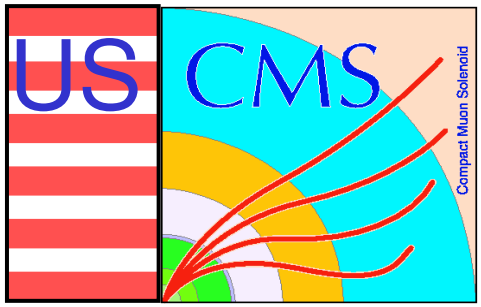
Test beam data analysis & validation of OSCAR/ORCA



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CMS Physics Week

Fermilab

Apr 12 - 15, 2005

Outline

- **Status of work on section in Physics TDR, Vol 1 (T. Cox, UC Davis)**
- **Endcap Muon Cathode Strip Chambers (CSC): comparison of test beam raw data and ORCA simulation/digitization**
  - **The time profile of signal for the cathode strips.**
  - **The ratio of charges for two adjacent cathode strips.**
- **Plans**

Status of work on section in Physics TDR, Vol 1

- **What this is about**
  - **"Test beam data analysis and validation of OSCAR simulation", one of the Muon PTDR tasks listed on http://cmsdoc.cern.ch/cms/Physics/muon/www/management/tasks_page.html**
  - **Good: more people actually working on this than mentioned there.**
  - **Details in https://uimon.cern.ch/twiki/bin/view/CMS/Muon**
  - **Bad: work is really just starting so few real results.**
  - **Bad: we haven't got a list of 'target' plots yet. Please suggest such plots - evidence and support for reliability of simulation and reconstruction.**
    (I presume we'd even like to know the detectors really work to measure what we expect they will.)

Status of work on section in Physics TDR, Vol 1

- **Task 'Test beam data analysis and validation of OSCAR simulation'**

	DTs	CSCs	RPCs	OSCAR	Neutron bkgd
Work underway?	yes	yes	no?	–	yes
People known to be contributing	Cerminara Marcellini Hoepfner (Amapane)	Belotelov Breedon Chertok Cox Meshcheryakov Moissenz Mumford Terentiev	?	Arce	Srimanobhas (Phat) Arce Cox
Comments	Web page: https://uimon.cern.ch/twiki/bin/view/CMS/DTTestBeam	Much work is getting going… need changes in ORCA for test beam data (& geom)	Is anybody there?	OSCAR general support, & knowledge of validation	Phat has restarted work under Pedro's guidance.

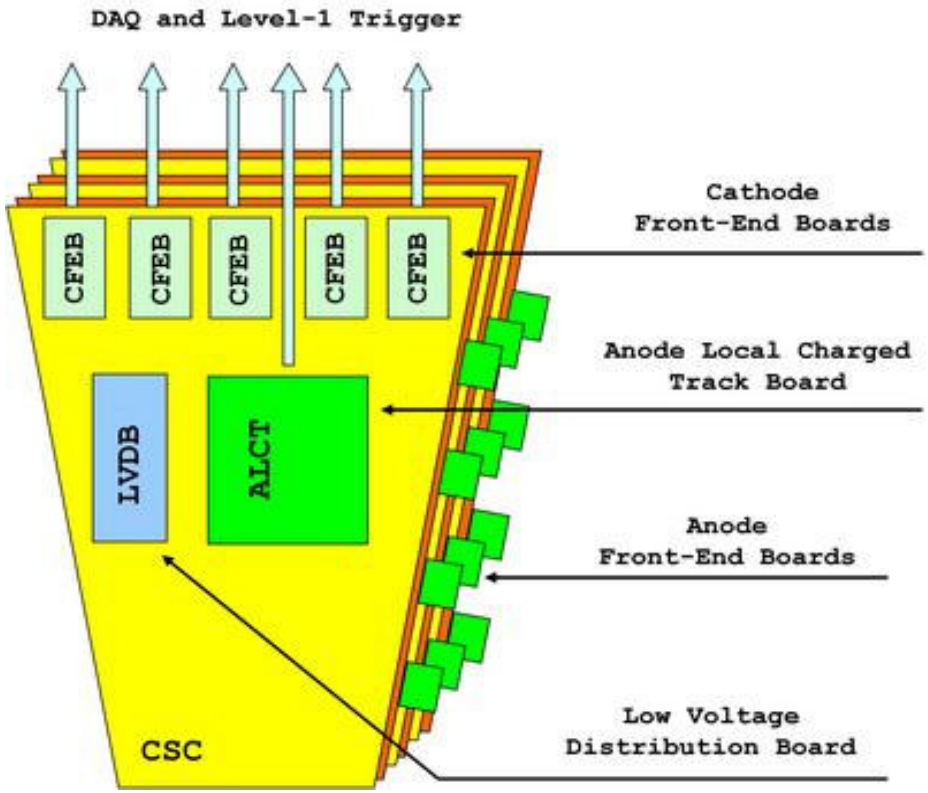
- **Conclusions**
  - **Good: work underway for DTs and CSCs.**
  - **Bad: no RPC-related program of work?**
  - **Suggestions for *what plots* the task needs to supply for the PTDR, from physics, hardware, or software viewpoint, gratefully accepted.**

