

# Neutron tomography at ETRR -2

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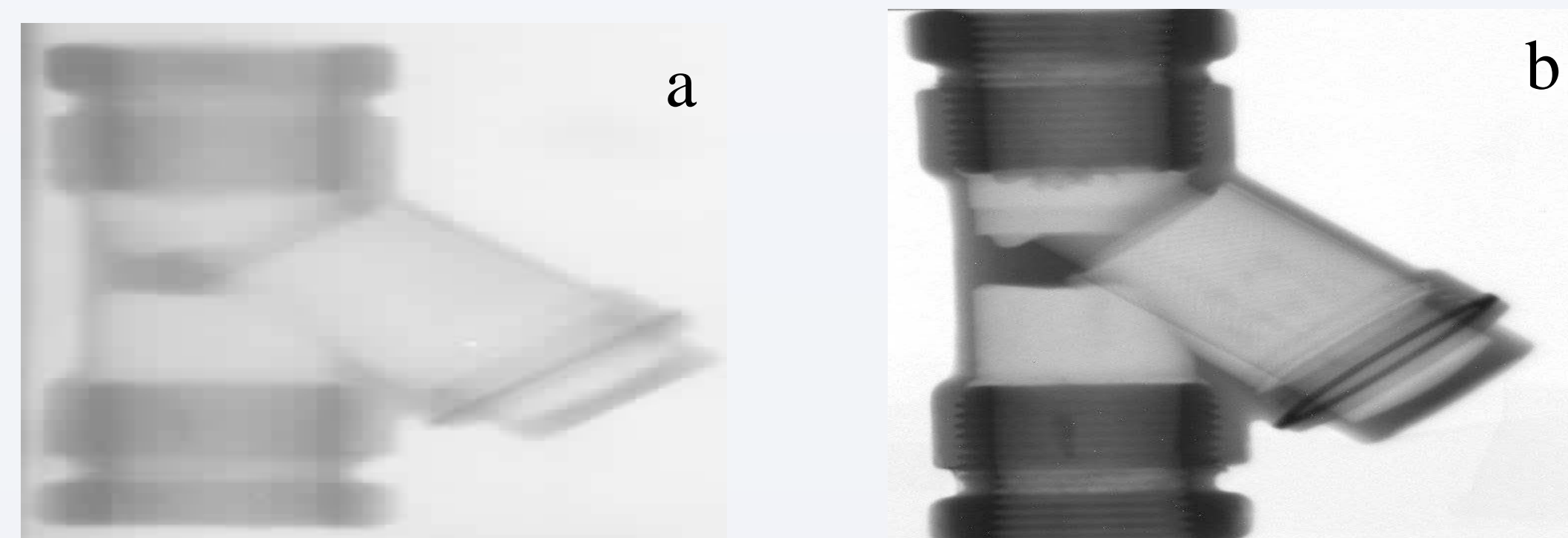
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## Abstract :

- ETRR-2 is an open pool-type reactor with variable core arrangement , the reactor power is 22 MWth cooled and moderated by light water with beryllium reflectors.
- The neutron radiography facility has been built with static based film In 1998 and upgraded into dynamic system neutron radiography / tomography using Scintillation screens and a CCD-camera , under TCP number ( EGY/4/048 06 02 ) with IAEA. instrument was commissioned in January 2013 .
- A NR / T facility installed at radial beam channels of ETRR-2 comprises the following subsystems

