Final Report of the Working Groups

The Working groups met in four occasions, once every year after the EGAN Workshops.
1) The first meeting took place in Padova on July 1st 2011.
In that occasion the groups were formed and the group leaders elected.
EGAN (ENSAR) TASK 2:   Coordination on Ancillary Instrumentation Subtasks as activity of Working Groups:

- Activity of WG1: Co-operation on the use, design and construction of ancillary detectors to improve the performance and compatibility of the devices.
- Activity of WG2: Co-operation on designing and building the electronics and data acquisition and on the mechanical integration.
- Activity of WG3: Exchange of information on the development of simulation tools.

Aims of the subtasks:
1) exchange of information between the groups involved in the design and construction of ancillary detectors: to optimize the use of present resources and to improve the performance and compatibility of devices presently in the R&D phase.
2) exchange of information between groups responsible of the electronics, data acquisition coordination for the construction of common component. Exchange of information for mechanical integration and mechanical compatibility.
3) exchange of information between groups working on the development of simulation tools for the optimization of the detector design.

***Meeting of the* WG1:** Co-operation on the use, design and construction of detectors aiming to improve the performance and compatibility of the devices: Ancillary / Complementary Instrumentation for Large Ge Arrays. Detectors for new generation RIB facilities.

The goal is to Disseminate Information on:

- Detector availability and capabilities
- R&D on New materials (e.g. solid Scintillators with n discrimination capability)
- R&D on new Solid State or Scintillator detector design (e.g. PAD Si detectors, DSSSD design, etc…).
- R&D on light readout for scintillator detectors

Discussion on the Subtask 1 was done. General agreement on the goals of the W.G. Requested the inclusion of Spectrometers as Complementary Instrumentation

Nominated Convener of this W.G.: Daniele Mengoni (INFN and University of Padova)

Members of the W.G.:
    Johan Nyberg (Univ. Uppsala)

Alejandro Algora (IFIC Valencia)
Maria Doncel (Univ. Salamanca)
Franco Camera (INFN, Univ. Milano)
Andrea Gottardo (INFN-LNL Legnaro)
Tayfun Hüyük (IFIC Valencia)
Francesco Recchia (INFN, Univ. Padova)
Daniele Mengoni (INFN, Univ. Padova)
Jose Javier Valiente Dobon (INFN-LNL Legnaro)
Alfred Dewald (IKP, Univ. Köln)
Matthias Hackstein (IKP, Univ. Köln)
Dave Cullen (Univ. Manchester)
Helen Boston (Univ. Liverpool)
Andy Boston (Univ. Liverpool)
Miroslaw Zieblinski (IFJ-PAN Cracow)
Adam Czermak (IFJ-PAN Cracow)
Piotr Bednarczyk (IFJ-PAN Cracow)
Adam Maj (IFJ-PAN Cracow)
Silvia Leoni (INFN, Univ. Milano)
Didier Beaumel (IPNO Orsay)
Diego Barrientos (IFIC Valencia)
Victor Modamio (INFN-LNL Legnaro)
Akis Pipidis (INFN-LNL Legnaro)
Marcin Palacz (HIL, Univ. Warsaw)
Jan Mierzejewski (HIL, Univ. Warsaw)
Pawel J. Napiorkowski (HIL, Univ. Warsaw)
M. Nizamettin Erduran (Univ. Istanbul)
Andres Gadea (IFIC Valencia)

***Meeting of the* WG2:** Co-operation on designing and building the electronics and data acquisition and on the mechanical integration.

The goal is to Disseminate Information on:

- Interfacing analogue electronics with the Digital electronics arrays
- Development of digital electronics
- High analogue/digital channel densities (ASICS)
- Participation in the trigger decision trees

Discussion on the Subtask 2 was performed and there is a general agreement on the goals of the W.G.