CSC test beam data vs ORCA

- **Sep-Oct '04 EMU CSC Beam Test**
  - Asynchronous (1.5 week).
  - 25 ns structured beam (1 week).
- **Setup features**
  - 5 CSCs, 3 RPCs, HCAL.
  - 4 peripheral crates.
  - New DDU/DCC.
  - TrackFinder crate (SP1+SP2).
  - Trigger: SC (Scint. Counters), TF (Track Finder).
- **Details and some results at EMU Oct 2004 meeting by F. Geurts, D. Acosta, A. Korytov, M. Von der Mey, J. Hauser, S. Durkin**

CSC test beam data vs ORCA

- **CSC – Cathode Strip Chamber, six layers, two coordinates in each layer**
  - Anode wires in azimuthal, cathode strips in radial directions.
  - Provides ~ 99% efficient 25 ns bunch crossing identification (anode front end + ALCT).
  - Precise measurement of the azimuthal coordinate (~ 150 μ) by cathode strips.
  - Trigger primitives for Level-1 trigger system.

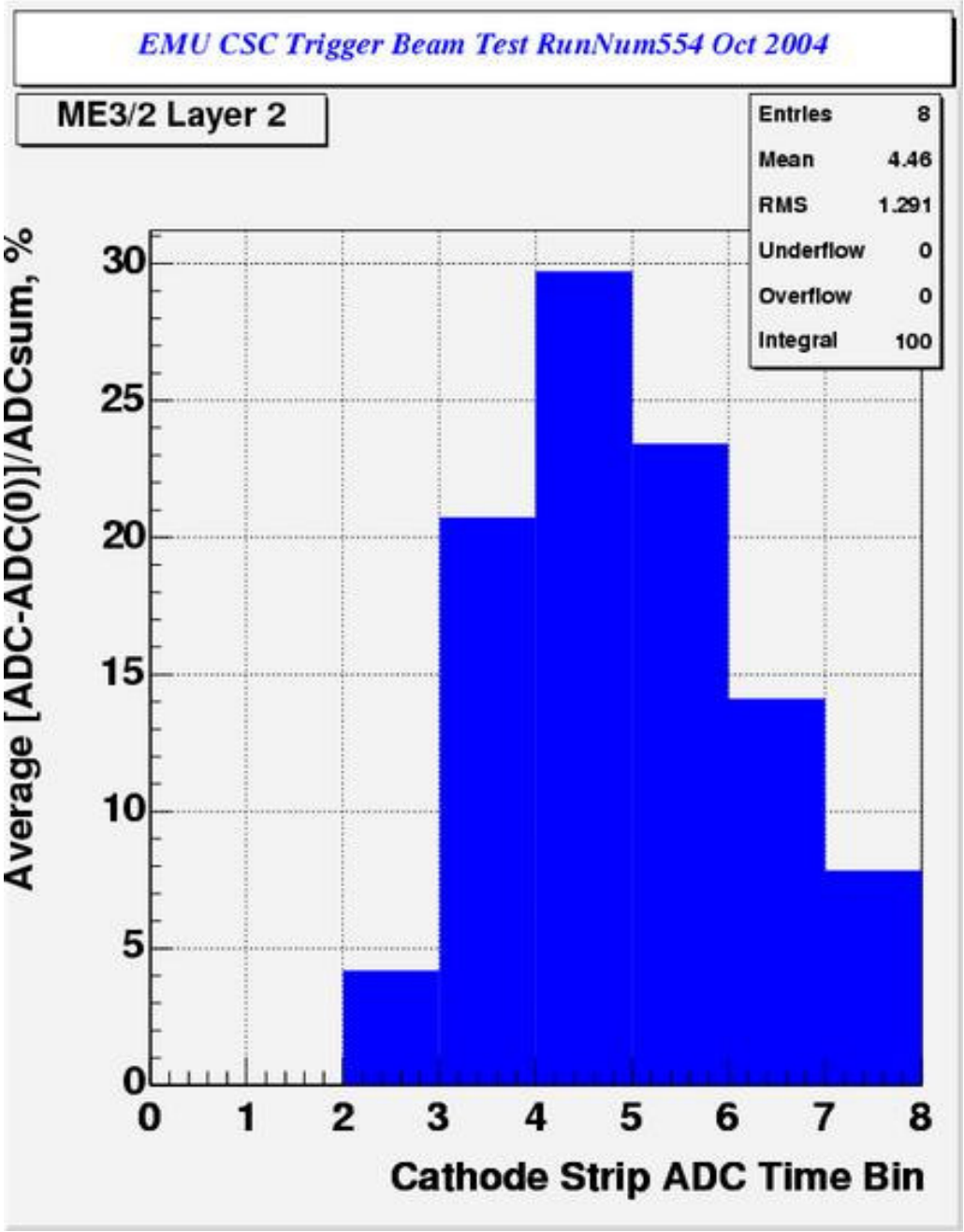


CSC test beam data vs ORCA

- **Test beam data (see details in www-hep.phys.cmu.edu/cms/Beam_Test_Sep_2004/tb.html)**
  - **CERN H2 150 GeV Muons.**
  - **25 ns structured beam.**
  - **Require single muon track in analysis (one anode wire hit, one cathode comparator hit per CSC layer).**
- **ORCA (for EMU CSC simulated digitization in full CMS detector, not yet available for beam test geometry)**
  - **The single muon particle gun sample, Pt=100 GeV.**
  - **Flat in Phi over all Phi.**
  - **Flat in Eta from -2.5 to 2.5.**
  - **Used versions are OSCAR_3_2_2 and ORCA_8_1_3 (newer versions have the same code for the CSC raw data).**

