



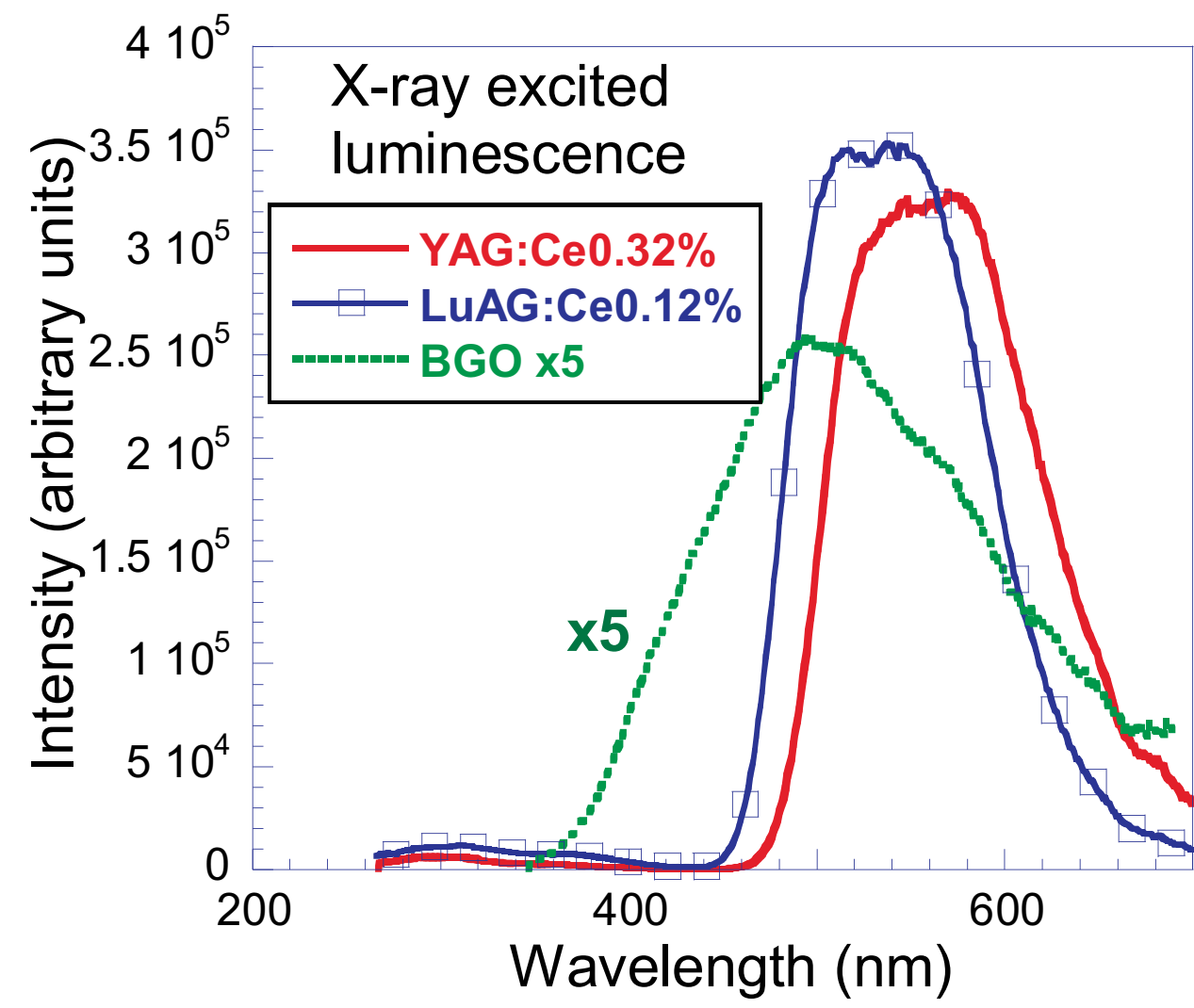
High Resolution Thin Scintillator Imaging Plates Used for X-Rays NDT Applications

J. Tous, P. Horodysky, K. Blazek / Crytur Ltd., Turnov, Czech Republic

M. Nikl, J.A. Mares / Academy of Sciences of the Czech Republic, Institute of Physics, Prague, Czech Republic

Recently, very thin scintillator imaging plates became of great interest. In high resolution X-rays microradiography, very thin scintillator layers of about 5-20 micrometers are used to achieve spatial resolution around one micrometer. Such thin screens are mainly used in micro-CT and nano-CT systems with either micro-focus X-ray tubes or with synchrotron sources.

