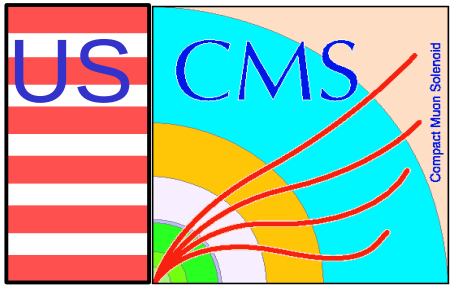
FAST site test results – a global view from ROOT



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EMU Meeting

University of Florida

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Outline

- FAST site test results and ROOT
- Reuse of the Beam Test Analysis Package
- Examples of global distributions of test results
- Conclusions/Suggestions

FAST site test results and ROOT

- **Goals**
  - **Get in ROOT distributions of the test results for all chambers and FAST sites including ISR**
  - **Compare in ROOT results chamber by chamber (wire,strip) at FAST sites (UF, UCLA, IHEP, PNPI) and at ISR**
  - **Prepare data for the database at CERN (shell script)**
  - **Choose a reference set of results for future use**

FAST site test results and ROOT

- **What, Where and How To**
  - **Data by Dec. 10, 2003 for 70 CSC (UF), 62 CSC (UCLA), 39 CSC (IHEP), 12 CSC (PNPI) and 150 CSC (ISR)**
  - **Available at FAST site Web pages**
  - **Test results are in pictures (Postscript files) and tables (text files) for each chamber and test**
  - **Download (automatically) only the tables and make a ROOT tree for further analysis in ROOT**

FAST site test results and ROOT

- **Problems**
  - **Cases of deviation from UF standards (folder names, file extensions, data format)**
  - **Missing files (a few)**
- **Solutions**
  - **Complicated scripts to download and convert files**
  - **Check and monitor a size of the result table**
  - **Convert files to the standard form**
  - **Suggestion to automate results saving and uploading from DAQ to Web to minimize operator impact (in SX5 tests)**

FAST site test results and ROOT

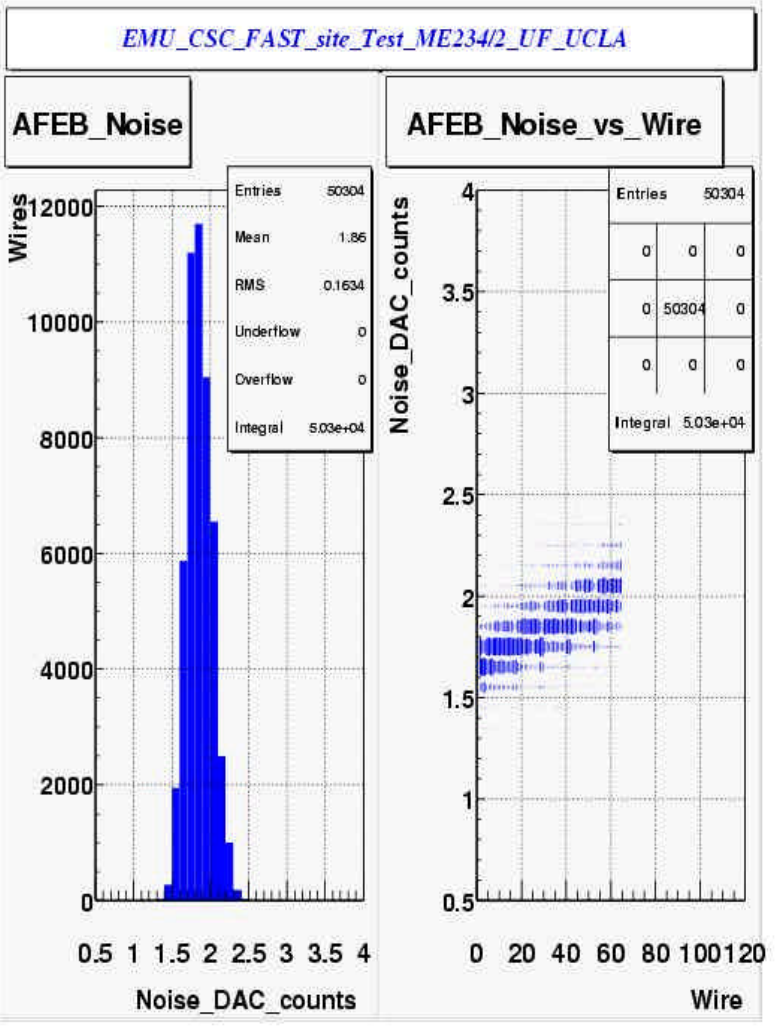
- **List of tests for presentation in ROOT**
  - **List of FAST site tests – 28 tests (~90 tables) per chamber**
  - **Candidates for ROOT tree – 21 tests (67 tables) (not finalized yet)**
- **So far 5 tables in the ROOT tree:**
  - **Test 11_01 – AFEB Rate (wire, layer) at HV = 3.6 kV**
  - **Test 13_01 – AFEB analog noise (wire, layer)**
  - **Test 13_12 – AFEB 20 fC threshold (wire, layer)**
  - **Test 15_01 – CFEB pedestal RMS (strip, layer)**
  - **Test 17_08 – CFEB gain (strip, layer)**

