

§ 2. Dimensional Neutron Measurement Using Thermo-Luminescent Sheets

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INTRODUCTION: Our studies aim to two-dimensionally measure neutron rays separating from X/gamma rays by means of thermo-luminescent sheets (TL sheets). We have already confirmed that (1) the TL sheets could detect thermal neutron rays two-dimensionally eliminating X/gamma rays, (2) they had at least 1mm of resolution factor and (3) they could measure neutron ray dose for five decades^[1]. This method is an application of an imager using new thermo-luminescent sheets developed by Nemoto & Co. Ltd. Experiments on neutron exposure were carried out at Kyoto University Research Reactor Institute (KURRI).

IMAGING SYSTEM: The readout system of the TL sheets consists of a controlled panel heater, a CCD camera, a control box, and a host computer, as shown in Fig.1. The TL sheets were composed of Teflon homogeneously mixed with an average of 30 $\mu\text{m}\phi$ BaSO₄:Eu. We used 0.2 mm \times 100 mm \times 100 mm TL sheets.

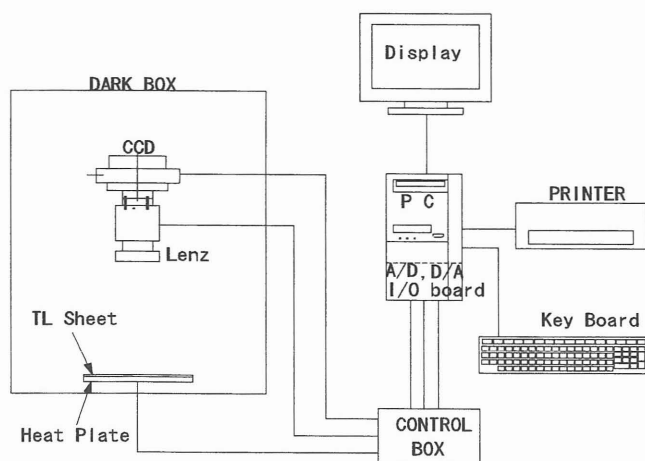


Fig.1 The block diagram of the TL-sheets imager.

EXPERIMENTS & RESULTS: The TL sheets are waterproof. We tried to measure neutron rays under the water. This measurement is useful for health physics, because water and human tissue are similar in terms of neutron rays. We carried out preliminary experimental runs last year. Fig. 2 shows the results of collimating measurement under the water. A TL sheet was installed with a shield sheet which contained boron and had nine holes. They were, from right to left, three 10m ϕ holes, three 5m ϕ holes and three 3 m ϕ holes (See Fig. 3).

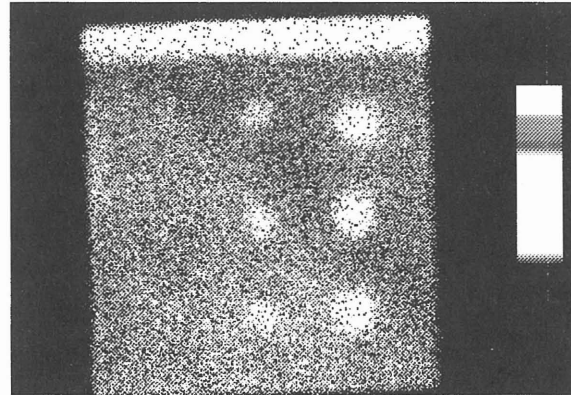


Fig. 2 A TL sheet with spots caused by neutron rays.

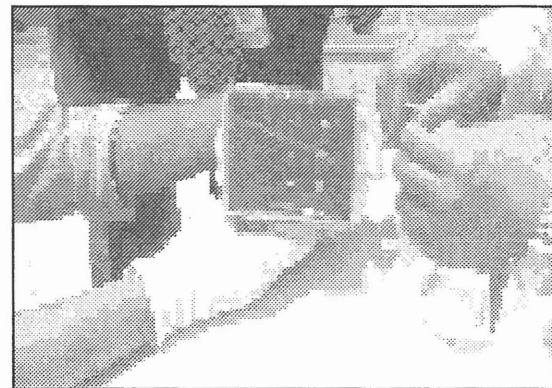


Fig. 3 The neutron measurement apparatus under the water.

CONCLUSION:

- (1) The TL-sheet was able to measure neutron rays two dimensionally.
- (2) The resolution of this system was at least 1mm.
- (3) The TL sheet was able to measure neutron rays under the water.

Referece:

- [1] Hiroo Sato, Houshasen, Vol.28, No.3 (2003) pp.249-258.
- [2] Yoichi Sakuma et al., KURRI Progress Report 2002 (2003) to be published.