



Contribution ID: 55

Type: not specified

Progress with the nRPC-4D detector concept for neutron scattering applications: assessment of XYZ-position and nTOF readout capability in beam tests

Friday 13 September 2024 13:20 (20 minutes)

Building upon our prior work on the development of the neutron RPC detection technology [1, 2], we have recently introduced the nRPC-4D detector concept. It provides high cold/ thermal neutron detection efficiency and the capability to simultaneously readout the XYZ-position of each detected neutron and its time-of-flight (nToF). For the simplicity of construction and maintenance, the detector architecture is based on stand-alone neutron detection modules. Each module features a double gap timing RPC with $^{10}\text{B}_4\text{C}$ -coated cathodes, faced on both sides with arrays of signal pickup strips for X- and Y-position readout. We are conducting the development of this type of detector for neutron scattering applications, such as time-of-flight neutron diffraction and time resolved neutron imaging. The concept also shows good potential for other applications benefiting from simultaneous readout of the neutron events position and time.

We will report on the recent progress related to this detector concept along with the implementation details of a prototype. It will be shown that the new arrangement of the signal pickup strips allows one to identify the $^{10}\text{B}_4\text{C}$ layer along the stack where a neutron is captured. This enables the determination of the nToF with an unprecedented precision and allows to correct misalignment between the planes of signal pickup strip arrays, which can spoil the spatial resolution. Finally, in-beam experimental results on the XYZ-position resolution, nToF measurements and counting rate capability will also be presented.

Acknowledgements

This work was funded by the Portuguese national funds OE and FCT-Portugal (<http://doi.org/10.54499/EXPL/FIS-NUC/0538/2021>). L. Margato acknowledges FCT-Portugal support through contract CEECINST/00106/2018/CP1494/CT0001.

References

- [1] L.M.S. Margato and A. Morozov 2018 JINST 13 P08007, DOI: 10.1088/1748-0221/13/08/P08007
- [2] L.M.S. Margato et al 2020 JINST 15 P06007, DOI: 10.1088/1748-0221/15/06/P06007

Author: MARGATO, Luís (Laboratory of Instrumentation and Experimental Particles Physics, Dep. of Physics, University of Coimbra)

Co-authors: BLANCO, Alberto (Laboratory of Instrumentation and Experimental Particles Physics, Dep. of Physics, University of Coimbra); MOROZOV, Andrey (Laboratory of Instrumentation and Experimental Particles Physics, Dep. of Physics, University of Coimbra); GUERARD, Bruno (Institut Laue Langevin); LAI, Chung Chuan (European Spallation Source ERIC (ESS)); SARAIVA, João (Laboratory of Instrumentation and Experimental Particles Physics, Dep. of Physics, University of Coimbra); MARCHAL, Julien (Institut Laue Langevin); FONTE, Paulo (Coimbra Polytechnic –ISEC); SVENSSON, Per-Olof (European Spallation Source ERIC (ESS))

Presenter: MARGATO, Luís (Laboratory of Instrumentation and Experimental Particles Physics, Dep. of Physics, University of Coimbra)

Session Classification: Applied research and new ideas (part II)