



Thin Scintillator Imaging Screens

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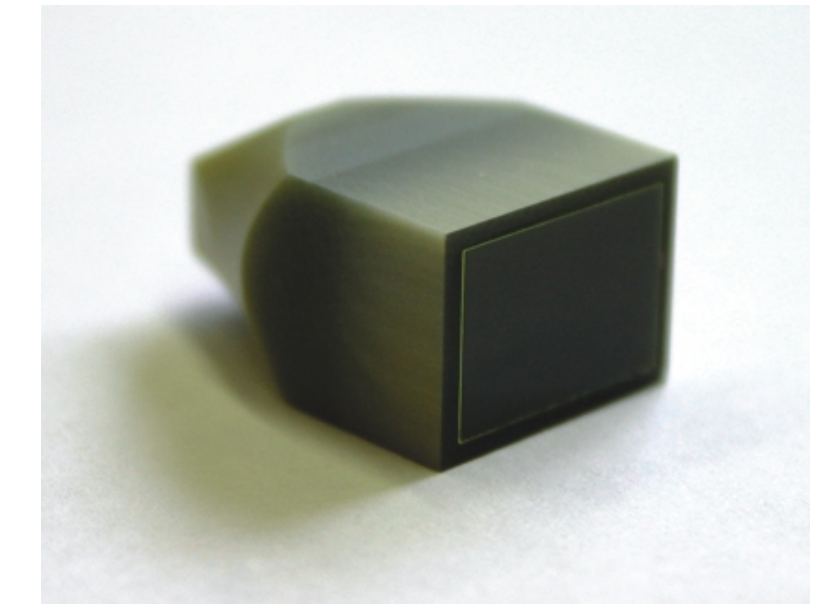
Scintillation Materials for Imaging Screens

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.

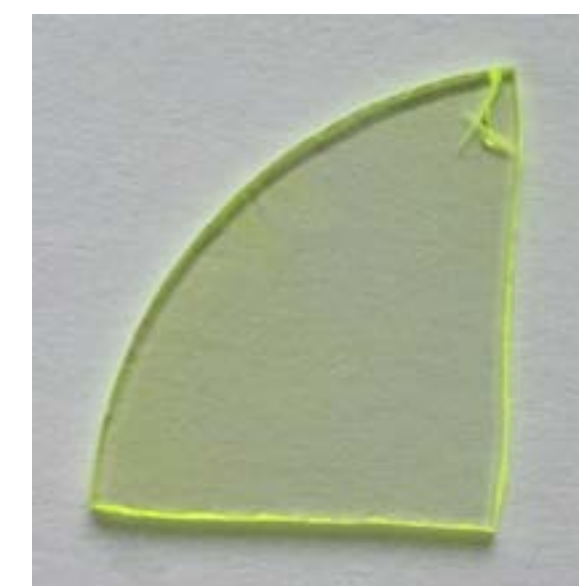
Lutetium aluminum garnet activated by cerium or europium is a scintillator with high absorption to X-ray radiation and excellent mechanical and chemical resistance. LuAG:Ce scintillation detectors are the preferred choice for X-ray radiography imaging screens.



