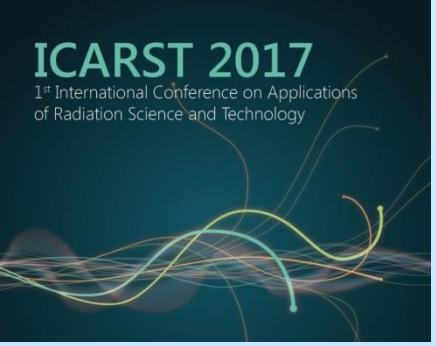


IAEA 60 Years
Atoms for Peace and Development

Using X-ray to detect hidden images on priming canvases

Artemiev B., Artemyev I.

Moscow, Russia

Improving the technology of radiation: enhancing the stability of the sources, the possibility of fine adjustment of the anode voltage, emission control range and high sensitivity and stability of detectors allow the use of this equipment for the detection of latent images on the canvases (paintings).

Experience in the use and methods of application of this equipment to solve the problem of detection of illegal movement of works of art. Emerging issues and their solutions.

The beginning

The founder of the use of NDT methods for the analysis works of art in Russia is the painter Igory Grabary, who in 1919 expressed interest in developing methods for studying works of art by means of ionizing radiation. The first in the USSR laboratory for physical and chemical research of art monuments was opened in 1925 year.

NDT methods using electromagnetic radiation

Optical: Binocular and Polarization Microscopy. Microstructures Research in the infrared and ultraviolet spectrum. Investigation of the binder and organic pigments by IR spectroscopy the most important method for identifying the preparatory drawing (pencil, coal, pen or carpal). With the help of infrared photography, it becomes possible to decipher the half-eroded inscriptions on the stretcher or the back of the base.


Microscope MBS-10


Fluke

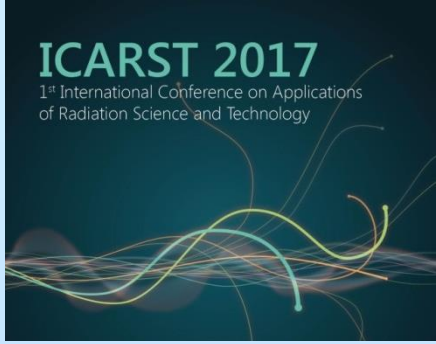

POLAM L-213M


Tensor

NDT methods using electromagnetic radiation

Kustodiev Fair

IONIZING RADIATION



- Radiography,
- X-ray diffraction,
- Small-angle X-ray scattering,
- X-ray microtomography,
- X-ray fluorescence spectrometry,
- Micro RF spectrometry and RF spectrometry at the angles of total reflection,
- Energy dispersive X-ray spectroscopy,
- Optical emission spectrometry,
- CS / ONH - Carbon / sulfur analysis.

- . . . .

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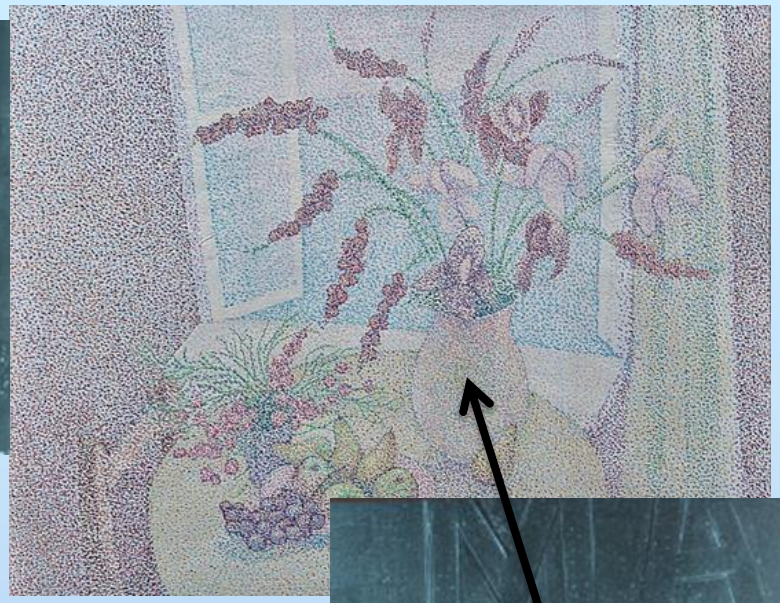

