



XXVIIth International Conference on Ultrarelativistic Nucleus–Nucleus
Collisions (Quark Matter 2018)

LHCb Collaboration

I. Bediaga, M. Cruz Torres, J.M. De Miranda, A.C. dos Reis, A. Gomes ^a,
A. Massafferri, J. Molina Rodriguez ^y, L. Soares Lavra,
R. Tourinho Jadallah Aoude

¹ *Centro Brasileiro de Pesquisas Físicas (CBPF), Rio de Janeiro, Brazil*

S. Amato, K. Carvalho Akiba, F. Da Cunha Marinho, L. De Paula,
F. Ferreira Rodrigues, M. Gandelman, A. Hicheur, J.H. Lopes, I. Nasteva,
J.M. Otalora Goicochea, E. Polycarpo, C. Potterat, M.S. Rangel,
L. Silva de Oliveira, B. Souza De Paula

² *Universidade Federal do Rio de Janeiro (UFRJ), Rio de Janeiro, Brazil*

L. An, C. Chen, A. Davis, Y. Gan, Y. Gao, C. Gu, F. Jiang, T. Li, X. Liu,
Z. Ren, J. Sun, Z. Tang, M. Wang, A. Xu, Z. Xu, Z. Yang, L. Zhang,
W.C. Zhang ^z, X. Zhu

³ *Center for High Energy Physics, Tsinghua University, Beijing, China*

M. Chefdeville, D. Decamp, Ph. Ghez, J.F. Marchand, M.-N. Minard,
B. Pietrzyk, M. Reboud, S. T’Jampens, E. Tournefier, Z. Xu

⁴ *Univ. Grenoble Alpes, Univ. Savoie Mont Blanc, CNRS, IN2P3-LAPP, Annecy, France*

Z. Ajaltouni, E. Cogneras, O. Deschamps, G. Gazzoni, C. Hadjivasiliou,
M. Kozeiha, R. Lefèvre, J. Maratas ^v, S. Monteil, P. Perret, B. Quintana,
V. Tisserand, M. Vernet

⁵ *Clermont Université, Université Blaise Pascal, CNRS/IN2P3, LPC, Clermont-Ferrand, France*

J. Arnau Romeu, E. Aslanides, J. Cogan, D. Gerstel, R. Le Gac, O. Leroy, G. Mancinelli, M. Martin, C. Meaux, A.B. Morris, J. Serrano, A. Tayduganov, A. Tsaregorodtsev

⁶ Aix Marseille Univ, CNRS/IN2P3, CPPM, Marseille, France

Y. Amhis, V. Balagura^b, S. Barsuk, F. Bossu, D. Chamont, J.A.B. Coelho, F. Dese, F. Fleuret^b, J. Lefrançois, V. Lisovskyi, F. Machefert, C. Marin Benito, E. Maurice^b, V. Renaudin, P. Robbe, M.H. Schune, A. Stocchi, A. Usachov, M. Winn, G. Wormser, Y. Zhang

⁷ LAL, Univ. Paris-Sud, CNRS/IN2P3, Université Paris-Saclay, Orsay, France

E. Ben-Haim, E. Bertholet, P. Billoir, M. Charles, L. Del Buono, G. Dujany, V.V. Gligorov, A. Mogini, F. Polci, R. Quagliani, F. Reiss, A. Robert, E.S. Sepulveda, D.Y. Tou

⁸ LPNHE, Sorbonne Université, Paris Diderot Sorbonne Paris Cité, CNRS/IN2P3, Paris, France

S. Beranek, M. Boubdir, S. Escher, T. Kirn, C. Langenbruch, M. Materok, S. Nieswand, S. Schael, E. Smith, T.A. Verlage, M. Whitehead, V. Zhukov³⁵

