Contribution ID: **12** Type: **not specified**

High resolution neutron radiography and microtomography with fast MCP-Timepix detector operating at >1Khz frame rates

Wednesday, April 18, 2012 11:30 AM (30 minutes)

The unique capability of MCP detectors to count neutrons with high detection efficiency (70% for cold and 50% for thermal), high spatial resolution (sub-15 um) and no readout noise can be very attractive for some applications where relatively small area of the detector (currently 28x28 mmˆ2) is acceptable. The recent development of fast parallel readout electronics for a 2x2 Timepix readout enabled high resolution imaging with event centroiding at ˜MHz counting rates. In addition to imaging resolution, the dynamical studies can be performed by time tagging of every neutron with accuracy of 1 us (for 55 um spatial resolution) and sub-ms for sub-15 um spatial resolution. Another advantage of MCP detectors is their high dynamic range, allowing simultaneous event detection in case of very low neutron fluxes (<10 n/cmˆ2/s) and fluxes as high as 10ˆ8 n/cmˆ2/s with 1 KHz frames/s readout rates.
Our latest imaging experiments conducted at ICON and BOA beamlines will be presented, demonstrating not only the capabilities of the detection system, but also the excellent quality of those beamlines for high resolution neutron radiography and tomography. We will also describe the performance of the latest micropore neutron collimators used for scatter rejection in neutron radiography of samples with considerable neutron scattering, e.g. quantification of water content at a close distance to the detector required for high resolution imaging.

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Session Classification: Water transport II