Single Crystal Scintillation Materials and Imaging Screens



YAG:Ce ($Y_3Al_5O_{12}$) Yttrium Aluminum Garnet
LuAG:Ce ($Lu_3Al_5O_{12}$) Lutetium Aluminum Garnet
 Czochralski Grown Single Crystals
 Screen Thickness Down to Several Micrometers



High-Quality YAG:Ce Single Crystal



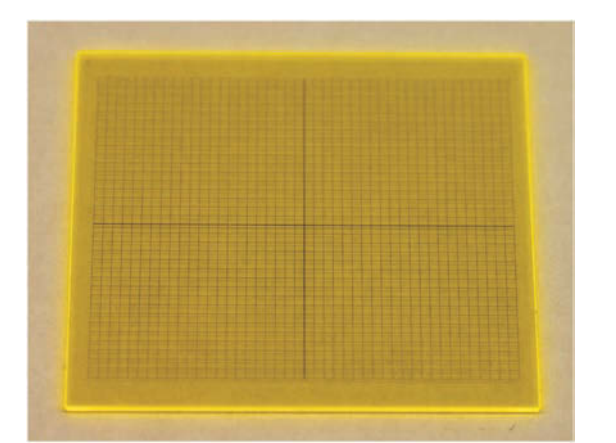
5 μ m Thin YAG:Ce Screen



Thin YAG:Ce Screen on FOP



Thin YAG:Ce Screen on Alumina Frame



LuAG:Ce Screen with a Grid

Yttrium aluminum garnet activated by cerium is a fast scintillator with excellent mechanical and chemical resistance. YAG:Ce scintillation detectors are the preferred choice for electron microscopy, beta and X-ray counting, as well as for electron and X-ray imaging screens.

Lutetium aluminum garnet activated by cerium or europium is a scintillator with a high absorption to X-ray radiation and excellent mechanical and chemical resistance. LuAG:Ce scintillation detectors are the preferred choice for X-ray radiography imaging screens.

High Spatial Resolution Imaging System



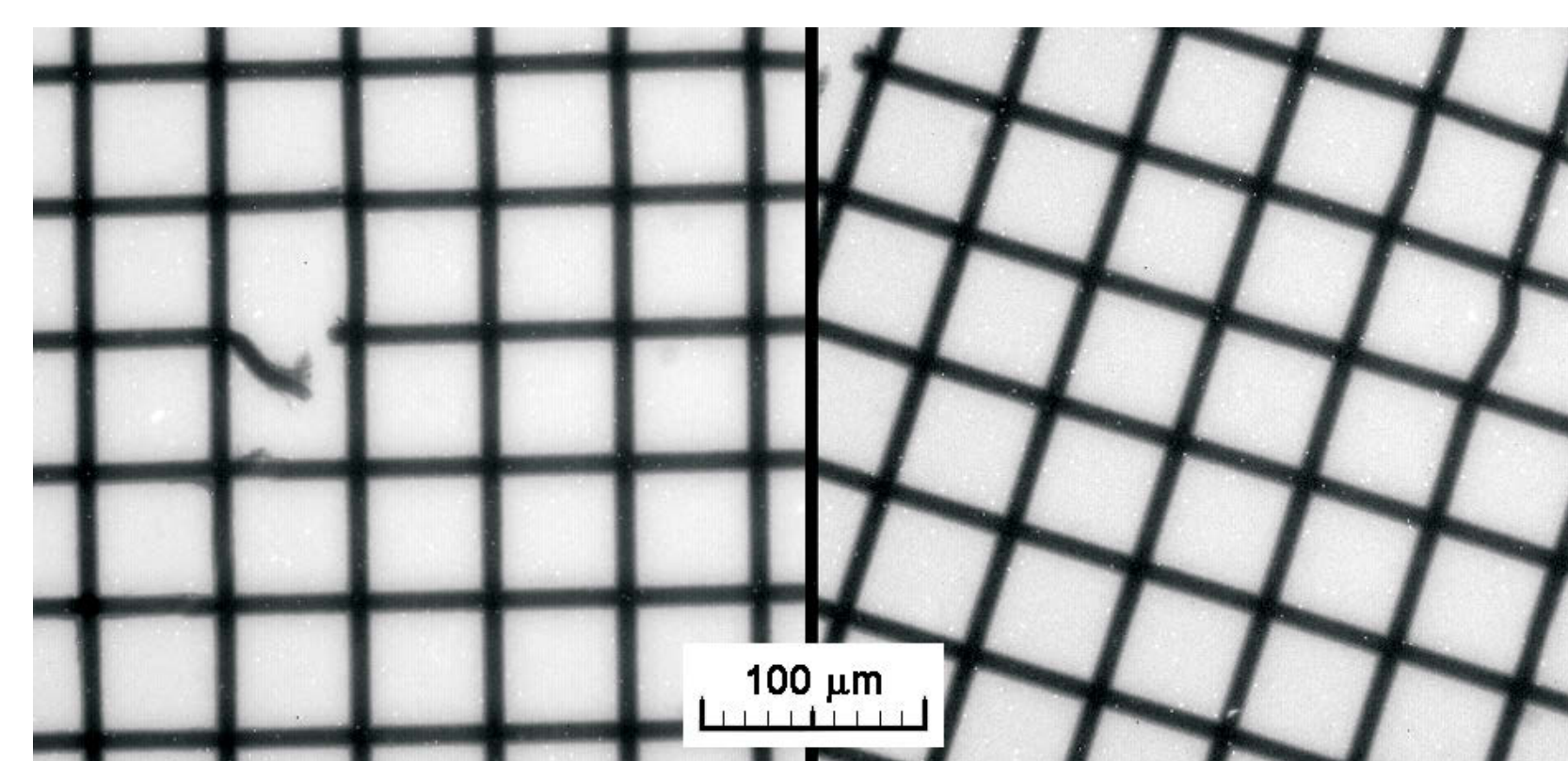
High-Resolution X-Rays Imaging Digital Camera