⁹ I. Physikalisches Institut, RWTH Aachen University, Aachen, Germany

J. Albrecht, A. Birnkraut, M. Demmer, U. Eitschberger, R. Ekelhof, L. Gavardi, K. Heinicke, A. Heister, P. Ibis, P. Mackowiak, F. Meier, A. Mödden, T. Mombächer, J. Müller, V. Müller, R. Niet, S. Reichert, M. Schellenberg, T. Schmelzer, A. Seuthe, B. Spaan, H. Stevens, T. Tekampe, J. Wishahi

¹⁰ Fakultät Physik, Technische Universität Dortmund, Dortmund, Germany

H.-P. Dembinski, T. Klimkovich, M. Schmelling, M. Zavertyaev^c

¹¹ Max-Planck-Institut für Kernphysik (MPIK), Heidelberg, Germany

S. Bachmann, D. Berninghoff, S. Braun, A. Comerma-Montells, P. d'Argent, M. Dziewiecki, D. Gerick, J.P. Grabowski, X. Han, S. Hansmann-Menzemer, M. Kecke, B. Khanji, M. Kolpin, R. Kopečna, B. Leverington, J. Marks, D.S. Mitzel, S. Neubert, M. Neuner, A. Piucci, N. Skidmore, M. Stahl, S. Stemmler, U. Uwer, A. Zhelezov

¹² Physikalisches Institut, Ruprecht-Karls-Universität Heidelberg, Heidelberg, Germany

R. McNulty, N.V. Veronika

¹³ *School of Physics, University College Dublin, Dublin, Ireland*

M. De Serio ^d, R.A. Fini, A. Palano, A. Pastore, S. Simone ^d

¹⁴ *INFN Sezione di Bari, Bari, Italy*

F. Betti ⁴², A. Carbone ^e, A. Falabella, F. Ferrari, D. Galli ^e, U. Marconi, D.P. O'Hanlon, C. Patrignani ^e, M. Soares, V. Vagnoni, G. Valenti, S. Zucchelli

¹⁵ *INFN Sezione di Bologna, Bologna, Italy*

M. Andreotti ^g, W. Baldini, C. Bozzi ⁴², R. Calabrese ^g, M. Corvo ^g, M. Fiorini ^g, E. Luppi ^g, L. Minzoni ^g, L.L. Pappalardo ^g, B.G. Siddi, G. Tellarini, L. Tomassetti ^g, S. Vecchi

¹⁶ *INFN Sezione di Ferrara, Ferrara, Italy*

L. Anderlini, A. Bizzeti ^u, G. Graziani, G. Passaleva ⁴², M. Veltri ^r

¹⁷ *INFN Sezione di Firenze, Firenze, Italy*

P. Albicocco, G. Bencivenni, P. Campana, P. Ciambrone, P. De Simone, P. Di Nezza, S. Klaver, G. Lanfranchi, G. Morello, S. Ogilvy, M. Palutan ⁴², M. Poli Lener, M. Rotondo, M. Santimaria, A. Sarti ^k, B. Sciascia

¹⁸ *INFN Laboratori Nazionali di Frascati, Frascati, Italy*

R. Cardinale ^h, G. Cavallero ^h, F. Fontanelli ^h, A. Petrolini ^h

¹⁹ *INFN Sezione di Genova, Genova, Italy*

N. Belloli ⁱ, M. Calvi ⁱ, P. Carniti ⁱ, L. Cassina, D. Fazzini ^{42, i}, C. Gotti ⁱ, C. Matteuzzi

²⁰ *INFN Sezione di Milano-Bicocca, Milano, Italy*

J. Fu ^q, P. Gandini, D. Marangotto ^q, A. Merli ^q, N. Neri, M. Petruzzo ^q

²¹ *INFN Sezione di Milano, Milano, Italy*

B. Audurier, D. Brundu, A. Bursche, S. Cadeddu, A. Cardini, S. Chen, A. Contu, M. Fontana⁴², P. Griffith, A. Lai, A. Loi, G. Manca^f, R. Oldeman^f, B. Saitta^f

