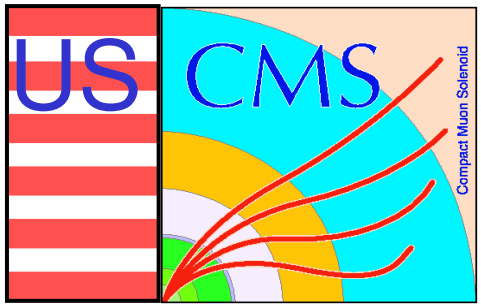
Test Beam Results Of Front End Timing



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Outline

- Sep-Oct '04 beam test conditions
- CSC front-end timing
- Anode front-end timing
- Cathode comparators timing

Sep-Oct '04 beam test conditions

- **Beam**
  - 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 main results in EMU Oct 2004 talks by**
  - F.Geurts, D.Acosta, A.Korytov, M.Von der Mey, J.Hauser, S.Durkin

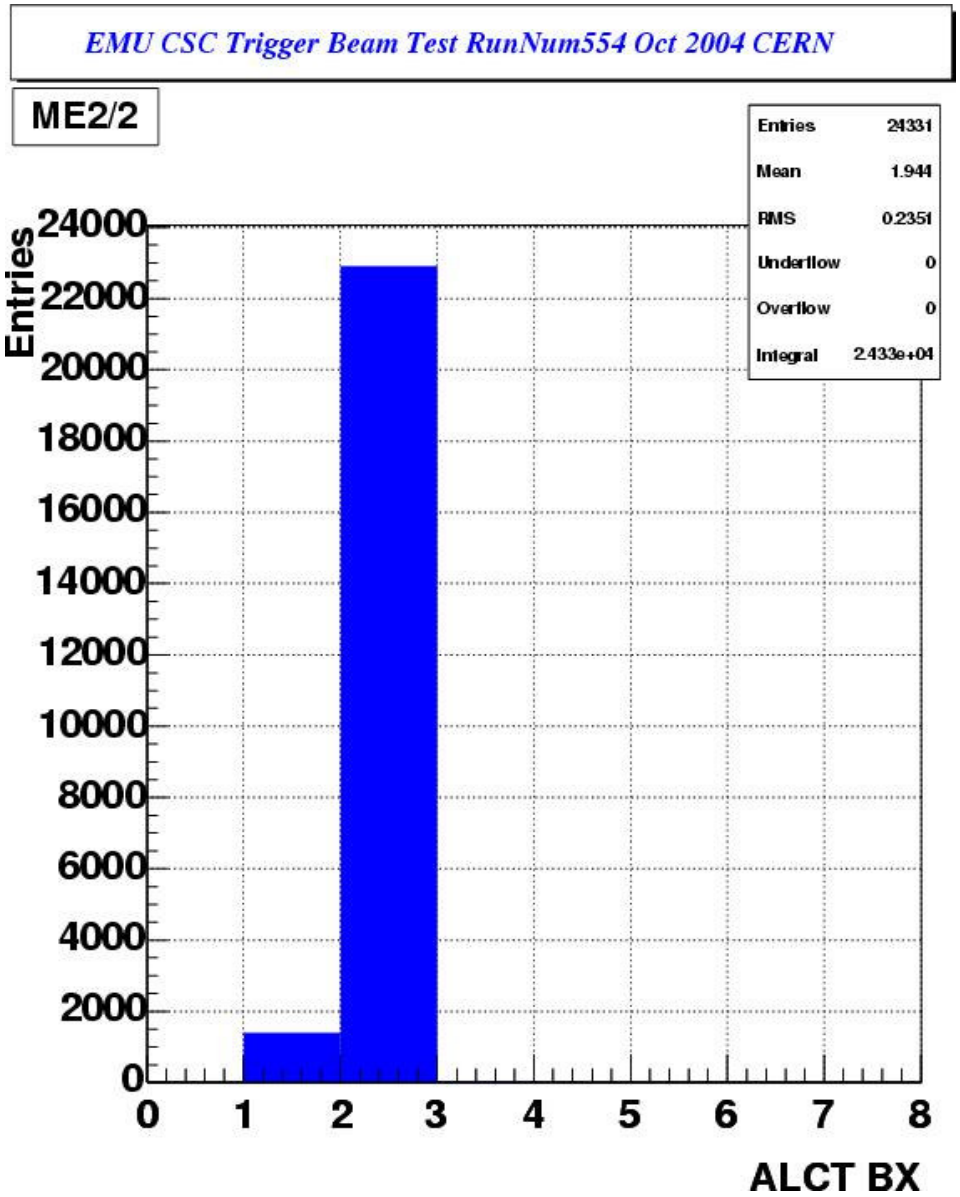
CSC front-end timing

- **CSC synchronization – complicated and challenging procedure**