High resolution imaging system is a combination of a high sensitive digital CCD camera and an optical system with a thin scintillator imaging screen.

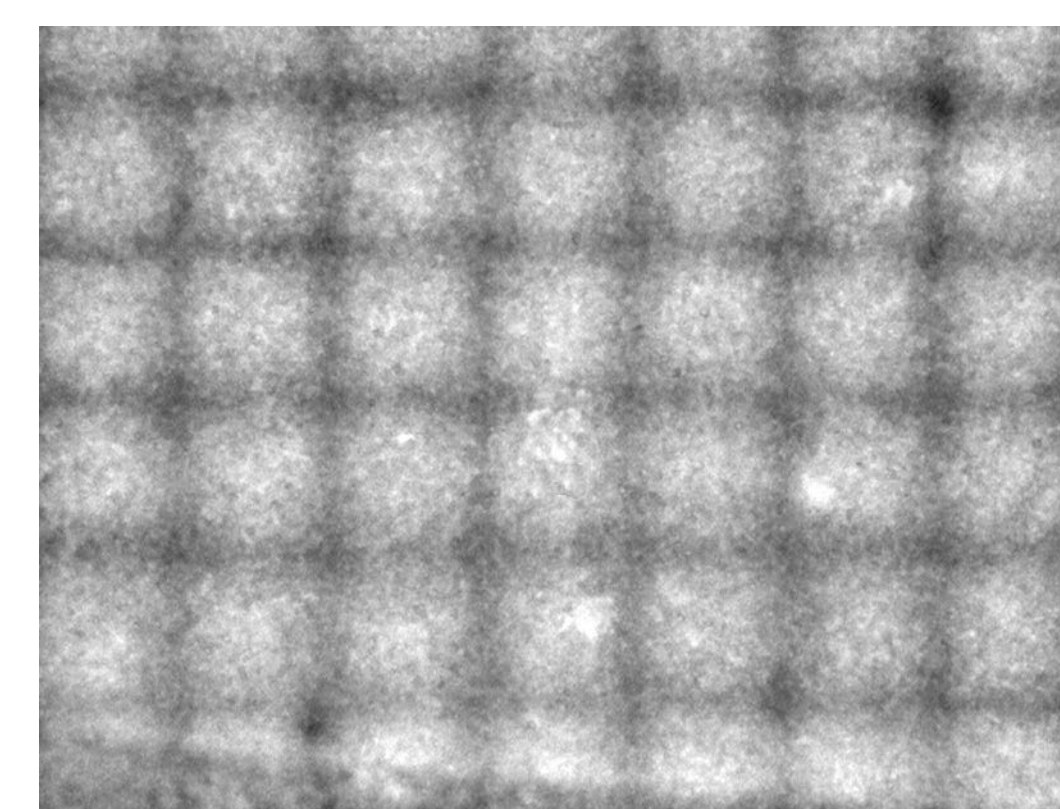
Very thin (down to 5 microns) screens of YAG:Ce were developed for imaging applications requiring high spatial resolution. The 2D-spatial resolution of an X-ray or other ionizing radiation imaging systems is one of the critical parameters in non-destructive micro-radiography and radiation beam inspection.

