

Curriculum Vitae: Matteo Volpi

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Education

January 2016 - Current

Project associate at CERN, collaboration with the Compact Linear Collider experiment. Advisors: Nuria Catalan Lasheras (Nuria.Catalan.Lasheras@cern.ch) and Prof. Roger Paul Rassool (rogerpr@unimelb.edu.au).

March 2011 - July 2015

Research fellow in experimental particle physics at the University of Melbourne. Advisors: Prof. Geoffrey Taylor (director@coepp.org.au) and Prof. Elisabetta Barberio (barberio@unimelb.edu.au).

December 2010

Ph.D thesis on the Minimum Bias analysis, “Charged-particle multiplicities in pp interactions at $\sqrt{s} = 900$ GeV and $\sqrt{s} = 7$ TeV measured with the ATLAS detector at the LHC”. Advisors: Prof. Matteo Cavalli-Sforza (matteo@ifae.es) and Prof. Ilya Korolkov (korolkov@ifae.es).

February 2003 - October 2003

Advanced Degree in Physics (*Laurea Specialistica in Scienze Fisiche*) University of Pisa, Italy. Advisor: Prof. Tarcisio Del Prete (tarcisio.delprete@pi.infn.it).

September 1997 - February 2003

Bachelor of Science in Physics (*Laurea di Primo livello*) University of Pisa, Italy. Advisor: Prof. Tarcisio Del Prete (tarcisio.delprete@pi.infn.it).

Research Experience

During my academic studies I played several important roles in hardware and software projects with the ATLAS collaboration at the Large Hadron Collider (LHC). I also played a leading role in the assembling and testing of the Silicon Vertex Detector (SVD) of Belle II. I was responsible of the underground background measurements at Stawell Mine of the Crocodile Gold Corporation for a dark matter research. Since 2016 I have been based at CERN to coordinate the conditioning of the high-gradient prototype structures for the CLIC experiment.

2016 - 2019

High-gradient X-band technology- High-gradient linear accelerator technology developed for fundamental exploration has matured to the point where it is being transferred to applications beyond high-energy physics. Specifically, the unique requirements for the Compact Linear Collider (CLIC) project at CERN have led to a new high-gradient “X-band” accelerator technology that is attracting the interest of light-source and medical communities. Critical to CLIC’s development of high-gradient X-band technology has been an investment in four test stands, which allowed investigations of the complex, multi-physics effects that affect high-power behaviour in operational structures. The test stands provided the RF klystron power, dedicated instrumentation and diagnostics to operate, measure and optimise prototype RF components. Since 2016 I have been responsible for the X-band test stands at the CERN facility. At the University of Melbourne and in association with the Australian Synchrotron, I am the responsible for a novel high gradient electron accelerator test facility in the School

of Physics laboratory at the University of Melbourne. The research at this facility will have impact at the Australian Synchrotron and will be central to the University's newly created Medical Accelerator research and development activities.

2014 - 2015

Dark Matter- Understanding the nature of dark matter is one of the most important questions faced by particle physics today. A direct detection is possible by measuring the nuclear recoil energy following an elastic scattering off nuclei. Because of the very low expected event rate, about $10^{-2} eV/kg/day$, experiments aiming at a direct dark matter search have very stringent background requirements. The only way to reduce the flux of cosmic ray-induced particles is to build the experiment in a deep underground site (a tunnel, a mine, etc.). The Stawell mine will be the first laboratory in the Southern Hemisphere. It is important, because its initial job will be to duplicate an experiment in the Northern Hemisphere that has provided some of the only credible direct evidence of dark matter (DAMA/LIBRA). To be able to host the experiment we need to pass the acceptance criteria of the background level. I am responsible for the background measurements of the muon flux, neutron flux, gamma flux, rock composition and radon concentration. The measurements have been made with the help of Australian Nuclear Science and Technology Organisation (ANSTO), which also provided the radon, gamma and neutron counters and performed the analysis of the rocks.

Belle II- The Belle II experiment, which will search for a new physics beyond the Standard Model, plans to start physics run on 2018 with super KEKB accelerator in Japan. SVD of Belle II is one of the inner most sub detectors of the Belle II detector. The Belle II SVD has four layers of sub detectors, and each sub detector has multiple sensor units. Our group is responsible of the assembling of the layer 3. The sensor unit of SVD consists from double sided silicon detector (DSSD), which can be read out from two perpendicular sides. We use many advanced techniques, such as high quality wire bonding, in order to read out high density lines of the DSSD. I'm expert on the full path of the assembling procedure including the electrical tests and the laser scan. I'm able to use and to program high precision machineries like the coordinate measurement machine (CMM), the micromanipulator, the gluing dispenser, the XYZ robot, the pulling machine and the wire bonding machine. I'm also expert of the data acquisition system.

