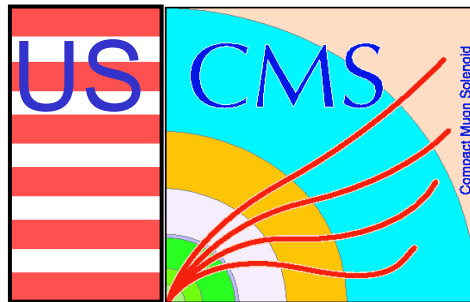


LPC Muon Group CMSSW code development efforts



N. Terentiev

Carnegie Mellon University

*CMS EMU Meeting,
Florida Institute of Technology*

February 17-18, 2006



Outline

- **EMU CSC Digi status in CMSSW.**
- **Muon Event Display in CMSSW (S. Stoynev).**
- **Example of Muon Analysis Code in CMSSW (S. Stoynev).**
- **Plans.**



EMU CSC Digi status in CMSSW

- **Writing CSC Digi Code in CMSSW**
(E. James, M. Schmitt, N. Terentiev, A. Tumanov).
 - Front-end/DAQ raw data format is hardware driven → unpacking and reformatting to Digi objects (wire, strip, time bin, signal amplitude ADC etc.).
 - Digi → Hits → CSC Track Segments → Tracks.
 - Digi is used also in monitoring, visualization and calibration.
 - We started in Nov. 2005 (see Oct. 2005 EMU Meeting, talk by M. Schmitt).



EMU CSC Digi status in CMSSW

- **Writing CSC Digi Code in CMSSW.**
 - **CMSSW/DataFormats/CSCDigi package (M. Schmitt, N. Terentiev, L. Gray).**
 - **Digi code done for:**
 - **Anode wire, time bin (CSCWireDigi).**
 - **RPC data coming thru RAT-ALCT-DDU (CSCRPCDigi).**
 - **Cathode strip, SCA amplitudes (CSCStripDigi).**
 - **Cathode comparators and time (CSCComparatorDigi).**
 - **ALCT trigger primitives (CSCALCTDigi).**
 - **CLCT trigger primitives (CSCCLCTDigi).**
 - **Correlated LCT trigger primitives (by L. Gray).**
 - **Unpacking raw data to Digi (A. Tumanov), CMSSW/EventFilter/CSCRawToDigi package.**



EMU CSC Digi status in CMSSW

- **Adding new CSC Digi (raw data format unpacking errors, hardware status, calibration conditions).**
 - Important in the hit reconstruction, monitoring and calibration.
 - Unpacking errors flags (consult with experts).
 - Status bits and flags available for CFEB (S. Durkin), examples:
 - Switched Capacitor Array ADC overflow for each time sample
 - CFEB-SCA serialized controller data
 - Etc.
 - Status bits and flags from TMB, DMB, DDU and DCC headers (S. Durkin, to be provided).
 - For ALCT ?
 - Calibration conditions (threshold, delay and test pulse amplitude DACs).
- **An internal CMS note is being written: “EMU CSC Digi’s in CMSSW”.**



