Curriculum Vitae

Prof. Andrea Alici

Personal details

NAME: Andrea Alici
DATE OF BIRTH: 9th March 1974
NATIONALITY: Italian

Education

8th July 2005: Ph.D., Physics (Dottorato di ricerca in Fisica) at the University of Bologna with the dissertation: "*Development of Quality Assurance procedures for the Production of the MRPC based detectors for the Time-Of-Flight system of the ALICE experiments at LHC*".

13th March 2001: Master's degree in physics at the University of Bologna with the dissertation: "*Study and Development of Multigap Resistive Plate Chambers for the Time-Of-Flight system of the ALICE experiment*".

Current Position

29th October 2019 – present*: Associate Professor* at the Department of Physics and Astronomy, Bologna University.

Fellowships

28th October 2016 – 28th October 2019*:* *Senior assistant professor (fixed-term)* at the Department of Physics and Astronomy, Bologna University.

1st January 2014 – 27th October 2016: *fellowship* at the Museo Storico della Fisica e Centro Studi e Ricerche "Enrico Fermi" whitin the project "*Quark Gluon Coloured World ALICE and beyond*".

1st October 2015 – 27th October 2016: *Project Associate* at CERN for research activities within the Collaboration responsible for the upgrade of the micro-vertex system (Inner Tracking System, ITS) of the ALICE experiment.

1st January 2010 – 31st December 2010: *INFN simil-fellow (CERN associate)* at CERN with the project "*Analysis of proton-proton collisions at the LHC with the charged particles identification provided by the TOF detector and the combined PID of ALICE*".

1st January 2010 – 31st December 2013: *Junior Grant* at the Museo Storico della Fisica e Centro Studi e Ricerche "Enrico Fermi" whitin the project "*Quark Gluon Coloured World ALICE and beyond*".

1st January 2005 – 31st December 2009: *Research fellow* at the Bologna University and INFN, sezione di Bologna, with the title: "*Development of hardware and software procedures for the control of the ALICE TOF (Time-Of-Flight) detector modules at LHC*".

1st January 2002 – 31st December 2004: *Ph.D. Scholarship* at the Bologna University.

Research Collaboration

2000 – 2016: Scientific Association INFN (National Institute for Nuclear Physics)

2017 – present: Research Assignment INFN (National Institute for Nuclear Physics)

2000 – present: *Associated Member of the Personnel* at CERN

Roles of Responsibility

2010 – 2020*: **ALICE contact person*** at the **LHC Background Study Group (LBS)**, responsible for optimizing the background conditions in the LHC during the data collection runs.

2012 – 2015*: **System Run Coordinator (SRC)*** of the **ALICE – TOF (Time-Of-Flight) detector**, responsible for the proper working and data quality of the TOF during the ALICE data taking, and for the maintenance and development of the hardware and software components of the whole system.

August 2012*: **ALICE Period Run Coordinator***, i.e., monthly deputy of the ALICE Run Coordinator, responsible for the proper working and data quality of the ALICE experiment.

2015 – 2016*: **Coordinator*** of the **ALICE PWG-PP Run Conditions** working group, responsible for online and offline monitoring and removal of beam-induced background from the data and measurement of luminosity and cross sections for the processes studied in ALICE.

2016 – 2020: ***ALICE contact person*** at the **SPS and LHC Machine Protection Panel (MPP)** working group, whose mandate is to protect accelerator and experimental equipment of the LHC and its injector complex against uncontrolled release of energy stored in the magnet system and the particle beams while at the same time allowing for efficient operation.

2016 – 2018*: **System Run Coordinator (SRC)*** of the **ALICE – ITS (Inner Tracking System)**, responsible for the proper working and data quality of the ITS during the ALICE data taking, and for the maintenance and development of the hardware and software components of the whole system.

2020 – 2022: ***Coordinator*** of the **ALICE 3 Time-of-Flight detectors** working group, dedicated to the development of technologies for the Time-Of-Flight system of the ALICE 3 experiment based on silicon detectors with excellent time resolution.

2020 – present: ***Member*** of the ALICE Technical Board.