  - **See details, plan and extensive discussion in the EMU Oct 2004 talk by J. Hauser**
- **AFEB timing in the 25 ns beam tests**
  - **Scan 0-25 ns ALCT delays in 2.2 ns steps to get >99% ALCTs BX occupancy in one BX 25 ns time bin**
  - **Set one and the same best delay for ALL AFEBs of given CSC (no individual settings)**
  - **No AFEB nominal 20 fC threshold settings (ALCT DACthr = 20 setting gives Qthr = 20 - 35 fC)**
- **AFEB individual delay and threshold settings will be done in future CSC synchronization**

Anode front-end timing

- In most cases in the 25 ns beam test the ALCT BX one 25 ns bin efficiency was > 99% with no individual fine delay tuning done
  - Hits are in a compact group of a few AFEBs for SC trigger (similar cable lengths)
  - Delay chips in each given ALCT board have similar delay characteristics
  - ALCT delay was set so that

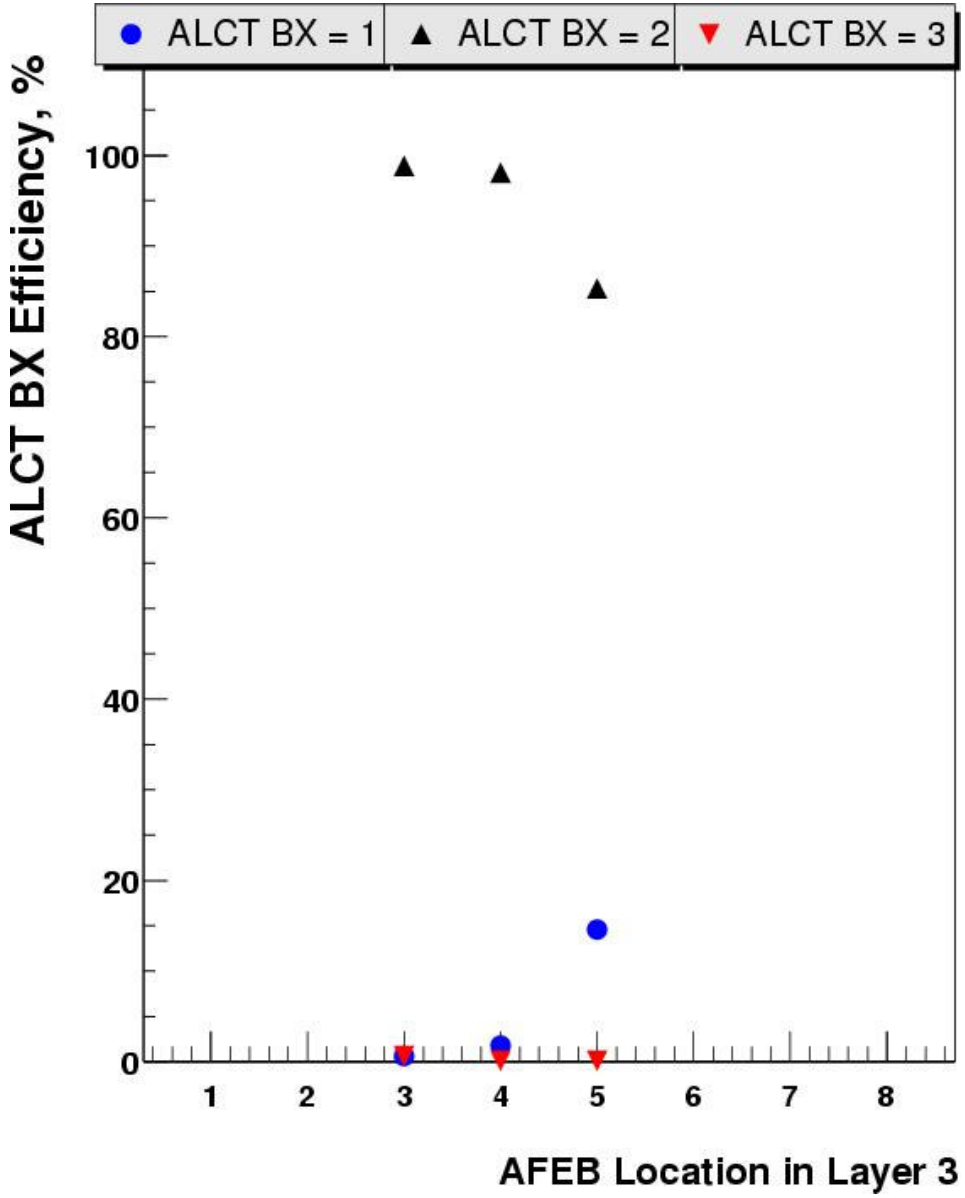
    ALCT BX = 2 was the most likely
- In cases of the ALCT BX efficiency of ~ 95% (see Fig.)
  - More peripheral AFEBs involved in TF trigger
  - The ALCT BX one bin inefficiency is tracked down to AFEB/ALCT delay chips which need the fine delay tuning



