Status of P2" Anode Front End Data Analysis

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- **Introduction**
- **GIF rate measurements**
- **Bunch crossing tagging efficiency**
- **Conclusion**

Introduction

- **Anode front end hardware**
  - all 6 layers (384 ch)
  - 96 ch and 16 ch boards
  - Q_{thr} and T_{delay} calibrations implemented in DAQ
  - multi hit TDC readout in 32 μsec
  - Q_{thr} = 20 - 30 fC
- **Trigger diversity**
  - beam scint $\rightarrow$ unbiased ϵ (no data for 16 ch boards)
  - CLCT(4/6),CLCT(4/6)*Scint, CLCT(3/6)*Scint,P0*CLCT*Scint $\rightarrow$ biased anode ϵ at low HV, CLCT trigger efficiency ?
  - better to have CLCT/ALCT decisions in latches and TDCs, not in the trigger
- **Results**
  - GIF rate estimate
  - Single layer and BX tagging efficiencies vs HV and GIF rate

GIF rate measurements

(details in http://www-hep.phys.cmu.edu/cms/ analysis page)

- **Use of anode front end**
  - 32 μsec range of LeCroy TDC 3377
  - large signal from Cs^{137} 0.66 MeV γ
  - bias due to crosstalk (extra hits)

- **Chip by chip based off-line analysis**
  - count hits grouped in space and time as one hit
  - losses are small (from MC), 6% for 40 kHz/wire group rate, 15% for 200 kHz/wire group

- **Results (as low limit)**
  - at GIF K=5 detected GIF rate $\sim$40 kHz/wire group (#23)
  - to be cross checked against cathode front end data
  - anode noise $<$ 0.1 kHz/wire group at GIF off, HV=3.6 kV, out of spill

Bunch crossing tagging efficiency

- **Single layer anode efficiency vs HV**
  - "knee" HV point as HV($\epsilon = 95\%$)
  - plateau starts at HV = 3.3-3.4 kV
    at Q_{thr} = 20-30 fC
  - at GIF off ϵ =100% on plateau
  - at GIF K=1 (rate 200 kHz/wire group)
    ϵ =97% - 98% on plateau

- **Hit patterns used in BX tagging**
  - MC yields 7 simple patterns at $\theta_x = 20^\circ \pm 5^\circ$
  - in data 6 patterns due to $\theta_x = 20^\circ \pm 0.4^\circ$
  - for ≥ 4 hits pattern ϵ = 100%
    at HV ≥ 3.4 kV

- **Bunch crossing tagging efficiency in 25 nsec**
  - time resolution (2-nd hit,fit) σ=5.5 nsec
    (a layer σ=8.8-9.5 nsec) at HV=3.6 kV
  - BX ϵ >97% at HV$\geq$3.4 kV (GIF off)
  - at 3.6 kV BX ϵ=97% at GIF rate up to
    40 kHz/wire group (ϵ=94% at 200 kHz)

Conclusions

- **GIF rate - 40 kHz/wire group at K=5, HV = 3.6 kV and Q_{thr} = 20 fC**

- **Single layer efficiency plateau starts at HV = 3.4 kV**

- **Pattern hit finding efficiency (4 and more hits from 6) 100% at HV ≥ 3.4 kV**

- **Bunch crossing tagging (for the 2-nd earliest hit at HV=3.6 kV)**
  - time resolution σ = 5.5 nsec
  - ϵ (25 nsec) = 97 % at GIF rate up to 40 kHz/wire group

- **Work to do:**
  - analyze data with P0 in trigger
  - GIF rate from cathode data