Software Development for Neutron Computed Tomography at Thai Research Reactor (TRR-1/M1)

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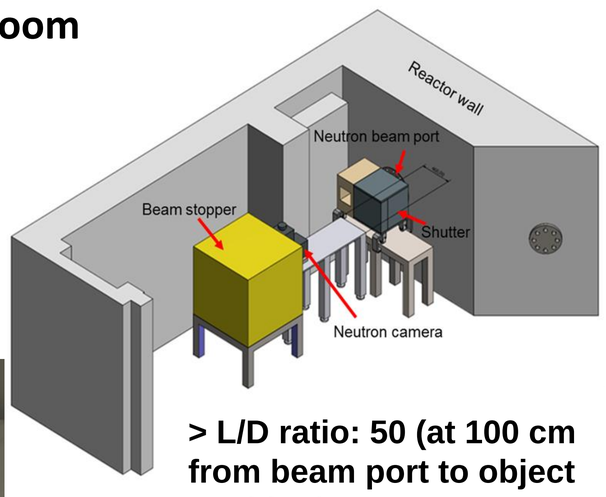
Abstract

During the last couple of years, the manual control of data acquisition for neutron computed tomography at a 1.2-MW TRIGA Mark III reactor, Thai Research Reactor (TRR-1/M1), were difficultly operated. A simple system for data acquisition with control software for the newly renovated neutron tomography facility has been developed using LabVIEW. The hardware of the system consists of a programmable CCD camera combined with a static stepping motor. The software was in-house developed to replace the previous one which is no longer used due to its capacity limitations. The new software is capable of displaying live images and automatically recording the images on a computer. In order to obtain optimal image quality, the software drives the image capture processes by adjusting camera temperature, exposure time and number of projections as well as images integration in certain frame numbers. For the neutron tomography setup, the software takes particular snapshots automatically at a sample position in line with the stepping movement of the rotating sample holder. Subsequently, the snapshots were saved in picture and numerical formats for further image processing. The new controller software has successfully tested for automatic real time data acquisition providing the appropriate input for tomographic reconstruction. The success in development of controller software contributes to the productivity and safety of neutron imaging routine at TRR-1/M1.

Neutron Radiography Facility

Renovated neutron imaging room

- **The facility consists:**
  - **Inner collimator inside the reactor wall**
  - **The shutter driven by an electric motor**
  - **Sample stage**
  - **Neutron camera**

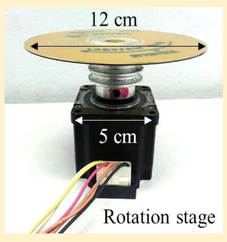


> L/D ratio: 50 (at 100 cm from beam port to object position)

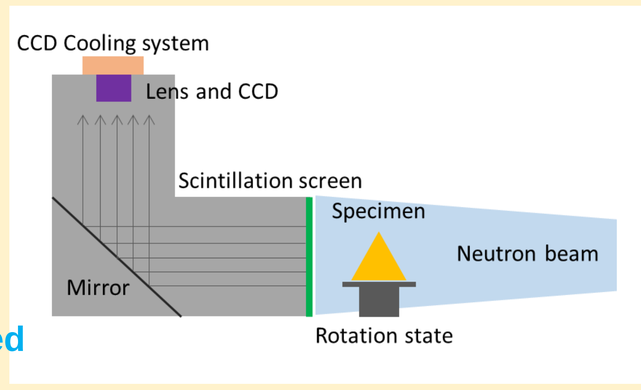
> The shielding wall and neutron shutter of the neutron imaging room have been renovated.

- **Neutron Beam Characterizations:**
  > neutron flux : 4.6 x 10^6 n/cm^2 -s at 1,200 kW, 100 cm from beam port to object position
  > neutron beam size: 18 cm x 18 cm at 100 cm from beam port to object position