Anode front-end timing (cont'd)

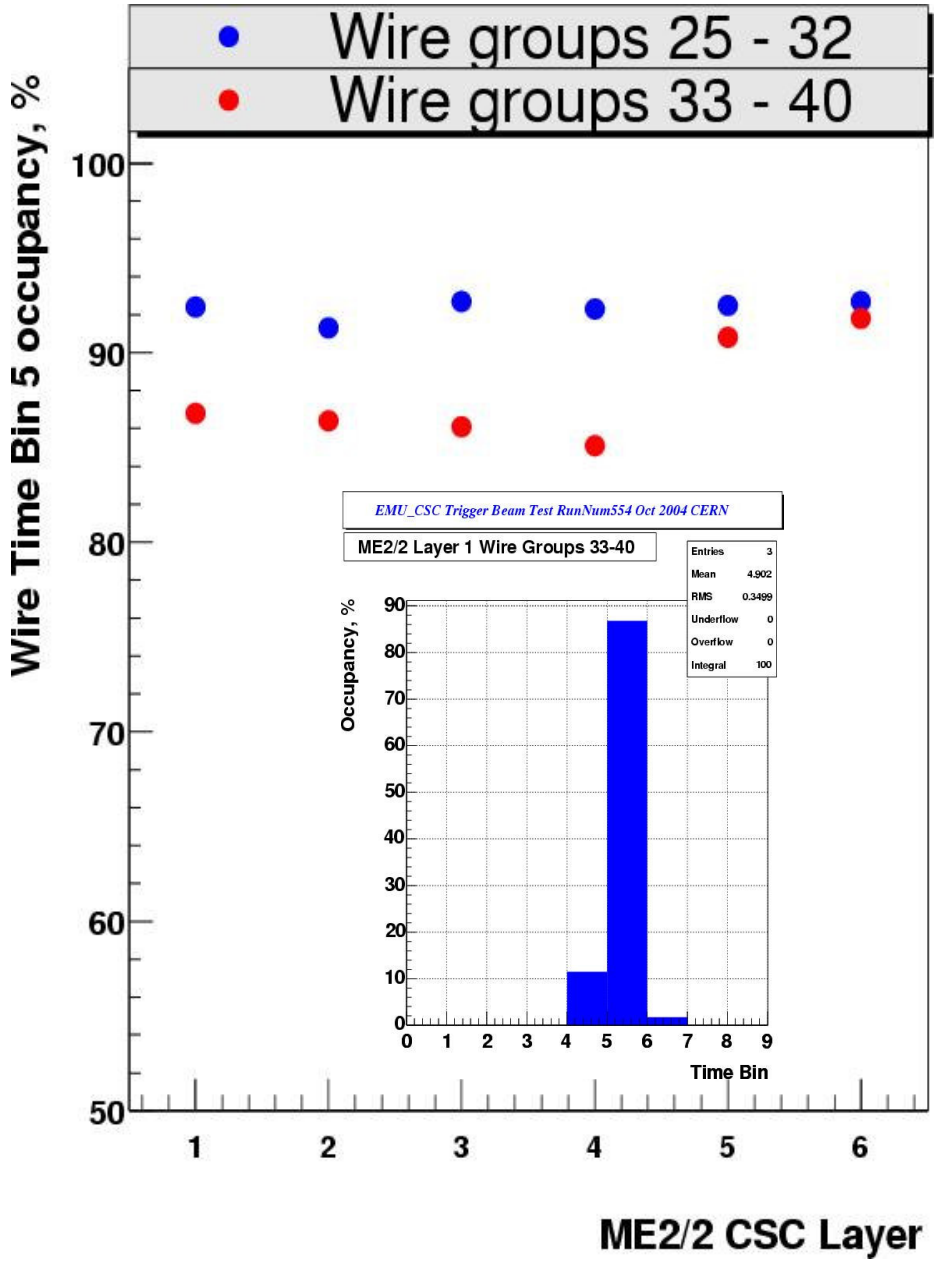
- **ALCT BX efficiency vs AFEB location**
  - Choose events with one anode wire group hit and one cathode comparator hit in each layer of ME2/2 (Run 554, TF trigger)
  - Look at single ALCT track events
  - ALCT BX one bin efficiencies vs ALCT track location in layer 3, see Fig.

    (one AFEB serves 8+8 wire groups in 2 CSC layers, therefore 8 AFEB locations in one layer with 64 wire groups)
  - ALCT delays for AFEBs in location 5 need tuning



