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FINAL REPORT ON THE ACTIVITY OF THE SCIENTIFIC COMMITTEE
AND WORKING GROUPS

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LIST OF ACRONYMS AND ABBREVIATIONS

ScC	Scientific Committee
StC	Steering Committee
WGs	Working Groups

EXECUTIVE SUMMARY

Introduction

NUSPIN is the network in ENSAR2 for the Nuclear Spectroscopy and Complementary Equipment community involved in frontline research on nuclear structure, reaction dynamics and applications. The main goals are the promotion and coordination of scientific and technological activities, the exchange of knowledge and transfer of expertise between the working groups including training of young researchers, and the optimisation of the use, construction and maintenance of the resources.

Scientific Committee

The main goals of the Scientific Committee are:

- to promote collaborative ventures for the optimisation of the use of the resources
- to encourage the pooling of distributed equipment at the different infrastructures
- to enhance synergies between complementary resources for common large-scale projects
- to promote the research on new detection methods and techniques.

Members of the Steering Committee are representatives from the ENSAR2 Infrastructures and the main collaborations and institutions in Europe:

Michael Bentley (York)
Alison Bruce (Brighton)
Giacomo de Angelis (LNL)
Gilles de France (GANIL)
Gilbert Duchene (Strasbourg)
Maria Jose Garcia Borge (Madrid)
Juergen Gerl (GSI)
Georgi Georgiev (Orsay)
Paul Greenlees (Jyväskylä)
Jan Jolie (Cologne)
Wolfram Korten (Saclay)
Silvia Leoni (Milano)
Adam Maj (Krakow)
Gerda Neyens (CERN)
Johan Nyberg (Uppsala)
Peter Reiter (Cologne)
Berta Rubio (Valencia)
Calin Ur (Bucharest)

The Scientific Committee has met every year during the week of the annual NUSPIN Workshop:

1. **First ScC Meeting:** Venice, 28/06/2016: As this was the first meeting, there were oral presentations from the members of the ScC illustrating the activities in the respective institutions or collaborations.

2. **Second ScC Meeting:** Darmstadt, 28/06/2017: There was a discussion on the problem of maintaining the valuable equipment, in particular Ge detectors. Some laboratories and/or collaborations have engineers and technicians who have developed useful skills that could be shared and transferred to other laboratories. It was decided to organise a workshop the following year where for the first time these experts will meet and exchange experience and techniques. This will help the transfer of know-how as well as the collaboration between the different laboratories. The meeting would be organised at the University of Cologne in 2018.
3. **Third ScC Meeting:** Valencia, 26/06/2018: The WP Leader reported on the meeting between the AGATA management and the directors of the hosting ENSAR2 facilities, organised by NUSPIN in GANIL on February 22, 2018 (LNL, GSI/FAIR, ISOLDE, GANIL). A discussion followed on the different possibilities envisaged for the future AGATA campaigns.
The WP Leader reported on the future Hands-on Workshop on the Operation, Test and Repair of Ge Detectors, organised by NUSPIN in Cologne on September 4-7, 2018. The Workshop was suggested by the ScC in the 2017 meeting at GSI and was organised by J. Gerl, D.R. Napoli, and P. Reiter and can be found at (<http://agenda.infn.it/event/nuspin.hpge2018>). The number of registered participants exceeded by large the expectations.
There was a discussion on the arguments to be covered by the NUSPIN School on gamma detectors to be organised in 2019 in Liverpool.
An exchange of information followed on the opportunities at the different infrastructures, the availability of resources, the distribution of resources and planned campaigns, exchange and pooling opportunities.
4. **Fourth ScC Meeting:** Orsay, 26/06/2019. After a presentation by the NUSPIN coordinator about the status and perspectives of the network, the ScC discussed the organisation of a hands-on school on Nuclear reactions for Spectroscopists. Historically, the nuclear structure and nuclear reactions communities have grown without much exchange or collaboration. However, with the advent of radioactive beams, the mutual knowledge of reaction mechanisms and nuclear structure have become more and more important to plan experiments and interpret the data. Moreover, gamma-ray spectrometers have become a key tool for reaction-mechanism studies. A NUSPIN hands-on school will therefore be organised in the summer of 2020.

