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Design study of a 1-m^2 Position Sensitive Neutron Detector (PSND)

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Modern neutron Multi-Wire-Proportional-Chambers (MWPC) operating with $^{10}B_4C$ films as solid-state-converter can surpass the performance of ones based on ^{3}He in terms of position resolution and count rate capability at similar detection efficiency [1,2]. The use of large area coated converters on thin foils forces to develop a mechanical concept to avoid deformations of the neutron sensitive surface due to their own weight and due to acting electrostatic resulting from HV in operation. This concept must allow a parallel stacking of the converter elements in mm distance in order to accumulate conversion efficiency as needed for perpendicular neutron incidence geometry. HZG has introduced [1] and investigated as a contribution to the ESS the idea of stabilizing the converter elements by gas pressure gradient between both sides of the converter to counteract the forces resulting from operation. This concept is applied to the design study of a 1-m^2 PSND with a position resolution of 2 mm. The MWPC consists of up to 24 $^{10}B_4C$ coated 0.3 mm thick Aluminum parallel stacked converters with a detection depth < 12 mm each. The deposition method of $^{10}B_4C$ coatings with thicknesses up to 10 µm on pretreated Al substrates was elaborated [2, 3]. The delay-line read-out of the detector coupes for up to 170 kcps per detector plane.
[1] European Patent: EP 17184906.0 (filed at 04.08.2017)
[2] European Patent Application 2 997 174 (14.07.2014)
[3] G. Nowak, et al. J. Appl. Phys. 117, 034901 (2015)

Primary author: NOWAK, Gregor (Helmholtz-Zentrum Hereon)

Co-authors: STEFANESCU, Irina (European Spallation Source ERIC); Mr BELDOWSKI, Andreas (Helmholtz-Zentrum Hereon); FENSKE, Jochen (Hereon); Prof. MÜLLER, Martin (Helmholtz-Zentrum hereon GmbH)

Presenter: NOWAK, Gregor (Helmholtz-Zentrum Hereon)

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