

Measurement of the Trigger Efficiency for the new J/Psi Data

De Li

(Lid@hpws5.ihep.ac.cn)

April, 2000

Introduction

- The trigger efficiency was calculated with the data of Run13931-Run13939 (Jan. 11, 2000). The trigger efficiencies for Bhabha, Dimuon and Hadron are 0.99998, 0.99642 and 0.99619 separately.

The event samples for calculating the trigger efficiency

- Trigger table for the measurement of the trigger efficiency

For measuring the trigger efficiency, a special trigger table (Table 1) was used to take the data. For every sub-detector, a special trigger channel was design to determine the trigger efficiencies of the trigger conditions from this sub-detector. In the special trigger channel, the trigger conditions from this sub-detector were avoided being used. Event samples getting with this channel don't depend on the trigger conditions from this sub-detector.

Table 1 TRIGGER CONDITION TABLE for measuring trigger efficiencies

TYPE CONDTN	MDC	VC	BSC	TOF	ESC	ETOF	ENDVC	NML
Active?	Y	Y	Y	Y	Y	Y	Y	Y
TOF B-B	-	-	-	-	-	-	-	-
Ntof>=1	-	-	Y	-	-	-	-	Y
Ntof>=2	Y	Y	-	-	-	-	-	-
RADIAL.	-	-	-	-	-	-	-	-
Nvc>=1.	Y	-	Y	Y	Y	-	-	Y
Eradi sl	-	-	-	-	-	Y	-	-
ETOF B-B	-	-	-	-	Y	-	Y	-
ETOF>=1	-	-	-	-	-	-	-	-
Nvc>=2	-	-	-	-	-	-	-	-
Ntrk>=1	-	-	-	-	-	-	-	Y
Ntrk>=2	-	Y	Y	Y	-	-	-	-
Ntrk>=4	-	-	-	-	-	-	-	-
MUON-OR	-	-	-	-	-	-	-	-
Etrk	-	-	-	-	-	-	-	-
ESC-Etot	-	-	-	-	-	Y	Y	-
E tot.l	Y	Y	-	Y	-	-	-	Y
E tot.h	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-

● Offline event sample selection

Both the trigger system and the efficiency of the detector have influences on the trigger efficiency. To get the trigger efficiency of a trigger condition from a sub-detector, the information from this sub-detector should not be used to select the event sample to calculate the trigger efficiency. Therefore, different offline selecting criteria were used to select the event samples for calculating the trigger efficiency for different sub-detectors.

The criteria for selecting hadron samples are given below:

● Hadron sample for calculate the trigger efficiency of VC and BSC

Selected with information from MDC and TOF. The main cut conditions:
 $MFIT=2$ or (-19) , $V_r \leq 0.02m$, $|V_z| \leq 0.15m$, $|\cos\theta| \leq 0.84$, $2 \leq Tof \leq 20ns$,

● Hadron sample for calculate the trigger efficiency of MDC

Selected with information from VC and BSC. The main cut conditions:
 $MFIT_{vc}=1$, $V_r \leq 0.02m$, $|V_z| \leq 0.18m$, $N_{goog} \geq 2$, $\Sigma E \geq 0.28E_{beam}$,

● Hadron sample for calculate the trigger efficiency of TOF

Selected with information from MDC and BSC. The main cut conditions:
 $MFIT=2$ or (-19) , $V_r \leq 0.02m$, $V_z \leq 0.15m$, $|\cos\theta| \leq 0.84$,
 $\Sigma E \geq 0.28E_{beam}$,

Calculating the trigger efficiency

● Trigger efficiencies of different trigger conditions

The trigger efficiencies of different trigger conditions for different kinds of events were calculated. The results are given in Table 2.

● Trigger efficiencies of different trigger channels

The trigger table for getting J/ψ data was given in Table 3. Three trigger channels (CHARGED, CHAR2, NUTRAL) were opened for the barrel detectors in this trigger table. According to the trigger table, the trigger efficiencies for different trigger channels were calculated with the formula below:

$$\text{Eff}_{\text{charged}}(e_1) = \text{Eff}_{\text{Ntof} \geq 1} \bullet \text{Eff}_{\text{Nvc} \geq 1} \bullet \text{Eff}_{\text{Ntrk} \geq 1} \bullet \text{Eff}_{\text{Etot}_1}$$

$$\text{Eff}_{\text{char2}}(e_2) = \text{Eff}_{\text{Ntof} \geq 2} \bullet \text{Eff}_{\text{Nvc} \geq 1} \bullet \text{Eff}_{\text{Ntrk} \geq 2}$$

$$\text{Eff}_{\text{neutral}}(e_3) = \text{Eff}_{\text{radial}} \bullet \text{Eff}_{\text{Etot}_h}$$

The results are given in Table 2.