Nominated Convener of this W.G.: Sergio Brambilla (INFN and University of Milano)

Members of the WG2:

Johan Nyberg (Univ. Uppsala)

Sergio Brambilla(INFN, Univ. Milano)
Francesco Recchia (INFN, Univ. Padova)
Andrea Triossi (INFN, Univ. Padova)
Daniele Mengoni (INFN, Univ. Padova)
Jose Javier Valiente Dobon (INFN-LNL Legnaro)
Miroslaw Zieblinski (IFJ-PAN Cracow)
Adam Czermak (IFJ-PAN Cracow)
Piotr Bednarczyk (IFJ-PAN Cracow)
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***Meeting of the* WG3:** Exchange of information on the development of simulation tools.

The goal is to Disseminate Information on:

- New Tools for MC simulation.
- Full Ge array + complementary instrumentation   ☐ full simulat
  figures
- Realistic simulations including physical processes in experimental conditions.

Discussion on the Subtask 3 was performed and there is a general agreement on the goals of the W.G.

Nominated Convener of this W.G.: Marcin Palacz (HIL, Univ. Warsaw)

Members of the WG3:
Johan Nyberg (Univ. Uppsala)
Alejandro Algora (IFIC Valencia)
Maria Doncel (Univ. Salamanca)
Michail Axiotis (DEMOKRITOS Athens)
Tayfun Hüyük (IFIC Valencia)
Francesco Recchia (INFN, Univ. Padova)
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2) The second meeting of the Working groups took place at Orsay on June 28th 2012. During this meeting, we went through ground-breaking ancillary detectors under development for the coupling with a gamma-ray tracking array. Three main aspects as outlined in the previous EGAN edition, see minutes, have been discussed and time-shared during a common session: innovative detectors, electronics and simulation.

The pulse shape analysis in the silicon detector have been presented (J.A.Duenas-Diaz, M. Assie), focusing on the recent experiment led by the GASPARD-HYDE-TRACE collaboration and aiming at the separation via a digital pulse shape discrimination among light charge particles and ions. Kroell presented and alternative analog method to separate light charge particles. Complementary, Jaworski discussed the optimal digital sampling rate to disentangle gamma-ray and neutron by using innovative neutron detectors.

In the second session the front-end electronics needs for large-channel array has been treated. Two options, close to be operational, has been proposed, both considering ASIC solution. The first one AGET (E. Pollacco) foresees a chip of analog memories and it was originally thought, yet not exclusively, for TCP detectors. The second one AIDA (I. Lazarus), a multi-plane Si DSSD array, using a peak detector and a multiplexer implemented in ASICs. A.Triossi briefly presented a promising low-cost digitizer under development for the TRACE Si-pad array, which uses a FPGA with a digital time-to-amplitude converter on board.

In the simulation session the two-layer criterion, LaBr+CsI, have been investigated (O.Stezowski), considering a variable length of the two scintillator. The final geometry of PARIS has been also simulated. M. Krzysiek presented possible experiments with RFD giving the simulated widths of the gamma lines when using complete simulations of GASP+RFD and AGATA+RFD performed with the COMPA event generator. NEDA array simulation has been presented by G.Jaworski, focusing, after the validation of the Geant4 neutron physics,on the options for the final geometries. D. Bloor finally gave a contribution on the LYCCA detector, resident at GSI, able to track and identify the recoiling nuclei and selecting the reaction channels after the secondary reaction.

3) The third meeting of the Working groups was held in Liverpool on June 28th 2013.

In continuity with the two previous editions the meeting of the Working Groups was held in a single session such that everybody had the opportunity to attend all presentations. The sessions included presentations on DSSD Si detectors, Diamond and

Neutron detectors. Presentations focused on the new generation of electronics for Ge-arrays and complementary instrumentation and on the new developments on ASICS. Finally presentations of the ongoing simulation activity, for complementary instruments in the coming campaigns of AGATA and large Ge arrays have been presented.

