ALLEGATO A (Verbale 2)

Vedi documenti allegati

Elenco Tesi di Dottorato e Pubblicazioni Presentato:

-Tesi: "Systematic study of the response and calibration of the Monitored Drift Tubes of the ATLAS Muon Spectrometer", Universita' degli Studi Roma Tre, January 2007.
-"T2K Neutrino Flux Prediction", PhyRev. D 87 012001 2013
-"Measurement of production properties of positively charged kaons in proton-carbon interactions at 31 GeV/c",PRD C 85 035210 (2012)
-"Search for short baseline nue disappearance with the T2K near detector", Phys.Rev. D 91 051102 R (2015)
-"Indication of electron neutrino appearance from an Accelerator-Produced Off-Axis Muon Neutrino Beam", PRL 107 041801 (2011)
-"Commissioning of the ATLAS Muon Spectrometer with cosmic rays", EPJ (2010) 70: 875-916
-"Meausrements of pi+-,K+-,K0s,Lambda and proton production in proton-carbon interactions at 31 GeV/c with the NA61/SHINE spectrometer at the CERN SPS",EPJ C (2016) 76:84
-"Measurement of neutrino oscillation in appearance and disappearance channels by the T2K experiment with 6.6x10^20 proton on target", Phys.Rev. D 91, 072010 (2015)
-"Measurement of Muon Antineutrino Oscillation with an Accelerator-Produced off Axis Beam",PRL 116, 181801 (2016)
-"Neutron irradiation test on ALTAS MDT chambers", NIM A 574 (2007)
-"The mass-hierarchy and CP-violation discovery reach of the LBNO long-baseline neutrino detector",JHEP05(2014)094
-"Measurement of the instrinsic electron neutrino component in the T2K neutrino beam with the ND280 detector", PRD 89 092003 (2014)

Firme 29/03/2017

E. Meroni

Pubblicazioni Scientifiche su riviste Peer Reviewed

[1] L. Cavallini et al. "Assessment of the Čerenkov light produced in a $PbWO_4$ crystal by means of the study of the time structure of the signal." In: *Astroparticle, Particle And Space Physics, Detectors And Medical Physics Applications* 63 (set. 2008), pp. 359–363. DOI: 10.1142/9789812819093_0063.

[2] C. Mancini Terracciano e M. Vignati. "Noise correlation and decorrelation in arrays of bolometric detectors." In: *Journal of Instrumentation* 7.06 (giu. 2012), P06013. DOI: 10.1088/1748-0221/7/06/P06013.

[3] T. Adam et al. "Measurement of the neutrino velocity with the OPERA detector in the CNGS beam using the 2012 dedicated data." In: *Journal of High Energy Physics* 2013.1 (gen. 2013), pp. 1–14. DOI: 10.1007/JHEP01(2013)153.

[4] N. Agafonova et al. "Search for $\nu_\mu \rightarrow \nu_e$ oscillations with the OPERA experiment in the CNGS beam." In: *Journal of High Energy Physics* 7 (lug. 2013), pp. 1–16. DOI: 10.1007/JHEP07(2013)004.

[5] F Bellini et al. "Extended calibration range for prompt photon emission in ion beam irradiation". In: *Nuclear Instruments and Methods in Physics Research Section A* 745 (mag. 2014), pp. 114–118.

[6] C. Mancini Terracciano. "Analysis and interpretation of Carbon ion fragmentation in the Bragg peak energy range." Tesi di dott. Scuola Dottorale in Scienze Matematiche e Fisiche. Università degli Studi Roma Tre, 2015.

[7] E. Solfaroli Camillocci et al. "First Ex-Vivo Validation of a Radioguided Surgery Technique with $\beta-$ Radiation." In: *Physica Medica* 32.9 (set. 2016), pp. 1139 –1144. DOI: 10.1016/j.ejmp.2016.08.018.

[8] E. Solfaroli Camillocci et al. "Intraoperative probe detecting $\beta-$ decays in brain tumour radio-guided surgery." In: *Nuclear Instruments and Methods in Physics Research Section A* (apr. 2016). DOI: 10.1016/j.nima.2016.04.107.

[9] C. Mancini Terracciano et al. "Feasibility of the $\beta-$ Radio-Guided Surgery with a Variety of Radio-Nuclides of Interest to Nuclear Medicine". In: *arXiv, submitted to Physica Medica* (mar. 2017). arXiv: 1610.09246.

[10] I. Mattei et al. "Secondary radiation measurements for particle therapy applications: prompt photons produced by ^4He, ^{12}C and ^{16}O ion beams in a PMMA target". In: *Physics in Medicine and Biology* 62 (gen. 2017). DOI: 10.1088/1361-6560/62/4/1438.

Roma, li 29 marzo 2017

ELENCO DELLE PUBBLICAZIONI E DELLA TESI DI DOTTORATO

Paolo Montini

Tesi di dottorato

1. P. Montini, "The cosmic ray spectrum measured by the ARGO–YBJ experiment in the 1–1000 TeV energy range", Università degli Studi Roma TRE

Pubblicazioni

1. B. Bartoli *et al.* (ARGO-YBJ Collaboration) *ARGO–YBJ observation of the large–scale cosmic ray anisotropy during the solar minimum between cycles 23 and 24*, Ap. J. 809, 90 (2015) DOI:10.1088/0004-637X/809/1/90

2. B. Bartoli *et al.* (ARGO-YBJ Collaboration) *Cosmic ray proton plus helium energy spectrum measured by the ARGO-YBJ experiment in the energy range 3-300 TeV*, Phys. Rev. D 91, 112017 (2015) DOI:10.1103/PhysRevD.91.112017

3. B. Bartoli *et al.* (Argo-YBJ Collaboration), *Medium scale anisotropy in the TeV cosmic ray flux observed by ARGO-YBJ*, Phys. Rev. D 88, 082001 (2013). DOI:10.1103/PhysRevD.88.082001

4. B. Bartoli *et al.* (Argo-YBJ Collaboration), *TeV gamma–ray survey of the northern sky using the ARGO–YBJ detector* Ap. J., 779, 27 (2013). DOI:10.1088/0004-637X/779/1/27

5. B. Bartoli *et al.* (Argo-YBJ Collaboration), *Measurement of the cosmic ray antiproton/proton flux ratio at TeV energies with the ARGO-YBJ detector*, Phys. Rev. D 85, 022002 (2012). DOI:10.1103/PhysRevD.85.022002

6. B. Bartoli *et al.* (Argo-YBJ Collaboration), *Light–component spectrum of the primary cosmic rays in the multi–TeV region measured by the ARGO-YBJ experiment.*, Phys. Rev. D 85, 092005 (2012). DOI:10.1103/PhysRevD.85.092005

7. B. Bartoli *et al.* (Argo-YBJ Collaboration), *Long-term monitoring of Mrk 501 for its very high energy γ emission and a flare in 2011 October*, Ap. J. 758 (2012). DOI:10.1088/0004-637X/758/1/2

8. B. Bartoli *et al.* (Argo-YBJ Collaboration), *Observation of TeV Gamma Rays from the Cygnus region with the ARGO-YBJ experiment.*, Ap. J. Lett. 745 (2012) L22. DOI:10.1088/2041-8205/745/2/L22

9. B. Bartoli *et al.* (Argo-YBJ Collaboration), *Long-term monitoring of the TeV emission from Mrk 421 TeV with the ARGO-YBJ experiment.* Ap. J. 734 (2011) 110 DOI:10.1088/0004-637X/734/2/110

10. B. Bartoli *et al.* (Argo-YBJ Collaboration), *Observation of the cosmic ray moon shadowing effect with the ARGO-YBJ experiment.* Phys. Rev. D 84 (2011) 022003. DOI:10.1103/PhysRevD.84.022003

11. G. Aielli *et al.* (Argo-YBJ Collaboration), *Gamma-ray flares from Mrk421 in 2008 observed by the ARGO-YBJ Detector*, Ap. J. Lett. 714 (2010) L208–L212. DOI:10.1088/2041-8205/714/2/L208

12. G. Aielli *et al.* (Argo-YBJ Collaboration), *Proton-air cross section measurement with the ARGO-YBJ cosmic ray experiment*, Phys. Rev. D 80:092004, 2009. DOI:10.1103/PhysRevD.80.092004

Roma, 20 Marzo 2017

ALLEGATO B (Verbale 2)

Vedi documenti allegati

Silvestro di Luise

Degrees

January 2007	Ph.D. in Physics, achieved defendig the thesis: *"Systematic study of the response and calibration of the Monitored Drift Tubes of the ATLAS Muon Spectrometer"*. Supervisor: Prof. Filippo Ceradini, Università degli Studi di Roma *Roma Tre*, Rome, Italy.
March 2003	B.S. and M.S. in Physics ("Laurea in Fisica") with top marks 110/110 *cum laude*. Title of the thesis: *"Study of the performance of the hadronic trigger for the $B \to D^0 K$ channel based on the online reconstruction of the secondary vertexes with the SVT at the CDF experiment"*. Supervisors: Prof. Carlo Dionisi e Dr. Marco Rescigno, Università degli Studi di Roma *La Sapienza*, Rome, Italy.

Positions

2009 – today	*Post Doc Research Associate*, ETH Zurich (Swiss Federal Institure of Technology). Director of the research: Prof. A. Rubbia.
2014 – today	Member of the collaboration *WA105/DUNE*.
2011 – today	Member of the collaboration *LAGUNA-LBNO*
2009 – today	Member of the collaborations *T2K* (KEK, JP) and *NA61/SHINE* (CERN, CH)
2008 – 2009	*Cern Fellowship*. Supervisor: Dr. R. Voss.
2007 – 2009	*Post Doc*, INFN (Istituto Nazionale di Fisica Nucleare) e Università *Roma Tre*. Director of the research: Prof. F. Ceradini.
2003 – 2012	Member of the collaboration *ATLAS* (Cern, CH).
2003 – 2007	*Dottorato di Ricerca*, Università degli Studi *Roma Tre*. Supervisor: Prof. F. Ceradini.
2003	Ph.D Scholarship, "Univeristat Autonoma de Barcelona" (Barcelona, ES). Supervisor: Prof. Matteo Cavalli Sforza.
2000 – 2003	Member of the collaboration *CDF* (Fermilab, USA).

29/03/2017

Si Luis Di Le

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Teaching

Teaching Assistant at *ETH Zurich* :

2015	*Physik II*, Prof. K. Kirch (klaus.kirch@phys.ethz.ch)
2014	*Praktika (Physics Lab)*, Prof. E. Felder (felder@phys.ethz.ch)
2014	*Physik I*, Prof. M. Meyer (mmeyer@phys.ethz.ch)
2013	*Physik I*, Prof. M. Meyer (mmeyer@phys.ethz.ch)
2013	*Physik I*, Prof. André Rubbia (andre.rubbia@cern.ch)
2012	*Physik III*, Prof. J. Home (jhome@phys.ethz.ch)
2012	*Teilchenphysik ("Particle Physics")*, Prof. K. Kirch (klaus.kirch@phys.ethz.ch)
2011	*Physik II*, Prof. A. Vaterlaus (vaterlaus@solid.phys.ethz.ch)
2011	*Physik I*, Prof. André Rubbia
2010	*Physik III*, Prof. Simon Lilly (simon.lilly@phys.ethz.ch)

Teaching Assistant at the Physics Department of the University of *Roma Tre*:

2008	*Fisica delle Particelle Elementari II* (Particle Physics), Prof. Fernanda Pastore
2008	*Complementi di Fisica Nucleare e Subnucleare* (Complements in Nuclear Physics), Prof. Fernanda Pastore.
2006	*Laboratorio di Calcolo* (Programming Languages), Dr. Domizia Orestano (orestano@fis.uniroma3.it).
2005	*Fisica della Particelle Elementari I* (Particle Physics), Prof. Filippo Ceradini (ceradini@roma3.infn.it).

