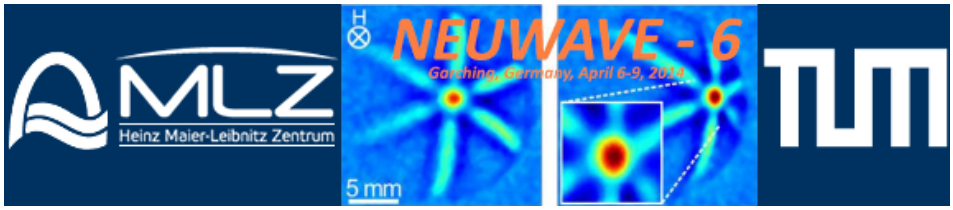

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Introducing the GP2 detector; Event-mode neutron imaging using the 'PImMS'sensor with gadolinium converter

Tuesday 8 April 2014 16:00 (30 minutes)

The demand for energy resolved neutron imaging has generated several recent advances in detector instrumentation and techniques[1], particularly with the use of borated MCP's[2] or fast, gated, CCD technology[3]. This presentation reports on the development of a new type of detector, the Gadolinium-PImMS-2 detector. GP2 utilizes a PImMS-2 CMOS sensor[4], so named as it was developed for Particle Imaging Mass Spectrometry[5], modified to record event-mode data from a pulsed neutron source[6]. The CMOS sensor has been made neutron sensitive by using gadolinium; the sensor directly detects the conversion electrons generated from neutron capture.

The active area of the current version of GP2 is 22.6mm x 22.6mm, with a single pixel size of 70µm. This gives a total of 104976 pixels. Each pixel has four 12-bit SRAM registers for storing timing information, allowing each pixel to record up to four independent hits per frame. The PImMS architecture records a hit after signal shaping and discrimination, meaning no dark-field correction is required. The discrimination level can be independently adjusted for each pixel, which improves the uniformity of the sensitivity, compensating for gain variations. A range of gadolinium thicknesses were measured to determine the optimum detector efficiency, which is ~10% for neutron wavelengths above 1.8Å, using a single layer of ^{NAT}Gd.

Summary

The new GP2 neutron imaging camera will be introduced, reviewing results from the last two years of R&D. A full detector specification will be given, discussing neutron efficiency, gamma sensitivity, spatial resolution and temporal resolution. Measurements from standard samples demonstrate the detector's capability to measure Bragg-edges, radiographs and tomograms.

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