The X-ray CCD camera was tested either with several small biological objects (insect or small animals) or with special grids. The 2D-spatial resolution achieved in the images was about 1 micrometer.

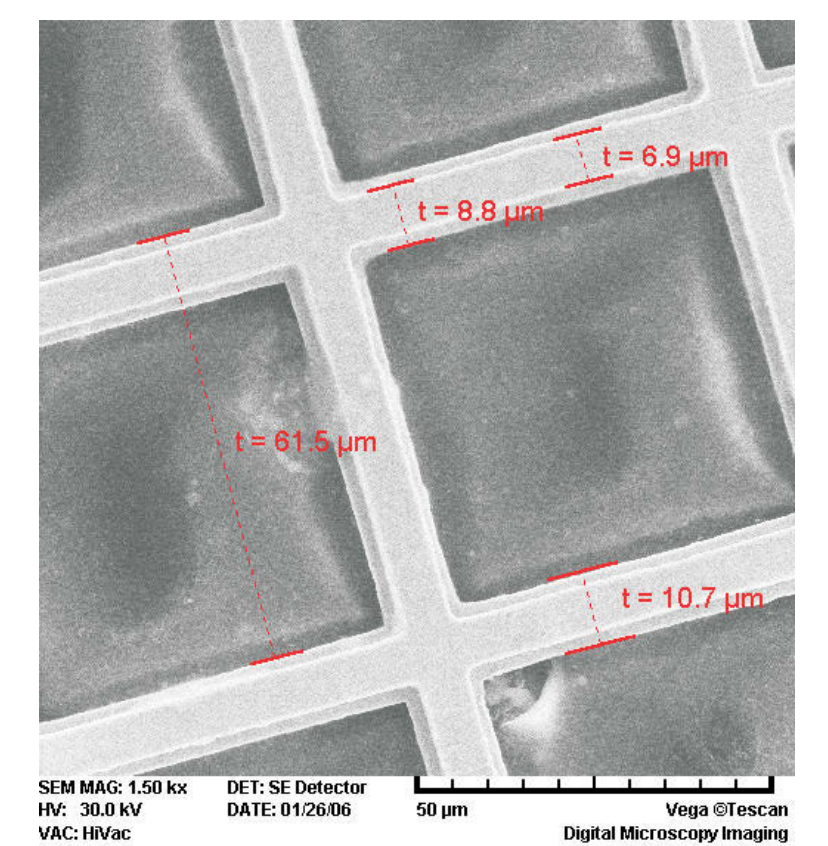
The images were taken using a microfocus X-ray tube with Cu anode @ 40kV/2mA



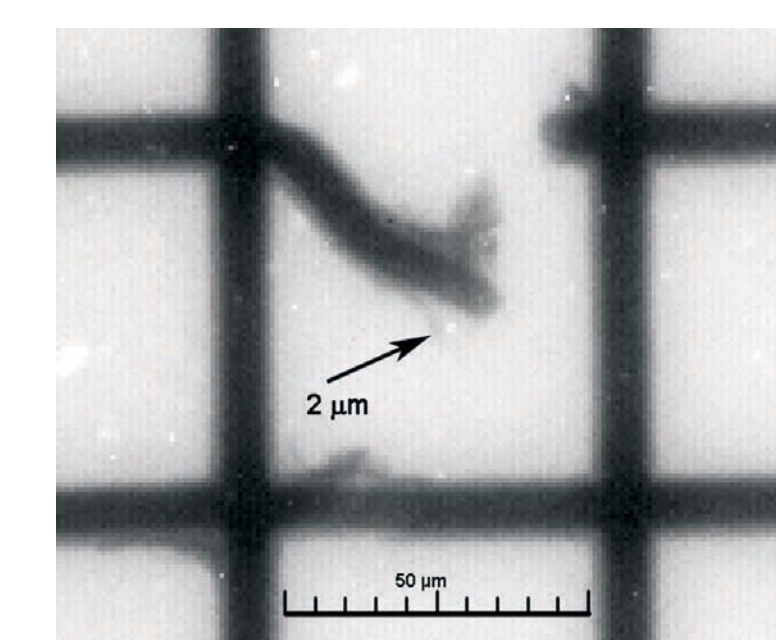
Radiographies of the 8-Microns Grid Imaged by LuAG:Ce (left) and YAG:Ce (right) Thin Plates