²² INFN Sezione di Cagliari, Monserrato, Italy

S. Amerio, A. Bertolin, S. Gallorini, D. Lucchesi^o, A. Lupato, E. Michielin, M. Morandin, L. Sestini, G. Simi^o

²³ INFN Sezione di Padova, Padova, Italy

F. Bedeschi, R. Cenci^p, A. Lusiani, M.J. Morello^t, T. Pajero^t, G. Punzi^p, M. Rama, S. Stracka^p, D. Tonelli, G. Tuci, J. Walsh

²⁴ INFN Sezione di Pisa, Pisa, Italy

G. Carboni, L. Federici, E. Santovetti^j, A. Satta

²⁵ INFN Sezione di Roma Tor Vergata, Roma, Italy

V. Bocci, G. Martellotti, G. Penso, D. Pinci, R. Santacesaria, C. Satriano^s, A. Sciubba^k

²⁶ INFN Sezione di Roma La Sapienza, Roma, Italy

R. Aaij, S. Ali, F. Archilli, L.J. Bel, S. Benson, E. Dall'Occo, J.A. de Vries, L. Dufour, S. Esen, M. Féo Pereira Rivello Carvalho, E. Govorkova, R. Greim, W. Hulsbergen, D. Hynds, E. Jans, P. Koppenburg, I. Kostiuik, M. Merk, M. Mulder, A. Pellegrino, C. Sanchez Gras, N. Tuning⁴², M. van Beuzekom, J. van Tilburg, M. van Veghel, C. Vázquez Sierra, M. Veronesi, A. Vitkovskiy

²⁷ Nikhef National Institute for Subatomic Physics, Amsterdam, Netherlands

T. Ketel, G. Raven, V. Syropoulos

²⁸ Nikhef National Institute for Subatomic Physics and VU University Amsterdam, Amsterdam, Netherlands

J. Bhom, J. Brodzicka, A. Dziurda, W. Kucewicz^l, M. Kucharczyk, T. Lesiak, B. Malecki, A. Ossowska, M. Pikies, M. Witek

²⁹ Henryk Niewodniczanski Institute of Nuclear Physics Polish Academy of Sciences, Kraków, Poland

A. Dendek, M. Firlej, T. Fiutowski, M. Idzik, W. Krupa, M.W. Majewski, J. Moron, A. Oblakowska-Mucha, B. Rachwal, K. Swientek, T. Szumlak, M. Tobin

³⁰ *AGH - University of Science and Technology, Faculty of Physics and Applied Computer Science, Kraków, Poland*

V. Batozskaya, K. Klimaszewski, W. Krzemien, D. Melnychuk, A. Ukleja, W. Wislicki

³¹ *National Center for Nuclear Research (NCBJ), Warsaw, Poland*

L. Cojocariu, A. Ene, L. Giubega, A. Grecu, F. Maciuc, V. Placinta, M. Straticiuc

³² *Horia Hulubei National Institute of Physics and Nuclear Engineering, Bucharest-Magurele, Romania*

G. Alkhazov, N. Bondar, A. Chubykin, A. Dzyuba, K. Ivshin, S. Kotriakhova, O. Maev ⁴², D. Maisuzenko, N. Sagidova, Y. Shcheglov [†], M. Stepanova, A. Vorobyev

³³ *Petersburg Nuclear Physics Institute (PNPI), Gatchina, Russia*

I. Belyaev ⁴², A. Danilina, V. Egorychev, D. Golubkov, T. Kvaratskheliya ⁴², D. Pereima, D. Savrina ³⁵, A. Semennikov

³⁴ *Institute of Theoretical and Experimental Physics (ITEP), Moscow, Russia*

A. Berezhnoy, I.V. Gorelov, A. Leflat, N. Nikitin, V. Volkov

³⁵ *Institute of Nuclear Physics, Moscow State University (SINP MSU), Moscow, Russia*

