Barlini Sandro

EDUCATION:

1996- High School Dipl, “Liceo Scientifico”

2002- Master thesis at the University of Bologna (Italy) with 110/110 with LAUDE discussing the thesis “Multiframmentazione in reazione fra ioni pesanti con l’apparato Garfield. Calibrazioni e risultati preliminari”.

2006- Ph.D thesis at the University of Padova discussing the thesis “Damping mechanisms of the Giant Dipole Resonance at high excitation energy using the Garfield and Hector setup”.

EMPLOYMENT:

2006-2008 Post-Doc experience in France for 2 years in the FAZIA collaboration

2008-now University of Florence with different temporary positions (assegnista, Rtd a, RtD b)

December 2021-now Professore Associato at University of Florence

RESEARCH ACTIVITIES:

During his 20 years of research, he accumulated experience in heavy-ion reactions, detectors and digital electronics mainly in the GARFIELD and FAZIA collaborations. GARFIELD is an INFN (Italian) based initiative with strong contacts with other groups (both from Italy and Poland); FAZIA is an international collaboration.

Master Thesis and Ph.D:

The Master Thesis and Ph.D concern experiments performed at L.N.L. (National Laboratories of Legnaro) with the GARFIELD (General ARray for Fragment Identification and for Emitted Light particles in Dissipative collisions) apparatus[1]. In particular, during the Master thesis he approached the problem of Nuclear Equation of State and dynamic and thermodynamic of the nuclear reaction studying the reaction $^{32}S + ^{58,64}Ni$ at 15.5 AMeV ([2][3]). This field of study is still up to date, not only for GARFIELD but also for the FAZIA collaboration.

In the Ph.D period, the GARFIELD apparatus has been coupled with some BaF_2 crystal for gamma detection from the HECTOR group giving the possibility to study the Giant Dipole Resonance in Compound Nucleus (CN). The systems $^{64}Ni + ^{68}Zn$ at 500,400 and 300 MeV and $^{16}O + ^{112}Mo$ at 250 MeV has been studied, all producing the same CN in case of complete nuclear fusion. The analysis showed a strong difference of the energy spectra of light charged particles emitted by the CN, comparing the symmetric and asymmetric reaction entrance channels [4][5], producing a different estimation of the energy and mass losses from the hot CN due to pre-equilibrium emission. This different behavior changes the effective properties of the GDR [6] in the two systems.

French Post-Doc:

In May 2006, S.B. started a fellowship inside the FAZIA (Four-pi A and Z Identification Array) collaboration in France. FAZIA is a new detector for charged particles, fully digital and based on three stage telescopes (Silicon 300 um-Silicon 500 um – CsI(Tl)). During this period, S.B. started his studies on the Pulse Shape Analysis (PSA) with FAZIA Silicon detectors in order to decrease the identification threshold with respect to the standard ΔE-E technique. He showed that the maximum of the current signals is a very simple and useful parameter for PSA [7], as confirmed in the years with many other FAZIA tests.

Italian contracts:

In July 2008, S.B. came back to Italy obtaining different consecutive temporary contracts with the University and INFN-Florence until 31/12/2013. Then, he got a RtD a contract at the University of Florence until 30/11/2018, transformed in RtD b and finally he got the position of Professore Associato. Within these contracts, besides the new teaching duties started in 2013, he is continuing his strong work in the FAZIA and GARFIELD collaborations, offering his effective contribution in all the experimental phases from detector and electronics test and preparation to final data analysis.

Details of the activity within the FAZIA collaboration:

Starting from 2006, S.B. has participated to all the FAZIA tests or experiments, helping to the preparation, data taking and analysis, with a strong and important contribution in all the published articles.

Among the various results, it is worth to cite first the excellent ion identification capability, in terms of ΔE-E and PSA technique obtained with the FAZIA telescopes [8]. The contribution of S.B. to achieve these results has been decisive. His contribution has been also relevant in the investigation of the effect of worsening of PSA due to radiation damage in the Silicon diodes [9].