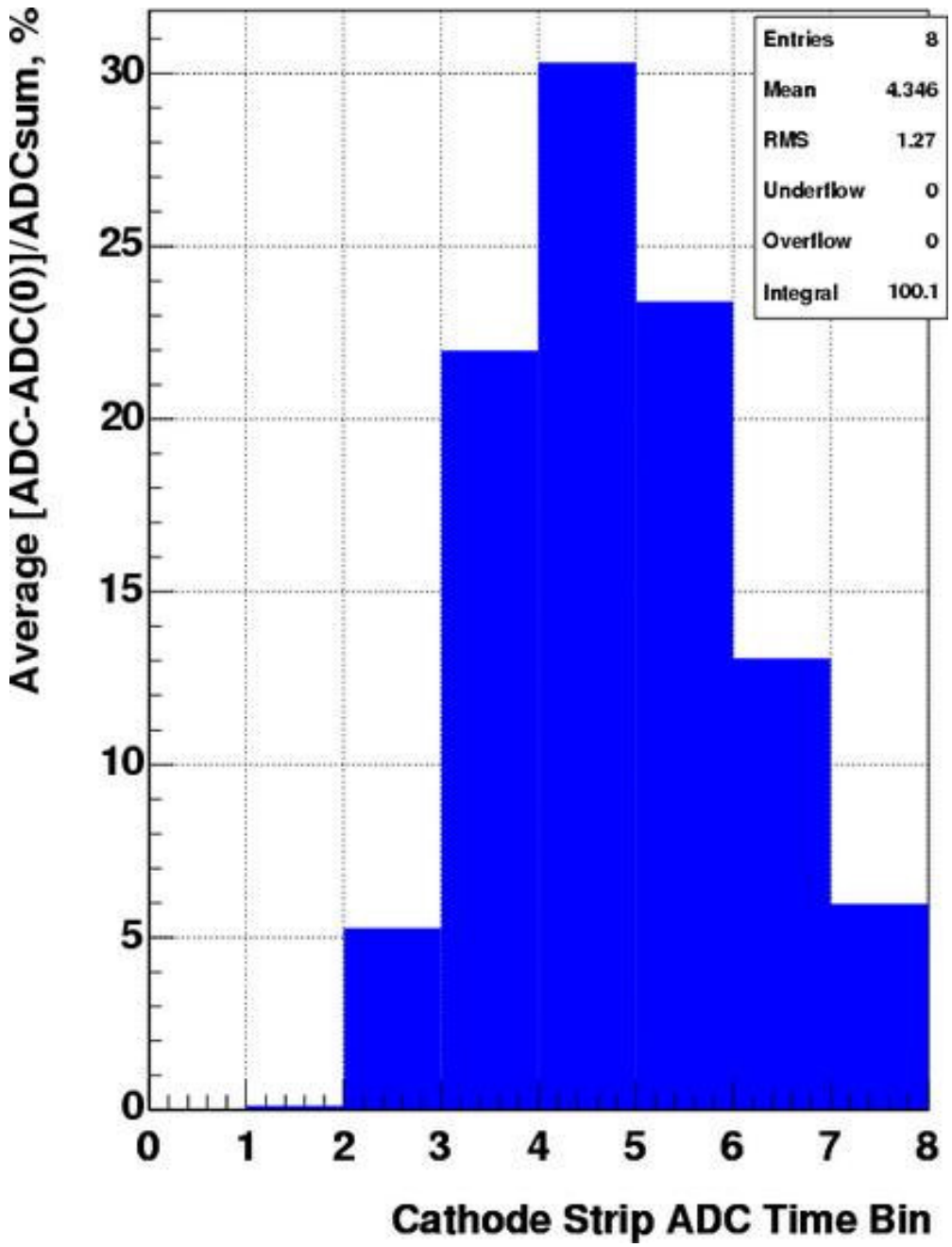
CSC test beam data vs ORCA

- **Test beam - the time profile of signal for the cathode strip with max. amplitude**
  - **Data from CSC ME3/2.**
  - **Normalize to area in each event, average thru all events.**
  - **Time bin 50 ns.**