Radiography

Obtaining images by layer-contact radiography

The Kanevskay Mother of God. Two-sided remote icon of the XVI century. With the image of the Savior on the back. Ordinary photos of the sides and layer-contact radiographs. During the survey, the X-ray film is in contact with the surface under investigation, and the X-ray tube is moved. We obtain the image of a layer in contact with which was an x-ray film; The opposite side is smeared.

Photoelectronography method for the study of the ink layer

Shota Rustaveli. Medieval miniature on paper. A conventional photograph and a photoelectronogram, which revealed details of the image.

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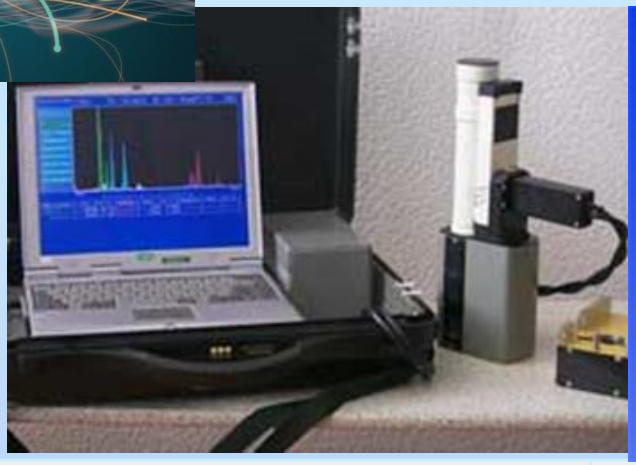
Портативные рентгеновские аппараты



	Единица	Модуль-50	XC-15	XC-50	XC-70
Напряжение на рентгеновской трубке	кВ	20 - 50	3 - 15	10 - 50	30 - 70
Ток анода	мА	0,02 - 0,5	0,05 - 1,5	0,01 - 0,2	0,01 - 0,2
Фокусное пятно	мм	0,6 - 2,0	до 3	до 4	до 4
Материал анода		W, Ag, Ge, Cu, Mo, Ti, Au			
Тип рентгеновской трубки: прострельная /с боковым выходом		+ / -	+ / +	+ / +	+ / -
Допустимая мощность на аноде	Вт	10	4,5	7	7
Потребляемая мощность, не более	Вт				
- в режиме излучения		30	15	18	18
- в режиме ожидания		1	1	1 - 7	1 - 7
Время выхода на рабочий режим	с	5	5	3	3
Напряжение питания (постоянное)	В	9,6 - 15	12	12	12
Масса	кг	1,2	0,45	0,55	0,65
Габаритные размеры	мм	298x52x67	170x48x42	250x48x42	300x48x42
Индикация		излучение / готовность / блокировка			

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X-ray fluorescence spectrometry

X-ray fluorescence analysis (XRF) is one of the most demanded analytical methods of elemental analysis. Regardless of the type of sample, whether liquids, powders or solid samples are measured, XRF combines high accuracy with simple and quick sample preparation. X-ray fluorescence spectrometers allow measuring the entire elemental range from beryllium (Be) to uranium (U) in concentrations from ppm to 100%.

