# Predrag Milenovic

## Personal Information

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| **Date of birth:** | November 9th 1976 |
| **Nationalities:** | Serbia, Switzerland |
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## Profile

**Expertise:**

- Experimental & phenomenological aspects in particle physics, and statistical data analysis
- Detector technologies and instrumentation, control systems for large-scale experiments
- Coordination of research groups and projects, scientific writing, academic lecturing

**Language fluency:** Serbian (native), English (fluent), French (B1), German (A2)

## Education

**2011 Doctorate in Experimental Particle Physics**
Swiss Federal Institute of Technology Zurich (ETHZ), Switzerland

**2006 Magister degree in Elementary Particle Physics** (3 years degree program)
Faculty of Physics, University of Belgrade, Serbia

**2001 Diploma in Theoretical Physics** (4.5 years degree program)
Faculty of Physics, University of Belgrade, Serbia

**equiv. to Bachelor in Electrical Engineering** (4 years degree program, w/o thesis)
Faculty of Electrical Engineering, University of Belgrade, Serbia

## Employment

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| 2019 – | **Associated Professor**, Faculty of Physics, University of Belgrade |
| 2020 – 2021 | **Visiting Scientist**, Chinese Academy of Sciences, IHEP Bejing |
| 2018 – 2019 | **Associated Research Professor**, Faculty of Physics, University of Belgrade |
| 2016 – 2018 | **Research Fellow**, CERN, Geneva |
| 2011 – 2016 | **Postdoctoral Researcher**, IHEPA, University of Florida, Gainesville |
| 2007 – 2011 | **Doctoral student**, Institute for Particle Physics, ETH Zürich |
| 2001 – 2006 | **Research assistant**, VINCA Institute of Nuclear Sciences, Belgrade |

## Research Responsibilities, Services and Projects

**2021 – Advisory and steering roles** within CERN, LHC, and CMS projects

- **CERN Quantum Technologies Initiative Advisory Board** (2021 - )
  Strategic advices on R&D and application of quantum technologies in HEP.
- **LHC Higgs WG Steering Committee** (2021 - 2023)
  Guidance on recommendations for Higgs boson properties measurements.
- **CMS Implementation Team on Diversity and Inclusion** (2021 - 2023)
  Recommendations on diversity & inclusion policies implementation at CMS.

## Research Responsibilities, Services and Projects (continued)

**2016 – 2021**  **Co-coordinator of Higgs boson physics groups** in LHC Higgs WG
- **Higgs properties (WG2) group** (2019 - 2021) [100+ people]
  Published studies & recommendations in 2 LHC H WG public documents.
- **Higgs cross sections sub-group** (2016 - 2019) [50+ people]
  Published studies in CERN Yellow Report (ISBN 9789290834427).

**2015 – 2023**  **Co-coordinator of physics analysis groups** in CMS collaboration
- **Effective Field Theory interpretations** (2020 – 2023) [100+ people]
  Preparation for 1st global EFT interpretations of CMS measurements.
- **Higgs Future sub-group** (2017 - 2019) [50+ people]
  Published studies in 3 CMS TDRs & CERN YR (ISBN 9789290835493).
- **Higgs ZZ sub-group** (2015 - 2017) [30+ people]
  Published measurements in 3 journals and 3 CMS PAS public documents.

**2014 –**  **Editorial and referral duties**
- Analysis Review Committee for 10 analyses, Principal editor of 2 analyses
- External reviewer for the scientific journals EPJ C and JHEP
- Co-editor of CERN Yellow Reports (CERN-2017-002-M, CYRM-2019-007)

**2011 –**  **National and international HEP R&D projects and fundings**
- COMETA COST Action CA22130, Horizon Europe, 2023-2027, MC member
- Multilateral Italy-Serbia project, RS19MO06, 2019-2021, PI
- VBSCAn COST Action CA16108, EU Horizon 2020, 2018-2021, MC member
- National project ON171019, MoESTD, Serbia, since 2011, participant
- SCOPES projects, SNF SDC, Switzerland, 2005-2015, participant

## Research Activities and Experience

**2018 –**  **Associated (Research) Professor**, Faculty of Physics, Belgrade
- **Detector R&D activities**:
  - Development of system for automatised large-scale testing of the readout electronics, as well as the control and safety system for the upgrade of CMS Electromagnetic Calorimeter (ECAL) [C1].
  - Application of FPGA-based machine learning techniques in HEP (particle identification, event classification, etc.).
  - Study of ageing effects and identification of optimised gas chemical composition for the upgrade of CMS Cathode Strip Chambers (CSCs).
- **Physics studies, measurements, and searches**:
  - Coordination of CMS group for global EFT interpretation of electroweak, top quark and Higgs boson physics measurements
  - Preparation of public tool for parameterisation of EFT effects with focus on vector-boson scattering and Higgs boson processes (4l final state)
  - Development/coordination of CMS measurements of the Higgs boson properties (mass, couplings, fiducial/differential cross sections) [A1,A2].
  - Coordination and steering of LHC Higgs WG group that establishes recommendations for Higgs boson properties measurements [B1].
  - Development of phenomenological and experimental tools/methods for probing for non-commutativity of quantum space-time using LHC data.