Other Qualifications

2010	INFN Qualification (R5): certificate issued, upon referees evaluation, by the Istituto Nazionale di Fisica Nucleare (INFN). It is required to partecipate to INFN national recruitment contests in Italy.
2009	*Qualification*, sector 29-*Constituants élèmentaires*: issued upon referees evaluation, required to partecipate to University national recruitment contests in France.

Awards

Breaktrorugh price 2015 for Fundamental Physics awarded to the T2K/K2K collaboration https://breakthroughprize.org/Laureates/1/L155.

Languages

Italian, English, French

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Technical Skills

Programming: C++CUDA C (GPU), Python, Linux Shell, FORTRAN, LaTex.

Analysis and Simulation tools: ROOT, GEANT4, CORSIKA, GENIE, GARFIELD.

Commercial Softwares: COMSOL Multiphysics, R, MATLAB.

Machine Learning and Numerical Methods: Supervised and Usupervised Methods, Clustering, Neural Networks, Genetic Algorithms, Markov Chain Monte Carlo.

Data Analysis: Multivariate Analysis, Confidence/Credible Intervals Estimation:Bayesian and Frequentist.

Big Data and High Perfomance Computing: Hadoop ecosystem, Spark, GPU parallel programming.

Scientific Divulgation

2007 – today	Official Cern guide.
1998	Scientific guide at the "QUARK 2000" exposition, "Palazzo delle Esposizioni", Rome, Italy.

Further Professional Experiences

2005	Consultant, division *R&D-Information Technology*, TCS, Tata Consultancy Services, Mumbai, India.
2000 – 2002	Military Serivice accomplished as fireman in the National Fireman Corp.

Presentations

A selection:

July 2015	*"Recent developments in software, simulation and analysis tools for liquid argon detectors"*, Groupement de Recherche NEUTRINO, Clermont Ferrand, France.
April 2015	*"Recent results from NA61/Shine"*, HyperKamiokande EU Meeting, CERN.
July 2014	*"Numerical Optimization of neutrino fluxes for future long baseline neutrino oscillation experiment"*, ICHEP 2014, Valencia, Spain.
Oct. 2013	*"Simulation of a Magnetic Horn for charged particle focusing"* COMSOL Conference, Rotterdam, NL.
July 2013	*"Results form the T2K experiment"*, SLAC Summer Institute, SLAC, CA.
July 2012	*"Optimization of neutrino fluxes for future long baseline neutrino oscillation experiment"*, ICHEP 2012, Melbourne, AU.
July 2012	*"LAGUNA-LBNO: A very Long Baseline Neutrino Oscillation Experiment"*, ICHEP 2012, Melbourne, AU.
July 2012	*"Recent results and future plans from the NA61/SHINE experiment"*, ICHEP 2012, Melbourne, AU.
May 2012	*"Results from T2K"*, 29^{th} Rencontres de Blois, Blois, FR.
Nov. 2011	*"Constraining Neutrino Flux Uncertainties with Hadro-Production Experiments"*, NNN11 Next Generation Nucleon Decay and Neutrino Detectors Conf., Zurich, CH.
Aug. 2011	*"Strange Particles Production for Neutrino Experiments"*, NuFact XIII Workshop on Neutrino Factories, Superbeams and Betabeams, Geneve, CH.
Oct. 2009	*"New algorithm for time slewing correction with drift tubes"*, IEEE Nuclear Science Symposium, Orlando, FL.
Oct. 2009	*"Systematics in the Tracking with the ATLAS Muon Spectrometer"*, IEEE Nuclear Science Symposium, Orlando, FL.
Oct. 2008	*"Systematic Study of the Calibration of the Drift Tubes for Muon Tracking in the ATLAS Experiment at the LHC"*, IEEE Nuclear Science Symposium, Dresden, DE.
Oct. 2008	*"Data Quality Monitor of the Tracking Detectors of the Muon Spectrometer of the ATLAS Experiment at the Large Hadron Collider"*, IEEE Nuclear Science Symposium, Dresden, DE.
Feb 2007	*"ATLAS MDT chamber behaviour after neutron irradiation and in a high rate background of photons and neutrons"*, XI Conference on Instrumentation, Vienna, AUT
Nov. 2006	*"Global Time Fit for Track Finding on MDT Muon Chambers for the ATLAS Muon Spectrometer"*, IEEE Nuclear Science Symposium, San Diego, CA.
Nov. 2006	*"Intensive Irradiation Study on Monitored Drift Tubes"*, IEEE Nuclear Science Symposium, San Diego, CA.
Oct. 2005	*"MDT chamber ageing test at ENEA Gamma and Neutron Irradiation Facilities"* , IX ICATPP, International Conference on Astroparticle, Particle, Space Physics and Detectors, Como, IT.

Colloquia and Seminars

July 2013	*"Results form the T2K experiment"*, SLAC Summer Institute, SLAC, CA.
Sep. 2011	*"First Oscillation Results from the T2K Experiment"*, CHIPP, Swiss Institute of Particle Physics, Leysin, CH.
Feb. 2007	*"The Atlas Muon Spectrometer at the CERN Large Hadron Collider: Calibration and Pattern Recognition"*, CNRS-SUBATECH, Nantes, FR.
Jun. 2004	*"Rare B decays trigger at CDF with the secondary vertex tracker"*, Universitat Autonoma de Barcelona (UAB), Barcelona, ES.

E Meroni

Selected Papers and Publications

T2K experiment
&
NA61/SHINE experiment for neutrino physics

1. **Measurement of muon anti-neutrino oscillations with an accelerator-produced off-axis beam**
   K. Abe *et al.* [T2K Collaboration].
   arXiv:1512.02495 [hep-ex]
   Phys. Rev. Lett. 116 (2016) no. 18, 18101.
2. **Measurements of $\pi^{\pm}$, $K^{\pm}$, K^0_S, Λ and proton production in proton-carbon interactions at 31 GeV/c with the NA61/SHINE spectrometer at the CERN SPS**
   N. Abgrall *et. al.*
   arXiv:1510.02703 [hep-ex]
   Eur.Phys.J. C76 (2016) no. 4, 198
3. **"Measurements of $\pi^{\pm}$ differential yields from the surface of the T2K replica target for incoming 31 GeV/c protons with the NA61/SHINE spectrometer at the CERN SPS"**
   N. Abgrall *et al.* [NA61/SHINE Collaboration].
   arXiv:1603.06774 [hep-ex] (submitted for publication)
4. **Measurements of neutrino oscillation in appearance and disappearance channels by the T2K experiment with 6.6×10^{2} protons on target.**
   K. Abe *et al.* [T2K Collaboration].
   Phys. Rev. D91 (2015) 7, 072010 (arXiv:1502.01550 [hep-ex]).
5. **"Search for short baseline ν_e disappearance with the T2K near detector"**
   K. Abe *et al.* [T2K Collaboration].
   Phys. Rev. D91 (2015) 051102 (arXiv:1410.8811 [hep-ex]).
6. **"Observation of Electron Neutrino Appearance in a Muon Neutrino Beam"**
   K. Abe *et al.* [T2K Collaboration].
   arXiv:1311.4750 [hep-ex]
   (Phys.Rev.Lett. 112 (2014) 061802.)
7. **"Precise Measurement of the Neutrino Mixing Parameter θ_{23} from Muon Neutrino Disappearance in an Off-Axis Beam"**
   K. Abe *et al.* [T2K Collaboration].
   arXiv:1403.1532 [hep-ex]
   (Phys.Rev.Lett. 112 (2014) 18, 181801)
8. **"Results from T2K"**
   S. Di Luise.
   proceedings from the 24^{th} *Rencontres de Blois*
   accepted for publication (http://www.t2k.org/docs/proc/localDocDetail?docid=028)
9. **"Evidence of Electron Neutrino Appearance in a Muon Neutrino Beam"**
   K. Abe *et al.* [T2K Collaboration].
   arXiv:1304.0841 [hep-ex]
   10.1103/PhysRevD.88.032002
   Phys. Rev. D 88, 032002 (2013)
10. **"Indication of Electron Neutrino Appearance from an Accelerator-produced Off-axis Muon Neutrino Beam"**

K. Abe *et al.* [T2K Collaboration].
arXiv:1106.2822 [hep-ex]
10.1103/PhysRevLett.107.041801
Phys. Rev. Lett. **107**, 041801 (2011)

11. **"Measurement of Neutrino Oscillation Parameters from Muon Neutrino Disappearance with an Off-axis Beam"**
K. Abe *et al.* [T2K Collaboration].
arXiv:1308.0465 [hep-ex]
10.1103/PhysRevLett.111.211803
Phys. Rev. Lett. **111**, 211803 (2013)
12. **"First Muon-Neutrino Disappearance Study with an Off-Axis Beam"**
K. Abe *et al.* [T2K Collaboration].
arXiv:1201.1386 [hep-ex]
10.1103/PhysRevD.85.031103
Phys. Rev. D **85**, 031103 (2012)
13. **"Recent results and future plans from the NA61/SHINE experiment"**
S. Di Luise.
PoS ICHEP **2012**, 412 (2013).
14. **"The T2K Neutrino Flux Prediction"**
K. Abe *et al.* [T2K Collaboration].
arXiv:1211.0469 [hep-ex]
10.1103/PhysRevD.87.012001, 10.1103/PhysRevD.87.019902
Phys. Rev. D **87**, 012001 (2013)
15. **"Strange particle production in proton-carbon interactions at 31-GeV/c"**
S. Di Luise [NA61/SHINE Collaboration].
10.1088/1742-6596/408/1/012049
J. Phys. Conf. Ser. **408**, 012049 (2013).
16. **"Measurement of Production Properties of Positively Charged Kaons in Proton-Carbon Interactions at 31 GeV/c"**
N. Abgrall *et al.* [NA61/SHINE Collaboration].
arXiv:1112.0150 [hep-ex]
10.1103/PhysRevC.85.035210
Phys. Rev. C **85**, 035210 (2012)
17. **"Pion emission from the T2K replica target: method, results and application"**
N. Abgrall *et al.* [NA61/SHINE Collaboration].
arXiv:1207.2114 [hep-ex]
10.1016/j.nima.2012.10.079
Nucl. Instrum. Meth. A **701**, 99 (2013)
18. **"Measurements of Cross Sections and Charged Pion Spectra in Proton-Carbon Interactions at 31 GeV/c"**
NAbgrall *et al.* [NA61/SHINE Collaboration].
arXiv:1102.0983 [hep-ex]
10.1103/PhysRevC.84.034604
Phys. Rev. C **84**, 034604 (2011)

Long Baseline Neutrino Oscillation Experiments: LAGUNA/LBNO

1. **"Optimization of neutrino fluxes for future long baseline neutrino oscillation experiments"**

M. Calviani, S. Di Luise, V. Galymov, P. Velten
Nuclear Physics B Proceedings (2014) 13 [xrXiv:1411.2418].

2. **The LBNO long-baseline oscillation sensitivities with two conventional neutrino beams at different baselines**
S.K. Agarwalla *et. al.* [LAGUNA-LBNO coll.]
arXiv:1412.0804 [hep-ph].
3. **"LBNO-DEMO: Large-scale neutrino detector demonstrators for phased performance assessment in view of a long-baseline oscillation experiment "**
L. Agostino *et al.* [WA105 collaboration]
CERN-SPSC-2014-013, SPSC-TDR-004
arXiv:1409.4405 [physics.ins-det]
4. **"Optimised sensitivity to leptonic CP violation from spectral information: the LBNO case at 2300 km baseline"**
S. Agarwalla *et al.* [LAGUNA-LBNO Collaboration].
arXiv:1412.0593 [hep-ph] (Dec 1, 2014)
to be submitted to JHEP
5. **"The mass-hierarchy and CP-violation discovery reach of the LBNO long-baseline neutrino experiment"**
S. Agarwalla *et al.* [LAGUNA-LBNO Collaboration].
arXiv:1312.6520 [hep-ph] (Dec 23, 2013)
Published in JHEP 1405 (2014) 094
6. **"LAGUNA-LBNO: a very long baseline neutrino oscillation experiment"**
S. Di Luise.
PoS ICHEP **2012**, 387 (2013).
7. **"Optimization of neutrino fluxes for future long baseline neutrino oscillation experiments"**
S. Di Luise, A. Longhin and A. Rubbia.
PoS ICHEP **2012**, 386 (2013).
8. **"Expression of Interest for a very long baseline neutrino oscillation experiment (LBNO)"**
A. Stahl *et al.*. (2012)
`http://inspirehep.net/record/1194418`

Detector R&D for the ATLAS experiment

1. **"A new technique for charge dependent corrections to the time response of the drift tubes of the ATLAS experiment"**
S. di Luise.
10.1109/NSSMIC.2009.5402171
IEEE Nucl. Sci. Symp. Conf. Rec. **2009**, 738 (2009).
2. **"Systematic study of the calibration and resolution of drift tubes for Muon tracking in the ATLAS experiment at the LHC"**
S. di Luise [ATLAS Muon Collaboration].
10.1109/NSSMIC.2009.5402437
IEEE Nucl. Sci. Symp. Conf. Rec. **2009**, 1025 (2009).