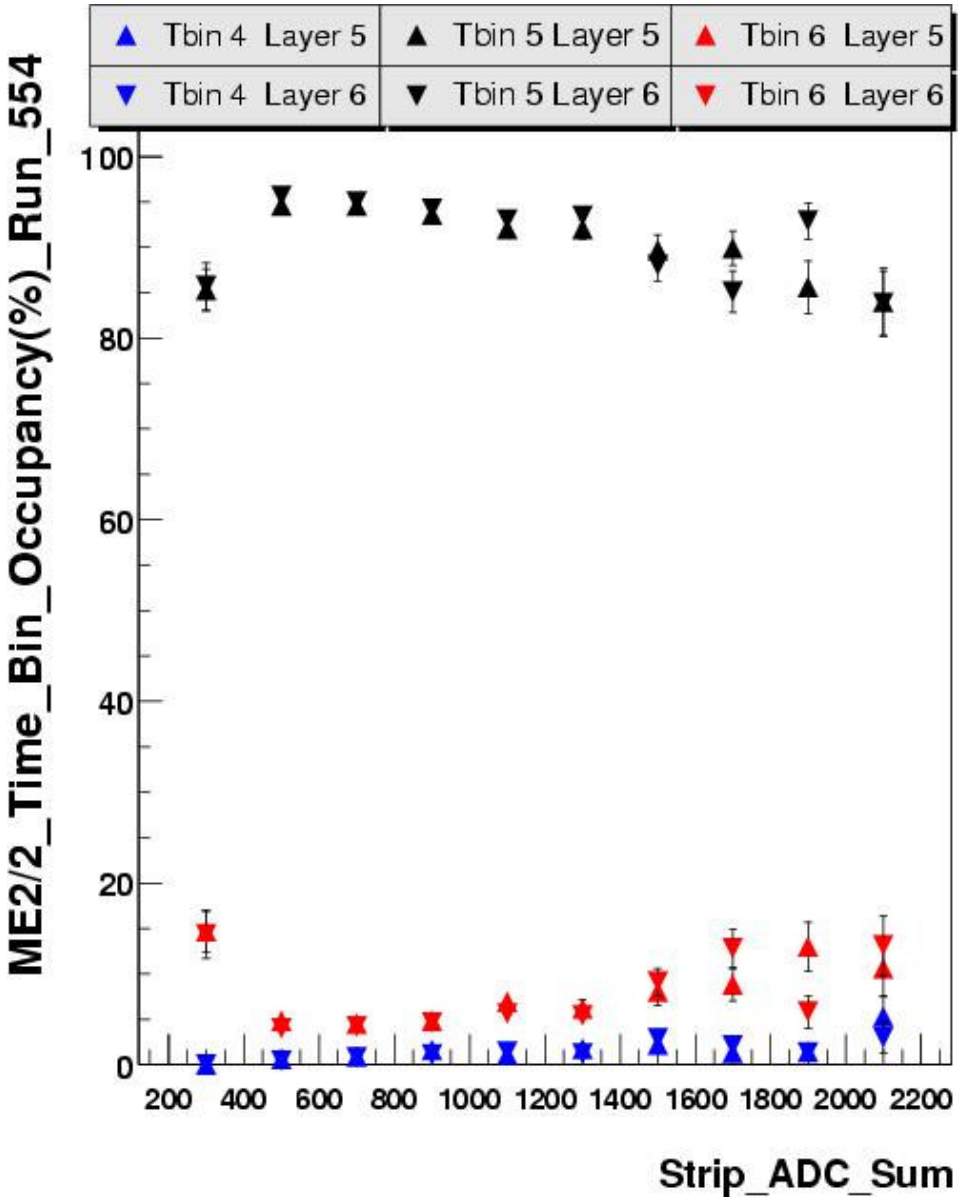
Anode front-end timing (cont'd)

- **AFEB one time bin occupancy**
  - Look at max. occupancy in time bin 5 (Bunch Crossing Number BXN=5)
  - ALCT delays for AFEBs with wires 33–40 in layers 1 – 4 need fine tuning
- **For ALCT delay tuning**
  - Find optimum delay for each AFEB using results of the ALCT delay scan
  - Rescan ALCT delay with fewer 2.2 ns steps around delays with max. AFEB's one time bin occupancy to confirm higher ALCT BX efficiency



