# Instrument Data Scientist Report

Søren Schmidt, April 23th 2023

**Timepix3 detector system**

The TimepixCam (Timepix3) is planned to be main imaging detector for time-of-flight measurements at ODIN. Recently, two experiments were conducted with this type of camera at LANL and J-PARC. At LANL the experiment took place at the HIPPO instrument. In Figure 1 the flight path calibration is seen using Fe powder.

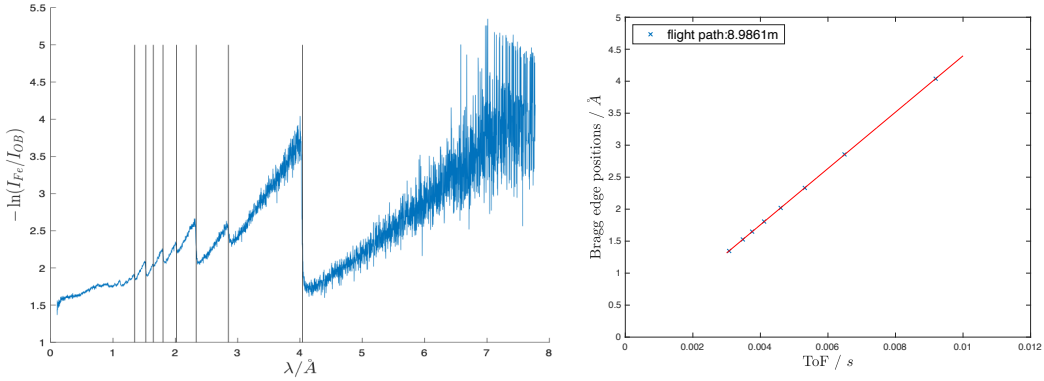


*Figure 1: Flight path calibration data (Timepix3) from the HIPPO instrument at LANL using Fe powder*

The timepix3 detector system, see Figure 2, comes with data reduction software from LoskoVision operating in three steps: Raw data from the timepix sensor, mainly photon data originating from neutrons passing through a scintillator, is reduced to neutron events through coherence of multiple photon events in time and space and then transformed into image stacks (Tiffs). Through this process a spatial resolution of roughly ¼ of the effective pixel size can be obtained (through centroiding photons). The second experiment took place at the SENJU instrument at J-PARC. The timepix3 detector was acquired by a Center of excellence among Danish universities and ESS DMSC. It comes with a microscopy setup (7-20 mm FoV) and a diffraction setup (250 mm FoV),

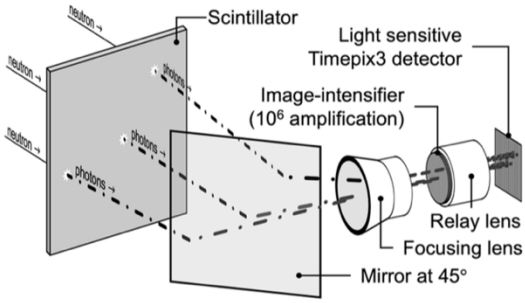


*Figure 2: Schematic view of the Timepix3 detector system (A.S. Losko, Sci. Rep. (2021) 11:21360)*

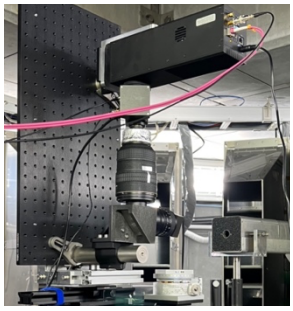

*Figure 4: Microscopy setup*

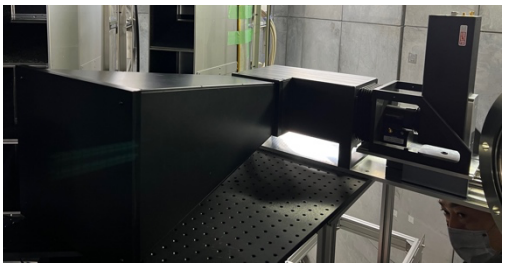

*Figure 3: Diffraction setup*

see Figures 3 and 4. The beamtime at J-PARC also included participation from DRAM, ECDC and ICS. The plan is to implement photon to neutron conversion on event formation units (EFUs) to ensure immediate availability of neutron event data.

**YMIR**

YMIR light tomography data has been reconstructed offline using Muhrec and pymuhrec software. In the next step the aim is to link up data acquisition of a well-known sample at YMIR with pymuhrec reconstruction at a remote VISA platform and then visualize the reconstructed volume back at YMIR. Milestone is to be defined early May.

**ODIN**

The coming milestones for ODIN include scipp based transformation of timepix3 events into image stacks (Q3, 2023), McStas generated ODIN data for attenuation tomography and Bragg edge (isotropic texture case) (Q4, 2023), and data reduction of simulated ODIN attenuation Tomography and Bragg edge data (isotropic texture case) (Q1, 2024).

In the event of an additional core programmer joining DMSC opens up an opportunity to extend the Easy framework to include analysis of transmission data, including Bragg edges extended to textured materials.

ODIN will have access to both x-rays and neutrons from day 1 operation. The estimated delivery time for the x-ray source is spring of 2024. A similar setup already exists at the NeXT imaging instrument at ILL from RX Solutions using their X-ACT platform. The plan is to adopt this system for ODIN.

**BEER**

The plan is - together with the BEER instrument team – through McStas simulations to identify procedures on how to set up an experiment using the Pulse shaping and Modulation modes. The pulse shaping mode (double blind chopper setting) is similar to WFM at ODIN. Modulation mode produces a series of narrow pulses from the modulation chopper leading to multiplexing of the diffraction lines (which can be combined into a single peak with high resolution and high intensity). Switching back and forth between the two modes and verifying that the multiplexing is done correctly is the aim of this task. A proof of concept is planned for Q1, 2024.

At the ODIN-BEER STAP meeting in March the timepix3 detector was suggested as a way to include texture measurements at BEER. As this is beyond the initial scope for BEER this could potentially be pursued through applying for external funding.