99' Improvement of Main Trigger System

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1 Motivation

- The old main trigger system, which mainly consist of module 2365, has bee aging severly. Its low intallation density and massive cable connections cause frequent bad connetion, which affect the whole performance of the system. It need to be upgraded urgently.
- Using neural network as the third trigger decision to explore new trigger decision method on BES.

2 Improvement

- The first level and second level trigger(TR55A).
  - We make a double size CAMAC module to replace old first level trigger and second trigger, which consist of seven single size CAMAC module, and increase the trigger conditions from 8 to 10 every level.
  - The method to implement the first and second level trigger is look-up table method. Information in the trigger table is converted and stored in the RAM. The first and second level trigger decision then can be implemented by looking up the information in the RAM, using trigger conditions as it addresses.
- The third level trigger(TR90).
  - The third trigger is implemented using neural network. Its algorithm is BP algorithm. TR90 is a double size CAMAC module using DSP to carry out the trained neural network.
  - The arrangement of the first, second and third level trigger in the data acquision of BES. Because the third level trigger is only an exploration on BES, it will not involve in online trigger decision. But we manage to record the third level information when recording the good event information which is decided by the first and second level trigger.

3 Current status

Module TR55A and TR90 have been installed to BES now. Hardware tests have been passed, and main parts of online softeware have been revised. There are still some online software to be changed, but they don't affect data acquision. The main trigger system can fulfil the requirements of data acquistion now.

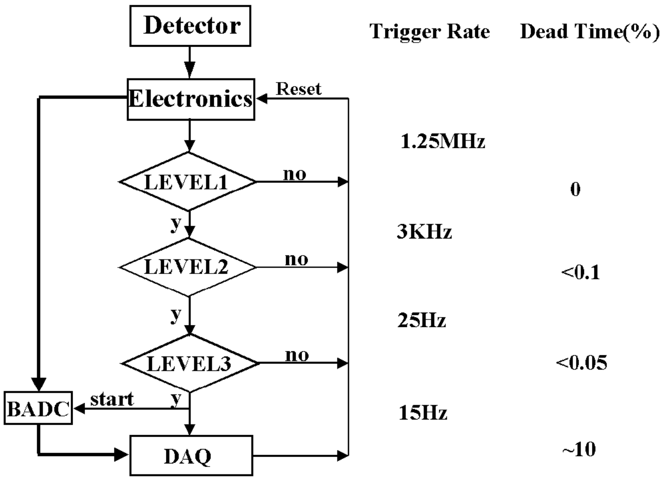
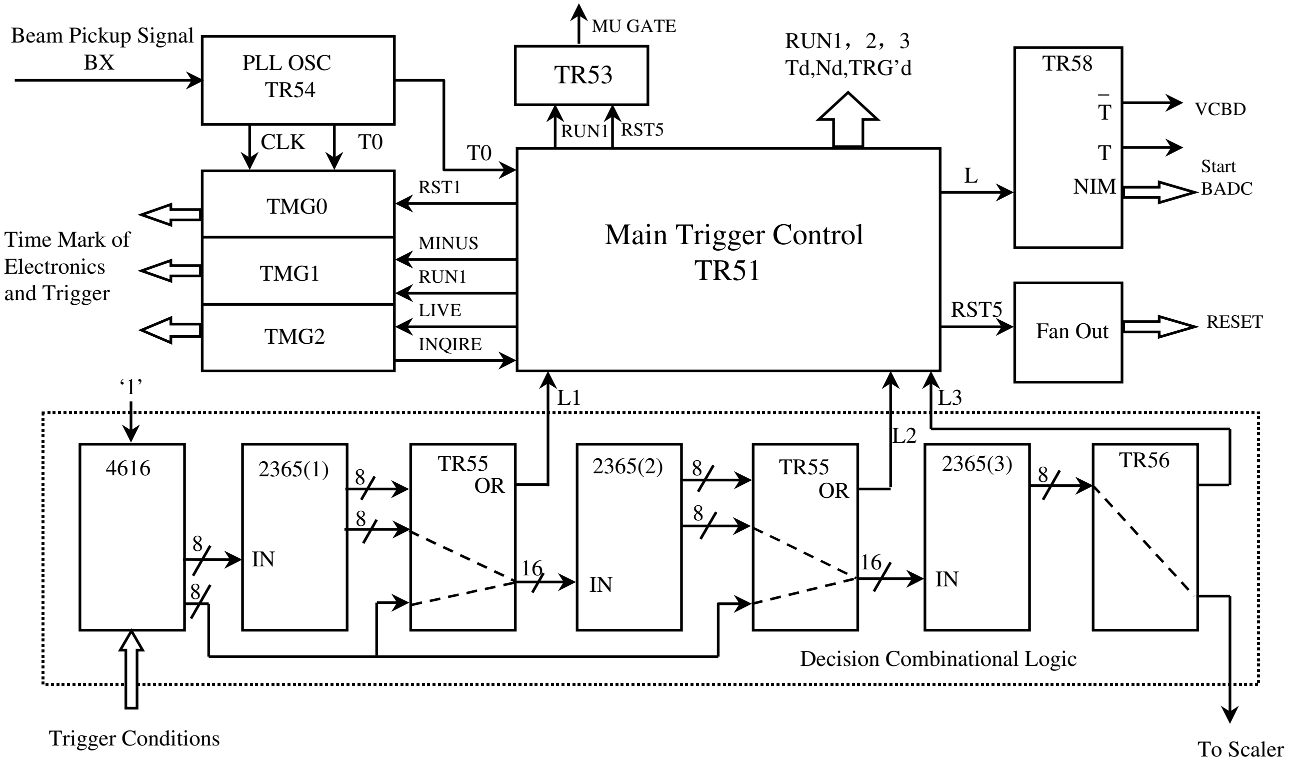