COORDINATION MEETING FOR THE AGATA CAMPAIGNS. The meeting between the AGATA management and the directors of the hosting laboratories took place at GANIL on February 22, 2018. The participants were the directors (or their representatives) from the ENSAR2 facilities GANIL, LNL-INFN, GSI/FAIR, ISOLDE-CERN, the chair of the AGATA Steering Committee, the chair of the AGATA Managing Board, the AGATA Project Manager at GANIL and the NUSPIN Coordinator. After the presentations from the AGATA management, the directors presented the status of the different infrastructures and their plans to host AGATA. There was ample time for discussions and exchange of information in a very collaborative atmosphere.

WORKING GROUPS:

The Working Groups in NUSPIN aim at cooperating on the use, research and development of the detectors and improving the performance and compatibility of the devices: mechanics, electronics, data acquisition, simulations tools, R&D. The Working Groups are coordinated by Daniele Mengoni (Univ. Padova).

The first meeting of the WGs took place in San Servolo, Venice International University on June 28, 2016. Following the introduction by the WG Convener, Dr. Daniele Mengoni, several oral presentations were given by the participants on the four different subjects of the WGs. The WGs were then formed and the respective conveners elected:

WG1: High-resolution gamma-ray spectroscopy. Convener: Francesco Recchia (University of Padova and INFN)

WG2: Particle detectors. Convener: Marlène Assié (CNRS, Orsay)

WG3: High-efficiency and fast-timing scintillator detectors. Convener: Enrique Nacher (CSIC, Madrid)

WG4: Devices for nuclear moments and transition probabilities. Convener: Alain Goasduff (University Of Padova and INFN)

There are common interests among the members of the different WGs that are not exclusive and therefore some researchers participate in more than one WG. The list of members can be found in the website and has been communicated in the deliverable D4.1.

Members of the WGs are:

WG1: BEDNARCZYK, Piotr (IFJ-PAN), BENTLEY, Michael (University of York), BENZONI, Giovanna (INFN-MI), BOSO, Alberto (Univ. Padova), BRUCE, Alison (University of Brighton), CLEMENT, Emmanuel (GANIL), CULLEN, David (University of Manchester), DE FRANCE, Gilles (GANIL), GADEA RAGA, Andres F. (IFIC CSIC-University of Valencia), GEORGIEV, Georgi (CSNSM), GIAZ, Agnese (Padova University), GOASDUFF, Alain (Padova University), Prof. GREENLEES (University of Jyväskylä), HADYNSKA-KLEK, Katarzyna (INFN LNL), HUYUK, Tayfun (CSIC - Universidad de Valencia), JAWORSKI, Grzegorz (INFN-LNL), JOHN, Philipp Rudolf (TU Darmstadt), KORICHI, Amel (CSNSM-IN2P3/CNRS), KROLL, Thorsten (TU Darmstadt), LEONI, Silvia (Milano University and INFN), LI, Hongji (GANIL), LJUNGVALL, Joa (CSNSM), LOPEZ-MARTENS, Araceli (CSNSM), MAJ, Adam (IFJ PAN Krakow), MARGINEAN, Nicolae (IFIN-HH), MENGONI, Daniele (University of Padova and INFN), NANNINI, Adriana (INFN-Firenze), NAPOLI, Daniel Ricardo (INFN-LNL), NYBERG, Johan (Uppsala University), PAKARINEN, Janne (University of Jyväskylä), PETRACHE (University Paris Sud & CSNSM-CNRS/IN2P3), PULLIA, Alberto (University of Milano & INFN), PREZ VIDAL, Rosa (IFIC-CSIC Valencia), RALET, Damian (CSNSM), RECCHIA, Francesco (University of Padova and INFN), REITER, Peter (IKP University of Cologne), RICCETTO, Serena (Università di Perugia), ROCCHINI, Marco (University of Florence and INFN), SICILIANO, Marco (University of Padova and LNL), SMITH, John F. (University of the West of Scotland), THEISEN, Christophe (CEA Saclay), UR, Calin Alexandru (ELI-NP / IFIN-HH), VALIENTE DOBON, Jose' Javier (INFN-LNL), VOGT, Andreas (University of Cologne), VON SCHMID, Mirko (IKP TU Darmstadt), ZIELINSKA, Magda (CEA Saclay).