Thanks to the excellent quality of the ion identification, the widely debated issue of the isospin transport [10] and of the yield staggering [11] at the Fermi energies has been devised and performed in 2012. By using a single FAZIA telescope it has been possible to focus on these subjects, validating and extending other published results to larger fragment masses.

Starting from 2015, the first real experiments with at least 4 FAZIA blocks have been performed at the Laboratori Nazionali del Sud. In particular

- ^{80}Kr+^{40,48}Ca@35 AMeV and ^{40,48}Ca+^{40,48}Ca@35 AMeV to study the Quasi-Projectile (QP) decay and the isospin transport phenomena to approach the Nuclear Equation of State (NEoS).
- ^{20}Ne,^{32}S+^{12}C@25,50 AMeV to study the In-medium effects on cluster formation and/or decay.
- ^{40,48}Ca+^{12}Ca@**25,**40 AMeV to study how the excess of the neutron in ^{48}Ca with respect to the ^{40}Ca is effectively transmitted in the fragments produced in the reaction as a function of the beam energy.

- The test measurement on $^{12}C+^{12}C$@62 AMeV to measure at 0° degree the cross-sections of the different channels (perfectly identified by the FAZIA telescopes) in order to evaluate the average nuclear radius. The same approach with a similar apparatus will be used in more interesting reactions using exotic beams from fragmentation.

S.B. has been deeply involved in the mounting of the set-up for all those experiments, in the data taking and indirectly in the data analysis mainly approached by the Ph.D students of the Florence group. For the $^{40,48}Ca+^{40,48}Ca$@35 AMeV measure he is also co-spoken person. The first results concerning the first two experiments has been recently published. In [12,13] the reaction $^{80}Kr+^{40,48}Ca$@35 AMeV is fully analyzed. In [12], the dynamical fission of the excited QP interacting with different isotopes of Ca is approached. Respect to previous studies, the excellent performance of the FAZIA detector permits to extend the isospin investigation of fission fragments up to Z around 24. The study of the isospin transpo**rt is a**pproached in [13]. Once more, the excellent isotopic identification reached by FAZIA permits to study the isospin also in heavier nuclei than before. The experimental data are compared with a refined reaction model based on molecular dynamics (AMD) followed by an after-burner (GEMINI) filtered to reproduce the geometry and resolution of the experimental apparatus. A slightly better agreement is obtained using a stiff prescription, in the model, for the symmetry energy term of the EOS. In [14] the analysis of the $^{40,48}Ca+^{40,48}Ca$@35 AMeV is presented. The more interesting aspect of this experiment is the possibility to investigate the isospin transport through the imbalance ratio technique; for the first time this has been applied not only to the dissipative channel where a QP remnant survives after the de-excitation (i.e. a massive fragment at the end of the QP* decay is detected) but also to the channel where a secondary fission-like process lead to two fragments coming from the QP* rupture. The imbalance ratio is studied as a function of a centrality estimator in the two reaction channels and is compared with the predictions of the AMD+GEMINI model scheme. The data clearly show the evolution of the isospin transport toward charge-equilibration with increasing centrality and a substantial similarity of this trend for the two channels, when the QP decay via evaporation or breakup.

Since 2019, FAZIA has reached its final configuration of 12 blocks to create a FAZIA wall at forward angle ($1.5°\leq\theta\leq14°$) coupled to the 4π INDRA detector in the GANIL laboratory. A first measurement also devoted to the isospin transport and its connection with the NEoS has been already performed**.** The aim is to explore isospin dynamics with the imbalance ratio for the heavier systems $^{58,64}Ni+^{58,64}Ni$ measured at two bombarding energies 32 e 52 AMeV**.** This represents a very important step forward in such type of studies because the FAZIA detectors will permit to separate isotopes until Z=20-25, as never done using similar detectors, while INDRA will permit a good event selection thanks to its large angular coverage. It is important to underline the very important contribution of S.B. in the preparation of the detectors and the final assembling of the FAZIA blocks which is performed in the Florence laboratory under responsibility of the local group.

The contribution of S.B. in the FAZIA activity is pointed out by his responsibilities in the FAZIA collaboration. In fact, from January 2011 up to now, S.B is co-responsible of the Task Group in charge of the FAZIA data analysis and from 2018 is also member of the FAZIA Project Management Board (FPMB).