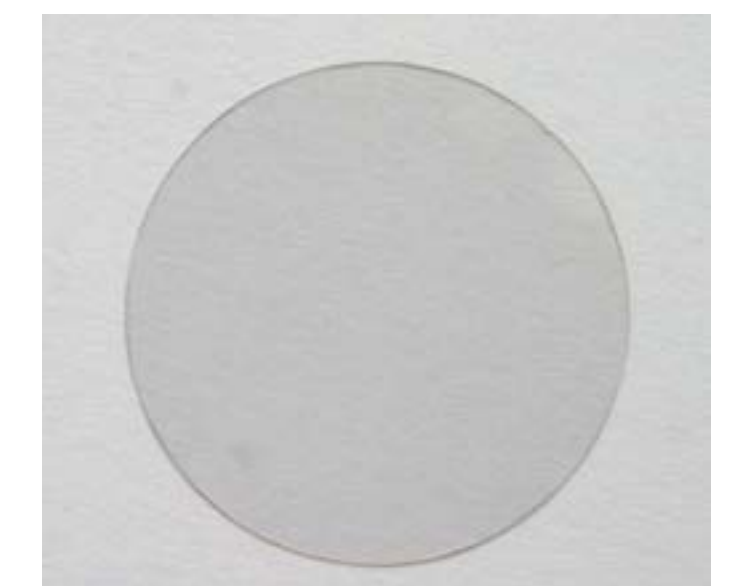
5 μm thin YAG:Ce screen



Thin YAG:Ce screen on FOP



LPE LuAG:Ce sample

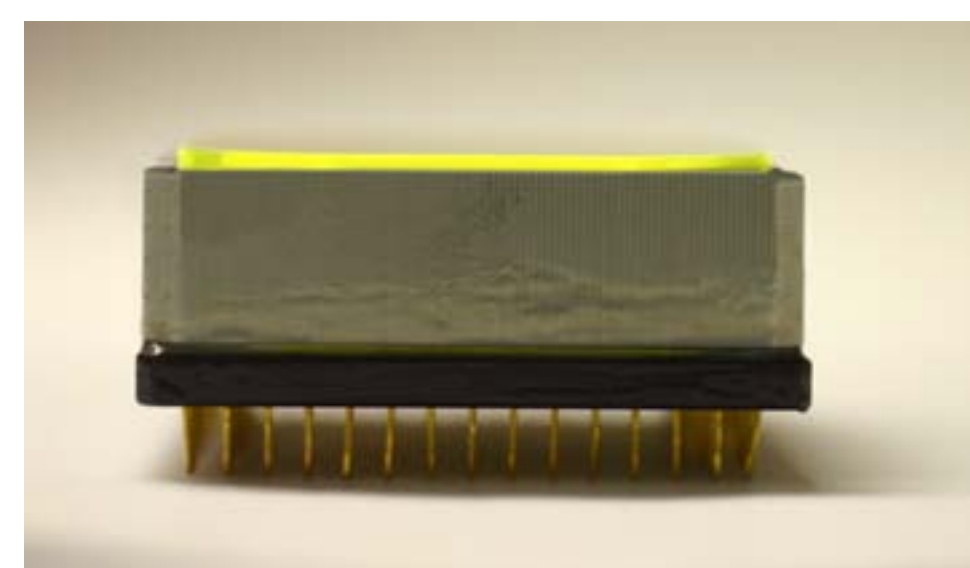


LPE LuAG:Eu screen

High Spatial Resolution Imaging Systems



High-resolution X-ray imaging digital camera



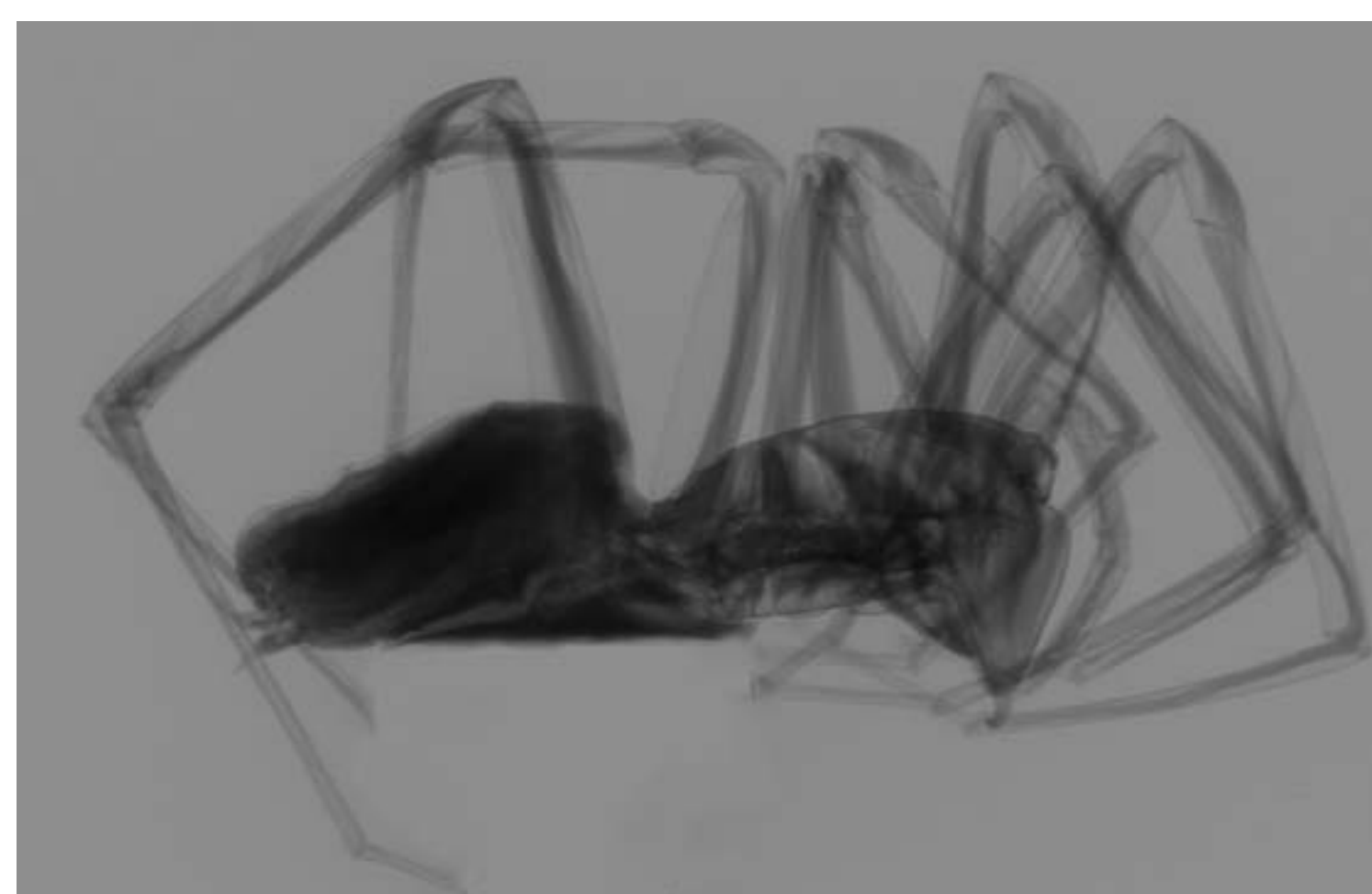
High-resolution digital camera for TEM

High resolution imaging system is a combination of a high sensitive digital CCD camera and an optical system with a thin scintillator imaging screen. The screen is the YAG:Ce ($Y_3Al_5O_{12}$) or