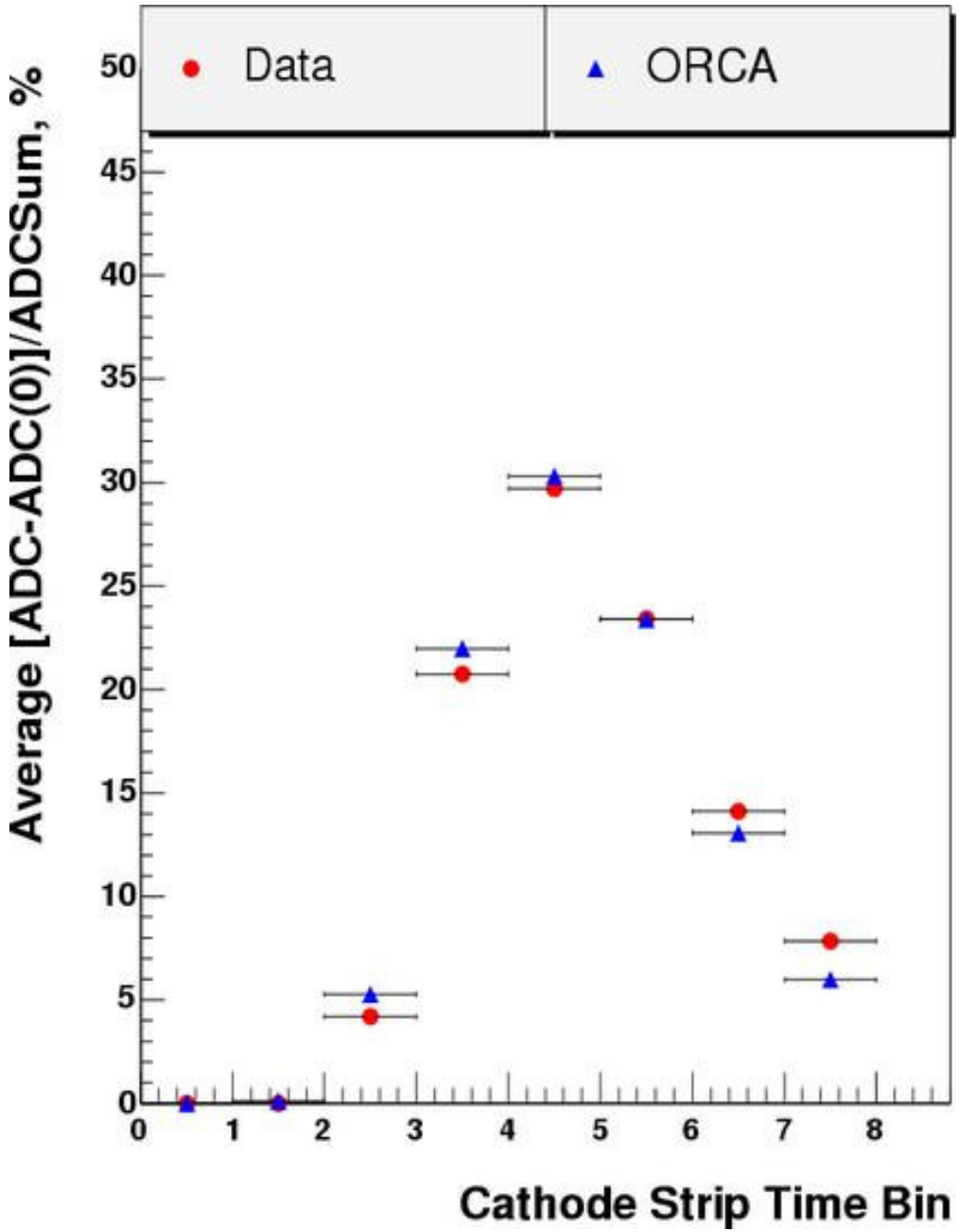
CSC test beam data vs ORCA

- **ORCA - the time profile of signal for the cathode strip with max. amplitude**
  - **All CSCs (Station 1 excluded).**
  - **Max. amplitude always in time bin 4.**
  - **Normalize to area in each event, average thru all events.**
  - **Time bin 50 ns.**