Details of the activity within the GARFIELD collaboration:

Since his master thesis, S.B has been deeply involved in experiments with the GARFIELD apparatus at LNL. The activity with GARFIELD is related to the characterization of nuclear reactions at moderate energies and in

particular to some details of the emission of particles and clusters which deviate from the conventional description within the statistical model for hot nuclei. These studies have been done on medium-heavy systems where the main goal was the evolution of the decay with increasing bombarding energies and on reactions with light nuclei, to put into evidence the effects related to alpha-cluster structure.

Just to give an idea and limiting to some recent activities, I mention a series of experiments in collaboration with the HECTOR group (made of Milan and Krakow scientists). This has a particular value because the coupling of the Garfield array for charged particles with a set of BaF2 for hard gamma rays allowed quite interesting and exlusive studies on nuclear properties performed using fusion-like reactions. The experiments are as it follows:

1) ^{37}Cl+^{44}Ca@154 MeV compared to ^{40}Ca+^{40}Ca@200 MeV to study the isospin mixing effect at high temperature [15]

2) ^{48}Ti+^{40}Ca@300,450 e 600MeV to investigate signals of a possible Jacobi phase transition through the GDR emission [16,17] and to estimate the contribution of non-statistical emission of particles with increasing energy.

3) ^{16}O+^{116}Sn@192 MeV to complete a previous measurement to study the Prompt Dipole emission of this system at different energies [18]

S.B. has participated in the experiment preparation and data analysis of all those experiments, also coordinating the work between the Italian and Polish parts of the collaboration, focusing his contribution on the calibrations and analysis of the charged particle detectors and strongly contributing to the paper writing.

In 2011, a series of experiments was performed on nuclear thermodynamics with GARFIELD, devoted to the isospin equilibration process. The focus was on the reaction ^{32}S+^{40,48}Ca@17.7 AMeV. The idea was to study the mechanism of neutron-proton exchange that is responsible of the energy dissipation and of the trend to equilibration with reaction centrality. The data were compared to model predictions to check the sensitivity of the symmetry energy term of the Nuclear Equation of State even at relatively low bombarding energies [19].

As said, a second important general research field with GARFIELD is that of cluster correlations in nuclei, studied using reactions between very light systems at typical Tandem energies (as ^{12}C+^{12}C@96 MeV, ^{14}N+^{10}B@80.7 MeV, ^{16}O+^{12}C @90,110 and 130 MeV, ^{24}Mg+^{12}C@162MeV). The small size of such systems and the wide angular coverage of the apparatus permits to access events which are complete or quasi-complete in charge, allowing also for precise particle correlations. Some results connected to the ^{12}C+^{12}C system have been published [20-24]. In particular, in [20] the ^{12}C+^{12}C reaction is studied comparing the experimental data with a statistical Hauser-Feshbach (HF) code, optimized in the A≈20 region, in which also a relevant part of discrete decay channels is included (in other words the properties of known excited states are explicitly considered in the decay chains) In [21-22], the “complete” (Qtot=12) or “almost-complete” (Qtot>=10) events have been analyzed in terms of proton and alpha emission (LCP) in coincidence with a charge identified heavy residue (after fusion) showing that the channels C+3α and O+2α are the ones where differences from a pure HF decay appear. This suggests a certain effect of the underlying alpha-structure even in the decay from very excited states of 24Mg, and/or the possibility of a strong contribution direct reactions**.** In [23], a particular attention is dedicated to the ^{12}C* decay from the Hoyle state populated in the inelastic reaction or from the decay of the ^{24}Mg*. The characteristics of the Hoyle state decay are very similar in the two samples and point to a mainly sequential decay through the population of an intermediate Be-8(gs), with a small contribution (around 1%) from simultaneous processes. The decay of

the excited ^{16}O into 4 alpha particles emitted in the reaction $^{16}O+^{12}C$ @130 MeV is approached in [24]. Once more, using the particle-particle correlation, it is possible to disentangle the different decay chains.