## Examples of Neutron Radiography



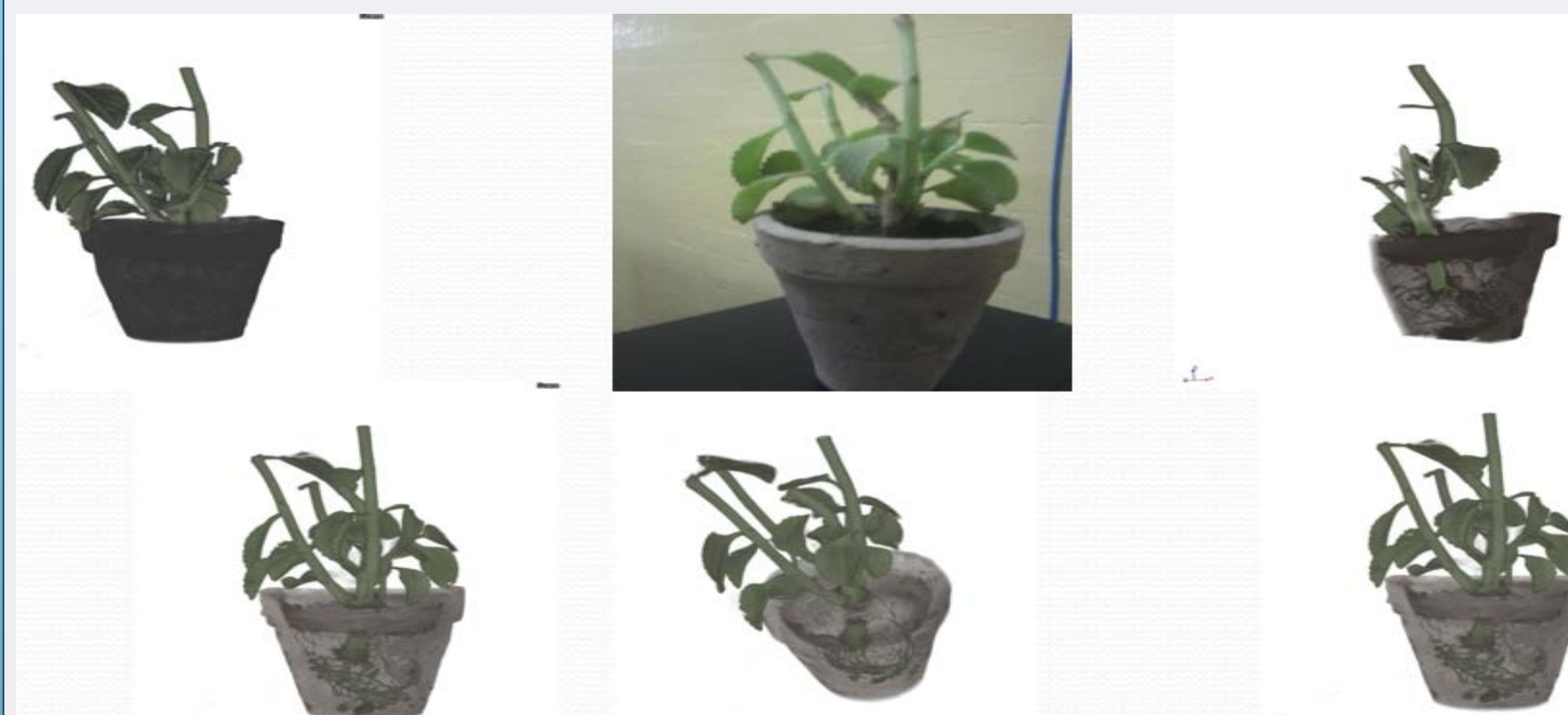
Neutron radiography of Y-Filter. a) by using Nitrocellulose film b) by using CCD camera . The high resolution and high dynamic range help to resolve the mesh grid (filter)by using CCD camera (b).

