5.6. Mr Tarek Mongy (Egypt)

Introduction
Egypt Second Research Reactor (ETRR-2) is a pool-type reactor with an open water surface and variable core arrangement. The core power is 22 MW_{th} cooled by light water, moderated by water and with beryllium reflectors. The design concept is based on the requirement of being a reactor of versatile utilizations, It has been mainly designed for:

Basic and applied research in reactor physics and nuclear engineering, neutron radiography for research and industrial purpose, radioisotope production for medical and industrial purposes, beam hole experimentation for neutron scattering experiments and neutron radiography, material testing, material irradiation, activation analysis and training of scientific and technical personnel.

Experimental facility:
ETRR-2 has neutron radiography facility has the following characterization parameters:

γ rate intensity at beam outlet is 3.3 Sv/hr at 13.3 Mwatt thermal, thermal neutron flux at nominal power, 22 MWatt, is 1.5×10^7 n/cm^2. sec., fast neutron flux is at nominal power, 22 MWatt, is 1.6×10^6 n/cm^2. Sec., n/γ ratio is $0.132*10^6$ $n.cm^{-2}$ $.mR^{-1}$, Cd ratio is 10, L/D ratio is 117, Facility resolution is 188 μm (Agfa Stucturix D7).

Previous work had been done toward culture heritage reservation, as; determine of hydrogenous contents in soil and porous construction materials with high accuracy, detect the underground water for ancient Egyptian and Islamic heritage protection, test the soil for preventing water migration inside.

The present Status is Commissioning of ETRR-2 neutron radiography facility in1998 by using nitrocellulose film as a first step, in 1999 Agfa Structurix D7 photographic film was used rather than nitrocellulose film to get high quality image formation, in 2012 the commissioning of dynamic system neutron radiography/tomography is in process according to TC project between AEA and IAEA.

Workplan year 1-4:
The activities will be carried out under the framework of the CRP involve; First year activity, to protect monuments from migration of underground water by stat-of-the-art non-destructive tool, use neutron imaging technology for elemental and chemical analysis, and use computer software to detect hidden objects and study of material characterization and properties. Second year activity; for data analysis and imaging processing using different software, collaboration with Egyptian museums for mummies investigation, neutron tomographic investigation of cultural heritage objects to get information about the manufacturing techniques in the past, developing of restoration strategies and estimation of the degradation state of the samples by using neutron tomographic data, investigation of water penetration in cultural heritage building materials (marble, concrete and wood), and optimize of impregnation techniques by using dynamic neutron radiographic method. Third year activity; dedicated for examination of the internal structures of ancient Egyptian artifacts and make contacts with cultural heritage institutions (e.g. museums, archaeological institutes and universities) and collect samples. Fourth year activity**;** for Implement the necessary standardization procedures and methodology to achieve synergy between ETRR-2 NR Facility and international laboratories/facilities, develop a database of NR/T in ETRR-2 and

standard neutron imaging services for culture heritages needs, technology transfer between the specialist of NR/T in ETRR-2 and researcher from culture heritage communities, use of available software for data analysis and simulations, enhance awareness and effective utilization of ETRR-2 NR/T technique by culture heritages activities. The expected results are promising and verify technology transfer and data analysis between ETRR-2 and international facilities, more training, more experiences and more education is extremely added and is the main future challenge, also, in the near future, development of computer software is planned towards imaging processing and elemental analysis.

The employed software is summarized in the following table:

Software	Functions
Camware software	For camera control, image acquisition and archiving of images in various file formats (PCO2000),
ImageJ	- Display, edit, analyze, process, save, and print 8-bit color and grayscale, - Can read images with many different formatting,
LabVIEW	For data acquisition and motion control.
Octopus	- Image processing, 3D viewer, reconstruction and image analysis program, - Can read images with different formatting,
VGStudioMax	- 3D Image processing, - Animation capability, - Data analysis and measurement, - Support interactive analysis of three dimensional/volumetric data to characterize a volume element, - Visualization of interior structure with high-quality detail representations are applicable.

Main objective	Sub objectives	Year 1				Year 2				Year 3			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Database	Get information		X	X									
	Compile info			X	X								
	Send info				X	X							
Rosseta National Museum	Planning				X	X	X						
Islamic Museum in Cairo	Round Robin				X	X	X	X					
Copts Museum in Cairo	Results								X	X	X		
	Report									X	X	X	X