S. Filippov, E. Gushchin, L. Kravchuk

³⁶ *Institute for Nuclear Research of the Russian Academy of Sciences (INR RAS), Moscow, Russia*

K. Arzymatov, A. Baranov, M. Borisyak, V. Chekalina, D. Derkach, M. Hushchyn, N. Kazeev, E. Khairullin, F. Ratnikov ^{ab}, A. Rogozhnikov, A. Ustyuzhanin

³⁷ *Yandex School of Data Analysis, Moscow, Russia*

A. Bondar ^w, S. Eidelman ^w, P. Krokovny ^w, V. Kudryavtsev ^w, T. Maltsev ^w, L. Shekhtman ^w, V. Vorobyev ^w

³⁸ *Budker Institute of Nuclear Physics (SB RAS), Novosibirsk, Russia*

A. Artamonov, K. Belous, R. Dzhelyadin, Yu. Guz⁴², V. Obraztsov, A. Popov, S. Poslavskii, V. Romanovskiy, M. Shapkin, O. Stenyakin, O. Yushchenko

³⁹ *Institute for High Energy Physics (IHEP), Protvino, Russia*

A. Alfonso Albero, M. Calvo Gomez^m, A. Camboni^m, S. Coquereau, L. Garrido, D. Gascon, R. Graciani Diaz, E. Graugés, X. Vilasis-Cardona^m

⁴⁰ *ICCUB, Universitat de Barcelona, Barcelona, Spain*

B. Adeva, A.A. Alves Jr, O. Boente Garcia, M. Borsato, V. Chobanova, X. Cid Vidal, A. Dosil Suárez, A. Fernandez Prieto, A. Gallas Torreira, B. Garcia Plana, M. Lucio Martinez, D. Martinez Santos, M. Plo Casasus, J. Prisciandaro, M. Ramos Pernas, A. Romero Vidal, J.J. Saborido Silva, B. Sanmartin Sedes, C. Santamarina Rios, P. Vazquez Regueiro, M. Vieites Diaz

⁴¹ *Instituto Galego de Física de Altas Enerxías (IGFAE), Universidade de Santiago de Compostela, Santiago de Compostela, Spain*

F. Alessio, M.P. Blago, M. Brodski, J. Buytaert, W. Byczynski, D.H. Campora Perez, M. Cattaneo, Ph. Charpentier, S.-G. Chitic, M. Chrzaszcz, G. Ciezarek, M. Clemencic, J. Closier, V. Coco, P. Collins, T. Colombo, G. Coombs, G. Corti, B. Couturier, C. D'Ambrosio, O. De Aguiar Francisco, K. De Bruyn, A. Di Canto, H. Dijkstra, F. Dordei, M. Dorigo^x, P. Durante, C. Färber, P. Fernandez Declara, M. Ferro-Luzzi, R. Forty, M. Frank, C. Frei, W. Funk, C. Gaspar, L.A. Granado Cardoso, L. Gruber, T. Gys, C. Haen, C. Hasse, M. Hatch, R. Jacobsson, D. Johnson, C. Joram, B. Jost, M. Karacson, D. Lacarrere, F. Lemaître, R. Lindner, O. Lupton, M. Martinelli, R. Matev, Z. Mathe, D. Müller, N. Neufeld, N.S. Nolte, A. Pearce, M. Pepe Altarelli, S. Perazzini, J. Pinzino, F. Pisani, S. Ponce, M. Ravonel Salzgeber, M. Roehrken, S. Roiser, T. Ruf, H. Schindler, B. Schmidt, A. Schopper, R. Schwemmer, P. Seyfert, F. Stagni, S. Stahl, F. Teubert, E. Thomas, S. Tolk, A. Valassi, S. Valat, E. van Herwijnen, R. Vazquez Gomez, J.V. Viana Barbosa, B. Voneki, K. Wyllie