X-MET 7500 OXFORD INSTRUMENTS

СПЕКТРОСКАН МАКС

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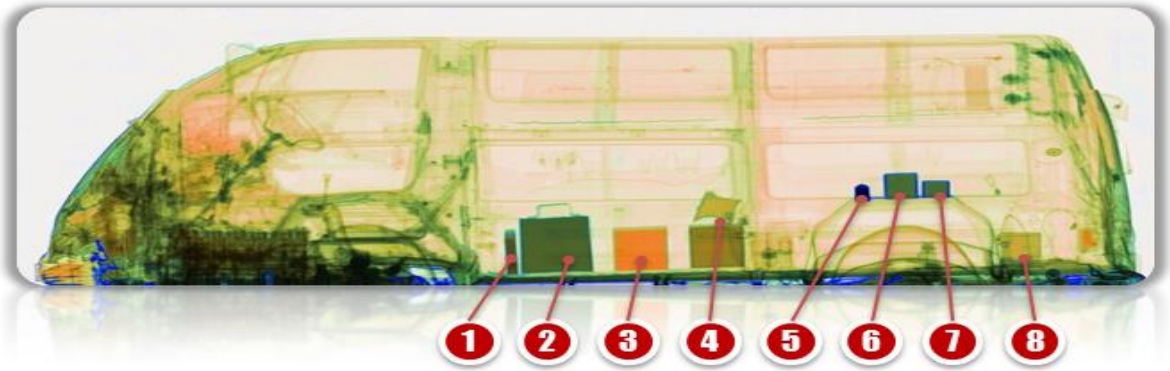
The problem of illegal circulation of works of art

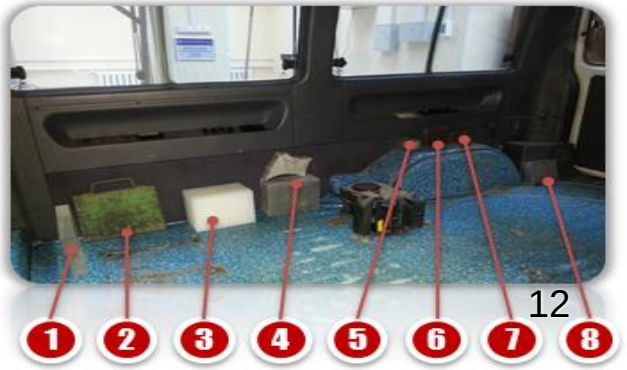
Шток+ядро

«Igla-150»

Kalan-2M



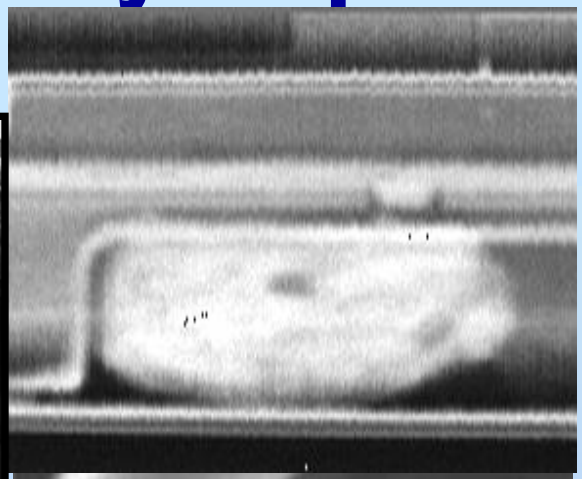
1. Glass Block
2. Steel Block
3. Polythene Block
4. Aluminum Block
5. Lead Brick
6. Steel Plate
7. Steel Brick
8. Aluminum Plate

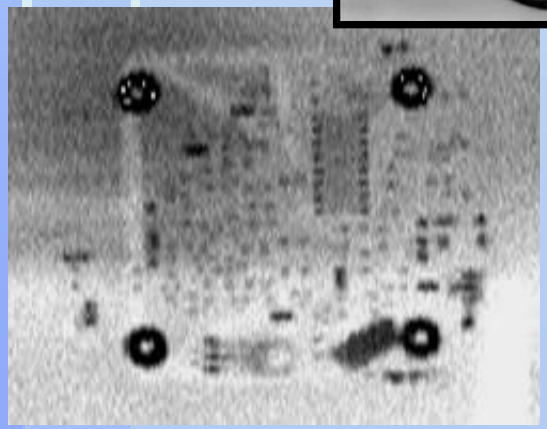


Portal-Auto and Portal-Beta

Inspection and inspection complexes are designed for inspection of trucks and cars, vans and various types of containers with the purpose of detecting prohibited investments (smuggling, weapons, explosive devices, means of secretly extracting information, etc.) without their opening.

