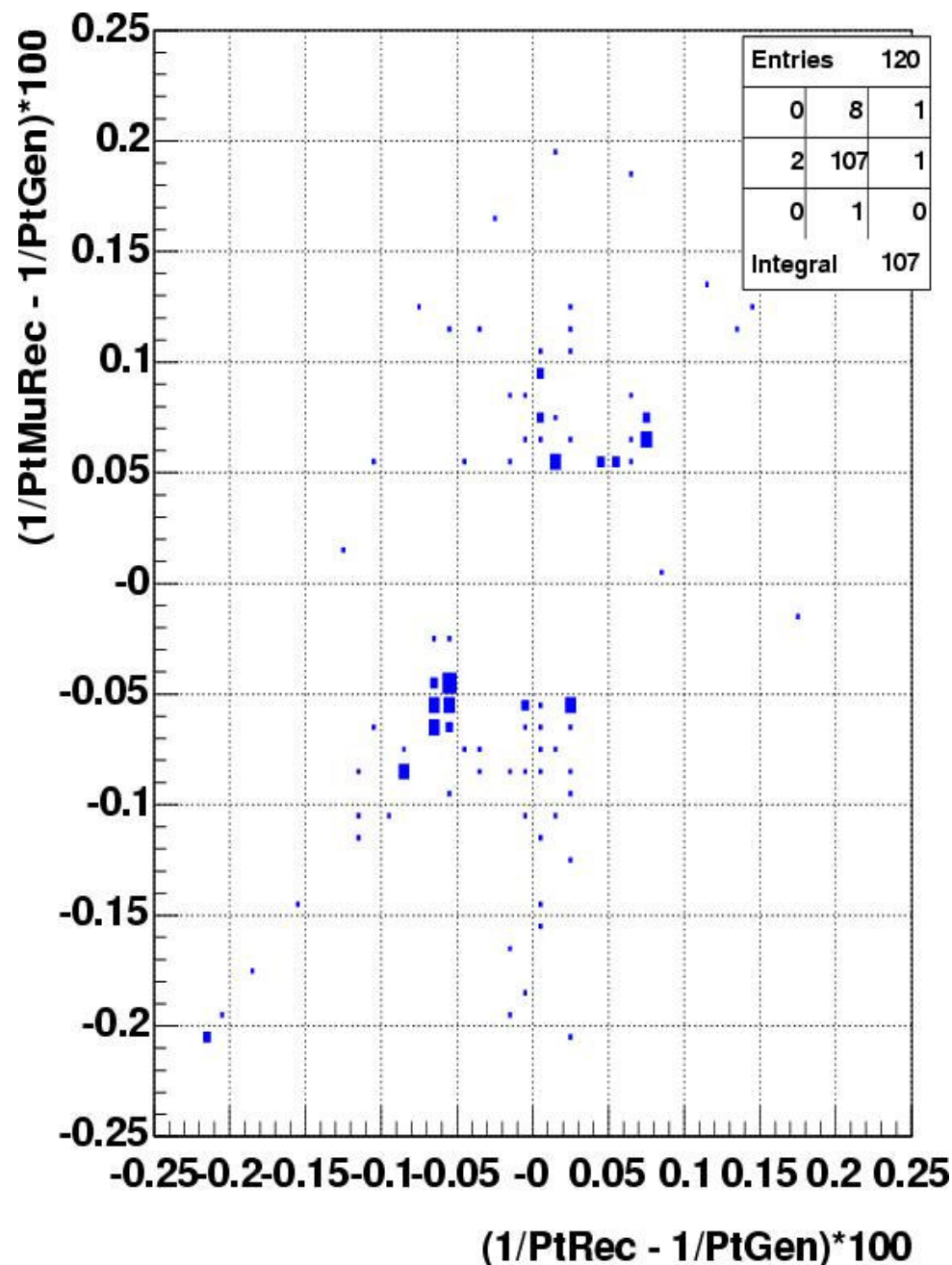
- **Non-gaussian 1/PtMuRec tails vs EtaGen**
  - Define tails as  $|\text{residual}| > 0.05$
  - Tails occupancy  $\sim 12\%$
  - Tails vs EtaGen :
    - $|\text{Eta}| \sim 1$  - fewer Barrel/Endcap layers
    - $|\text{Eta}| = 2-2.5$  - weaker bending in magn. field
  - Need much more statistics if tails defined as  $|\text{residual}| > 0.1$





