New Cosmic Muon Stand at Fermilab: Trigger time resolutuon and Bunch Xing Identification Efficiency

(http://www-hep.phys.cmu.edu/cms/cosm99.html)

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(Presented by T. Ferguson, CMU)

Introduction

- In operation since Nov. 1998.
  Team work:

  - proposal, development, design by E.Borisov Yu.Bonushkin,A.Korytov,Yu.Pischalnikov, O.Prokofiev,N.Chester
  - bench scint.counter test, time resolution
    $\sigma = 0.5$ nsec (A.Korytov)
    $\sigma = 0.6$ nsec (S.Medved,Yu.Pischalnikov)
  - assembling,counter work (Yu.Pischalnikov)
  - trigger, data taking (S.Medved)
  - DAQ, online software (A.Bujak)
  - offline software, analysis (A.Bujak,N.Terentyev)

- Objectives

  - CSC test
  - anode and cathode electronics test

Muon trigger time resolution

- **Muon trigger:**

  - 12 large area vertical hodoscopes from 24 scint. counters (two rows), 48 PMT
  - timing depends on coordinate in scint. counter (Fig.1)
  - smearing (due to coordinate and angle dependence) small, $\sigma = 2.3$ nsec (Fig.2)
  - easy offline correction (Fig.3)
  - after correction average resolution (Fig.4)
  $D(SUM) = D(t1 + t2 - t3 - t4) = 4 * D(t)$
  $\sigma = 0.5 * \sqrt{D(SUM)} = 0.8 - 1.0$ **nsec**
  where $SUM = tdc3 + tdc4$, sum of TDC from top two PMTs in one counter

Bunch Xing identification efficiency

- **"Bunch Xing identification" efficiency from Cosmic Muon Stand data**

  - "old" anode front end (from CERN98 test)
  - P2' chamber, wide edge, HV=4.1 kV
  - $\sigma = 5 - 6$ nsec for the 2-nd arrival
  - 90% efficiency in 20 nsec gate
  (no trigger correction),
  91% - with correction (Fig.5)

- **First results on new card and new chips CMP16B**

  - P2' chamber, wide edge, HV=4.1 kV
  - plane efficiency ~ 100 %
  - $\sigma = 4 - 6$ nsec for the 2-nd arrival
  - 2-nd arrival efficiency at HV=4.1 kV
  (in 4 and more from 6)
  $>$ 92 % in 20 nsec gate (Fig.6)
  - HV scan, plane efficiencies (Fig.7)
  - HV scan, the 2-nd arrival efficiencies (Fig.8)