● Trigger efficiencies of different kind events

The trigger efficiencies of different kind events calculated with the formula:

$$\begin{aligned} \text{Eff}_{\text{total}} = & \text{Eff}_{\text{Ntof} \geq 1} \bullet \text{Eff}_{\text{Nvc} \geq 1} \bullet \text{Eff}_{\text{Ntrk} \geq 1} \bullet \text{Eff}_{\text{Etot}_1} \\ & + (1 - \text{Eff}_{\text{Ntof} \geq 1} \bullet \text{Eff}_{\text{Nvc} \geq 1} \bullet \text{Eff}_{\text{Ntrk} \geq 1}) \bullet \text{Eff}_{\text{radial}} \bullet \text{Eff}_{\text{Etot}_h} \\ & + (1 - \text{Eff}_{\text{Etot}_1}) \bullet \text{Eff}_{\text{Ntof} \geq 2} \bullet \text{Eff}_{\text{Nvc} \geq 1} \bullet \text{Eff}_{\text{Ntrk} \geq 2} \end{aligned}$$

Table 2 Trigger efficiency

	Bhabha Events			Dimuon Events			Hadron Events		
Conditions	Passed	Total	Efficiency	Passed	Total	Efficiency	Passed	Total	Efficiency
TOF BB	4020	4404	0. 91281	1716	1782	0. 96296	17311	37152	0. 46595
Ntof>=1	4400	4404	0. 99909	1782	1782	1. 00000	36973	37152	0. 99518
Ntof>=2	4309	4404	0. 97843	1733	1782	0. 97250	36221	37152	0. 97494
Nvc>=1	3878	3878	1. 00000	1733	1737	0. 99770	23531	23533	0. 99992
Ntrk>=1	4355	4355	1. 00000	1769	1769	1. 00000	25296	25306	0. 99960
Ntrk>=2	4309	4355	0. 98944	1733	1769	0. 97965	25095	25306	0. 99166
Radial	3561	3613	0. 98561	439	1832	0. 23963	8841	23600	0. 37462
Etot_l(20)	3613	3613	1. 00000	1782	1832	0. 97271	23568	23600	0. 99864
Etot_h(55)	3602	3613	0. 99696	28	1832	0. 01528	18117	23600	0. 76767
Charged			0. 99909	0. 97047			0. 99336		
Char2			0. 96809	0. 95052			0. 96673		
Neutral			0. 98261	0. 00366			0. 28758		
Eff_total			0. 99998	0. 99642			0. 99619		

Etot_l(20) \approx 150Mev, Etot_h(55) \approx 950Mev

Table 3 TRIGGER CONDITION TABLE for J/psi

TYPE	BHABHA	CHARGED	2-MU	CHAR2	NEUTRAL	ENEU	EBB	BB2
CONDTN								
Active?	N	Y	N	Y	Y	Y	Y	N
TOF B-B	-	-	-	-	-	-	-	-
Ntof>=1	-	Y	Y	-	-	-	-	-
NTOF>=2	-	-	-	Y	-	-	-	Y
RADIAL.	-	-	-	-	Y	-	-	-
Nvc>=1.	-	Y	-	Y	-	-	-	-
Eradl	-	-	-	-	-	Y	-	Y
ETOF B-B	-	-	-	-	-	-	Y	-
ETOF>=1	-	-	-	-	-	-	-	-
Nvc>=2	-	-	-	-	-	-	-	-
Ntrk>=1	-	Y	-	-	-	-	-	-
Ntrk>=2	-	-	-	Y	-	-	-	-
Ntrk>=4	-	-	-	-	-	-	-	-
MUON-OR	-	-	Y	-	-	-	-	-
Etrk	-	-	-	-	-	-	-	Y
ESC-Etot	-	-	-	-	-	Y	Y	-
E tot.l	-	Y	-	-	-	-	-	-
E tot.h	-	-	-	-	Y	-	-	-
3	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-

Summary

The trigger efficiencies for different events are:

$$\text{Eff}_{\text{Bhabha}}=0.99998$$

$$\text{Eff}_{\text{Dimuon}}=0.99642$$

$$\text{Eff}_{\text{Hadron}}=0.99619$$

The trigger efficiencies of the trigger system are high enough.