ATLAS- The LHC, has started to get ready for its second three-year run. Cool down of the vast machine has already begun in preparation for research to resume early in 2015 following a long technical stop to prepare the machine for running at almost double the energy of run 1. I'm helping the tau working group to prepare the energy scale calibration of hadronic tau decays and the associated uncertainty for run 2.

2012 - 2013

Searches for new heavy resonances decaying to tau lepton pairs are both theoretically and experimentally well motivated. Some models offering an explanation for the high mass of the top quark predict that such bosons preferentially couple to third-generation fermions. We were looking for high-mass ditau resonances decaying in the fully hadronic final state. No statistically significant excess above the Standard Model expectation is observed. As a result, Z' bosons of the Sequential Standard Model with masses less than 1.90 TeV are excluded at 95% confidence level ([arXiv:1502.07177](https://arxiv.org/abs/1502.07177)). In this analysis I was responsible of the muon to tau fake rejection study.

2011 - 2012

Tau leptons play a central role in the LHC physics program, in particular as an im-

portant signature for the Higgs boson and Supersymmetry searches. I'm the main responsible of the energy scale calibration of hadronic tau decays and the associated uncertainty. Using a data-driven method, the systematic uncertainty on the hadronic tau energy scale is found to be on average 3%. The results were concluded in two public notes (**ATLAS-CONF-2012-054, ATLAS-CONF-2013-044**), in the last one I'm part of the editors.

2010 - 2011

Using a single-arm trigger overlapping with the acceptance of the tracking volume we measure inclusive inelastic distributions at centre-of-mass energy $\sqrt{s} = 900$ GeV and $\sqrt{s} = 7$ TeV. I took a leading role in developing and implementing the D3PDs data structure. By quickly validating the event selection and verifying the detector performance, I had become one of the focal points of the first Atlas analysis of the LHC data. This work culminated with the first ATLAS paper (**arXiv:1003.3124 [hep-ex]**). The charged particle multiplicity per event and unit of pseudorapidity at $\eta = 0$ at $\sqrt{s} = 900$ GeV was measured to be 1.333 ± 0.003 (stat.) ± 0.040 (syst.). That is 5-15% higher than the Monte Carlo model predictions.

2008-2009

I had responsibilities in commissioning of the Tile hadronic calorimeter (TileCal) and in analysis of the data from beam tests.

In 2008 I re-analyzed the test beam data taken in the year 1995 with a stack of five TileCal prototype modules and another data set taken in the years 2002-2003 with the final Atlas TileCal modules. We had measured the fundamental calorimetry ratio (e/π) as a function of the pion energy for both: prototype and production modules. We had found a much better agreement between two measurements. The results were concluded in two public notes (**ATL-TILECAL-PUB-2009-006, ATL-TILECAL-PUB-2009-004**) and one publication (**NIM A 606 (2009) 362-394**).

The commissioning of the calorimeter culminated in September 2008 when the LHC circulated proton beams at an energy of 450 GeV for the first time. I had used the data recorded in the first thirty hours of the beam to study time and energy response of the TileCal. I had established the procedure to calibrate the TileCal timing which eventually yielded 0.3 ns channel resolution across all the calorimeter.

Since June 2008 I developed a set of tools for checks of the data quality (DQ) in TileCal. These tools are used constantly since then and were reported in **NIM A 617 (2010) 123-125**. I was DQ leader from December 2008 until March 2009. I took a number of normal and expert shifts.

2006-2007

I played a major role in commissioning and calibration of the TileCal detector. These include:

- instrumentation and software development for movable data acquisition system, used to commission TileCal Read-Out;
- defining the protocol to measure and to control the properties of the optical fibers that are used for communication in TileCal;
- very first checks of reliability and functionality of LV and HV supplies;
- leading role in hardware and software development of the Minimum Bias Monitoring system of the TileCal. This system takes advantage of electronics associated with the Cesium calibration system to measure the minimum bias current, which is generated in proton-proton interactions with low transverse momentum;
- contributed most strongly to development of the so-called "Shaft" electronics

board, indispensable for the trigger system of TileCal.