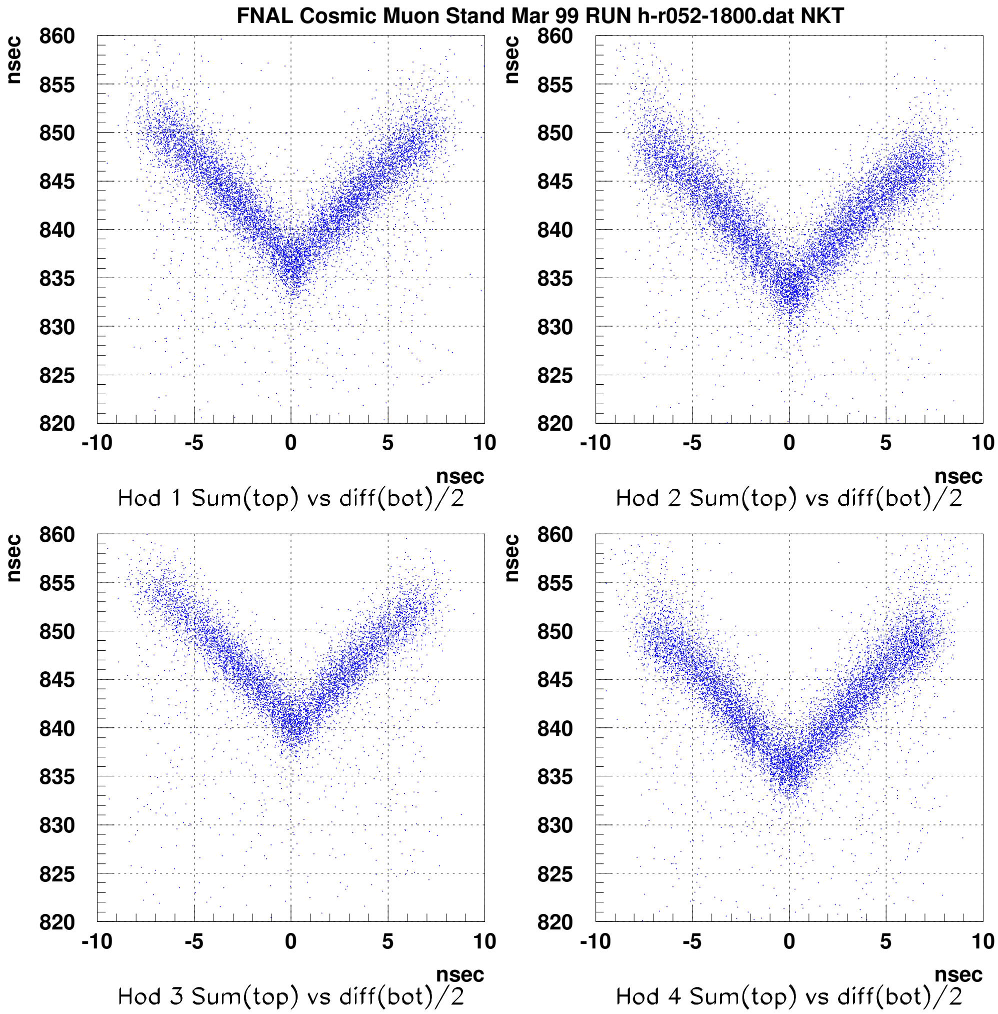

Figure 1: The time sum of the two top PMTs in each hodoscope (y axis) versus time difference of the two bottom PMTs (x axis)