The interest of those studies with light systems is such that, after an important upgrading of the apparatus involving mainly the digital electronics and an improvement of the cabling, other systems have been measured such as $^{18}O+^{12,13}C$@300 and 130MeV, to complete the series of measurements on the Silicon CN decay.

A recent attempt has been done with the GARFIELD setup, to extend the study on alpha cluster effects to heavier nuclei, to see if they persist in the decay of CN formed in fusion reactions. For such a reason, 4 different reactions using alpha or not alpha-cluster nuclei leading to the same $^{46}Ti^*$ CN have been performed and analyzed. The details of the evaporative emissions (Z=1,2 particles) in coincidence with the CN measured at forward angles has shown a possible slight effect of alpha structure persisting also for these nuclei. The analysis is finished and accepted for publication [25]

Others collaborations:

•S.B has been involved also in the X-Rays French-Italian collaboration, which investigated the measurement of lifetimes and fission-times of super-heavy elements (Z around 120) using the analysis of the X-rays created in their internal shell [26].

• S.B. is in contact with many Polish Researchers through the POLITA collaboration. S.B has proposed a project with the title “Tests of scintillator detectors (CsI, Polysiloxane) with protons at Cyclotron Center Bronowice IFJ PAN” to the HARMONIA call which has been approved. In 2017, the International Advisory Committee of the CCB has approved an experiment with the FAZIA and GARFIELD CsI crystal realized in 2018 and 2019. The results of this test on the energy calibration of CsI(Tl) with proton are published in [27], pointing out a non-linearity in energy response at high energy and giving an experimental measure of the proton inefficiency detection due to a nuclear energy loss compared with a GEANT4 simulation.

[1] F.Gramegna et al., 2004 IEEE Nuclear Science Symposium, Medical Imaging Conference, and Workshop of Room-Temperature Semiconductor Detectors

[2] M.D’Agostino et al., Nucl.Phys. A 861(2011), 47

[3] M.D’Agostino et al., Nucl.Phys. A 875(2012), 139

[4] F.Gramegna et al., Acta Phys. Pol. B36-4(2005), 1155

[5] V.L.Kravchuk et al, Eur. Phys.Journ., EPJ Web of Conferences 2 (2010), 10006

[6] O.Wieland et al., Journal of Physics G 31 (2005), S1973

[7] S.Barlini et al., NIMA 600 (2009), 644

[8] S.Carboni, S.Barlini et al., NIMA 664 (2012), 251

[9] S.Barlini et al., NIMA 707(2013), 89

[10] S.Barlini et al., Phys. Rev.C87(2013), 054607

[11] S.Piantelli et al., Phys. Rev.C88(2013), 064607

[12] S.Piantelli et al., Phys. Rev. C 01 (2020), c034613

[13] S.Piantelli et al., Phys. Rev.C 103 (2021), 014603

[14] A.Camaiani et al., Phys. Rev.C 103 (2021),014605

[15] A.Corsi et al., Phys.Rev. C 84(2011),041304(R)

[16] S.Valdre et al., Phys.Rev. C 93(2016),034617

[17] M.Ciemala et al., Phys.rev. C 91(2015), 054313

[18] A.Giaz et al., Phys.Rev. C 90(2014),014609

[19] S.Piantelli et al., Phys.Rev. C 96(2017), 034622

[20] G.Baiocco et al., Phys. Rev. C 87(2013), 054614

[21] L.Morelli et al., J.Phys. G : Nucl.Part.Phys. 41 (2014), 075107

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[23] L.Morelli et al., J.Phys. G : Nucl.Part.Phys. 43 (2016), 045110

[24] M.Bruno et al., J.Phys. G : Nucl. Part.Phys. 46 (2019), 125101

[25] M.Cicerchia et al., J. Phys. G : Nucl. Part.Phys. accepted

[26] M.O.Frégeau, Phys.Rev.Lett. 108, 122701 (2012)

[27] C.Frosin et al., NIMA 951(2020), 163018

Scientific Responsibilities:

- National Responsible of the NUCLEX project (which include the GARFIELD and the Italian part of the FAZIA project) from July 2015 to 2021

- Local Responsible of the NUCLEX project for Florence from July 2015 to now

- Member of the commission for the judgment of temporary position for the INFN-Florence (2015-2017).