2004-2005

In March 2004 I joined the ATLAS group of IFAE in Barcelona (Spain) under the supervision of Prof. Ilya Korolkov. With few colleagues we set up all the elements of the beam trigger system (placement, calibration and testing of scintillators and beam chambers) for the 2004 combined test beam of ATLAS. The work was reported in **ATL-TECH-PUB-2005-00**.

2001-2003

Under the supervision of Prof. Marco Maria Massai, I had the opportunity to test the behaviour of Micro-Strip Gas Chamber (MSGC) particle detectors. With Prof. Giuseppe Maria Pierazzini, I measured the absorption coefficient in different materials and performed experimental tests of the Compton scattering. In October 2002, I started working on my degree thesis, which I earned in October 2003. Signals from the TileCal plastic scintillator are read out using photomultiplier tubes (PMTs). At the University of Pisa using a dedicated tools I tested and characterized 1500 PMTs, which correspond to the 15% of the total PMT used in TileCal.

Software Knowledge

From the recently experimental work I have a good knowledge of programming in LabVIEW and GEANT4. Over the years I learned to use Linux, Windows and specially Mac environments. Through reconstruction of signals produced in the detector, I have acquired deep familiarity with the data analysis system of ATLAS, in particular with Python and C++. I am also proficient with ROOT.

Languages

Italian : native.
English: good.
Spanish: fluent.
French: working knowledge.
Catalan: working knowledge.

Miscellaneous

- Australian Permanent Visa. Italian and Australian driver licenses.
- Sports: football, table tennis, tennis and volleyball.
- Other: photography (<http://experimentum.wixsite.com/vmdiciotto>), painting (<https://volmeur.web.cern.ch>).

Latests important publications with strong personal contribution

- Title: Dark current analysis at CERN's X-band facility
Authors: Volpi, M; *et al.*
Published: Proceedings of IPAC2019, Melbourne, Victoria, Australia
- Title: The effect of the SLED installation on extracted and lost beam at the Australian synchrotron linac
Authors: Volpi, M; *et al.*
Published: Proceedings of IPAC2019, Melbourne, Victoria, Australia
- Title: High power conditioning of X-band variable power splitter and phase shifter
Authors: Volpi, M; *et al.*
Published: Proceedings of IPAC2019, Melbourne, Victoria, Australia
- Title: High power and high repetition rate X-band power source using multiple klystrons
Authors: Volpi, M; *et al.*
Published: Proceedings of IPAC2018, Vancouver, BC, Canada

- Title: Design, fabrication, and high-gradient testing of an X-band, traveling-wave accelerating structure milled from copper halves
 Authors: Volpi, M; *et al.*
 Published: Physical review accelerators and beams 21, 061001 (2018)
 Electronic link to the full text:
<https://journals.aps.org/prab/abstract/10.1103/PhysRevAccelBeams.21.061001>
- Title: High Power X-Band Generation Using Multiple Klystrons and Pulse Compression
 Authors: Catalán Lasheras, N; *et al.*
 Published: 8th International Particle Accelerator Conference, Copenhagen, Denmark, 14 - 19 May 2017, pp.THPIK095
 Electronic link to the full text: <http://cds.cern.ch/record/2289145?ln=it>
- Title: Commissioning of XBox-3: A very high capacity X-band test stand
 Authors: Catalán Lasheras, N; *et al.*
 Published: 28th Linear Accelerator Conference, East Lansing, Michigan, 25 - 30 Sep 2016, pp.TUPLR047
- Title: A search for high-mass resonances decaying to $\tau^+\tau^-$ in pp collisions at $\sqrt{s} = 8$ TeV with the aTLAS detector
 Authors: The ATLAS Collaboration.
 Published: CERN-PH-EP-2015-018.
 Electronic link to the full text: <http://cds.cern.ch/record/1994408>
- Title: Determination of the tau energy scale and the associated systematic uncertainty in proton-proton collisions at $\sqrt{s} = 8$ TeV with the ATLAS detector at the LHC in 2012
 Authors: The ATLAS Collaboration.
 Published: ATLAS-CONF-2012-044.
 Electronic link to the full text: <https://cds.cern.ch/record/1544036>
- Title: Calorimeter Performance for Tau Reconstruction and Identification at ATLAS.
 Authors: Matteo Volpi (on behalf of the ATLAS Collaboration).
 Published: 2012 J. Phys.: Conf. Ser. 404 012009 doi:10.1088/1742-6596/404/1/012009.
 Electronic link to the full text: http://iopscience.iop.org/1742-6596/404/1/012009/pdf/1742-6596_404_1_012009.pdf
- Title: Determination of the tau energy scale and the associated systematic uncertainty in proton-proton collisions at $\sqrt{s} = 7$ TeV with the ATLAS detector at the LHC in 2011.
 Authors: The ATLAS Collaboration.
 Published: ATLAS-CONF-2012-054.
 Electronic link to the full text: <https://cds.cern.ch/record/1453781>
- Title: Search for the Standard Model Higgs boson in $H \rightarrow \tau^+\tau^-$ decays in proton-proton collisions with the ATLAS detector.
 Authors: The ATLAS Collaboration.
 Published: arXiv:1206.5971.
 Electronic link to the full text: <https://cds.cern.ch/record/1493624>
- Title: Charged-particle multiplicities in pp interactions at $\sqrt{s} = 900$ GeV measured with the ATLAS detector at the LHC.