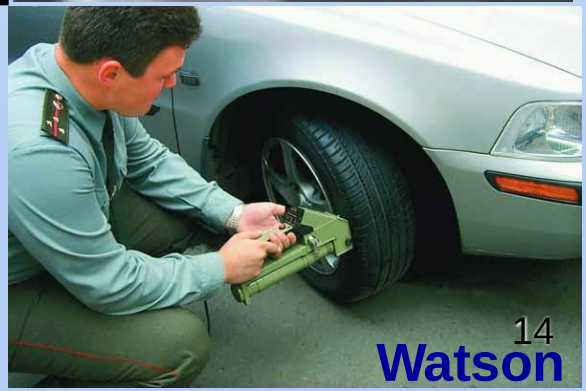
Backscattered radiation. The results of the application of the x-ray complex "Watson-TV“





Folded fabric simulator
Behind the bumper of
the car and in the tire

Electronic board in car door



Watson

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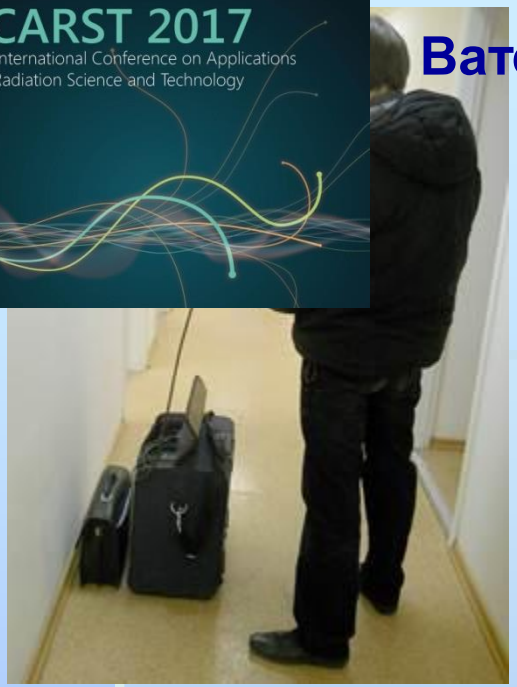
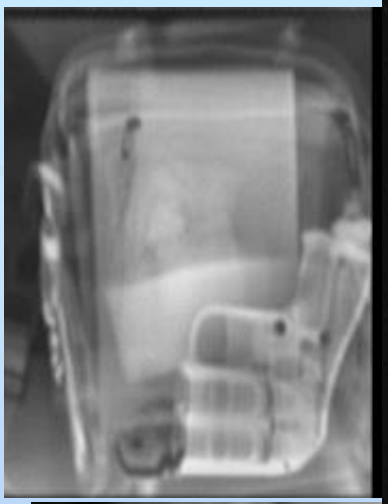
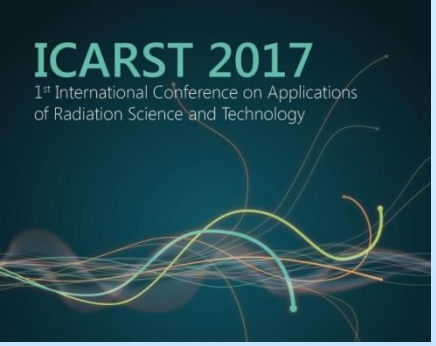
Personal control

Ватсон-2





- Рубеж ПЧ



Conclusions

Even with the use of algorithms for vector analysis of images obtained by the method of shadow radiography and the presence of reference images in the image library, identification errors of both the first and second kinds are possible, i.e. Omission or false detection.

- It is necessary to expand image libraries and organize international public databases on a fee basis.
- Radiation methods of research of paintings can provide useful information for art historians, but the problem is not completely solved and it is necessary to develop control techniques and create new equipment especially in such promising areas as planar tomography, backscattered radiation and neutron radiography.

Thank you for attention!