Reuse of the Beam Test Analysis Package

- **The ROOT tree making code**
  - Based on EmuDAQ/Analysis package (simplified version)
  - Event -> CSC chamber, includes:
    - FAST site ID (1-6 for UF, UCLA, IHEP, PNPI, ISR, SX5)
    - CSC type (1-6 for ME1.2, ME1.3, ME2.1, ME3.1, ME234.2, ME4.1)
    - CSC ID
    - CSC location on disk in SX5 (up to 5 coordinates)
    - … gas leak, …
  - CSC object for each test result (wire/strip, layer, result)
  - TClonesArray of objects for the table (result vs layer and wire/strip)
  - Add a FileReaderEvent Class to read out the tables
- **The ROOT tree analysis code**
  - The same structure as in the code for tree analysis of the beam test data
  - A few small modifications

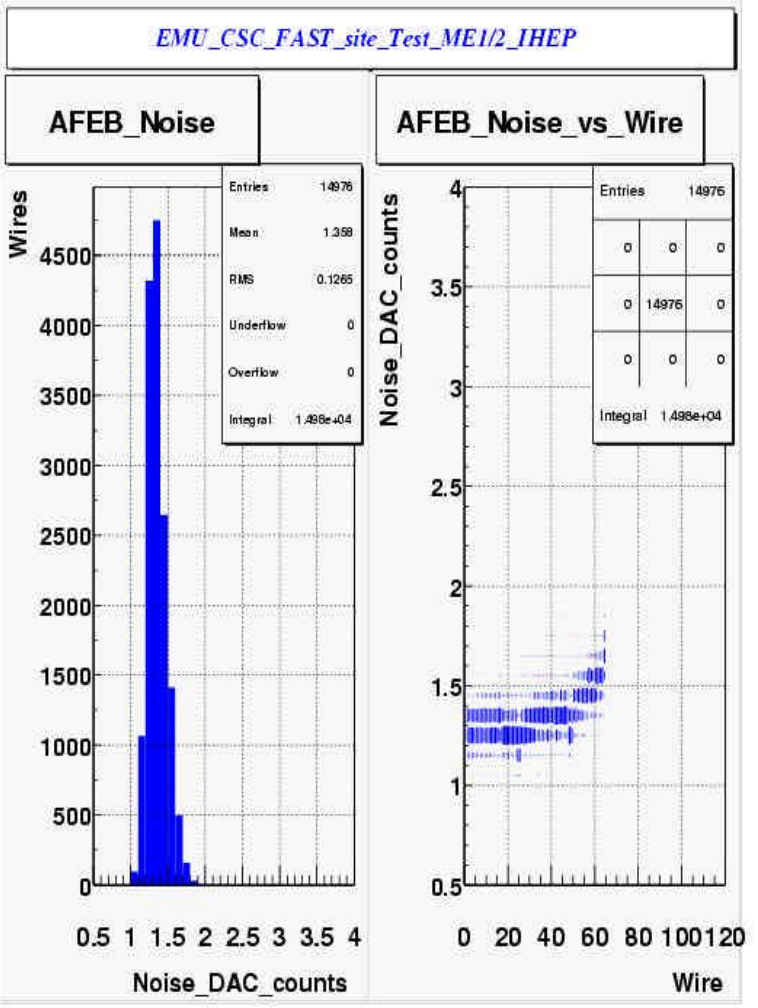
Examples of the test result distributions

- **AFEB analog noise**
  - Test 13_01
  - For 131 ME234/2 CSC (UF, UCLA)
  - Per AFEB channel (“wire”) at ~30 fC of ALCT test pulse
  - Measured as RMS of the integrated threshold curve, in threshold DAC units
  - Goes up with wire number (capacitance)
  - Mean noise ~1.9 DAC (~1.5 fC at calibration of ~0.8 fC/DAC)
  - 0.5 < noise (DAC) < 4 are the test acceptance limits