Authors: The ATLAS Collaboration.
Published: arXiv:1003.3124 [hep-ex].
Electronic link to the full text: <http://arxiv.org/pdf/1003.3124v2.pdf>

- Title: Readiness of the ATLAS Tile Calorimeter for LHC collisions.
Authors: The ATLAS Collaboration.
Public note: ATLAS-TCAL-2010-01-003 and to be published in EPJC.
- Title: ATLAS tile calorimeter data quality assessment and performance with calibration, cosmic and first beam data.
Authors: Volpi, M.
Published: NIM A 617 (2010), pp. 123-125.
- Title: Testbeam studies of production modules of the ATLAS Tile Calorimeter.
Authors: Adragna, P; *et al.*
Published: NIM A 606 (2009) 362-394, doi:10.1016/j.nima.2009.04.009.
- Title: Reanalysis of the Response of 95 Prototype Modules.
Authors: Volpi, M; Cavalli-Sforza, M.
Public note: ATL-TILECAL-PUB-2009-006.
- Title: Response of the ATLAS Tile Calorimeter to Hadrons in Stand-Alone Testbeam Data.
Authors: Davidek, T; Volpi, M; Zenis, T.
Public note: ATL-TILECAL-PUB-2009-004.
- Beamline instrumentation in the 2004 combined ATLAS testbeam.
Authors: Di Girolamo, B; Dotti, A; Giangiobbe, V; Johansson, P; Pribyl, L; Volpi, M. Public note: ATL-TECH-PUB-2005-00.
- I'm also author of internal notes supporting the published papers.

Conferences and Workshop

- June 2019
International Workshop on Breakdown Science and High Gradient Technology (HG2019), Chamonix, France
- May 2019
The 10th International Particle Accelerator Conference (IPAC'19), Melbourne, AS-ANSTO, (Australia)
- April 2018
The 9th International Particle Accelerator Conference (IPAC'18), Vancouver, British Columbia, (Canada)
- June 2017
The tenth international workshop on high-gradient acceleration, HG2017, Instituto de Fisica Corpuscular - IFIC (CSIC-University of Valencia), Spain.
- November 2014
Construction status of layer 3 of Belle II detector at the 19th B2GM, KEK, (Japan)
- June 2014
Construction status of layer 3 of Belle II detector at the 18th B2GM, KEK,

(Japan)

- February 2014
Construction status of layer 3 of Belle II detector at the 17th B2GM, KEK, (Japan)
- February 2013
Poster and Talk about the silicon vertex detector of Belle II at the CoEPP Summer School and Workshop in Wollongong, NSW (Australia).
- June 2012
Designated ATLAS speaker for a presentation on Calorimeter Performance for Tau Reconstruction and Identification at ATLAS at the XVth International Conference on Calorimetry in High Energy Physics (Calor 2012) in Santa Fe, New Mexico (USA).
- February 2012
Talk in CoEPP Lorne Summer School and Workshop 2012. Lorne, Victoria (Australia).
- February 2010
Designated ATLAS speaker for a presentation on Minimum bias physics with ATLAS at the Lake Louise Winter Institute 2010 , Alberta (Canada).
- August 2009
Tile calorimeter status and commissioning.
Presentation given at ATLAS Physics Workshop of the Americas.
New York University in Manhattan (USA).
- June 2009
Participation in CERN Fermilab HCP Summer School.
Location: CERN (Switzerland).
- May 2009
Poster presentation in 11th Pisa Meeting on Advanced Detectors.
La Biodola, Isola d'Elba (Italy).
- April 2007
Attendance of Hadronic Calibration Workshop.
Universita' degli Studi, Milan (Italy).
- October 2005
Attendance of ATLAS Overview Week.
Ministry of Research, Paris (France).
- June 2017
The tenth international workshop on high-gradient acceleration, HG2017, IFIC, CSIC-University of Valencia, (Spain)
- February 2015
The Stawell underground Laboratory at the annual CoEPP workshop in Hobart,