# 1/Pt resolution

- **Tracker + Muon (1/PtMuRec) vs Tracker (1/PtRec)**
  - Region  $|\text{residual}| < 0.05$  excluded
  - Diagonal - due to tails in Tracker, Muon is OK
  - Vertical in  $-0.05 - + 0.05$  - due to tails in Muon, Tracker is OK







## ***Moving to More Recent Software Releases***

- **Recently, have begun to update this study using muon samples generated with newer software releases (OSCAR\_3\_7\_0 and ORCA\_8\_7\_1).**
- **Using newer Volume Based Magnetic Field Map.**
- **Also, taking advantage of new generic Stntuple making package developed by other members of LPC.**
- **Stntuple is being designed as a general purpose ntuple suitable for use in both physics analysis and algorithm development applications. The ntuple which is still under development consists of multiple branches, each containing objects of one type.**



## ***CSC test beam data vs ORCA***

- **Total cathode strip charge (ADC)**
  - No direct comparison due to different gas gain, incident angle.
  - However, distributions are similar (Table and Fig.).
- **Cathode strip pedestals (ADC in the 1-st time bin)**
  - RMS ~ 2.9 (beam test), ~4.2 (ORCA\_8\_1\_3, see Fig.)
- **Total cathode strip charge (ADC)**