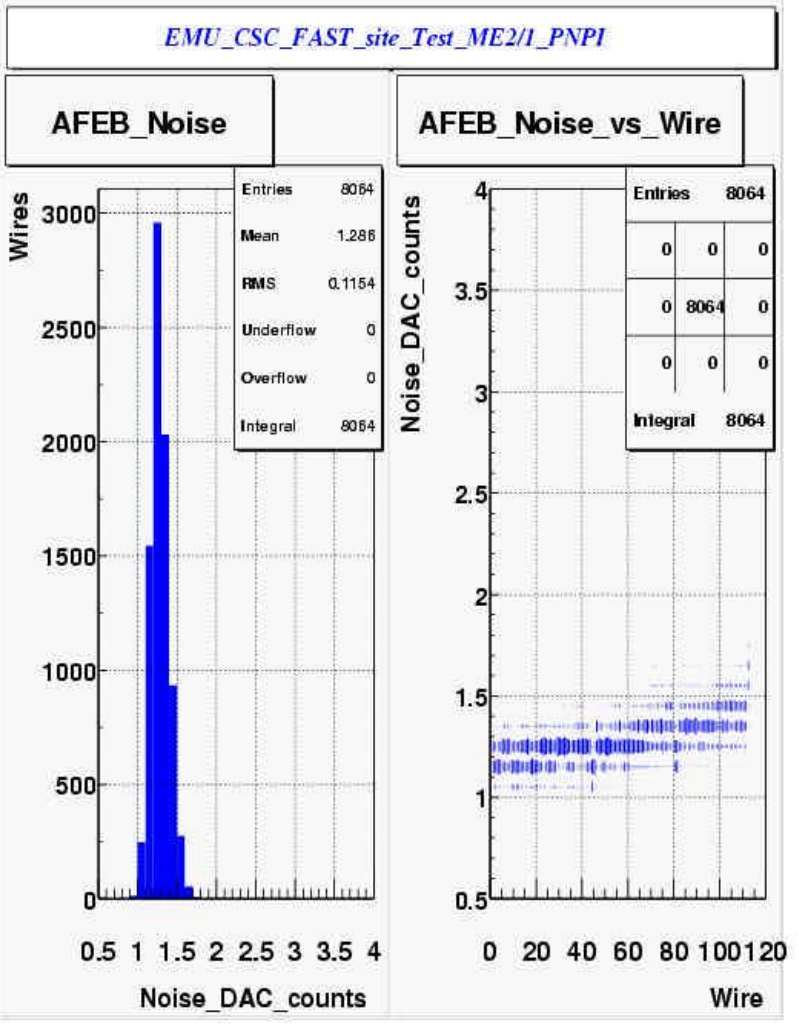
Examples of the test result distributions

- **AFEB analog noise**
  - **Test 13_01**
  - **For 39 ME1/2 CSC (IHEP)**
  - **Mean noise ~1.4 DAC (~1.1 fC)**



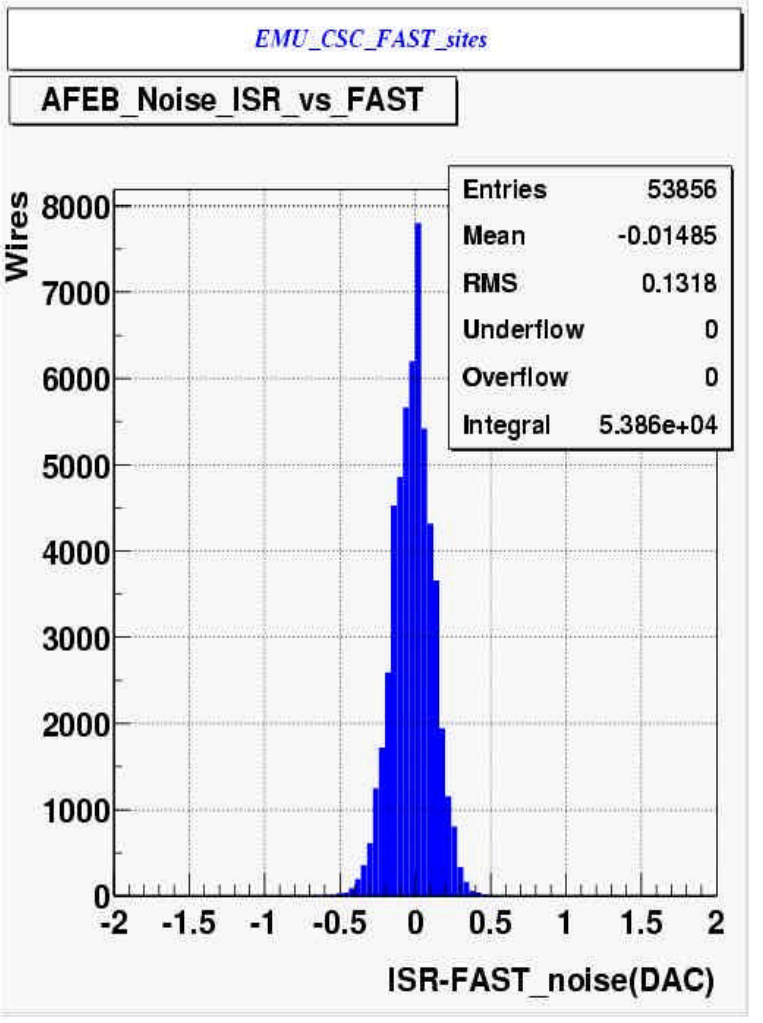
Examples of the test result distributions