the LuAG:Ce ($Lu_3Al_5O_{12}$) inorganic scintillator. These materials have the advantages in the mechanical and chemical stability, non-hygroscopicity, and a high radiation hardness. Very thin (down to 5 microns) screens of YAG:Ce were developed for imaging applications requiring high spatial resolution. Crytur also integrated these plates into CCD camera enabling imaging of objects in X-ray and electron beams with high resolution.

High Resolution Application in X-ray Radiography

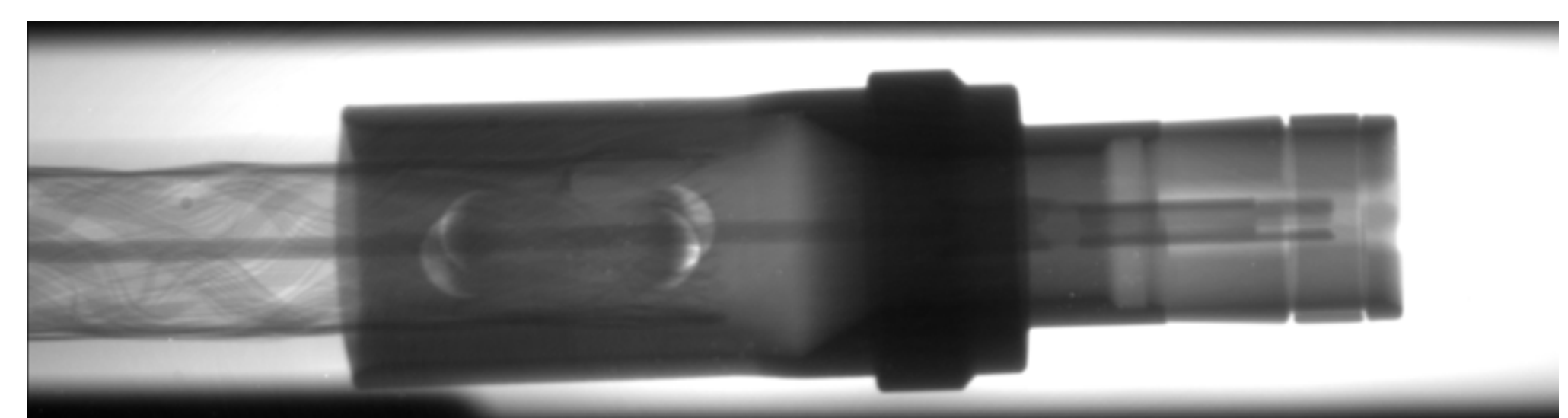
Other applications:

- X-ray spectroscopy
- X-ray topography
- X-ray beam adjustment
- X-ray thin films diffraction
- X-ray optics adjustment
- X-ray microfocus spot measurement
- X-ray imaging in industry
- X-ray food inspection
- ... and many others



X-ray radiography of a Spider

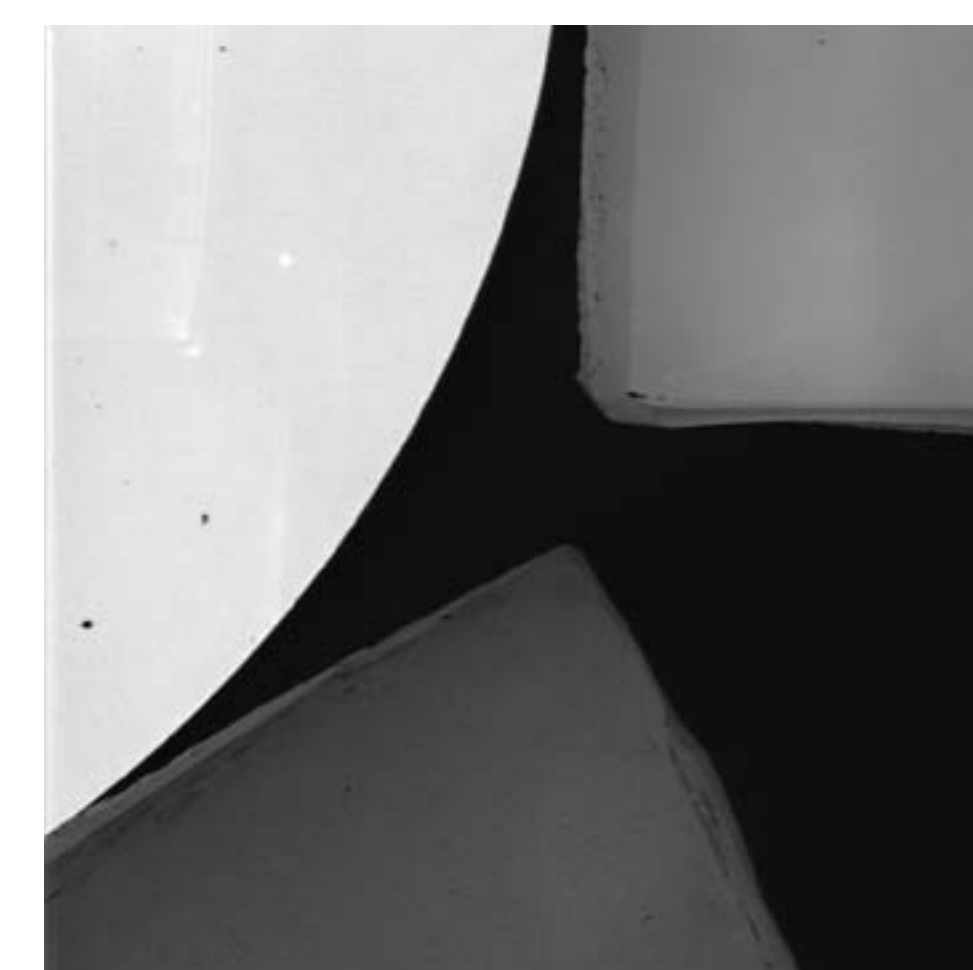
The images were taken using a microfocus X-ray tube with Cu anode @ 40kV/2mA



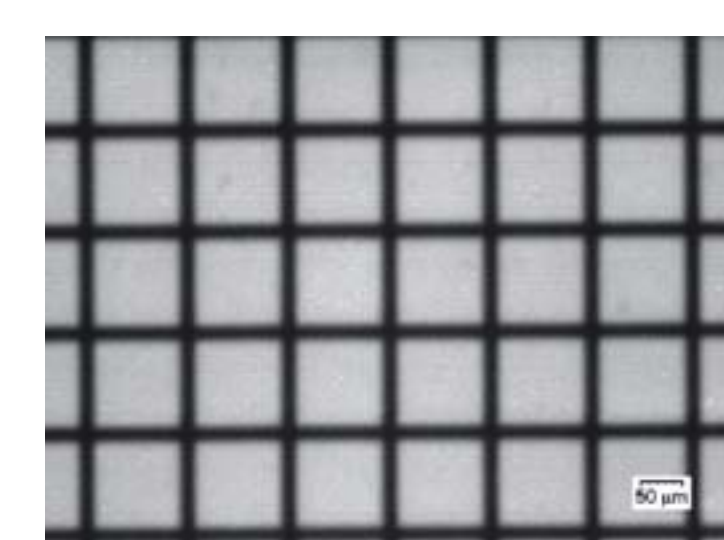
X-ray Inspection of fine wires in a data cable