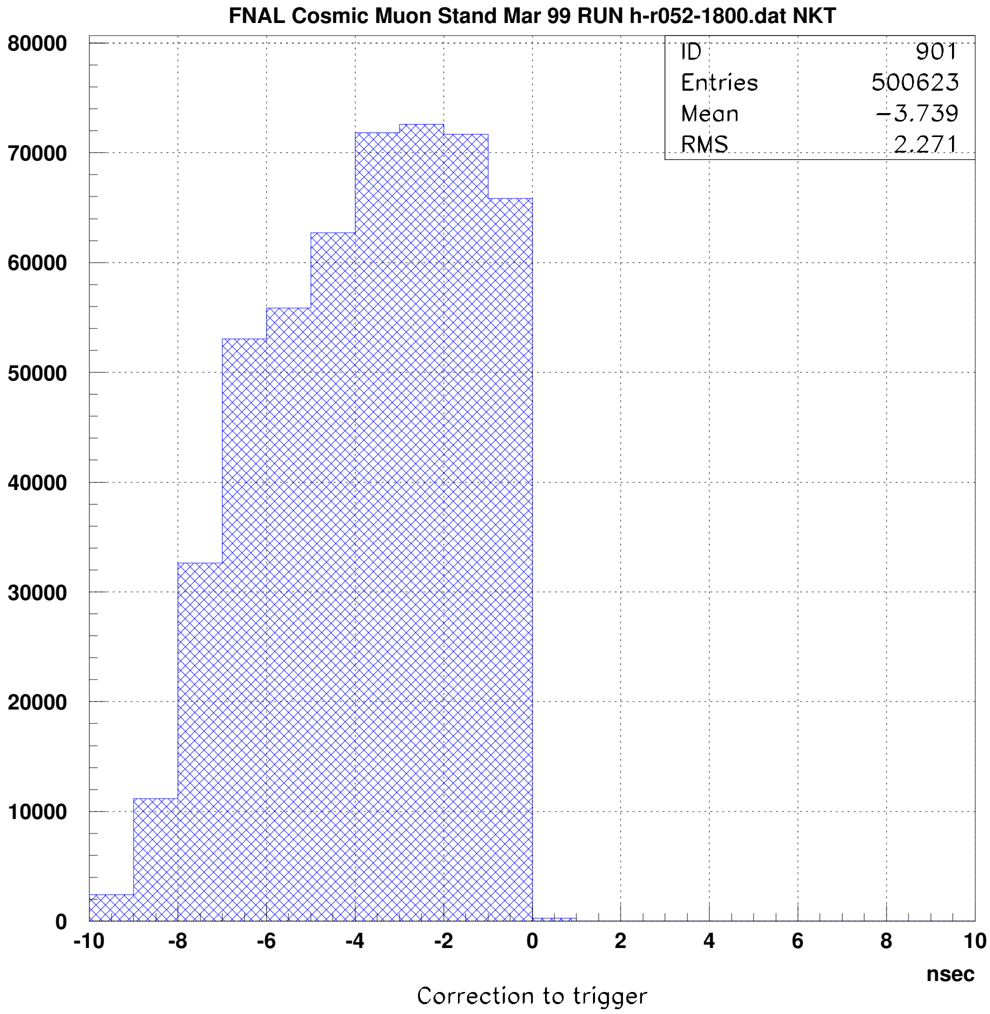

Figure 2: Correction for the trigger time dependence on the muon track coordinate in bottom counter and the vertical angle of the muon track