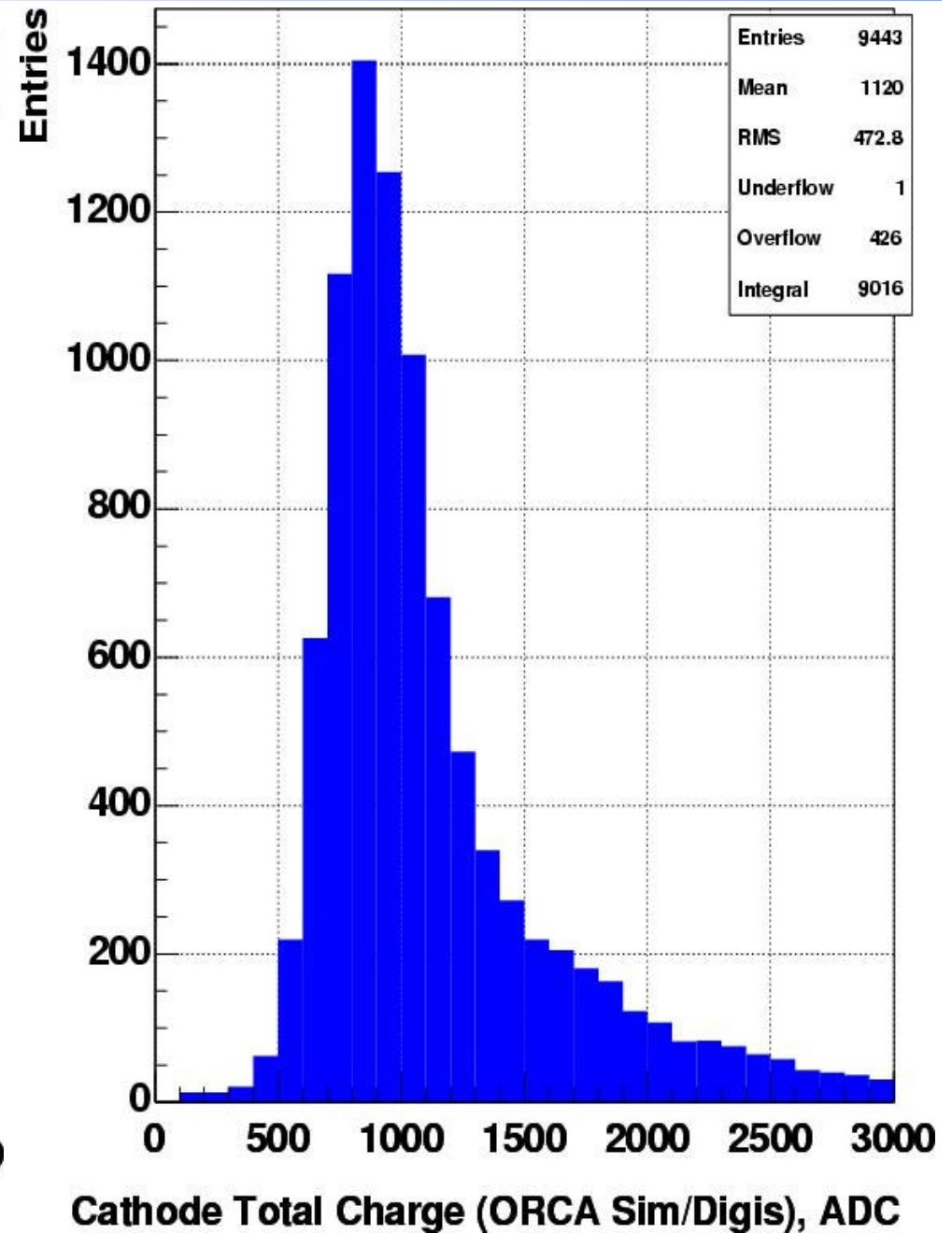
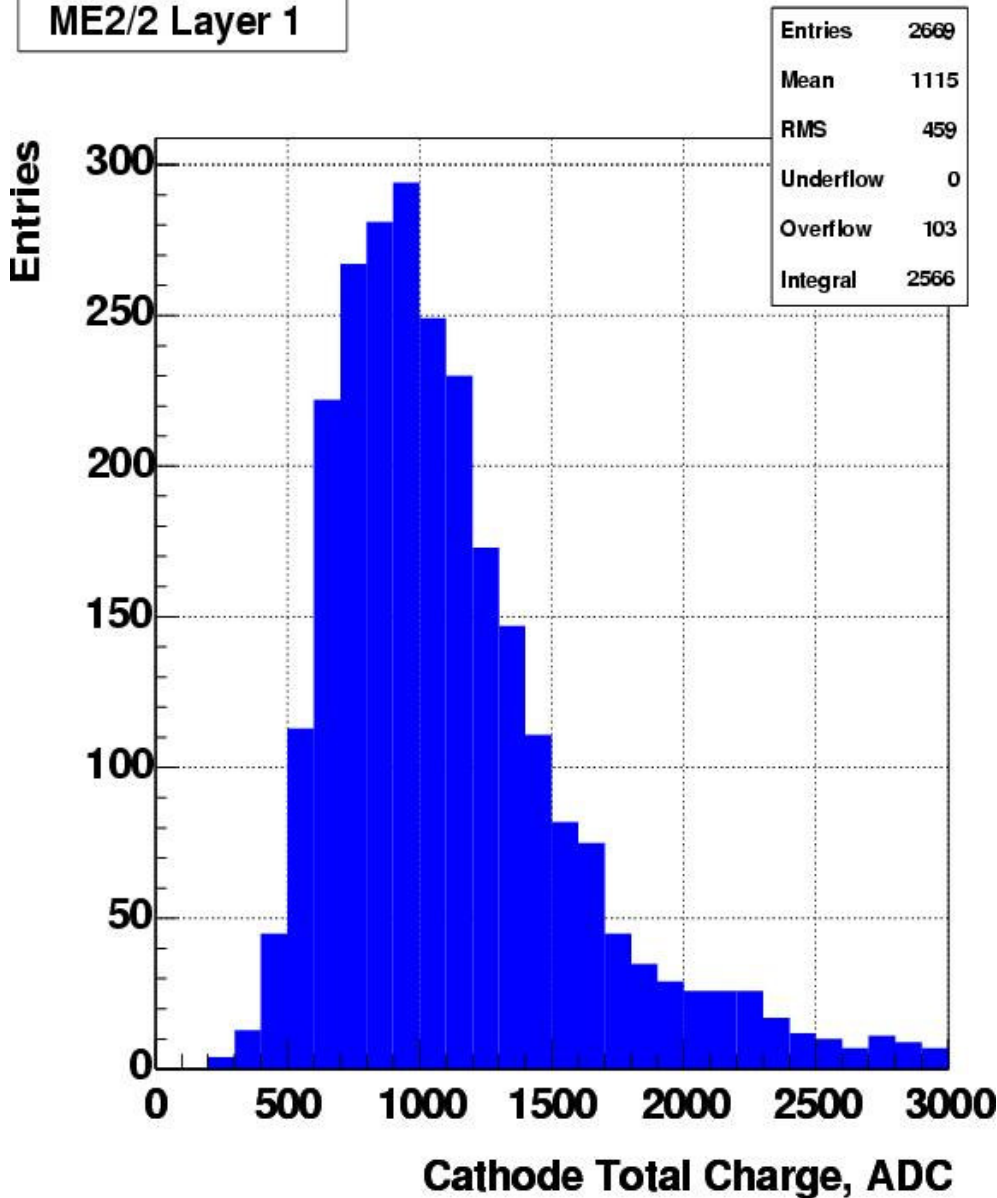
	<b>MEAN</b>	<b>RMS</b>	<b>ADC&gt;3000</b>
<b>Beam Test</b>	<b>1115</b>	<b>459</b>	<b>3.8%</b>
<b>ORCA_8_1_3</b>	<b>1120</b>	<b>473</b>	<b>4.5%</b>