⁴² *European Organization for Nuclear Research (CERN), Geneva, Switzerland*

G. Andreassi, V. Battista, A. Bay, V. Bellee, F. Blanc, M. De Cian, L. Ferreira Lopes, C. Fitzpatrick, S. Gianì, O.G. Girard, G. Haefeli, P.H. Hopchev, C. Khurewathanakul, A.K. Kuonen, V. Macko, M. Marinangeli, P. Marino, B. Maurin, T. Nakada, T. Nanut, T.D. Nguyen, C. Nguyen-Mauⁿ, P.R. Pais, L. Pescatore, G. Pietrzyk, F. Redi, A.B. Rodrigues, O. Schneider, M. Schubiger, P. Stefko, M.E. Stramaglia, M.T. Tran

⁴³ *Institute of Physics, Ecole Polytechnique Fédérale de Lausanne (EPFL), Lausanne, Switzerland*

M. Atzeni, R. Bernet, C. Betancourt, Ia. Bezshyiko, A. Buonauro, J. García Pardiñas, E. Graverini, D. Lancierini, F. Lionetto, A. Mauri, K. Müller, P. Owen, A. Puig Navarro, N. Serra, R. Silva Coutinho, O. Steinkamp, B. Storaci, U. Straumann, A. Vollhardt, Z. Wang, A. Weiden

⁴⁴ *Physik-Institut, Universität Zürich, Zürich, Switzerland*

A. Dovbnya, S. Kandybei

⁴⁵ *NSC Kharkiv Institute of Physics and Technology (NSC KIPT), Kharkiv, Ukraine*

S. Koliiev, V. Pugatch

⁴⁶ *Institute for Nuclear Research of the National Academy of Sciences (KINR), Kyiv, Ukraine*

S. Bifani, R. Calladine, G. Chatzikonstantinidis, N. Farley, P. Ilten, C. Lazzeroni, A. Mazurov, J. Plews, D. Popov¹¹, A. Sergi⁴², N.K. Watson, T. Williams, K.A. Zarebski

⁴⁷ *University of Birmingham, Birmingham, United Kingdom*

M. Adinolfi, S. Bhasin, E. Buchanan, M.G. Chapman, J. Dalseno, S.T. Harnew, J.M. Kariuki, S. Maddrell-Mander, P. Naik, K. Petridis, G.J. Pomery, E. Price, C. Prouve, J.H. Rademacker, S. Richards, J.J. Velthuis

⁴⁸ *H.H. Wills Physics Laboratory, University of Bristol, Bristol, United Kingdom*

M.O. Bettler, H.V. Cliff, B. Delaney, J. Garra Tico, V. Gibson, S.C. Haines, C.R. Jones, F. Keizer, M. Kenzie, G.H. Lovell, J.G. Smeaton, A. Trisovic, A. Tully, M. Vitti, D.R. Ward, I. Williams, S.A. Wotton

⁴⁹ *Cavendish Laboratory, University of Cambridge, Cambridge, United Kingdom*

J.J. Back, T. Blake, A. Brossa Gonzalo, C.M. Costa Sobral, A. Crocombe, T. Gershon, M. Kreps, T. Latham, D. Loh, A. Mathad, E. Millard, A. Poluektov, J. Wicht

⁵⁰ *Department of Physics, University of Warwick, Coventry, United Kingdom*

S. Easo, R. Nandakumar, A. Papanestis, S. Ricciardi, F.F. Wilson⁴²

⁵¹ *STFC Rutherford Appleton Laboratory, Didcot, United Kingdom*

L. Carson, P.E.L. Clarke, G.A. Cowan, R. Currie, S. Eisenhardt, E. Gabriel, S. Gambetta, K. Gizdov, F. Muheim, M. Needham, M. Pappagallo, S. Petrucci, S. Playfer, I.T. Smith, J.B. Zonneveld