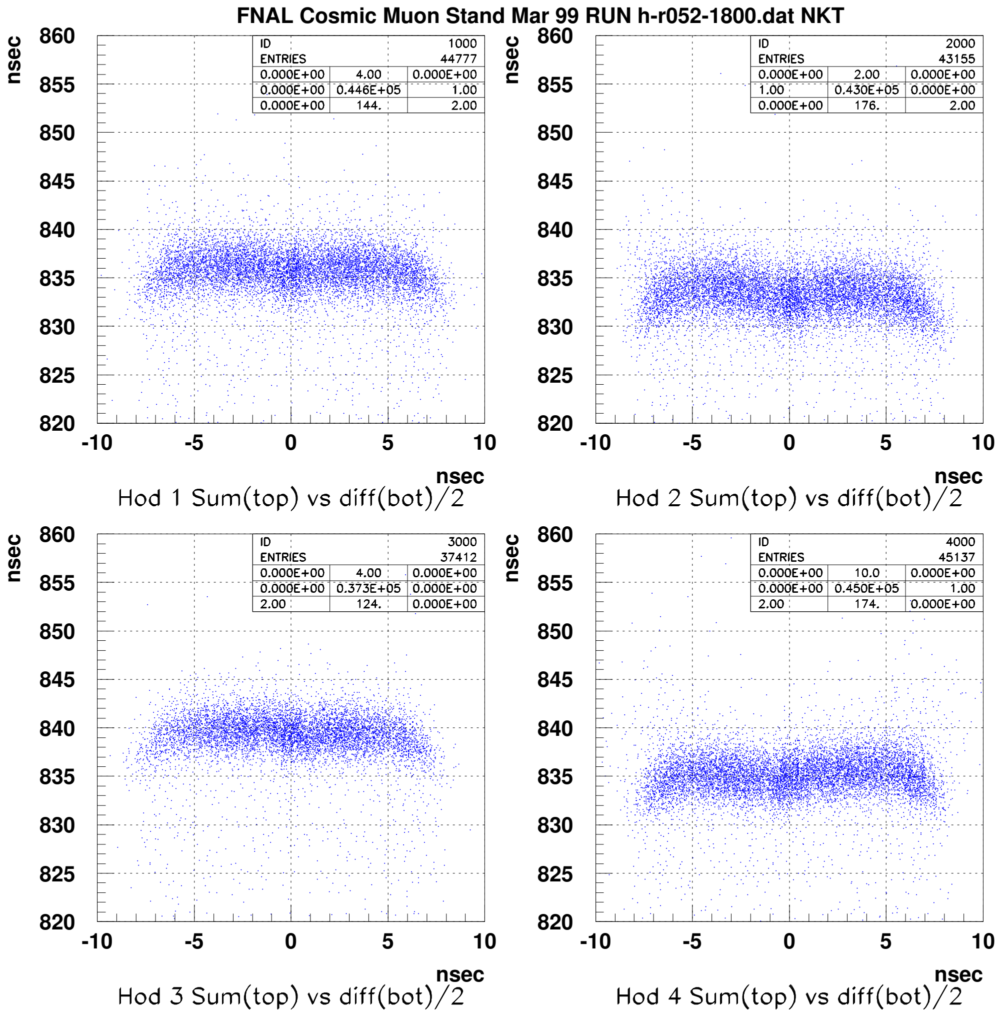

Figure 3: The time sum of the two top PMTs in each hodoscope (y axis) versus time difference of the two bottom PMTs (x axis) after correction

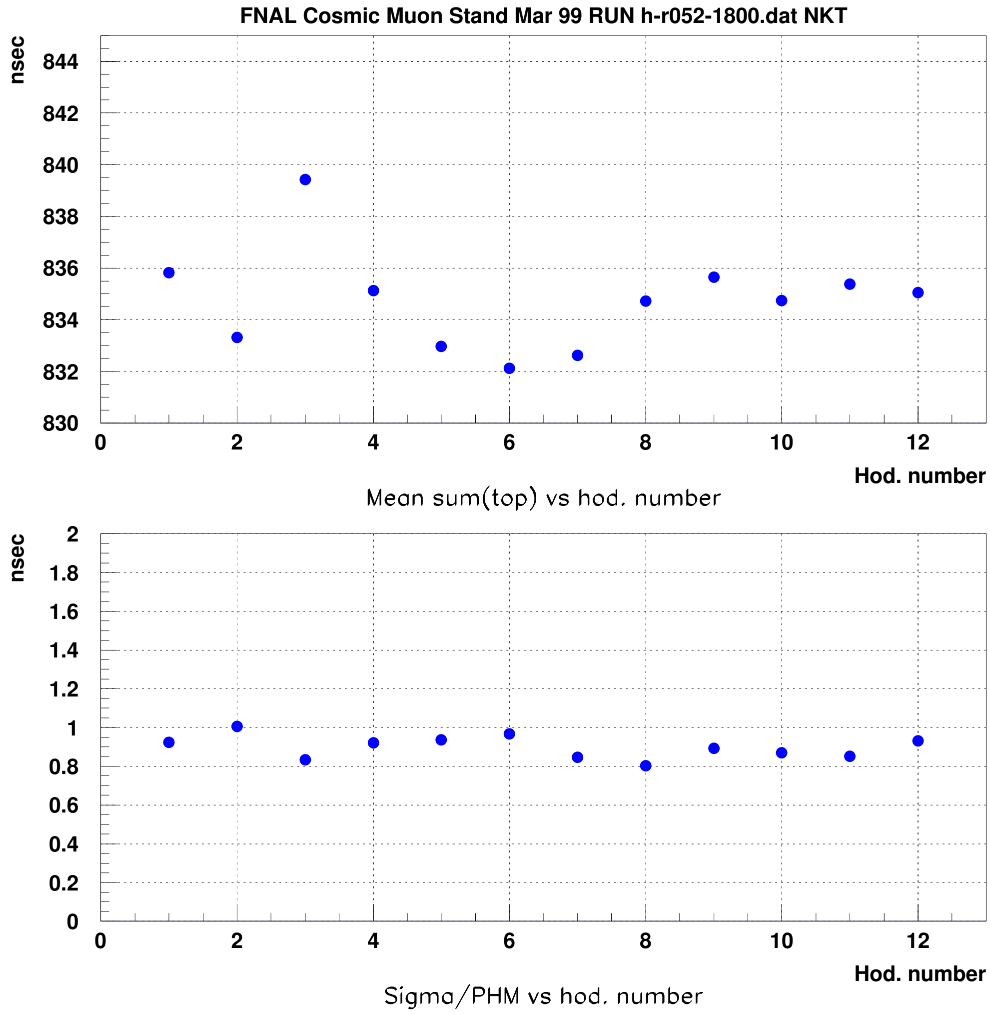

Figure 4: The mean times for the top counters and the corresponding single-counter time resolution versus hodoscope number.