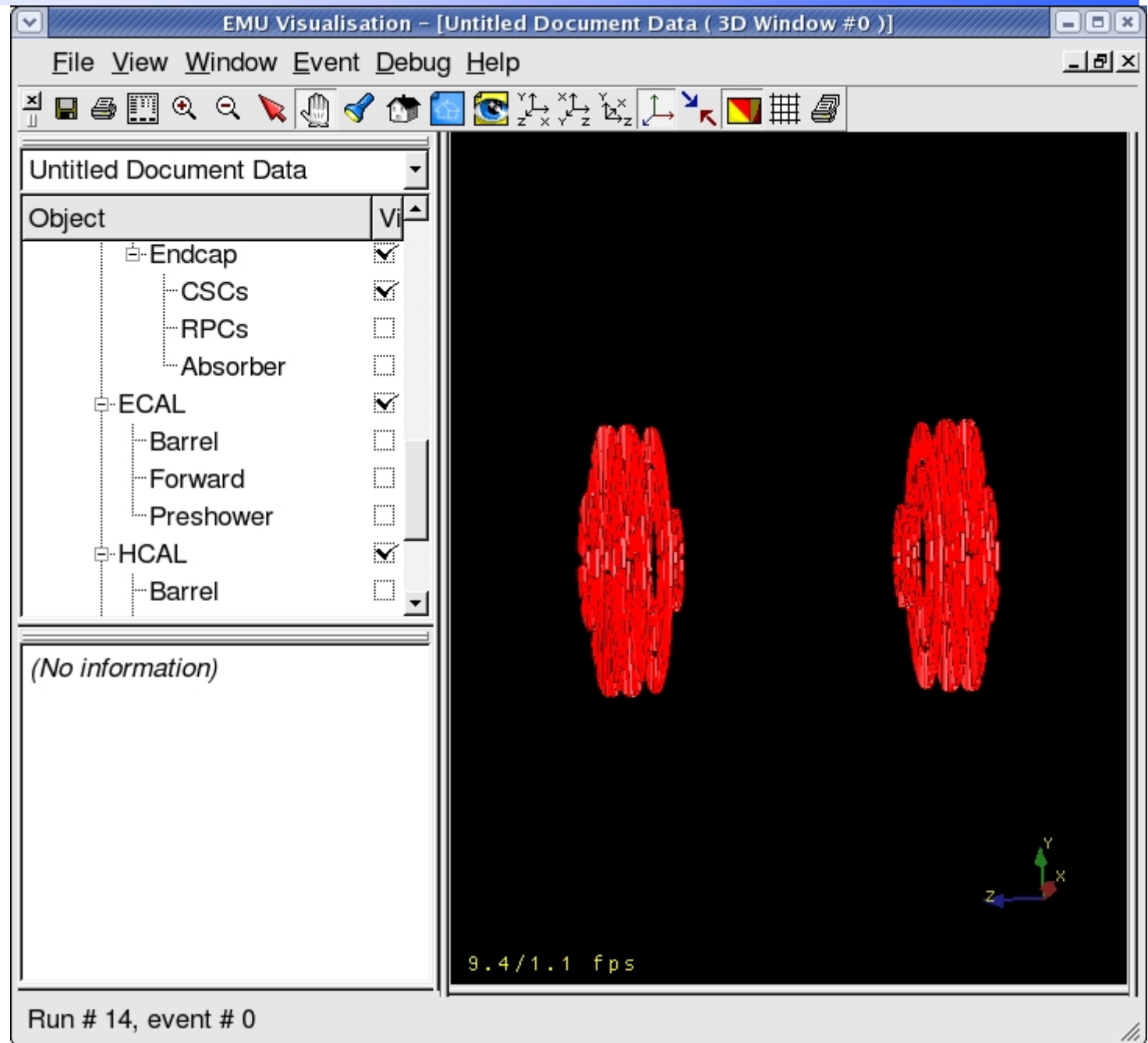
Muon Event Display in CMSSW

- **CSC Endcap visualization with IGUANACMS**
(S. Stoynev, agenda.cern.ch/fullAgenda.php?ida=a06799).
- The working source code available on cmsuaf.fnal.gov (under development).
- Full scale IGUANA features + Focus on CSCDigi presentation (wires, strips, time bins, ADC, etc.).
 - To be used in EMU Slice Test and Magnet Test.
 - Good candidate for Remote Operation Center at FNAL.
- Work is done in cooperation with Y. Osborne, see the code in cmsdoc.cern.ch/swdev/viewcvs/viewcvs.cgi/CMSSW/VisReco/VisMuonCSC/?cvsroot=CMSSW.
- Examples (next slides, by S. Stoynev).