## Examples of Neutron Tomography

Copy of culture heritage article from Peru manufactured and provided by IAEA,



Plant-Soil of Thymus serpyllum

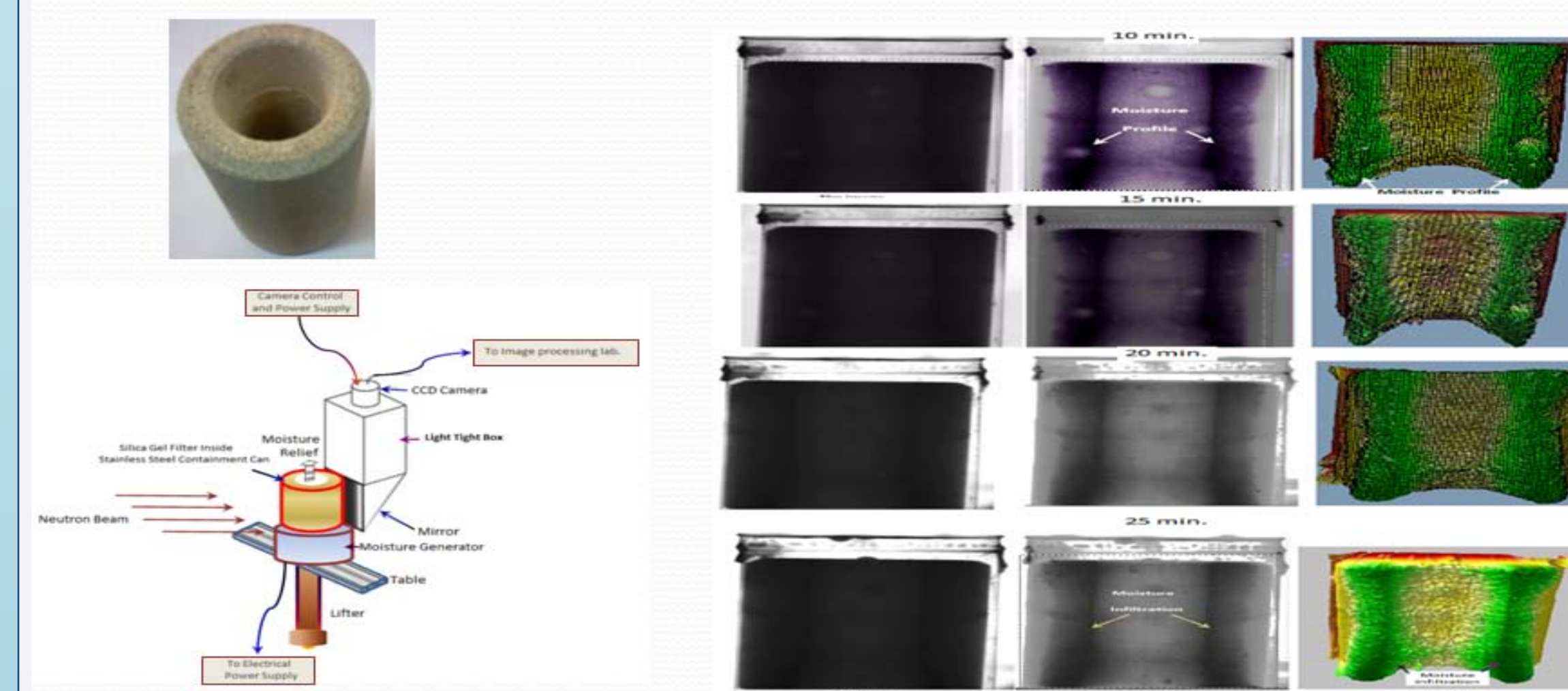


Quality Control



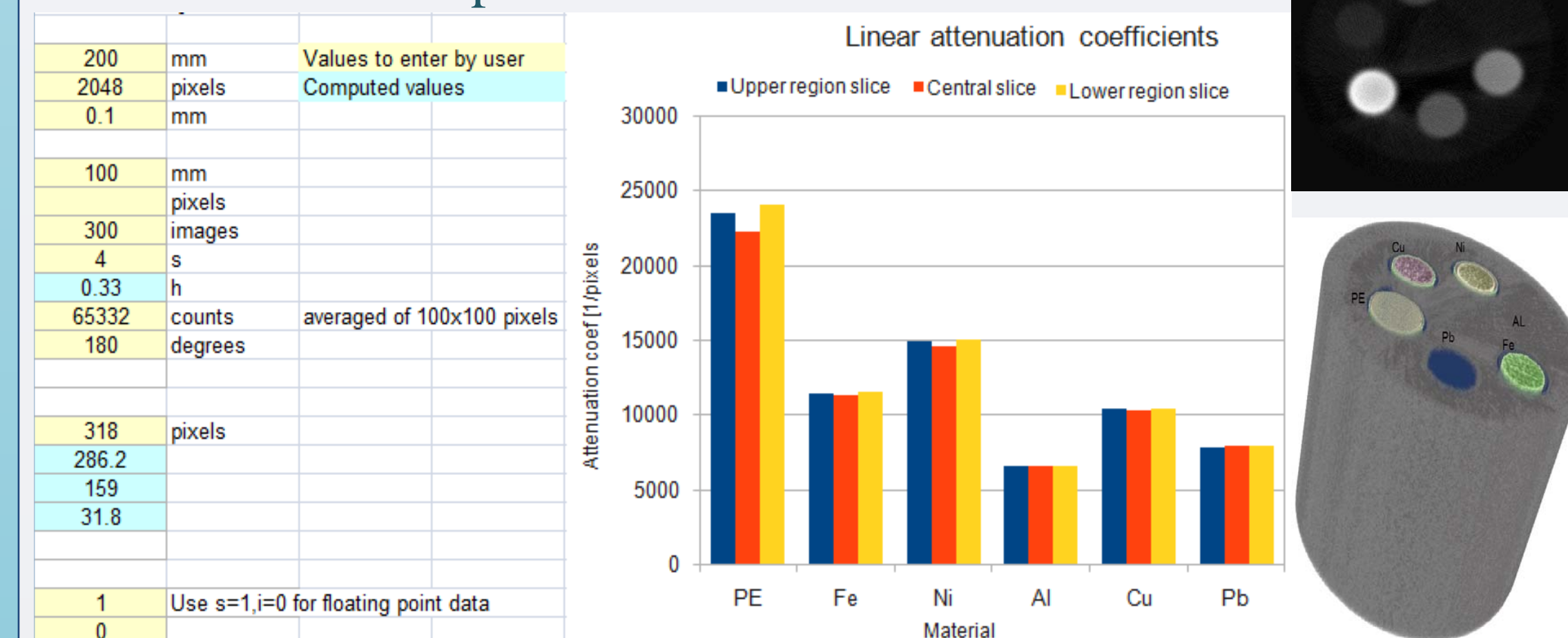
## Dynamic Radiographic images.