WG2: ALIAGA, Ramon J. (IFIC-CSIC- University of Valencia), BEDNARCZYK, Piotr (IFJ-PAN), BENTLEY, Michael (University of York), BENZONI, Giovanna (INFN-MI), BOSO, Alberto (Univ. Padova), CANET, Francisco Javier Egea (INFN-Padova), CAPRA, Stefano (Milano University). CLEMENT, Emmanuel (GANIL), CULLEN, David (University of Manchester), DE ANGELIS, Giacomo (INFN-LNL), DE FRANCE, Gilles (GANIL), Prof. ERDURAN, M. Nizamettin (Istanbul Zaim University), FLAVIGNY, Freddy (IPNO), FRANSEN, Christoph (Institut fur Kernphysik Koln), GADEA RAGA, Andres F. (IFIC CSIC-University of Valencia), GALTAROSSA, Franco (INFN LNL), HADYNSKA-KLEK, Katarzyna (INFN LNL), JOHN, Philipp Rudolf (TU Darmstadt), KORICHI, Amel (CSNSM-IN2P3/CNRS), KROLL, Thorsten (TU Darmstadt), LEONI, Silvia (Milano University and INFN), LJUNGVALL, Joa (CSNSM), MARCHI, Tommaso (IKS KU), MENGONI, Daniele (University of Padova and INFN), NANNINI, Adriana (INFN-Firenze), OBERTELLI, Alexandre (CEA Saclay), PULLIA, Alberto (University of Milano & INFN), RECCHIA, Francesco (University of Padova and INFN), ROCCHINI, Marco (INFN and University of Florence), TESTOV, Dmitry (University of Padova and INFN), THEISEN, Christophe (CEA Saclay), VALIENTE DOBON, Jose' Javier (INFN-LNL), VOGT, Andreas (University of Cologne), VON SCHMID, Mirko (IKP TU Darmstadt), ZIELINSKA, Magda (CEA Saclay).

WG3: ALGORA, Alejandro (IFIC CSIC- Uni. Valencia), BEDNARCZYK, Piotr (IFJ-PAN), BENZONI, Giovanna (INFN-MI), BOSO, Alberto (Univ. Padova), BRUCE, Alison (University of Brighton), Dr. DUDOUE (IPNL),

GADEA RAGA, Andres F. (IFIC CSIC-University of Valencia), GIAZ, Agnese (Padova University), JOHN, Philipp Rudolf (TU Darmstadt), LEONI, Silvia (Milano University and INFN), LI, Hongji (GANIL), LOPEZ-MARTENS, Araceli (CSNSM), MAJ, Adam (IFJ PAN Krakow), MARGINEAN, Nicolae (IFIN-HH), MENGONI, Daniele (University of Padova and INFN), PREZ VIDAL, Rosa (IFIC-CSIC), RALET, Damian (CSNSM), RECCHIA, Francesco (University of Padova and INFN), RICCETTO, Serena (Università di Perugia), RUBIO, Berta (IFIC CSIC- Uni. Valencia), SICILIANO, Marco (University of Padova and LNL), SMITH, John F. (University of the West of Scotland), THEISEN, Christophe (CEA Saclay), UR, Calin Alexandru (ELI-NP / IFIN-HH), VALIENTE DOBON, Jose' Javier (INFN-LNL), VOGT, Andreas (University of Cologne), VON SCHMID, Mirko (IKP TU Darmstadt), ZIELINSKA, Magda (CEA Saclay).

WG4: BEDNARCZYK, Piotr (IFJ-PAN), BENZONI, Giovanna (INFN-MI), BOSO, Alberto (Univ. Padova), BRUCE, Alison (University of Brighton), CLEMENT, Emmanuel (GANIL), CULLEN, David (University of Manchester), CULLEN, David (University of Manchester), DE ANGELIS, Giacomo (INFN-LNL), GADEA RAGA, Andres F. (IFIC CSIC-University of Valencia), GEORGIEV, Georgi (CSNSM), GOASDUFF, Alain (Padova University), HADYNSKA-KLEK, Katarzyna (INFN LNL), JOHN, Philipp Rudolf (TU Darmstadt), LEONI, Silvia (Milano University and INFN), LJUNGVALL, Joa (CSNSM), MENGONI, Daniele (University of Padova and INFN), NANNINI, Adriana (INFN-Firenze), RALET, Damian (CSNSM), RECCHIA, Francesco (University of Padova and INFN), RICCETTO, Serena (Università di Perugia), ROCCHINI, Marco (INFN and University of Florence), SMITH, John F. (University of the West of Scotland), TESTOV, Dmitry (University of Padova and INFN), UR, Calin Alexandru (ELI-NP / IFIN-HH), VALIENTE DOBON, Jose' Javier (INFN-LNL), VOGT, Andreas (University of Cologne), VON SCHMID, Mirko (IKP TU Darmstadt), ZIELINSKA, Magda (CEA Saclay), VALIENTE DOBON, Jose' Javier (INFN-LNL), ZIELINSKA, Magda (CEA Saclay).