⁵² *School of Physics and Astronomy, University of Edinburgh, Edinburgh, United Kingdom*

M. Alexander, J. Beddow, D. Bobulska, C.T. Dean, L. Douglas, L. Eklund, S. Karodia, I. Longstaff, M. Schiller, F.J.P. Soler, P. Spradlin, M. Traill

⁵³ *School of Physics and Astronomy, University of Glasgow, Glasgow, United Kingdom*

T.J.V. Bowcock, G. Casse, F. Dettori, K. Dreimanis, S. Farry, V. Franco Lima, T. Harrison, K. Hennessy, D. Hutchcroft, P.J. Marshall, J.V. Mead, K. Rinnert, T. Shears, H.M. Wark, L.E. Yeomans

⁵⁴ *Oliver Lodge Laboratory, University of Liverpool, Liverpool, United Kingdom*

P. Alvarez Cartelle, S. Baker, U. Egede, A. Golutvin⁷⁰, M. Hecker, T. Humair, F. Kress, M. McCann⁴², M. Patel, M. Smith, S. Stefkova, M.J. Tilley, D. Websdale

⁵⁵ *Imperial College London, London, United Kingdom*

R.B. Appleby, R.J. Barlow, W. Barter, S. Borghi⁴², C. Burr, L. Capriotti, S. De Capua, D. Dutta, E. Gersabeck, M. Gersabeck, L. Grillo, R. Hidalgo Charman, M. Hilton, G. Lafferty, K. Maguire, A. McNab, D. Murray, C. Parkes, G. Sarpis, M.R.J. Williams

⁵⁶ *School of Physics and Astronomy, University of Manchester, Manchester, United Kingdom*

M. Bjørn, B.R. Gruberg Cazon, T. Hadavizadeh, T.H. Hancock, N. Harnew, D. Hill, J. Jalocha, M. John, N. Jurik, S. Malde,

C.H. Murphy, A. Nandi, M. Pili, H. Pullen, A. Rollings, G. Veneziano,
M. Vesterinen, G. Wilkinson

⁵⁷ *Department of Physics, University of Oxford, Oxford, United Kingdom*

T. Boettcher, D.C. Craik, C. Weisser, M. Williams

⁵⁸ *Massachusetts Institute of Technology, Cambridge, MA, United States*

S. Akar, T. Evans, Z.C. Huard, B. Meadows, E. Rodrigues,
H.F. Schreiner, M.D. Sokoloff

⁵⁹ *University of Cincinnati, Cincinnati, OH, United States*

J.E. Andrews, B. Hamilton, A. Jawahery, W. Parker, J. Wimberley,
Z. Yang

⁶⁰ *University of Maryland, College Park, MD, United States*

M. Artuso, B. Batsukh, A. Beiter, S. Blusk, S. Ely, M. Kelsey, K.E. Kim,
Z. Li, X. Liang, R. Mountain, I. Polyakov, M.S. Rudolph, T. Skwarnicki,
S. Stone, A. Venkateswaran, J. Wang, M. Wilkinson, Y. Yao, X. Yuan

⁶¹ *Syracuse University, Syracuse, NY, United States*

C. Göbel, V. Salustino Guimaraes

⁶² *Pontificia Universidade Católica do Rio de Janeiro (PUC-Rio), Rio de Janeiro, Brazil, associated to ²*

N. Belyi, J. He, W. Huang, P.-R. Li, X. Lyu, W. Qian, J. Qin, M. Saur,
M. Szymanski, D. Vieira, Q. Xu, Y. Zheng

⁶³ *University of Chinese Academy of Sciences, Beijing, China, associated to ³*

H. Cai, L. Sun

⁶⁴ *School of Physics and Technology, Wuhan University, Wuhan, China, associated to ³*

B. Dey, W. Hu, Y. Wang, D. Xiao, Y. Xie, M. Xu, H. Yin, J. Yu ^{aa},
D. Zhang

⁶⁵ *Institute of Particle Physics, Central China Normal University, Wuhan, Hubei, China, associated to ³*