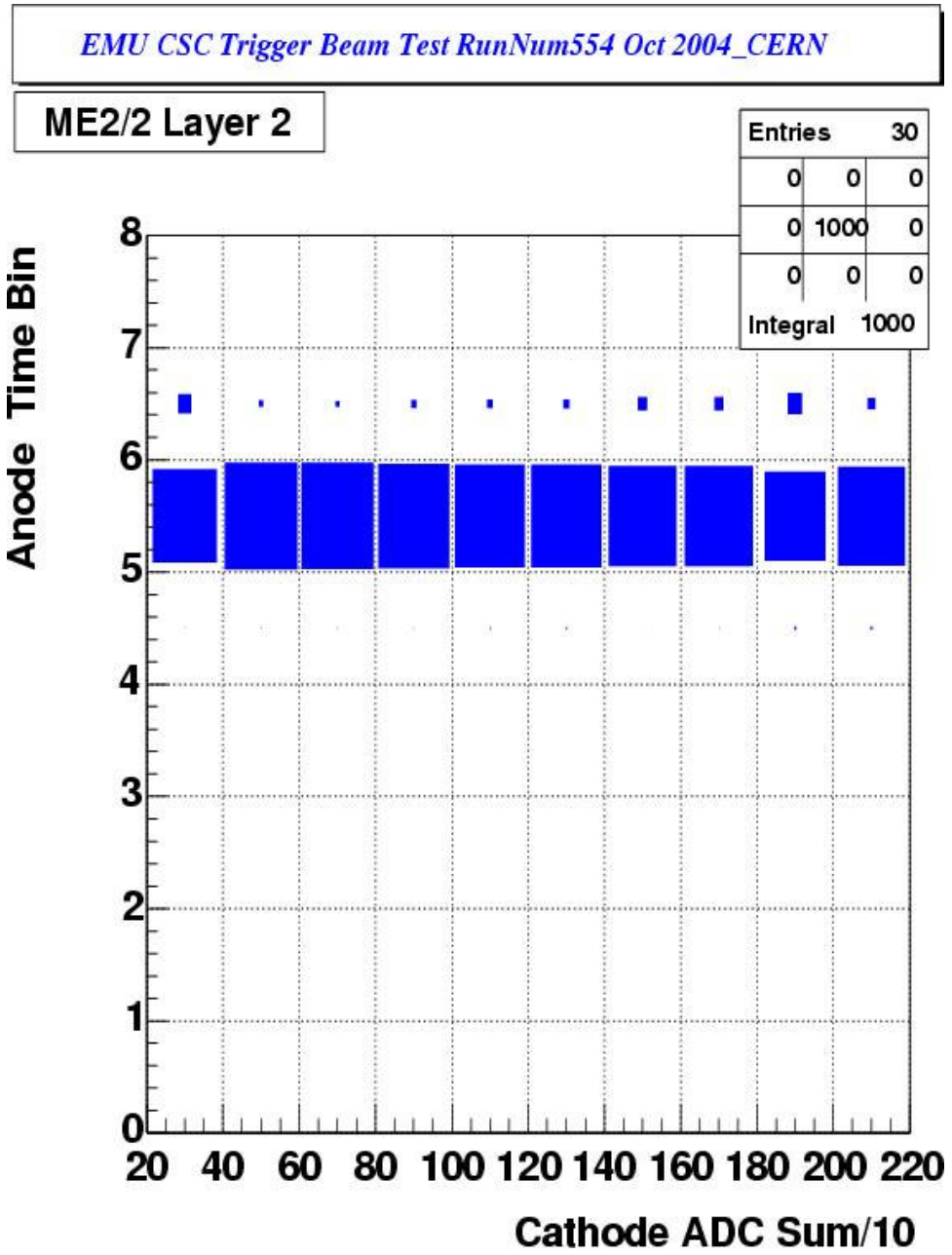
Anode front-end timing (cont'd)

- **AFEB time bin occupancy vs cathode signal amplitude (see Fig.)**
  - **Single anode wire hit and single comparator hit per plane**
  - **Look at normalized occupancies (time bins 4 - 6) vs cathode signal amplitude**
  - **In general agrees with slewing time data from the AFEB test stand**