# Test beam data vs ORCA

EMU CSC Trigger Beam Test RunNum554 Oct 2004

ME2/2 Layer 1

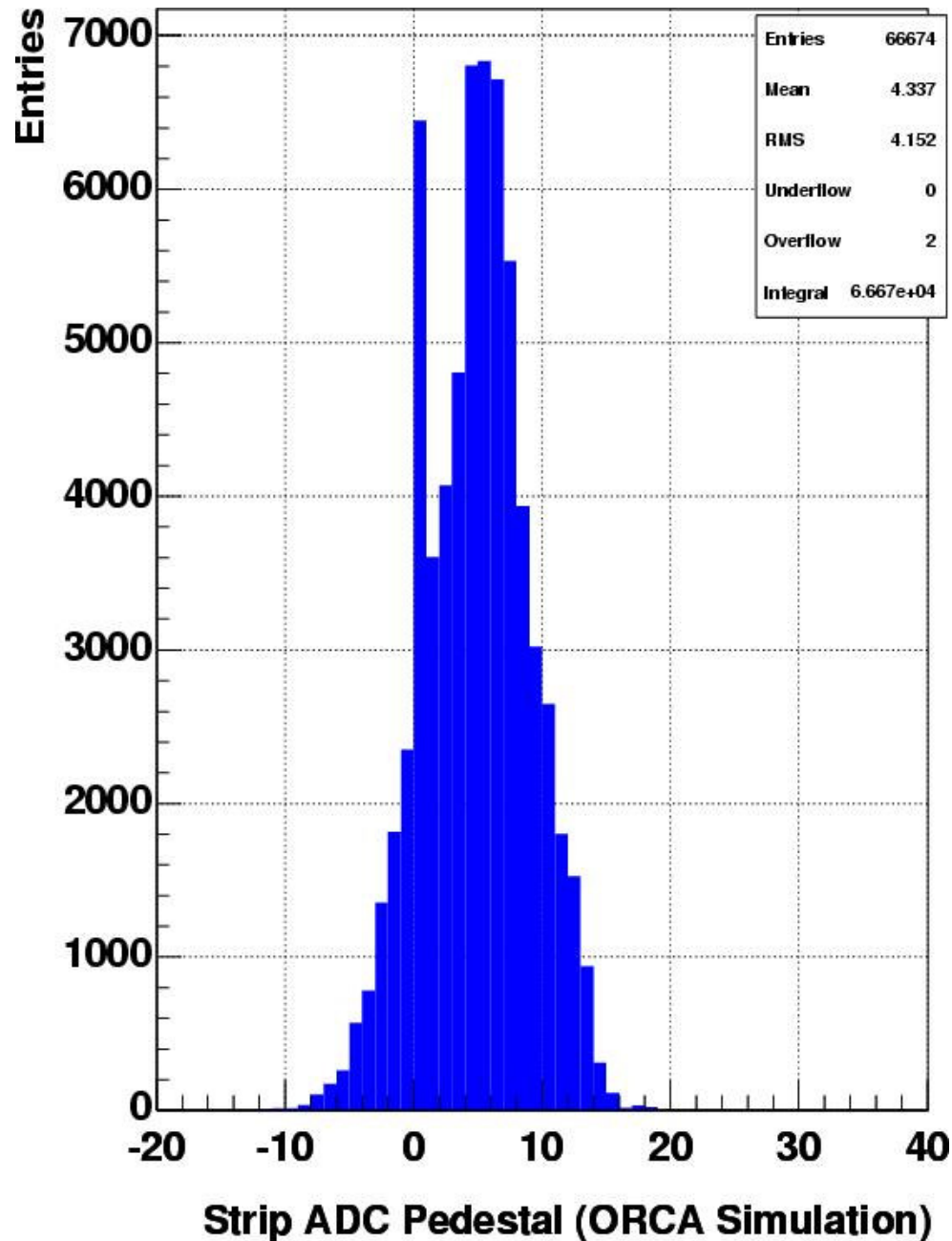
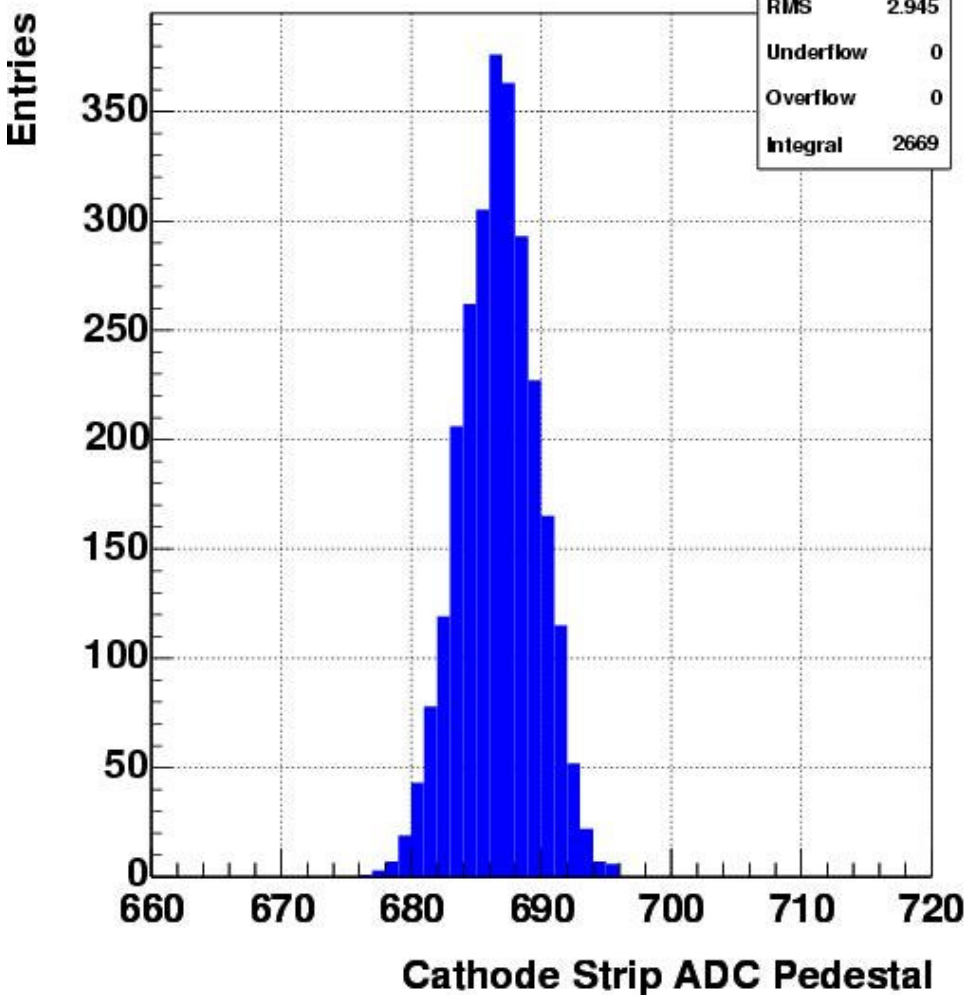