A **"Commissioning of the ATLAS Muon Spectrometer with Cosmic Rays"**
G. Aad *et al.* [ATLAS Collaboration].
arXiv:1006.4384 [physics.ins-det]
10.1140/epjc/s10052-010-1415-2
Eur. Phys. J. C **70**, 875 (2010)

3. **"Study of the ATLAS MDT spectrometer using high energy CERN combined test beam data"**
   C. Adorisio, G. Aielli, T. .Alexopoulos, M. Alviggi, C. Amelung, C. .Anastopoulos, G. Avolio and R. Avramidou *et al.*.
   10.1016/j.nima.2008.09.031
   Nucl. Instrum. Meth. A **598**, 400 (2009).
4. **"Global time fit for tracking in an array of drift cells: The drift tubes of the ATLAS experiment"**
   P. Branchini, F. Ceradini, M. Iodice, F. Petrucci and S. Di Luise.
   10.1109/TNS.2007.914020
   IEEE Trans. Nucl. Sci. **55**, 620 (2008).
5. **"Intensive irradiation study on Monitored Drift Tubes Chambers"**
   P. Branchini, S. Di Luise, E. Graziani, A. Passeri, F. Petrucci, C. Mazzotta, E. Meoni and G. Morello *et al.*.
   10.1109/TNS.2007.894210
   IEEE Trans. Nucl. Sci. **54**, 648 (2007).
6. **"Gamma and neutron massive irradiation tests of the ATLAS MDT chambers"**
   E. Meoni, P. Branchini, S. Di Luise, E. Graziani, L. La Rotonda, C. Mazzotta, G. Morello and A. Passeri *et al.*.
   10.1016/j.nima.2006.10.195
   Nucl. Instrum. Meth. A **572**, 187 (2007).
7. **"Neutron irradiation test on ATLAS MDT chambers"**
   P. Branchini, S. Di Luise, E. Graziani, C. Mazzotta, E. Meoni, G. Morello, A. Passeri and F. Petrucci *et al.*.
   10.1016/j.nima.2007.01.102
   Nucl. Instrum. Meth. A **574**, 57 (2007).

Internal Notes: T2K

`http://www.t2k.org/docs/technotes`

1. **"Study of electron neutrino disappearance with the ND280 tracker"**
   S. di Luise *et al.*, T2K-TN-158, 100 pp., May 2013
2. **"Simulation and tuning of the Magnetic Field in the ND280 detector"**
   S. di Luise *et al.*, T2K-TN-232, 20 pp., Oct. 2014
3. **"Data Quality at the Near Detectors for RUN V,IV and III"**
   S. di Luise *et al.*
   T2K-TN-209, 90 pp., Dec 2014
   T2K-TN-168, 85 pp., July 2013
   T2K-TN-127, 96 pp., July 2012
4. **"Flux Prediction and Uncertainties for the Oscillation Analysis"**
   S. di Luise *et al.*
   T2K-TN-099, 142 pp., Oct 2013 (update)
   T2K-TN-099, 69 pp., March 2012
5. **"B-Field Calibration and systematic errors"**
   E. Frank *et al.*, T2K-TN-081, 27 pp., Nov. 2011
6. **"SuperK ν_μ Flux Uncertainties for RUN I+II"**
   S. di Luise *et al.*, T2K-TN-066, 15 pp., Jul. 2011

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7. **"Beam Uncertainties for ν_e Analysis using RUN I+II"**
   S. di Luise *et al.*, T2K-TN-054, 26 pp., Jul. 2011
8. **"Neutrino Flux Prediction"**
   S. di Luise *et al.*, T2K-TN-038, 47 pp., Feb. 2011

Internal Notes: ATLAS

`http://cdsweb.cern.ch`

1. **"The MDT data quality assessment at the Calibration Centers "**
   S. di Luise *et al.*, ATL-COM-MUON-2010-023, 32 pp, 2010.
2. **"Fast gas studies for the Atlas MDT Upgrade"**
   S. di Luise *et al.* 2009 IEEE Nuclear Science Symposium Conference Record.
   "Fast and High-Resolution Gas Mixtures for Pressurized Drift Tubes",
   Proceeding prepared for Società Italiana di Fisica, XCIII Congresso Nazionale, Pisa.
3. **"Systematic Study of the Calibration of the Drift Tubes for Muon Tracking in the ATLAS Experiment at the LHC"**,
   S di Luise, 2008 IEEE Nuclear Science Symposium Conference Record: N30-202, 978-1-4244-2715-4/08.
4. **"Study of the ATLAS MDT Spectrometer using High Energy CERN Combined Test Beam Data"**,
   S. di Luise *et al.*, ATL-MUON-PUB-2008-005, 42 pp., 2008.
5. **"Calibration Model of the MDT Chambers of the ATLAS Muon Spectrometer"**,
   S. di Luise *et al.*, ATL-MUON-PUB-2008-004, 23 pp., 2008.
6. **"First cosmics data taking in Sector 13 with the MDT precision chambers of the muon spectrometer"**
   S. di Luise *et al.*, ATL-MUON-2006-018, 25 pp., 2006.
7. **"Study of MDT calibration constants using H8 Test Beam Data"**,
   S. di Luise *et al.*, ATL-MUON-PUB-2007-004, 32 pp., 2007.

Internal Notes: CDF

1. **"Study of the performance of the hadronic SVT trigger for $B \to D^0 K$"**
   S. di Luise, CDF Internal Note, Nr. 6064, 2003.
2. **"Study of the performance of the SVT trigger tracker "**
   S. di Luise, CDF Internal Note, Nr. 6063, 2003.

Research Activity

A resume of my research activity is reported in the following.
References to papers and/or notes to which I have most directly contributed are listed at the end of each section.
The refrence number indicates the corresponding number in the list of selected publications shown in the prevoius section.

Activity within the T2K and the NA61/SHINE experiments

T2K is a long-baseline neutrino oscillation experiment that aims to precisely measure the PMNS mixing angles through the observation of electron neutrino (ν_e) appearance and muon neutrino (ν_μ) disappearance in a ν_μ beam. T2K is also looking for first hints of CP violation in the leptonic sector. The experiment uses an intense proton beam (31 GeV/c) generated by the J-PARC accelerator in Tokai (JP) impinging a Carbon target. It is composed of a neutrino beamline, a near detector complex and a far detector (Super-Kamiokande) located 295 km away from J-PARC.

In 2011, the T2K collaboration published the first indication of electron neutrino appearance (i.e. $\theta_{13} \neq 0$) from a muon neutrino beam at 2.5σ significance based on a data set corresponding to 1.43×10^{20} protons on target (POT) [10].

This result was followed by the publication of further evidence for electron neutrino appearance at 3.1σ in early 2013 [9].
As of early 2014, a new paper has been prepared presenting new results from the T2K experiment that definitively establish (7.3σ significance) the appearance of electron neutrinos from a muon neutrino beam [6].
The T2K collaboration has then publised a precision measurement of muon neutrino disappearance (i.e. $\sin^2\theta_{23}$) with an off-axis neutrino beam [12].
and joint fit of both muon neutrino disappearance and electon nutrino appearance [4].
The collaboration has just published first results with data taken with a beam of antineutrinos reporting its first measurement of muon anti-neutrino disappearance [1].
`T2K Papers:` [10,4, 12].

Oscillation Analysis: Generic

I am the developer of the `TOscAny (Tools for Oscillation neutrino Analysis)` library, a software package designed to provide an integrated set of tools to perform generic neutrino physics analysis: mainly Oscillation Analysis in the current version, Cross Section Analysis will be possible in the next release. The first version of the framework has been used to perform sensitivity studies in LBNO (see following sections). The plan is to use the last, fully fledged version, to perform the next sterile neutrino searches analysis at T2K near detector where both the appearence and disappearance transitions are measured together.
The library offers advanced statistical and numerical tools e.g.: Markov Chain Marginalization for Bayesian Confidence Interval Estimation.
The software is now being tested whitin the T2K-Exotic Working Group.
I am also one of the developer of the oscillation analysis VALOR framework, which is used for the T2K analysis, mainly with Super Kamiokande data.

E. Ulerani

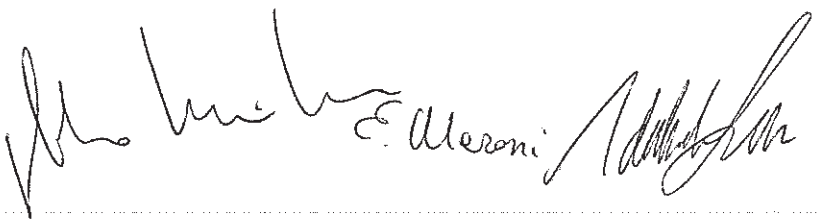
General Analysis Tools:

I am the developer of the `TShine` library, a software package designed to provide an integrated set of tools to perform generic analysis (PID, Model Fit, Unfolding) within the experimental cases of the NA61/Shine physics program. The software can be used for the different analysis in Neutrino to Heavy Ions physics.
I have also implemented a multi sample fit procedure in order to fit correlations between difference bins of the kinematic phase space.

Precise hadroproduction measurements

Second generation neutrino oscillation experiments, like T2K, do require more and more precise knowledge of neutrino fluxes. Prediction of the neutrino flux is constrained by using dedicated hadron production measurements. These measurements are being performed with the NA61/SHINE fixed target experiment at the CERN SPS. Thanks to an excellent particle identification and a large acceptance in the forward region the NA61/SHINE spectrometer covers most of the hadron production phase space of interest for T2K.
It is also worth noticing that those measurements are providing awaited inputs to the phenomenolgy for what concern the tuning of the Monte Carlo Production Models with experimental data
During the 2007, 2009 and 2010 data taking campaign dedicated runs have been delivered using both a proton beam momentum of 31 GeV/c and a graphite target, same as T2K. The first set of measurements, dedicated to the determination of the $\pi^{\pm}$ and K^{+} differential pro- duction cross section performed on the 2007, limited statistics, dataset contributed significantly to the T2K measurement of the electron neutrino appearance ($\nu_{\mu} \rightarrow \nu_{e}$) and the muon neutrino disappear- ance. Thanks to significant upgrades in the apparatus (e.g.: trigger logic, detector acceptance), carried on in the 2008, data size of the later samples is about and order of magnitude larger. This allowed for a simultaneous extraction of yields of $\pi^{\pm}$, $K^{\pm}$, K^{0} and protons.
I have significantly contrubuted to the definition, implementation and optimization of dedicated analysis techniques optimized in order to extract charged particles raw yields by using the combined information of the specific ionization energy loss (dE/dx) and the Time of Flight (ToF). I developed as well unified strategies for raw yields Monte Carlo correction (unfolding) and for the systematic errors estimation.
I have been as well in the editorial board of many of the main publications.
The total $p + C$ interaction cross section is a crucial information for the absolute normalization of the hadron spectra. A dedicated procedure was developed in order to fully exploit the apparatus upgrades: in the new setup the beam trigger ran simultaneously with the physics trigger. It is therefore possible to apply an event-by-event based selection to reduce the systematic uncertainties. The ultimate precision on the hadron production cross sections will come from the analysis of $p + C$ (large statics) data form the 2009/2010 runs which were taken with an exact replica, in terms of nuclear radiation lengths, of the T2K target. These data will allow to reduce the contribution to the systematic error in the neutrino flux prediction related to the uncertainty in the prediction of the secondary interactions in the target.
A new paper which will describe all the new results from the hadron-production analysis of high statistics datasets, including the total p+C cross section measurement, has just been submitted for publication 3

`NA61/SHINE Papers`: [2, 13],[3],[15],[18],[16].