1.01.2021 – 30.06.2024: ***Responsible*** of the ALICE TOF research group at the INFN, sezione di Bologna.

1.07.2022 – 31.12.2025: ***Team Leader*** of the ALICE TOF research group at CERN and ***Voting Member*** of the ALICE Collaboration Board.

1.07.2024 – 17.07.2025: ***Deputy Project Leader (DPL)*** of the ALICE TOF detector.

17.07.2025 – present: ***Project Leader (PL)*** of the ALICE TOF detector and ***Member*** of the ALICE Management Board.

Research activity

Since 1999 I carry out my research activities playing a leading role in the Bologna ALICE TOF group, that is responsible for the construction of the Time-Of-Flight System (TOF) of the ALICE experiment at the CERN LHC (Large Hadron Collider). The ALICE project is one of the most challenging experiments in the high-energy physics, involving an international collaboration of more than 1200 physicists, engineers, and technicians from all around the world. The ALICE experiment at the CERN LHC is one of the largest experiments in the world devoted to research in the physics of matter at an infinitely small scale.

1999 – present: ALICE Time-Of-Flight (TOF) system

As a member of the ALICE TOF Group, I actively participated in the assembly, study, and development of the first prototypes of Multigap Resistive Plate Chamber (MRPC) ever built in Italy, at the INFN laboratories in Bologna. This innovative technology, specifically developed by the ALICE TOF research group, achieves an intrinsic time resolution of less than 50 ps and a detection efficiency close to 100%, while maintaining performance even under high counting rate conditions (several hundred Hz/cm²).
During my Ph.D., I was responsible for the mass production of over 1600 MRPC strips for the ALICE TOF detector in Bologna, and I had full responsibility for the quality control of the assembled detectors. This included building the test stations, developing monitoring software, data acquisition, and analysis software (using SCADA NI LabVIEW), and managing the databases.
From January 1, 2005, I shared the responsibility for assembling the TOF detector modules, each containing 15 to 19 MRPC strips, and the 18 Super-Modules, each composed of 5 modules, up to the definition of an optimal standard assembly procedure. I was responsible for all quality controls on the assembled detector. Since 2006, I also shared the responsibility for installing the Super-Modules within the ALICE experiment, their commissioning, and the entire system's commissioning.
Since 2007, I have been responsible for the Detector Control System (DCS) for the ALICE TOF, which monitors the detector's operating parameters, provides a graphical interface for users to operate it, and automatically adjusts the system's operational state based on possible changes in experimental conditions. This automatic adjustment involves aspects related to the stabilization of the operating point and safety processes connected to fault and alarm management. The development environment used is the Siemens WinCC software platform, the standard adopted by CERN for all LHC experiments. At present, I still have the responsibility of the maintenance and update of the TOF DCS system.
From January 1, 2012, to December 31, 2016, I served as the System Run Coordinator (SRC) of the TOF detector, responsible for the proper working and data quality of the TOF during the ALICE data taking, and for the maintenance and development of the hardware and software components of the whole system.

Since January 1, 2022, I'm the responsible of the ALICE TOF group at the INFN Bologna section and the Team Leader of the same group at CERN. As such, I'm responsible for coordinating all activities related to the scientific and financial management of the research group, including the growth and professional training of young group members, and all operations, interventions, and hardware, firmware, and software developments on the TOF detector to maintain its performance to the required standard for an LHC experiment detector. Since July 17, 2025, I'm the Project Leader of the ALICE TOF detector.

2015 – 2018: ALICE Inner Tracking System (ITS)

