In this study we have only demonstrated a portable digital fast neutron system was exposed to light sources from outside to confirm that there is no light leakage without neutron sources. The optic box was painted matt black color to prevent light reflections. We chose lead as the construction material of the optic box because of their high attenuation for light and low attenuation for neutron. The fast neutron sensitivity, detective quantum efficiency, dynamic range and temporal resolution are not counted.

2 Description of the systems

The FNR system was designed as shown in Fig.1. Aluminum sheets were chosen for the construction material of the optic box because of their short half life activation when interaction with fast neutrons. In order to prevent light reflections from the optic box the whole surface of the optic box was painted matt black color to prevent light reflections. After the light leakage tests the CCD camera was mounted. The optic box system was exposed to light sources from outside to confirm that there is no light leakage without neutron sources.

3 Some image examples

The first tests of the imaging system were performed with plate composed of Plexiglass materials (200x200x32 mm). Upon the plane different radii and depth holes were formed. The radius and depth of the holes were between 0.5 to 12 mm and 4 to 15 mm respectively. The numerical gray level of the plexiglass sample was determined and the values of the signal to noise ratio (SNR) were shown at Table 1. SNR is a measure used in science and engineering to quantify how much a signal has been corrupted by noise. It is defined as the ratio of signal power to the noise power corrupting the signal. A ratio higher than 1 indicates noise signal is higher. The higher the ratio, the less obtrusive the background noise is. As seen in Fig.4b and Table 1 the resolution of the system is pretty good as all of the holes are clearly distinguished according to their sizes.

4 Conclusion

Although gamma, x-ray and neutron radiographies are a well-known techniques but FNR is quite new and unfamiliar. The most important superiority of the FNR to the other radiography techniques is the larger depth of penetration in the non-destructive testing of thicker objects. In this study, FNR images were taken for materials with different compositions. According to our results FNR technique can be successfully applied for industrial applications or research.