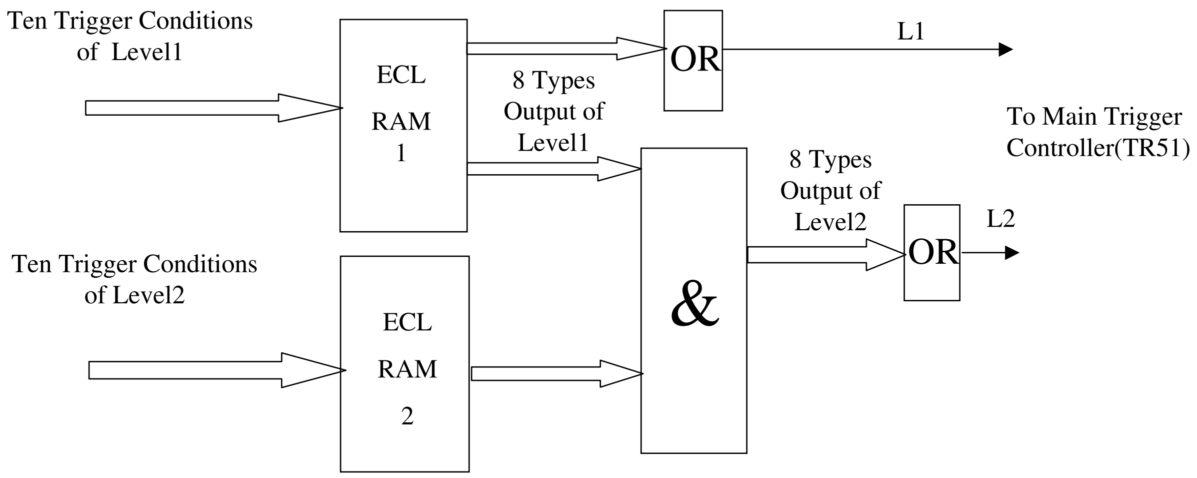
Figure 1: The decision flow chart of the trigger of BES

Trigger Condition Table After Improvement

\ TYPE CONDTN\	BHABHA	CHAR	2–MU	CHAR2	NEUTRAL	COSMIC	ESC	BB2
active?	N	Y	N	Y	Y	N	N	N
TOF B–B	–	–	Y	–	–	–	–	Y
$N_{TOF} \geq 1$	–	Y	Y	–	–	–	–	–
$N_{TOF} \geq 2$	–	–	–	Y	–	–	–	Y
RADIAL.	–	–	–	–	Y	–	–	–
$N_{VC} \geq 1$	–	Y	Y	–	–	Y	Y	–
$N_{ETOF} \geq 1$	Y	–	–	–	–	–	–	–
END B-B	–	–	–	–	–	–	Y	–
1	–	–	–	–	–	–	–	–
2	–	–	–	–	–	–	–	–
$N_{TRK} \geq 1$	–	Y	–	–	–	–	–	Y
$N_{TRK} \geq 2$	–	–	–	Y	–	Y	–	–
$N_{TRK} \geq 4$	–	–	–	–	–	–	–	–
MU–OR	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–
ESC-E_{tot}	–	–	–	–	–	–	Y	–
E_{tot-l}	–	Y	–	–	–	–	–	Y
E_{tot-h}	–	–	–	–	Y	–	–	–
3	–	–	–	–	–	–	–	–
4	–	–	–	–	–	–	–	–

