

Trigger Definitions for RP phase-II* for Run15

J.H. Lee and I. Alekseev

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LABELING

There are eight trigger counters in Roman Pots. Each counter is read by two PMTs. Hence there are 16 signals delivered to the STAR trigger system. The RPs are located in the RHIC tunnel on the East and West side of the STAR detector. We record both amplitude and timing information of each of the 16 PMTs. The labeling for the PMTs is:

E2U1, E2U2 – Roman Pot East 2 (Back) Up 1 and 2
E2D1, E2D2 – Roman Pot East 2 (Back) Down 1 and 2
W2U1, W2U2 – Roman Pot West 2 (Back) Up 1 and 2
W2D1, W2D2 – Roman Pot West 2 (Back) Down 1 and 2

E1D1, E1D2 – Roman Pot West 1 (Front) Down 1 and 2
E1U1, E1U2 – Roman Pot West 1 (Front) Up 1 and 2
W1D1, W1D2 – Roman Pot West 1 (Front) Down 1 and 2
W1U1, W1U2 – Roman Pot West 1 (Front) Up 1 and 2

The assignment of channels is in Table 1 below. It is similar to 2009 with a natural change from horizontal stations to vertical.

Table 1 (QT VME slot 8 (0x12) board label PP001)
The assignment of channels as per STAR MXQ Crate Cable Map, 01/27/2009

QT ch#	PP2PP PMT
1	E2U1
2	E2U2
3	E2D1
4	E2D2
9	W2U1
10	W2U2
11	W2D1
12	W2D2
17	E1D1
18	E1D2
19	E1U1
20	E1U2
25	W1D1
26	W1D2
27	W1U1
28	W1U2

QT AND DSM LOGIC COMBINATIONS

A “good hit” is defined for each of 16 PMTs as “ADC over threshold and TAC in window”. We start making basic combination as an “or” of the two PMTs looking at the same counter and then make or of both “up” or “down” counters of the same side, see Table 2.

Table 2 (Basic “or”s)

Combination	Logic	QT#8 channels
E2U (East Back Up)	E2U1 or E2U2	Ch1, Ch2
E1U (East Front Up)	E1U1 or E1U2	Ch19, Ch20
W1D (West Front Down)	W1D1 or W1D2	Ch25, Ch26
W2D (West Back Down)	W2D1 or W2D2	Ch11, Ch12
E1D (East Front Down)	E1D1 or E1D2	Ch17, Ch18
E2D (East Back Down)	E2D1 or E2D2	Ch3, Ch4
W2U (West Back Up)	W2U1 or W2U2	Ch9, Ch10
W1U (West Front Up)	W1U1 or W1U2	Ch27, Ch28
EU (East Up)	E1U or E2U	Ch1, Ch2, Ch19, Ch20
ED (East Down)	E1D or E2D	Ch3, Ch4, Ch17, Ch18
WU (West Up)	W1U or W2U	Ch9, Ch10, Ch27, Ch28
WD (West Down)	W1D or W2D	Ch11, Ch12, Ch25, Ch26

Elastic and inelastic trigger components EA, EB, IA and IB are defined in Table 3 and trigger bits for TCU are defined in Table 4.

Table 3 (Definition of Elastic and Inelastic Arms)

EA (Elastic Trigger A)	EA = EU and WD
EB (Elastic Trigger B)	EB = ED and WU
IU (Inelastic Trigger Up)	IU = EU and WU
ID (Inelastic Trigger Down)	ID = ED and WD

Table 4 (Definition of bits for TCU)

ET (Elastic Trigger)	ET = EA or EB
IT (Inelastic Trigger)	IT = IU or ID
EOR (East Or)	EOR = EU or ED
WOR (West Or)	WOR = WU or WD

We assume that there we are assigned a single scaler board read at the end of each run and with standard bits 24:16 assignment. Proposed layout of the bits 15:0 is given in Table 5.

Table 5 (Definition of bits for scaler board)

Bit#	Definition
0	E2U (East Back Up)
1	E1U (East Front Up)

2	W1D (West Front Down)
3	W2D (West Back Down)
4	E1D (East Front Down)
5	E2D (East Back Down)
6	W2U (West Back Up)
7	W1U (West Front Up)
8	BBCEIN (BBC Inner (small) tiles East)
9	BBCWIN (BBC Inner (small) tiles West)
10	BBCEOUT (BBC Outer (large) tiles East)
11	BBCWOUT (BBC Outer (large) tiles West)
12	ZDCE (ZDC East)
13	ZDCW (ZDC West)
14	VPDE (VPD East)
15	VPDW (VPD West)

PHYSICS TRIGGERS

Here we use TCU bits definitions from Table 4.

Elastic trigger: Determined by requiring that there is one proton on East and one on West side and nothing else, and they are collinear. Prescale to 20 Hz expected. No other subsystems readout.

$$ET = ET$$

Central Production Triggers: Protons in RP trigger counters with ToF multiplicity and no activities in BBC and FMS. This is the main trigger for this run. DD should be prescaled to 50 Hz, DDX – to 300 Hz. We expect TOF, TPC and calorimeters to be readout.

$$DD = EOR \& WOR \& TOF \& (!BBC) \& (!FMS)$$

$$DDX = IT \& TOF \& (!BBC) \& (!FMS)$$

Single Diffraction Dissociation Triggers: proton (nuclei) moving one side dissociates with the other side proton hit RP. SD should be prescaled to 10 Hz, SDT – to 50 Hz and SDF to 60 Hz. We expect TOF, TPC and calorimeters to be readout for SD and SDT and FMS only for SDF.

$$SD = (EOR \& !ZDCE \& !BBCE \& (ZDCW | BBCW)) | \text{symmetric}$$

$$SDT = SD \& TOF$$

$$SDF = EOR \& !ZDCE \& !BBCE \& FMS$$

Direct gamma – J/Psi trigger: an event similar to central production with both protons hit RPs, but with dilepton in the central region. We expect no prescale, MTD, TOF, TPC and calorimeters to be readout.

$$RP-DL = EOR \& WOR \& \text{Dilepton}$$

ZDC-RP Trigger – $Z_c(3900)^+$ production: neutron in ZDC on one side, proton in the other side RP and J/Psi (dilepton) in the center region. We expect no prescale, MTD, TOF, TPC and calorimeters to be readout.

$$\mathbf{RPZ = ((EOR \ \& \ ZDCW) \ | \ (WOR \ \& \ ZDCE)) \ \& \ JPSI}$$