

Neutron Detectors Group

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1. Position-sensitive detectors for cold / thermal neutrons based on ¹⁰B-RPCs technology for applications in NSS requiring neutron TOF

Proof-of-concept nRPC-4D prototype

- -Design optimized in Geant4 / ANTS2 simulations
- -Demonstrator constructed
- -Preliminary tests conducted at a neutron beamline at PSI in collaboration with the Fundamental Neutron and Precision Physics Group of the University of Bern

2. Detectors of fast neutrons for nuclear physics, e.g., for beta-delayed neutron emission experiments

Together with the NUC-RIA and RPC groups, submitted a joint proposal dedicated to the benchmarking of the performance of ¹⁰B-RPC detectors for **fast** and **epithermal** neutrons at the HISPANOS neutron source (Seville, Spain)

Funding

EXPL/FIS-NUC/0538/2021 (50 k€, 2022/01/01 – 2023/12/31): "nRPC-4D - Fast timing high resolution nRPC-4D detector concept for neutron science"

Collaborations

Internal: ongoing with RPC group and initiated with NUC-RIA group **External:** Detector groups from TUM - FRMII, ESS, ILL and ISIS

LIP Advisory Committee meeting, 27 April 2023

Proof-of-concept nRPC-4D demonstrator at LIP, Coimbra



Testing the nRPC-4D demonstrator on a neutron beamline at PSI





Neutron Detectors Group

Strengths

Experienced team in the **development and characterisation of position-sensitive neutron detectors**;

Strong **background in simulation** of particle detectors and the development of position reconstruction techniques;

Long-standing collaborations with international partners from world-leading large scale neutron facilities.

Weaknesses

Difficulty in **attracting** young researchers (**PhDs and postdocs**); Lack of an in-house neutron source (e.g., ²⁵²Cf) in LIP for preliminary testing of the detectors.

Opportunities

¹⁰B-RPC technology shows a **strong potential for applications at large scale neutron facilities**; Primary cosmic rays The European Spallation Source is currently driving the development of new types of neutron detectors;

New opportunities to test our detectors at the beamlines of ISIS (UK) and PSI (Switzerland); Societal focus on "smart agriculture" opens a window of opportunity to test feasibility of using ¹⁰B-RPC detectors for **soil moisture monitoring**.

Threats

Non-sustainable funding; Non-permanent position of the group coordinator (fixed term contract); Long **delays in accessing neutron beamlines**.

