Minutes of the ICC Electronics Working Group meeting
GANIL, January 22nd, 2015

Synchronization and trigger system

Attendees:
M. Bini - INFN Firenze
F. Salomon - IPN Orsay
V. Gonzalez - University Valencia
A. Czermak - IFJ PAN Krakow
X. Grave, N. Karkour - CSNSM Orsay
M. Bezard, A. Boujrad, J. Frankland, G.F.Grinyer, M. Tripon, G. Wittwer - GANIL Caen

Apologized:
S. Panebianco - CEA Saclay
J.J. Dormard – IPN Orsay

Agenda:
- 9h30: Coffee and croissants welcome
- Introduction: ICC news and recommendations (Michel Tripon: 10mn)
- Synchronization and trigger system: Your needs and specifications, the current status (each representative: 10 mn)
- The GTS system (Matthieu Bezard: 20mn)
- The MUTANT system (Gilles Wittwer: 20mn)
- 13h00-14h00: Lunch
- Presentations of GTS tree and MUTANT test benches (GAP building: 1h)
- The software trigger processor (Xavier Grave: 20mn)
- 15h30 Coffee break
- Discussions
- 17h00 End of the meeting

Presentations made during this meeting are located at:
http://pro.ganil-spiral2.eu/laboratory/ganil-spiral2-icc/meetings/electronics-wg/iccewg-meeting-1-22-15

Meeting:
1 Introduction: ICC news and recommendations (presented by Michel Tripon)
http://pro.ganil-spiral2.eu/laboratory/ganil-spiral2-icc/meetings/electronics-wg/iccewg-meeting-1-22-15/iicewg_ganil_22janv15/view
        The last ICCEWG meeting was on January 2012; it was devoted to the writing of the recommendations and technical specifications report. At the ICC Bormio meeting in February 2014, it was decided to resume ICCEWG meeting;   the synchronization and trigger system is among the suggested items which have been addressed to the ICCEWG representatives.

2 Synchronization and trigger system: Your needs and specifications, the current status
2 1 AGATA
Presentation made by M. Tripon
http://pro.ganil-spiral2.eu/laboratory/ganil-spiral2-icc/meetings/electronics-wg/iccewg-meeting-1-22-15/iicewg_ganil_22janv15/view

AGATA has implemented the GTS system. In its full setup, ie 180 core Ge channels, GTS tree should feature 271 GTS V3 mezzanines: 180 GTS V3 leaves, 90 FIFOs, 1 ROOT. The ongoing new instrumentation based on the PCIe processing board embeds the GTS leaf; as a result the number of GTS V3 mezzanines in the GTS tree is drastically reduced.

2 2 S3
Presentation made by N. Karkour
http://pro.ganil-spiral2.eu/laboratory/ganil-spiral2-icc/meetings/electronics-wg/iccewg-meeting-1-22-15/sirius-icc-trigger/view

The S3 SIRIUS project consists in the implementation of two kinds of instrumentations featuring the GTS system (Si and Ge detectors) and the MUTANT (trackers). The coupling of both systems will be done with the BEM module which will house in a new generation Xilinx FPGA the firmware of the GTS leaf. Due to the high number of Trigger Requests (346 Si and Ge channels, one tracker channel), it is pointed out that a software trigger processor is more suitable than a firmware one.

2 3 EXOGAM2
Presentation made by A. Boujrad
http://pro.ganil-spiral2.eu/laboratory/ganil-spiral2-icc/meetings/electronics-wg/iccewg-meeting-1-22-15/exogam2_iccewg_jan_2015/view

EXOGAM2 has being implemented the GTS system which has been retrieved from AGATA. The GTS system is updated in order to embed the GTS leaf functionality into the NUMEXO2 digitizer and to increase the number or Trigger Request per GTS leaf link. A new GTS trigger processor is being studied in order to deal with several hundreds of Trigger Requests.
An option based on CENTRUM system connected to the NUMEXO2 digitizer was presented; no work is currently done and is planned.

2 4 FAZIA
Presentation made by M. Bini
http://pro.ganil-spiral2.eu/laboratory/ganil-spiral2-icc/meetings/electronics-wg/iccewg-meeting-1-22-15/fazia-presentation/view

A Very Front End FAZIA block was presented. The VFE block is optically link to a FAZIA regional VME board which controls it and processes the incoming data. Moreover, the regional board houses a trigger daughter board which includes the CENTRUM receiver. The ongoing work is to associate the FAZIA detector to the INDRA detector. Each detector is autonomous; they get the 48 bits time stamp from the CENTRUM master module.

2 5 PARIS
Presentation made by A. Czermak
http://pro.ganil-spiral2.eu/laboratory/ganil-spiral2-icc/meetings/electronics-wg/iccewg-meeting-1-22-15/paris-czermak_final/view

For the early experiments in which PARIS is coupled to AGATA and VAMOS, the PARIS detector is instrumented with the analog Milano PARIS_pro electronics. The AGAVA module links the PARIS instrumentation to the GTS system. The presentation emphasizes on two modes of operation: the slow conversion mode (common dead time) and the fast conversion mode (parallel like). The near future work consists in the evaluation of two digital modules: NUMEXO2 (developed by GANIL for EXOGAM2 and NEDA) and VC1730 commercialized by CAEN Italy.