# Test beam data vs ORCA

EMU CSC Trigger Beam Test RunNum554 Oct 2004

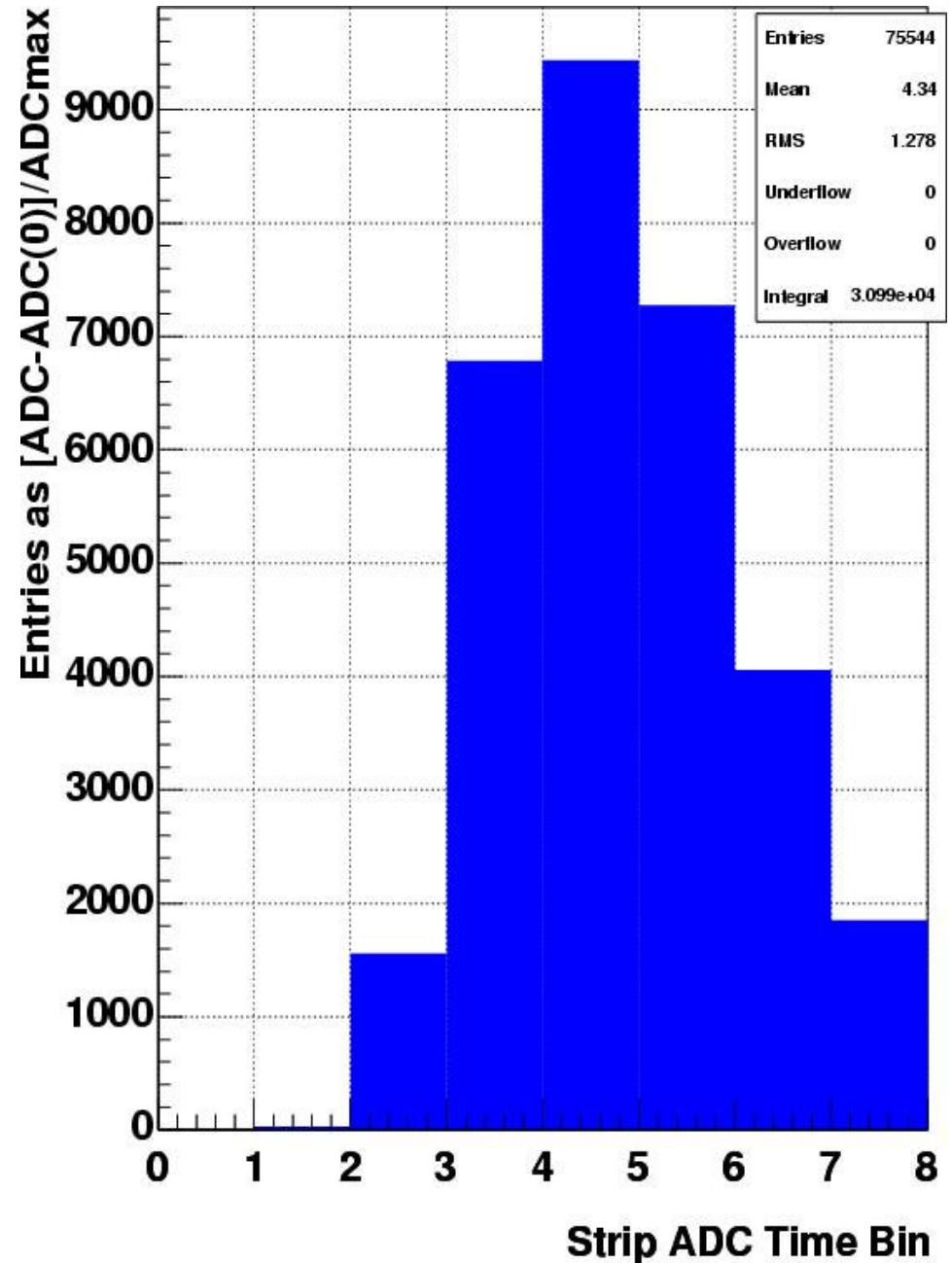
ME2/2 Layer 1 Strip 40





# Test beam data vs ORCA

- **The time profile of the signal on the cathode strip (ORCA simulation / digitization, see Fig.)**
  - Max. amplitude is always in the 5-th time bin
  - Time since primary interaction corresponding to the 1-st time bin is provided
  - To be compared with the beam test data ...





## *Future plans*

- **We hope to increase the number of people working within our core group this summer.**
  - Dimitri Bourilkov (U. of Florida) has applied for funding to join us for some period this summer.
  - Aron Soha (UC-Davis) has expressed an interest in becoming more actively involved in the group.
  - Additional funds are available for others who might be interested in working with us this summer. Please contact Eric and/or Martijn if interested.
- **The near-term goal of our group will be to contribute to Volume I of the Physics TDR. We are currently in contact with Darin and Norbert to pick a specific set of TDR topics that need attention and are compatible with the “know-how” and interests of our group.**