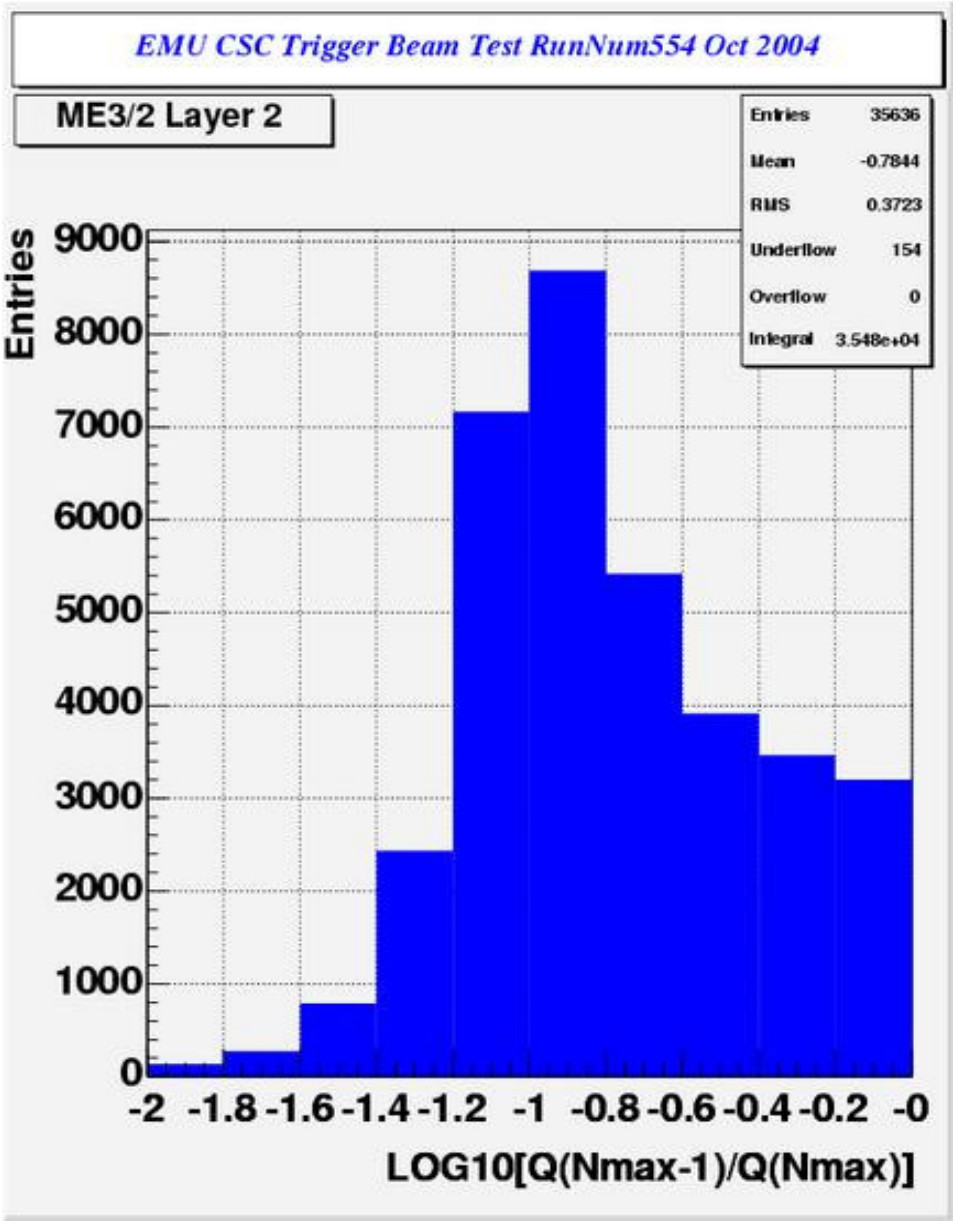
CSC test beam data vs ORCA

- **ORCA vs data for the time profile of the cathode strip signal**
  - **Reasonable agreement.**