Muon Event Display in CMSSW

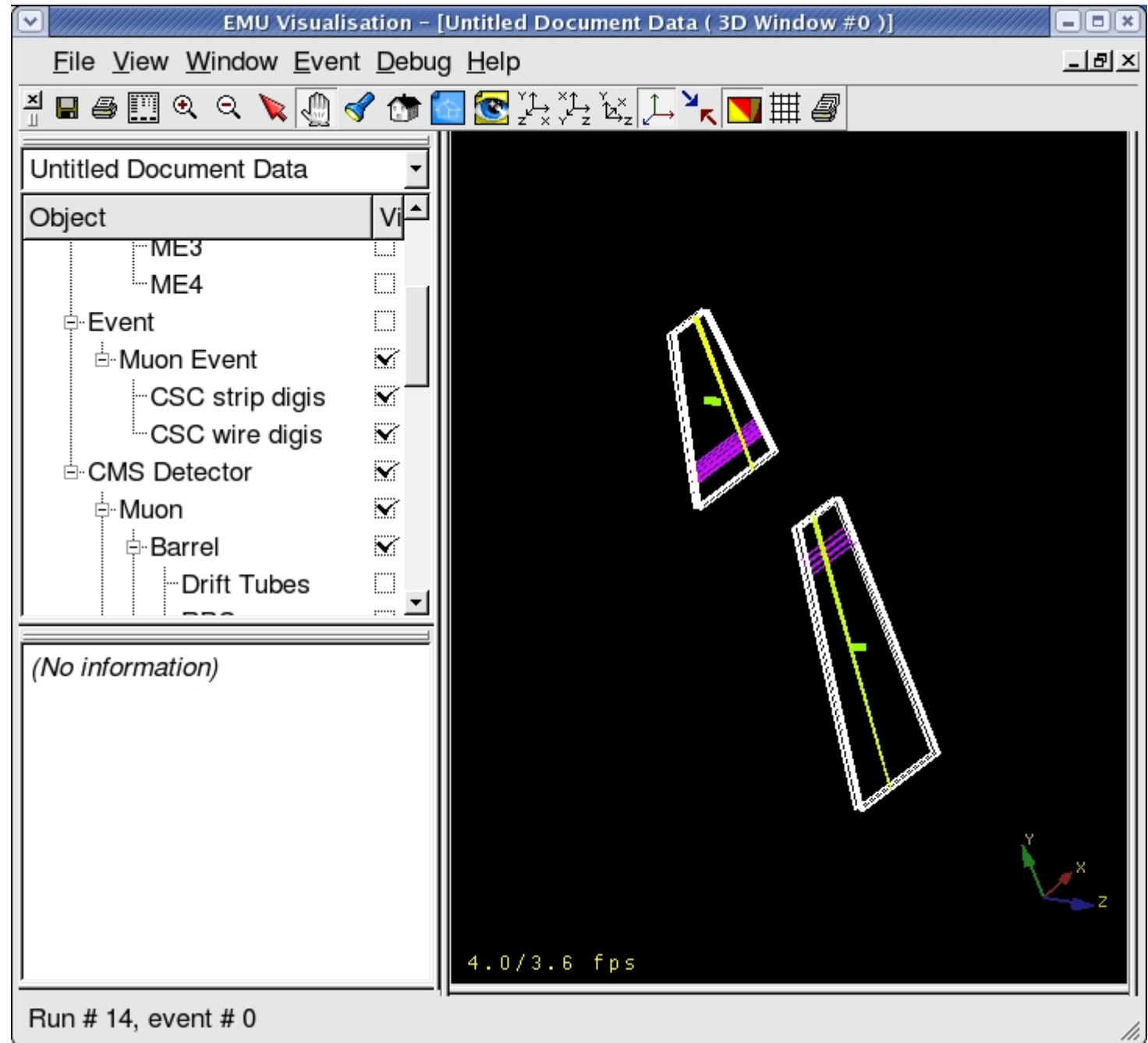
- **Iguana CSC Endcaps view (main window).**
- **New feature – station by station visualization.**





Muon Event Display in CMSSW

- **CSC strips and wires**
 - Strip Digis – yellow
 - Wire Digis – purple
 - Active layers – white
 - Center of chamber – green
 - Data from SX5 slice test, global DAQ





Muon Event Display in CMSSW

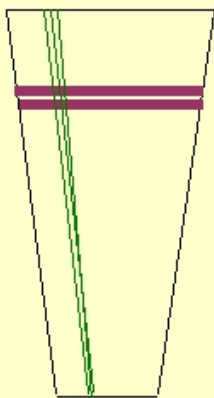
- **For EMU Slice Test – some ideas how to present CSCDigi for all CSCs with hits for a given track (S. Stoynev).**
 - In FAST site tests it was done for one CSC on one picture.
 - Large list of objects (wires, strips, time bins, SCA ADCs, ALCT, CLCT and LCT trigger primitives) in several CSCs along the track.
 - Next three slides are artificial events.



