Strong2020 and Radio MonteCarLow activities

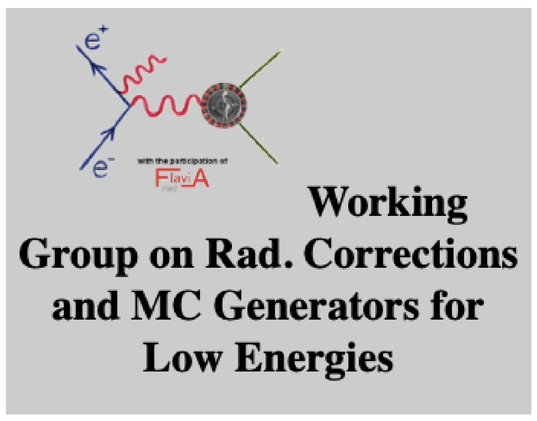
Anna Driutti [a], Graziano Venanzoni [b]
on behalf of Strong2020 and Radio MonteCarLow groups.

[a] University and INFN Pisa, Italy
[b] INFN, Sezione di Pisa, Pisa, Italy

Abstract

For over 15 years the **Radio MonteCarLow WG** ("Radiative Corrections and Monte Carlo Generators for Low Energies Working Group") [1], has provided valuable support to the development of radiative corrections and Monte Carlo generators for low energy e^+e^- data and τ-lepton decays. The working group, composed of theoretical and experimental experts from the e^+e^- physics and tau communities have published the highly cited report *"Quest for precision in hadronic cross sections at low energy: Monte Carlo tools vs. experimental data"* S. Actis et al. Eur. Phys. J. C 66, 585-686 (2010) [2]. Parts of the Radio MonteCarLow WG program have recently been included as a Joint Research Initiative in the group application of the European hadron physics community, **STRONG2020** [3], with a more specific goal of creating an annotated database for low-energy hadronic cross sections in e^+e^- collisions. The database will contain information about the reliability of the data sets, their systematic errors, and the treatment of radiative corrections.

The Radio MonteCarLow Activities



- 20 **meetings between theorists and experimentalists** to discuss status of radiative corrections and Monte Carlo generators at low energies

RADIO MONTECARLOW

"Combining MonteCarlo efforts from the wild east to the wild west since 2006!"

- Working **list of Monte Carlo Generators**:

– for luminosity
– for $e^+e^- \to$ leptons and hadrons
– for $e^+e^- \to$ hadrons + energetic γ from initial state radiation (ISR)
– for τ production and decays

- **Final Working Group Report** [2]:

– 5 sections with overview of experimental results and status of Monte Carlo generators:

1. luminosity measurements at low energies (up to B factories energy)
2. R measurement by energy scan
3. R meas.with radiative return
4. tau physics
5. calculation of vacuum polarization with emphasis on the hadronic contributions

– achievements on hadronic cross section measurements and tau physics
– outline of the prospects for future years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THE EUROPEAN PHYSICAL JOURNAL C

Review

Quest for precision in hadronic cross sections at low energy: Monte Carlo tools vs. experimental data

Working Group on Radiative Corrections and Monte Carlo Generators for Low Energies

S. Actis[38], A. Arbuzov[9,e], G. Balossini[32,33], P. Beltrame[13], C. Bignamini[32,33], R. Bonciani[15], C.M. Carloni Calame[35], V. Cherepanov[25,26], M. Czakon[1], H. Czyż[19,s,t], A. Denig[22], S. Eidelman[25,26,g], G.V. Fedotovich[25,26,e], A. Ferroglia[23], J. Gluza[19], A. Grzelińska[8], M. Gunia[19], A. Hafner[22], F. Ignatov[25], S. Jadach[8], F. Jegerlehner[3,19,41], A. Kalinowski[29], W. Kluge[17], A. Korchin[20], J.H. Kühn[18], E.A. Kuraev[9], P. Lukin[25], P. Mastrolia[14], G. Montagna[32,33,b,d], S.E. Müller[22,f], F. Nguyen[34,d], O. Nicrosini[33], D. Nomura[36,h], G. Pakhlova[24], G. Pancheri[11], M. Passera[28], A. Penin[10], F. Piccinini[33], W. Płaczek[7], T. Przedzinski[6], E. Remiddi[4,5], T. Riemann[41], G. Rodrigo[37], P. Roig[27], O. Shekhovtsova[11], C.P. Shen[16], A.L. Sibidanov[25], T. Teubner[21,h], L. Trentadue[30,31], G. Venanzoni[11,c,i], J.J. van der Bij[12], P. Wang[2], B.F.L. Ward[39], Z. Was[8,a], M. Worek[40,19], C.Z. Yuan[2]