- **AFEB analog noise**
  - **Test 13_01**
  - **For 12 ME2/1 CSC (PNPI)**
  - **Mean noise ~1.3 DAC (~1.0 fC)**



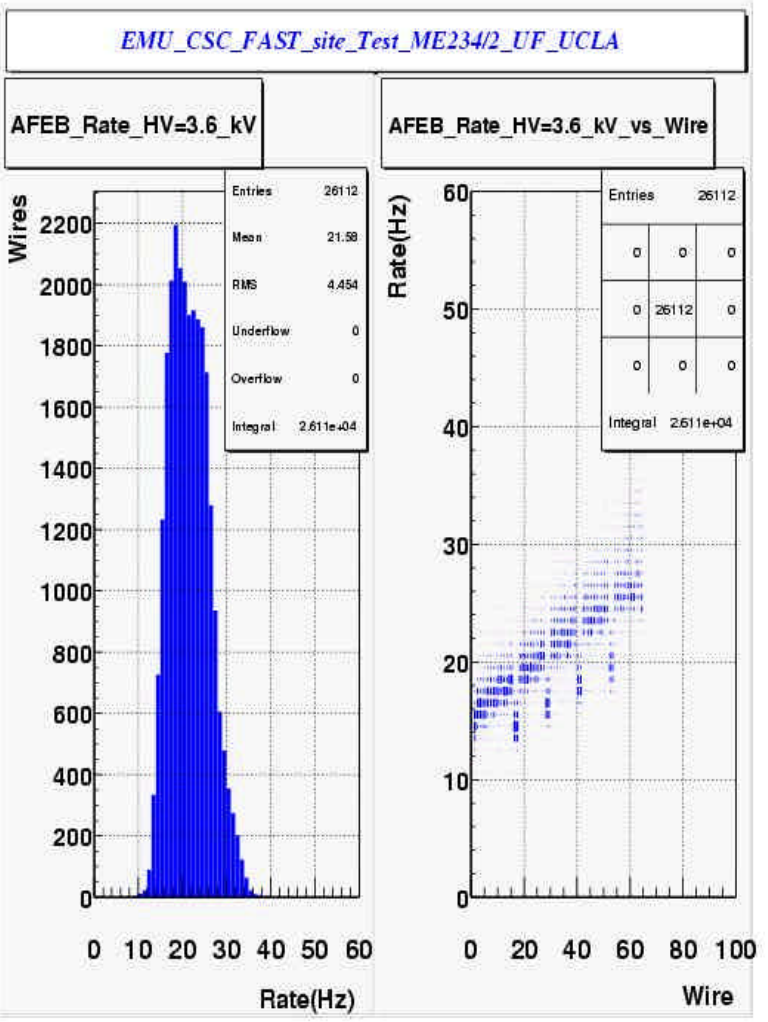
Examples of the test result distributions

- **Compare ISR and FAST sites AFEB analog noise**
  - **Test 13_01**
  - **For 11 ME2/1 CSC (PNPI) and 121 ME234/2 (UF and UCLA)**



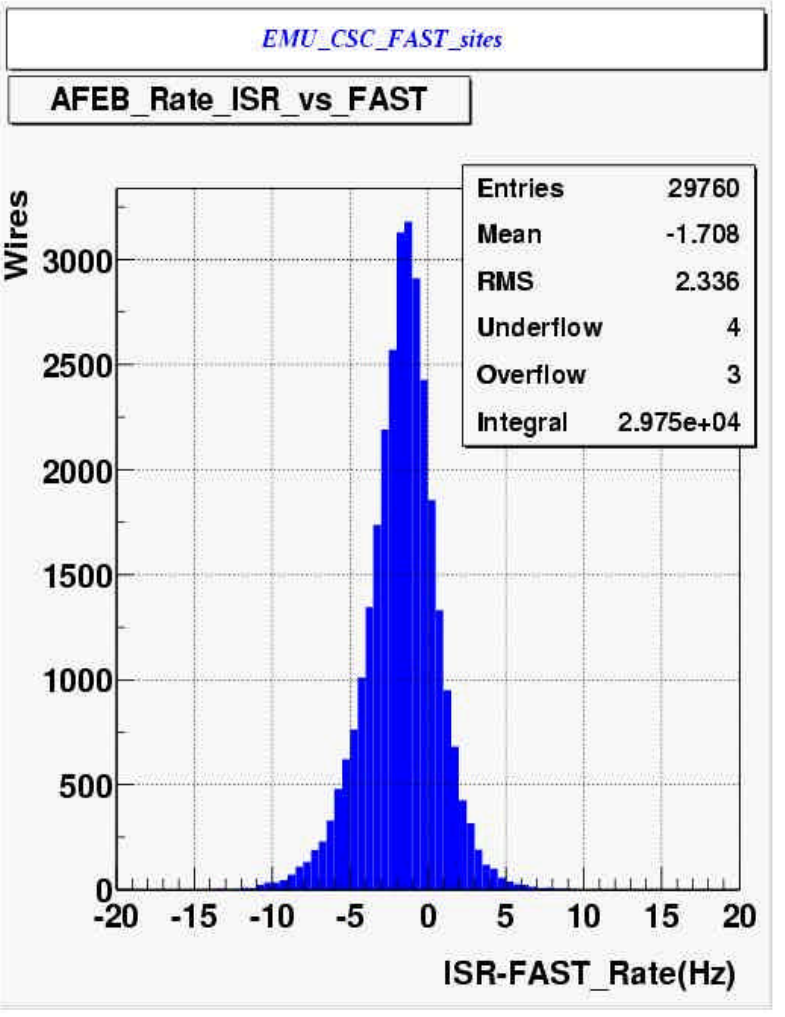
Examples of the test result distributions