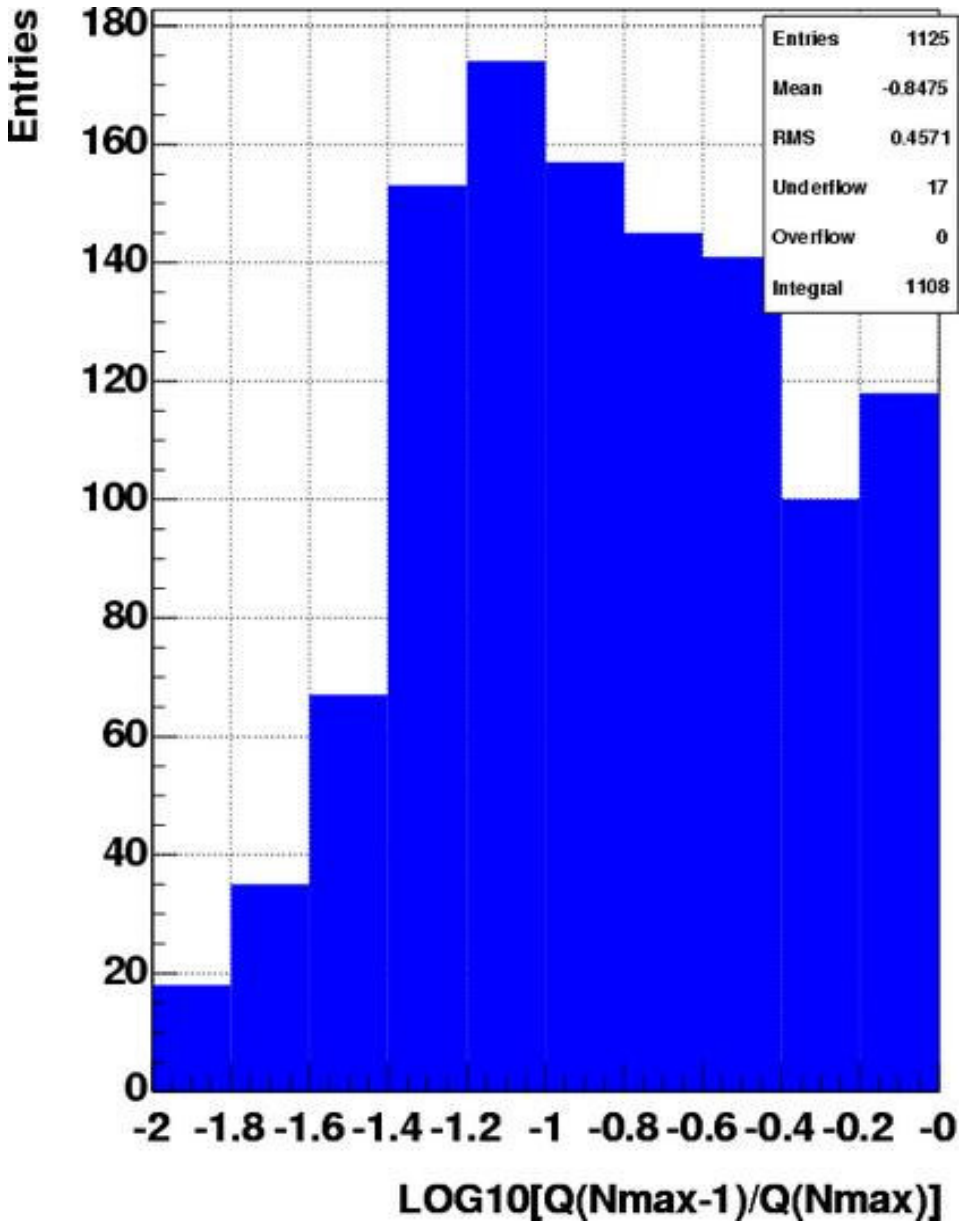
CSC test beam data vs ORCA

- **Test beam - the ratio of charges Q (Log10) for two adjacent strips (Nmax is a strip with Qmax)**
  - Data from CSC ME3/2.
  - At 0 – track between strips Nmax-1 and Nmax.
  - At ~-2 – track between strips Nmax and Nmax+1.
  - No correction for beam profile within two strips.