Neutron camera



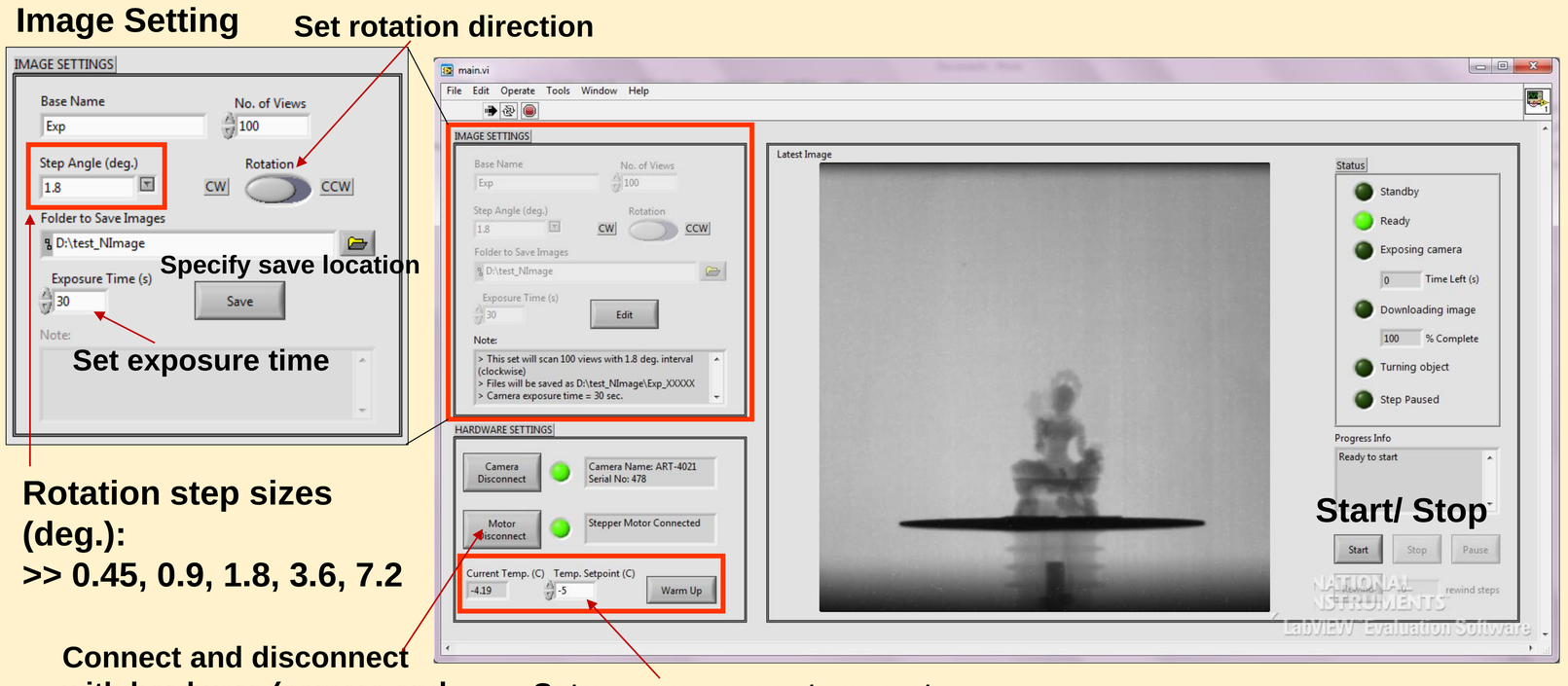
In-house developed rotation stage

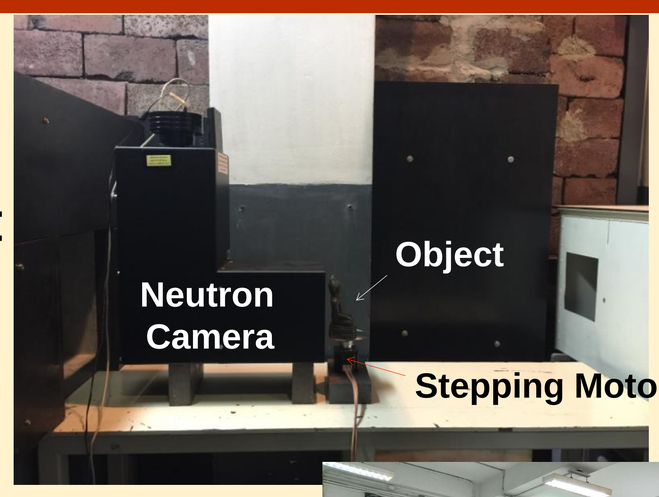


Experimental setup

New Control Software

Image Setting

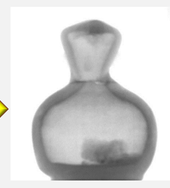


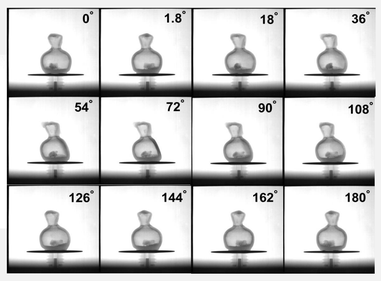


New control software was performed in 2nd ASEAN Nuclear School 2017

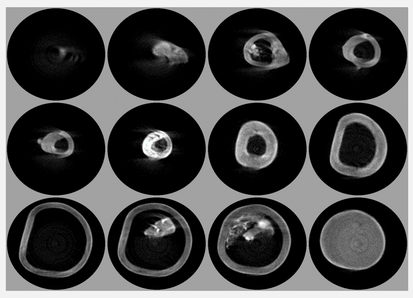
❑ Neutron tomography reconstruction by Commercial Software (Octopus)

Ancient doll

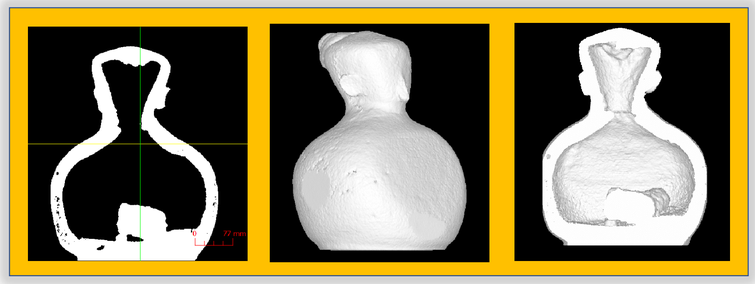




Neutron projections



Neutron tomographic images



3D neutron visualization

Conclusion

A new data acquisition and control software has been developed. It is more user-friendly than the one previously used at TRR-1/M1, allows remote operation (reducing radiation dose received), automatic and consistent operation. Commercial computed tomography software verified that the data from the data acquisition and control software was able to be reconstructed to both 2D and 3D images. The new control software has been utilized in the neutron radiography facility at TINT, Thailand for non-destructive testing of various objects mainly archeological samples.

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