- **AFEB Rate**
  - Test 11_01
  - For 68 ME234/2 CSC (UF, UCLA, early data with normalized rate excluded)
  - Per AFEB channel ("wire") at ~20 fC threshold and HV = 3.6 kV
  - Measured as the rate of trigger on any AFEB hit in ALCT single-plane self-trigger mode
  - Goes up with wire number (length)
  - Low rate in vicinity of CSC buttons (low gas gain)
  - 10 Hz < Rate < 100 HZ are the test acceptance limits



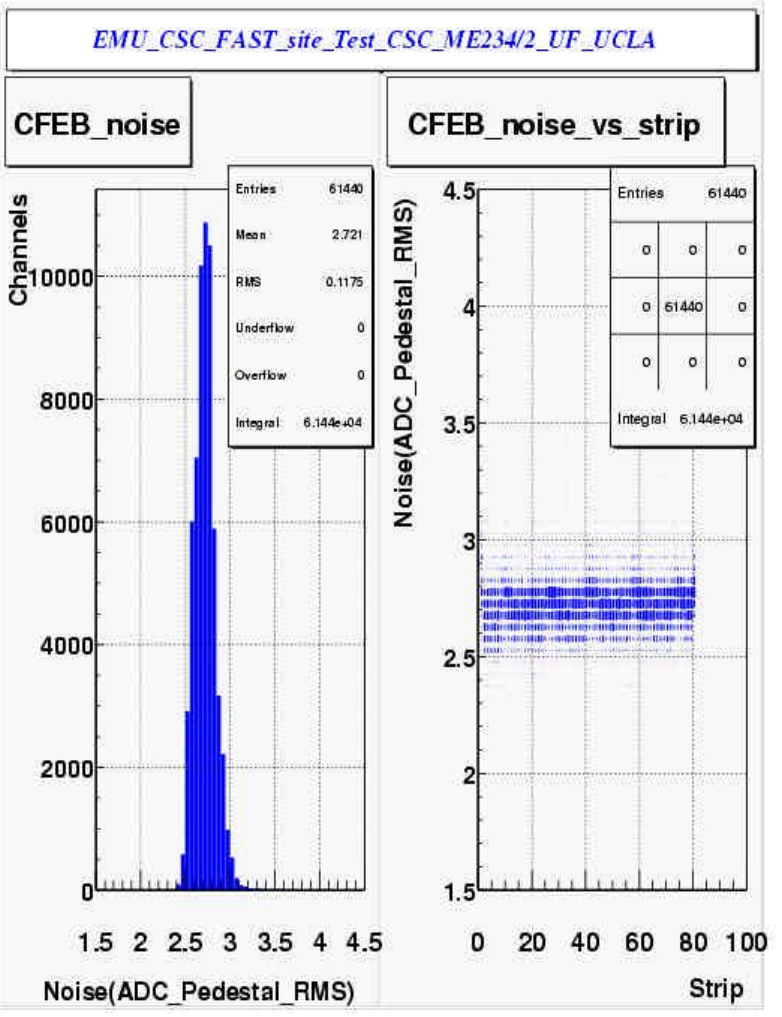
Examples of the test result distributions

- **Compare ISR and FAST site AFEB rates**
  - For 10 ME2/1 CSC (PNPI) and 60 ME234/2 CSC (UF, UCLA)
  - Early data with normalized rate excluded
  - ISR rate is less by ~ 2 Hz (10%)