Neutrino flux predictions

The prediction of the T2K flux model is one of the most important input to T2K neutrino oscillation and cross section measurements.
In particular the modeling of hadronic interactions is re-weighted using thin target hadron production data, including hadron production measurements from the NA61/SHINE experiment.
I have been involved in the definition of the strategy for the propagation of the production cross section uncertainties into the flux total covariance matrix and in the estimation of the impact on the total systematics errors.
A dedicated paper on the subject has been published in the 2012.
T2K Papers: [14]
T2K Notes: [4],[7],[8].

Oscillation Analysis

I have contributed to the joint analysis of neutrino appearance and disappearance. I particular I have developed a Markov Chain Monte Carlo method for the parameter estimation in the Bayesian framework. I have also implemented High Performance Computing solutions (GPU) for the optimization of intensive numerical calculations in the production of simulated events.
T2K Papers:[4]

Sterile neutrino searches

One of the most interesting topics in neutrino physics is the possible existence of sterile neutrinos (ν_s). Sterile neutrinos are right-handed non interacting particles. Their presence can be proved by detecting non standard oscillations of muon, electron or tau neutrinos. Sterile neutrinos masses could be to be much higher than the masses of standard neutrinos, in this case neutrino oscillations into sterile states are expected at very short baselines. In this respect the T2K near detector, located at 280 m form the neutrino production point, offers a promising setup for this kind of searches.
As of now there are many conflicting experimental results. The so-called "reactor neutrino anomaly" and the "Gallium anomaly" , from SAGE and GALLEX experiments, give results compatible respectively with a consistent deficit of electron neutrinos and anti-neutrinos close to 3σ. A 3σ evidence of non standard electron neutrino appearance ($\nu_\mu \to \nu_s \to \nu_e$) was found at LSND and MiniBooNE , short baseline experiments designed to search for $\bar{\nu}_e \to \bar{\nu}_\mu$ oscillation. On the other hand, experiments like KAMLAND and MINOS didn't find any significant indication of sterile neutrino mediated oscillations.
I am involved in the study of $\nu_e \to \nu_s$ disappearance in the context of the "3+1 model", where one sterile neutrino is added to the standard neutrino flavors. In partcular I am following the research subject of an ETH Ph.D. student. The ν_e selection strategy has been optimized and used to obtain the reconstructed energy templates. Moreover a control sample of selected $\gamma \to e^+e^-$ events is used to constrain the background at low energy. All the systematic uncertainties are taken into account as nuisance parameters in the fit. Considering also the $\nu_e \to \nu_s$ oscillation parameters, $\sin^2 2\theta_{ee}$ and Δm^2_{41}, 52 parameters are fitted in total.
First, a full sensitivity study in the $\{\sin^2 2\theta_{\mu e}, \Delta m^2_{41}\}$ parameter space has been performed. Then, fit to data has been performed using 5.9×10^{20} proton on target. The p-value for the null hypothesis is 0.085 and the excluded region at 95% CL is approximately $\sin^2 2\theta_{ee} > 0.3$ for $\Delta m^2_{eff} > 7\ eV^2/c^4$.
A paper was published in 2015 to PRD.
The analysis is now moving towards a global fit where ν_μ disappearance, ν_e appearance and ν_e disappearance are measured together. The measurement will be done in the $\{\sin^2 2\theta_{ee}, \sin^2 2\theta_{\mu\mu}, \Delta m^2_{41}\}$ oscillation parameter space.

E. Ucroni

T2K Notes:[1]
T2K Papers:[5]

Near Detector Magnet Operation and Data Quality

Since March 2012 I am the responsible for the operation, data quality and calibration of the Magnet of the T2K Near Detector (ND280).

T2K Notes: [3].

Near Detector Magnetic Field Simulation

The ND280 Magnet iron yokes are instrumented with Side Muon Range Detectors (SMRD). So far the charged track reconstruction algorithm was using a constant approximated value for the magnetic field in the yokes' volume since no field measurements have been performed in the past in that detector element.
Upon request of the Reconstruction Group I recently set up a Magnetic Field Simulation Task Force in order to provide a fine grained map of the magnetic field in the ND280. I developed a fully fledged simulation of the whole magnet apparatus using a Finite Element Analysis program (COMSOL). The several configuration parameters have been tuned in order to reproduce the correct magnetic field in those regions where direct measurements are available (e.g.: from the previous calibration campaign). At the moment the new field map is being implemented in the general reconstruction framework.

T2K Notes: [2]

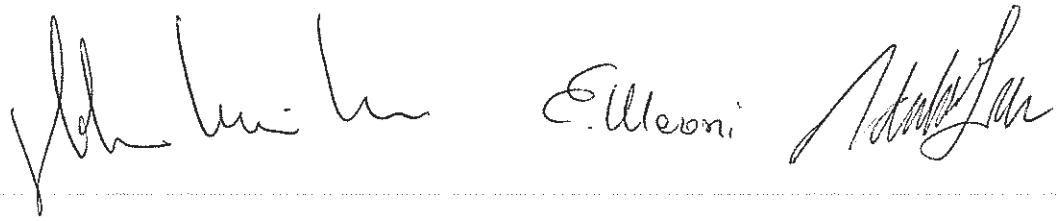
Activity within the WA105/DUNE collaboration

A mandatory milestone in view of any future long baseline experiment is a concrete prototyping effort towards the envisioned large-scale detectors, and an accompanying campaign of measurements aimed at assessing the systematic errors that will be affecting their intended physics programme. In 2013, the CERN-SPSC has approved the physics case for CP-violation and neutrino mass hierarchy determination described in the LBNO EoI (2012), the choice of the Liquid Argon (LAr) detector technology. As a consequnce the WA105 collaboration has been formally established with the purpose of being the leading R&D project for what concern large LAr detectors operation.
A Technical Designed Report has been submitted in view of a realisation of the facility and an exposure to the charged particle beam before the LHC Long Shut Down 2 (LS2) in 2018.

I am the software coordinator and one of the main developers of the simulation/reconstruction general framework for Liquid Argon TPC (LAr-TPC) detector. I am one of the main developers of the LAr-TPC reconstrucion package.
I am the main developer of the simulation package for the Light Readout studies with LAr-TPCs. I that context I have developed a metodology, based on detector response lookup tables, to improve the simulaton time of the propagation of photons in Liquid Argon.

I have as well designed and implemented Finite Element Analysis in order to study space charge effect in a Liquid Argon detector.

LBNO Papers: [3]



Activity within the LAGUNA/LBNO collaboration

The next generation neutrino observatory proposed by the LBNO collaboration will address fundamental questions in particle and astroparticle physics.
The LBNO experiment is the outcome of intense and comprehensive design studies sup- ported by the European Commission since 2008.
The main goals of the proposed LBNO next-generation long-baseline neutrino and antineutrino oscillation experiment are to discover CP-violation in the leptonic sector (CPV or $\neq 0$ and π) and determine the neutrino mass hierarchy (MH or sign(Δm^2) $=\pm 1$).
The experiment consists of a far detector, in its first stage a 20 kt LAr double phase TPC and a magnetised iron calorimeter, situated at 2300 km from CERN and a near detector based on a high-pressure argon gas TPC.
The long baseline provides a unique opportunity to study neutrino flavour oscillations over their 1^{st} and 2^{nd} oscillation maxima exploring the L/E behaviour, and distinguishing effects arising from δCP and matter.

Sensitivity studies

We have seen that the LBNO first phase has significant physics goals, in particular it is guaranteed to be fully conclusive for MH discovery with an expected 5σ C.L. over the full range of δCP.
We have addressed the impact of the knowledge of the oscillation parameters and of the systematics errors of the experiment. We employed a Monte-Carlo technique simulating a very large number of toy experiments to estimate the confidence level of the MH and CPV measurements. We find that, with the capability of reversing the horn focusing polarity, and even under pessimistic assumptions on systematic errors, LBNO alone provides a direct and guaranteed discovery of MH with $\geq 3\sigma (\geq 5\sigma)$ confidence level, independently of the value of the CP phase and the octant of $_{23}$, within $\sim$2.5(5) years of CERN SPS running. The first stage of LBNO will therefore discover the mass hierarchy with certainty.
LBNO has also a unique sensitivity to CPV through the exploration of the first and second oscillation maxima, making possible to study the L/E modulation which should match that expected by δCP terms in the oscillation probability. With conservative expectations on the systematic errors and after 10 years of CERN SPS running, a significance for CPV above $> 3\sigma$ C.L. will be reached for 25(40)% of the δCP values, under the assumption that $\sin^2 2\theta_{13}$ will be known from reactor experiments with a precision of 10(2.5)%. The ultimate CPV reach is sensitive to the knowledge of the oscillation parameters and to the assumed flux, cross-section and detector-related systematic errors. The CPV reach is larger if sources of systematic errors can be controlled below the values conservatively assumed in our present study. In particular, improvements in the present knowledge of differential neutrino interaction cross-sections would increase the expected CPV discovery potential of LBNO. Alternatively, with an increased exposure aimed at increasing the num- ber of oscillated around the 2nd maximum, a CPV discovery level $> 5\sigma$ C.L. is reachable over a wide range of δCP values. With a new powerful proton driver such as the concep- tual HP-PS and a 70 kton detector mass, the coverage at $> 5\sigma$ C.L. will be $\sim$ 54% after 10 years.

LBNO Papers: [6], [5], [8].

Optimization of the neutrino beam line optics

Since the CP-asymmetry at the 2^{nd} maximum is more sensitive to δCP than at the first maximum, a significant gain is obtained by populating this region with oscillation events. This is one of the main goals of the LBNO.

E. Meroni

The neutrino beamline design becomes then a central component of the LBNO optimisation, since it will directly impact the long-baseline physics reach.
Specific scenarios for the proton driver and the far detectors have been investigated. In particular, the flux predictions have been obtained by means of a full GEANT4 simulation of the primary proton beam interaction in the target, the secondary hadrons focusing system (e.g. horn-reflector layout) and the decay pipe.
A dedicated algorithm has been then developed to search for the optimal configuration of the beam line by scanning the multidimensional space of the desgin parameters. The aim is to maximize the LAGUNA-LBNO physics performance in terms of the discovery potential for both the CP-violation and the mass hierarchy.
The original optimization algorithm has been then complemented by other groups within the LBNO collaboration, for example machine learning techniques (i.e.: genetic algorithm) have been successfully applied leading to further improvements in the CP sensitivity.