The Grid Imaged by P43 Powder Scintillator



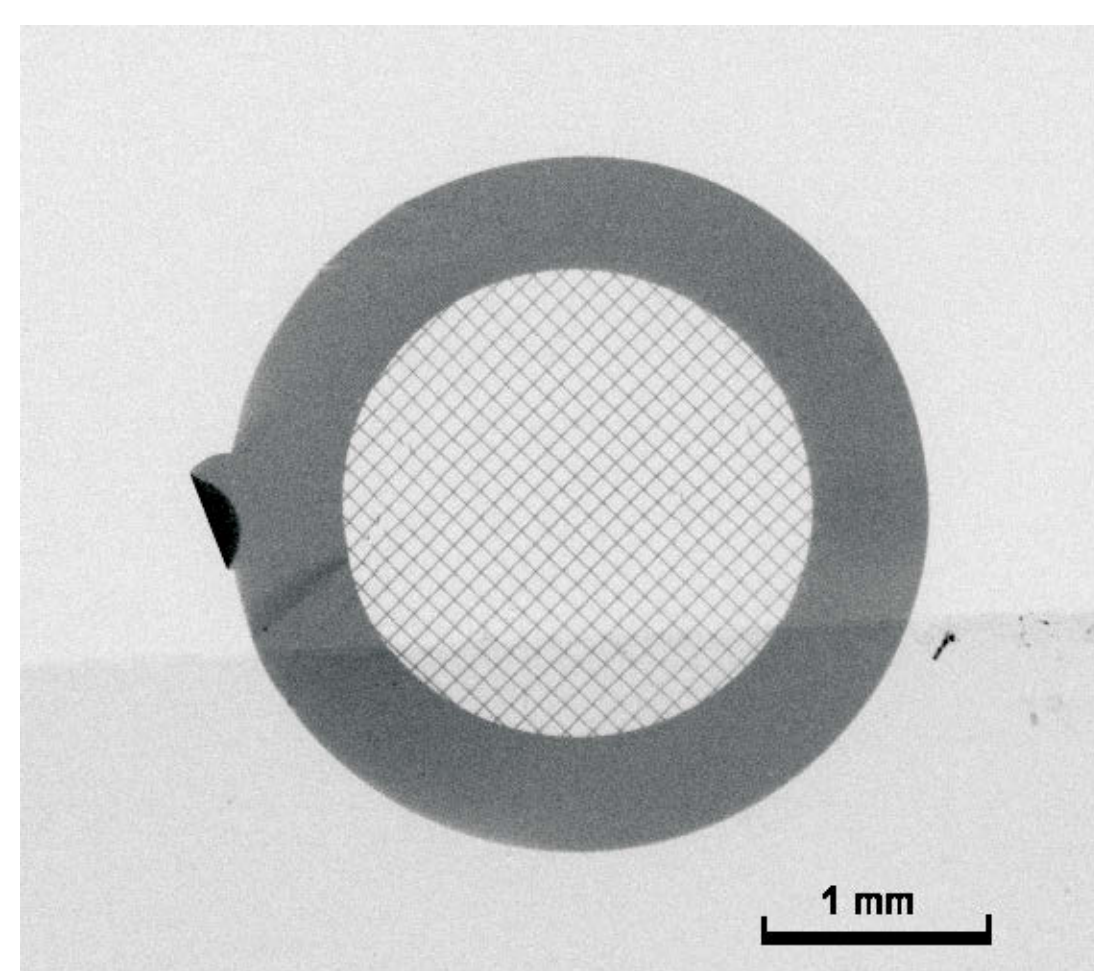
SEM Image of the Test Grid



Detail of the Broken Wire

The high resolution of the system with YAG:Ce thin screen is compared to a standard P43 phosphor screen using the same conditions. The objects is a gold grid with the wires 8 microns wide. The images were taken by using the 20 micrometers thick YAG:Ce imaging screen or 20 microns thick phosphor P43 (GADOX), both on quartz glass.