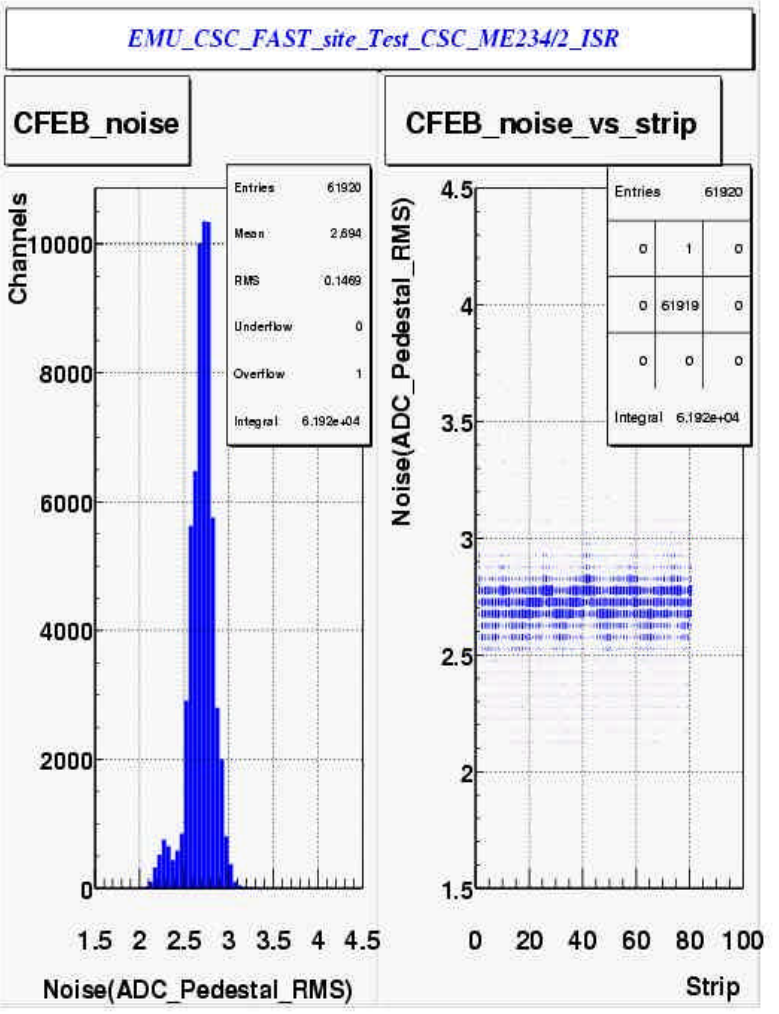
Examples of the test result distributions

- **CFEB noise (Pedestal RMS)**
  - **Test 15_01**
  - **For 128 ME234/2 CSC (UF, UCLA)**
  - **2 < RMS < 6 are the test acceptance limits**



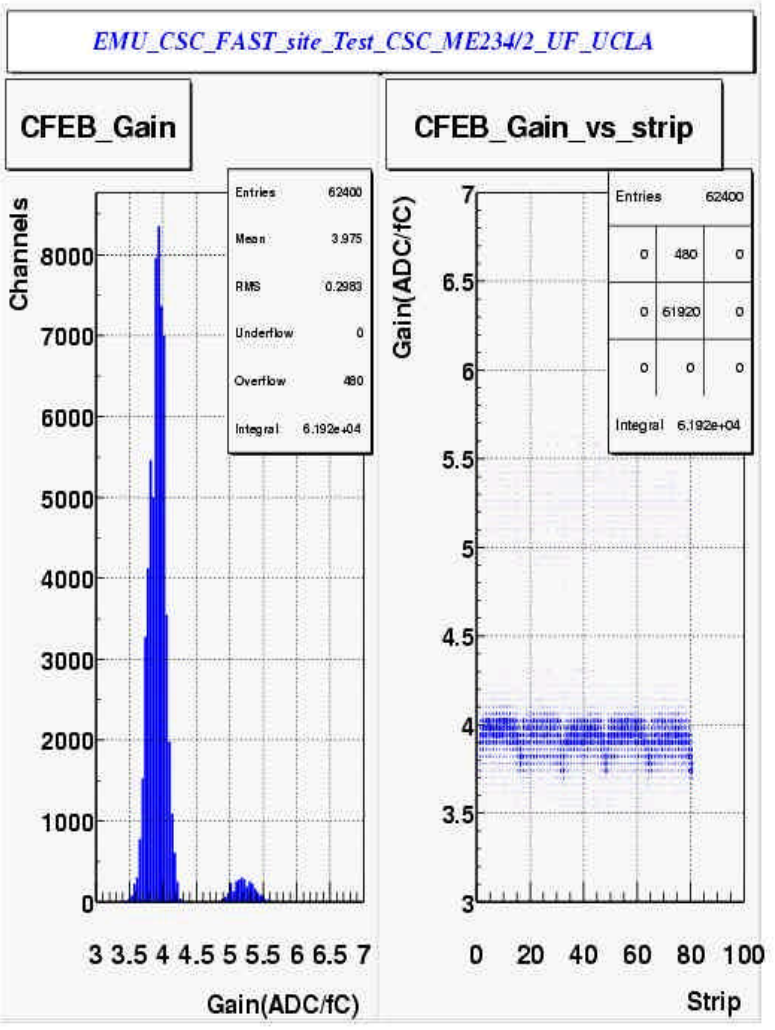
Examples of the test result distributions

- **CFEB noise (Pedestal RMS)**
  - **Test 15_01**
  - **For 129 ME234/2 CSC (ISR)**
  - **8 CSC in the peak at lower noise (~2800 strips, 4%, CSC 1, 5, 8, 15, 29, 44, 71, 90)**