D.A. Milanes, I.A. Monroy, J.A. Rodriguez Lopez

⁶⁶ *Departamento de Física, Universidad Nacional de Colombia, Bogota, Colombia, associated to ⁸*

O. Grünberg, M. Heß, N. Meinert, H. Viemann, R. Waldi

⁶⁷ *Institut für Physik, Universität Rostock, Rostock, Germany, associated to* ¹²

C.J.G. Onderwater

⁶⁸ *Van Swinderen Institute, University of Groningen, Groningen, Netherlands, associated to* ²⁷

T. Likhomanenko, A. Malinin, O. Morgunova, A. Nogay, A. Petrov,
V. Shevchenko

⁶⁹ *National Research Centre Kurchatov Institute, Moscow, Russia, associated to* ³⁴

F. Baryshnikov, S. Didenko, N. Polukhina ^c, E. Shmanin

⁷⁰ *National University of Science and Technology "MISIS", Moscow, Russia, associated to* ³⁴

G. Panshin, S. Stokov, A. Vagner

⁷¹ *National Research Tomsk Polytechnic University, Tomsk, Russia, associated to* ³⁴

L.M. Garcia Martin, L. Henry, F. Martinez Vidal, A. Oyanguren,
C. Remon Alepuz, J. Ruiz Vidal, C. Sanchez Mayordomo

⁷² *Instituto de Fisica Corpuscular, Centro Mixto Universidad de Valencia – CSIC, Valencia, Spain, associated to* ⁴⁰

C.A. Aidala

⁷³ *University of Michigan, Ann Arbor, United States, associated to* ⁶¹

C.L. Da Silva, J.M. Durham

⁷⁴ *Los Alamos National Laboratory (LANL), Los Alamos, United States, associated to* ⁶¹

^a Universidade Federal do Triângulo Mineiro (UFTM), Uberaba-MG, Brazil.

^b Laboratoire Leprince-Ringuet, Palaiseau, France.

^c P.N. Lebedev Physical Institute, Russian Academy of Science (LPI RAS), Moscow, Russia.

^d Università di Bari, Bari, Italy.

^e Università di Bologna, Bologna, Italy.

^f Università di Cagliari, Cagliari, Italy.

^g Università di Ferrara, Ferrara, Italy.

^h Università di Genova, Genova, Italy.

ⁱ Università di Milano Bicocca, Milano, Italy.

^j Università di Roma Tor Vergata, Roma, Italy.

^k Università di Roma La Sapienza, Roma, Italy.

^l AGH – University of Science and Technology, Faculty of Computer Science, Electronics and Telecommunications, Kraków, Poland.

^m LIFAELS, La Salle, Universitat Ramon Llull, Barcelona, Spain.

ⁿ Hanoi University of Science, Hanoi, Vietnam.

^o Università di Padova, Padova, Italy.

- p* Università di Pisa, Pisa, Italy.
- q* Università degli Studi di Milano, Milano, Italy.
- r* Università di Urbino, Urbino, Italy.
- s* Università della Basilicata, Potenza, Italy.
- t* Scuola Normale Superiore, Pisa, Italy.
- u* Università di Modena e Reggio Emilia, Modena, Italy.
- v* MSU – Iligan Institute of Technology (MSU-IIT), Iligan, Philippines.
- w* Novosibirsk State University, Novosibirsk, Russia.
- x* Sezione INFN di Trieste, Trieste, Italy.
- y* Escuela Agrícola Panamericana, San Antonio de Oriente, Honduras.
- z* School of Physics and Information Technology, Shaanxi Normal University (SNNU), Xi'an, China.
- aa* Physics and Micro Electronic College, Hunan University, Changsha City, China.
- ab* National Research University Higher School of Economics, Moscow, Russia.
- †* Deceased.