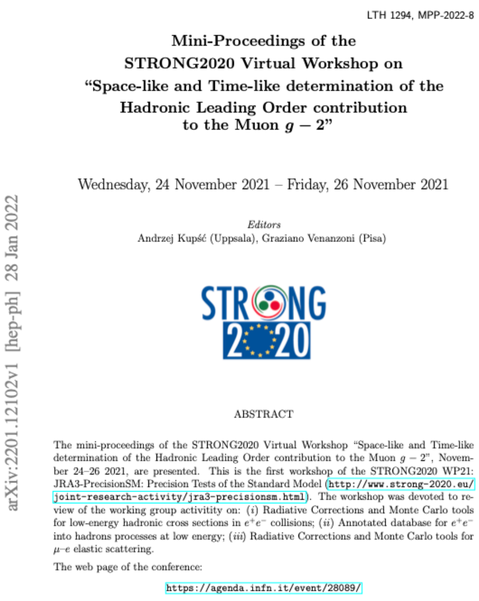
[1] Institut für Theoretische Physik E, RWTH Aachen Universität, 52056 Aachen, Germany
[2] Institue of High Energy Physics, Chinese Academy of Sciences, Beijing 100049, China
[3] Institut für Physik Humboldt-Universität zu Berlin, 12489 Berlin, Germany
[4] Dipartimento di Fisica dell'Università di Bologna, 40126 Bologna, Italy
[5] INFN, Sezione di Bologna, 40126 Bologna, Italy
[6] The Faculty of Physics, Astronomy and Applied Computer Science, Jagiellonian University, Reymonta 4, 30-059 Cracow, Poland
[7] Marian Smoluchowski Institute of Physics, Jagiellonian University, Reymonta 4, 30-059 Cracow, Poland
[8] Institute of Nuclear Physics Polish Academy of Sciences, 31342 Cracow, Poland
[9] Bogoliubov Laboratory of Theoretical Physics, Joint Institute for Nuclear Research, 141980 Dubna, Russia
[10] Department of Physics, University of Alberta, Edmonton, AB T6G 2J1, Canada
[11] Laboratori Nazionali di Frascati dell'INFN, 00044 Frascati, Italy
[12] Physikalisches Institut, Albert-Ludwigs-Universität Freiburg, 79104 Freiburg, Germany
[13] Physics Department, CERN, 1211 Genève, Switzerland
[14] Theory Department, CERN, 1211 Genève, Switzerland
[15] Laboratoire de Physique Subatomique et de Cosmologie, Université Joseph Fourier/CNRS-IN2P3/INPG, 38026 Grenoble, France
[16] University of Hawaii, Honolulu, HI 96822, USA
[17] Institut für Experimentelle Kernphysik, Universität Karlsruhe, 76021 Karlsruhe, Germany
[18] Institut für Theoretische Teilchenphysik, Universität Karlsruhe, 76128 Karlsruhe, Germany
[19] Institute of Physics, University of Silesia, 40007 Katowice, Poland
[20] National Science Center "Kharkov Institute of Physics and Technology", 61108 Kharkov, Ukraine
[21] Department of Mathematical Sciences, University of Liverpool, Liverpool L69 3BX, UK
[22] Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, 55128 Mainz, Germany
[23] Institut für Physik (THEP), Johannes Gutenberg-Universität, 55099 Mainz, Germany
[24] Institute for Theoretical and Experimental Physics, Moscow, Russia
[25] Budker Institute of Nuclear Physics, 630090 Novosibirsk, Russia
[26] Novosibirsk State University, 630090 Novosibirsk, Russia
[27] Laboratoire de Physique Théorique (UMR 8627), Université de Paris-Sud XI, Bâtiment 210, 91405 Orsay Cedex, France
[28] INFN, Sezione di Padova, 35131 Padova, Italy
[29] LLR-Ecole Polytechnique, 91128 Palaiseau, France
[30] Dipartimento di Fisica, Università di Parma, 43100 Parma, Italy
[31] INFN, Gruppo Collegato di Parma, 43100 Parma, Italy
[32] Dipartimento di Fisica Nucleare e Teorica, Università di Pavia, 27100 Pavia, Italy
[33] INFN, Sezione di Pavia, 27100 Pavia, Italy
[34] Dipartimento di Fisica dell'Università "Roma Tre" and INFN Sezione di Roma Tre, 00146 Rome, Italy
[35] School of Physics and Astronomy, University of Southampton, Southampton SO17 1BJ, UK
[36] Theory Center, KEK, Tsukuba, Ibaraki 305-0801, Japan
[37] Instituto de Fisica Corpuscular (IFIC), Centro mixto UVEG/CSIC, Edificio Institutos de Investigacion, Apartado de Correos 22085, 46071 Valencia, Spain
[38] Paul Scherrer Institut, Würenlingen and Villigen, 5232 Villigen PSI, Switzerland
[39] Department of Physics, Baylor University, Waco, TX 76798-7316, USA
[40] Fachbereich C, Bergische Universität Wuppertal, 42097 Wuppertal, Germany
[41] Deutsches Elektronen-Synchrotron, DESY, 15738 Zeuthen, Germany