- Co-responsible of the Task Group in charge of the FAZIA data analysis from 2018

- Member of the FAZIA Project Manager Board (FPMB).

Tutorial activities:

- Supervisor for the Post-Doc Diego Gruyer (INFN-Florence) between October 2014 and March 2015.

- Supervisor for the Post-Doc Alberto Camaiani (INFN-Florence) between November 2019 and October 2020

- Supervisor for the Post-Doc Catalin Frosin (INFN-Florence) from November 2020

- Supervisor for the thesis “Determinazione di Energia, Carica e Massa di frammenti nucleari mediante un telescopio ΔE -E a Silicio dell'apparato FAZIA.” of Daniel Tossani, Tesi di Laurea Triennale in Fisica e Astrofisica.

- Co-supervisor for the thesis “Misura degli effetti di non linearità nella risposta energetica di rivelatori CsI(Tl)” of Lucia Baldesi, Tesi Triennale in Fisica ed Astrofisica

- Supervisor for the Ph.D thesis “Commissioning tests under beam of the new Active Target detector ATS in the perspective of experiments on the isoscalar giant resonances” of Antonio Buccola (University of Florence)

-Supervisor for the Master Thesis “Study of the fusion-evaporation channel in the $^{18}O+^{12}C$ system at 17 AMeV bombarding energy” of Lucia Baldesi (University of Florence)

-Supervisor for the thesis “High-precision determination of the positioning of the gamma-ray spectrometer MINIBALL at CERN exploiting the Doppler effect “ of Filippo Simonelli, Tesi Triennale in Fisica ed Astrofisica

Other:

- Referee for different Journal as Nuclear Instrument and Method, Radiation Measurements and Journal of Physic G

- Activity of teaching of 6CFU or 9 CFU per years from 2013 to 2021. From December 2021 to now, 12 CFU per years.

Publications:

- ISI Web of science recognizes 128 publications on Scientific Refereed Journals with 1284 citations by 559 citing articles in the period 2003-2022, giving an h-index of 21, with 10.03 average citation per item

- SCOPUS recognizes 133 publications on Scientific Referred Journals with 1354 citations by 582 documents in the period 2003-2022, giving an h-index of 22.

- More than 20 different talks presented at major international conferences and workshops

Curriculum Vitae di Silvia Cappelli

Attività professionale

- Dal 9.3.82 al 6.6.82 presta servizio presso l'I.N.F.N. Sezione di Firenze come Assistente Amministrativo con un contratto di lavoro a tempo determinato ai sensi dell'art.6 della legge 70/75.
- Il 16.11.82 viene assunta presso l'I.N.F.N. Sezione di Firenze come Assistente Amministrativo quale vincitrice del concorso n.312/82.
- Dal 16.11.82 al 31.3.92 svolge la propria attività nell'ambito del Servizio Amministrativo della Sezione di Firenze occupandosi di tutti i settori di tale servizio e assumendo l'incarico di Cassiera per i trienni 1987/89 e 1990/92.
- Dall'1.4.92 al 15.5.2001 svolge la propria attività per la Segreteria Scientifica istituita presso la sezione di Firenze dell'I.N.F.N. occupandosi di organizzazione convegni, pagine web della sezione e supporto alla Biblioteca di Fisica.
- Dal Febbraio 1998 al Dicembre 2002 è stata Responsabile del Servizio di Direzione della Sezione INFN di Firenze**.**
- Dal 15.5.2001 è Responsabile del Servizio di Amministrazione della Sezione INFN di Firenze e coordina quattro collaboratori.
- Dal 1.8.2018 è Responsabile anche dell'Amministrazione della struttura INFN Centro Nazionale Studi Avanzati Galileo Galilei Institute.
- È Financial Officer dei progetti finanziati con fondi esterni: SIDDARTA_PNRA16_00252, H2020 GA 823914-ARIADNEPLUS, H2020 GA 804815-MEGANTE, H2020 GA 824096-RADIATE, PON PER-ACTRIS-IT PIR01_00015, CRF-CALZOLAI, CRF-CIVININI, INFN PCT - Bando POR FSE 2014 – 2020 progetto MIMA-SITES, PRIN REDI - 2017FNJFMW, PRIN CAPPELLI - 2017E44HRF
- Ha fatto parte delle commissioni esaminatrici nei concorsi PI/C7/295, PI/C7/568, PI/C7/679, FI/C7/20332, FI/C7/22415, FE/23589, FI/23999 e presidente nella commissione per la selezione 19471/2017.