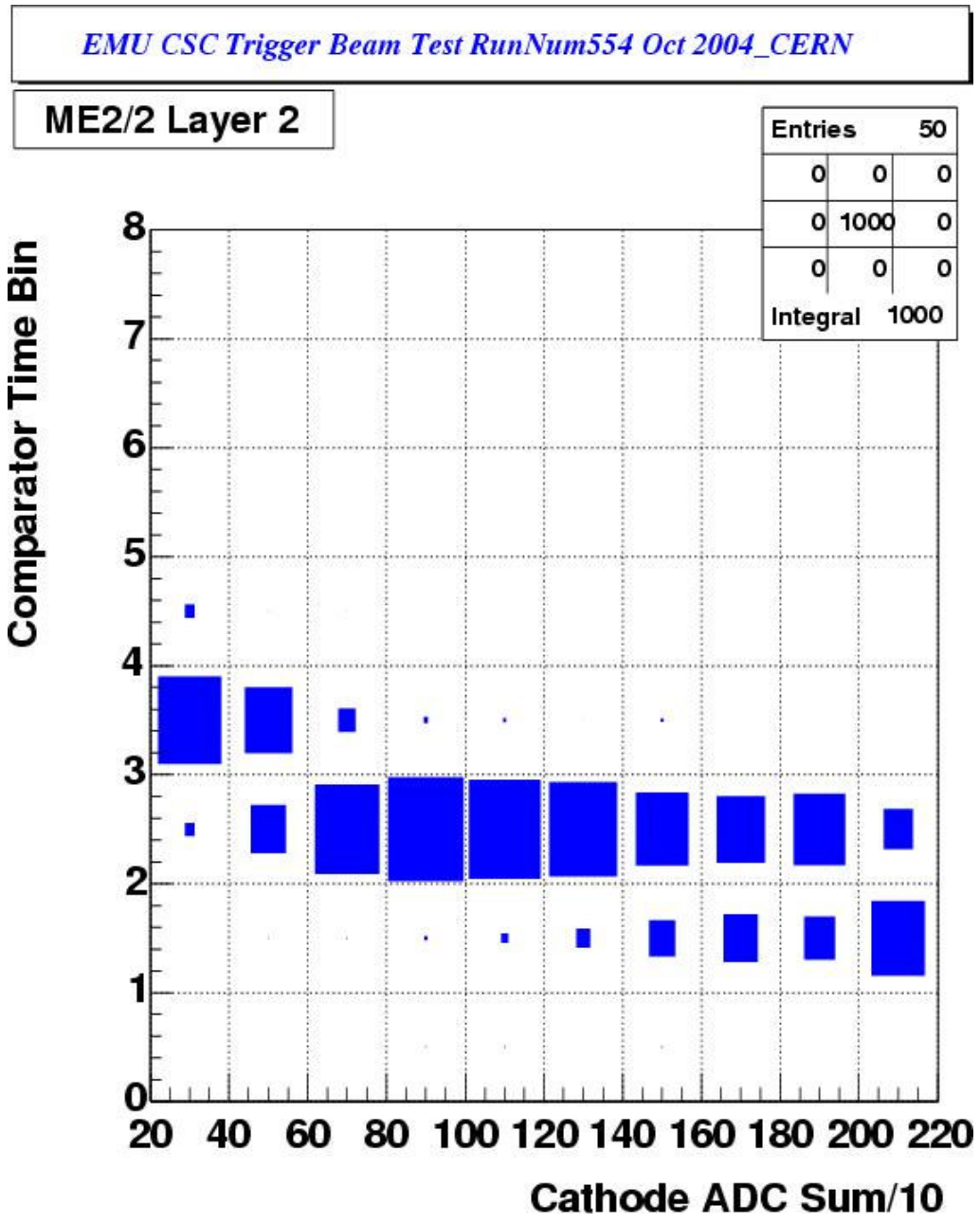
Anode front-end timing (cont'd)

- 2D presentation of the anode time vs total cathode charge



Cathode comparators timing

- **Cathode comparator time vs total cathode signal charge (see Fig.)**
  - **Single anode hit and single comparator hit (Strip #42)**
  - **Occupancy is normalized at each amplitude bin**
  - **Comparator time is within three 25 ns time bins**



Conclusion

- **The beam test data confirm that:**
  - **ALCT individual delay settings for AFEBs will improve ALCT BX efficiency (as expected)**
  - **The AFEB one time bin occupancy to be used in the delay tuning.**
- **Future plans – continue analysis and compare the beam test data with ORCA simulation/digitization:**
  - **Cathode signal amplitude vs time bin**
  - **ORCA Muon tracking in the beam test data for all four CSC?**