Muon Event Display in CMSSW

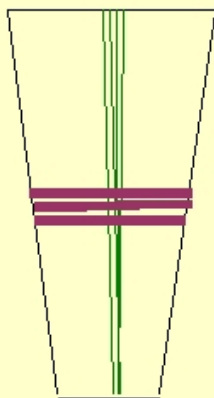
Static view (plan)

$I\Phi=23$



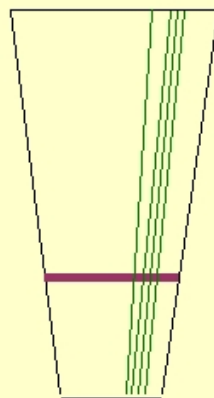
ME1

$I\Phi=23$



ME2

$I\Phi=24$



ME3

$I\Phi=24$

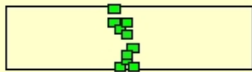


ME4

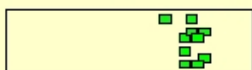
ME1



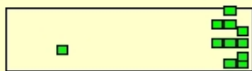
ME2



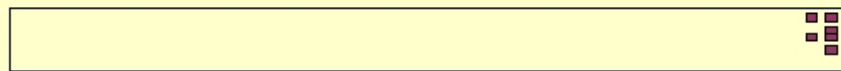
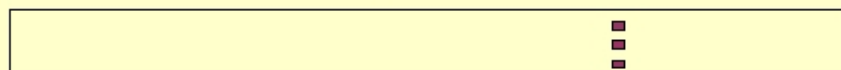
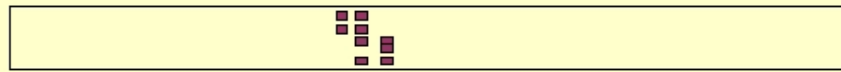
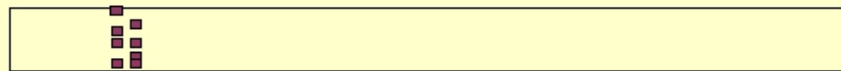
ME3



ME4



strips



wire groups

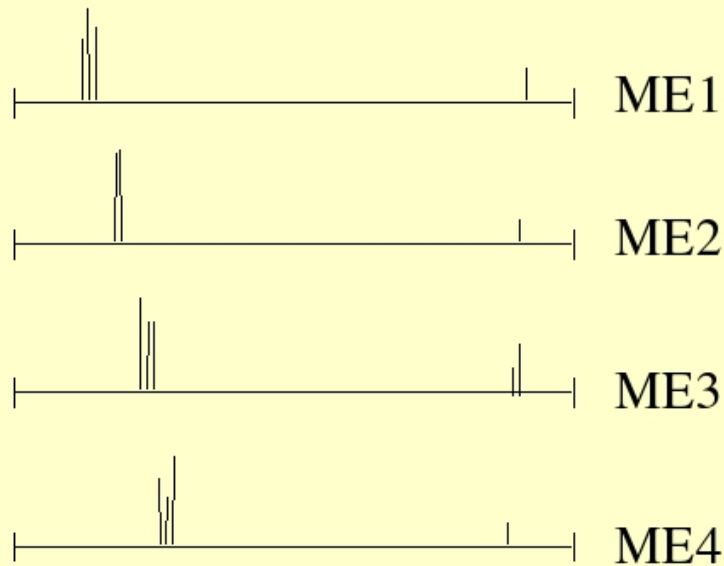


Muon Event Display in CMSSW

More plans

- Static Phi plots

ADC counts or
Number of strips
or...



$I\Phi=0$

$I\Phi=2\pi$

- Plotting ADC vs. time slots for chosen (using mouse) strips region
(next slide)

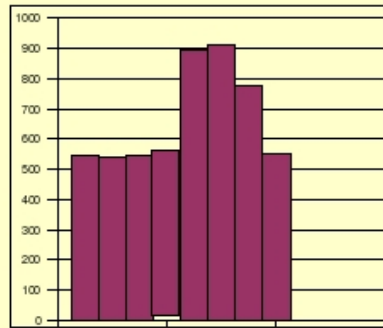


Muon Event Display in CMSSW

More plans (2)