Sesto Fiorentino, 16.2.2023

CURRICULUM
Carla Gentile

Titolo di studio: Diploma di Ragioniere e Perito Commerciale conseguito presso l'Istituto Tecnico Commerciale "O.G. Costa" di Lecce

Collaboratore di Amministrazione V livello professionale presso la Sezione di Lecce dell'Istituto Nazionale di Fisica Nucleare in servizio dal 1 febbraio 1991 *(in corso)*

Responsabile del Servizio Amministrazione della Sezione INFN di Lecce dal 1 febbraio 1991 *(in corso)*.
Responsabile Servizio Amministrazione della Sezione INFN di Lecce e di Bari dal 1/6/2019 al 31/12/2019

Attività lavorativa:

- Gestione del Bilancio e della Spesa in base alla normativa vigente
- Controllo documentazione Ciclo acquisti (tool informatizzato)
- RUP procedure affidamento diretto cat. Merceologica "Organizzazione eventi e convegni"
- Supporto ai RUP
- Reportistica per Amministrazione centrale
- Rendicontazione fondi esterni
- Coordinamento, organizzazione e supervisione delle attività amministrativo-contabili del personale afferente al Servizio di tutte le attività del Servizio Amministrazione

Altri incarichi:
Segreteria di Direzione
Gestione del Personale della Sezione di Lecce

Attività lavorativa:

- Gestione e reportistica presenze dipendenti
- Archivio digitale
- Benefit e Assicurazioni
- Concorsi, assegni di ricerca e borse di studio
- Convenzioni ed accordi con altri Enti
- Organizzazione manifestazioni e convegni

Formazione in ambito contabile-amministrativo:
Corso nazionale INFN: *Procedure per l'acquisto di beni e servizi, Aggiornamento Normativo e operativo (AVCPASS)*
20 e 21 aprile 2015
Corso nazionale INFN: *Gli acquisti sul MePA e gli altri strumenti del programma di razionalizzazione degli acquisti della PA* – 5 aprile 2016
Corso nazionale INFN: *Gli affidamenti di importo inferiore alla soglia di rilevanza comunitaria nel nuovo codice dei contratti pubblici* – 4 e 5 ottobre 2016
Corso CODIGER : *EPR e Codice degli Appalti, l'autonomia degli EPR, Digitalizzazione e la nuova legge sul bilancio*-
19, 20 e 21 ottobre 2016
Corso nazionale INFN:*Le procedure di selezione del contraente nel nuovo codice dei contratti pubblici e le linee guida ANAC*-
14 e 15 dicembre 2016
Corso nazionale INFN: *Aggiornamento in materia contrattuale prima parte "Il MePA: la nuova organizzazione e le novità introdotte nell'invito dei fornitori* - 27 ottobre 2017
Corso nazionale INFN: *Gestione e rendicontazione dei progetti finanziati dai Fondi strutturali*- 11, 12 e 13 marzo 2019
Corso nazionale INFN: *Gare Telematiche: illustrazione della normativa di riferimento e della convenzione con CONSIP* – 18 e 19 novembre 2019
Corso nazionale INFN: *Corso per Responsabili Unici del Procedimento di livello intermedio* – 25,26 e 27 febbraio 2020
Corso nazionale INFN*: Corso di formazione manageriale per Responsabili di Servizi* - maggio 2020
Corso nazionale INFN *Le procedure dell'INFN per la gestione dei fondi esterni* dall'8 al 15 novembre 2021

Autorizzo il trattamento dei dati personali presenti nel CV ai sensi del D.Lgs. 2018/101 e del GDPR (Regolamento UE 2016/679).