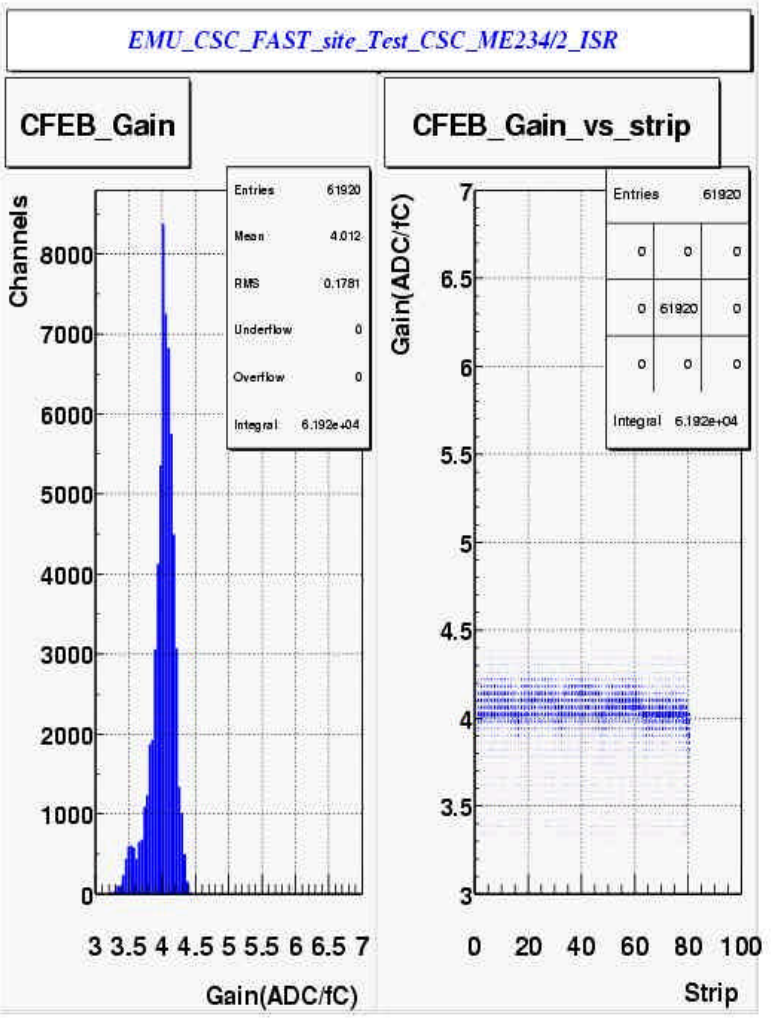
Examples of the test result distributions

- **CFEB Gain**
  - Test 17_08
  - For 130 ME234/2 CSC (UF, UCLA)
  - 6 CSC (with all channels) are in the peak at 5-5.5 (2880 strips, 5%, CSC 22, 24, 30,3 4, 52, 53)
  - CSC #51 with gain of ~40 in all channels
  - Each 16th strip has lower gain
  - 1.9 < Gain < 6 are the test acceptance limits



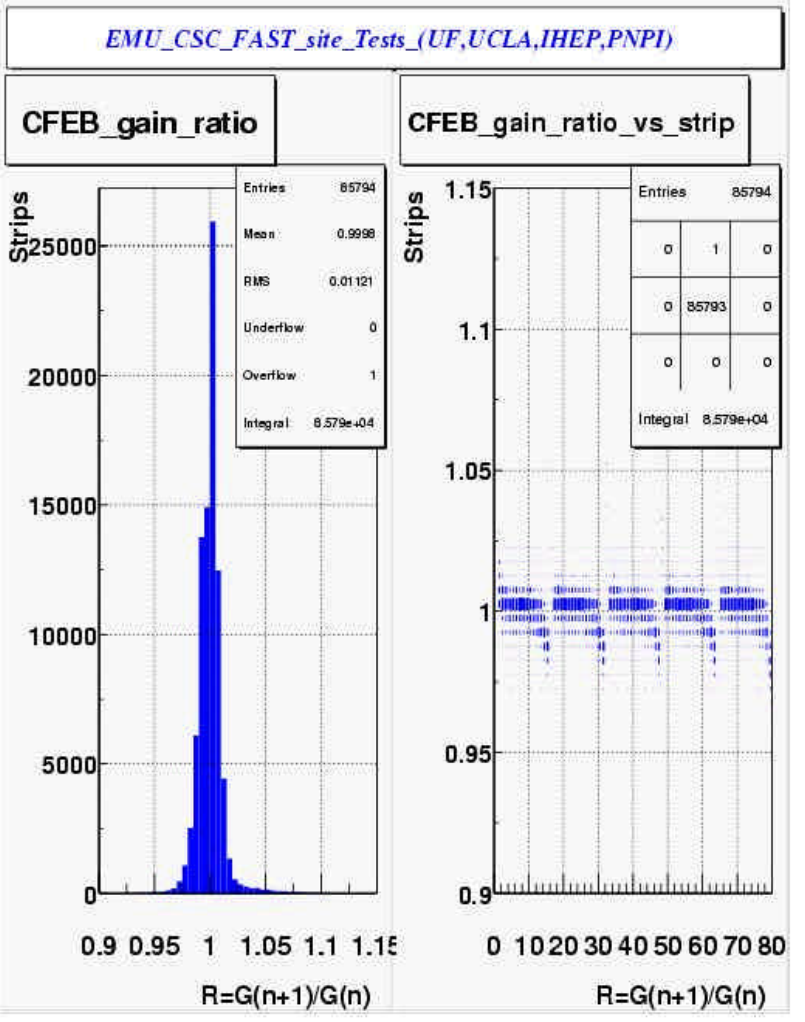
Examples of the test result distributions

