EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

COMPACT MUON SOLENOID COLLABORATION

URL : http://cms.cern

INTERNATIONAL CALL
RESEARCH AT CERN WITHIN CMS COLLABORATION BRIL PROJECT FOR ECUADORIAN PROFESSIONALS

1. About CERN

CERN's origins can be traced to the 1940s. A small number of visionary scientists in Europe and North America identified the need for Europe to have a world-class physics research facility. Their vision was both to stop the brain drain to America that had begun during the Second World War, and to provide a force for unity in post-war Europe. Today, CERN unites scientists from around the world in the pursuit of knowledge.

Scientists at CERN strive to uncover what the universe is made of and how it works. This is done by providing a unique range of particle accelerator facilities to researchers, to advance the boundaries of human knowledge.

The Laboratory, established in 1954, has become a prime example of international collaboration.

CERN's mission is to:

- Provide a unique range of particle accelerator facilities that enable research at the forefront of human knowledge.
- Perform world-class research in fundamental physics.
- Unite people from all over the world to push the frontiers of science and technology, for the benefit of all.

2. Research at CERN

CERN's primary research is in fundamental particle physics but the Laboratory also plays a vital role in developing the technologies of tomorrow.

3. Research in the CMS Collaboration/Experiment

The CMS Collaboration brings together members of the particle physics community from across the globe in a quest to advance humanity's knowledge of the very basic laws of our Universe. CMS has over 4000 particle physicists, engineers, computer scientists, technicians and students from around 200 institutes and universities from more than 40 countries. The collaboration operates and collects data from the Compact Muon Solenoid, one of the general-purpose particle detectors at CERN's Large Hadron Collider.

The CMS Beam Radiation Instrumentation and Luminosity Project (BRIL) is responsible for the simulation and measurement of luminosity, beam conditions and radiation fields in the CMS experiment. A precise and accurate measurement of the delivered luminosity is of paramount importance for the CMS physics program.

4. Profiles of the 2 candidates (detailed profiles in Annex 1)

a. Electronics Engineer (FPGA) in CMS BRIL Project
b. Software Engineer in CMS BRIL Project

5. **Country and city of research:** Switzerland – Meyrin

6. **Living costs covered (including travel to/from and mandatory health insurance to be taken up by the selected person):** 4800 CHF/m (single person), or 5184 CHF/m (with spouse/family)

7. **Modality of research:** in person – 8 hours per day

8. **Process of selection and deadlines:**

Launching of the call	24.02.2020 until 01.04.2020
Validation of the documents	06.04.2020 until 10.04.2020
Interview of the preselected profiles by the leader Universities USFQ and EPN.	13.04.2020 until 17.04.2020
CERN final selection by CMS Experts	20.04.2020 until 01.05.2020
Visa application via CMS	Four or five weeks as of the selection
Starting date at CERN (ideally)	01.06.2020

***** The profiles that pass the validation process will be taken into consideration for the interview process.

9. **Duration of the program:** 1 year with a possible extension by mutual agreement

10. **Documentation needed:**
    - Official certificates that confirm studies, work experience and knowledge in the required areas
    - Curriculum vitae
    - Academic record of the last obtained title

    *English knowledge will be confirmed through an interview.

11. **For more information:** Contact: Prof. Edgar Carrera, email: ecarrera@cern.ch

12. **Where to present the application:** at IFTH

13. **Special considerations:**

    Status at CERN is that of an associated member of the personnel (USER) and the person remains employed by the Ecuadorian Institute in the CMS Collaboration.

    The candidates should be able to demonstrate their experience and knowledge regarding the profiles in English.

Annex 1

a. Electronics Engineer (FPGA)
You will work in the CMS BRIL Project and collaborate with many different specialists in the field of detector commissioning, electronics, slow control and data acquisition to master the challenges of building, testing, installing and maintaining the electronic systems required to measure the CMS beam backgrounds and luminosity in real time.

Functions
As an FPGA Firmware Developer your main task will be to develop, test and maintain the digital electronics and the firmware used for the BCM1F uTCA and BHM backend electronics as well as the electronics required for the distribution of timing signals for the BRIL systems.

The job will involve:

- The design, design verification, upgrade and maintenance of digital acquisition electronics based on field programmable logic-based devices (FPGA), including maintenance of low-level SW driver libraries
- The design verification, upgrade, commissioning and maintenance of a prototype clock and orbit distribution board for the BRIL electronics
- Maintenance and contribution to the upgrade strategy for the CMS Beam Timing System (BPTX)
- Simulation and modifications of printed circuit board schematics.
- Installation, test, commissioning and consolidation of these systems.

Qualifications
Bachelor's degree or equivalent relevant experience in the field of digital electronics design, electronics engineering or a related field.

Experience:

- Demonstrated hands on experience in the field of digital design, in particular FPGAs.
- Hands on experience in electronic engineering, in particular schematic design and testing of PCBs
- Practical experience with data acquisition systems or modular electronics (uTCA standard) desirable
- Practical experience with Xilinx design tools (ISE & Vivado) is of advantage

Technical competencies:

- Design and simulation of FPGA-based electronics.
- Design and simulation of digital electronic circuits.
- Testing and measurement of analog and digital electronic circuits.
- Knowledge of programming languages for the design of test benches. (Python or C/C++ would be an advantage)

Language skills:

- Ability to draw-up technical specifications and/or scientific reports and to make oral presentations in English. Language ability in French is an advantage but not a requirement

b. Software Engineer

You will work in the CMS BRIL Project and collaborate with Detector Instrumentation and Monte-Carlo simulation specialists in the fields of Radiation Simulation and Real Time measurements of the CMS Luminosity and Beam Induced Background.

Functions

As a Software Engineer your main areas of involvement will be:

1. In the maintenance and development of the web-platform for the visualisation of radiation simulation data and general support of radiation simulation software.
2. In the development and deployment of the cloud based software tools using modern containerisation platforms
3. in the development and maintenance of web based monitoring system that fetches data from monitoring databases and displays them as real time or historical charts.

The job will involve:

- A migration of the radiation simulation webtool backend from 2-tiers deployment model to OpenShift continuous integration framework and DevOps.
- Development of Python scripts to manipulate data matrices to improve the visualisation of radiation simulation data for CMS users; for example translations, rotations and projections of 3D to 2D data.
- Supporting the radiation simulation team in high volume MC simulations, taking into account the upgrades to the CERN linux environment e.g. centos and compatibilities with the FLUKA fortran compiler
- Possibilities to contribute to the improvements and upgrades of the geometry description of CMS in the FLUKA model.
- Possibilities to contribute to radiation simulation studies and benchmarking
- The development and deployment of new monitoring pages and the maintenance of the existing web monitoring and elasticsearch services
- Contribute to software support for the commissioning of the BRIL instrumentation for Run 3.

Qualifications

Master's degree or equivalent relevant experience in the fields of computer science. Monte Carlo simulation experience, statistical analysis and mathematical skills in linear algebra is advantageous.

Experience:

- Mandatory strong knowledge of the Linux OS
- Basic understanding of the container based software development
- Solid understanding of JavaScript and basic web technologies (HTTP, HTML5 CSS3) is essential
- Modern web frontend technologies of Angular, and RxJS.
- Experience with databases
- Experience in large scale computing job submission software will be an advantage.
- Familiarity with javascript based data visualization is also useful

Technical competencies:

- Knowledge of programming techniques and languages: web development and maintenance.
- Knowledge and application of software life-cycle tools and procedures: Issue tracking systems, Git, dependencies and build tools.
- Re-use, integration and porting of existing software: migration of user interfaces from old technologies to new standards