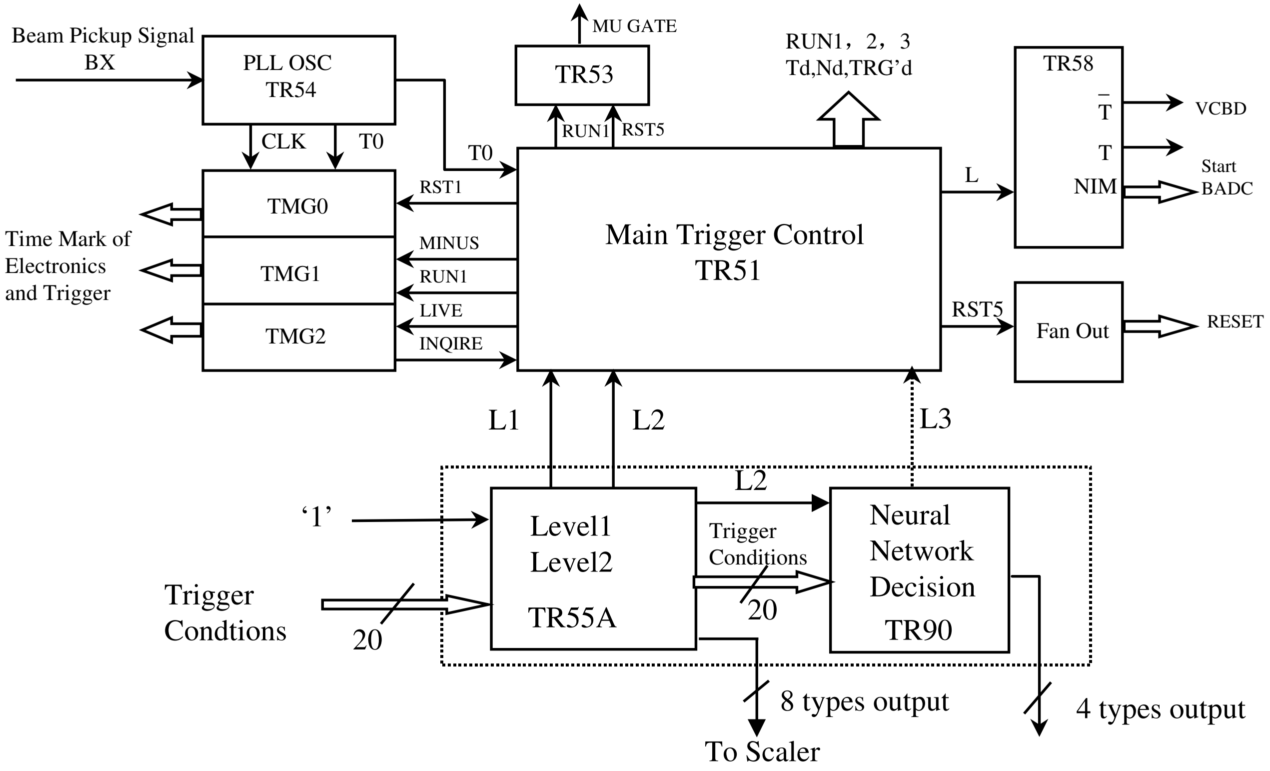


Main Trigger System Logic Diagram Before Improvement



(Two levels of trigger table are converted to binary format according to the requirements of trigger table and hardware design and stored into two 1k×8 RAMs respectively. Then the trigger conditions are uesed as addresses to look for corresponding information in the RAMs, giving Level1 and Level2 decision.)

Fundamental of New Trigger Table Implementation



Main Trigger System Logic Diagram After Improvement