LBNO Papers: [7], [1], [4]

E. Meroni

Activity whithin the ATLAS experiment

Sudies of the Performance of the ATLAS detector using cosmic-ray muons

Cosmic ray interactions provide a source of physics signals in the ATLAS detector that have allowed for investigations of the detector alignment, calibration and performance prior to the arrival of the LHC beams. Such events have been used to exercise the detector readout and associated data-handling infrastructure, and the accumulated datasets have been axploited for both standalone and combined performance studies of the detector susbsystems. In the work carried on relevant results have been achieved in the lepton identification and reconstruction as well as for the missing transverse energy and the Muon Spectrometer performance both in standalone and combined tracking. Studies related to the rejection of background from cosmic-ray events have been performed as well. All the results are shown to be in good agreement with simulated events based on cosmic-ray generator and full detector response simulations.
`Atlas Papers:` [2]
Since the beginning of my Ph.D. I have been performing my research activity in the ATLAS collaboration.
The thesis
"Systematic study of the response and calibration of the monitored drift tubes of the ATLAS muon spectrometer" is public at the link: `http://inspirehep.net/record/775487?ln=en`
The different studies presetend in the thesis have lead so far to several publications. For example:
`Atlas Papers:` [1], [3],[4] (for what concern calibration and tracking), [6],[7],[5] (for background studies)

Study of the Drift Tubes tracking performance with a high momentum muon beam

I worked on the analysis of Monotored Drift Tubes chamber data taken with a high momentum ($\sim$ 200 GeV/c) muon beam at the CERN SPS. The auto-calibration method has been developed to calculate the space-time relation from the data themselves and to extract the resolution function. The method has been extensively tested and optimized to study the systematic effects and the statistics needed to guarantee that the calibration error is indeed much smaller than the single point resolution. The various sources of uncertainties (temperture and composition instabilities, trigger time measurements ...) and the most critical factors (sample size, track angulat spread, number of hits, selection criteria ...) affecting the space-time relation and the resolution function measurements have been put in evidence. All the results have been validated with detector simulation packages based on GEANT for the particle transport and dedicated software for gas ionization and the digitization stage. The effect of miscalibration on the track reconsctruction in the spectrometer has been investigated. A modified version of the standard procedure, wich can also be used in the absence of an external trigger and for the measurement of the track position in the wire direction in those regions of the spectrometer where the information on the second coordinate is missing, has been conceived and implemented. A novel algorithm to derive the spatial resolution by requiring a flat track fit probability distribution has been also developed. These two algorithms are now being extensively used in the analysis of the data taking in the ATLAS Muon Spectrometer with cosmics. Mathematical methods for fast (analytical) fit of both straight and curved tracks in an array of drift tubes have been developed for the calibration in an intense magnetic field.
A novel technique has been concived in order to improve the spatial resolution. The method exploits the correlation between the cluster charge (as measued by the ADC) and the drift time (as measured by the ADC).
All the achieved results have been published and presented at serveral conferences.

E. Meroni

Atlas Papers: [1], [3], [4]
Atlas Notes: [4], [7], [3]

Study of the Drift Tubes performance in a high radiation background

The MDT detectors will have to operate in a high photon and neutron flux during the LHC operation. Two bundles of 24 tubes each equipped with the ATLAS standard gas distribution and electronics have been exposed to neutron and photon fluxes to test the aging of the detectors, in view also of possible applications to the SLHC, and to verify pattern recognition and tracking capabilities in a high background environment. The Tapiro nuclear reactor neutron source and the Calliope ^{60}Co photon source at the ENEA Casaccia center have been exploited. The integrated flux corresponds to more than 100 years of LHC operations or 10 years at SLHC. For background studies the neutron [1] (photon) flux was tuned to the one expected during the LHC operation at the higher luminosity. The study of the performance at different stages of the irradiation campaign was performed using cosmic ray tracks and resulted in a very good behavior of the detectors after intensive irradiation. For this measurements, I worked on the assembly and test of the detectors and of the gas and HV systems. I set up the DAQ system and the analysis procedures. I was involved in the installation of all the system in the irradiation sites and in data collection during irradiation and in the final offline analysis.
Selected Papers: [6,7]

Studies on Gas Mixtures

The $Ar-CO_2(93:7)$ gas mixtures used for the MDT was chosen mainly for its low aging properties. The drawbacks of such a mixture is a high non linearity of the space-time relation and the long maximum drift time. This make the gas drift properties very sensitive to density and electric field variations, the latter mainly induced by space charge fluctuations. Part of the work has been put on the study of alternative gas mixtures to be used in the MDT also in anticipation of the luminosity upgrade of the LHC. In that case, in fact, the increase in the spatial ionizing particle density will enhance the space charge related effects and the consequent spoil of the track reconstruction performance. The usage of gas mixtures with a good resolution, a better linearity and a lower maximum drift time would reduce the side effects of the space charge and of the higher collision rate with limited effect on the detector performance. First results have been obtained both with simulation and measurements on test detectors with cosmic rays . It is ongoing also an analysis aimed to optimize the relative fraction $Ar:CO_2$ and the operation parameters of the standard gas mixture in order to get a more linear space-time realtion while keeping a low afterpulsing rate.
At the moment a test beam data taking has just finished and another data taking has been organized beginning next year. The setup consists of a prototype chamber and a silicon strip detector as trigger device and external tracker for high precision extrapolation of the track inside the drift tube.
Atlas Notes: [2]

Detector Commissioning and data taking with cosmics

I am involved in the commissioning of the MDT chambers since the very first data taking run in 2006, where the trigger was provided by two long scintillator counters, up to the today's data taking campaigns where almost all the Muon Spectrometer chambers are acquired simultaneously. I

[1] The results on the neutron background have been used in the studies on the LHC luminosity upgrade: D. Bortoletto (Purdue U.) "*The ATLAS and CMS Plans for the LHC Luminosity Upgrade*", HCP2008: 19th Hadron Collider Physics Symposium 2008, Galena, Illinois, 27-31 May 2008. e-Print: arXiv:0809.0671 [hep-ex].

partecipated to the in-situ installation and equipment of the MDT as well. At the end 2008 a Muon Cosmic Task Force between all the groups involved in the Muon Specrometer operation have been set up in order to optimize the full chain of data processing from read-out to the tracking. The Roma Tre group is in charge for the data quality assessment and data processing on the calibration stream (see relative section). More details in the next paragraphs.
Atlas Papers: [2]
Atlas Notes: [6].

The MDT Calibration Framework and MDT DQA

The drift properties of the $Ar \sim CO_2$ gas mixtured used for the ATLAS MDT depend strongly on environmental and operational parameters. To exploit the intrinsic momentum resolution of the muon spectrometer, an accurate calibration of the detectors should be performed and continuously monitored and eventually updated. Requirements on the statistics and latency imposed the development of a dedicated data stream ("calibration stream") extracted on-line at the level-2 trigger and distributed to three calibration sites (one in Rome). At the calibration sites data are analysed to produce a set of calibration constants with a latency of about one day. The information are then stored in a database at CERN where they are accessible to the collaboration for muon track reconstruction. A framework has been conceived and implemented in order to manage all the phases of the MDT calibration from the data extraction procedure to the calibration constants measurements and the databases interconnections. I have contibuted to the implementation of various algorithms applied in the calibration procedure. I am taking care of the data processing and calibration computation at the Tier-2 in Rome. An important task of the calibration framewok is the monitoring and validation of the calibration parameters as a part of the Data Quality Assessment (DQA) of the muon spectrometer. I have contributed to the DQA at the calibration sites in the definition of the critical quantitities and the relative acceptance criteria to be used for the data validation. I have developed several tools in order to provide information on the correlation between tracking and trigger chambers, trigger coverage, channel noise and occupancy, tube effciency and segment fit quality, time stability of the drift properties and other dedicated tests performed by comparison with user defined reference histograms. I also worked on the implementation of a dedicated tool for a cross check of the results with the online monitoring and the Detector Control System information for the final assessment of the MDT subdetector status. The general framework has been tested extensively both on cosmic data taken during the spectrometer commissioning phase with cosmic rays and on muon calibration stream extracted from samples of simulated data and presented to a recent conference. Commissiong data are being used extensively for trigger performance studies as well. In particular trigger timing issues need to be investigated carefully. At reconstruction level the problem of the trigger jitter and non-synchronization has been solved with a "floating time" segment fit algorithm which adjust the trigger time in order to get the best fit quality. The outcome of the "floating time" fit has been used as input to an automatic procedure for the detection of the different trigger time sources and the relative time shift for each trigger chamber. This information can be directly used in the synchronization of the trigger chamber response.
Atlas Notes: [1], [5].

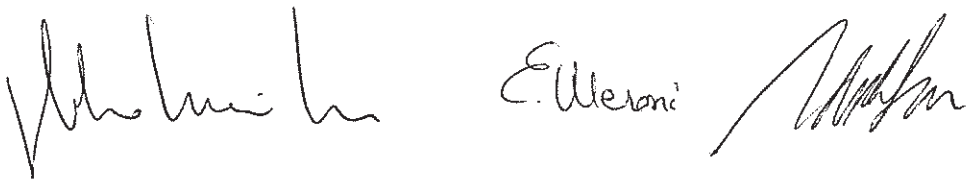
Activty whithin the CDF experiment

The work during my undergraduate thesis was performed whithin the CDF collaboration.

E. Meroni

Study of the performance of the hadronic secondary vertex trigger

The construction of the Silicon Vertex Tracker (SVT) trigger device represented one of the most important upgrade of the Run II data taking phase. Thanks to their long lifetime ($\sim 1.5\,ps$), hadrons containing b quarks decay in a (secondary) vertex distant about 100 μm from the primary vertex. The tracks of the b hadrons decay products are therefore characterized by a distance of closest approach (impact parameter) to the primary interaction vertex wich is significantly different from zero. The SVT, using the information of the silicon vertex tracker, performs the online reconstruction of charged tracks and the measurement of the impact parameter with such a resolution to allow the selection of events with b quarks production already at trigger level. The SVT plays a central role in the CDF Run II b physics program. I first performed a study of the performance of the SVT using both simulation and early Run II data. The analysis has singled out the critical parameters to be optimized in order to maximize the selection efficiency while keeping the allowed trigger bandwidth within the requirements. Different trigger thresholds has been established as a function of the instantaneous luminosity. It has been quantified the contribution, in terms of trigger rate, of errors in the pattern recongnition with respect to the offline algorithms, and of the hit efficiency and noise. It was then studied the capability of the SVT to collect a statistically significant sample of the decays $B \to D^0 K$, characterized by a small branching ratio ($\sim 10^{-7}$), to be used in the mesurement of the angle γ of the Unitarity Triangle. In particular, different trigger scenario, based on both kinematical and quality cuts, has been proposed to optimize the hadronic trigger algorithm to the $B \to D^0 K$ signal for both the three ($D^0 \to K\pi$) and five particles ($D^0 \to K\pi\pi\pi$) final state.
CDF Notes: [1],[2].



Carlo Mancini Terracciano

Roma, li 29 marzo 2017

C. Mancini T.

Formazione

27 gennaio 2015 **Dottorato di Ricerca** in Fisica (XVII Ciclo)
presso l'Università degli Studi "Roma Tre".
Titolo della tesi: *"Analysis and interpretation of Carbon ion fragmentation in the Bragg peak energy range"*.
Relatore : Prof. Filippo Ceradini. Relatore esterno: Dr. Alfredo Ferrari.
Dottorando presso l'Università di Berna (gennaio 2011-gennaio 2012)
e presso "Roma Tre" (gennaio 2012 – gennaio 2015).

20 dicembre 2010 **Laurea Specialistica** in Fisica (DM 509/99 - Ordin. 2007 classe 20/S)
presso l'Università degli Studi di Roma "Sapienza".
Voto: 110/110 e lode.
Titolo della tesi: *"Studio del rumore correlato in una schiera di rivelatori bolometrici" [2]*.
Relatore: Prof. Fernando Ferroni. Correlatore: Dr. Marco Vignati.

luglio-settembre 2008 **Stage** presso SLAC (Stanford Linear Accelerator Centre), Menlo Park (California).
Studio del decadimento della risonanza esotica Y(4260) in $\psi(2s)\pi^+\pi^-$ con l'esperimento BaBar.
Responsabile: Dr. Gianluigi Cibinetto.