Thin Screens Characterization

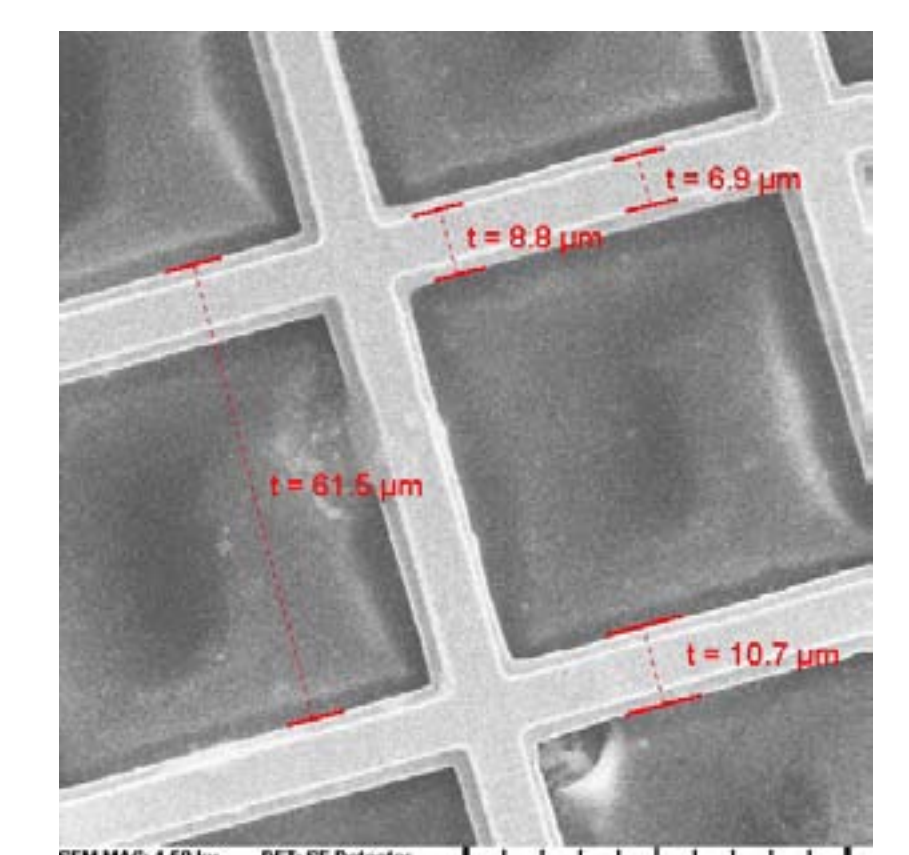
Characterization technique/property	Nuclear emitter	SEM/Cathodoluminescence	X-ray/CCD
Repeatability	Very good (1-2%)	Good	Good
Spectral sensitivity	300-600 nm, limited by bialkali cathode of PMT, more sensitive at blue/UV	300-700 nm, limited by bialkali cathode of PMT, more sensitive at blue/UV	Silicon sensitivity, very good, more sensitive at red VIS
Dynamic range	Lower limit is about 20% efficiency of standard single-crystal YAG:Ce	Good, due to large dynamic electron current and PMT voltage	Good, limited by acquisition time
Absorption depth	3 μm using ⁶⁷ Ni emitter (max. 67 keV beta)	From 20 nm to 1 μm, depending on electron beam acceleration voltage	Full depth of layer
Imaging of homogeneity	No	Limited field of view (3x3 mm ²)	Limited by CCD chip size and optical magnification (max. 36x24 mm ²)



SEM/CL image of Czochralski grown YAG:Ce and LPE LuAG:Ce



Grid imaged by Czochralski YAG:Ce thin plate



SEM image of the test grid