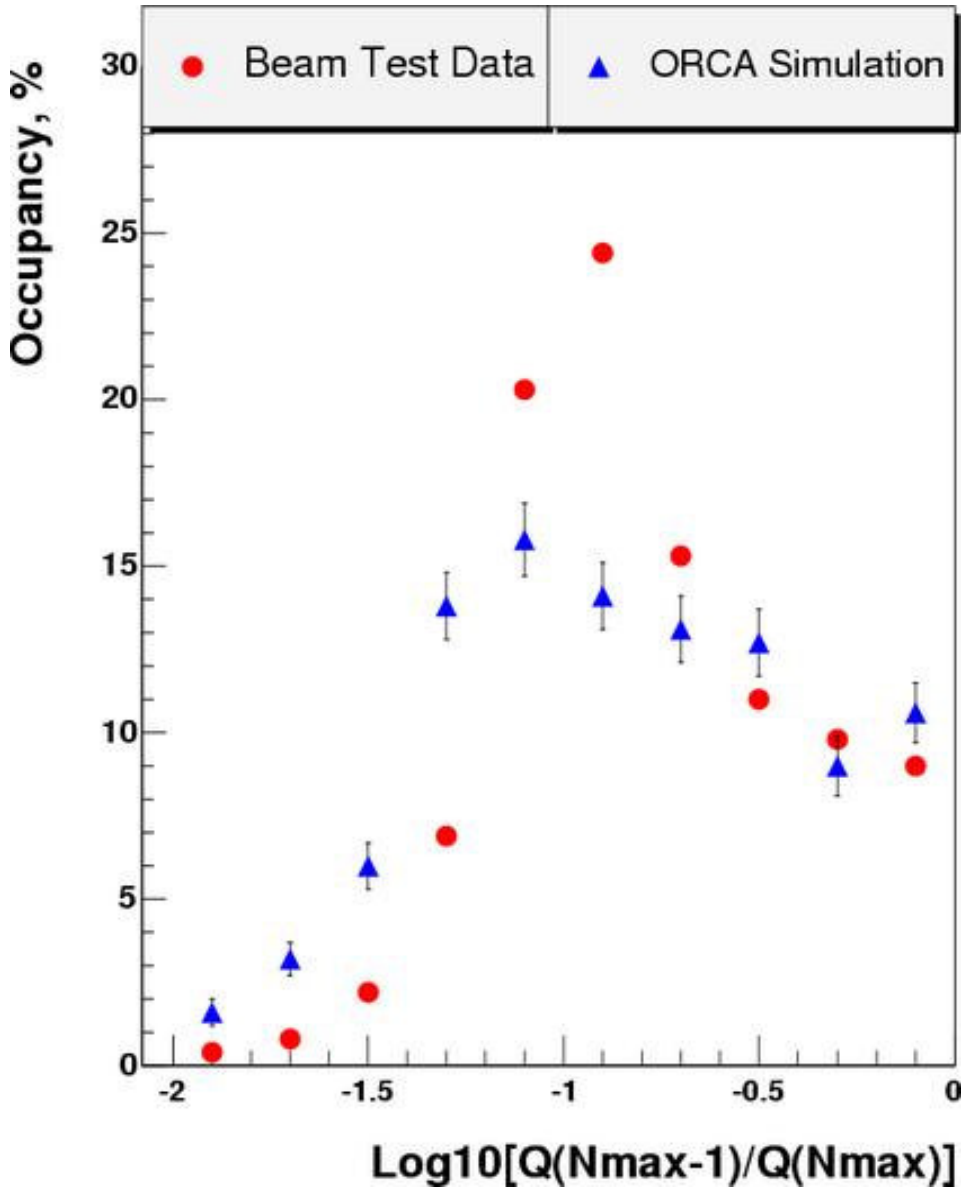
CSC test beam data vs ORCA

- **ORCA - the ratio of charges Q (Log10) for two adjacent strips (Nmax is a strip with Qmax)**
  - **Cut 1.3 < EtaGen < 1.6 (~ as in the beam test).**
  - **All ME234/2 CSCs (Station 1 is excluded).**
  - **Preliminary, need more Monte Carlo statistics or switch to using actual beam test geometry in ORCA.**



CSC test beam data vs ORCA

- **ORCA vs data (preliminary)**
  - Occupancies from previous figures are normalized to the distribution areas.
  - Reasonable agreement. in case of the track between strips.
  - ORCA needs more study in other cases.
  - To adjust ORCA for the beam test conditions in the final comparison.



Plans

- **Continue ORCA with test beam data comparison**
  - Cathode strip pedestal RMS, amplitudes, noise, crosstalk.
  - Cathode strip comparator thresholds and timing.
  - Anode front end thresholds, timing.
  - Tracking in the beam test, cathode strip coordinate resolution.
- **The beam test option in ORCA is greatly needed**
  - Work is in progress (R. Wilkinson, A. Tumanov, T. Cox, J. Mumford,…).
- **Picture/accompanying text selection for the Physics TDR, Vol 1**