3 ottobre 2007 **Laurea** in Fisica (DM 509/99 - Ordin. 2002 classe 25).
presso l'Università degli Studi di Roma "Sapienza"
Voto: 106/110.
Titolo della tesi: *"Studio del segnale prodotto in un rilevatore bolometrico da un segnale prodotto da decadimento doppio beta senza emissione di neutrini"*.
Relatore: Prof. Riccardo Faccini.

Esperienze professionali

da marzo 2017 **Grant di ricerca** presso l'INFN, Sezione di Roma.
Sviluppo dei modelli di interazione nucleare al di sotto di 100 MeV/n per Geant4, un pacchetto per simulazioni Monte Carlo di interazione fra radiazione e materia.

febbraio 2015 - febbraio 2017 **Assegnista di ricerca** presso l'Università degli Studi di Roma "Sapienza".
Sviluppo di una sonda intraoperatoria per chirurgia radioguidata con radiazione $\beta-$

agosto 2016 **Visiting researcher** presso i laboratori iThemba, Cape Town (Sudafrica).
Analisi di dati sperimentali sulle interazioni di ioni ^{14}N a 33 MeV/n con bersagli fissi.

aprile - maggio 2015 **Cooperation Associate** presso il CERN, Ginevra (Svizzera).
Implementazione dei modelli di interazione quasi elastica degli ioni Carbonio a poche decine di MeV/n in Fluka, un programma di simulazione Monte Carlo delle interazioni fra radiazione e materia.

luglio 2012 - gennaio 2015 **Fellow** presso il CERN nell'ambito del progetto Marie Sklowska-Curie "ENTERVISION" (MSCA Grant Agreement: 264552).
Sviluppo e benchmarking di Fluka. Sviluppo dei modelli di interazione degli ioni ^{12}C alle energie rilevanti per l'adroterapia.

aprile 2015 **Visiting researcher** presso i laboratori iThemba, Cape Town (Sudafrica).
Analisi di dati sperimentali sulla frammentazione di ioni ^{12}C a 33 MeV/n.

giugno - luglio 2011 **Visiting researcher** presso l'Institut de Physique Nucléaire di Lione (Francia).
Ricerca di eventi di oscillazione $\nu_\mu \to \nu_e$ con l'esperimento OPERA [5].

Abilitazioni

2016 **Idoneo** al concorso per titoli ed esami per 58 posti con il profilo professionale di Ricercatore di III livello professionale con contratto di lavoro a tempo indeterminato dell'INFN (Bando n.: 18221/2016).

Responsabilità riconoscimenti e grant

2017 **Grant** per il progetto "**GeNIALE**" (Geant Nuclear Interaction at Low Energy) finanziato dalla Commissione Scientifica Nazionale 5 dell'INFN (Bando n.: 18203/2016).

dal 2017 **Principal Investigator** e responsabile nazionale della sigla "**GeNIALE**" dell'INFN.

2017 **Ideatore** e promotore del progetto di ricerca MaRIANNe (Magnetic Resonance Image Analysis with Neural Networks) presentato al bando "Progetti Gruppi di Ricerca, Conoscenza e cooperazione per un nuovo modello di sviluppo (L.R. 13/2008 - art. 4)" del Programma Strategico regionale per la ricerca, l'innovazione ed il trasferimento tecnologico della Regione Lazio. In fase di valutazione.

2015 **Ideatore** e principale promotore del progetto Marie Sklowska-Curie Individual Fellowship "MISP" (Multichannel Intraoperative Surgery Probe) nell'ambito del programma "Horizon 2020" valutato positivamente ma non ammesso al finanziamento.

2012 **Marie Sklowska-Curie Fellowship** per il progetto "ENTERVISION" finanziato nell'ambito del programma "Horizon 2020" (MSCA Grant Agreement: 264552).

2012 **Responsabile** del "Work Package 2" (programma degli eventi e direzione scientifica) del Progetto Europeo, finanziato nell'ambito del Settimo Programma Quadro (RESPECT FP7-316436), "Notte Europea dei Ricercatori 2012"[1], realizzato dall'associazione no-profit "Frascati Scienza" (www.frascatiscienza.it).

dal 2010 **Presidente** dell'Associazione "Accatagliato" (www.accatagliato.org), associazione di volontariato riconosciuta come ONLUS dalla Regione Lazio e dedita alla divulgazione scientifica (partner ufficiale di Frascati Scienza per l'organizzazione della Notte Europea dei Ricercatori dal 2011 ed editrice della rivista di divulgazione scientifica "Accastampato"[2]).

Didattica

2016 Relatore unico di un corso (dal 1 al 5 agosto 2016) sui metodi Monte Carlo per le simulazioni delle interazione della radiazione con la materia presso i laboratori iThemba, Cape Town (Sudafrica).

2015 e 2016 Assistente nel corso "Laboratorio di Calcolo" per il corso di laurea in Fisica dell'Università degli Studi di Roma "Sapienza"

2015 Correlatore della tesi di Laurea in Fisica di Adriano Cimmini
"Effetti radiobiologici della radiazione ionizzante"

2014 Correlatore della tesi di Laurea in Fisica di Giulia Pullano
"Acceleratori compatti di protoni finalizzati all'Adroterapia"

2013 Co-supervisor di Stefano Pioli durante il suo stage come summer student presso il CERN

2014 Assistente al corso di Fisica II per i corsi di Laurea Chimica, Farmacia, Filosofia, Matematica e Informatica della Facoltà di Scienza dell'Università degli Studi di Berna (Svizzera).

2014 Assistente al corso di Laboratorio di Fisica Moderna per il corso di Laurea Specialistica in Fisica della Facoltà di Scienza dell'Università degli Studi di Berna (Svizzera).

[1] http://www.frascatiscienza.it/pagine/notte-europea-dei-ricercatori-2012/
[2] www.accastampato.it

E. Ulerani

dal 2017 GeNIALE - Geant Nuclear Interaction At Low Energy
Sto attualmente lavorando sul progetto da me proposto e finanziato dall'INFN. Lo scopo del progetto è di migliorare la capacità di Geant4 di simulare le interazioni nucleari al di sotto di 100 MeV/n implementando un modello dedicato. Al GeNIALE collaborano il gruppo teorico dei Laboratori Nazionali del Sud e dell'Institut de Physique Nucléaire di Orsay (Francia), il gruppo che sviluppa le interazioni adroniche e nucleari di Geant4 del CERN e i laboratori iThemba di Cape Town (Sudafrica) per il benchamark con dati sperimentali non ancora pubblicati.

2015 – 2017 ARPG
All'interno dell'*Applied Radiation Physics Group* (ARPG) dell'Università degli Studi di Roma "Sapienza" ho lavorato allo sviluppo di una sonda intraoperatoria per la chirurgia radio-guidata con radiazione $\beta-$ [13] (progetto CHIRONE dell'INFN). Ho avuto la responsabilità dello sviluppo delle simulazioni Monte Carlo (MC) del detector, che includono la simulazione della produzione dei fotoni ottici nel cristallo scintillante e le sue proprietà ottiche. Ho anche sviluppato un protocollo sperimentale per misurare le proprietà ottiche dei diversi prototipi in modo da permettere l'ottimizzazione della simulazione stessa. Ho inoltre sviluppato una simulazione per valutare le prestazioni dei prototipi della sonda durante l'uso clinico. Questa simulazione riproduce le caratteristiche del corpo del paziente, come densità, composizione chimica e captazione del radiofarmaco ed è stata usata per predire le performance della sonda con nuovi potenziali radiofarmaci [14]. Ho anche preso parte alle misure pre-cliniche ex-vivo che hanno dimostrato l'efficacia della tecnica per il meningioma [12]. In ARPG ho anche lavorato alle simulazioni MC di detector per il monitoraggio del fascio durante l'adroterapia. Inoltre, dall'ultimo anno sono il responsabile dello sviluppo di un codice per l'analisi di immagini da risonanza magnetica volto alla classificazione dei pazienti affetti da tumore al retto in base alla risposta al trattamento radio-chemioterapico previsto dal protocollo clinico prima della resezione chirurgica.

2012 - 2015 Sviluppo di FLUKA
Ho lavorato al CERN nel gruppo che si occupa dello sviluppo di FLUKA. Mi sono occupato dei modelli di frammentazione degli ioni ^{12}C in seguito ad un'interazione di poche decine di MeV/n [8]. In particolare ho contribuito all'implementazione dell'emissione di particelle α nelle fasi di pre-equilibrio. Sono stato il responsabile dell'analisi e della simulazione MC di un esperimento realizzato ai laboratori iThemba che ha misurato la frammentazione del ^{12}C interagendo con diversi bersagli a 33 MeV/n. Con lo scopo di velocizzare FLUKA fino a permettere di usarlo per simulare le misure di fotoni durante un trattamento adroterapico ho lavorato sull'ottimizzazione di diverse tecniche di biasing [7] ed ho implementato un generatore di numeri pseudo-random in CUDA per esplorare le potenzialità del calcolo parallelo su GPU.

2011 - 2012 OPERA
Ho partecipato alla ricerca di eventi di oscillazione $\nu_\mu \rightarrow \nu_e$ con il detector OPERA lavorando per l'Università di Berna. Sono stato il responsabile dello sviluppo di un protocollo per una campagna di scanning esteso delle emulsioni volto ad aumentare l'efficienza di identificazione delle cascate elettromagnetiche, incrementando quindi l'efficienza alle interazioni di corrente carica dei ν_e [5].

Come studente

Durante la Laurea Specialistica ho avuto l'opportunità di contribuire ad alcuni progetti di ricerca, i più significativi sono:

- Come lavoro di testi ho sviluppato un algoritmo per rimuovere il rumore correlato fra i diversi canali di Cuoricino [2], un esperimento fatto per misurare il decadimento doppio-β senza emissione di neutrini. Questo algoritmo è ancora in uso nell'esperimento CUORE e per svilupparlo ho implementato la libreria per la gestione della matematica dei numeri complessi in Diana, il framework di analisi dati degli esperimenti Cuoricino e CUORE.

- Il lavoro fatto per il Laboratorio di Fisica Subnucleare è stato pubblicato [1]. Abbiamo, infatti, progettato e implementato un setup sperimentale, e sviluppato il relativo software di analisi dati, per valutare la componente Cerenkov della luce misurata in un cristallo scintillante, con lo scopo di permette di valutare la componente elettromagnetica di uno sciame adronico.

Pubblicazioni Scientifiche su riviste Peer Reviewed

[1] L. Cavallini et al. "Assessment of the Čerenkov light produced in a $PbWO_4$ crystal by means of the study of the time structure of the signal." In: *Astroparticle, Particle And Space Physics, Detectors And Medical Physics Applications* 63 (set. 2008), pp. 359–363. DOI: 10.1142/9789812819093_0063.

[2] C. Mancini Terracciano e M. Vignati. "Noise correlation and decorrelation in arrays of bolometric detectors." In: *Journal of Instrumentation* 7.06 (giu. 2012), P06013. DOI: 10.1088/1748-0221/7/06/P06013.

[3] T. Adam et al. "Measurement of the neutrino velocity with the OPERA detector in the CNGS beam using the 2012 dedicated data." In: *Journal of High Energy Physics* 2013.1 (gen. 2013), pp. 1–14. DOI: 10.1007/JHEP01(2013)153.

[4] N. Agafonova et al. "Addendum: search for $\nu_\mu \to \nu_e$ oscillations with the OPERA experiment in the CNGS beam." In: *Journal of High Energy Physics* 85 (lug. 2013). DOI: 10.1007/JHEP07(2013)085.