Springer

The Strong2020 Project and the Precision SM DB

- EU project that aims to **study strong interactions** combining knowledge from many frontiers:

- Task within the project: **PrecisionSM "Hadron Physics for Precision Tests of the Standard Model"** with goal of:
– combining theory and experiment for Standard Model and Beyond precision tests, **Recent Working Group Report** [4]:


LTH 1294, MPP-2022-8

Mini-Proceedings of the STRONG2020 Virtual Workshop on "Space-like and Time-like determination of the Hadronic Leading Order contribution to the Muon $g-2$"

Wednesday, 24 November 2021 – Friday, 26 November 2021

Editors
Andrzej Kupść (Uppsala), Graziano Venanzoni (Pisa)

ABSTRACT

The mini-proceedings of the STRONG2020 Virtual Workshop "Space-like and Time-like determination of the Hadronic Leading Order contribution to the Muon $g-2$", November 24–26 2021, are presented. This is the first workshop of the STRONG2020 WP21: JRA3-PrecisionSM: Precision Tests of the Standard Model (http://www.strong-2020.eu/joint-research-activity/jra3-precisionsm.html). The workshop was devoted to review of the working group activitity on: (i) Radiative Corrections and Monte Carlo tools for low-energy hadronic cross sections in e^+e^- collisions; (ii) Annotated database for e^+e^- into hadrons processes at low energy; (iii) Radiative Corrections and Monte Carlo tools for μ-e elastic scattering.

The web page of the conference:

https://agenda.infn.it/event/28089/

contains the presentations.

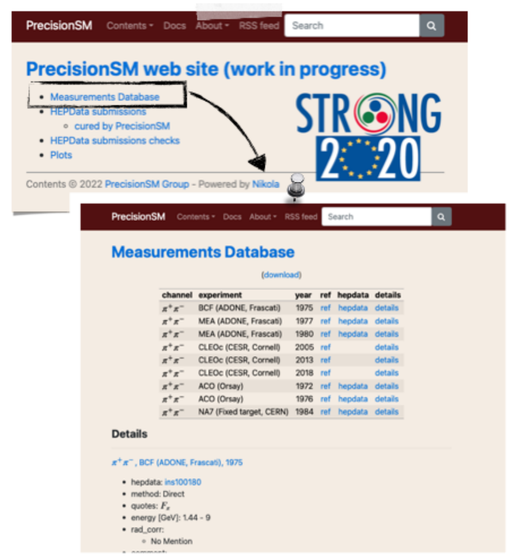
arXiv:2201.12102v1 [hep-ph] 28 Jan 2022

→ Topics:

1. R measurement
2. Radiative Corrections and Monte Carlo generators for time-like processes
3. Radiative Corrections and Monte Carlo generators for space-like processes

– constructing the annotated **Strong2020 Precision SM DataBase** for low-energy cross sections in $e^+e^- \to hadronic$, which includes:

1. uploading in the public repository HEPData [5] all measurements from all experiments
2. cataloguing the measurements in the **PrecisionDB Website** [https://precision-sm.github.io]



– At present we are in the process of cataloging $e^+e^- \to \pi^+\pi^-$ measurements, important for the calculation of the Muon $g-2$ theoretical value

Conclusions

The Radio MonteCarLow and the Strong2020 Working Groups are facilitating the collaboration between the experimental and theoretical groups with the goal of understanding the status of the Monte Carlo generators and the measurements in hadronic physics. All these efforts have been recently revitalized by the new high-precision measurement of the anomalous magnetic moment of the muon at Fermilab [6]. The Fermilab measurment combined with the final result from the Brookhaven experiment shows a 4.2σ discrepancy with respect to the Standard Model theoretical prediction that includes an evaluation of the leading-order hadronic-vacuum-polarization contribution from $e^+e^- \to hadrons$ cross-section data.

References

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[3] http://www.strong-2020.eu
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[5] https://www.hepdata.net
[6] B. Abi *et al.* [Muon g-2 Collaboration], Phys. Rev. Lett. **126**, no.14, 141801 (2021)

Acknowledgements

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