Trigger selector system for BigRIPS DAQ

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A new trigger selector system has been introduced for the BigRIPS data acquisition (DAQ) system. One of the advantages of this system is that trigger signals could be switched by a web-interface controller without physically chaining connections between trigger-related circuits. This function will help the RI-beam tuning in BigRIPS because the trigger for the BigRIPS DAQ is frequently switched to obtain profiles of RI beams at each focal plane. In addition, it is possible to configure a complex trigger condition by applying logic gates of AND, OR, and NOT for triggers from each focal plane.

The new system consists of five Generic Trigger Op $erator^{1}$ (GTO) modules and a web-interface controller coded in the PHP language. A connection diagram of the system is shown in Fig. 1. This system is divided into three sections: the focal plane section, trigger logic section, and trigger output section. The trigger signal for the measurement is hierarchically selected by these three sections. GTO modules with selector firmware²) (SELGTO) are used for the focal plane and trigger output sections. To configure complex trigger conditions in the trigger logic section, new firmware for the logic unit has been developed and implemented in the GTO module (LUGTO). LUGTO has 20 input channels and 8 output channels. Up to 8 logic conditions, a combination circuit of input signals with AND, OR, and NOT logic gates can be configured in LUGTO.

In the focal plane section, the signals from plastic scintillators and PPACs at the F1-F12 focal planes are separately connected to three SELGTO modules. Here, signals named as F1–F12 Beam are produced and sent to the trigger logic section. For example, the F2 Beam signal is defined from the selection of signals from F2Plastic, F2PPAC1, and F2PPAC2 detectors. By using LUGTO in the trigger logic section, coincidence triggers named as BigRIPS, ZeroDegree, and dE can be configured by signals labeled as F1-F7 Beam, F8-F11 Beam and F3–F7dE (energy-loss gate at each focal plane), respectively. For example, the BigRIPS (ZeroDegree) trigger can be defined as F3Beam×F7Beam (F8Beam×F11Beam). Finally, the trigger output is determined by choosing signals of BigRIPS, down-scaled BigRIPS (BigRIPS(1/n)), ZeroDegree, dE, etc. in the trigger output section.

The trigger configuration is selected from the webinterface controller as shown in Fig. 2. The settings in GTO modules are updated on pushing the "Save" button. However, these settings will be lost when a power cycle occurs. The "EEPWrite" button is used to keep configurations permanently in GTO modules. Compo-

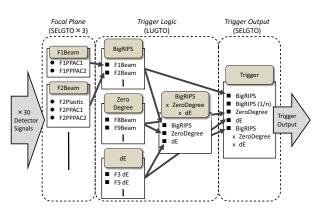


Fig. 1. Diagram of signal connections.

BigRIPS GTO Trigger

		BigRIPS			
GTO-1		GTO-2			
 F1PPAC1 (in0) 		♦ AND			
F1PPAC2 (in1)		F1Beam (in0)			
\Rightarrow out0	F8Beam	F2Beam (in1)			
F2Beam	GTO-4	F3Beam (in2)			
GTO-1	 F8Pla (in0) 	F4Beam (in3)			
F2Pla (in2)	F8PPAC1 (in1)	F5Beam (in4)			
F2PPAC1 (in3)	F8PPAC2 (in2)	F6Beam (in5)			
F2PPAC2 (in4)	\Rightarrow out0	F7Beam (in6)		Trigger	
\Rightarrow out1	F9Beam	⇒ out0		GTO-3	
F3Beam	GTO-5	⇒ out4		♦ OR	
GTO-1	 F9PPAC1 (in0) 	dE		BigRIPS	(int
F3Pla (in5)	F9PPAC2 (in1)	GTO-2		BigRIPS(1/n)	(in:
F3PPAC1 (in6)	\Rightarrow out0	♦ AND		🔲 dE	(in:
F3PPAC2 (in7)	F10Beam	F3 dE (in12)		ZeroDegree	(in:
\Rightarrow out2	GTO-5	F5 dE (in13)		BigRIPS x ZeroDegr	ree x dE (in-
F4Beam	F10PPAC1 (in2)	F7 dE (in14)		Clock(1k)	(1k
GTO-1	 F10PPAC2 (in3) 	⇒ out1		⇒ out0	
F4PPAC (in8)	\Rightarrow out1	⇒ out6		Strobe	
\Rightarrow out3	F11Beam	ZeroDegree		GTO-3	
F5Beam	GTO-5	GTO-2		Strobe On (none)	
GTO-1	 F11Pla1 (in4) 	♦ AND		 Strobe Off (level) 	
F5Pla (in9)	F11Pla2 (in5)	F8Beam (in7)		\Rightarrow out3	
F5PPAC1 (in10)	F11PPAC1 (in6)	F9Beam (in8)		BigRIPS(1/n)	
F5PPAC2 (in11)	 F11PPAC2 (in7) 	F10Beam (in9)		GTO-3	
\Rightarrow out4	\Rightarrow out2	F11Beam (in10)		DS 100 (in0)	
F6Beam	F12Beam	F12Beam (in11)		\Rightarrow out1	
GTO-1	GTO-4	\Rightarrow out2			
F6PPAC (in12)	F12Pla (in3)	⇒ out5			
⇒ out5	F12PPAC1 (in4)	BigRIPS x ZeroDe	gree x dE		
F7Beam	F12PPAC2 (in5)	GTO-2			
GTO-1	\Rightarrow out1	AND			
 F7Pla (in13) 		 BigRIPS 	(in16)		
 F7PPAC1 (in14) 		ZeroDegree	(in17)		
 F7PPAC2 (in15) 		🔲 dE	(in18)		
⇒ out6		⇒ out3			
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Fig. 2. Screenshot of the web-interface controller.

nents of the web-interface contoller can be customized by a text setting file to facilitate the modification of trigger connections.

This trigger selector system for the BigRIPS DAQ has been in operation since from April 2018, enabling us to perform RI-beam tuning efficiently.

References

- 1) H. Baba et al., RIKEN Acc. Prog. Rep. 46, 213 (2013).
- 2) H. Baba et al., RIKEN Acc. Prog. Rep. 49, 201 (2016).

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