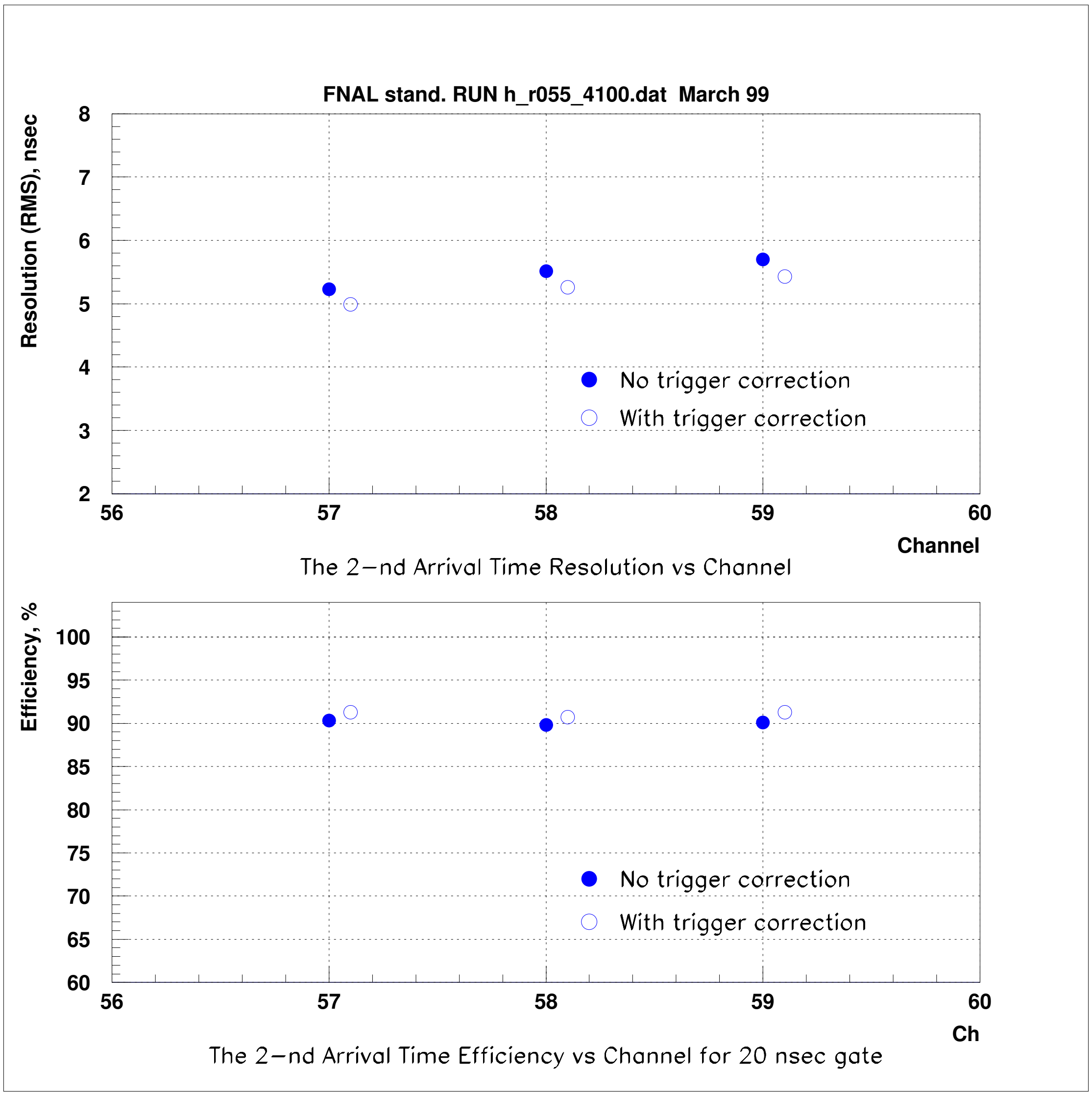

Figure 5: The anode wire time resolution and efficiency for having the second earliest time be within a 20 nsec gate for three different anode channels of the CMP16A electronics with and without the trigger timing corrections.