layer 1, strip 29

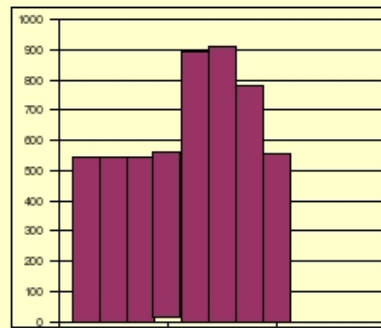
ADC counts



time slices

layer 1, strip 30

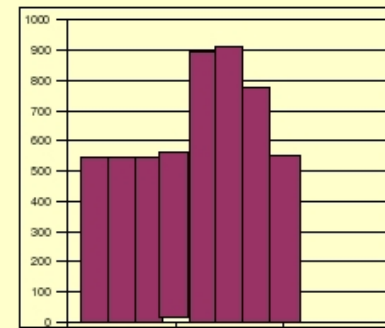
ADC counts



time slices

layer 2, strip 30

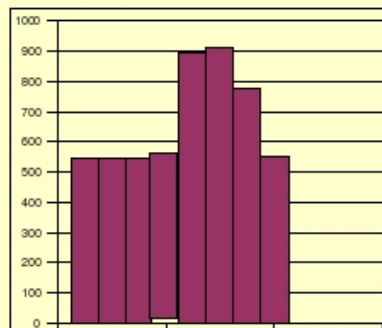
ADC counts



time slices

layer 3, strip 31

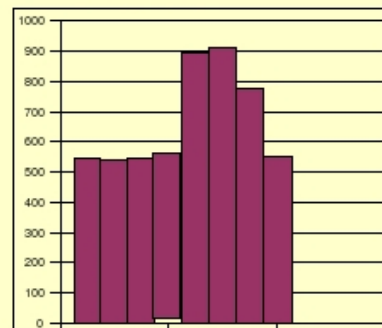
ADC counts



time slices

layer 5, strip 32

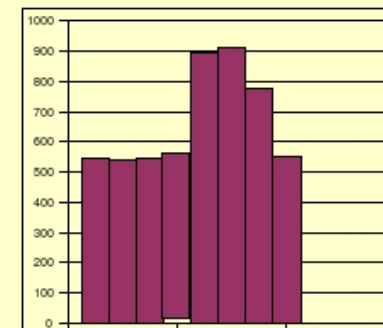
ADC counts



time slices

layer 6, strip 32

ADC counts



time slices



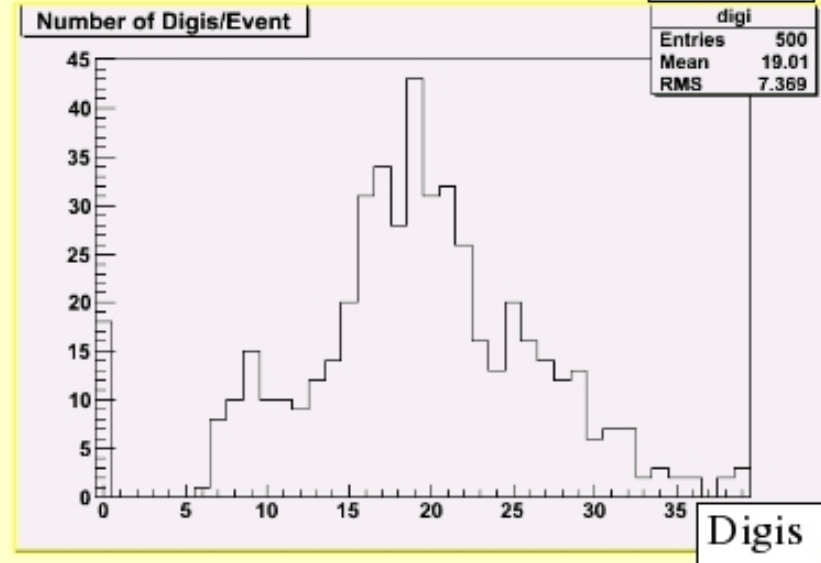
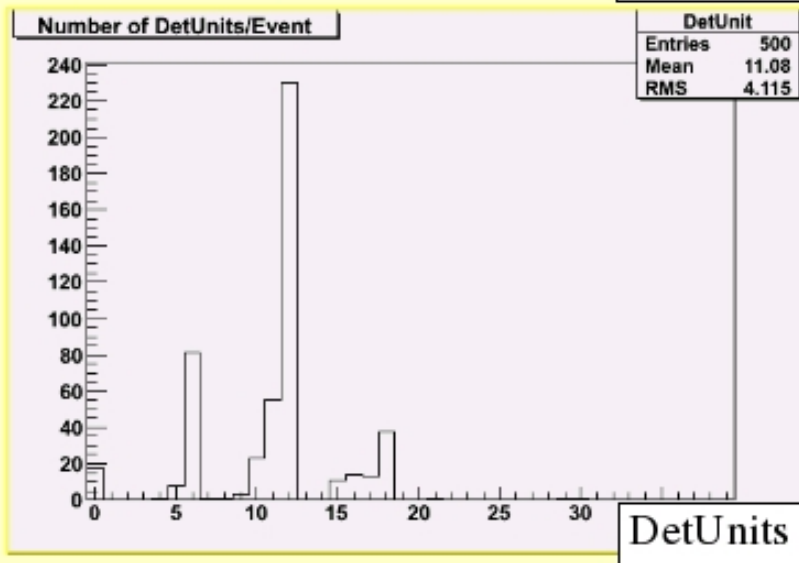
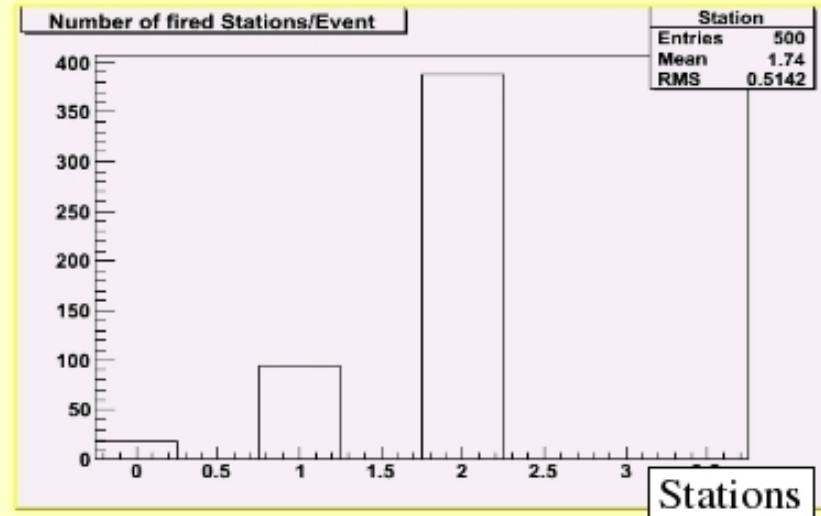
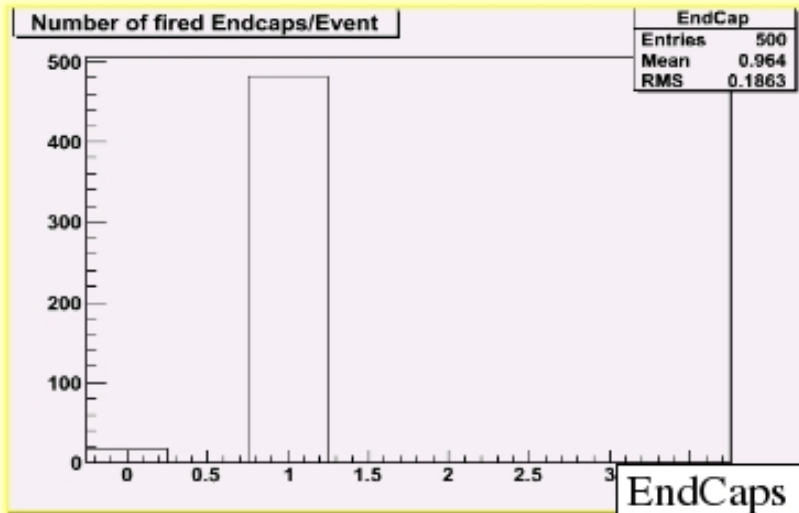
Example of Muon Analysis Code in CMSSW

- **S. Stoynev has also been working on an example of code for looking at EMU data (S. Stoynev, agenda.cern.ch/fullAgenda.php?ida=a06799).**
- **The first version of this is in the form of the CMS DQM package (historical – Stoyan also works on HCAL DQM).**
 - **Example of use of monitoring tool for EMU data analysis.**
 - **Three parts running independently:**
 - **Monitoring producers (analysis + histogram filling).**
 - **Clients (subscribe for and receive histograms with updating results).**
 - **Collector (interface layer between clients and producers).**
 - **Among many features - Web-interface and GUI with publish/subscribe functionality.**
- **Stoyan is in the process of making simpler version without DQM framework.**



Example of Muon Analysis Code in CMSSW

Example of monitoring objects





Plans

- **Complete CSCDigi package (add hardware status flags). Finish CMS Internal note describing the package.**
- **Thinking about contribution to the CSCRecHit code development in CMSSW (E. James et al., to contact T. Cox).**
- **For Remote Operation Center at FNAL:**
 - **Run CSC Endcap visualization with IGUANACMS.**
- **Validation of CSC simulation in CMSSW.**