Study the diffusion mechanism of moisture in silica gel filter

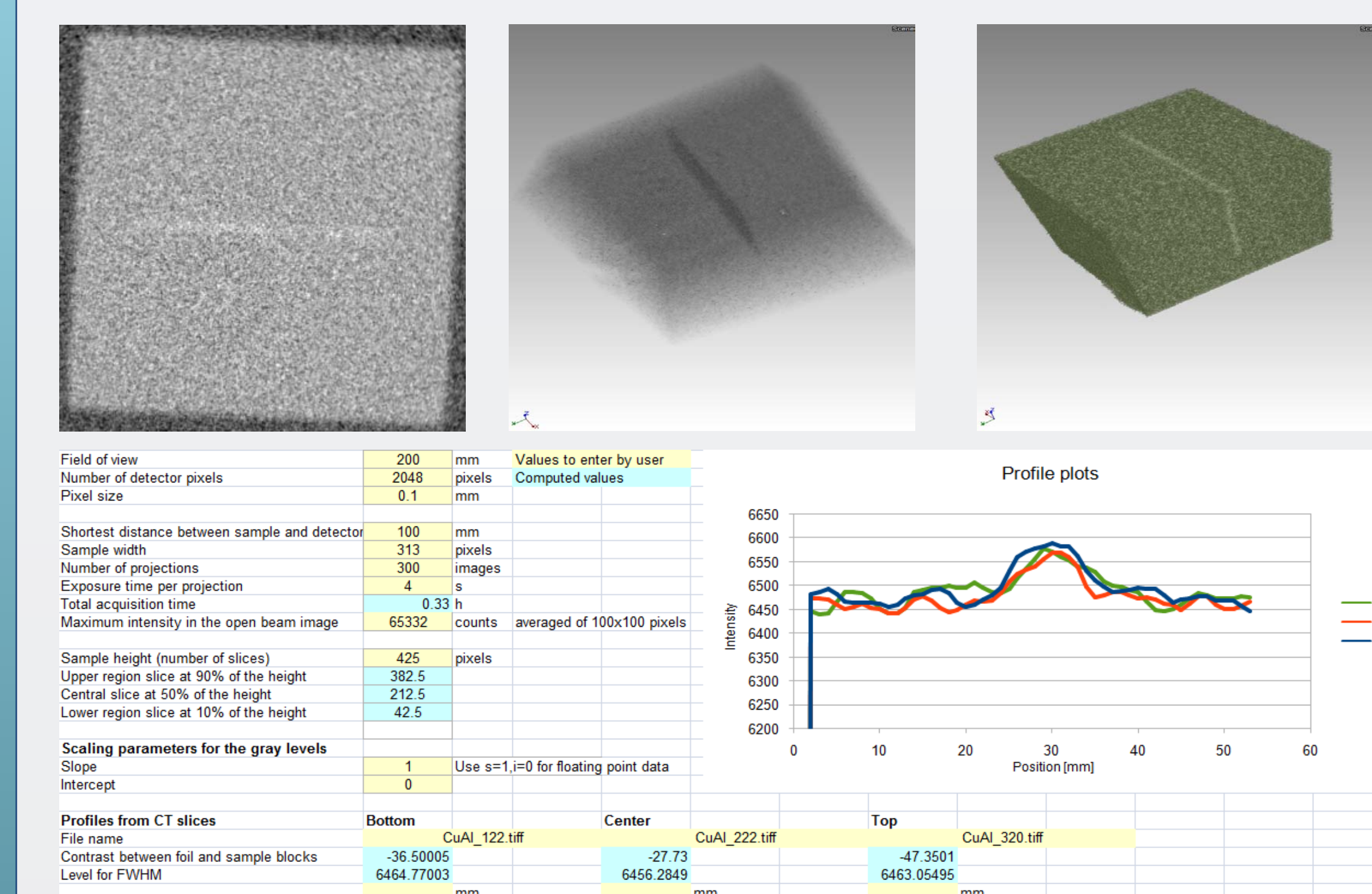


## Quality assurance samples for nCT

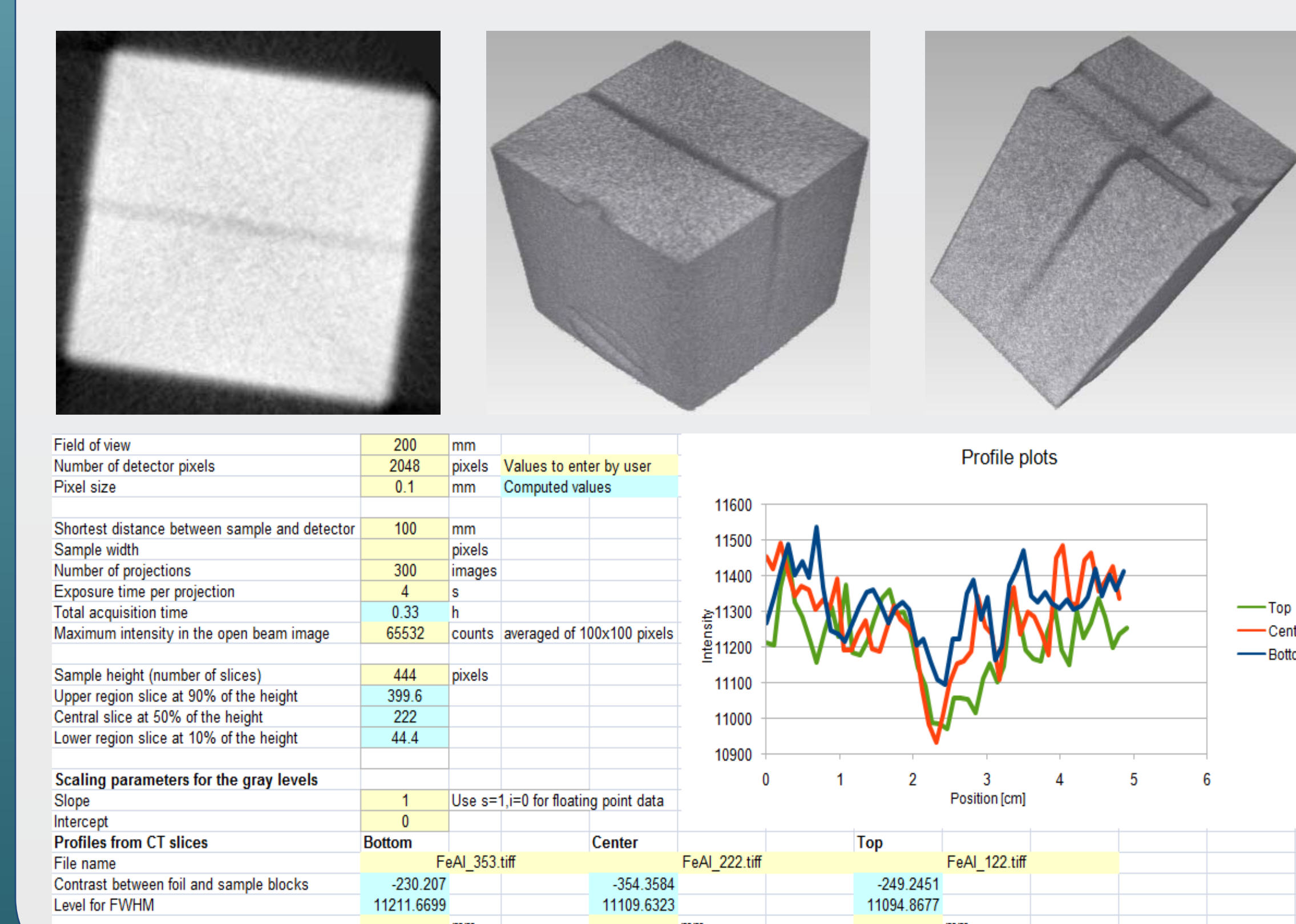
### The contrast sample



### The Al -Cu ( 20 μm ) resolution sample



### The Fe-Al ( 20 μm ) resolution sample



## Main characteristics of NR/T at ETRR-2

Dose rate intensity at beam outlet	3.3 Sv/hr at 13.3 Mwth
Thermal neutron flux at nominal power (22 MW)	$8.6 \times 10^7$ n/cm <sup>2</sup> . sec
Fast neutron flux is at nominal power (22 MW)	$1.6 \times 10^7$ n/cm <sup>2</sup> . sec
n/γ ratio	$0.132 \times 10^6$ n.cm <sup>-2</sup> .mR <sup>-1</sup>
Cd ratio	10
L/D ratio	117
Facility resolution	188 μm (Agfa Stucturix D7).

## Detector Components

1. Al-Box: light tight -box,



2. Scintillation screens (ZnS (Ag)-6LiF) ,

3. Mirror: 2 mm thick glass plate coated with Al and TiO2 ,

4. Pco.2000 CCD camera system :

Active pixels	: 2048 x 2048
Pixel size	: 7.4 x 7.4 μm <sup>2</sup>
Quantum efficiency	: up to 55%,
Digitalization	: 14 Bit
Lenses	: Nikon NOKT