In the first part, the signals induced in a highly-segmented silicon-strip detector have been classified as coming from charge drift-diffusion, integral and differential cross talk and interstrip effect. The latter has been characterized (J.Duenas) during an experiment held within the GASPARD-HYDE-TRACE (GHT) collaboration. The effect on the the pulse-shape analysis (PSA) discrimination has been also evaluated. In the same experiment the PSA technique has been tested (M.Assie) against the effect of bias, the effect on P and N-side, the filter algorithm and the sampling frequency.
Recent test for the PARIS phoswich detector has been presented by P.Bednarczyk, together with the most likely configuration for the demonstrator to be combined with AGATA for the GANIL phase.
The neutron detector array NEDA has been presented by M.Palacz. The contribution focused on the final 2-pi geometry consisting of 355 identical 3 liter detectors, located 1 m from the target. The design of a single detector is (almost) ready and consists in a standard BC501A scintillator. Test on the FEE electronics, based on NUMEXO2 card and customized FADC, is in progress. Extensive tests of detectors, photomultiplier tubes and algorithms are also in progress to evaluate efficiency, timing, PSD and energy-to-light correlation.
The last talk ideally concluding the first part was devoted to the diamond-based detectors for charged radiations (A. Lohstroh). The contribution focused on some attractive properties of diamond for radiation detection, the challenging growth of artificial diamond, the demonstration of high performance in terms of spectroscopy and timing and some yet unresolved issues. The feasibility of larger area and more radiation hardness detectors have been also discussed.

In the second part two FEE-BEE systems for traditional Compton-Shielded HPGe detector array, EXOGAM ans GALILEO, have been presented by M.Tripon and D.Barrientos respectively. The NUMEXO2 digitizer cards for EXOGAM have been validated and a mass production is soon expected. Synergy exists with most of the detectors foreseen for the SPIRAL2 phase. The GALILEO electronics, which represents the second release of the AGATA electronics, is presently under test at LNL.
Within this working group, trigger options for the future combination of fully pipelined gamma array either with traditional and digital complementary detectors have been extensively explored.

In the last part, devoted to simulation activities, M. Labiche gave a survey of the AGATA Geant4 simulation package with all those complementary detectors presently available in the simulation suite. A call for the still missing detectors in the simulation has been also pursued.
D. Mengoni presented a signal simulation, based on the AGATA Data Format (ADL) library, for the light charge particles interacting in a highly segmented silicon array. The

results were able to account for the experimental results achieved during the PSA tests of the GHT collaboration.
An update of the PARIS simulation results was given by O. Stezowski, mainly focusing on a virtual scan of a phoswich detector by using a Geant4 simulation.

4) The fourth Working Groups Meeting took place in GIS (Darmstadt) on June 25th 2014.

In continuity with the previous editions the meeting of the Working Groups was held in a single session such that everybody had the opportunity to attend all presentations. The sessions included presentations on new scintillator detectors, integrated electronics for highly-segmented silicon detectors and simulation of various setup.

In the first part, and exhaustive presentation on the new scintillator detectors, such as CLYC and GYGAG, was given by A.Giaz. The large potentiality of the CLYC were accounted for. The typical capability of disentangling protons from gammas, that is based on the different pulse shapes induced by such radiation, is combined with the possibility to detect both thermal and fast neutrons and the use of an energy signal in addition to the common time signal for the neutrons. The performance obtained with different photomultiplier was also reported.

In the second part, talks about the two FEE systems for highly segmented silicon arrays, were given by S. Capra, JJ. Dormand and finally R. Aliaga focused onto a solution, made up of cascade of analog memories to read out the signals out of the preamplifier chips. S. Capra discussed the design of a multichannel charge-sensitive preamplifier for solid state detectors with tunable parameters through I2C interface. R. Aliaga presented the a self-triggered, deadtime-less analog memory ASIC for TRACE. JJ. Dormand presented a possible implementation of a dual charge-current preamplifier for GASPARD.

In the last part, devoted to simulation activities, a series of talks was given, concerning some of the detectors, which are candidates to be combined with AGATA in the GANIL phase, such as EXOGAM, PARIS and NEDA. Each talk presented the actual status of the respective simulation package. In addition the full simulation suite of the SAGE facility at JYF, together with the current development of the SPEDE detector for ISOLDE was given.