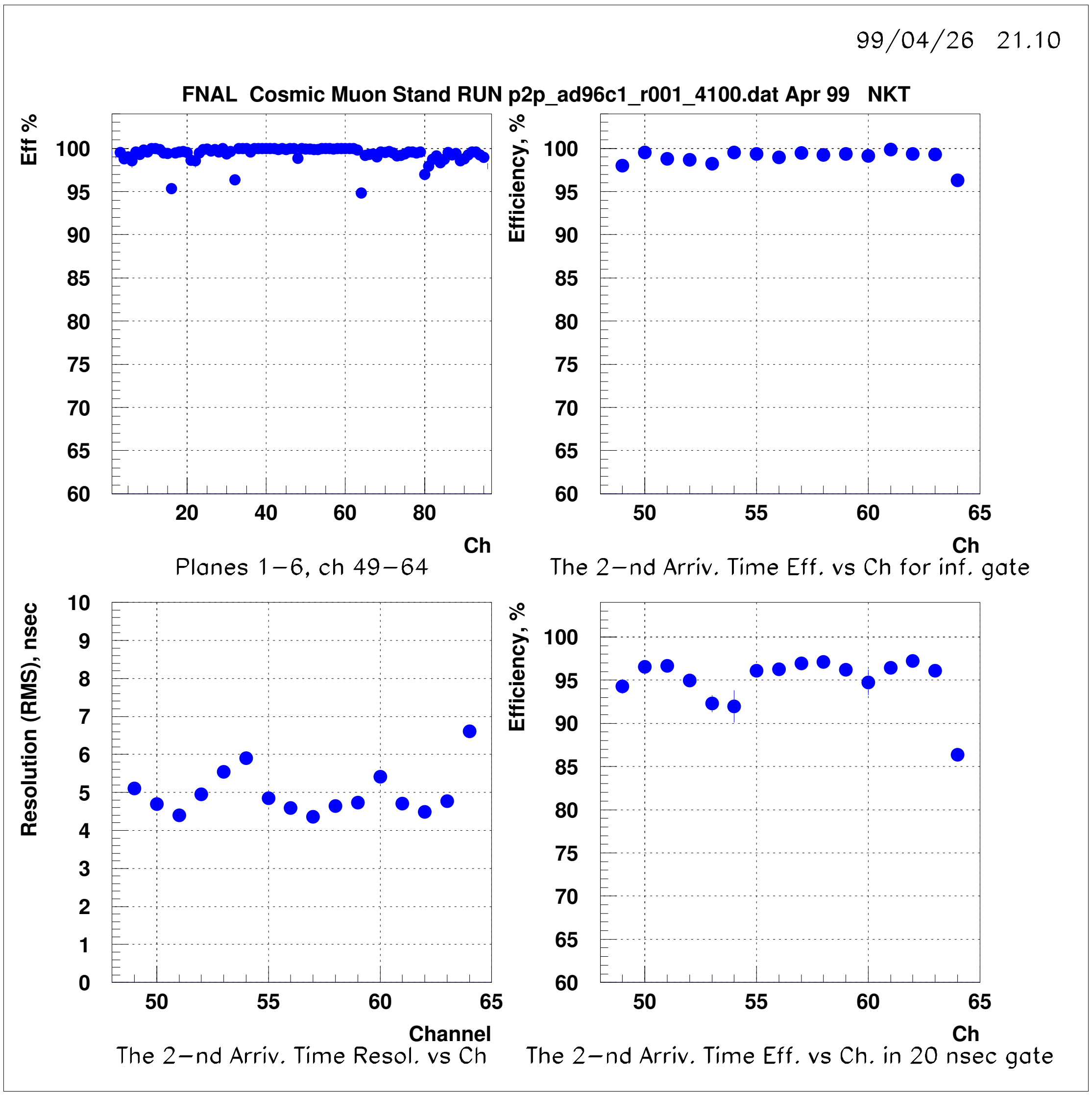

Figure 6: The anode wire efficiencies overall, for an infinite gate and a 20 nsec gate, and the corresponding time resolution versus channel number for the new CMP16B electronics.

