Options for Eurogam Anti-Comptoning

Ian Lazarus

June 1990

1 Introduction

There are several methods of anti-Comptoning which could be used in Eurogam, and this short paper is intended to list advantages and drawbacks of each.

1.1 Assumptions

I have assumed that we do shared suppression in software so only individual suppression is performed in hardware. I have also assumed that each BGO shield (i.e. 10 elements) will generate a single signal somewhere on the BGO card to indicate that one or more elements has been hit.

2 Method 1: Anti-Compton module

This is the Gamic approach (using LCA cards) and was also proposed in the rev 1.00 Eurogam trigger specification. It works by taking front panel signals from the Ge and BGO cards and wiring them to a module (or set of modules) which contain programmable logic elements containing the logic for anti-Comptoning. This is essentially 70 logical AND operations on the Ge CFD signal and the inverse of the BGO discriminator signal where a logical one output indicates a clean Ge. These 70 outputs must then be used to generate a multiplicity signal for the trigger unit. This would probably be performed by switching current sources (1 mA per clean Ge) to generate an analogue multiplicity to the central trigger unit.

The *disadvantages* are the cabling and the need to design and house an additional module. *Advantages* are the programmablity which allows reconfiguration when modules are swapped for repair and the potential to generate a clean (or raw) Ge hit pattern. It could also be used to house scalers for rate monitoring if they don't fit on the Ge cards. There is no need to match the number of channels on Ge cards to that of shields on BGO cards.

3 Method 2: Cabling Between cards

This method would use front panel outputs from BGO shields (one per shield) to connect the logic signal from each shield to its associated Ge channel. Within the Ge card there would be two multiplicity outputs to two sumbuses; one would depend only on the raw Ge and the other would gate the current pulses with the signal from the BGO.

Disadvantages are that there are cables required and another set of inputs to the Ge card. There is, however, only half the number of cables in compared to method 1. *Advantages* are that no extra card need be designed or built for anti-Comptoning. There is a degree of reprogrammablity during board swaps by making the corresponding cable swaps. There is no need to match the number of channels on Ge cards to that of shields on BGO cards.

4 Method 3: Adjacent BGO/Ge cards

Like method 2, this uses 2 sumbuses for raw and clean Ge multiplicity with the anti-Comptoning performed by gating the Ge multiplicity output with the signal from its associated BGO shield. The difference is that by placing BGO and Ge modules adjacent in the same crate (1:1 for coax; 2 Ge:1 BGO for stacks) we can now use the VXI local bus to transfer the logic signal from the BGO to the Ge card so there is no cabling at all.

The main *disadvantages* is that we can no longer use the local bus for data readout. This is not problem in common deadtime mode and it has yet to be decided whether there is any impact during the parallel, pipelined second phase of Eurogam. This matter is under discussion by a second group whose conclusions are not yet known. Another potential problem is the fixed topology imposed in that Ge and BGO cards must map on a 1:1 or 2:1 basis[1]. There will normally be one or two free slots left in the crate with only 10 (coax) or 9 (stacks) of the 11 available slots used. The *advantages* are that there is no cabling required, the system can be expanded easily in pairs of Ge/BGO rather than crates of Ge and crates of BGO. It maps neatly onto the current implementation of Ge and BGO cards and does the same as method 2 but without cables. As with method 2 there is no need to design and build a separate anti-Comptoning module.

5 Maintainability

What happens if a single Ge detector or BGO shield breaks?

All solutions allow the Ge channel's electronics to be switched off by disabling its CFD. Presumably the BGO can do the same. This is unaffected by the choice of methods 1 to 3.

The next stage is to swap the faulty Ge detector. Again if we swap a coax for a coax or a stack for a stack there are no problems. If, however, we have a failed coax, but no spare coax detectors the question is whether we can replace the failed coax with a stack detector. Methods 1 and 2 allow this by recabling and possible reprogramming in method 1 too. All that is required is a spare channel on a Ge stack card. Method 3 doesn't allow this type of swap without recabling the BGO shield to the BGO card next to the new Ge channel as well. If there are no spare channels, then it means that we must insert a BGO card as well as a Ge stack card for method 3 whereas methods 1 and 2 require only the new Ge stack card.

Against this must be balanced the increased reliability and reduced potential for miscabling by using method 3 which uses no cables instead of 1 or 2 which require cables.

6 Time alignment

The CFD output pulses have a 0 to 100ns range of adjustment in Ge (and presumably BGO too) in their delay. Is this sufficient to delay the CFD signals to overlap the Ge CFD signals? How fast is BGO — will there be a BGO pulse by the time Ge CFD fires if it is set just above the noise or must we delay the Ge to wait for BGO? (Method 1 allows additional delays in the anti-Compton box which could cover any problms in this area.)

---

[1] This is not a problem in the present Eurogam design where we have 6 Ge and 6 BGO shields per card.