P2" Anode Front End Data Analysis

(CMS Beam Test 99 at CERN)

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- **Introduction**
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Introduction

- Data from runs 440-478 (Sep 3)
  - Beam μ 100 GeV
  - GIF OFF
  - HV scan 3.1-3.9 kV 50 V step
  - Trigger from scint. counters
  - Wide gate TDC (32 μsec)

- Anode front end
  - AD96D board 2 in the beam spot
  - Qthr = 15 - 20 fC

- Analysis goals
  - Single layer efficiency vs HV
  - GIF rate
  - Beam crossing efficiency vs HV
  - How anode cross-talk biases all above

Anode cross-talk from calibration

- Was not a problem in CERN 98 data
  - High thresholds
  - No calibration data taken
- Less than 0.5 - 1.0% in the chip
  - Bench test result, N.Bondar
  - Here cross-talk is Q_{crst}/Q_{signal}
- From calibration data at CERN 99:
  - AD96D boards with input cables
  - Test pulse thru the test cathode strip (one layer only)
  - Large cross-talk to the next layer (Fig.1) (max. 3–4% for chips 1-5, 12% for chip 6, no cross-talk in chip 3)
  - In the chip test pulse fires 2 groups, 4 ch each, no info about cross-talk between adjacent channels
- For the 8+8 ch plug-in boards
  - No input cables, one chip/layer
  - No cross-talk between layers (at DAC<1500), have to measure it up to DAC_{max}=4000

Cross-talk from beam data

- Event selection:
  - Three sets of beam chambers this year allow to eliminate wrong predictions in P2"
  - 125 nsec window in 32 μsec TDC gate (Fig.2a,b,c) to look at hits produced by beam only
  - One channel with max. occupancy from each layer (only two channels in beam)
  - Beam track within $\pm$ 1.5 cm off the channel center (at $\theta = 20^\circ$ eff. width = 4.75 cm)

- Anode cross-talk within one plane:
  - Seen as a signal in the adjacent channels (Fig.3a-c, extreme case at HV = 3.9 kV)
  - Comes later by $\sim$ 30 nsec due to time slewing at $Q_{crst} \sim Q_{thr}$
  - Fraction of events with cross-talk is $< 4\%$ at nominal HV = 3.6 kV and goes up to $50 - 60\%$ at HV=3.9 kV (Fig.4)
  - Cross-talk probability at given Q_{crst}/Q_{signal} depends on Q_{thr} and Q_{signal}, puts limits on too low Q_{thr} and too high Q_{signal} (HV)

Conclusion

- **Anode cross-talk within one plane was measured in calibration and beam data at HV = 3.1 – 3.9 kV**
- **Fraction of events with cross-talk < 4% (upper limit) at nominal HV = 3.6 kV for AD96D board with input cables**