# Research Activities and Experience (continued)

**2016 – 2018**  **Research Fellow**, CERN, Geneva
- Coordination of the CMS Higgs Future group studies of <u>performance of the upgraded detector at HL-LHC</u> (published in 3 CMS TDRs and [B2]).
- Co-development of analysis tools for characterisation of e.m. and hadronic showers and <u>study of High-Granularity Calorimeter (HGCAL) performance</u>.
- Development of the analysis framework for calibration of energy response and <u>study of resolution of hadron showers</u>, including different schemas for pile-up subtraction, in HGCAL [C2].
- Coordination of LHC HXSWG sub-group that established <u>recommendations for Higgs boson cross section</u> measurements [B3, B4].
- Co-development of the <u>method that improved precision of the Higgs boson mass measurement</u> by about 10% using H→4l decay mode by performing the refitting of the lepton kinematics
- Coordination of physics analyses with Run-2 data within Higgs ZZ group.
- Coordination of the analysis that has <u>improved the sensitivity to the small anomalous HVV interactions</u> by exploiting correlations between the kinematics of the Higgs boson and associated jets [A3].

**2011 – 2016**  **Postdoctoral Researcher**, IHEPA, University of Florida, Gainesville
- One of the key persons in the analyses that led to the <u>observation of the 125 GeV Higgs boson and measurement of its properties</u> in its decay to four leptons [A6 - A8],
- Development of a matrix element method and the public <u>software tool MEKD</u> for <u>characterisation of the spin and parity</u> of the newly discovered boson (improvement in sensitivity to exotic states by up to 15%) [B6],
- Development of the method that significantly improves the sensitivity to the anomalous HZZ interactions by <u>exploiting the interference between the amplitudes of anomalous and SM HZZ interactions</u> [B5],
- Development and coordination of the analysis that led to the <u>constraints on the anomalous HZZ interactions</u> [A5],
- Development and coordination of the <u>Higgs boson fiducial and differential cross section measurements</u> using its decay to four leptons [A4],
- Observation of the Z→4l decays in pp collisions at 7TeV [A9],
- Study of the <u>performance</u> of the CMS CSCs, and development of the algorithms for an <u>improved muon reconstruction</u> in the presence of multiple hits within CSCs.

**2007 – 2011**  **Doctoral student**, Institute for Particle Physics, ETH Zürich
- Contribution to <u>searches for supersymmetric particle signals</u> in events with two same-sign leptons at the LHC [A10],
- Development of a general <u>method for computing contamination from mis-identified and non-isolated leptons</u> in multi-lepton final states,
- <u>Integration and testing</u> of the CMS ECAL, its <u>calibration with the electron and pion test-beams</u>, as well as <u>commissioning and operation</u> of ECAL within the CMS experiment,
- Design, implementation, installation and commissioning of the <u>Control and Safety Systems for the ECAL detector</u> at the CMS experiment [C3, C4].

## Event Organisation

- **Organisation of international schools and conferences (IOC/LOC/IAC):**
  1. Probing space-time properties at HEP experiments, Belgrade, May 29, 2023
  2. 11th LHC Physics (LHCP) conference, Belgrade, May 22-26, 2023
  3. PRecision Effective Field Theory School (PREFIT20), DESY, Hamburg, 1-13 Mar, 2020
  4. Series of Schools of High Energy Physics in Split and Sarajevo, in years 2015-2019
  5. CERN Danube School on Instrumentation (in PNP), Novi Sad, Serbia, 8-13 Sep 2014

## Lecturing and Student Supervision

- **Co-supervision of PhD, master and summer students (Belgrade, Florida, CERN):**
  - Postgrad. students: J.Mitic (PhD, 2022-), L.Bulaja (master, 2023-), E.Maricic (master, 2022-2023), L.Markovic (PhD, 2020-), Q.Guo (PhD, 2019-2023), B.Brkic (master, 2018-2019), H. Mei (PhD, 2014-2018), V.Milosevic (master, 2015-2016), M.Snowball (PhD, 2011-2014)
  - CERN summer students: D.Brunet (2024), I. Bubanja (2018), O. Arzi (2017), N. Rho (2016), A. Polaczek (2016), I Novak (2014), D. Markovic (2007)
- **Courses at Faculty of Physics (2019-present):**
  - Elementary particles physics (under/post-grad.), Statistical & comp. methods (under/post-grad.), Particle detectors in HEP (post-grad), Particle accelerators (post-grad.).
- **Lectures and exercises at HEP schools (since 2012):**
  - Split School of High Energy Physics (Split 2015), CMS Data Analysis School (Fermilab & CERN 2014), Trans-European School of High Energy Physics (Petnica 2012)

## Computing Experience

- High-level GPLs:                C/C++, Python
- HEP tools & packages:           CMSSW, CRAB, ROOT, SOFTSUSY, MEKD, MELA
- MC tools & generators:          MadGraph5_aMC@NLO, POWHEG BOX, HRes, PYTHIA
- Math, DB, web DSLs:             Matlab, Mathematica, SQL, HTML
- Symbolic GPLs:                  Assembly (Intel x86, PICmicro), STL/SCL (Siemens PLCs)
- SCADA systems & protocols:      WinCC (PVSS), LabView, Modbus, telecontrol (IEC 60870-5)
- Virtualisation solutions:       VMware Infrastructure, Parallels VDI
- Graphics & web design:          Adobe suite (Photoshop, Illustrator, Dreamweaver, Flash)

## Awards

- Special distinction for excellence at the CERN School of Computing, Saint-Malo, 2005

## References

- **Dr Luca Malgeri**, EP Department, CERN, Switzerland          luca.malgeri@cern.ch
- **Prof. Dr Guenther Dissertori,** ETH Zurich, Switzerland      guenther.dissertori@cern.ch
- **Prof. Dr Andrey Korytov**, University of Florida, USA        korytov@phys.ufl.edu
- **Prof. Dr Peter Adzic**, University of Belgrade, Serbia       peter.adzic@cern.ch
- **Prof. Dr Paris Sphicas**, University of Athens and CERN      paris.sphicas@cern.ch
- **Dr Tiziano Camporesi**, EP Department, CERN, Switzerland     tiziano.camporesi@cern.ch