2 6 NEDA
Presentation made by V. Gonzalez
http://pro.ganil-spiral2.eu/laboratory/ganil-spiral2-icc/meetings/electronics-wg/iccewg-meeting-1-22-15/iccewg_neda_caen_2015/view

The NEDA detector and its instrumentation based on NUMEXO2 connected to the GTS tree are presented. Two phases are planned. In the phase 1, 45 NEDA scintillators are associated to the current Neutron Wall. In the phase two, the full set of NEDA is made of 355 scintillators. Each detector channel provides a Trigger Request. For the phases 1 and 2, 3 GTS V3 and 12 GTS V3 are respectively needed. It is worth to notice that trigger partitions are not required.

3 The GTS system
Presentation made by M. Bezard
http://pro.ganil-spiral2.eu/laboratory/ganil-spiral2-icc/meetings/electronics-wg/iccewg-meeting-1-22-15/gts_iccewg_ganil_jan15/view

Main features of the GTS system were presented. Firstly, the emphasize was put on the GTS tree for EXOGAM2; in the full EXOGAM setup, the GTS tree is made of 32 GTS leaves embedded in 32 NUMEXO2 digitizers and 18 GTS V3 mezzanines housed in NIM modules. After the GTS leaf embedding work, GANIL is studying a new trigger processor able to handle several hundreds of TR. Then, the limitations of the current GTS were pointed out. To get rid of them, GANIL has brought modifications to the GTS leaf firmware and has made a proposal in order to migrate the GTS tree towards the µTCA standard.

A GTS test bench made of a light GTS tree featuring 4 GTS V3 (1 Root, 1 FanIn FanOut, 1 Leaf) and two NUMEXO2 digitizers was presented. Attendees were shown the GTS running: GTS tree was built and calibrated; GTS cycles were issued from common trigger pulses feeding both digitizers; their Time Stamps were seen matching.

4 The MUTANT system
Presentation made by G. Wittwer
http://pro.ganil-spiral2.eu/laboratory/ganil-spiral2-icc/meetings/electronics-wg/iccewg-meeting-1-22-15/mutant-system/view

MUTANT, Multiplicity Trigger and Time, is a synchronization and trigger system which has been developed in the framework of the GET project. MUTANT is a component of the µTCA instrumentation that will equip ACTAR TPC and S3 tracking detectors and is foreseen for the upgrade of the two existing instrumentations of INDRA and CATS detectors. Main features are the 100MHz clock and start/stop sampling signal distributions, the building of the digital multiplicity, the time stamp broadcast, the 3 trigger levels. MUTANT system is based on the master slave concept, allowing the system to handle thousands of detector

channels. Moreover, with the BEM module, MUTANT can be connected to different systems such as GTS and CENTRUM. MUTANT mass production will be launched early this year.

Attendees saw MUTANT test bench made of MUTANT A and B boards, μTCA shelf and modules.

5 The software trigger processor
Presentation made by X. Grave
http://pro.ganil-spiral2.eu/laboratory/ganil-spiral2-icc/meetings/electronics-wg/iccewg-meeting-1-22-15/trigger_soft_22_jan_2015/view

For several months, a software trigger is being investigated in the AGATA acquisition. It aims at fixing the trigger issue which could happen with the implantation of extra Ge clusters and at being a substitute to the firmware trigger processor

A diagram of AGATA data flow was presented, from the very front end to the storage. From the current diagram, two blocks attached to the PreProcessing block output are added: a Head Collector which keeps only the meta data of frame and the wait zone block which memorizes the data until the trigger validation arrives. Assuming a software trigger latency of 30 s and a data rate of 10 Gb/s, a RAM size of 32GB is depth enough. A preliminary version of the software trigger is being tested off line with AGATA data. Attendees agreed on deeper tests should be carried out on line.

6 Discussions

A summary of the synchronization and trigger systems which are being implemented or are planned to be implemented in the detector instrumentations is done:
CENTRUM: FAZIA, INDRA
MUTANT: ACTAR TPC, S3, INDRA, CATS
GTS: AGATA, EXOGAM2, NEDA, PARIS, S3

The current status of the three systems is discussed:
CENTRUM:
For several years, CENTRUM has been used to couple instrumentation GANIL. The system is reliable and fulfills most of the coupling configurations.
MUTANT:
The mass production of 12 modules is ongoing. Moreover, MUTANT will be soon available off-the-shelf. The development of BEM is on the GANIL roadmap.
GTS:
GTS V3 can no more be manufactured; the current firmware trigger processor is not powerful enough for handling extra channels. EXOGAM2 and NEDA are not impacted: both bought enough GTS V3 for building their GTS trees; EXOGAM2 is developing its own trigger processor. It is not the case for AGATA, PARIS and S3 for which the availability issues of GTS V3 and trigger processor must be fixed. GANIL has studied the possibility of a GTS upgrade that consists of the migration of the current GTS system towards the μTCA standard. This upgrade cannot be undertaken without extra human resources who are estimated at 2 FTE during 2 years.

Starting from the GTS issues was originated a discussion about to move from CENTRUM and may be GTS to a new Time Stamping system @ GANIL. G. Wittwer made a presentation (see http://pro.ganil-spiral2.eu/laboratory/ganil-spiral2-icc/meetings/electronics-wg/iccewg-meeting-1-22-15/mmh-concept/view) which shows a system based on MUTANT and MicoTCA MuTANT Hub boards connecting to many modules such as NUMEXO2, FASTER, GAMER, CENTRUM… Such a system, combined with a software trigger processor, would be worthy of investigation.