On October 1, 2015, I got a Project Associate contract at CERN with the Collaboration responsible for the upgrade of the Inner Tracking System (ITS) of the ALICE experiment.
The ITS of ALICE was a system composed of three silicon detectors: SPD (Silicon Pixel Detector), SDD (Silicon Drift Detector), and SSD (Silicon Strip Detector). It was the innermost detector, closest to the primary interaction vertex, and was of fundamental importance to the experiment as it provides the measurement of the primary vertex position and secondary vertices for strange and heavy-flavor particle decays, particle identification (PID), and standalone tracking for low transverse momentum particles and impact parameter measurement for charged particles. It was also used for measuring pile-up and beam-induced background.
During this period, I was involved in the characterization tests of the detector prototypes (based on CMOS Monolithic Active Pixel Sensors) concerning the different technologies considered for the interconnections between the chip and the Printed Circuit Board (particularly laser soldering, wire-bonding, and isotropic conductive epoxies). I also conducted aging tests on the conductive resins to rule out variations in electrical and mechanical properties due to mechanical or electro-chemical stress.
From January 1, 2017, to December 31, 2019, I served as the System Run Coordinator (SRC) of the ITS detector, with full responsibility for its proper functioning and the quality of the data collected. I coordinated all activities related to data acquisition and the hardware and software maintenance of the system.

2010 – 2020: Machine-Induced Background (MIB) in ALICE

From 2010 to 2020, I was involved in monitoring and removing beam-induced background (beam-halo and beam-gas) from the data collected by the ALICE experiment. Initially, I worked on the offline removal of background in the data, and I was responsible for the online background monitoring system and all aspects related to beam instrumentation in ALICE.
I served as contact person for the ALICE Collaboration with the CERN LHC Background Study Group (LBS), which is responsible for optimizing background conditions in the LHC during data taking. Since January 2016, I have represented the ALICE Collaboration at the SPS and LHC Machine Protection Panel, whose mandate is to protect accelerator and experimental equipment of the LHC and its injector complex against uncontrolled release of energy stored in the magnet system and the particle beams while at the same time allowing for efficient operation.
From January 1, 2015, to December 31, 2016, I served as the coordinator of the ALICE PWG-PP (Physics Working Group – Physics Performance) Run Conditions working group, whose primary objective was to study and remove

background from the data and measure luminosity and cross-sections for the various processes studied in the experiment.

2010 – present: heavy-flavour analys with the ALICE detector

Since 2012, I'm an active member of the ALICE PWG-HF (Physics Working Group – Heavy Flavour) working group, dedicated to the study of heavy-flavour particles, which contain heavy quarks such as charm and bottom, produced at the LHC.
I particularly focused on measuring the production cross-section of the charmed baryon Λ_C in various collision systems and at different center-of-mass energies. This measurement is crucial for evaluating the total charm quark production cross-section at LHC energies. Additionally, by combining the results for the different collision systems (pp, p-Pb, and Pb-Pb), important insights can be gained into the dynamics of charm within the Quark-Gluon Plasma (QGP) created in Pb-Pb collisions. Heavy quarks are produced in the earliest stages of the collision through hard-scattering processes with time scales shorter than the QGP formation time. Therefore, they traverse the system, interacting with its constituents through both elastic and inelastic QCD processes, exchanging energy and momentum with the expanding medium, ultimately providing a direct measurement of the QGP properties. Moreover, comparing this measurement with that obtained with D mesons extends the study of the baryon-to-meson production ratio at LHC energies to the domain of heavy quarks.
The main challenges of this measurement are the limited available statistics and the fact that the ALICE Inner Tracking System during LHC Run 1 and Run 2 did not have the spatial resolution necessary to resolve the secondary decay vertex of the Λ_C ($c\tau \sim 60\ \mu m$). To cope with such small signal-to-background ratio, multivariate and machine learning techniques, where multiple kinematic and topological variables are considered simultaneously to classify events based on their likelihood of being signal or background events, were used for the first time within the ALICE Collaboration.
The results of these analyses revealed a significant discrepancy between the Λ_C baryon production cross-section at LHC energies and theoretical models, demonstrating that the hadronization process of the charm quark into baryons was not yet fully understood. The comparison of the baryon-to-meson production ratio, however, clearly indicated that, in ultra-relativistic heavy-ion collisions, the fragmentation process alone cannot describe the experimental results, suggesting the emergence of other quark recombination mechanisms (coalescence), especially at low transverse momentum values.
The results of my analyses have been published in several articles in international journals and presented at numerous national and international conferences. Additionally, I was a member of the Paper Committee for the following articles published in international journals:

- Λ_C *production in pp collisions at* $\sqrt{s} = 7$ *TeV and in p-Pb collisions at* $\sqrt{s_{NN}} = 5.02$ *TeV*, JHEP 04 (2018) 108

- Λ_C *production in Pb-Pb collisions at* $\sqrt{s_{NN}} = 5.02$ *TeV*, Physics Letters B 793 (2019) 212-223

- *Measurement of prompt* D^0, Λ^+_c, *and* $\Sigma^{0,++}_c(2455)$ *production in pp collisions at* $\sqrt{s} = 13$ *TeV*, Phys. Rev. Lett. 128 (2022) 012001

- *Constraining hadronization mechanisms with Λ^+_c/D^0 production ratios in Pb–Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV*, Physics Letters B 839 (2023) 137796

2020 – present: ALICE 3 experiment

From November 2020 to March 2023, I served as the coordinator of the ALICE 3 – Timing Layers working group, which was focused on the design and implementation of a large-scale Time-Of-Flight system based on silicon detectors with excellent time resolution.
ALICE 3 is a next-generation, compact and ultra-light detector for studying ultra-relativistic heavy-ion collisions at the CERN LHC collider, proposed as an upgrade of the current ALICE experiment for LHC Run 4 and Run 5. The goal is to build a detector composed of cylindrical layers of ultra-thin, curved silicon sensors using MAPS technology, characterized by a very low material budget (0.05% X0 per layer). In addition to high tracking and vertexing capabilities for transverse momenta down to a few tens of MeV/c, the detector must identify charged particles through time-of-flight determination with a resolution of about 20 ps. The proposed detector is designed to study pp, pA, and AA collisions at luminosities 20 to 50 times higher than those sustainable with the current ALICE detector, enabling a rich physics program, from measurements with electromagnetic probes at ultra-low transverse momenta to precision physics in the charm and beauty sector.
PID (Particle Identification) plays a crucial role in ALICE 3. The compact size of the experiment imposes very stringent requirements to the TOF sensors, including a time resolution of about 20 ps which is beyond the state-of-art of current silicon-based sensor technologies.
The research group's activities focused on various silicon sensor technologies, such as Low Gain Avalanche Detectors (LGADs), Silicon Photo-Multipliers (SiPMs), and fully-depleted MAPS, aiming to further improve the performance of existing sensors while also seeking innovative solutions, such as monolithic LGAD CMOS sensors.

Teaching activity

Teaching at the Bologna University:

- Laboratory Of Physics 3 (Module 2) – First cycle degree programme (L) in Physics, *2016-17, 17-18.*
- Laboratory Of Electronics (Module 2) – First cycle degree programme (L) in Physics, *2018-19, 19-20, 20-21, 21-22, 22-23, 23-24, 24-25.*
- Relativistic Physics (Module 2) – First cycle degree programme (L) in Physics, *2017-18, 18-19, 19-20, 20-21, 21-22.*
- Relativistic Physics – First cycle degree programme (L) in Physics, *2022-23, 22-23, 23-24, 24-25.*
- General Physics T-B – First cycle degree programme (L) in Civil Engineering, *2019-20, 20-21, 21-22.*
- Laboratory of Nuclear and Subnuclear Physics 1 (Module 2) – Second cycle degree programme (LM) in Physics, *2023-24, 24-25.*

Contributions at National and International Conferences

1. **ALICE 3: a next-generation heavy-ion experiment at the LHC**
   4th The 4th African Conference on Fundamental and Applied Physics (14 – 20 September 2025, Lomé, Togo)

2. **Charm-baryon production with pp, p-Pb and Pb-Pb collisions with ALICE at the LHC**
   22nd High-Energy Physics International Conference on Quantum Chromodynamics (2 – 5 July 2019, Montpellier, France)

3. **Charmed meson and baryon production with ALICE at the LHC**
   7th International Conference on New Frontiers in Physics (4 – 12 July 2018, Kolymbari, Crete, Greece)

4. **Operational experience with the ALICE ITS**
   26th International Workshop on Vertex Detectors (10 – 15 September 2017, Las Caldas, Asturias, Spain)

