Pietro Antonioli

Current position: Senior Researcher at INFN, sezione di Bologna

Co-author of 481 publications (article on international journals), wih h-index: 77 (Web of Science)

Current responsibilities:

- ALICE Bologna group leader, coordinating the analyses carried out in Bologna and the maintenance and operations of the TOF detector (managing 200 KEU/year budget, ALICE Bologna group has currently 24 persons with 17.8 FTE). I'm leading the group since 2012.
- ALICE TOF DAQ and TDC Electronics coordinator (since 2001)
- ALICE Collaboration, Collaboration Board, member (since 2012)
- ALICE TOF Upgrade Project Leader (managing total 500 KEU budget)
- co-chair of ALICE Conference Committee: responsibility over speakers' assignments and review/approval of all presentations at International Conferences (since 2017). This position includes ex-officio membership of Physics Board and Management Board
- INFN representative in Comitato di Indirizzo Scientifico of ASTER, the Consortium promoted by Regione Emilia Romagna for Innovation and Technology Transfer (since 2015)

Career (including awards and selected past responsibilities)

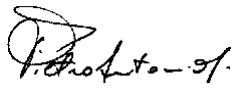
- 1990 Master Degree in Physics, Turin University, dissertation on "Detection of neutrino from stellar collapse via neutral current interactions on ^{12}C in liquid scintillator experiment" (110/110 cum laude and honor mention)
- 1992 winner of the Special Award by Italian Physics Society for Physics for young graduates
- 1994 Ph.D. in Physics, Turin University, dissertation on "First results on the study of e.m. and hadronic components inside EAS cores"
- 1994-1995, post-doc position at INFN, sezione di Torino
- 1995-2008 INFN, Sezione di Bologna, researcher
- 2006-2009, INFN Scientific Committee III ("Nuclear Physics"), member
- 2008-current, INFN, Sezione di Bologna, senior researcher
- 2010-2014 ALICE Collaboration, Particle Identification coordinator

Scientific activity

Neutrino and high energy physics are my main fields of research. For the latter I had the opportunity to work both at cosmic ray experiments and at accelerators, for the former in underground laboratories. My activity is roughly divided in three main periods.

1) (**1989-1994)** During my degree, Ph.D. and a post-doc grant at Turin University I worked in the LSD (Mont Blanc), LVD and EAS-TOP (Gran Sasso Laboratories) experiments. Main analyses achievements included:

- best limit on the stationary flux of relic ν_μ and ν_τ neutrinos from stellar collapses using data of the LSD Mont Blanc detector;
- measurement of the muon intensity-depth underground and study of the muon energy losses with the LVD detector in correlated events with the EAS-TOP experiment;
- successful operation of the quasi-proportional chambers of the EAS-TOP calorimeter to measure with high granularity the electromagnetic component of the EAS shower. This then brought to the measurement of the jet production cross section in proton-ion collisions at large pseudorapidities derived from EAS data;
- calibration, monitoring and data analysis of both LVD and EAS-TOP experiments, gaining experience on data acquisition and electronics.



2) **(1995-2000)** As staff at INFN Bologna, I maintained during these years a prevailing interest for neutrino physics but I gradually moved to high energy physics, joining the ZEUS Collaboration at HERA. This was a great opportunity to learn experimental methodologies at accelerators. The uniqueness of the HERA machine allowed to probe the proton's structure to thoroughly test QCD predictions. Working with the ZEUS experiment, I contributed to outstanding physics results such as the extraction of the F_2 parton distribution function measured over a large kinematic region. Main analyses achievements included:

- study of the distortion of the detected neutrino signal at Earth from stellar collapses due to neutrino oscillations;
- work with professor T. Ypsilantis on a proposed water Cerenkov detector with focusing mirrors (AQUA-RICH) and with the Monolith Collaboration proposing a magnetized tracking calorimeter for new neutrino experiments;
- development of a fully 3D Monte Carlo simulation code for muon propagation in the rock;
- the study of the photoproduction of Υ and J/ψ quarkonium states via the channel γ p --> μ^+ μ^- p, using the Forward Muon detector.

Experimentally, besides providing support for data taking and data quality assurance in LVD and ZEUS, I used the know-how gained at ZEUS on VME bus to upgrade the Data Acquisition system at LVD with full responsibility of the project.

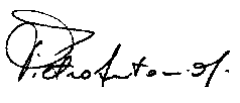
3**) (2001-current)** I then joined the ALICE Collaboration, the LHC experiment focusing on the hot QCD matter generated in nuclear collisions at collider energies. The Bologna group is responsible for the time-of-flight TOF detector. Based on Multi-Gap Resistive Plate Chambers, the TOF covers the pseudorapidity interval [−0.9, +0.9] and the full azimuthal angle, for a total active area of 141m^2. The TOF is responsible to provide Particle Identification (PID) in the region of intermediate momenta (0.5 – 5.0 GeV/c) for charged hadrons (pions, kaons and protons).