[5] N. Agafonova et al. "Search for $\nu_\mu \to \nu_e$ oscillations with the OPERA experiment in the CNGS beam." In: *Journal of High Energy Physics* 7 (lug. 2013), pp. 1–16. DOI: 10.1007/JHEP07(2013)004.

[6] F Bellini et al. "Extended calibration range for prompt photon emission in ion beam irradiation". In: *Nuclear Instruments and Methods in Physics Research Section A* 745 (mag. 2014), pp. 114–118.

[7] C. Mancini Terracciano et al. "Development of a technique to speed up the simulation of PET and SPECT." In: *Radiotherapy and Oncology* 110 (feb. 2014), S62. DOI: 10.1016/S0167-8140(15)34148-7.

[8] P. Sala et al. "The recent developments of the FLUKA Monte Carlo code oriented to its applications in hadron-therapy." In: *Radiotherapy and Oncology* 110 (feb. 2014). DOI: 10.1016/S0167-8140(15)34195-5.

[9] V. Bocci et al. "Development of a radioguided surgery technique with $\beta-$ decays in brain tumor resection." In: *Radiotherapy and Oncology* 118 (2016). DOI: 10.1016/S0167-8140(16)30081-0.

[10] R. Donnarumma et al. "A novel radioguided surgery technique exploiting $\beta-$ decay." In: *Physica Medica: European Journal of Medical Physics* 32 (feb. 2016), pp. 104–105. DOI: 10.1016/j.ejmp.2016.01.362.

[11] A. Russomando et al. "An Intraoperative $\beta-$ Detecting Probe for Radio-Guided Surgery in Tumour Resection." In: *IEEE Transactions on Nuclear Science* 63.5 (ott. 2016), pp. 2533–2539. ISSN: 0018-9499. DOI: 10.1109/TNS.2016.2600266.

[12] E. Solfaroli Camillocci et al. "First Ex-Vivo Validation of a Radioguided Surgery Technique with $\beta-$ Radiation." In: *Physica Medica* 32.9 (set. 2016), pp. 1139 –1144. DOI: 10.1016/j.ejmp.2016.08.018.

[13] E. Solfaroli Camillocci et al. "Intraoperative probe detecting $\beta-$ decays in brain tumour radio-guided surgery." In: *Nuclear Instruments and Methods in Physics Research Section A* (apr. 2016). DOI: 10.1016/j.nima.2016.04.107.

[14] C. Mancini Terracciano et al. "Feasibility of the $\beta-$ Radio-Guided Surgery with a Variety of Radio-Nuclides of Interest to Nuclear Medicine". In: *arXiv, submitted to Physica Medica* (mar. 2017). arXiv: 1610.09246.

[15] M. Marafini et al. "Secondary radiation measurements for particle therapy applications: nuclear fragmentation produced by ^{4}He ion beams in a PMMA target". In: *arXiv, submitted to Physics in Medicine and Biology* (mar. 2017). arXiv: 1608.08068.

[16] I. Mattei et al. "Secondary radiation measurements for particle therapy applications: prompt photons produced by ^{4}He, ^{12}C and ^{16}O ion beams in a PMMA target". In: *Physics in Medicine and Biology* 62 (gen. 2017). DOI: 10.1088/1361-6560/62/4/1438.

[17] A. Rucinski et al. "Secondary radiation measurements for particle therapy applications: Charged secondaries produced by ^{4}He and ^{12}C ion beams in a PMMA target at large angle". In: *arXiv, submitted to Physics in Medicine and Biology* (mar. 2017). arXiv: 1608.04624.

E. Meroni

Divulgazione Scientifica

dal 2010 Ideatore, Principale promotore e redattore della rivista di divulgazione scientifica "Accastampato". La rivista è dedicata principalmente agli studenti delle scuole superiori, è distribuita gratuitamente su internet (www.accastampato.it) e tramite una app dedicata. I numeri di settembre 2010, 2011 e 2012 sono stati stampati e distribuiti durante la "Notte Europea dei Ricercatori" a Roma e Frascai; il numero di settembre 2013 è stato realizzato in Italiano, Inglese, Francese e Spagnolo e stampato e distribuito al CERN durante gli "Open Days" e durante la "Nuit Européenne des Chercheurs" dell'"Ecole Polytechnique" di Parigi.

dal 2012 Collaboratore di "Fisicast", il primo Podcast italiano dedicato alla fisica (www.radioscienza.it/fisicast)

2010 e 2015 Collaboratore di Frascati Scienza per la "Notte Europea dei Ricercatori"

2014, 2015 e 2016 Ideatore e organizzatore di un Laboratorio di Scrittura Divulgativa dedicato a studenti e dottorandi di Fisica tenutosi presso il Dipartimento di Fisica dell'Università degli Studi di Roma "Sapienza". Il progetto è stato finanziato dalla European Physics Society (EPS).

2013 Collaboratore del CERN per la "European Researchers' Night" di Ginevra e per gli "Open Days" del CERN.

2012 Direttore Scientifico dell'associazione "Frascati Scienza". Ideatore del programma degli eventi della "Notte dei Ricercatori 2012" e della "Settimana della Scienza 2012".

2010 Promotore e organizzatore dello spettacolo teatrale "Copenaghen" in collaborazione con la Facoltà di Scienze Matematiche Fisiche e Naturali dell'Università degli Studi "Roma Tre".

2009 Direttore Scientifico per il festival di divulgazione scientifica "Il Cielo di Argoli", Tagliacozzo (L'Aquila).

Pubblicazioni divulgative

1. Monte Carlo and hadrontherapy. Scritto con il Dr. Pablo Garcia Ortega. *Accastampato* n.11 pp 22-24 (sett. 2013).
2. La velocità del neutrino, come misurare una particella invisibile. Scritto con il Dr.Marcello Messina *Accastampato* n.9 pp 6-7 (sett. 2012).
3. Il neutrino, protagonista di storie singolari. *Accastampato* n.9 pp 8-10 (sett. 2012).
4. Mancini: Misure difficili, l'errore era possibile. Intervista scritta da Emanuele Perugini *Il Messaggero* p 25 (23 feb. 2012).
5. Imbrigliare l'energia del Sole. *Accastampato* n.2 pp 12-13 (sett. 2010).

Competenze Informatiche

Linguaggi di Programmazione

- Ottima conoscenza dei linguaggi di programmazione: C, C++ (inclusi gli standard C++11 e C++14), Python e CUDA;
- Buona conoscenza dei linguaggi di programmazione: Fortran, Java e LabView;
- Ottima conoscenza delle librerie: GSL, Qt, numpy, scipy, scikit, ITK, pydicom e pyqtgraph.

Software di analisi dati e altri applicativi

- Ottima conoscenza dei pacchetti: ROOT e LaTeX;
- Buona conoscenza dei software: R, Mathematica, Git e SVN.

Software per simulazioni Monte Carlo

- Ottima conoscenza di Geant4 e Fluka.

Competenze linguistiche

- Italiano: madrelingua
- Inglese: ottima conoscenza
- Francese: conoscenza base

Presentazioni in Conferenze Internazionali

- *Quasi-elastic break-up of ^{12}C in ^{8}Be and ^{4}He at an incident energy of 33 MeV/n.* 14th International Conference on Nuclear Reaction Mechanisms 2015, Varenna (Italy).
- *Development of techniques to speed up the simulation of PET and SPECT for hadrontherapy monitoring.* ICTR-PHE 2014, Geneva.

Presentazioni in Conferenze Nazionali

- *European Reserchers' Night 10th anniversry, the story of Frascati Scienza.* 101° Congresso Nazionale della Società Italiana di Fisica 2015, Roma.
- *The "Accastampato" magazine of scientific divulgation and a proposal for an interactive digital magazine.* 101° Congresso Nazionale della Società Italiana di Fisica 2015, Roma.
- *Study of the correlated noise in a bolometric detector array.* XCVI Congresso Nazionale della Società italiana di Fisica, Bologna.

E. Ueroni

Paolo Montini

Curriculum vitæ

Personal information

Name

Date/place of birth

Citizenship

Home Address

e–mail

Scientific and academic career

Since Jul. 2016 **PostDoctoral Researcher**, *Dipartimento di Fisica – Sapienza Università di Roma*, Roma.
Search for Dark Matter with the SABRE experiment and the SABRE-PoP setup.

May 2016–Aug 2016 **Contratto di collaborazione di ricerca**, *Consorzio Interuniversitario di Fisica Spaziale (CIFS), Sez. IAPS di Roma*, Roma.

Jan. 2015–Dec. 2015 **PostDoctoral Researcher**, *INFN – Sezione di Roma Tor Vergata*, Roma.
Study of the cosmic radiation

May 2014–Aug. 2014 **Contratto di collaborazione di ricerca**, *Dipartimento di Matematica e Fisica – Università degli Studi Roma TRE*, Roma.
Development of a DAQ software for a Motorola MVME–6100 system

Apr. 2012–Apr. 2014 **PostDoctoral Researcher**, *INFN – Sezione di Roma TRE*, Roma.
Data analysis for the ARGO–YBJ experiment and investigation on a possible upgrade of the detector

Nov. 2011–Feb. 2012 **Contratto di collaborazione di ricerca**, *Dipartimento di Fisica – Università degli Studi Roma TRE*, Roma.
Data analysis for the ARGO–YBJ experiment

Education

2012 **PhD in Physics**, *Università degli Studi Roma TRE*, Roma.
Thesis title: *The cosmic ray spectrum measured by the ARGO–YBJ experiment in the 1–1000 TeV energy range.*
Supervisor: Prof. Stefano Maria Mari

2008 **Master degree in Physics**, *Università degli Studi Roma TRE*, Roma.
Mark: 110/110 *cum laude*
Thesis title: *Lo spettro all–particle nella regione dei multi–TeV misurato dall'esperimento ARGO–YBJ mediante l'analisi bayesiana*
Supervisor: Prof. Stefano Maria Mari

2004 **Bachelor degree in Physics**, *Università degli Studi Roma TRE*, Roma.
Mark: 110/110 *cum laude*
Thesis title: *Studio preliminare dell'emissione di luce Čerenkov per eventi rivelati con l'apparato ARGO–YBJ*
Supervisor: Prof. Stefano Maria Mari

2001 **High school Diploma**, *Liceo Scientifico Statale I. Newton*, Roma.

Awards and scholarships

2009 Winner of the 2008 edition of the Award for Thesis in Astroparticle Physics given by the Roman Association for the Astroparticle Physics (ARAP–Associazione Romana per le Astroparticelle

2008–2011 PhD Scolarship from Università degli Studi Roma TRE

Membership

Since Nov. 2016 User at Laboratori Nazionali del Gran Sasso (LNGS)

Since Jul. 2016 Member of the SABRE Collaboration

Since Jul. 2016 Associated to INFN Roma

Jan. 2015–Dec. 2015 Associated to INFN Roma Tor Vergata

2008–2016 Member of the ARGO–YBJ Collaboration

Feb. 2008–Jul. 2014 Associated to INFN Roma TRE

Teaching

2016–2017 **Teaching assistant** for the C Programming course, Degree in Physics, Sapienza Università di Roma

2013–2014 **Teaching assistant** for the Electromagnetism course, Degree in Mathematics, Università degli Studi Roma TRE

2013–2014 **Teaching assistant** for the C++ Programming course, Degree in Physics, Università degli Studi Roma TRE

2012–2013 **Teaching assistant** for the C++ Programming course, Degree in Physics, Università degli Studi Roma TRE

2012–2013 **Teaching assistant** for the Mechanics and Thermodynamics course, Degree in Mathematics, Università degli Studi Roma TRE

2011–2012 **Teaching assistant** for the Introduction to computing course, Degree in Optics, Università degli Studi Roma TRE

2009–2011 **Teaching assistant** for the Mechanics and Thermodynamics course, Degree in Geology, Università degli Studi Roma TRE

2006–2008 **Tutor** for the Calculus, Geometry and C++ Programming courses, Degree in Physics, Università degli Studi Roma TRE

Conference talks and seminars

Jun. 2016 *The Cosmic Ray spectrum in the energy region between 10^{12} and 10^{16} eV measured by ARGO–YBJ*,"6^{th} Roma international conference on astro–particle physics (RICAP-16)", Frascati (Italy)

Oct. 2015 *The Proton plus Helium energy spectrum*, presented at "6th Workshop on Air Shower Detection at High Altitude", Chengdu (China). **Invited talk**

Sep. 2015 *Cosmic ray physics with ARGO–YBJ*, presented at "Cosmic Ray International Seminar", Gallipoli (Italy). **Invited talk**

Aug. 2015 *Observation of a knee in the p+He energy spectrum below 1 PeV by using a bayesian technique for the data analysis of the ARGO–YBJ experiment*, presented at "34^{th} International Cosmic Rays Conference (ICRC)", Den Haag (Netherlands).

