

ATTRACT TWD Symposium: Trends, Wishes and Dreams in Detection and Imaging Technologies



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A pixelised detector for thermal neutrons

For the European Spallation Source (ESS), now under construction, a new generation of neutron detectors will be

required with groundbreaking properties in terms of 2D spatial resolution, time resolution, efficiency, rate capability, gamma discrimination and radiation hardness.

We propose to deposit a 10B containing semiconducting layer directly onto a pixel chip with charge-sensitive pixel input pads.

This layer is coated with a thin metal contact: by applying a certain potential to this contact, a bias field is created in

the semiconducting layer volume. Thermal neutrons, interacting with a ^{10}B nucleus will cause a nuclear reaction resulting

in the emission of an alpha-particle and a recoil ^7Li ion. These charged energetic particles will strongly ionise the semiconductor

material. The bias field will separate electrons and holes, and with just a few ns life time of these charge carriers, sufficient

charge is induced onto the pixel input pads to activate the pixel circuitry.

With the available TimePix-3 chip, a high performance neutron detector would be feasible if a B containing compound can

be created and deposited with charge carrier properties meeting specific requirements. These properties should not change

after the absorption of a certain amount of neutrons. The TimePix-3 chip itself is shielded from neutrons by the

active ^{10}B contains layer. As layer material, BC, BNC, B₄C are potential candidates.

Summary

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