The second meeting of the WGs took place at GSI on Wednesday, 28 June 2017. It was organised within the NUSPIN workshop in order to maximise the participation in the event. Approximately 30 scientists participated in the meeting. There were 11 oral presentations. During the WGs meeting, after a short introduction, four sessions on the four WG topics took place sequentially.

On the topic of WG1 “Perspective for the use of gamma-ray spectrometers” three contributions were presented. These ranged from the perspective of having a distributed detector laboratory of the community to the description of future set-ups like JUROGAM III as well as new set-ups involving superconducting solenoids and germanium detectors.

On the topic of WG2 “Particle detectors”, which involves “Data treatment for PSA, FEE, and beam-tracking devices”, also three contributions were presented with topics including the effect of radiation damage on PSA, new electronic developments for analogue sampling based on ASICS as well as new techniques for sub-picosecond time-resolution measurements in beam-tracking devices.

On the topic of WG3 “High-efficiency and fast-timing scintillators”, contributions were presented on the high-energy response of LaBr₃ detectors, the digital electronics strategies for ultra-fast scintillator detectors and on innovative solutions for the CALIFA end-cap scintillator detector array.

On the topic of WG4 involving “Coupling a plunger device with a particle detector”, two contributions, one on a new plunger device and another on high-precision g-factor measurements, were presented.

There was ample time for discussions and exchange of information.

The third meeting of the WGs took place at the IFIC Research Institute, in Valencia, Spain, on June 26, 2018. It was organised within the NUSPIN 2018 workshop in order to maximise the participation in the event. Approximately 35 scientists participated in the meeting. This time there was a general oral presentation for each WG, followed by

one/two short selected presentation for each WG, with a total of 8 oral presentations. This organisation allowed to have more time available for the discussion and exchange of information.

On the topic of WG1, the introductory talk was about “Nuclear structure by missing-mass and gamma-ray spectrometry” followed by “COMSOL simulations of HPGe detectors with multiple contacts” and “Novel contacts in HPGe for gamma ray detectors” by young researches.

On the topic of WG2 “Particle detectors”, there was a talk on “Charged-particle detection systems for direct reaction studies”.

On the topic of WG3 “High-efficiency and fast-timing scintillators”, the selected topic was “Development of a new scintillation detector based spectrometer at RIBF” followed by another contribution on “Recent news from the PARIS array”.

Finally, on the topic of WG4 involving “Coupling a plunger device with a particle detector” a contribution on “Internal conversion electron measurements at SPES” was presented.

There was ample time for discussions and exchange of information.

The fourth meeting of the WGs took place at IPN Orsay, France, on June 26, 2019. This meeting was nuclear-astrophysics oriented in order to exchange information and start new ventures.

There have been plenary presentations on recent developments:

- Charge-exchange reaction studies combined with high-resolution γ -ray spectroscopy for astrophysical applications
- LUNA: Underground laboratory to study primordial and stellar nucleosynthesis using particle and gamma detectors
- Transfer reactions for explosive nuclear astrophysics
- Nuclear astrophysics with TAS (Total Absorption Spectrometer)
- PANDORA: an experiment for measuring nuclear beta decays of astrophysical interest in magnetised plasmas

These presentations were followed by a general discussion.

CONCLUSIONS

The Scientific Committee has met along the period of the project during the same week as the NUSPIN Workshops. Several initiatives were discussed and workshops and schools planned. There has been an exchange of information on ongoing and future physics campaigns, including AGATA, on the use and status of the resources, on future plans at the different ENSAR2 infrastructures by the gamma-spectroscopy collaborations.

An extension of the networking to the community on nuclear reactions research is considered a wonderful opportunity to strengthen the research at the ENSAR2 facilities.

The pooling of resources has been promoted with high success.

The organisation of a meeting between the AGATA management and the directors of the hosting laboratories was very successful.

The meetings of the WGs served to show the developments and perspectives of the different types of detectors at the different infrastructures and institutions. There was an exchange of information and experience, together with a

discussion on possible cooperation and sharing of equipment. An extension of the collaboration to other neighbour communities, such as the nuclear astrophysics one, opens new opportunities to both communities at the different ENSAR2 infrastructures.