Scintillation Screens for Neutron Imaging

It was shown in the past years that Neutron Imaging have become powerful, competitive and promising methods for material research, many industrial applications and a tool for different branches in university related studies. One main reason for the progress is given by the development and application of dedicated digital neutron imaging devices in combination with scintillator screens as the backbone of the detector system. Using scintillations screens the exposure time has been reduced from hours to seconds and nowadays even down to micro second scale. Therefore it is obvious that the performance of the scintillator screen directly influence the performance of a NI beamline.

In collaboration with the Paul Scherrer Institut (PSI) RC Tritec developed optimised scintillator screens to guarantee the customer best possible light output combined with optimal spatial resolution.

The scintillation material is applied with a binder on an aluminium substrate. Due to the proper fixing of the scintillation material handling of the screens is very easy (mechanically stressable).

How does a scintillation screen work?

The scintillation is a two step mechanism: First a core reaction with ions of high capture cross section ($^{155/157}$Gd, ^{6}Li or ^{10}B) to create a secondary radiation took place followed by the excitation of a luminous material showing a fluorescence emission in the optimal range of the detection system. You can have a separated system with ^{6}LiF / ZnS as absorber / fluorescence pigment or a single component system like Gd_2O_2S:Tb with Gd as the absorbing ion integrated in the fluorescent pigment.

Most important features of the scintillator plates:

A perfect combination of absorber ion and fluorescence pigment applied homogeneous in a reasonable thickness to reach high light output (save measurement time) and high resolution (perfect image). Actually, the combination ^{6}Li/ZnS is known to have the highest

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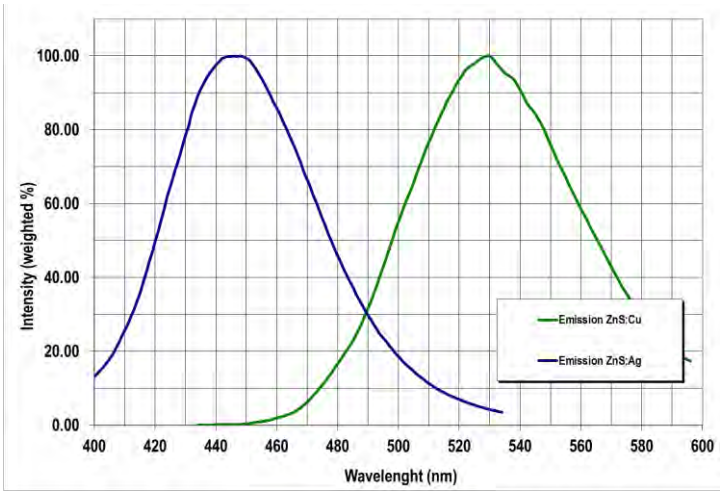
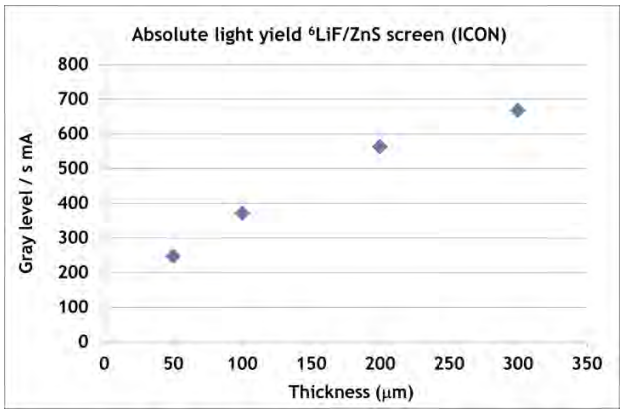
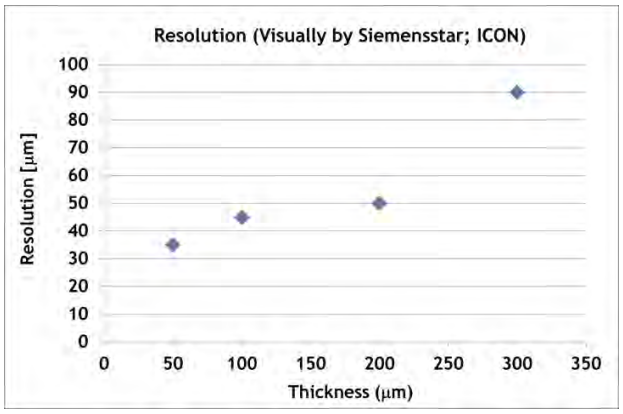
light output,while Gd-based phosphors have the highest resolution due to their high cross capture section. Customer can choose between different thicknesses to adjust the performance to his needs…

1.) ZnS / ^{6}LiF



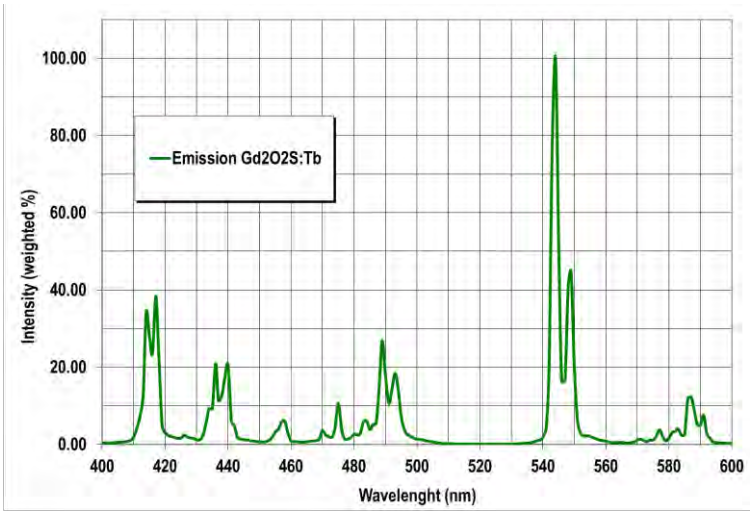
Most used screens with actual highest light output. They are available with two different emission wavelength (blue or green), while the green emitting type matches very good with standard CCD-camera systems. Due to the big range of available thicknesses (50 up to 400 µm) you are able to adjust the performance of the screen perfectly to your environment. (High light output or high resolution).