**Seminar and
workshop**

Tasmania (Australia)

- September 2014
Stawell gold mine underground measurements at CoEPP-CAASTRO workshop
Great Western , Victoria (Australia)
- June 2014
Convener of the energy scale and simulation section at ATLAS HSG4 and Tau Workshops, placed at the LAL-Orsay in Paris (France).
- April 2013
Tau energy scale at ATLAS HSG4 and Tau Workshops, placed at the European Institute for Sciences and Their Applications in Corfu (Greece).
- March 2012
Jet fake-rate comparison at ATLAS HSG4 and Tau Workshops, placed at the University of Oxford (UK).
- March 2010
Invited speaker in the frame of first physics results from ATLAS in pp collisions at 900 GeV, given at Institut de Fisica d'Altes Energies (IFAE), Universitat Autònoma de Barcelona (Spain).

Presentations

I have given about 140 talks within the ATLAS Collaboration, plus 50 in the last few years. Below I list few of the most relevant.

- Title: <https://indico.cern.ch/event/656356/contributions/2848512/>
Meeting: CLIC workshop 2018.
Link: <https://indico.cern.ch/event/656356/contributions/2848512/>
- Title: Multi-klystron operation experience in Xbox-3
Meeting: HG2017 workshop.
Link: <https://indico.cern.ch/event/589548/>
- Title: X-band pulse compressor: tuning and high-power operation
Meeting: CLIC workshop 2017.
Link: <https://indico.cern.ch/event/577810/contributions/2485038/>
- Title: Tau performance for HL-LHC upgrade.
Meeting: TauWG Meeting.
Link: <https://indico.cern.ch/event/340634/>
- Title: TES studies on upgrade samples.
Meeting: TauWG Meeting.
Link: <https://indico.cern.ch/event/255829/>
- Title: Tau selection updates.
Meeting: Z' to tau tau analysis meeting.
Link: <https://indico.cern.ch/event/288181/>
- Title: TES recommendations.
Meeting: TauWG Meeting.

Link: <https://indico.cern.ch/conferenceDisplay.py?confId=224405>

- Title: Tau Energy Calibration Sign-Off.
Meeting: TauWG Meeting.
Link: <https://indico.cern.ch/conferenceDisplay.py?confId=194225>
- Title: Jet fake-rate comparison.
Meeting: TauWG Workshop 2012 (Oxford).
Link: <https://indico.cern.ch/conferenceTimeTable.py?confId=172493#20120321.detailed>
- Title: Energy Scale Uncertainties Sign-off (Decomposition).
Meeting: TauWG Meeting.
Link: <https://indico.cern.ch/conferenceDisplay.py?confId=165480>
- Title: Calorimeter Performance for Tau Reconstruction and Identification at ATLAS
Meeting: CALOR 2012 (USA)
Link: <http://indico.ads.ttu.edu/conferenceTimeTable.py?confId=3#20120604.detailed>
- Title: $H \rightarrow \tau\tau$
Meeting: CoEPP Lorne Summer School and Workshop 2012.
Link: <https://indico.cern.ch/conferenceDisplay.py?confId=178392>.
- Title: Tile Calorimeter Performance with calibration, cosmic rays and LHC single beam data.
Meeting: Hadronic calibration workshop, Foz do Arelho (Portugal).
Link: <http://indico.cern.ch/conferenceDisplay.py?confId=48780>
- Title: Status of the Tile calorimeter for Jet/Etmiss analysis.
Meeting: ATLAS week Jet/EtMiss, CERN (Switzerland).
Link: <http://indico.cern.ch/conferenceDisplay.py?confId=48778>
- Title: News from single beam analysis.
Meeting: Rio TileCal Week (Brazil).
Link: <http://indico.cern.ch/conferenceDisplay.py?confId=45356>
- Title: Muons from first beam.
Meeting: TileCal Week, CERN (Switzerland).
Link: <http://indico.cern.ch/conferenceDisplay.py?confId=42524>

I am also giving a regular weekly talk about the status of the X-band test facility.