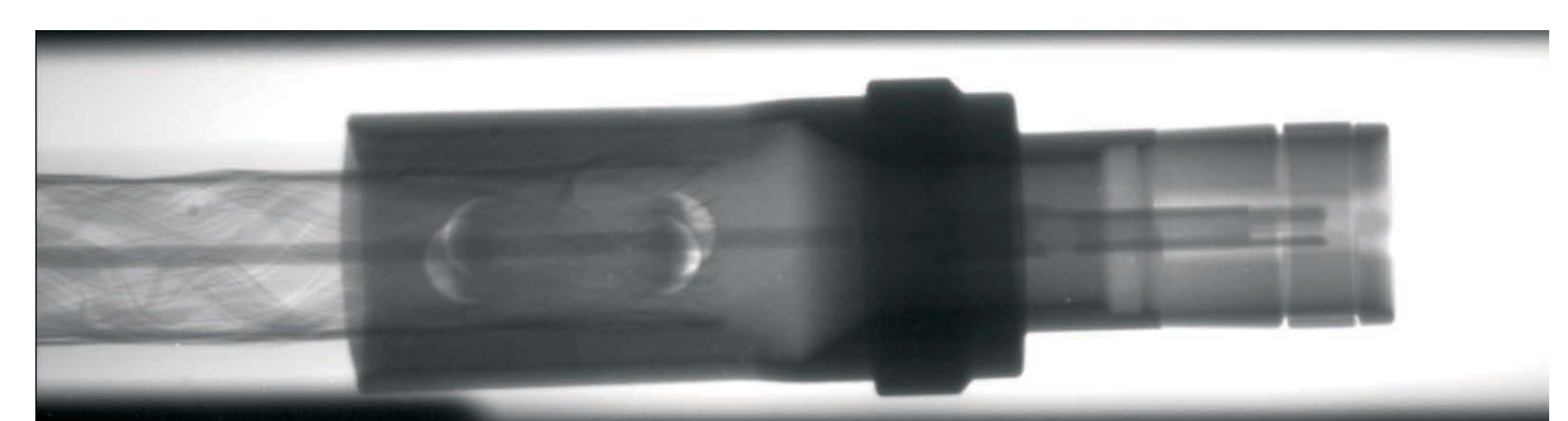
High Resolution X-Rays Radiography



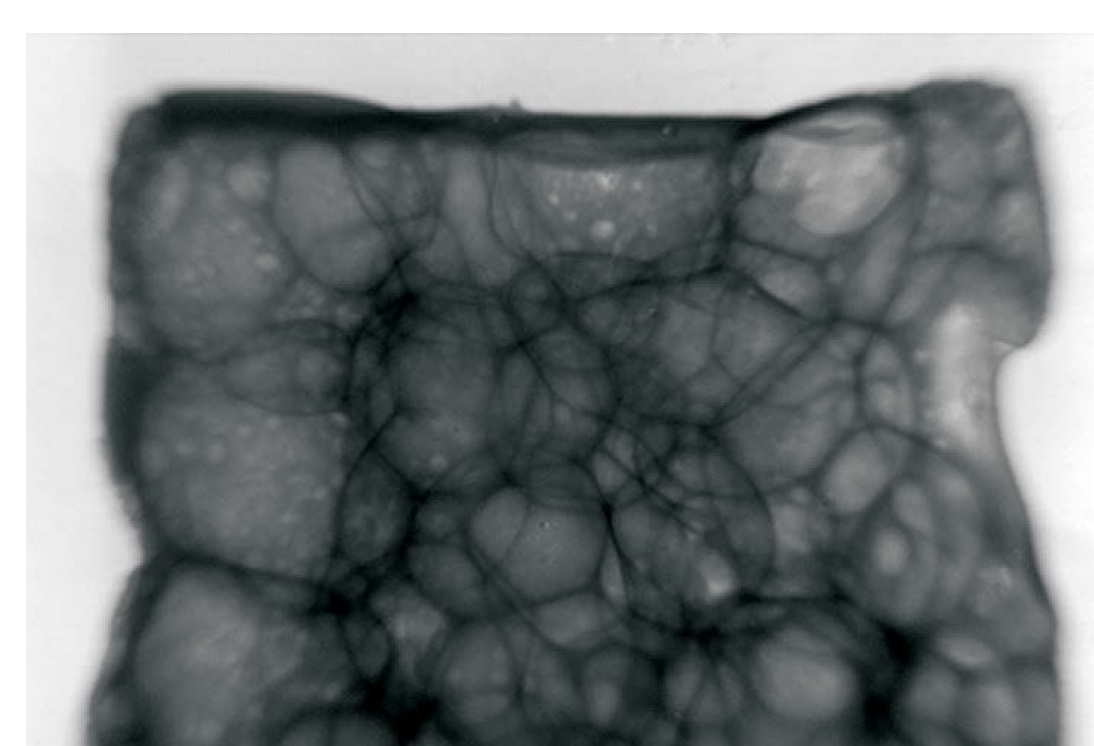
The Grid with 8 Microns Wires



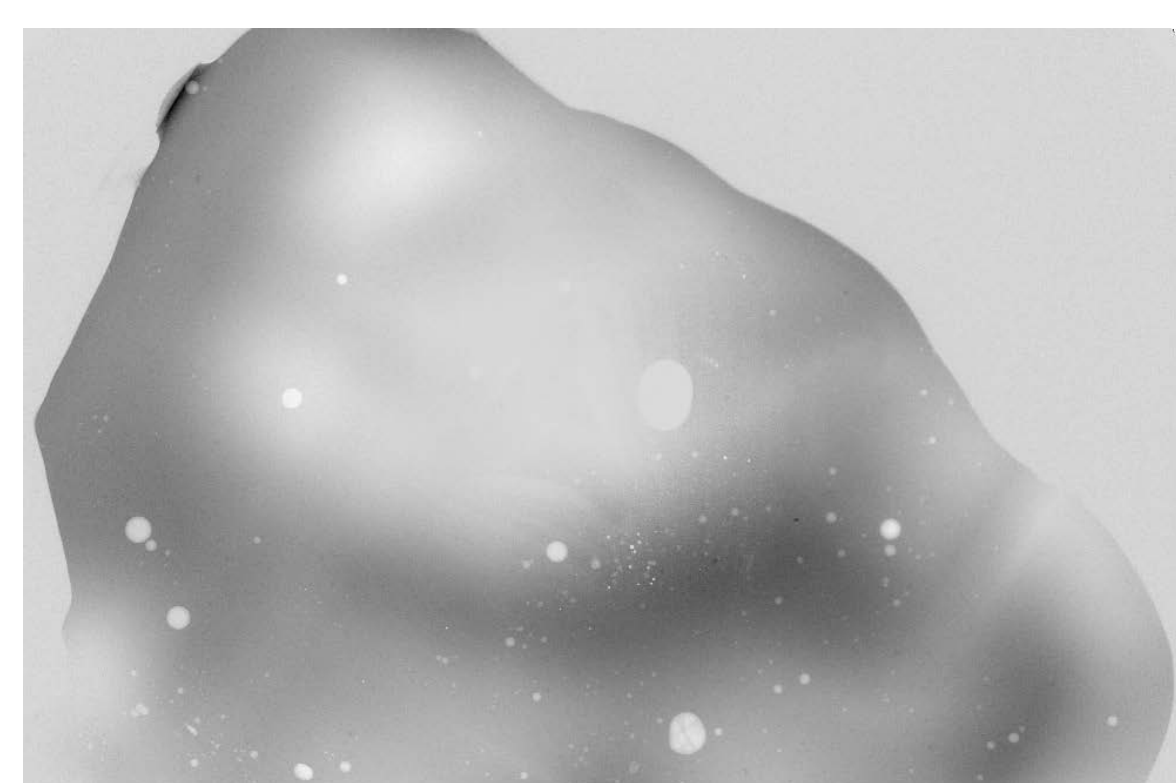
A Plastic Foam



X-Rays Inspection of Fine Wires in a Data Cable



Aluminum Foam



Air Bubbles in a Resin



X-Rays Radiography of a Spider

- Other applications:**
- X-rays spectroscopy
 - X-rays topography
 - X-rays beam adjustment
 - X-rays thin films diffraction
 - X-rays optics adjustment
 - X-rays microfocus spot measurement
 - X-rays imaging in industry
 - X-rays food inspection
 - UV, VUV beams, imaging ... and many others