Apr. 2015 *Measurement of the Cosmic Ray light component (p+He) energy spectrum with the ARGO–YBJ experiment*, presented at "Incontri di Fisica delle Alte Energie (IFAE 2015)", Roma (Italy)

Sep. 2104 *The Cosmic Ray p+He energy spectrum in the 3-3000 TeV energy range measured by ARGO-YBJ*, presented at "5^{th} Roma international conference on astro–particle physics (RICAP-14)", Noto (Italy)

Lug. 2013 *The light component spectrum in the energy region 1-300 TeV measured by ARGO–YBJ with a bayesian approach*, presented at "33^{rd} International Cosmic Rays Conference (ICRC)", Rio De Janeiro (Brazil)

May 2013 *Energy spectrum of cosmic ray protons and helium nuclei measured by the ARGO–YBJ experiment*, presented at 4^{th} Roma international conference on astro–particle physics (RICAP) Roma (Italy)

Jun. 2012 *Cosmic Ray measurements in the region 1-100 TeV: combined proton and helium spectrum*, presented at 9^{th} Workshop on Science with the New Generation of High Energy Gamma–ray experiments (SciNeGHE 2012), Lecce (Italy)

Aug. 2011 *Cosmic ray elemental composition study by using an artificial neural network based on the measurement of the lateral particle density distribution in showers induced by primaries in the 30-10000 TeV energy region*, presented at 32^{nd} International Cosmic Ray Conference (ICRC)", Beijing, (China)

Aug. 2011 *The light component spectrum measured by the ARGO-YBJ experiment in the energy region 1-300 TeV.*, presented at 32^{nd} International Cosmic Rays Conference (ICRC)", Beijing, (China)

Oct. 2010 *The observation of the light component spectrum in the 5-250 TeV region by the ARGO-YBJ experiment*, presented at ICATPP Conference on Cosmic Rays for Particle and Astroparticle Physics, Como (Italy).

Lug. 2009 *The all-particle spectrum measured by means of a Bayesian unfolding technique in the energy range 1-100 TeV with the ARGO-YBJ data*, presented at 31^{st} International Cosmic Rays Conference (ICRC), Łódź (Poland).

Lug. 2009 *Data simulation and analysis for the ARGO-YBJ experiment using the GRID tools*, presented at 31^{st} International Cosmic Rays Conference (ICRC), Łódź (Poland).

Relevant skills and knowledge

Languages Italian (native speaker), English (fluent)

Programming languages	C++,C, PYTHON, HTML/CSS, LaTeX, bash
Software packages	ROOT, GEANT4, CORSIKA
Operating systems	Linux/Unix, MacOS, Windows
Other	Data acquisition systems

Detailed research interests and activity

My research activity has been focused on **astroparticle physics** since the beginning of my career, with particular interest to **Dark Matter** and **Cosmic Ray experiments**. From July 2016 I am participating to the experimental activity of the SABRE Dark Matter experiment at Laboratori Nazionali del Gran Sasso (LNGS). From 2008 I am contributing to the ARGO–YBJ Cosmic Ray experiment at the Yangbajing International Cosmic Ray observatory. My research activity is mainly focused on Monte Carlo simulations and data analysis.

SABRE experiment

From July 2016 I am participating to the **SABRE (Sodium Iodide with Active Background Rejection)** experiment as a postdoctoral researcher at the Sapienza university of Rome. Here I share my time between the development of the Monte Carlo simulations and the experimental activity at the Gran Sasso underground laboratory. The SABRE experiment aims to directly detect Dark Matter particles through the model–independent signature of the annual modulation signal by using an array of ultra–radiopure NaI(Tl) scintillating crystals operated underground in a liquid scintillator veto plus a further passive shielding. The development of SABRE is expected to follow a two phase program. The first phase (SABRE PoP) aims to develop and test radio-pure NaI(Tl) crystals in an active veto detector at LNGS and is currently under deployment. The second phase foresees an array of these low background crystal detectors. To strengthen the reliability of the result against possible seasonal systematic effects, we currently plan twin full-scale experiments, one in the northern hemisphere at LNGS, one in the southern hemisphere inside the Stawell gold mine in Victoria, Australia, which is being converted into an underground laboratory (SUPL).

SABRE background model: A crucial aspect is the control and the rejection of the background that can mimic or cover the Dark Matter signal. The SABRE background rejection capability is based both on the active veto tagging efficiency and on the external background suppression by the passive shielding and the liquid scintillator mass. In this framework my activity is deeply focused in the **Monte Carlo simulations of the full SABRE background**, which plays a fundamental role both in the design phase of the detector as well as in the validation of data and signal extraction. There are two main sources of background: internal background coming from radioactive elements that contaminate the crystal and all the materials used in the detector construction, and external background coming from the environment around the detector. A GEANT4 Monte Carlo simulation code has been implemented in order to investigate the SABRE background rejection potential and to evaluate the amount of all the residual backgrounds. I am contributing to the development of the SABRE Monte Carlo simulation code by implementing the geometries of the SABRE PoP active veto and passive shielding, working in direct contact with the engineers and technicians of the mechanical service. I am involved in the development of the SABRE PoP background model taking into account all internal and external background sources. Results will be presented at the next summer conferences and a paper is actually in preparation. I am also investigating the possibility of using different radionuclides as calibration sources.

Experimental activity at LNGS: The SABRE PoP experiment is now being assembled at LNGS and will

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be operating during spring/summer 2017. The active veto of the SABRE PoP detector consists on $\sim$ 2 ton of pseudocumene (PC) doped with PPO as a wavelength shifter sealed in a light–tight stainless steel vessel. The veto is read–out by 10 8" wide FoV PMTs. I am currently involved in the **installation and commissioning of the SABRE PoP detector**. In particular I am participating to the installation and the commissioning of the veto. I have contributed to the installation of all the PMTs and I have conducted some preliminary dark tests in order to check their performances. Additional tests using a light source and the coincidence between two or more PMTs are currently ongoing in a dedicated area in the underground hall B of the LNGS. Planned future investigations include characterization of the 10 veto PMTs, measurement of light-collection efficiency of the vessel, measurement of trigger efficiency in different trigger modes, and test with water filling.
I am planning to be deeply involved in the further operations at LNGS as well as in the data analysis.

ARGO–YBJ experiment

The ARGO–YBJ experiment was a ground–based extensive air shower Cosmic Ray and γ–ray astronomy experiment operated at the Yangbajing International Cosmic Ray Observatory (Tibet, P.R. China). The detector was made of a full–coverage carpet of RPC detectors. The high altitude (4300 m a.s.l.), combined with the high segmentation of the detector allowed a detailed study of both Cosmic Rays and γ–rays in a very wide energy range. The detector has been in full and stable data taking from the end of 2007 up to the first months of 2013.

Cosmic ray physics: Within the ARGO–YBJ collaboration I was involved in the **cosmic ray hadronic physics group**. In particular I was responsible for the measurement of the cosmic ray energy spectrum and composition, which were two of the main research goal of the ARGO–YBJ experiment. I started my research activity as a member of the ARGO–YBJ collaboration as a PhD student with a grant from the Roma TRE university. During my PhD I have worked to the measurement of the **cosmic ray energy spectrum in the multi–TeV region** [C1], [U1]. This was the first measurement of the cosmic ray light–component spectrum in the TeV energy region made with a ground–based experiment. For the first time data coming from indirect measurements have been directly compared with data coming from satellite and balloon–borne experiment. The analysis was carried out by using a **bayesian unfolding algorithm** in order to extract the energy spectrum of primary cosmic rays from the space–time distribution of secondary particles of the shower [C4, C5], [U2], [P11]. I have also participated to the development of a grid–based Monte Carlo simulation tool [C2].
As a postdoctoral researches at Roma TRE INFN section I have carried out a deep investigation on the **lateral distribution of particles in the shower front**. These studies have shown that the shape of the lateral particle distribution within few meters from the shower core can be exploited in order to discriminate showers produced by primaries of different mass at energies. In particular the discrimination between Hydrogen and Helium nuclei and nuclei heavier than Helium is particularly effective at energies around the "knee" of the all–particle spectrum, opening the possibility to investigate the composition of cosmic rays at the knee. I have developed an algorithm in order to identify a set of discrimination parameters that were included in the ARGO–YBJ official event reconstruction code [C3]. I was responsible of the measurement of the cosmic ray light–component (protons and Helium nuclei) energy spectrum in the energy range between 1-300 TeV by using the full data sample collected by the ARGO–YBJ experiment during the years 2008–2012 [P26] [C8, C7, C6].
As a postdoctoral researcher at INFN Tor Vergata section i was the responsible of the measurement of the **cosmic ray energy spectrum and composition at the knee**. The knee of the cosmic ray all–particle spectrum at energies around 3 PeV is usually addressed to a decrease of the flux of protons. The data shows a strong decrease of the flux of protons and Helium nuclei at energies around 1 PeV, suggesting that the knee of the all–particle spectrum is due to elements heavier than helium. These results demonstrate the possibility

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of exploring the cosmic ray properties in a wide energy range with a single ground–based experiment and opens new scenarios about the evolution of the light component energy spectrum towards the highest energies and the origin of the knee [C10, C11, C12].
I have also participated to a preliminary study of the light element induced cosmic ray large scale anisotropy by looking at the full data sample collected by the ARGO–YBJ experiment [C9].
I have also collaborated with the INAF–IAPS section of Rome to the study of the characteristics of showers produced by protons and γ rays of different energies. I was the coordinator of the simulations and the analysis. These studies aims to investigate the properties of extensive air showers at different altitudes in order to identify a set of observables that allow the identification of γ ray induced showers. This is part of a feasibility study for a new large area full–coverage EAS detector to be installed at altitudes greater than 5000 m a.s.l.

Other experiences
DAQ systems: I have participated to the commissioning and testing phase of large field of view photomultiplier tubes. These PMTs are particularly suitable to be used in Dark Matter direct detection experiments. In particular I have been involved in the development and configuration of the DAQ system, based on a Motorola MVME CPU and CAEN v1720 digitizers. The aim of these tests is a detailed and precise measurement of the single electron response of the PMTs.

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Io sottoscritto ***Paolo Montini****, nato a Roma il 30 Aprile 1982, ai sensi degli articoli 46 e 47 del D.P.R. 28/12/2000 n. 445 e a conoscenza di quanto prescritto dall'art. 76 sulle sanzioni penali cui può andare incontro per le ipotesi di falsità in atti e dichiarazioni mendaci ivi indicate,* ***dichiaro che tutte le informazioni riportate nel presente curriculum vitae corrispondono a verità.***

Autorizzo il trattamento dei dati personali contenuti nel mio curriculum vitae in base all'art. 13 del D. Lgs. 196/2003.

Roma, 20 Marzo 2017

Paolo Montini