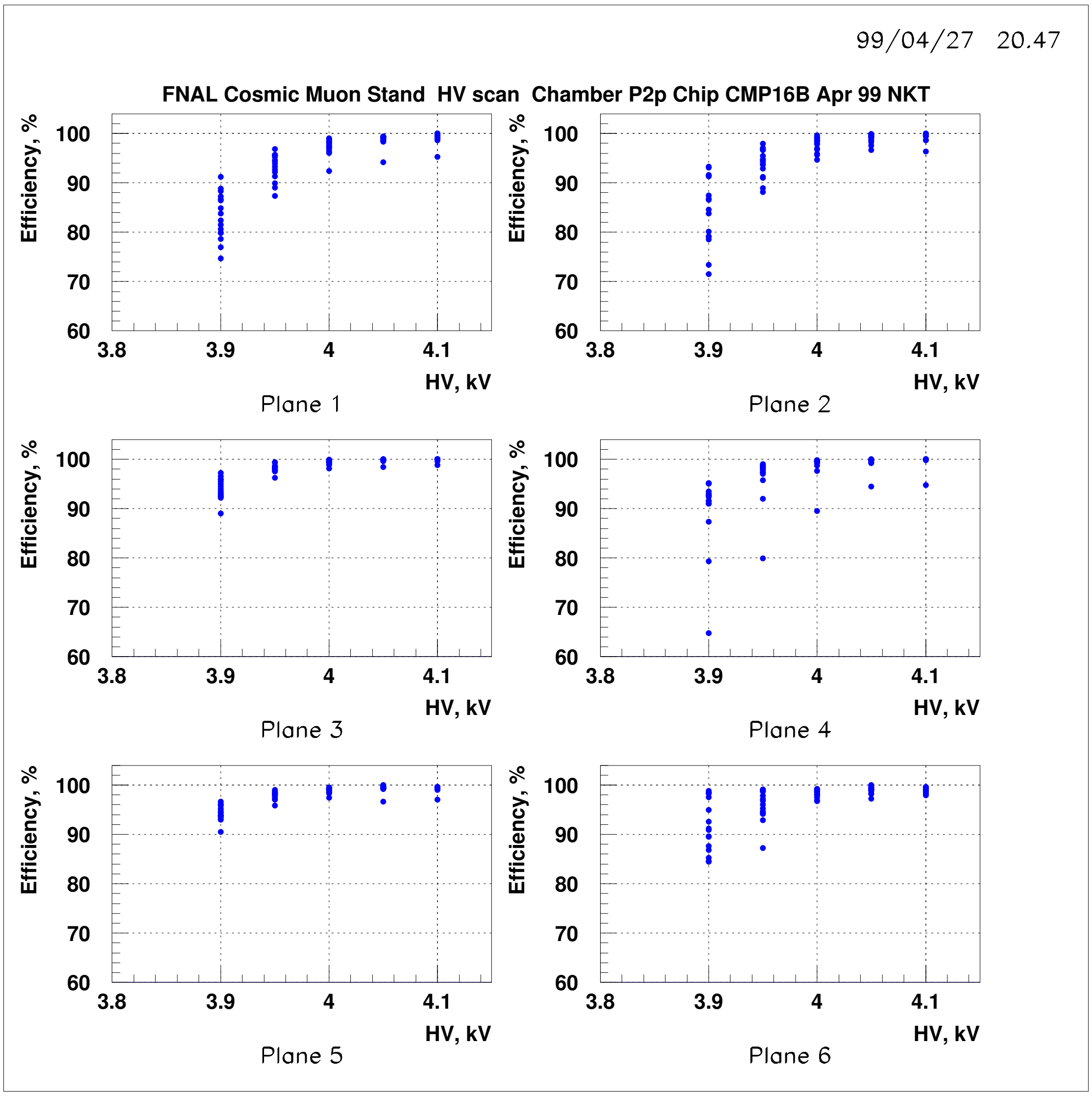

Figure 7: The single channels efficiency in HV scan of P2' with the CMP16B electronics