- **CFEB Gain**
  - Test 17_08
  - For 129 ME234/2 CSC (ISR)
  - No peak at 5-5.5
  - 7 CSC are in the peak at 3.5 (~2700 strips, 4%, CSC 5, 8, 15, 20, 29, 44, 90, correlated with pedestal RMS)



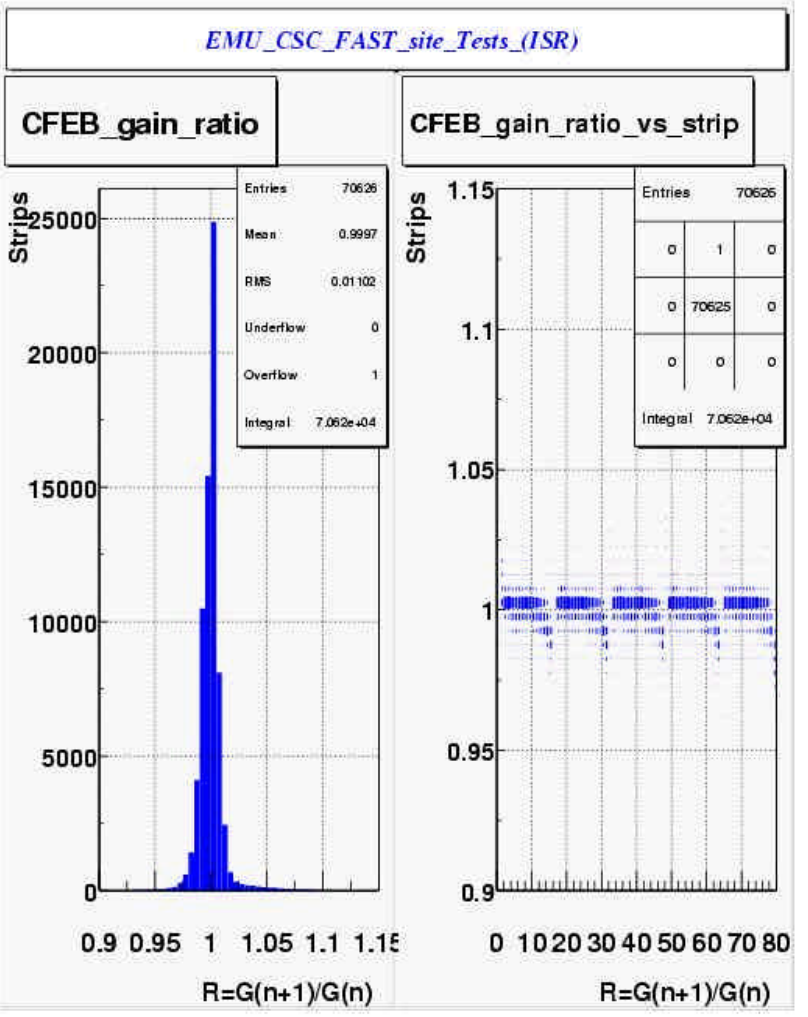
Examples of the test result distributions

- **CFEB Gain Ratio G(n+1)/G(n)**
  - From test 17_08
  - For 181 CSC (UF, UCLA, IHEP, PNPI)
  - The gains are uniform (for ratio mean=1, RMS=0.01)
  - Tails are due to the 16th strips



Examples of the test result distributions

- **CFEB Gain Ratio G(n+1)/G(n)**
  - From test 17_08
  - For 149 CSC (ISR)
  - The gains are uniform (for ratio mean=1, RMS=0.01)
  - Tails are due to the 16th strips



Conclusions/Suggestions

- Good results on AFEB noise and rate,
  CFEB noise, gain and gain ratio
- Presented ISR and FAST site results are consistent
- Finalize the list of tests and tables for the ROOT tree
- Include new data
- The ISR results are likely to be referenced
- Suggestion to automate results saving and uploading
  from DAQ to Web to minimize operator impact in SX5 tests