During last 18 years my engagement with ALICE moved naturally from a very intense experimental effort during the R&D and construction phase, to the optimization of the detector and to the engagement with major physics analysis, reaching since some years managerial responsibilities in the Collaboration.

The TOF detector had the challenge to maintain the excellent MRPC time resolution on a large scale and area detector (152K TDC channels over 140 m^2). I contributed to this effort leading the realization of the TDC cards (based on the HPTDC chips) . This included, among other activities, evaluate HPTDC performance and calibration procedures for them, conduct tests at irradiation facilities for critical electronic components, develop solutions for clock distribution (keeping the jitter below 15 ps) and maintain relationship with key commercial partners. The design of the DAQ system for the TOF was also under my responsibility. The choices made in terms of multi-buffering proved solid and far-reaching: for the planned upgrade during LS3 it will be necessary only to upgrade one readout card to operate the detector in continuous mode.

In ALICE I then took the co-responsibility of the coordination of the Particle Identification among the different detectors (ITS, TPC, TOF, EMCAL, TRD and HMPID) in the central barrel when the data taking just started. This led to the development of a common framework for PID data analysis in ALICE, allowing end users to easily manipulate the complexity of the different detectors. A big effort was the combination of the different detector signals, using a Bayesian approach. I was appointed as the lead author by the Collaboration for a paper (published in 2016) summarizing the results achieved during LHC Run-1 and the validation done for the Bayesian approach.

The Bologna group I'm now coordinating since 2012 contributed to critical analyses for the mainstream ALICE physics, devoted to the study of strongly interacting matter under extreme conditions reached during relativistic heavy-ion collisions:



- identified hadron spectra;
- the study of strange hadronic resonances, such a K*(890) and ϕ meson, to study the dynamic evolution of the QGP (and in particular the hadronic phase) and the study of strangeness as a function of multiplicity in different collision systems (the latter published on Nature Physics in 2017);
- the elliptic flow of identified hadrons;
- entirely within Bologna group, during 2013-2015, we performed a precision measurement of the mass differences between nuclei and their anti-matter counterparts using ALICE data. The new result on CPT invariance in the light-nuclei sector for d and ^{3}He improves on existing measurements by a factor of 10-100. It was published in Nature Physics and I was one of the members of the Paper Committee.
- the study of heavy-flavour production via identified hadron decays of charmed mesons (D0 -> K-pi+) and baryons (Λ_c -> K^0_s p). For the latter analysis, with a paper published on JHEP in 2018, we introduced for the first time Multivariate Analysis in ALICE to identify a rare signal from a large combinatorial background. I played here a direct role, coordinating the analysis and chairing the Paper Committee appointed by the ALICE Collaboration (the analysis group included members from Bologna, Salerno, Liverpool, CERN and Tsukuba). A further work on Pb-Pb data sample was submitted in late 2018 to Phys. Letters B (I again chaired the Paper Committee).

Other analyses and papers where I have been directly involved include:
- analysis of the TOF detector performance: the paper published in 2013 showed an overall 80 ps time resolution was achieved and a further paper about event time determination (published in 2017);
- the major ALICE performance paper published in International Journal of Modern Physics A (I authored the PID section)

International Conferences: talks and organization

I regularly reported at international conferences. The number of invited talks has increased during recent years, including the responsibility to give multi-experiment talks on behalf of the LHC Collaborations at major high energy physics conferences or overview talks for the whole ALICE program:
- "Double Parton Scattering, Multi-Parton interactions and Underlying Event and identified hadrons" (LHCP 2014, New York, June 2014)
- "Heavy flavour production in pA and AA" (LHCP 2015, Saint Petersburg, September 2015)
- "The ALICE upgrade programme", (LHCP 2016, Lund, June 2016)
- "Review of ALICE results", (ICPPA-2017, Moscow, October 2017)
- "Open heavy-flavour production with ALICE at the LHC (QCD2018, Montpellier, July 2018)

I organized workshop and conferences (such as XXIV International Symposium on Multiparticle Dynamics, Bologna, 2014). In particular I co-organized in 2015 a workshop in Bologna about "The physics of heavy ions at LHC" (https://agenda.infn.it/conferenceDisplay.py?confId=9453) and co-chaired the Sixth International Conference on Large Hadron Physics, held in Bologna in June 2018 (http://lhcp2018.bo.infn.it).

Tutoring and teaching activity at Bologna University

I regularly trained young researchers co-supervising Master Degree and Ph.D. thesis at Bologna University. During 2017/2018 I taught in the course "Metodologie sperimentali in Fisica e Astrofisica delle Particelle" (http://www.scienze.unibo.it/it/corsi/insegnamenti/insegnamento/2017/330153)