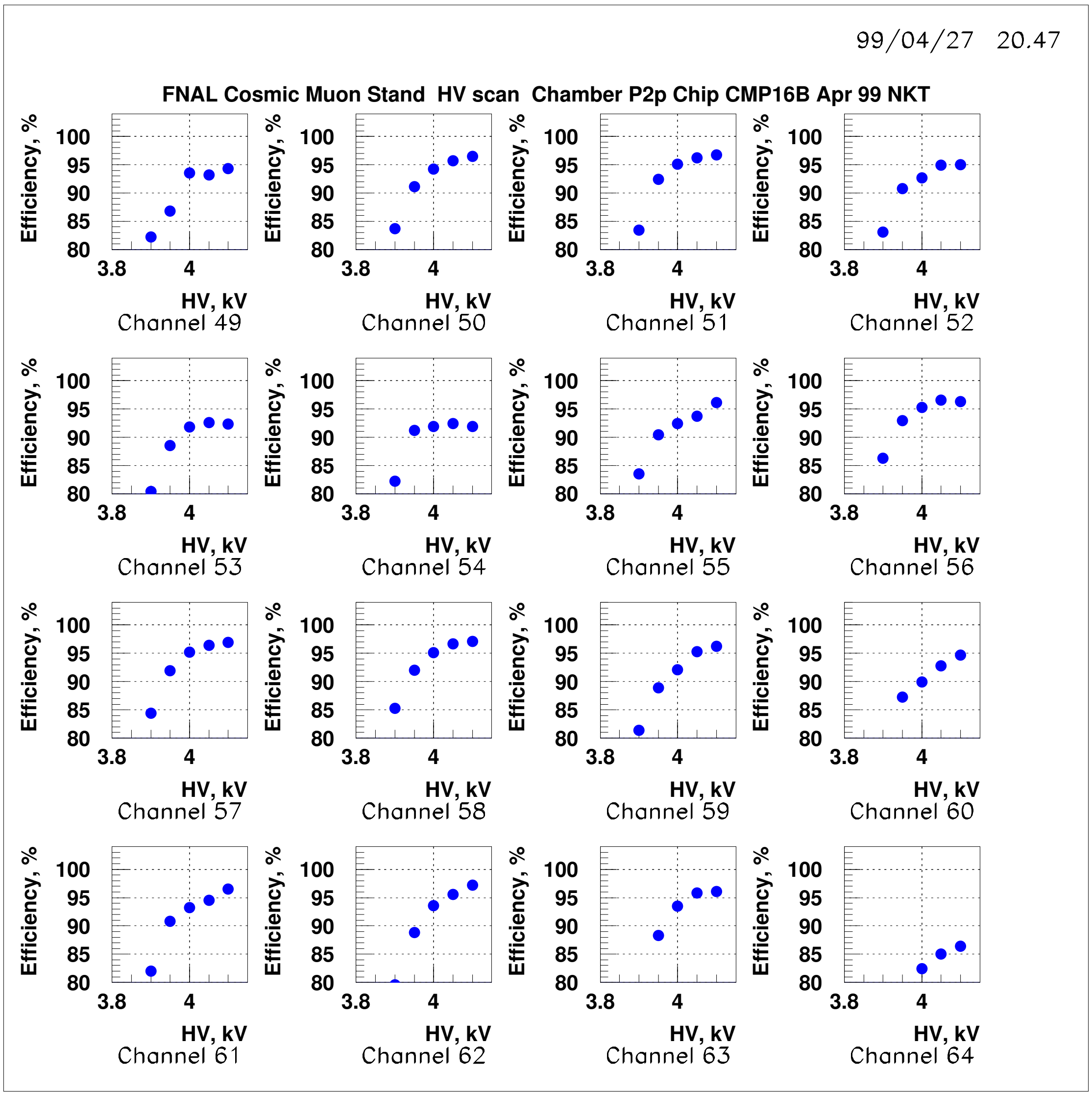

Figure 8: The efficiency for having the second earliest time be within a 20 nsec gate for different anode channels of the CMP16B electronics