15 Years of Service

OMI OPTIKA Engineering Ltd Mérnökiroda Kft

MMTP Magyar Magfúziós Technológia Platform

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Neutron Imaging Facilities Designed and Manufactured for the BNC

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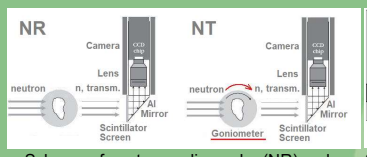
For decades, experts at the Centre for Energy Research of the Hungarian Academy of Sciences (MTA EK) have been using neutron imaging techniques. In recent years, on the basis of the specifications and continuous professional consultation of the MTA EK researchers, Zoltán KIS and László SZENTMIKLÓSI, OMI OPTIKA Engineering Ltd. has built two equipments that operate in the Budapest Neutron Centre (BNC).

In the operation of these complex neutron radiographic equipments, the neutrons passing through the test material are selectively attenuated and create a visible (shadow) image on the appropriate scintillator screen, emitting typically green light as a light source, that can be captured with a sensitive camera. The calibration of the image can be done using a test chart placed instead of the scintillator and illuminated by a similar colored homogeneous LED backlight.

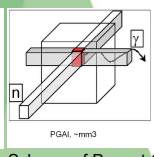
The NORMA equipment, using a maximum of 40mmx40mm cross-sectional beam of the cold neutron source of the BNC, is unique in the world since within one apparatus it performs both neutron radiography (NR), neutron tomography (NT) and 3D element analysis (PGAI). These all are important and state-of-the-art methods of non-destructive examination.

The RAD equipment is located directly at the base of the Budapest Research Reactor, at a distance of approximately 6m from the reactor core. Using a 250mm cross-sectional neutron beam, it is suitable for static and dynamic neutron radiography as well as neutron tomography. Field-of-view is adjustable with 3 exchangeable lenses (f50, f105 and f300mm) with resolution between 75-200 micrometers.

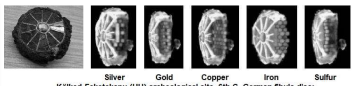
Basics of Neutron Imaging



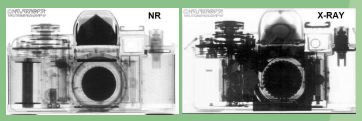
Scheme of neutron radiography (NR) and neutron tomography (NT)



Scheme of Prompt Gamma Activation Imaging (PGAI)

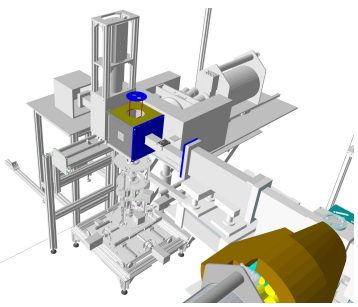


Typical PGAI 3D images with element analysis

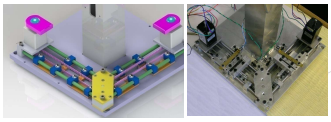


Typical neutron „shadow" image (NR, 2D) and difference between neutron and X-ray imaging

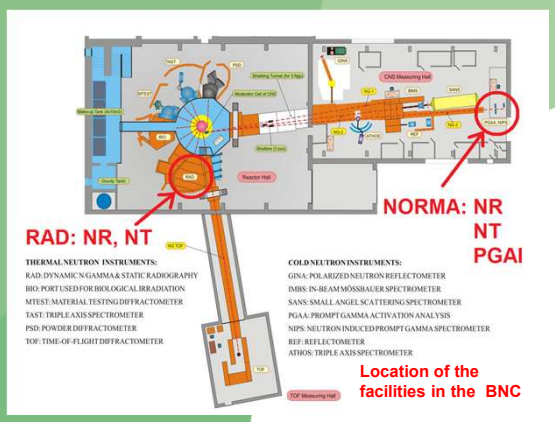
NORMA Equipment (NR, NT, PGAI)



Design layout of NORMA and camera with 1024x1024 pixel back-illuminated CCD with mirror light-tight housing



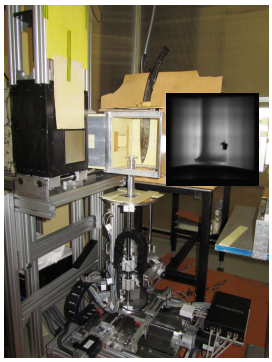
Neutron diaphragm mechanics, movement precision <0.05mm

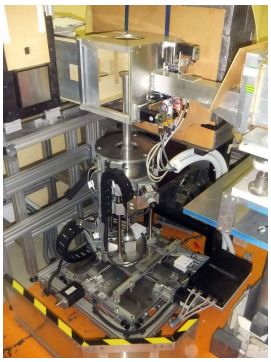


Location of the facilities in the BNC

Neutron diaphragm with Li shielding plates in operation

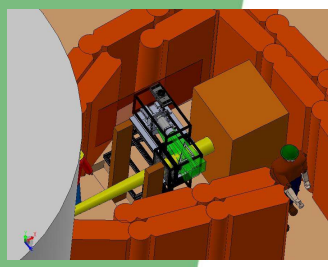
Close-up scintillator for enhanced resolution

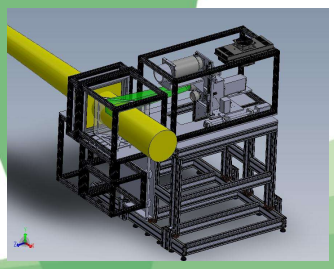




Views of NORMA and a shot of an ancient dagger with a neutron absorbent marker (left) in the sample chamber

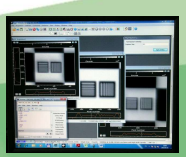
RAD Equipment (NR, NT)

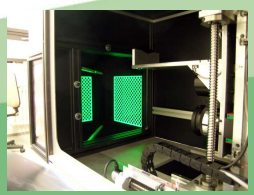




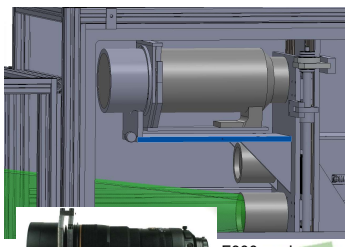
Design layout of RAD equipment and installation nearby the reactor

The RAD and the neutron emitting opening

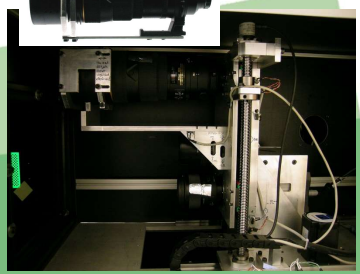




Calibration with an illuminated test chart



F300mm lens



Exchangeable lenses (f50, f105 and f300mm)