2.) Gd_2O_2S:Tb

Scintillation screens for very high resolution measurements.
Gd has highest cross capture section to make scintillation thicknesses of 10 mm and below possible to reach highest possible resolution. The emission maximum at 549 nm matches very good with standard CCD-Cameras.



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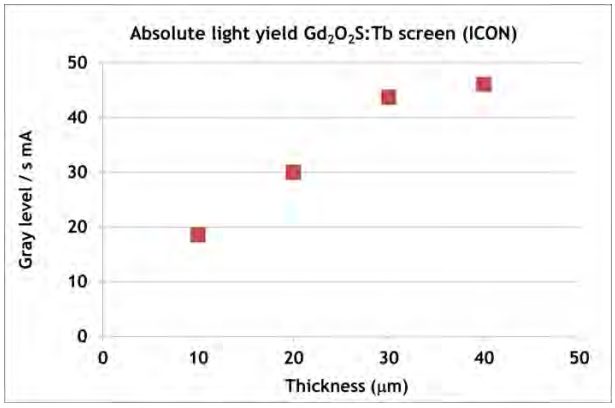
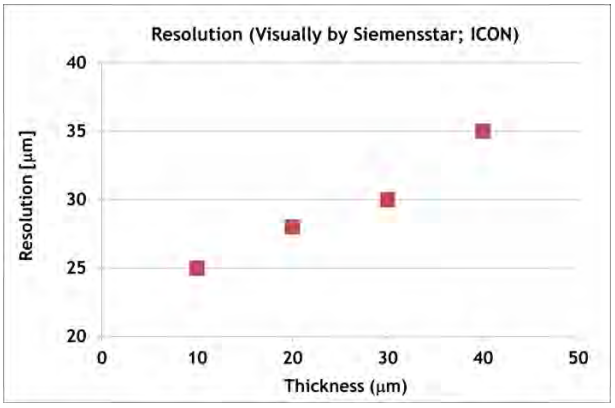
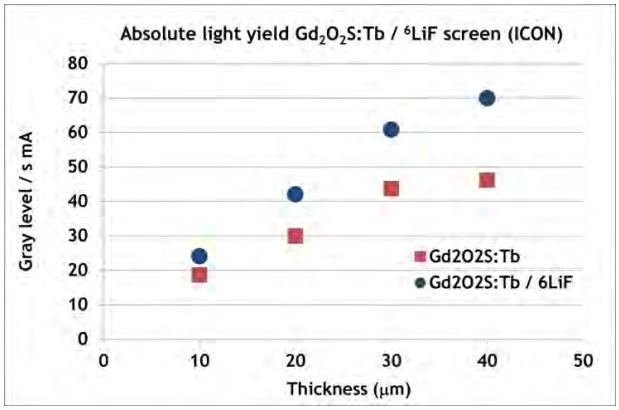
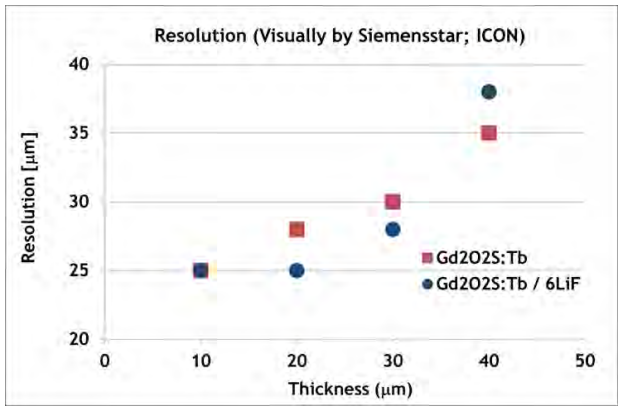




3.) Gd_2O_2S:Tb / ^{6}LiF

New development to increase the light output of the scintillator with still very high resolution. Emission maximum at 549 nm.





The addition of ^{6}LiF give a 30-50% higher brightness with same resolution!

Standard Program of Neutron Scintillation Screens (RC Tritec AG, PSI):

Base material	Emission	Dimension	Thickness	Comment
^{6}LiF / ZnS:Cu (ratio 1 / 2)	530 nm (green)	up to 400 x 400 mm	50 up to 400 µm	High light output and high resolution
^{6}LiF / ZnS:Ag (ratio 1 / 2)	450 nm (blue)	up to 400 x 400 mm	50 up to 400 µm	High light output and high resolution
Gd_2O_2S:Tb	447 / 549 nm (blue-green)	up to 100 x 150 mm	10 up to 40 µm	Very high resolution
Gd_2O_2S:Tb / ^{6}LiF (20%)	447 / 549 nm (blue-green)	up to 100 x 150 mm	10 up to 50 µm	Very high resolution with enhanced intensity

RC Tritec and PSI are willing to fulfil all customer requirements. For special sizes, thicknesses or any other requirement please contact us.

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