5. **ALICE results on open heavy-flavour production in pp, p-Pb and Pb-Pb collisions at the LHC**
   7th International Conference on Quarks and Nuclear Physics (2 – 6 March 2015, Valparaiso, Chile)

6. **Particle Identification with the ALICE Time-Of-Flight detector at the LHC**
   8th International Workshop on Ring Imaging Cherenkov Detectors (2 – 6 December 2013, Hayama, Kanagawa, Japan)

7. **Performance of the MRPC-based Time-Of-Flight detector of ALICE at LHC**
   XI Workshop on Resistive Plate Chambers and Related Detectors (5 – 10 February 2012, INFN, Laboratori Nazionali di Frascati, Frascati, Italia)

8. **The MRPC-based ALICE Time-Of-Flight detector: status and performance**
   4th Workshop on Advanced Transition Radiation Detectors for Accelerator and Space Applications (14 – 16 September 2011, Bari, Italia)

9. **The MRPC-based ALICE Time-Of-Flight detector: commissioning and first performance**
   X Workshop on Resistive Plate Chambers and Related Detectors (9 – 12 February 2010, GSI, Darmstadt, Germany)

10. **Status of the Time–Of–Flight detector in the ALICE experiment at LHC**
    International School of Subnuclear Physics, 47th course: the Most Unexpected at LHC and the Status of High Energy Frontier (29 Agosto – 7 September 2009, Erice, Italia)

11. **Quality assurance procedures for the construction of ALICE TOF detector**
    VIII Workshop on Resistive Plate Chambers and Related Detectors (10 – 12 October 2005, Seoul, South Korea)

12. **Primi risultati sulla produzione degli MRPC per il sistema TOF di ALICE**
XC Congresso Nazionale della Società Italiana di Fisica (20 – 25 September 2004, Brescia, Italia)

Poster:

1. **Towards a large-area 80 ps detector: the commissioning and first performance results of the ALICE TOF detector**
International School of Subnuclear Physics, 47th course: the Most Unexpected at LHC and the Status of High Energy Frontier (29 Agosto – 7 September 2009, Erice, Italia)

2. **First commissioning results on ALICE TOF SuperModules**
Quark Matter 2008, XX International Conference on nucleus-nucleus collisions (4 – 10 February 2008, Jaipur, India)

3. **Quality assurance procedures for the construction of the ALICE TOF SuperModules**
10th ICATPP Conference on Astroparticle, Particle, Space Physics, Detectors and Medical Physics Applications (8 – 12 October 2007, Como, Italia)

Local Organising Committee:

1. **7th international workshop on new Photon-Detectors PD2025**
https://web.infn.it/photondetectors2025/
3-5 December 2025, Bologna, Italy

Publications

h-index (WoS): **106**
h-index (SCOPUS): **101**
h_HEP index (inSPIRE, excluding self-citations): **74**
23044 citations (excluding self-citations) from inSPIRE
https://www.scopus.com/authid/detail.uri?authorId=6603646092
https://publons.com/researcher/3983414/andrea-alici/metrics/

ORCID ID: https://orcid.org/0000-0003-3618-4617

- **598** publications in national and international journals (SCOPUS):

  1 CERN Yellow Report:

  - **Radiation effects in the LHC experiments: Impact on detector performance and operation**, *I. Dawson et al.*,
    CERN Yellow Reports: Monographs, 2021, doi = 10.23731/CYRM-2021-001, url = http://cds.cern.ch/record/2764325

  2 LHC Internal Notes:

  - **LHC Bunch Current Normalisation for the October 2010 Luminosity Calibration Measurements**, *A. Alici et al.*,
    CERN-ATS-Note-2011-016 PERF. – 2011

- **Study of the LHC ghost charge and satellite bunches for luminosity calibration**, *A. Alici et al.*,
  CERN-ATS-Note-2012-029 PERF; BCNWG Note 4. - 2012.

1 ALICE Public Note:

- **Radiation Dose and Fluence in ALICE after LS2**, *A. Alici et al.*,
  ALICE-PUBLIC-2018-012
  http://cds.cern.ch/record/2642401

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